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Interpretation of associative cultural landscape based on text mining of poetry: taking Tianmu Mountain on the Road of Tang Poetry in Eastern Zhejiang as an example

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Abstract

Revealing the association between natural elements and “religion, culture, or art” through text mining of poetry provides a new perspective for in-depth interpretation of Associative Cultural Landscape. Taking Tianmu Mountain, an important spot on the Road of Tang Poetry in Eastern Zhejiang, as an example, this study focuses on 444 poems written by 269 poets from the Eastern Han Dynasty to the Qing Dynasty in the Tianmu Mountain region. Text mining methods, such as text segmentation and social network analysis, are employed to conduct frequency statistics and association analysis of Landscape Terms in the poetry. The findings are as follows: (1) The descriptions in the poems bear witness to the beautiful and diverse Natural Landscape, the abundant Humanistic Landscape, and the unique Folk Landscape of Tianmu Mountain. These collectively reflect Tianmu Mountain with its religious features of cultivating both Buddhism and Taoism, cultural features of accumulating abundance and influence, as well as artistic features of blending picturesque charm and poetic grace. (2) The Cultural Landscape of Tianmu Mountain described in poetry across different dynasties exhibits characteristics of four relationships: “Group Relationship, Hierarchical Relationship, Interactive Relationship, and Cognitive Relationship.” It reveals the close association between natural elements in the Tianmu Mountain and “religion, culture, or art.” The research has constructed a theoretical model for interpreting the Multi-relationship within Associative Cultural Landscape, as well as provide the support of theories and methods for understanding the characteristics and interpreting the association of global Associative Cultural Landscape. It offers crucial scientific foundations for their overall conservation and sustainable utilization.

Keywords Associative cultural landscape, Text mining, Interpretation of association characteristics, Tianmu Mountain, The Road of Tang Poetry in Eastern Zhejiang

Introduction

The Cultural Landscape that reflects the “collaboration between nature and humanities” is an important category within the World Heritage Protection System. According to the Operational Guidelines issued by the World Heritage Committee, it can be classified into three subtypes: (1) Clearly Defined Landscape Designed and Created Intentionally by Man, (2) Organically Evolved Landscape, and (3) Associative Cultural Landscape. Associative Cultural Landscape can include various regions, routes, or linear landscapes with different sizes, contiguous

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or non-contiguous. They embody the spiritual beliefs, cultural traditions, and intrinsic practices of a nation through material entities or psychological images. They demonstrate the close association between natural elements and “religion, culture, or art,” relying not only on material evidence but also emphasizing the interaction between humans and the environment at a spiritual level [1–3]. Since 1992, more than ten Associative Cultural Landscapes, such as Mount Lu in China (1996), Royal Hill of Ambohimanga in Madagascar (2001), Bamiyan Valley in Afghanistan (2003), and Mount Wutai in China (2009), which are mainly composed of natural mountains and rivers and are interconnected with religious, artistic, and cultural elements, and other natural features, have been selected as Cultural Landscape of World Heritage due to their Outstanding Universal Value recognized all over the world [4]. However, scholars have pointed out that compared to the first two categories of Cultural Landscape, the interpretation of Associative Cultural Landscape requires a systematic understanding of the combination of “natural elements” as well as “religion, culture, or art,” which is often complex due to the highly abstract symbolic forms [5]. Therefore, how to interpret them has become an important research topic in understanding Associative Cultural Landscape.

The current research regarding the interpretation of Associative Cultural Landscape mainly includes: Rossler [6], who interprets the relationship between the natural elements of Associative Cultural Landscape and religion, culture, and art from the perspective of indigenous people and intangible elements; Jewell [7], who uses film media to illustrate the association between religion, culture, art, and natural environment in Associative Cultural Landscape; Taylor [8], who analyzes the formation process of Associative Cultural Landscape of by examining the interdependent results of people, social relationships, and landscapes; Wu [9], who discusses the cultural value of Associative Cultural Landscape from the perspective of the landscape classification; McBryde [10], who raises questions about the applicability, definition, and classification of Cultural Landscape in different regions in the practice of global heritage by studying their historical evolution and influences; Popovic [11], who explores how to promote local development and prosperity while protecting natural and cultural heritage from the perspectives of culture, history, and natural resources; and Zhang [5], who proposes an approach to construct the symbolic meaning of natural prototypes in understanding Associative Cultural Landscape by using 11 psychological paintings “tree prototypes” from Jung’s Philosophy Tree as research materials. Most of these studies focus on well-established Associative Cultural Landscape

with sufficient evidence. However, according to WHC documents [1–3], for areas where archaeological physical evidence are lacking and cultural fabric is unclear, “landscapes of memory” such as existing texts (e.g., poetry, songs) or visual materials (e.g., photography, painting) can serve as evidence to demonstrate the relationship between natural geographical features and cultural significance. Based on the current research progress, it can be seen that there is relatively little research on the interpretation of Associative Cultural Landscape from the perspective of literary works such as poetry. By analyzing poetry using text mining methods widely used in word classification, clustering, and topic modeling [12], a new perspective of understanding the association between natural elements and “religion, culture, or art” can be revealed in the study of Associative Cultural Landscape.

Given this, this study proposes a hypothesis: throughout Chinese history, poetry has been the main form of writing expression and communication. Both literati and common people have used poetry to depict what they have seen, heard, felt, and thought. Undoubtedly, the poems from different historical periods contain a richly diverse “Genetic Code” of natural, historical, and cultural information. They serve as a “Cultural Gene Bank” for a comprehensive understanding of Associative Cultural Landscape, revealing the interaction between its natural and cultural elements. By mining the landscape information in specific regional poetry texts, we can better explore and interpret the association between nature and humanities in that area. Chinese Poetry, with characteristics by clear overall imagery, highly precise meaning, distinct spatial levels, clear spatial elements, and continuous temporal features [13–15], provides the feasibility for a profound understanding of the local Cultural Landscape patterns and the restoration of the regional cultural environment, exploring the association between natural and cultural elements.

Therefore, this study takes Tianmu Mountain, an important scenic spot along the Road of Tang Poetry in Eastern Zhejiang Province, China, as an example. Using text mining methods, it analyzes 444 poems written by 269 poets from the Eastern Han Dynasty to the Qing Dynasty in the Tianmu Mountain region. The aim is to reveal the characteristics and association between natural and cultural elements in the Cultural Landscape of Tianmu Mountain from the perspective of poetry. This research seeks to provide methodological support for the interpretation and value clarification of global Associative Cultural Landscape. It offers crucial scientific foundations for the overall conservation and sustainable utilization of these landscapes.

Research object, approach and methods

Research object

Overview of Tianmu Mountain

(1) *Geographic location and scope* Tianmu Mountain is located in the southeast of Xinchang County, Shaoxing City, Zhejiang Province. The defined range of Tianmu Mountain in this article is mainly based on the descriptions in the Song Dynasty’s “Yudi Jisheng” (《輿地纪胜》) and the Ming Dynasty’s “Travel Notes of Xu Xiake” (《徐霞客游记》). Specifically, it is defined as the area centered around the main peak of Tianmu Mountain, with Tengkong Mountain to the east, Banzhu Mountain to the north, Huishu Ridge to the west, and Lianhua Peak to the south. The boundaries are formed by the surrounding rivers, including the Thirty-Six Duqi, Xinchang River, Chouchang Creek, and Wangdu Creek. This area covers approximately 142 square kilometers and extends around 60 km in its vicinity [16] (Fig. 1).

(2) *Status on the Tang Poetry Road in Eastern Zhejiang* Tianmu Mountain is known for its abundant natural resources and profound cultural resource. Encompassed within its borders are myriad picturesque mountain and water landscapes, which include the enchanting views of Chuanyan Nineteen Peaks, Boyun Peak, Shuilian Peak, and Lianhua Peak. There are also famous cultural sites, including Sima Hui Bridge, Tianmu Ancient Path, Tianmu Mountain Rock Carvings, Miaolian Temple, and Wannian

Temple. In December 2009 it was designated as a National 5A-level scenic spot, and in 2010 it was designated the National Scenic Area, featuring 107 natural units and 62 cultural units. In the historical development of Tianmu Mountain, it is noteworthy that during the Eastern Jin Dynasty, eminent figures such as the 18 monks led by Zhidun (支遁) and renowned calligrapher Wang Xizhi (王羲之) jointly established the Buddhist Prajna school, known as the “Six Schools and Seven Sects,” making it the “Buddhist Prajna Center” and the birthplace of Sinitized Buddhism. In the flourishing period of Taoism during the Sui, Tang, and Northern Song Dynasties, Tianmu Peak was recognized as the sixteenth blessed land in Taoist classics, encompassed within Wozhou Mountain as the 15th Blessed Land (福地), Sima Hui Mountain as the 60th blessed land, and the 27th Cave Heaven (洞天), Jinting Temple, exerting a widespread influence. During the Southern Dynasties, royal painters innovatively depicted Tianmu Mountain on round fans, known as the “Yuanjia Round Fan” (元嘉团扇) in the history of Chinese landscape painting, designating this area as a birthplace of Chinese landscape painting. The renowned founder of Chinese landscape poetry, Xie Lingyun (谢灵运) of the Eastern Jin Dynasty, carved out the “Xiegong Ancient Road” (谢公古道) on Tianmu Mountain and composed poems in praise, marking the origin of early Chinese landscape poetry. As an important and famous mountain along the Road of Tang Poetry in Eastern Zhejiang—a cultural route of Chinese poetry, Tianmu Mountain has attracted numerous literati and poets throughout history with its magnificent scenery. Poetic masterpieces like Li Bai’s “Dreaming of Traveling to Tianmu Mountain and Leaving a Farewell Poem” (李白《梦游天姥吟留别》) and Du Fu’s “Heroic Journey,” as well as Bai Juyi’s “Record of the Zen Monastery on Wozhou Mountain,” (白居易的《沃洲山禅院记》) have further elevated the fame of Tianmu Mountain. Many famous literati and poets, such as Xie Lingyun in the Eastern Jin Dynasty, Li Bai and Du Fu in the Tang Dynasty, Lu You in the Song Dynasty, and Xu Xiake in the Ming Dynasty, visited and left numerous well-known writings, establishing Tianmu Mountain’s important position as a scenic, religious, cultural, literary and artistic mountain [17].

Poets and poetry associated with Tianmu Mountain

The dataset is based on the latest and most comprehensive compilation of literature related to Tianmu Mountain, namely “Tianmu Mountain Local Chronicle,” compiled in 2020 by Mr. Xu Yuelong, the Deputy Secretary-General of the Chinese Tang Poetry Research Association and a prominent local scholar.



Fig. 1 A regional location map of Tianmu Mountain

In this compilation, a total of 3 travelogues, 8 essays, 6 inscriptions, and 444 poems describing the Tianmu Mountain are included. Due to the relatively small amount of data and the lack of chronological coherence in travelogues, essays, and inscriptions, as well as limited landscape descriptions, they were not included in the dataset for text mining in this study. The research focused on the 444 poems included in the book, totaling 56,511 characters and comprising 7432 verses. These poems span approximately 1800 years, from the Eastern Han Dynasty (25 AD–220 AD) to the Qing Dynasty (1636 AD–1912 AD) [16]. The poems are characterized by their richness in quantity, comprehensive perspectives, chronological continuity, and detailed records.

A total of 444 poems were created by 269 poets, with 176 poets recorded in the “*Dictionary of Chinese Writers*” (《中国文学家辞典》), accounting for 65% of all poets who wrote about Tianmu Mountain [18]. Numerous renowned Chinese poets have all left their works at Tianmu Mountain, including Li Bai (4 poems), Du Fu (3 poems), Li He (1 poem), Bai Juyi (2 poems), and Wang Wei (1 poem). The earliest recorded poem was written during the Eastern Han Dynasty (1 poem), with the majority of poems concentrated in the Tang Dynasty (104 poems) Song Dynasty (94 poems), Ming Dynasty (133 poems), and Qing Dynasty (76 poems). It can be seen

that Tianmu Mountain has exerted great attraction and influence on poets and literati throughout history. The enduring poems provide valuable historical and cultural information, offering a comprehensive understanding of the Cultural Landscape of Tianmu Mountain.

Research approach

This study explores the approach of interpreting Associative Cultural Landscape through word frequency statistics and association analysis of Landscape Terms in the poetry of Tianmu Mountain. The specific technological approach is as follows (Fig. 2):

1. Extraction of Landscape Terms from the poems of Tianmu Mountain: Take photos of the poems that describe Tianmu Mountain from the compiled “*Tianmu Mountain Local Chronicle*” of various dynasties [15]. Then import the images into an OCR tool (CS CamScanner software) for text recognition, and finally vectorize all 444 poems. Conduct a comprehensive manual inspection and correction to ensure the accuracy of each poem’s information.

Using the “jieba” word segmentation tool in Python as the segmentation tool for this study, segment the

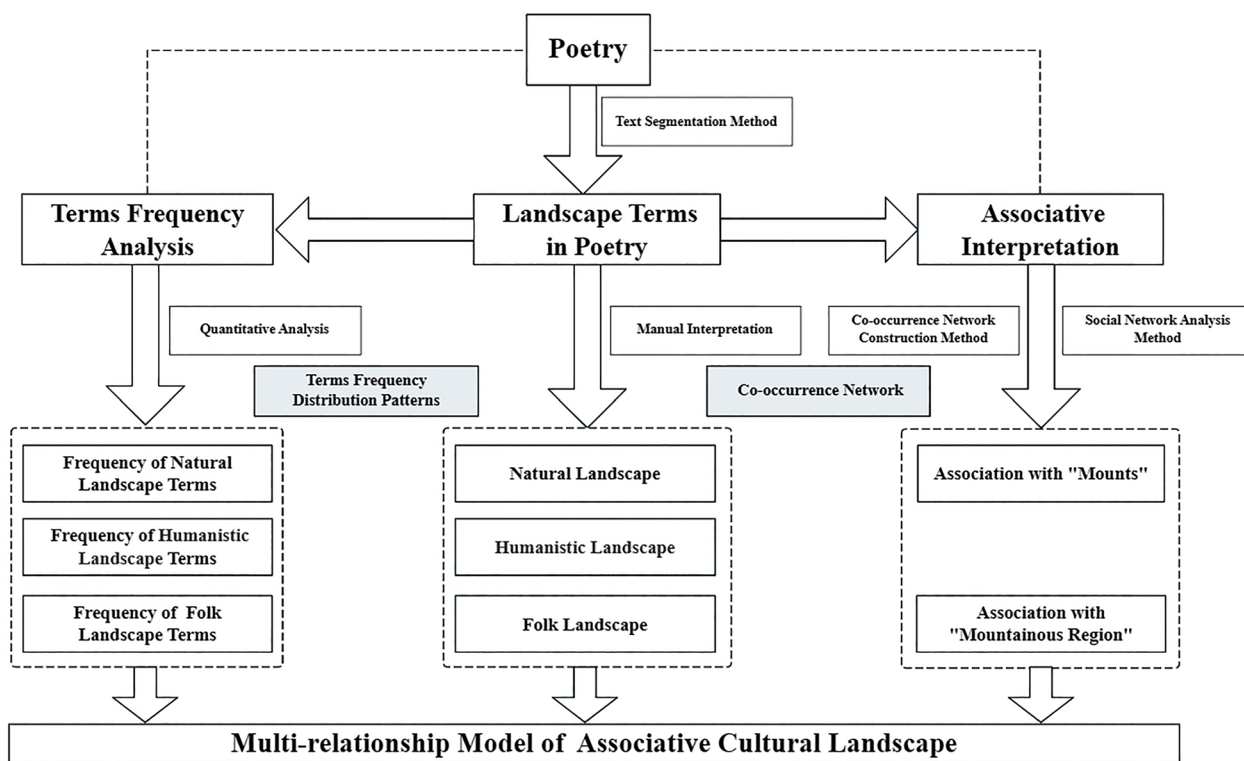


Fig. 2 Technological approach to interpret Associative Cultural Landscape

poems of Tianmu Mountain. Words with a frequency of two or more were further categorized through manual interpretation to determine if they were Landscape Terms.

2. Frequency statistics of Landscape Terms in Tianmu Mountain: Divide the selected Landscape Terms into three main categories: “Natural Landscape,” “Humanistic Landscape,” and “Folk Landscape.” Subcategories and subclasses within each major category were systematically classified. Landscape Terms that had been categorized were subjected to word frequency analysis, determining the frequency of each main category, subcategory, and subclass, which were then visualized through the creation of a radar chart.
3. Interpretation of the association of Landscape Terms in Tianmu Mountain: From the perspectives of “Mounts” and “Mountainous Region,” generate co-occurrence networks of Landscape Terms using Gephi tool. Analyze the association between various categories of Landscape Terms.
 Analysis of association with “Mounts”: Based on the types of Landscape Terms appearing in each poem, construct co-occurrence networks of words focusing on Tianmu Mountain, such as “Mount—Natural Landscape,” “Mount—Humanistic Landscape,” and “Mount—Folk Landscape.” Use social network analysis to examine the internal association characteristics of each category of Landscape Terms were dissected. Analysis of association with “Mountainous Region”: Based on the types of Landscape Terms appearing in each poem, we first construct a co-occurrence network of three categories of Landscape Terms in the Tianmu Mountain region: “Natural Landscape—Humanistic Landscape—Folk Landscape,” and then summarize the whole characteristics. Subsequently, utilizing Social Network Analysis Method, cluster analysis is applied to the three categories of Landscape Terms, summarizing their cluster features and group relationships. Furthermore, based on the co-occurrence network of Landscape Terms, the characteristics of association and their causes within the Cultural Landscape of Tianmu Mountain are analyzed. Finally, the relationship between the artistry of poetry and the Cultural Landscape of Tianmu Mountain is explored.
4. Construction of Multi-relationship Model of Associative Cultural Landscape: Summarize the mutual relationships among the “Natural Landscape—Humanistic Landscape—Folk Landscape” in the Cultural Landscape of Tianmu Mountain. Provide a summary of the relationship model between these three types of landscapes and their connections to “religion, culture, or art.”

Research methods

Research using the Text Segmentation Method and Co-Occurrence Network Construction Method, employing Python programming to split poetry texts and count the frequency of Landscape Terms. Subsequently, the program calculates the co-occurrence frequencies of various types of Landscape Terms within the same poem, building a co-occurrence matrix. Construct a Landscape Terms co-occurrence network using the Gephi tool and categorize the Landscape Terms into clusters. Utilize Social Network Analysis Method to examine the co-occurrence relationships among Landscape Terms.

Text segmentation method

Text segmentation is the process of dividing continuous sentences or paragraphs into individual words or lexical units. It is an important step in natural language processing [19–21]. For this study, the widely used “*jieba*” segmenter in Python was chosen as the segmentation tool [22].

The vectorized poetry texts were split using the “*jieba*” segmenter, keeping the title and content of each poem. The “*Counter*” function was used to calculate the word frequencies of the segmented words. An “*Openpyxl*” module was used to create an excel file to save the segmented words and their frequencies. Punctuation marks were removed from the segmented results. The words were then sorted and analyzed based on their frequencies. Words with a frequency of 2 or more were subject to attribute analysis. Throughout the process, comprehensive manual checks and corrections were carried out to ensure the accuracy of the semantic information of each segmented poem. The process also involved continuously classifying and summarizing words themselves and their “similar related” words (such as “white cloud,” “cloud layer,” “cloud sea,” all referring to “Clouds”). Segmented words were manually reviewed to select those landscape-related words, and these words were categorized into different Landscape Terms.

The research utilizes Python to build a co-occurrence matrix for Landscape Terms by implementing two nested for loops, which is then imported into Gephi tool to create an undirected edge network visualization of Landscape Terms co-occurrences: (1) For each *Landscape Term1*, the inner loop iterates through all other *Landscape Term2*. The research uses a condition to check for rows where both *Term1* and *Term2* columns have values greater than zero, indicating that the two *Terms* appear together in the same poem. (2) The research uses the *sum()* function to count the co-occurrences of *Term1* and *Term2*, thereby obtaining a co-occurrence matrix in CSV format that can be recognized by Gephi tool.

Finally, importing the co-occurrence matrix into Gephi tool allows us to visualize the co-occurrence network of Landscape Terms through undirected edges.

Social network analysis method

Social network analysis is a method that involves analyzing the co-occurrence network of Landscape Terms constructed in Gephi tool [23, 24]. The social network model consists of “nodes” and “edges”, where “nodes” refer to elements and “edges” represent the interactions or relationships between these elements [25]. In this study, various Landscape Terms are considered as the “nodes” in the model, and the co-occurrence level between Landscape Terms within the same poem is treated as the “edges” representing the association between them. The Gephi tool is used to visualize the co-occurrence network of Landscape Terms. The size of the nodes can indicate the frequency of their occurrence, while the thickness of the edges represents the weight of the co-occurrence relationship between two nodes.

In this research, the Node Degree and Node Connection Edge Weight of the co-occurrence network of Landscape Terms are used as measures, and their specific calculation formulas are shown in Table 1. The size of the nodes represents the number of times a particular Landscape Term appears in the poems, with larger nodes indicating a higher frequency of occurrence. The edges between nodes represent their shared occurrence in the same poem, and thicker edges indicate a stronger co-occurrence relationship. The study divides the co-occurrence network into different layers based on their node degrees and analyzes the association between Landscape Terms based on the connection weights between a node and other nodes. The Gephi software’s “modularity” function is then employed to cluster the co-occurrence network, dividing it into different clusters based on the high or low values of inter-node connectivity. Nodes within the same cluster exhibit higher interconnectivity, while the connectivity between nodes from different clusters is relatively lower.

Research results

Extraction and word frequency statistics of Landscape Terms

Extraction of Landscape Terms

In this study, a total of 14,715 terms data were obtained by splitting the poetry texts. After removing the punctuation marks from the word segmentation results, these words were statistically counted and sorted based on their frequency. The results showed that there were 3338 terms with a frequency of 2 or more. After manual judgment, a total of 702 Landscape Terms containing landscape content were selected from them.

Classification criteria for Landscape Terms segmentation

The Landscape Terms were divided into three main categories: “Natural Landscape, Humanistic Landscape, and Folk Landscape,” as well as fourteen corresponding subcategories and several subclasses (Table 2).

Frequency statistics of Landscape Terms

The classification and frequency distribution of Landscape Terms according to “Natural Landscape, Humanistic Landscape, and Folk Landscape” are shown in Fig. 3. Among them, the Natural Landscape accounts for 59.4%, the Humanistic Landscape accounts for 14.8%, and the Folk Landscape accounts for 25.8%.

(1) Word frequency statistics of Natural Landscape Terms

The Natural Landscape Terms are categorized into six subcategories: Celestial Phenomena, Weather, Famous Mountains and Peaks, Rivers and Lakes, Animals, and Plants. The frequency ranking of these six subcategories is as follows: Celestial Phenomenon (13.6%) > Mounts (11.6%) > Plants (10.5%) > Weather (8.8%) > Rivers and Lakes (7.9%) > Animals (8.8%). The frequency statistics of the Natural Landscape Terms are shown in Table 3.

From the frequency analysis of Natural Landscape Terms in poetry, it can be observed that the descriptions of Celestial Phenomenon landscapes primarily focus on “Clouds, Moon, Sun glow, Sky.” Descriptions of Mounts

Table 1 Description and significance of network structure indicators

Characteristic Indicators	Formula	Note	Indicator meaning
Degree	k_v	The number of edges connected to node v	Reflects the number of other nodes connected to a node, an important node is one with many connections
Weight	$s_v = \sum W_{vu}$	W_{vu} : the weight value from node v to node u	It reflects the level of participation of nodes in the network, and is a true presentation of the connection weight between a node and other nodes

Table 2 Standardized contrast table for Landscape Terms

Main category of Landscape	Subcategory of Landscape	Subclass of Landscape (etymology of Landscape Terms)
Natural Landscape	Celestial Phenomenon	Stars (Cold Star, Literary Star...), Clouds (Ocean of Clouds, White Cloud...), Sun (Mountain Sunshine, Dawn, Sunlight...), Rainbow (Rainbow...), Sunglow (Morning and Evening, Crimson Sunset...), Light (Bright Light), Moon (Moonlight...), Sky (Blue Sky, Dome...)
	Weather	Rains (Mountain Rain, Accumulated Rain...), Snows (Ice and Snow, Trudging Through the Snow...), Wind (Mountain Wind, Spring Wind...), Mists (Colorful Mist, Blue Mist...), Fogs (Mountain Fog, Cloud and Fog...), Thunders (Thunder and Lightning...), Frosts (Autumn Frost...), Sunny (Evening Clear, Snow Clear), Overcast (Cloudy Weather...)
	Animals	Birds (Mandarin Duck, Yellow Orioles...), Chickens (Crowing of A Rooster, Hens), Horses (Clatter of Hooves, White Horse...), Dog (Barking of A Dog), Sheep (Sheep Herding), Fireflies (Floating Fireflies), Tigers (Tiger, Tiger Head...), Apes (Howling Ape...), Deer (White Deer, Wild Deer...), Snakes (Snake), Bears (Bear), Rhinoceros (Rhino Protection), Fish (Carp, White Fish...), Frogs (Toad on the Back)
	Plants	Grasses (Moss, Root...), Forests (Tree, Ancient Cypress...), Pine Trees (Pine Branch, Pine Gate...), Willows (Weeping Willow, Willow Tree), Osmanthus Trees (Osmanthus Branch, Osmanthus Tree), Maple Trees (Maple Tree), Flowers (Yellow Flower, Floral Scent...), Hibiscus (Hibiscus), Peach Blossoms (Peach Blossom...), Calamus (Sweet Flag), Lotus (Lotus Flower...), Bauhinia Flowers (Bauhinia), Plum Blossoms (Plum Blossom), Osmanthus Flowers (Osmanthus Flower), Pine Flowers (Pine Flower), Epiphyllum Flowers (Epiphyllum Flower), Bamboos (Water Bamboo, Bamboo Grove...), Leaves (Maple Leaf, Falling Leaves...), Fruits (Pine Nut, Peaches and Plums...)
	Rivers and Lakes	Waves (Surging Waves...), Ponds (Heavenly Pond...), Islands (Islands...), Seas *(Dust Sea, South Sea...), Lakes (Lake...), Rivers (River, Spring River...), Waterfalls (Flowing Water, Cascade...), Springs (Rushing Spring, Flowing Spring...), Streams (Stream Sound, Twin Streams...)
	Mounts	Mountains (High Mountains...), Cliffs (Cliff Wall...), Strange Stones (Strange Stones, Pine Stones...), Valleys (Dark Valleys, Rock Valleys...), Slopes (Sunny Slope), Hills (Hill, Red Hill...), Peaks (Purple Hat Peak, Layered Peaks...)
	Humanistic Landscape	Water and Land Transportation
Buddhist and Taoist Sanctuaries		Temples (Ancient Temples, Temple Gate...), Cave Paradises (Cave Paradise, Wangwu Cave...), Taoist Temples (Tongbai...)
Rural Area		Monuments (Deserted Monument, Stone Altar), Farmlands (Mountain Fields, Return to Fields...), Furniture (Banquet, Couch...), Cottages (Hui Villa, Thatched Cottage...), Agricultural Tools (Hemp Shoes, Digging Wells...)
Urban Area		Houses (Liang Garden, Water Mansion...), Palaces (Southern Palace, Royal Palace...), Household Utensils (Eaves, Stairs...), Pavilions and Towers (Monk Tower, Yi Gate...)
Folk Landscape	Special Local Products	Tea (Longjing, Tea), Meals (Rice, Sea Bass), Marriage (Marriage Customs), Currency (Wine Money, Coins...), Wine (Fine Wine, Drinking Wine...), Weapons (Banners, Sword), Medicines (Cinnabar, Medicines), Clothing (Hairpin, Sleeve Brushing...), Jade (Pearls and Jade, Hanging Ring...)
	Artistic Crafts	Brush and Ink (Fine Brush, Calligraphy and Painting), Wall Writing (Inscribed on Wall), Calligraphy and Painting (Inscribed Painting, Books...)
	Traditional Performances and Dances	Songs (Sad Song, Flute Playing...), Scriptures (Samadhi, True Secret...), Musical Instruments (Bells and Drums, Iron Flute...), Archery (Archery), Poems (Poetic Works, Excellent Sentences...), Documents (Literature, Written Records...), Dances (Dance), Theater (Drama)
	Stories and Legends	Phoenixes (Phoenix and Female Phoenix, Phoenix...), Liu Ruan (Liu Ruan), Dragons (Fish-Dragon, Twin Dragons...), Dreamlands (Tianmu Dream, A Dream...), Mountain Spirits (Blue Bird, Spiritual Birds...), Divine Herbs (Yao Herbs), Divine Worlds (Divine Capital, Spiritual Realm...), Divine Miracles (Yellow Path, Primordial...), Divine Spirits (Immortal Transcendence, Divine Spirits...), Immortals (Zhuang Zhou, Xuan Yuan...)

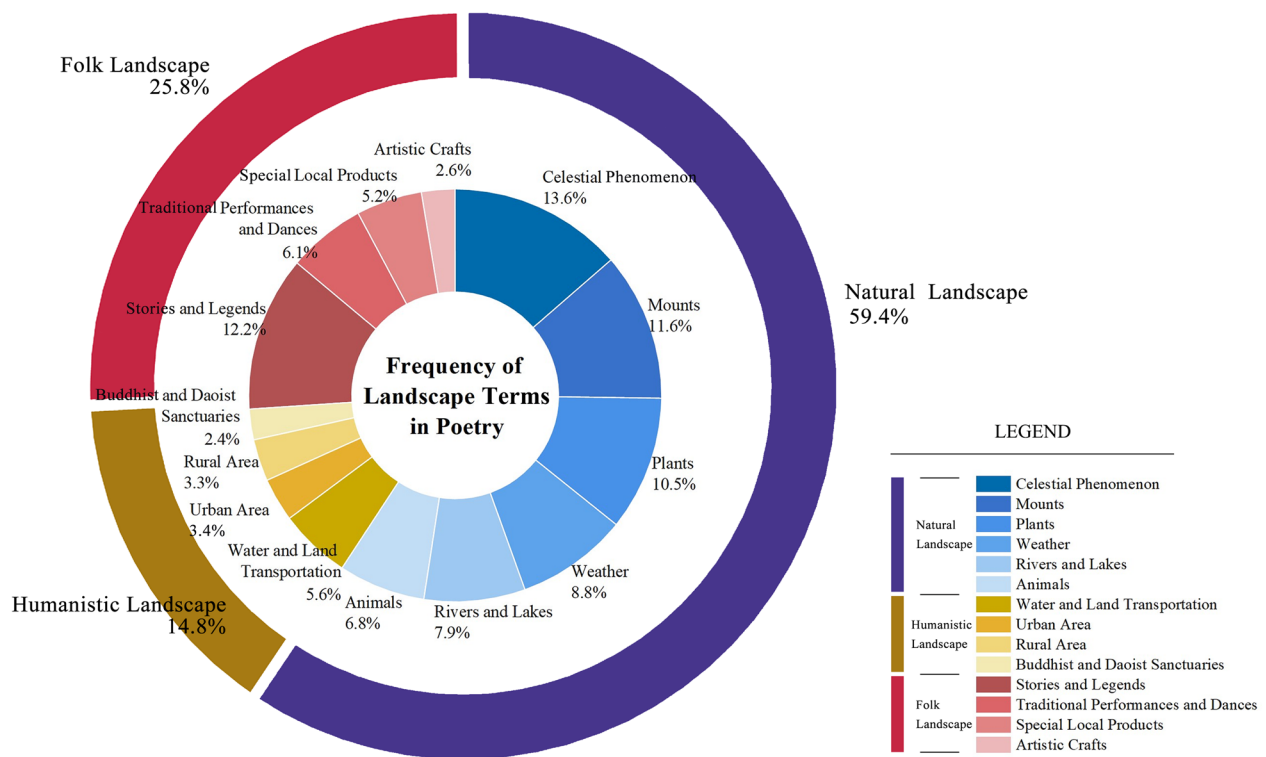


Fig. 3 Frequency of Landscape Terms in Poetry

Table 3 Word frequency statistics of Natural Landscape Terms

Natural Landscape types	Word frequency statistics
Celestial Phenomenon	Clouds (127 times), Moon (73 times), Sunglow (51 times), Sky (41 times), Stars (30 times), Sun (24 times), Rainbow (8 times), Light (2 times)
Mounts	Mountains (144 times), Peaks (51 times), Strange Rocks (41 times), Hills (27 times), Valleys (21 times), Cliffs (18 times), Slopes (2 times)
Plants	Grasses (58 times), Forests (31 times), Pine Trees (23 times), Flowers (22 times), Fruits (22 times), Peach Blossoms (20 times), Hibiscus (20 times), Lotus (16 times), Bamboos (14 times), Leaves (11 times), Bauhinia Flowers (8 times), Plum Blossoms (7 times), Osmanthus Trees (6 times), Willow (6 times), Osmanthus Flowers (3 times), Calamus (3 times), Epiphyllum (2 times), Pine Flowers (2 times), Maple Trees (2 times)
Weather	Wind (73 times), Rains (58 times), Snows (41 times), Mists (28 times), Overcast (17 times), Fogs (16 times), Thunders (9 times), Frosts (8 times), Sunny (4 times)
Rivers and Lakes	Streams (60 times), Seas (42 times), Waves (27 times), Waterfalls (21 times), Rivers (21 times), Springs (14 times), Islands (10 times), Lakes (8 times), Ponds (7 times)
Animals	Birds (81 times), Tigers (16 times), Chickens (14 times), Sheep (14 times), Horses (14 times), Deer (14 times), Apes (13 times), Fish (12 times), Snakes (4 times), Dogs (2 times), Fireflies (2 times), Rhinoceros (2 times), Bears (2 times), Frogs (2 times)

landscapes mainly revolve around “Mountains.” Descriptions of Plants primarily center on “Grasses, Forests, Pine Trees, Flowers, Fruits, Peach Blossoms, Hibiscus”. Depictions of Weather landscapes predominantly emphasize “Wind, Rains, Snows.” Descriptions of Rivers and Lakes landscapes are primarily concentrated on “Streams, Seas.” Descriptions of Animals landscapes primarily concentrate on “Birds” (Fig. 4).

(2) *Word frequency statistics of Humanistic Landscape Terms* Based on the statistical analysis of Humanistic Landscape Terms, they can be categorized into four sub-categories: water and Land Transportation, Buddhist and Taoist Sanctuaries, Rural Area, and Urban Area. The frequencies of these four categories are as follows: water and Land Transportation (5.6%) > Urban Area (3.4%) > Rural Area (3.3%) > Buddhist and Taoist Sanctuaries (2.4%). The

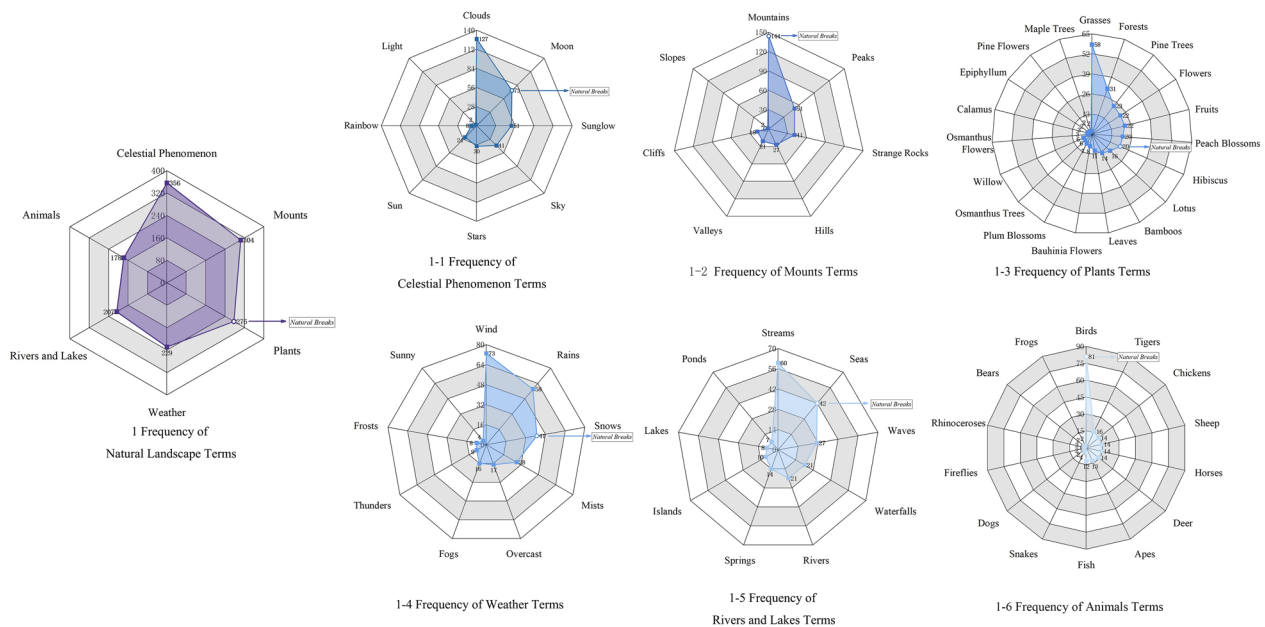


Fig. 4 Frequency Distribution Graph of Nature Landscape Terms in Poetry. Note: Natural Breaks refer to the points of significant change in the attribute values among a set of landscape frequency values

frequency statistics of Humanistic Landscape Terms are shown in Table 4.

It can be seen from the word frequency statistics of the Humanistic Landscape Terms in the poems that the description of Land and Water Transportation landscapes mainly focuses on “Roads, Boats”, and the description of Urban Area landscapes mainly focuses on “Palaces, Pavilions and Towers, Household Utensils”, the description of Rural Area landscapes mainly focuses on “Cottages”, and the description of Buddhist and Taoist Sanctuaries landscapes mainly focuses on “Temples, Cave Paradise” (Fig. 5).

(3) *Word frequency statistics of Folk Landscape Terms* Segmentation and statistics of Folk Landscape Terms are carried out according to the four subcategories of “Special Local Products, Artistic Crafts, Traditional Performances and Dances, and Stories and Legends”. The frequency distribution of the four subcategories is

as follows: Stories and Legends (12.2%) > Traditional Performances and Dances (6.1%) > Special Local Products (5.2%) > Artistic Crafts (2.6%). See Table 5 for word frequency statistics of Folk Landscape Terms:

It can be seen from the word frequency statistics of poetry, Folk Landscape Terms: the description of the landscape of Stories and Legends mainly focuses on “Immortals, Divine Worlds, Dreamlands”, the description of the landscape of Traditional Performances and Dances mainly focuses on “Poems, Songs, Documents”, the descriptions of landscapes and Special Local Products mainly focus on “Clothing, Jades”, and the descriptions of Artistic Crafts landscapes mainly focus on “Calligraphy and Painting” (Fig. 6).

Association analysis of Landscape

Association with “Mounts”

This paper analyzes the co-occurrence relationship between the “Mounts” Landscape Terms and other

Table 4 Word frequency statistics of Humanistic Landscape Terms

Material Humanities Landscape types	Word frequency statistics
Water and Land Transportation	Roads (69 times), Boats (41 times), Bridges (15 times), Vehicles (13 times), Wharves (9 times)
Urban Area	Palaces (30 times), Pavilions and Towers (28 times), Household Utensils (24 times), Houses (7 times)
Rural Area	Cottages (45 times), Agricultural Tools (16 times), Furniture (11 times), Farmlands (10 times), Monuments (4 times)
Buddhist and Taoist Sanctuaries	Temples (36 times), Cave Paradise (27 times), Taoist Temples (5 times)



Fig. 5 Frequency Distribution Graph of Humanistic Landscape Terms in Poetry

Table 5 Word frequency statistics of Folk Landscape Terms

Folk Landscape types	Word frequency statistics
Stories and Legends	Immortals (77 times), Divine Worlds (66 times), Dreamlands (55 times), Dragons (25 times), Divine Beings (25 times), Phoenixes (20 times), Divine Miracles (16 times), Divine Herbs (13 times), Mountain Spirits (12 times), Liu Ruan (9 times)
Traditional Performances and Dances	Poems (45 times), Songs (41 times), Documents (38 times), Musical Instruments (18 times), Dances (10 times), Scriptures (7 times), Theater (2 times), Archery (2 times)
Special Local Products	Clothing (43 times), Jades (28 times), Currency (20 times), Wine (16 times), Tea (8 times), Weapons (8 times), Meals (6 times), Medicines (4 times), Marriage (2 times)
Artistic Crafts	Calligraphy and Painting (53 times), Brush and Ink (6 times), Wall Writing (2 times)

Landscape Terms in poetry, and constructs the co-occurrence network of “Mounts—Natural Landscape”, the co-occurrence network of “Mounts—Humanistic Landscape”, and the co-occurrence network of “Mounts—Folk Landscape”.

(1) *Mounts—Natural Landscape* As shown in Fig. 7, the words co-occurrence network of “Mounts—Natural Landscape” contains 60 Landscape Terms nodes and 929 undirected edges. The research found that: with the landscape of “Mounts” as the core, the word “Mounts—Natural Landscape” can be divided into three layers according to the node degree value. The first layer has: “Clouds, Birds, Wind, Moon, Streams, Rains” 6 types of Landscape Terms (the node degree value greater than 33),

sorted according to the connection weight: Mounts—Clouds > Wind > Birds > Moon > Rains > Streams; the second layer has: “Grasses, Sky, Sunglow, Seas, Stars, Snows, Mists, Forests...” and other 16 types of Landscape Terms (the node degree values greater than 13), sorted according to the connection weight: Mounts—Sunglow > Sky > Grasses > Seas > Stars > Mists > Snows > Forests...; the third layer has: “Deer, Fruits, Tigers, Overcast, Horses, Springs, Apes, Lotus, Chickens, Flowers, Fish, Leaves, Bamboos, Thunders” 44 types of Landscape Terms (the node degree value less than 12), sorted by connection weight: Mounts—Tigers > Horses > Deer > Fruits > Springs...

As shown in Table 6, the weight value of the connection edge between each layer-level Landscape Terms



Fig. 6 Frequency Distribution Graph of Folk Landscape Terms in Poetry

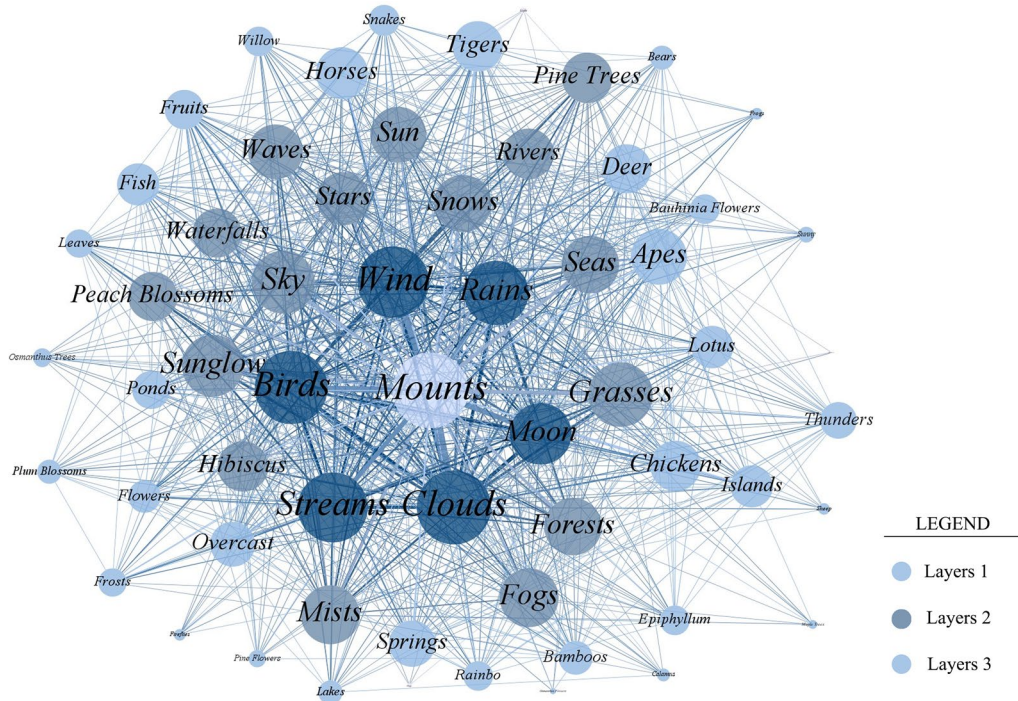


Fig. 7 Co-occurrence network of "Mounts—Natural Landscape"

Table 6 Connection edge weight values of Natural Landscape nodes

Layers	Serial Number	Node A	Node B	Weight	Serial Number	Node A	Node B	Weight
First Layer	1	Mounts	Clouds	140	4	Mounts	Moon	74
	2	Mounts	Wind	80	5	Mounts	Rains	64
	3	Mounts	Birds	80	6	Mounts	Streams	62
Second Layer	1	Mounts	Sunglow	52	9	Mounts	Sun	28
	2	Mounts	Sky	52	10	Mounts	Peach Blossoms	26
	3	Mounts	Grasses	52	11	Mounts	Hibiscus	26
	4	Mounts	Seas	48	12	Mounts	Pine Trees	26
	5	Mounts	Stars	42	13	Mounts	Waterfalls	26
	6	Mounts	Mists	42	14	Mounts	Fogs	24
	7	Mounts	Snows	40	15	Mounts	Waves	24
	8	Mounts	Forests	36	16	Mounts	Rivers	22
Third Layer	1	Mounts	Tigers	22	4	Mounts	Fruits	20
	2	Mounts	Horses	20	5	Mounts	Springs	20
	3	Mounts	Deer	20

This table only lists the cases where the weight value of the connecting edge is greater than 20

and “Mounts” in the words co-occurrence network of “Mounts—Natural Landscape” can be seen from it:

The association between “Mounts” and “Celestial Phenomenon Landscape” Terms such as “Clouds”, “Sunglow”, “Sun”, “Sky”, “Stars” shows the majestic clouds and majestic majesty of Tianmu Mountain on a sunny day. The majestic of the Natural Landscape features displayed in the sky and starry night. Li Bai, a poet, described this daytime scene in *Dreaming of Traveling to Tianmu Mountain and Leaving a Farewell Poem* with the poem “The Yue people speak Tianmu, the clouds are on and off, or you can see it. Tianmu Mountain reaches up to the sky, surpassing the Five Sacred Mountains and covering the Chicheng Mountain) (“越人语天姥，云霞明灭或可睹。天姥连天向天横，势拔五岳掩赤城”。 Yao Hu, a poet of the Song Dynasty, also used “People climb far away and the monks return to the temple at night, the moon shines on the empty mountains and the cranes are in autumn.” (“人攀远寺僧归晚，月照空山鹤唳秋”。

The association between “Mounts” and “Weather Landscape Terms” such as “Wind”, “Rains”, “Mists”, “Fogs” reflects the ethereal and dreamy landscape characteristics of the Natural Landscape of Tianmu Mountain in the windy and drizzle season. Wang Wenxue, a poet of the Qing Dynasty, used “Misty rain veils the distant valley, clouds and birds in the sky to the sky” (“雨后烟霞笼远谷，空中云鸟傍遥天”) in *Tianmu Poems* to show the misty and hazy scene of Tianmu Mountain.

The association between “Mounts” and “Plants Landscape Terms” such as “Forests”, “Grasses”, “Flowers”, “Fruits” as well as the association between “Mounts” and “Animals Landscape Terms” such as “Birds”, “Tigers”,

“Deer”, “Apes”, collectively reflect the unique biodiversity characteristics of Tianmu Mountain region since ancient times. In the Yuan Dynasty, Lu Bubu wrote: “The moose swims in the east of the house and the west of the house, and the tiger roars in the south or north of the mountain. Cranes sing all over the mountain, pines are pink and white, birds sing and fall, and the maple leaves are red.” (“麋游屋东复屋西，虎啸山南或山北。鹤鸣满山松粉白，鸟啼落照枫叶赤”) The mountains and forests are quiet, the birds and animals are harmonious, and the autumn is full of the beautiful scenery.

The connection between “Mounts” and “Rivers and Lakes Landscape Terms” such as “Streams”, “Waterfalls”, “Springs” reflects the landscape characteristics of mountains and rivers in the Tianmu Mountain region. Xu Pu, a poet of the Ming Dynasty, *Hanqing Tower*: “The upper floor is surrounded by green mountains, and the stream surrounds the building and hides like a ring” (“楼上四面皆青山，溪流抱楼隐若环”), which shows the surrounding mountains and rivers of Tianmu Mountain. At the same time, the frequent occurrence of “Seas” and “Waves” and other high-connectivity terms for Rivers and Lakes Landscape reflect the poet’s deep emotions after experiencing the beautiful scenery of lakes and pools in the mountains. Just as the poet Wei Zheng of the Tang Dynasty described in “Stay at Wozhou Mountain Temple” that “There is a clear moon by the sea, ten miles of fragrant wind and pines on the bottom” (“一声清磬海边月，十里香风涧底松”), after seeing the magnificent and picturesque mountains and rivers, he can only use “sea” in his poems, as a way to express the expansive state of mind that was evoked during that moment.

From the words co-occurrence network of the “Mounts Landscape Terms—Natural Landscape Terms” in Tianmu Mountain’s poems, it can be found that: “The natural phenomenon that repeats itself—The changing animal and plant landscapes in the four seasons—The beautiful and timeless natural mountain and water landscapes”. The combination of movement and stillness complements each other, showcases the picturesque and vibrant natural characteristics of Tianmu Mountain’s beauty.

(2) *Mounts—Humanistic Landscape* As shown in Fig. 8, the words co-occurrence network of “Mounts—Humanistic Landscape” contains 18 Landscape Terms nodes and 99 undirected edges. The research found that: with the landscape of “Mounts” as the core, the word “Mounts—Humanistic Landscape” can be divided into two layers according to the node degree value. The first layer has: “Roads, Cottages, Cave Paradise, Temples, Boats, Palaces” 6 types of Landscape Terms (the node degree value greater than 19), sorted according to the connection weight: Mounts—Roads > Boats > Cottages > Cave Paradise > Temples > Palaces; the second layer contains: “Household Utensils, Pavilions and Towers, Agricultural Tools, Vehicles, Bridges, Farmlands, Wharves...” and other 11 types of Landscape Terms (the node degree values less than 18), sorted by connection degree For: Mounts—Household Utensils > Pavilions and Towers > Vehicles > Agricultural Tools...

Table 7 Connection edge weight values of Humanistic Landscape nodes

Layers	Serial number	Node A	Node B	Weight
First Layers	1	Mounts	Roads	74
	2	Mounts	Boats	42
	3	Mounts	Cottages	40
	4	Mounts	Cave Paradise	36
	5	Mounts	Temples	34
	6	Mounts	Palaces	34
Second Layers	1	Mounts	Household Utensils	26
	2	Mounts	Pavilions and Towers	22
	3	Mounts	Vehicles	20
	4	Mounts	Agricultural Tools	20

This table only includes cases where the weight value of the connecting edge is greater than 20

As shown in Table 7, the weight value of the connecting edges between each layer’s Landscape Terms and “Mounts” in the co-occurrence network of “Mounts—Humanistic Landscape” can be observed:

The association between the Landscape Terms “Mounts” and “Roads”, “Boats” reflects the convenient Water and Land Transportation in the Tianmu Mountain region since the Tang Dynasty. This has been the basic condition for literati and scholars from various dynasties to travel to this place. In Li Bai’s poem *Parting with Chuyong at Shanzhong*, he said, “I ask about the way to

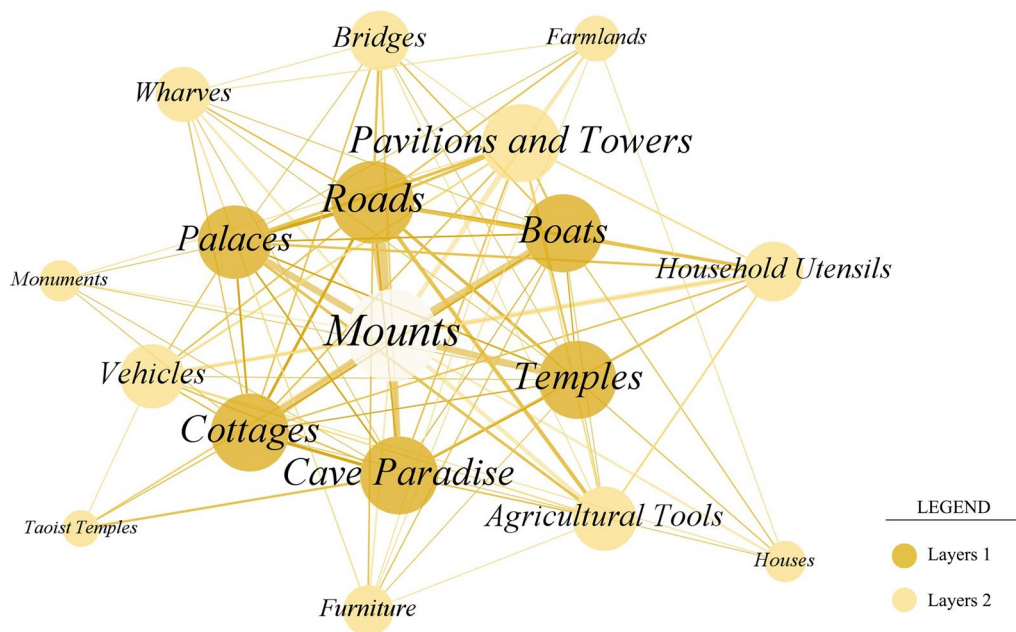


Fig. 8 Co-occurrence network of “Mounts—Humanistic Landscape”

Shanzhong, pointing southeast towards Yue village. Taking a boat from Guangling River, the water reaches Huiji Mountain for a long time. Bidding farewell to the lord, heading to Tianmu Mountain, lying on the frost-covered stones in autumn. (“借问剡中道，东南指越乡。舟从广陵去，水入会稽长。辞君向天姥，拂石卧秋霜”). This refers to the travel route from the south via the Jiangnan Canal, then to the Dong Lake section of the Jian Lake Canal in Zhejiang East, and upstream along the Cao'e River Xi Stream of Zhejiang, finally reaching Tianmu Mountain. It is also the possibility for one to “*The feet stand on Xie Gong's wooden clogs while the body ascends the ladder to the azure clouds,*” (“脚著谢公屐，身登青云梯”) (Li Bai, *Dreaming of Traveling to Tianmu Mountain and Leaving a Farewell Poem*). This is a way to explore and pay homage to his idol, Xie Lingyun, a famous figure from the Eastern Jin Dynasty.

The association between the Landscape Terms “Mount” and “Cottages,” “Agricultural Tools,” “Farmlands” reflects the picturesque Rural Area Landscape of the Tianmu Mountain region akin to an idyllic paradise. The Song Dynasty poet Li Yi wrote in his poem *To Zheng Tianhe While Dwelling in Jian*: “*Shan Creek offers countless places for settling, where one can take a small boat to visit with a joyful heart,*” (“剡溪随处可卜居，乘兴扁舟正相访”) and Ming Dynasty poet Zhang Bi mentioned in his work *Cloud and Mountain Scenery*: “*Thatched cottages scatter among cracks in the forest, mingling with the sounds of chickens, dogs, and people,*” (“茅屋参差出林罅，鸡犬声中杂人籁”) both illustrating a tranquil and harmonious living scene in mountain cottages.

The association between the Landscape Terms “Mounts” and “Palaces,” “Pavilions and Towers,” “Household Utensils” reflects the Urban Area Landscape of Tianmu Mountain region from the perspective of mundane life. (R1–3) The verses “*The heavy doors are fastened with golden hinges; Up and down, the brilliant lights are shining*” (“重户结金扃，高下华灯光”) by Zhang Heng, a poet from the Eastern Han Dynasty, and “*The sound of music and singing resembles the chirping of birds and barking of dogs; The pavilions and terraces, like peach blossoms, stand apart from the mundane world*” (“管弦鸡犬闻声似，桃李亭台与世非”) by Zhang Yue, a poet from the Song Dynasty, both depict the prosperous and affluent economic and social conditions of the local area.

The association between the Landscape Terms “Mounts” and “Temples,” “Cave Paradise,” “Taoist Temples” reflects the Buddhist and Taoist cultural of Tianmu Mountain region, where many eminent monks and scholars have resided for cultivation. The region is characterized by a multitude of Buddhist temples and Taoist sanctuaries, as described by Song dynasty poet Luo Shi in *Inscription on the Wannian Miaolian Pavilion*: “*To*

the west of Hua Peak lies Tianmu Mountain in the east, Miaolian Pavilion opens to the surrounding peaks,” (“华顶西边天姥东，妙莲开阁对群峰”) and by Yuan dynasty poet Ding Fu in *Sending Off Huai Monk to Travel Zhejiang*: “*Looking back at the peaks, Tianmu emerges in the clouds, ancient Buddhas in each smile.*” (“还向峰头望天姥，云中古佛各开颜”) These portray the abundance of temples and Taoist sanctuaries in the area. As depicted in the poetry of Song dynasty poet Li Gang, “*Dust attachments washed away, becoming immortals; scenic spots appear like blessed lands,*” (“尘缘洗尽便神仙，泉石幽奇即洞天”) and in the words of poet Liu Yuxi, “*The Buddhist monk achieved enlightenment, radiating an aura of tranquility; as the abbot of Qingliang Mountain... High banquet tables and discussions that stir the staff, the disciples below are as if awakened from drunkenness*” (“释子道成神气闲，住持曾上清凉山...高筵谈柄一麾拂，讲下门徒如醉醒”). These verses all reveal the societal trend among literati and officials since the Tang dynasty of seeking immortality, enlightenment, and seclusion in Tianmu Mountain.

From the words co-occurrence network of the “Mounts Landscape Terms—Humanistic Landscapes Terms” in Tianmu Mountain's poems, it can be found that: “The convenient and accessible water and land transportation—The flourishing market towns and villages where people live and work in peace and contentment—The thriving Buddhist temples and Taoist monasteries”. These interconnected elements demonstrate the prosperous and stable socio-economic conditions and the accumulation of abundant Humanistic Landscapes in the Tianmu Mountain region.

(3) *Mounts—Folk Landscape* As shown in Fig. 9, the words co-occurrence network of the “Mounts—Folk Landscape” consists of 31 Landscape Terms nodes and 274 undirected edges. Research has found that based on the landscape of “Mounts” as the core, the words of the “Mounts—Folk Landscape” can be divided into two layers based on their node degree values. The first layer includes 8 types of Landscape Terms: “Immortals, Divine Worlds, Dreamlands, Poems, Calligraphy and Painting, Songs, Documents, Clothing” (the node degree greater than 18). They are sorted by their connectivity as: Mounts—Immortals > Divine Worlds > Calligraphy and Painting > Poetry > Songs > Dreamlands > Clothing > Documents. The second layer includes 23 types of Landscape Terms: “Jades, Divine Beings, Dragons, Currency, Phoenixes, Musical Instruments, Wine...” (the node degree less than 17). They are sorted by their connectivity as: Mounts—Jades > Divine Beings > Phoenixes > Dragons > Currency > Divine Miracles > Wine...

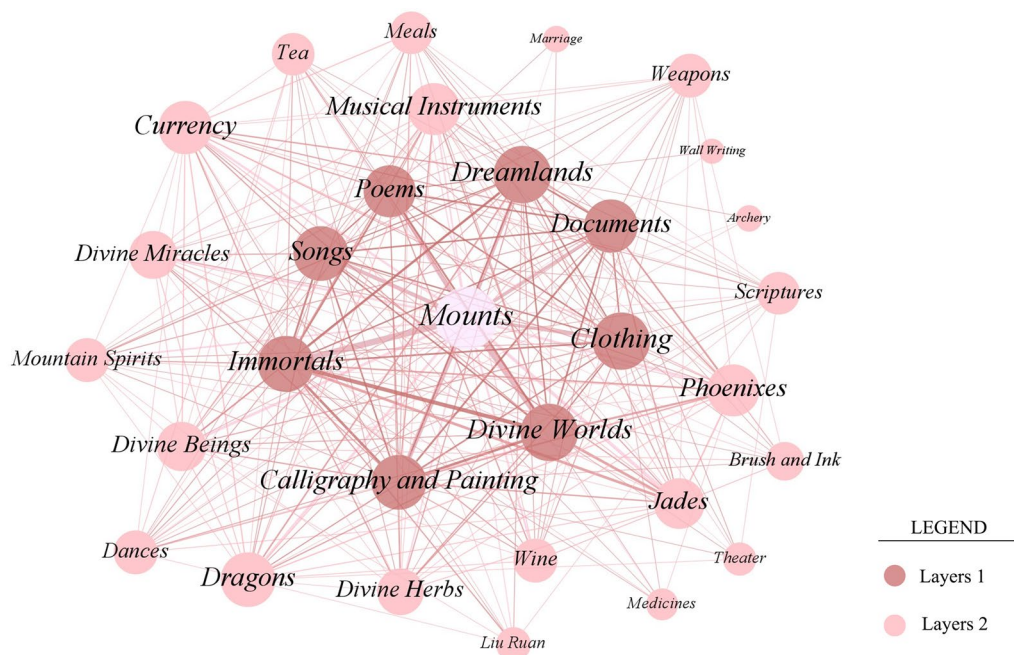


Fig. 9 Co-occurrence network of “Mounts—Folk Landscape”

Table 8 Connection edge weight values of Folk Landscape nodes

Layers	Serial number	Node A	Node B	Weight
First Layers	1	Mounts	Immortals	74
	2	Mounts	Divine Worlds	66
	3	Mounts	Calligraphy and Painting	54
	4	Mounts	Poems	44
	5	Mounts	Songs	44
	6	Mounts	Dreamlands	42
	7	Mounts	Clothing	36
	8	Mounts	Documents	36
Second Layers	1	Mounts	Jade	36
	2	Mounts	Divine Beings	30
	3	Mounts	Phoenixes	28
	4	Mounts	Dragons	28
	5	Mounts	Currency	24
	6	Mounts	Divine Miracles	24
	7	Mounts	Wine	20
...	

This table only lists the cases where the weight value of the connecting edge is greater than 20

As shown in Table 8, the weight value of the connection edge between each Layers-level Landscape Terms and “Mounts” in the co-occurrence network of the word “Mounts—Folk Landscape” can be seen from it:

The association between the Landscape Terms of “Mounts” and “Immortals,” “Divine Worlds,” and “Dreamlands” showcases the picturesque beauty and profound Buddhist and Taoist culture of the Tianmu Mountain region, resembling a realm of immortals. The fusion of these elements gives rise to various mythical stories and legends such as Liu Ruan’s encounter with immortals, the legend of Wangmu, the eighteen eminent monks, the eighteen literati, and Simahui Bridge, among others. Just like the description in Xun Hun’s poem: “To and from between Tiangai and Tianmu Mountain, seeking the true formula to delay aging,” (“来往天台山姥间，欲求真诀驻衰颜”) and Liu Yuxi’s poem: “High banquet tables and discussions that stir the staff, the disciples below are as if awakened from drunkenness.” (“高筵谈柄一麾拂，讲下门徒如醉醒”) These poetic depictions fill Tianmu Mountain with a strong atmosphere of seeking immortality through gathering herbs, pursuing longevity through cultivating Taoism, venerating Buddha, attaining enlightenment, and discussing the profound and the Confucian.

The association between “Mounts” and “Traditional Performances and Dances Landscape Terms”, as well as the association between “Mounts” and “Artistic Crafts Landscape Terms” such as “Poetry,” “Songs,” “Calligraphy and Painting” collectively reflect the historical interactions between literary scholars and the local culture of Tianmu Mountain region. These interactions encompassed entertaining performances, elegant

gatherings, and relationships with distinguished individuals, renowned Taoist, and revered monks. The poetry of Zhang Ji, a poet of the Song Dynasty, exemplifies the vibrant and colorful artistry of local crafts and performing arts, as depicted in lines such as “*Amidst the sound of flutes and drums, the carefree people and native land will celebrate in the lingering spring, with peonies swaying to the tunes of songs and dances.*” (“散人邦人箫鼓里，恰春留，芍药丛歌舞”).

The association between the Landscape Terms “Mounts” and “Clothing”, “Jades”, “Wine”, “Tea”, “Meals” presents a vivid picture of folk customs. The Tang Dynasty poet Jiao Ran wrote, “*The Yue people left me some Shan Stream tea, I collect golden buds and cook them in a golden cauldron... After one sip, my mind clears up and my thoughts become bright and clear, filling the whole world.*” (“越人遗我剡溪茗，采得金芽爨金鼎...一饮涤昏寐，情思朗爽满天地。”) Li Bai, in his poem *Autumn Descends on Jing Gate*, wrote, “*This journey is not for the delicacy of bass, but for my love of entering the beautiful mountains of Shanzhong.*” (“此行不为鲈鱼脍，自爱名山入剡中”) The Qing Dynasty poet Yan Boxun wrote, “*In spring, we gather fresh water chestnut grass, and in autumn, we count the scales of the fish.*” (“春蒹丝就拏，秋鱼鳞堪数”) These poetic lines document the unique

local products such as yellow wine, tea leaves, bass, water chestnut grass, etc., providing important historical evidence for the rich and diverse folk life in the area.

From the words co-occurrence network of the “Mounts Landscape Terms—Folk Landscape Terms” in Tianmu Mountain’s poems, it can be found that: “The popular stories and legends—The unique scenery and special products—The colorful arts and crafts and folk songs and dances” have a long history and have been passed down from generation to generation, showing the Tianmu Mountain is characterized by mysterious, varied and unique Folk Landscapes.

Association with “Mountainous Region”

(1) *Overall characteristics of Landscape Terms co-occurrence networks* Analyzing the interrelationships among the “Natural Landscape, Humanistic Landscape, and Folk Landscape” in the Tianmu Mountain region, the research utilizes the “ForceAtlas2” layout in Gephi to construct a co-occurrence network of Landscape Terms, specifically “Natural Landscape—Humanistic Landscape—Folk Landscape” (Fig. 10). This network consists of 113 types of Landscape Terms nodes and 3470 undirected edges, reflecting the strength of connections between different Landscape Terms. Nodes with degree values ranking in

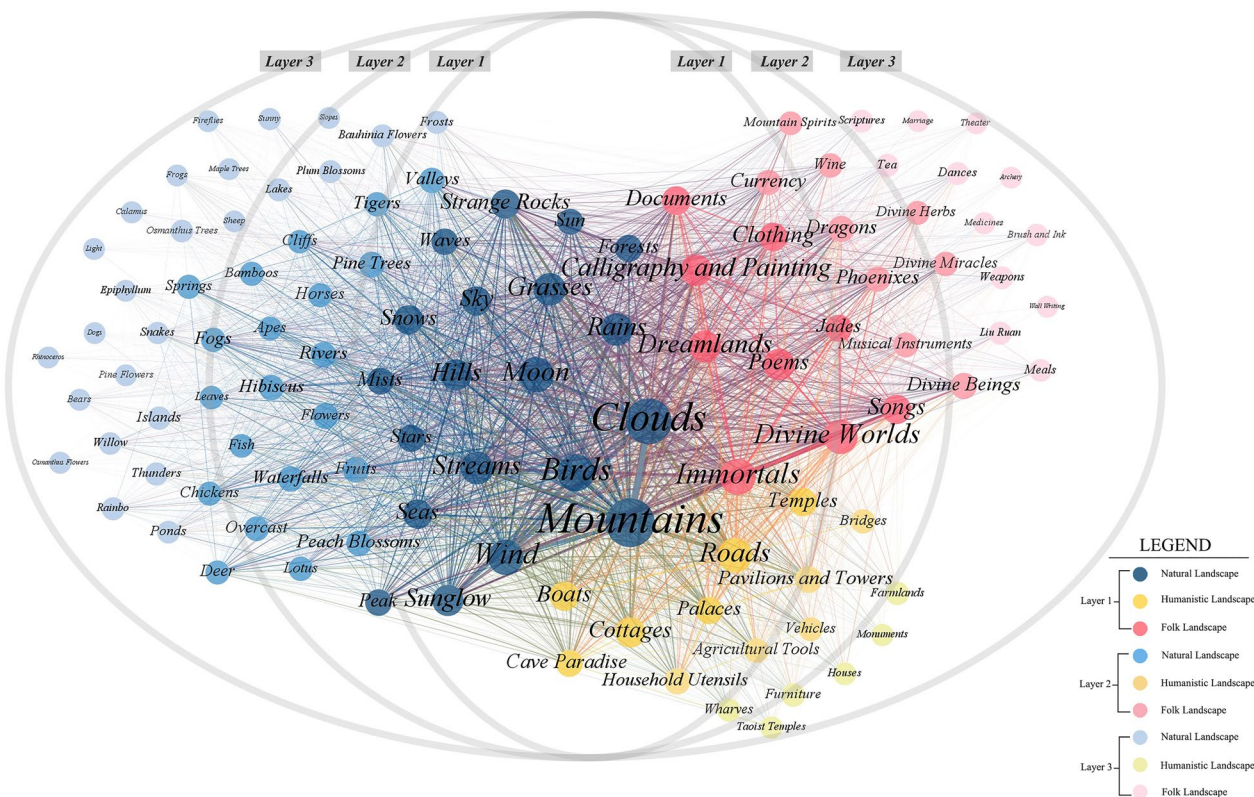


Fig. 10 Co-Occurrence network of Landscape Terms in Tianmu Mountain

Table 9 Layer division of Landscape terms

Landscape types	Natural Landscape	Humanistic Landscape	Folk Landscape
Core Words	Mountains (144), Clouds (127)	—	—
First Layers (The Node Degree in the Top 30%)	Birds (81), Moon (73), Wind (73), Streams (60), Rains (58), Grasses (58), Sunglow (51), Hills (51), Seas (42), Sky (41), Snows (41), Strange Rocks (41), Forests (31), Stars (30), Mists (28), Peaks (27), Waves (27), Sun (24)	Roads (69), Cottages (46), Boats (41), Temples (36), Palaces (30), Cave Paradise (28)	Immortals (77), Divine Worlds (66), Dreamlands (55), Calligraphy and Painting (53), Poems (53), Songs (41), Documents (38), Clothing (37), Jades (28)
Second Layers (The Node Degree in the Top 30%—60%)	Pine Trees (23), Flowers (22), Fruits (22), Valleys (21), Waterfalls (21), Rivers (21), Peach Blossoms (20), Hibiscus (20), Overcast (17), Fogs (16), Tigers (16), Lotus (16), Chickens (14), Horses (14), Deer (14), Bamboos (14), Springs (14), Apes (13), Fish (12), Leaves (11), Cliffs (11)	Pavilions and Towers (28), Household Utensils (24), Agricultural Tools (16), Bridges (15), Vehicles (13)	Dragons (25), Divine Beings (25), Currency (20), Phoenixes (20), Musical Instruments (18), Wine (16), Divine Miracles (16), Divine Herbs (13), Mountain Spirits (12)
Third Layers (The Node Degree after 60%)	Islands (10), Thunders (9), Rainbow (8), Frosts (8), Bauhinia Flowers (8), Lakes (8), Plum Blossoms (7), Ponds (7), Osmanthus Trees (6), Willow (6), Sunny (4), Snakes (4), Osmanthus Flowers (3), Calamus (3), Light (2), Sheep (2), Dogs (2), Fireflies (2), Rhinoceros (2), Bears (2), Frogs (2), Epiphyllum (2), Pine Flowers (2), Maple Trees (2), Slopes (2)	Furniture (11), Farmlands (10), Wharves (9), Houses (7), Taoist Temples (5), Monuments (4)	Liu Ruan (9), Tea (8), Weapons (8), Dances (7), Scriptures (7), Meals (6), Brush and Ink (6), Medicines (4), Marriage (2), Wall Writing (2), Theater (2), Archery (2)

Nodal degree values are in parentheses for each Landscape Terms

the “top 30%,” “30%–60%,” and “bottom 60%” within each landscape category are identified, and the network is divided into three nested layers accordingly (Table 9).

From the results of the co-occurrence analysis, it is observed that the Natural Landscape Terms “Mountains” (node degree value 144) and “Clouds” (node degree value 127) occupy central positions in the entire co-occurrence network. The relationship between the terms “Natural Landscape—Humanistic Landscape—Folk Landscape” exhibits a concentric pattern with “Mountains” and “Clouds” as the core and radiating outward. In the first layer, there are 18 types of Natural Landscape Terms such as “Moon,” “Wind,” “Streams,” “Snows,” “Stars,” 6 types of Humanistic Landscape Terms including “Roads,” “Cottages,” “Boats,” “Temples,” “Palaces,” “Cave Paradise,” and 9 types of Folk Landscape Terms like “Immortals,” “Divine Worlds,” “Dreamlands,” “Calligraphy and Painting,” “Poems,” “Songs.” As the network expands from the second layer to the third layer, there is an increase in the

number of terms, but the connection strength between terms progressively weakens.

(2) *Cluster characteristics of Landscape Terms co-occurrence networks* Utilizing the “Modularity” function in Gephi, the co-occurrence network of Landscape Terms is clustered, with different clusters distinguished based on the varying degrees of connectivity between nodes. Nodes within the same cluster exhibit higher connectivity, while connectivity between nodes in different clusters is relatively lower. Each cluster reflects the cohesive grouping characteristics formed by the high connectivity of the 3 types of Landscape Terms. Similarly, the network comprises 113 types of Landscape Terms nodes and 3470 undirected edges. Nodes ranking in the “top 30%,” “30%–60%,” and “bottom 60%” in terms of node degree are identified for each cluster, and the clustered network is divided into layers (Table 10). This division aims to compare the dominant features of different clusters, providing a com-

Table 10 Layer Division of Landscape Terms Clusters

Clusters	Landscape types	First layers (the node degree in the top 30%)	Second layers (the node degree in the top 30%–60%)	Third layers (the node degree after 60%)
Cluster 1	Natural Landscape	Birds (81), Sunglow (51), Hills (51), Sky (41)	Flowers (22), Cliffs (11)	Pond (7), Calamus (3), Dogs (2), Bears (2)
	Humanistic Landscape	Cottages (46), Cave Paradise (28)	–	Taoist Temples (5)
	Folk Landscape	–	Dragons (25), Phoenixes (20), Divine Miracles (16)	Marriage (2)
Cluster 2	Natural Landscape	Seas (42), Snows (41), Waves (27)	Pine Trees (23), Overcast (17), Deer (14), Fish (12)	Bauhinia Flowers (8), Plum Blossoms (7), Sunny (4), Snakes (4), Light (2), Frogs (2)
	Humanistic Landscape	Roads (69), Palaces (30)	Pavilions and Towers (28), Household Utensils (24), Agricultural Tools (16), Vehicles (13)	–
	Folk Landscape	–	–	Weapons (8), Medicines (4)
Cluster 3	Natural Landscape	Mountains (144), Clouds (127), Moon (73), Wind (73), Rains (58), Grasses (58), Peaks (27), Sun (24)	Lotus (16), Chickens (14), Bamboos (14), Apes (13)	Thunders (9), Rainbow (8), Rhinoceros (2), Epiphyllum (2)
	Humanistic Landscape	Temples (36)	–	Monuments (4)
	Folk Landscape	Dreamlands (55)	Mountain Spirits (12)	Wall Writing (2), Archery (2)
Cluster 4	Natural Landscape	Stars (30)	Valleys (21), Fogs (16), Springs (14), Leaves (11)	Islands (10), Sheep (2), Fireflies (2), Maple Trees (2), Slopes (2)
	Humanistic Landscape	–	–	–
	Folk Landscape	Clothing (37)	Divine Beings (25), Wine (16)	Brush and Ink (6)
Cluster 5	Natural Landscape	Strange Rocks (41), Forests (31), Mists (28)	Fruits (22), Waterfalls (21), Peach Blossoms (20), Hibiscus (20)	Osmanthus Trees (6), Osmanthus Flowers (3), Pine Flowers (2)
	Humanistic Landscape	–	–	Furniture (11), Farmlands (10), Wharves (9)
	Folk Landscape	Immortals (77), Divine Worlds (66), Calligraphy and Painting (53), Songs (41), Jades (28)	Divine Herbs (13)	Liu Ruan (9), Tea (8), Dances (7)
Cluster 6	Natural Landscape	Streams (60)	Rivers (21), Tigers (16), Horses (14)	Frosts (8), Lakes (8), Willow (6)
	Humanistic Landscape	Boats (41)	Bridges (15)	Houses (7)
	Folk Landscape	Poems (53), Documents (38)	Currency (20), Musical Instruments (18)	Scriptures (7), Meals (6), Theater (2)

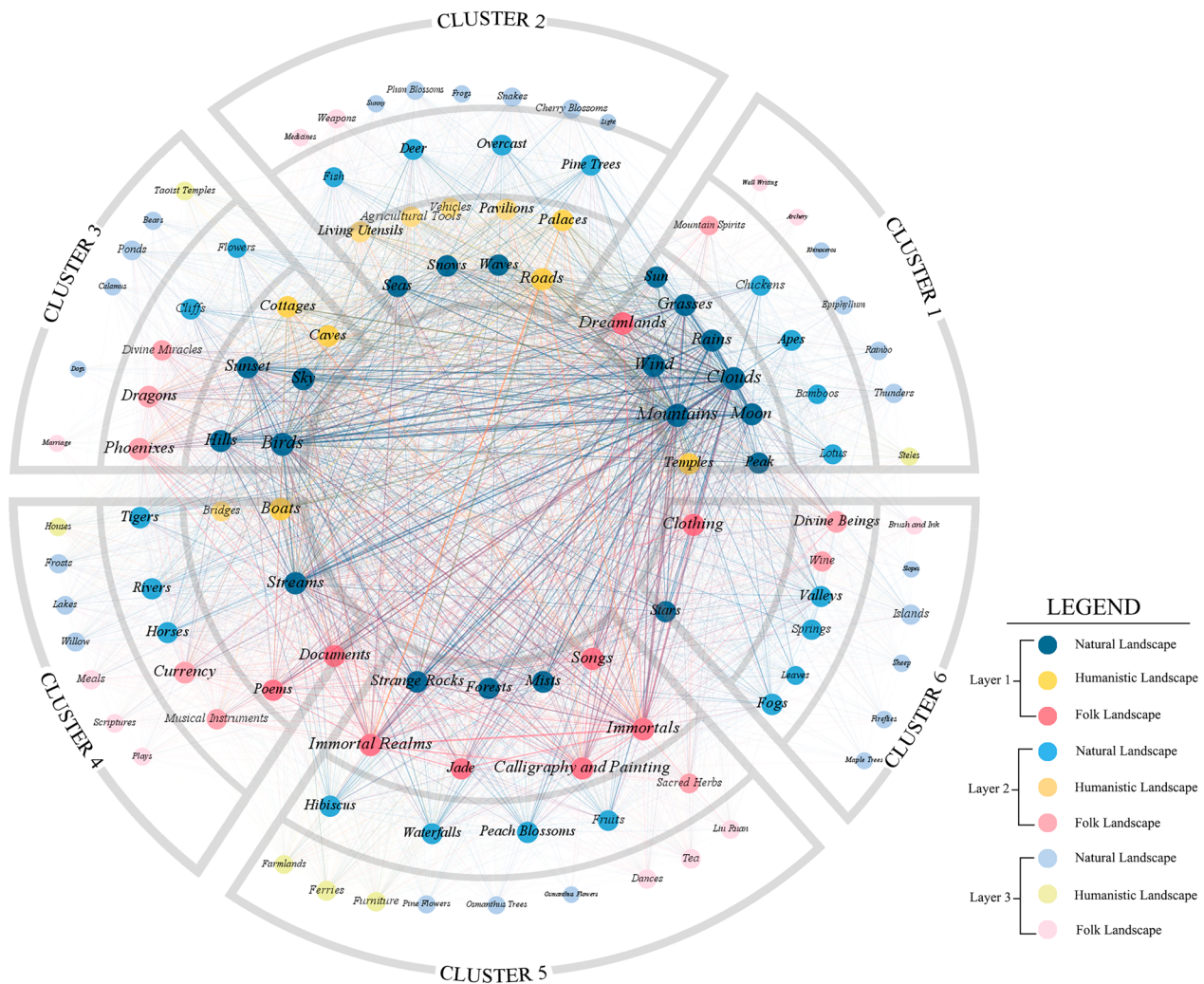


Fig. 11 Co-Occurrence network of Landscape Terms Clusters in Tianmu Mountain

prehensive summary of the shared associative significance of all clusters in interpreting the overall characteristics of the Cultural Landscape of Tianmu Mountain.

The research findings reveal that the co-occurrence network of Landscape Terms can be classified into six clusters (Fig. 11). Cluster 1 is mainly about Humanistic Landscape related to “Taoism” and Natural Landscape of “Celestial Phenomenon, Animals and Plants.” Cluster 2 focuses on Humanistic Landscape of “Urban Area” and Natural Landscape of “Rivers and Lakes, as well as Weather.” Cluster 3 is centered around Humanistic Landscape related to “Buddhism,” Natural Landscape of “Mounts, and Celestial Phenomena,” and Folk Landscape related to “Stories and Legends.” Cluster 4 is mainly about Natural Landscape of “Celestial Phenomena” and Folk Landscape related to “Special Local Products.” Cluster 5 focuses on Natural Landscape of “Mounts” and Folk Landscape related to the

“Stories and Legends.” Cluster 6 mainly involves in Natural Landscape of “Rivers and Lakes,” Humanistic Landscape related to “Water and Land Transportation,” and Folk Landscape related to “Traditional Performances and Dances, as well as Arts and Crafts.” All clusters exhibit a close connection between the 3 types of Landscape Terms, namely “Natural Landscape—Humanistic Landscape—Folk Landscape,” but there are significant differences in the cohesive grouping characteristics formed by these terms across different clusters (Table 10).

From the layer division, it can be observed that in “Clusters 1 to 6,” the 18 types of Natural Landscape Terms, such as “Mountains, Clouds, Birds, Streams, Seas, Sky, Snows, Strange Rocks, Forests, Stars,” the 6 types of Humanistic Landscape Terms, like “Roads, Cottages, Boats, Temples, Palaces, Cave Paradise,” and the 9 types of Folk Landscape Terms, such as “Immortals, Divine

Worlds, Dreamlands, Calligraphy and Painting, Poems, Documents, Clothing” are the Landscape Terms with the highest edge connectivity strength in each cluster. These form the first layer of greatly connected vocabulary describing the Cultural Landscape of Tianmu Mountain. As the network expands from the second layer to the third layer, there is a growth in the number of Landscape Terms, but the connectivity strength of the nodes continuously diminishes. This reflects a pattern of decreasing lexical association strength in describing the Cultural Landscape of Tianmu Mountain, from strong to weak as it extends from the second to the third layer.

(3) *Analysis of the association characteristics and causes of the Cultural Landscape based on the Landscape Terms co-occurrence network in Tianmu Mountain* From the analysis of the overall characteristics and cluster characteristics of the Landscape Terms co-occurrence network mentioned above, it can be observed that the six clusters exhibit prominent cores and tight connections, forming three nested layers that expand progressively. This reveals the structural characteristics of clusters and stratification through the association and interaction between among Natural Landscape at their core, Humanistic Landscape, and Folk Landscape. These features collectively reflect the high degree of integration and close correlation between the natural and cultural aspects in the Tianmu Mountain region.

In both network features, the first layer encompasses Natural Landscape Terms such as “Celestial Phenomenon, Weather, Mounts, Rivers and Lakes, Animals, And Plants,” which are closely associated with Humanistic Landscape Terms like “Temples, Cave Paradise,” and Folk Landscape Terms like “Immortals, Divine Worlds.” The close association features between Natural Landscape Terms and those religious-themed terms are evident in both Cluster 1 and Cluster 3. When poets depict Taoist concepts of “Cave Paradise,” they often intertwine with natural landscapes such as “Sky, Sunglow, Mountain, Birds,” and mythological elements like “Dragons, Phoenixes.” Similarly, when poets visit Buddhist “Temples” for worship, their verses may include references to natural landscapes such as “Mountains, Clouds, Moon, Wind, Rain,” and mythical elements like “Dreamlands, Mountain Spirits.” This phenomenon can be attributed to the religious features of cultivating both Buddhism and Taoism in the Tianmu Mountain, where numerous Buddhist temples and Taoist sacred sites have existed since the Eastern Jin dynasty.

These characteristics are substantiated by the poetry. During the Tang Dynasty, the poet Song Zhiwen wrote in his poem *Farewell to the Monk on the Lake*: “I wish to be close to Taoistic forest, and focus on the carefree

chapter.” (“愿与道林近，在意逍遥篇”) In the Song Dynasty, poet Lu You wrote in his poem *Composing on the Boat*: “From Shanzhong, it’s not far away, where I will meet with Master Zhi to listen to the sound of monkeys.” (“剡中此去无多地，会约支公听断猿”) Both “Taoistic Forest” and “Master Zhi” in these poems refer to the eminent monk Zhi Dun from the Eastern Jin Dynasty. In the Qing Dynasty, poet Zhuo Zhaochang wrote in his poem *Ballad of the Immortal Mountains*: “There is the Hongya Well above, and the immortal mansion of Xu Xian in front of the peak lies. Ascending the summit freely, one can trace the footsteps of immortals.” (“上有洪崖井，峰前许仙宅。逍遥登绝巅，来往仙人迹”) In this poem, “Xu Xian” refers to the Taoist Heavenly Teacher Xu Xun who cultivated himself in the area during the Eastern Jin Dynasty. The frequent appearance of “violet sunglow, Jade Pavilion and Divine Mountain” and other mystical places, as well as the depiction of “Liu Ruan, Wangmu” and other characters in poetry throughout different dynasties, reflect the profound influence of Taoism in the Tianmu Mountain region. The mentions of “Zen rooms, Zen courtyards, Zen temples, Zen masters, Zen visitors” by the poets reflect the flourishing Buddhist culture in this area. This demonstrates the profound and extensive influence of Buddhism and Taoism in the Tianmu Mountain region over the ages, as well as the nurturing and promoting role of the extraordinary and beautiful landscape on religious development.

In both network features, the Natural Landscape and Humanistic Landscape in the second and third layers are continuously enriched in terms of quantity and diversity based on the first layer. The description of Natural Landscapes blends with the depictions of cultural life in the Tianmu Mountain region, including “Palaces, Pavilions and Towers”, “Cottages, Agricultural Tools, Farmlands”, “Calligraphy and Paintings, Documents, Songs and Dance”. The close connection between Natural Landscape Terms and culturally related Landscape Terms is also reflected in the group relationships in Cluster 2, 5, and 6. When poets explore “Palaces, Temples, and Gardens,” they often mention “Roads, Vehicles, and Agricultural Tools” and natural landscapes such as “Seas, Snows, and Waves” along the way. When appreciating “Strange Rocks” and “Forests,” poets simultaneously describe surrounding natural landscapes like “Waterfalls, Flowers, Fruits, and Mists,” as well as expressing admiration for elements like “Immortals, and Divine Worlds.” When poets travel by “Boats” and navigate “Streams,” they incorporate the sights of “Bridges, Houses, Animals, Plants, Food, and Music” encountered along the route into their “Paintings, Poems, and Documents.” This phenomenon can be attributed to the enchanting

landscapes of Tianmu Mountain, adorned with lush forests, verdant grasslands, scattered lakes, and extraordinary rock formations. The region boasts convenient water and land transportation, picturesque villages with well-constructed houses, fertile fields, bustling towns with magnificent buildings, and a cultural atmosphere where literati gather in elegant chambers, enjoying fine wine and cuisine, playing the zither, composing poems, and engaging in philosophical discussions since the Wei and Jin dynasties.

These characteristics are also corroborated by poetry. Since the Eastern Jin Dynasty when the calligraphy sage Wang Xizhi composed the poem *"Inscription on Gu Mountain"* and Xie Lingyun, the founder of Chinese landscape poetry in the Southern and Northern Dynasties period, wrote lines like *"I spend the night in Mount Yin, and in the morning ascend Tianmu Mountain,"* (暝投剡中宿, 明登天姥岑) later generations of literati and artists have flocked here, constantly exploring and tracing the footsteps and cultural resource of their predecessors, relying on poetry as evidence. The lines from Tang Dynasty poet Li Bai, *"The feet stand on Xie Gong's wooden clogs while the body ascends the ladder to the azure clouds,"* (脚著谢公屐, 身登青云梯) Song Dynasty poet Li Peng, *"After indulging in evening tranquility, I rinsed my mouth outside the Shatin region, without envying the illustrious ascend to Tianmu Mountain's peak,"* (余酣晚漱沙汀外, 未羨明登天姥岑) Ming Dynasty poet Lu Shen, *"I am grateful for the hospitality extended by the guests, as I ascend the mountains wearing humble footwear. I humbly acknowledge that I fall far short of the literary talent possessed by the renowned poet, Sun,"* (不辞谢客登山屐, 远愧孙郎作赋才) and Qing Dynasty poet Yuan Jing, *"In the upcoming spring, I plan to present a poetic tribute to Mr. Xie by wearing his humble straw sandals. On the glorious peak of Mount Hua, we will both witness the vibrant hues of the first sunrise of the season,"* (来春拟著谢公屐, 华顶同看初日红) all pay tribute to their common idol Xie Lingyun. The poet Yu Liangneng's *"The spirit of Tianmu Mountain tires the immortal Tai Bai, while the imagination of Chicheng Mountain endows Xing Gong"* (天姥梦魂劳太白, 赤城想象赋兴公) is a response by later poets to the famous work *Dreaming of Traveling to Tianmu Mountain and Leaving a Farewell Poem* by the Tang Dynasty poet Li Bai. Similarly, the Ming Dynasty poet Zheng Shanfu's *"The Tiantai Mountain forty-eight thousand feet high, overlooking a flying rainbow crossing a stone bridge"* (天台四万八千丈, 俯看飞虹度石桥) and the Qing Dynasty poet Chen Chengran's *"The immortal Tai Bai's poetic brush spans horizontally, flying through the Red Cloud City in a dream"* (太白谪仙诗笔横, 梦中飞度赤霞城) are also responses to Li Bai's

masterpiece. It can be seen that although many poems have spanned thousands of years, the traditions, customs, and cultural lifestyles established by the scholars and elites of the Six Dynasties have greatly influenced poets of later generations. The homage, reflections, and pursuits of the previous masters and their works in this place have contributed to the accumulation and inheritance of the cultural spirit of the Wei and Jin dynasties along the poetic route. Each new creation in each era adds to the previous poets, works, and allusions, creating a greater "Siphon Effect," which has led to broader social recognition of the exceptional nature, culture, history, and local customs, allowing the influence of Tianmu Mountain to endure for a long time.

(4) *The interrelationship between cultural Landscape of Tianmu Mountain and the Artistry of Poetry* The association of the various Landscape Terms among the six clusters and the three nested layers is not a simple juxtaposition or concatenation of words, rather it is an artful expression that combines and creates a connection between regional natural landscapes, cultural customs, social trends, and spiritual realms using language that is elegant, vivid, concise, harmoniously phonetic, and adheres to metrical principles. This artistic expression comes from the subjective experience of poets who "sense the world and express their aspirations through poetry," incorporating the subjective "meaning" and transforming it into artistic works through the creative composition of poetic lines, which harmoniously unify form and content.

After personally witnessing, poets express the majestic and misty mountain landscapes of Tianmu Mountain using phrases like *"Tianmu Mountain reaches up to the sky"* (天姥连天向天横)(Li Bai, *Dreaming of Traveling to Tianmu Mountain and Leaving a Farewell Poem*), *"Countless layered peaks beyond Yue's absoluteness"* (越绝峰峦万叠余) (Shi Xianshun, *Traveling to Wozhou Mountain*), *"Scarlet clouds rise above Chicheng Mountain connecting to the heavenly Tianmu Mountain"* (赤城霞起连天姥)(Zhang Ji, *Congratulations to the Groom*), and *"Misty rain veils the distant valley with clouds and rosy dusk"* (雨后烟霞笼远谷) (Wang Wenxue, *Tianmu Mountain Poetry*). The use of verbs like "stretches," "layered," "rise" and "veils," in the literary expressions highlights the dynamic beauty of the mountain scenery. After hearing it with my own ears, the poetic lines *"Clear monkeys' cries echoing in the rippling water"* (绿水荡漾清猿啼)(Li Bai, *Dreaming of Traveling to Tianmu Mountain and Leaving a Farewell Poem*) and *"Cicadas harmonizing with a clear chant"* (蝉合伴清吟) (Lin Bu, *Summer Day in the Monastery and Replying to Zhu Zhongfang*) portray the sounds of animals in the mountains. The verse *"The wind howls as the dragon emerges from the water"*

(“云龙出水风声急”) illustrates the sound of wind in the mountains. The lines “*The sound of water along the ravine is accompanied by the melodies of flutes*” (“水声沿洞有笙簧”)(Cao Tang, *Meeting a Fairy in Liu Guan Cave*) and “*The flowing springs and waterfalls rush through deep ravines*” (“流泉瀑布奔深涧”)(Deng Yunxiao, *Song of Tianmu Mountain and Farewell to Li Boyuan*) depict the sound of water in the mountains. The phrases “*The evening drums and morning bells, woodcutters’ songs and shepherds’ flutes, and the melodies of leaves, reeds, and flutes*” (“暮鼓晨钟、樵歌牧笛, 韵叶笙簧”)(Wang Shouzheng, *Parallel and Preface to Nanshan Fu*) present the sounds of people in the mountains. The immersive and vivid sounds of nature are conveyed through poetic expressions such as “*The flowing water fills the ravine with the fragrance of peach blossoms*” (“流水桃花满涧香”)(Cao Tang, *Thoughts of Liu Guan and Ruan Ji in Fairy Cave*) and “*The fragrance of wildflowers on the path in the spring breeze*” (“春风陌上野花香”)(Shi Xinghai, *On the Way to Tianmu Mountain*). After experiencing the scent firsthand, one can use poetic verses like “*The Liu Ruan peaches are as sweet as melons, and the stream rice is flavored with sesame*” (“刘阮桃如瓜, 溪饭熟胡麻”)(Ding Fu, *A Return to Wu Region with Kwai Weng*) and “*This journey is not for the delicacy of bass*” (“此行不为鲈鱼脍”)(Li Bai, *Autumn Descends on Jing Gate*) to describe the unique and delicious local delicacies of Tianmu Mountain. Upon personal encounter, poetic lines such as “*The winding mountain road twists like a coiled sheep’s intestine*” (“萦纡岭路绕羊肠”)(Li Guang, *A Humble Verse*) depict the dynamic and meandering landscape, while lines like “*Miaolian Pavilion opens to the surrounding peaks*” (“妙莲开阁对群峰”)(Luo Shi, *Inscription on the Wondrous Lotus Pavilion of Ten Thousand Years*) and “*The pine and cypress trees in front of the hall appear dim and solemn, apricot trees surround the immortal altar and water encircles the corridors*” (“殿前松柏晦苍苍, 杏绕仙坛水绕廊”)(Xue Feng, *Inscription on the Chun Tai Guan*) illustrate the impressive and well-structured temple and garden views. The aforementioned descriptions are now translated into academic English without altering their original meanings.

After experiencing and exploring the “five senses” through the “five facial features”, poets often place their emotions in mountains and rivers, expressing their feelings in their poems. They may lament the unfulfilled ambitions and talents, express patriotic sentiments, draw inspiration from the past to criticize the present, pay tribute to the achievements of the predecessors, express longing for loved ones and deep affection, or reflect on the vicissitudes of life to clarify their goals. In Li Bai’s famous work “*Dreaming of Traveling to Tianmu Mountain and Leaving a Farewell Poem*”, he first depicts the

scenery with the lines “*The Tiantai Mountain forty-eight thousand feet high, and looking down, it appears as if the southeast will overturn*”. (“天台四万八千丈, 对此欲倒东南倾”) Afterwards, he expresses his aspirations with the lines “*Why should I lower my eyebrows and bend my back to serve the mighty? Let me not have a happy countenance*.” (“安能摧眉折腰事权贵? 使我不得开心颜”) The poem was written while Li Bai was drunk and ordered to remove the boots of Gao Lishi, the favored minister of Emperor Xuanzong of Dynasty Tang. It reflects the romantic and carefree nature of the poet as well as his desire to escape and retreat from the real world. Du Fu also employs the same technique in his work *Roaming*, depicting scenery and then expressing his emotions with the lines “*I disobeyed my superiors in the imperial examination, So I resigned from the office of the capital judge. I roamed about the states of Qi and Zhao, And suddenly, my clothes and horses became quite wild*.” (“忤下考功第, 独辞京尹堂。放荡齐赵间, 裘马颇清狂”) He expresses the pain of the chaos in the world after the An Lushan Rebellion, his helplessness in his pursuit of fame and accomplishments, and his frustration in serving his country with no opportunities. He expresses his feelings about life and clarifies his goals.

It is evident that the coupling of landscape space with poetic expression is perfectly integrated. Influenced by the values and aesthetics of Chinese culture of “learning from nature” and “man-nature harmony,” This forms the spatial artistic conception of “blending picturesque charm and poetic grace” in Tianmu Mountain, presenting the artistic characteristics of “poetic landscapes” unique to the local area. The historical poetry and literature of the region bear witness the aesthetic appreciation and experiential modes of Tianmu Mountain since ancient times.

Multi-relationship model of associative Cultural Landscape

Based on the aforementioned association analysis, the study reveals that the poetry across various dynasties in Tianmu Mountain exhibits characteristics of four relationships: “Group Relationship, Hierarchical Relationship, Interactive Relationship, and Cognitive Relationship.” As illustrated in Fig. 12 below.

1. Group Relationship: In Tianmu Mountain, there are six clusters with a “Dominant-Subordinate” structure among the three categories of “Natural Landscape—Humanistic Landscape—Folk Landscape.” Each cluster exhibits an overall characteristic of “clear dominant features and closely interconnected elements,” reflecting the profound integration between nature and humanities in the Tianmu Mountain region.

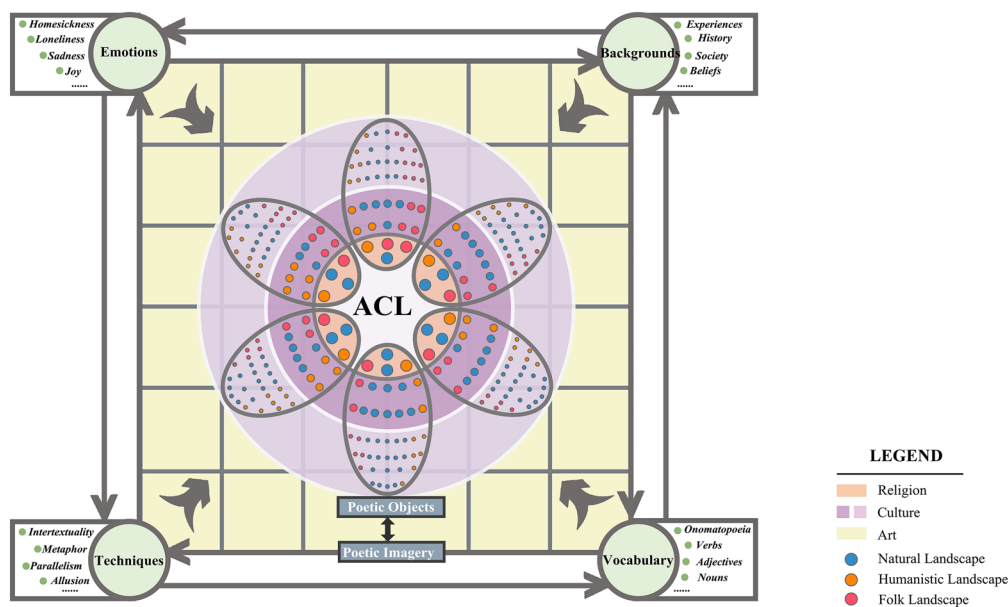


Fig. 12 Multi-relationship Model of Associative Cultural Landscape. Note: in the figure, ACL refers to Associative Cultural Landscape

2. Hierarchical Relationship: Three categories of Landscape Terms, “High-connectivity terms coupling, mutual correlation interpreting,” form three nested and progressively expanding nested layers. In the first layer, the largest number of Natural Landscape Terms, intertwines with Humanistic Landscape Terms reflecting “religious” characteristics, collectively concentrating on embodying the local characteristic of “cultivating both Buddhism and Taoism.” In the second and third layers, the quantity and diversity of Natural Landscape Terms, along with the other two categories, continue to enrich based on the first layer. However, the connectivity strength between terms diminishes progressively, reflecting a “from strong to weak” pattern, reflecting the local cultural characteristic of “multifaceted composition and accumulation.” The landscape spaces referred to by the three nested layers of Landscape Terms are perfectly integrated with the artistic expression of poetry, forming the spatial artistic conception of “blending picturesque charm and poetic grace” in Tianmu Mountain. This presents the artistic characteristics of “poetic landscapes” unique to the local area.
3. Interactive Relationship: Six clusters and three nested layers form closely related interactive relationships. The Group Relationship within the six clusters, namely “Natural Landscape—Humanistic Landscape—Folk Landscape,” require accurate interpretation within the “Religion, Culture, or Art” layers. Conversely, the characteristic relationships formed by the three nested layers also need to influence the

six clusters for a rational reflection. The interaction between clusters and layers creates an interplay of “cluster-layer co-construction, network interweaving, and correlated mutual interpretation.” Together, they embody the close association between the nature and humanities in the Tianmu Mountain region.

4. Cognitive Relationship: The Cultural Landscape expressed in the poems of Tianmu Mountain embody two cognitive levels, namely, “Objects—Imagery.” “Objects” represents the objective existence of Cultural Landscape, serving as the basic elements in verses and lines that constitute Natural Landscape, Humanistic Landscapes, and Folk Landscapes in the objective world. “Imagery” refers to the poet’s integration of their subjective experiences of objective phenomena with their Background (History, Society, etc.) and Emotions (Homesickness, Joy, etc.), processed and created by means of expressive Techniques (Metaphor, Parallelism, etc.) and Vocabulary (Adjective, Pronouns, etc.) to create a comprehensive artistic presenting. The overall relationship between “Objects—Imagery” exhibits a cognitive relationship.

Discussion

1. How to reveal the association between natural elements and “religion, culture, or art” is the key scientific proposition for defining the Associative Cultural Landscape. This research proposes that the Chinese poems from different historical periods contain a richly diverse “Genetic Code” of natural, historical

and cultural information. By excavating the landscape information in poetry texts, we can better explore and interpret the relationship between nature and humanities in this region. This hypothesis has been validated through the frequency statistics and association analysis of Landscape Terms in Tianmu Mountain poetry. From a quantitative perspective, this elucidates the characteristics of four relationship modes of the Associative Cultural Landscape: “Group Relationship, Hierarchical Relationship, Interactive Relationship, and Cognitive Relationship.” It reveals the close association between natural elements in the Tianmu Mountain and “religion, culture, or art.” The research results not only responds to the criteria defined by the World Heritage Committee for Associative Cultural Landscape from the perspective of poetry by text mining, but also interprets requirements such as “unique or exceptional testimony to a cultural tradition or civilization” and “related to outstanding artistic and literary works with universal significance” from WHC documents [1–3], as well as requirements for natural features such as “regions with exceptional natural beauty” or “regions of exceptional aesthetic importance,” and the assessment of the interaction between the natural environment and humanities from the perspectives of authenticity and integrity [1–3]. Moreover, the requirements mentioned in the WHC documents [1–3], such as Associative Cultural Landscape also include the intangible, such as the acoustic, kinetic (e.g., Air movements) and olfactory, as well as the visual (e.g., patterns of light, colors and shapes in landscape),” can also be demonstrated and explained through the analysis of poetry. The research findings provide the support of theories and methods for understanding the characteristics and interpreting the association of global Associative Cultural Landscape, expand the current research perspectives from the perspectives of film media [7], indigenous peoples [6], and the Philosophy Tree [5], as well as important scientific basis for their overall conservation and sustainable utilization.

2. Elucidating the relationship between literary phenomena and the geographical environment is a significant proposition in literary geography. Since the 1980s, various research methods, such as textual analysis, historical and cultural research, and comparative research, have qualitatively analyzed and summarized cultural connotations and features presented in “a specific poet’s works” [26], “certain poems” [27–31], or “all poems from a specific location” [32, 33]. In recent years, the integration of text mining and GIS-based spatial analysis with liter-

ary geography and Cultural Landscape research has produced a series of visual and quantitative research results. Scholars such as Zhang [34], Li [35], and Wei [36] demonstrated this integration by analyzing textual information from the poetry of Li Bai and Du Fu, utilizing GIS to summarize spatial characteristics and patterns, and creating spatial maps. Wu [14] conducted text mining on nearly 400 Tang Dynasty poems, categorizing the Guanzhong region into different types of landscape spaces and creating spatial maps. Xi [37] and Li [38] utilized digital humanities methods to analyze nearly 1600 poems along the Road of Tang Poetry in Eastern Zhejiang. They separately summarized the overall spatial pattern of the Cultural Routes and the spatial patterns of cities along the route, while also explaining their characteristics and causes. It is evident that traditional research methods and the integration of digital humanities methods in recent years complement each other, mutually benefiting and providing a reliable methodological framework for a comprehensive understanding of the mutual relationships between literary phenomena and geographical environments. Moreover, integration with the digital humanities can better provide data support for traditional literary geography and Cultural Landscape research from quantitative and visual perspectives.

Currently, research on the Cultural Landscape of the Tianmu Mountain region primarily unfolds from the perspective of traditional literary geography. Through historical records, geographical descriptions, poetry, travelogues, and other literature, scholars have elucidated the geographical location, historical significance, myths, and religious characteristics of Tianmu Mountain [39]. They have delved into the cultural development processes and reasons behind the formation of Buddhism and Taoism in the region [16], as well as summarized humanistic features such as poetry, literati, Buddhism, and tea culture in the Tianmu Mountain area [40]. These studies have been confined to analytical methods and qualitative summaries from the perspective of traditional literary geography, lacking quantitative analyses of the association between various landscape types in the Cultural Landscape and a summary of their characteristics and patterns. The scientificity of the research needs further enhancement. This study, through text mining of poetry, quantitatively summarized the association features among the “Natural—Material—Intangible” elements of Tianmu Mountain. It scientifically revealed the Interactive Relationship between natural elements and religious, cultural, and artistic aspects. The research findings complement those

achievement through local traditional literary geography research methods, providing mutual support. They not only contribute to the quantitative and visual aspects but also offer data support for traditional literary geography and Cultural Landscape research in the Tianmu Mountain region. This, in turn, provides a novel research perspective and a quantitative scientific basis for a deeper interpretation of the complex relationship between nature and humanities in the Tianmu Mountain region.

3. Research findings can provide essential scientific basis for the overall conservation of natural and cultural resources in the Cultural Landscape of Tianmu Mountain. In 2022, the Forestry Bureau of Zhejiang Province and the People's Government of Xinchang County organized the formulation of the guiding planning document "Tianmu Mountain Scenic Area Comprehensive Plan (2022–2035)." A comparative analysis between the research results of this article and the "Resource List of Scenic Areas" within the plan revealed significant omissions and deficiencies in the statistical aspects of local resources in the plan. For instance, in the statistics of Celestial Phenomenon and Weather landscape resources, only "Clouds" were listed, and the count of biological resources was 0. The statistical focus on Humanistic Landscape resources was solely on Buddhist cultural landscapes, neglecting Taoist cultural landscapes. The count of intangible cultural landscape resources was only 2 items, neglecting the rich Folk Landscape resources of the area. This contrasts sharply with the conclusion drawn in this article, which identified the rich Natural Landscape, Humanistic Landscape, and Folk Landscape in the Tianmu Mountain region through the analysis of historical poems. The frequency statistics of Landscape Terms in this study revealed that, in addition to "Clouds" being the most frequent Celestial Phenomenon Landscape Terms, there are 8 other terms, including "Sunglow," "Sky," "Moon," "Stars," etc. Similarly, Weather Landscape Terms include "Wind," "Rains," "Snows," "Mists," etc., totaling 9 terms. Combined with the alternating landscape features of mountains and waters, these terms collectively showcase the natural beauty of Tianmu Mountain, characterized by the day and night succession, seasonal changes, the harmony of movement and stillness, and the mutual reflection of landscapes. In the statistics of biological resource Landscape Terms, there are 14 categories of Animals and 19 categories of Plants, demonstrating the region's rich and diverse flora and fauna since ancient times. In the statistics of Humanistic Landscape Terms, Taoist terms such as "Cave Paradises" and "Taoist Temples," along with

Buddhist terms such as "Temples," emerged as high-frequency terms reflecting the religion of the region. In the statistics of intangible cultural landscape terms, 9 types of Special Local Products, 3 types of Artistic Crafts, 8 types of Traditional Performances and Dances, and 10 types of Stories and Legends collectively affirming the area's long-standing, diverse, and unique Folk Landscape. It is evident that the poems about Tianmu Mountain from the "Eastern Jin to Qing Dynasties" period provide direct evidence of the diversity of natural and cultural resources in the local area throughout history. This can be used as a scientific basis for the overall conservation of the Cultural Landscape of Tianmu Mountain, which will help to enrich and improve the resource composition of the Tianmu Mountain Scenic Area in future planning.

4. The research findings can provide crucial guidance for the development and branding of the Tianmu Mountain Scenic Area. The research findings comprehensively reveal the interrelationships between natural and cultural elements in the Cultural Landscape of Tianmu Mountain region, allowing the recognition of local natural and humanistic features that have been obscured due to historical changes and whose value is now challenging to clearly understand. Currently, the various attractions within the Tianmu Mountain Scenic Area exhibit relatively dispersed and independent features while engaging in tourism activities based on their respective advantages, whether centered around natural or cultural landscapes, they are relatively dispersed and independent. The core competitiveness and narrative capabilities of the Scenic Area remain relatively weak. Therefore, the structural characteristics identified in the Landscape Terms co-occurrence network, such as the "Clusters" and "Stratification" structures, hold significant importance for the planning and construction the 11 planned attractions within the Tianmu Mountain Scenic Area. The "six clusters" and "three nested layers" reflects the characteristics "clear dominant features and closely interconnected elements" in this region, forming the basis for understanding and creating complete "Objects" scenes in each attraction. Utilizing poetry as a narrative thread, combined with the artistic expression of poetry, the study interprets the overall "imagery" features of the Cultural Landscape on a spiritual level. The research recommends integrating "cultural imagery into the natural landscape, combining scenic tours with poetic narratives, and recreating the 'Objects + Imagery' features presented in poetry from different historical periods" as a crucial guiding principle for future Scenic Area

development. Using poetry as a medium to shape the overall tourism brand of “Poetic Tianmu Mount,” allowing visitors to “travel alongside poetry of the past” throughout the 11 scenic spots of Tianmu Mountain. In the tourism process, visitors can immerse themselves in the experience of the unique charm of the local natural and cultural fusion in scenes that transcend time and space. They can also “accompany with poets of the past” during their journey, creating various cultural and creative products related to poets and poetry, as well as digital twin products incorporating AR/VR technology based on the chronological sequence of historical development. This approach aims at stimulating the development of tourism and cultural and creative industries in each scenic spot. Together, they transform Tianmu Mountain Scenic Area into a tourism destination with the core feature of “Poetic Culture Imagery,” along the Road of Tang Poetry in Eastern Zhejiang.

5. This research has certain limitations. Firstly, when counting Landscape Terms, only words with a frequency of 2 or more after word segmentation were included for analysis, which may result in some key Landscape Terms not being included in the analysis due to insufficient frequency, which could affect a comprehensive understanding of Associative Cultural Landscape. Secondly, the statistical analysis in this paper was based solely on all the poetry included in the “*Tianmu Mountain Local Chronicle*” [16], which is a relatively complete collection of poems about Tianmu Mountain from various dynasties. Further expansion of the sources of poetry, covering works from different historical periods and different poets, can further improve the accuracy of the research. Thirdly, Classical Chinese Poetry has the complex characteristic of “multiple meanings for a single word.” The extracted and statistically analyzed Landscape Terms in this research only focus on the meanings of the vocabulary itself, without involving the complex multiple meanings such as “double entendre, emotional charm, symbolism, depth, implicit meaning” behind the Landscape Terms. Fourth, this study exclusively focuses on the “Objects” level of poetry, analyzing and tallying the three categories of Landscape Terms—“Natural Landscape, Humanistic Landscape, and Folk Landscape.” The study does not delve into the “Imagery” level, which involves the poet’s Background (History, Society, etc.), and Emotions (Homesickness, Joy, etc.), as well as the poetry’s Expressive Techniques (Metaphor, Parallelism, etc.), and Vocabulary (Adjective, Pronouns, etc.).

Conclusion

This study focuses on the Tianmu Mountain, where cultural fabrics are unclear, history is long and intricate, archaeological physical evidence are lacking, as well as systematic written records across dynasties are limited. It explores a novel idea and approach to interpreting Associative Cultural Landscape by analyzing poems. Utilizing text mining methods, a quantitative analysis of Landscape Terms in poetry was conducted, demonstrating the association between the region’s natural geographic features and cultural significance. The main findings are as follows:

1. Poetry contains rich information about both nature and humanities, providing important evidence for the association between the Natural Landscape, Humanistic Landscape, and Folk Landscape of Tianmu Mountain. ① From the association analysis of Nature Landscape Terms, which constitutes 59.4% of the total Landscape Terms, it is observed that the dynamic and static aspects of natural phenomena, changing seasons of flora and fauna, and exquisite scenery all reflect the beautiful and lively natural landscape. A total of 6 subcategories and 66 subclasses of descriptors showcases the diverse and lively Natural Landscape characteristics of Tianmu Mountain. ② From the association analysis of Humanistic Landscape Terms, which constitutes 14.8% of the total Landscape Terms, it is observed that the convenient transportation, prosperous urban and rural areas, and flourishing Buddhist temples and Taoist monasteries complement each other, representing the prosperous and stable economic and social conditions and abundant humanistic landscape. A total of 4 subcategories and 17 subclasses of terms depict the prosperous and stable economic and social conditions, as well as the rich and diverse Humanistic Landscape characteristics of the Tianmu Mountain region. ③ From the association analysis of Folk Landscape Terms, which constitutes 25.8% of the total Landscape Terms, it is discovered that the popular stories and legends, unique local specialties, and colorful performing arts, with a profound and enduring history, have been passed down through generations. A total of 4 subcategories and 30 subclasses of terms describe the mysterious, diverse, and distinctive characteristics of the Folk Landscape in Tianmu Mountain. This achievement can provide a scientific basis for the understanding and overall conservation of the resources of Tianmu Mountain.
2. The Cultural Landscape of Tianmu Mountain described in poetry across different dynasties presents “Group Relationship, Hierarchical Relation-

ship, Interactive Relationship, Cognitive Relationship” represent characteristics of three relationships: ① There are six clusters with a “Dominant-Subordinate” structure among the three categories of “Natural Landscape—Humanistic Landscape—Folk Landscape.” Each cluster exhibits an overall characteristic of “clear dominant features and closely interconnected elements,” reflecting the profound integration between nature and humanities in the Tianmu Mountain region. ② Three categories of Landscape Terms, “High-connectivity terms coupling, mutual correlation interpreting,” form the three nested and progressively expanding layers. The first layer prominently embodies the local “religious characteristics of cultivating both Buddhism and Taoism,” while the second and third layers, in a “strong to weak” progression, reflect the local cultural characteristic of “multi-faceted composition and accumulation.” The spatial representations referred to by the Landscape Terms in the three nested layers are perfectly coupled with the artistic expression of poetry, creating the spatial artistic conception of “blending picturesque charm and poetic grace” in Tianmu Mountain. This reflects the artistic characteristic of “Poetic Landscapes” in the local area. ③ The interactions between the six clusters and three nested layers form a “cluster-layer co-construction, network interweaving, and correlated mutual interpretation,” collectively showcasing the highly integrated and closely related nature and humanities in the Tianmu Mountain region. ④ These above relationships simultaneously reflect the dual cognitive levels of “Objects—Imagery,” and depict a Cognitive Relationship. Together, based on characteristics of four relationships, the research has developed a theoretical model for interpreting the multi-relationship within Associative Cultural Landscape. This model enables a systematic interpretation of the close association between natural elements and “religion, culture, or art” in the Tianmu Mountain.

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Supplement

“Sea” in poetry refers to the exaggerated technique employed by poets when describing large lakes. In the paper, it is used to depict the lakes. “Natural Breaks” refer to the points of significant change in the attribute values among a set of landscape frequency values. “ACL” refers to Associative Cultural Landscape.

Author contributions

XX is responsible for project conceptualization; JQ and SL completed the methodology and data analysis; GZ is responsible for investigation; JQ is responsible for curation, visualization; XX and JQ completed the writing of the manuscript; GZ and SL have been reviewed and edited the writing of the manuscript. All authors have read and agreed to the published version of the manuscript.

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Availability of data and materials

Data are available via request xixuesong@cau.edu.cn.

Declarations

Competing interests

The authors declare that they have no competing interests.

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