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Residents' Perception-Based Typology of Forest Landscape: A Case Study of Changsha, Central China

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Abstract: Forest management typically concentrates on biophysical phenomena, while social dimensions are relatively neglected in China. This manuscript aims to develop a typology of forest landscapes based on the individual perception in a cultural context of China with a random sample of 210 residents by utilizing the landscape image sketching technique. The results demonstrated that the typology of forest landscapes could be classified into 'a recreational space,' 'an idealized homeland,' 'an untouched forest,' and 'a utopian forest.' These types of forest landscapes suggest new ways of working with the public to achieve management goals of protecting and improving forest education and experience.

Keywords: perceived-based typology; landscape image; landscape image sketching technique; cluster analysis

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1. Introduction

Management of forest landscapes is typically predicated upon knowledge of the biophysical system, with limited attention directed towards understanding the natural and social dimensions between these intertwined systems [1,2]. Values, especially relational values, should be considered an important dynamic in the coupling of ecological and social systems [3]. Relational values offer a way to transcend the dichotomous thinking about intrinsic and instrumental values that have guided much sustainable management and utilization of the forest landscape [4,5]. The intrinsic and instrumental values of landscapes have attracted increasing public attention in China [6]. Under the guidance of the national forestry development philosophy of 'Clear waters and green mountains are as good as mountains of gold and silver' [7], the utilization of forests has transformed from a production space to a tourism consumption space and further to a strategic space for the supply of the ecological public goods of forests [8]. Typology of forest landscapes has been considered the synthesis of the intrinsic and instrumental values of forest landscapes perceived by the individual [9,10]. Therefore, a study on the typology of forest landscapes through individual perception would not only present the preference, meaning, and values of forest landscapes in a certain way [11] but also be regarded as the premise for people to understand and experience the forest landscape [12].

The forest landscapes have been classified using objective mathematical approaches and subjective approaches [13]. The objective mathematical approaches were analyzed through physical landscape characteristics [14,15]. For example, Carlier et al. (2021) used physiographic and land cover variables to develop a landscape classification in the Republic of Ireland, including extensive bedrock plains, extensive lowlands, and so on [16]. The objective mathematical approaches can be statistically tested and interpreted but were limited by the availability of spatial data [16,17]. The subjective approaches believed that categorical landscape classes were closely related to people's perceptions of landscape [18]. Thus, many subjective methods focused on exploring the identification of forest landscape values, relying on human perception and sociocultural relations to the

region [19–22]. Human values are a fundamental aspect of cognition that underpin the more changeable attitudes, norms, and behavior [23] and also shape preference judgments [24]. The classification of forest landscape has been transformed from the intrinsic values, for example, physiographic, hydrographic, biological, climatic, and human resources [14,15,25], to the merge between the intrinsic and instrumental values, which were preferred by respondents [26,27]. Brown (1984) first proposed relational values and described them as values that emerged from the relationship between a subject and an object, which may be tangible (e.g., recreation, economic, and ecological values) or intangible (e.g., aesthetic, spiritual, and wilderness values) [24]. Rolston and Coufal (1991) defined ten basic landscape values by integrating human and biotic values, including life support, economic values, scientific values, recreation, aesthetic values, wildlife, biotic diversity, natural history, spiritual values, and intrinsic values [28]. Bengston and Xu (1995) distinguished the values of forest landscapes into four types: economic/utilitarian, life support, aesthetic, and moral/spiritual value [13]. According to the 'biophilia hypothesis,' Kellert (1993, 2005, 2008, 2012) conceptualized a set of relational values between nature and humans, covering aesthetic, dominionistic, scientific-ecologistic, moralistic, naturalistic, negativistic, naturalistic, spiritual, symbolic, and utilitarian values [29–32]. Brown and Brabyn (2012) found that landscape values can be divided into tangible and objective (e.g., recreation and ecological values) and intangible and subjective values (e.g., aesthetic and wilderness values) [18].

Relational values carried an impression of both 'what' is considered important (from the object), but also an impression of 'how' that importance emerged from the subject's lived experience, encapsulating culture, norms, and language in a relational space in which the subject and object existed [33]. Previous studies showed that the direct experience of accessing outdoor space, the contact with forest, and the indirect experience of knowledge sources were the three main factors affecting the classification of forest landscapes through individual perceptions [34–36]. The outdoor space around the house (incorporating differing degrees of naturalness from courtyards and inner-city parks to less managed countryside and forests) played an important role in the choice of the individual preference and perception of the natural area [37–40]. Meanwhile, accessibility, recreational activities and facilities, and traditional human activities to forest landscapes were considered to affect the opportunity and willingness of contacting forests for the people [41–45]. Several studies also demonstrated that people with a high level of education or related forest education presented higher preferences for the natural landscape and focused on wilderness or relational values than less-educated ones [35,46]. Relational values of forest landscape could be driven to reflect aspects of cultural identity and social and moral responsibility toward nature [25,26,47].

The perception of forest landscapes is a personal process and arises from the interaction between humans and nature, which require not only information from stimuli in physical features but also previous experience, emotion, and imagination in the mind of the respondents [48]. The individual experience played a critical role in helping respondents make meaning of ecological and social surroundings [48,49]. Lerman (1989) indicated that 'knowledge is actively constructed by the cognizing subject, not passively received from the environment' and 'coming to know is an adaptive process that organizes one's experiential world; it does not discover an independent, pre-existing world outside the mind of the knower' [50]. As a consequence, some research on the typology of landscapes in a variety of contexts has shown that the same forest landscape types can hold different meanings and values for each individual, which makes the consideration of factors related to the previous individual experiences necessary, such as the cultural background, education, forest experience, and so on [34,35,42,44].

A number of authors adopted the visualization method to directly measure the perception-based typology of the landscape [46,51,52], e.g., on-site visits [46], original and manipulated photographs [20,53], virtual landscape simulators [54,55], and GIS mapping [18,56]. These kinds of methods focused on individual interpretation and understand-

ing of the perceived information about the forest landscape, which could be changed based on the provision of landscape information [57]. In fact, these studies showed a gap between using visual stimuli for the assessment of landscape perception and preference and those employing actual landscape experiences [46,58]. Some new methods should be explored to capture and understand better the subjective preferences, and the value orientation of the landscape have been increasingly explored in this field [2,59]. The Landscape Image Sketching Technique was considered an effective approach to analyzing relational values of the environment and can capture the people's perceptions and values orientation of the landscape [60]. This method consists of a brief landscape sketch, keywords referring to the landscape, and short verbal descriptions of landscapes by respondents [61], which could reveal respondents' views and value orientation of forest landscapes.

However, there exist great differences among individual perceptions about landscape in different cultural contexts [61], although several studies were conducted in Europe, the United States, Australia, and other areas with plenty of forest resources [51,55]. Humans, as active participants in a landscape, can assign the attribution of meaning and value to specific landscapes and places through their experience (thinking, feeling, and acting) [18]. A previous study demonstrated that the forest landscape values originating in the minds of stakeholders are a collective perception that reflects the common knowledge of cultural values [56]. Therefore, it is necessary to explore the classification of typology of forest landscapes through individual perceptions of intrinsic and instrumental values.

Consequently, this paper aims to develop the individual perception-based typology of forest landscapes in a Chinese context through the participatory study involving empirical data collection and attempts to incorporate feelings, memories, or associations into the process of characterizing forest landscapes. To achieve our aim, our approach acknowledges that 'forest' did not refer to a narrow conception but a broader definition of 'forest,' which was completely perceived and interpreted by respondents. Respondents could consider one of the forest parks as the forest, classify an authentic, untouched forest as the forest, or alternatively acknowledge the forest could be exhibited in their minds. The first objective of the manuscript was to quantitatively examine the different attributes of forest landscapes in a particular region in China. The second objective of the manuscript was to classify the typology of forest landscapes according to the respondents' perceived relational values. The third objective of the manuscript was to develop a conceptual model illustrating the interaction between the people and the forest in a Chinese context. The contribution of this manuscript is to uncover a perception-based typology of forest landscapes and explore the formatting mechanism of forest landscape typology of residents in Changsha, Central China.

2. Materials and Methods

Four main steps were taken to develop a typology of the individual perception-based forest landscape for Changsha, Central China (see Figure 1). We developed a landscape image diagram and a measuring scale to investigate respondents' opinions and views on forest landscapes. A landscape image sketching technique was subsequently undertaken to obtain data. The information on landscape image sketches was further analyzed using three key techniques. Finally, the clusters were used to define a forest landscape typology.

2.1. The Study Area

Changsha is the capital city of Hunan province, which is situated in central China, ranging from 111°53′ to 114°15′ N and 27°51′ to 28°41′ E, with a total population of and 10.24 million and a total land area of 11,819 km^2. It is an important city in Yangtze's middle reaches and a pilot area of the national 'resource-saving and environment-friendly society' construction. Changsha included 6 districts and 3 countries, namely, Furong, Tianxin, Yuelu, Kaifu, Yuhua, and Wangcheng district, Liuyang, Ningxiang, Changsha County. The study area is dominated by the subtropical evergreen broad-leaved forest, in which Liuyang, Ningxiang, and Changsha counties are key forest-distributed regions in the

Hunan Province. The area has a subtropical monsoon climate with superior hydrothermal conditions, which is suitable for the growth of a variety of vegetation. In 2021, the forest coverage rate of Changsha was 59.82%, which was awarded the title of "National Forest City" in 2006. Changsha is a well-known forest tourism destination and has many famous forest parks, such as Tianjiling National Forest Park, Yuelu Mountain Park, Heimi Mountain National Forest Park, and Shiyanhu Ecological Tourism Park [62].

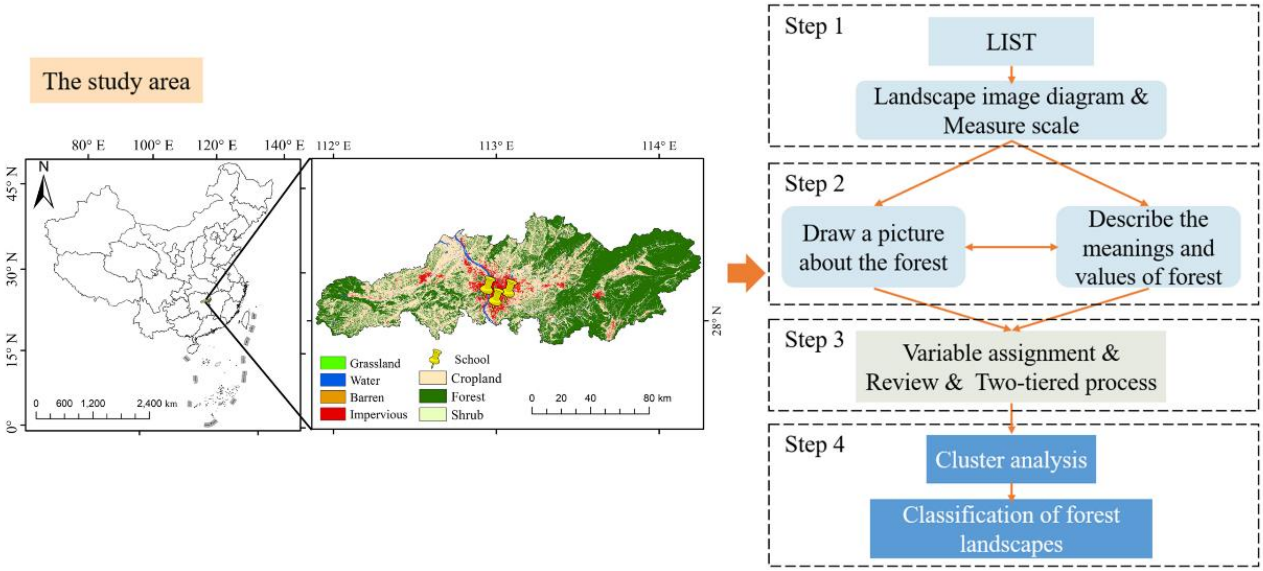


Figure 1. Schematic overview of the main steps taken to develop a forest landscape typology.

2.2. Landscape Image Sketching Technique

The formation of forest landscape images is a complex process [60,61]. Firstly, the orientation of the body-subject is anchored by the combination of the landscape elements and whether the subject stated the standpoint in the sketches. Secondly, the subject depicts the forests by graphics, vocabulary, and language by interpreting the processing of forest landscape element information in the subject's mind, then a representation composed of linguistic elements is formulated, namely linguistic knowledge. In addition, by integrating the processing of sense information (consciousness) of landscape elements and the individual's experience (experience) of the forest, the subject describes their viewing angle and distance from which they capture the special landscape by shape, size, and combination of forest landscape elements, namely spatial view. Thirdly, linguistic knowledge and spatial view are further normalized and changed through experience and communication among a certain social group, then formulated into a collective and normative way of seeing the landscape, namely social meaning. Finally, social meaning also reacts to language knowledge, spatial view, and adjusted self-orientation. In this study, the landscape image diagram is built according to the reaction among self-orientation, linguistic knowledge, spatial view, and social meaning (see Figure 2). This diagram includes the spatial and semiotic aspects of landscape (spatial view and linguistic knowledge) along with the individual and social aspects (self-orientation and social meaning). The consciousness, change, perception, and normalization were explored as the interactive structure and the path among these four elements.

In this diagram, linguistic knowledge refers to visual graphics, vocabulary, and language, which are used to depict the landscape elements and the types of the forest. The landscape elements could be categorized into herbaceous plants, terrain, creatures, water, brightness, sky, trails, artificial objects, and people, and the types of forest could be divided into mixed forest, coniferous forest, broad-leaved forest, deciduous trees, and the unknown. The spatial view is the view angle and distance from the observer, which is classified into close-up view, sideways view, bird's-eye view, and distant view according to the visual

appearance of each landscape element or a combination. Self-orientation refers to the orientation of the observer in the represented landscape, which was classified into a single object, objective scene, surrounding place, and scenic place in terms of the combination of the landscape elements and viewpoint. Social meaning refers to the personal interests of the observer, which were interpreted by using labeled landscape and verbal data and were categorized into forest structure, scenic view, recreational space, symbolic place, ecological system, natural resources, forestry operation, and life world. Consequently, a measuring scale was formatted to evaluate the landscape image sketches of forests.

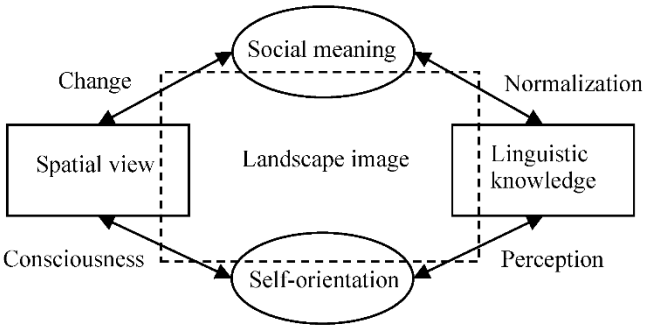


Figure 2. Diagram of a landscape image.

2.3. Data Collection and Processing

This research was conducted from April to May 2021 at the Hunan Agricultural University, Hunan Normal University, and Central South University of Forestry and Technology. The participants were 223 university students (18–25 years old), who had been living in Changsha, China at least 10 years. The students were recruited from three universities by putting up posters. The respondents were approached and interviewed individually. A total of 223 copies of forest landscape image sketches were collected on-site once they had been completed by the respondents, of which 210 copies were valid (with a response rate of 94%).

In this study, the data were gathered using the draw and explain technique. The pictures that the respondents drew and the explanation they made about them constituted the data of this study. The research process was as follows. Firstly, the authors conducted a preliminary communication with the respondents to confirm the research purpose and collect their demographic information (including gender, age, discipline, grade, place of residence, frequency of forest recreation activities, etc.). Secondly, one of the authors put the following question to the respondents, which is "what initially comes to your minds when you hear the word 'forest'?" Thirdly, the respondents were required to draw (on A4-sized paper in 15 min) a picture of the forest as depicted in their minds. If there were landscape elements that they couldn't draw, then a circle with the name of the element would be used as a substitute on the paper. Fourthly, this was followed by the interview stage; the respondents would be asked to do presentations, describing briefly what landscape elements are included in the sketches and what the meanings and values of forest landscapes they valued.

The MS Excel database was scrutinized to discern the relevance of the information to forest landscape images by utilizing three key techniques. First, the presence of the variables in the landscape image sketches was assigned to '1,' while the absence of ones was assigned to '0.' Second, the assignment of the variables was reviewed by an independent party to determine whether the information collected was relevant to each forest landscape image. Third, following an approach by Moyle et al. (2014), a select sample of variables was manually scrutinized for relevance to landscape image sketches [63]. A two-tiered process was used to systematically analyze the information of landscape image sketches collected [60,61].

2.4. Statistical Analyses

The software package R (version 3.2.2, R core team) was used for Cluster analysis. Cluster analysis used by Wards method and Jaccard distance was applied to characterize forest landscape. Then, as our data was not normally distributed, the nonparametric test (Kruskal–Wallis rank sum test) was calculated in SPSS 25.0 to estimate statistical significance differences among clusters on 30 variables.

3. Results

3.1. Basic Characteristic Analysis of Perceived Forest Landscape

The basic characteristics of the collected landscape image sketches are outlined in Table 1. The results demonstrated that the frequencies of nature landscape elements in the total sketches were quite higher than social landscape elements, for example, 'herbaceous plants' (66.19%), 'sky' (59.05%), 'water' (45.71%), 'terrain' (38.57%), and 'creatures' (34.76%). For the type of forest in the sketches, 'broad-leaved forest' (61.90%) was preferred, 'fallen trees' (0.95%) was mentioned the least. 'Sideways view' (81.43%) and 'objective scene' (80.48%) covered more than half of the sketches. In addition, the sketches of scenic views dominated slightly (38.10%), natural resources', 'life world,' 'symbolic place,' and 'forestry operation' was almost neglected, counting for 3.81%, 2.86%, 1.43%, and 0.00%, respectively.

3.2. Typology of Perceived-Based Forest Landscape

Cluster analysis using the Wards method and Jaccard distance was applied to characterize landscape images of forests. When Pearson Correlation Coefficient r = 0.74, the number of clusters was at its optimum (k = 4). Therefore, this would suggest the best cluster solution with four clusters, with 35 cases in the first cluster, 92 cases in the second cluster, 41 cases in the third cluster, and 42 cases in the final cluster. Kruskal–Wallis rank sum test was adopted to find significant differences in each cluster. Only the results significant at $p < 0.05$ will be discussed to characterize the landscape images in four clusters (see Tables 2 and 3).

3.2.1. The Common Characters in the Typology of Forest Landscape

According to the cluster analysis, this study revealed a typology of forest landscape with four types, which could be named as the type of 'recreational space', 'idealized homeland', 'untouched forest', and 'utopian forest'.

Regarding 'linguistic knowledge,' results demonstrated that four clusters did not differ on a statistical significance level of $p < 0.05$ in 'sky,' 'brightness,' 'broadleaf forest,' 'needleleaf forest,' 'fallen trees,' and 'unknown' (see Table 2). The sketches of 'sky' were the predominant category in all clusters ($n = 124$), while the sketches of 'brightness' were drawn the least frequently ($n = 2$). This might reflect different ways of representing brightness; the respondents focused on the weather conditions in the 'sky' from the outside of forests instead of sunbeams between trees from the inside ('brightness'). Next, the sketches of 'broadleaf forest' were the predominant category in all clusters ($n = 130$), while the sketches of 'needleleaf forest' were drawn the least ($n = 28$). This could reflect the respondents preferred the actual landscape and local native vegetation of the subtropical evergreen broad-leaved forest, which were easily found in outdoor spaces around the house, e.g., squares, streets and backyards, and so on. The sketches of 'fallen trees' ($n = 2$) had been expected to represent respondents' preference for untouched nature and its ecosystem, but the results did not show a significant preference in all clusters.

In terms of 'spatial view', results demonstrate that four clusters did not differ on a statistical significance level of $p < 0.05$ in 'sideways view' and 'close-up view' (see Table 2). The sketches of 'sideways view', which represented the virtual structure of a forest or the fringe of a forest, were the predominant category in all clusters ($n = 171$). It might have resulted from the 'familiarity' or an observation habit; respondents got accustomed to observing the landscapes by medium distance and side view in daily life. In addition, the sketches of 'close-up view' were drawn the least frequently in all clusters ($n = 9$). It represented a participatory perception of the landscape's content and details from inside

the better accessible forests. The result showed the majority of respondents perceived the forest landscape from the outside of forests from a medium or long distance. Thus, some landscapes with high visibility were described with a high frequency in sketches instead of the landscape's content and details, e.g., subtle details and distinctive elements.

Concerning 'self-orientation', results demonstrate that four clusters did not differ on a statistical significance level of $p < 0.05$ in 'scenic place' and 'single object' (see Table 2). The sketches of 'scenic place' were drawn the least frequently in all clusters ($n = 4$), which can be seen as a combination of the 'objective scene' and a viewpoint on the sketch, but the difference among clusters was not significant. Followed by the sketches of 'single object' ($n = 3$), which was often represented as a 'close up view,' but the results did not show a significant preference, as has been mentioned before.

Table 1. Explanation and analysis of basic characteristics of forest landscape image sketches.

Variables	Percentage
Linguistic knowledge	
Herbaceous plants	66.19%
Terrain	38.57%
Creatures	34.76%
Water	45.71%
Brightness	0.95%
Sky	59.05%
Trails	20.00%
Artificial objects	30.00%
People	7.14%
Mixed forest	19.52%
Needleleaf forest	13.33%
Broadleaf forest	61.90%
Fallen trees	0.95%
Unknown	6.67%
Spatial view	
Close up view	4.29%
Sideways view	81.43%
Bird's-eye view	16.19%
Distant view	39.05%
Self-orientation	
Single object	1.43%
Objective scene	80.48%
Surrounding place	15.71%
Scenic place	1.90%
Social meaning	
Forest structure	19.52%
Ecological system	20.00%
Scenic view	38.10%
Recreational space	16.19%
Symbolic place	1.43%
Natural resources	3.81%
Forestry operation	0.00%
Lifeworld	2.86%

Note: the total sum does not equal 1 as a drawing is composed of landscape elements of different viewing points and parts of the data are duplicated.

On the aspect of 'social meaning', results demonstrate that four clusters did not differ on a statistical significance level of $p < 0.05$ in 'life world,' 'symbolic place,' 'natural resources,' and 'forestry operation' (see Table 2). The sketches of 'life world' ($n = 6$), 'symbolic place' ($n = 3$), 'natural resources' ($n = 8$), and 'forestry operation' ($n = 0$) typically were drawn the less frequently in all clusters. It might have resulted from the abandonment of traditional human activities, the alterations of local ways of life, and the change in forestry methods and policies. Thus, it was usually difficult for the respondents to be

familiar with non-wood products on the forest ground for local daily use and the forestry industry or to perceive a strong impression of the forest landscape in their minds.

Table 2. Kruskal–Wallis rank sum test of each cluster.

	Mean Rank				Sig.
	Cluster 1 (a Recreational Space)	**Cluster 2 (an Idealized Homeland)**	**Cluster 3 (an Untouched Forest)**	**Cluster 4 (a Utopian Forest)**	
Herbaceous plants	99.00	83.93	130.76	133.50	0.000 ***
Sky	106.50	106.27	97.28	111.00	0.673
Creatures	99.00	92.97	69.00	174.00	0.000 ***
Terrain	68.00	156.30	65.00	65.00	0.000 ***
Water	84.50	151.09	57.50	70.00	0.000 ***
Brightness	107.50	105.64	104.50	104.50	0.542
Trails	174.50	98.20	84.50	84.50	0.000 ***
Artificial objects	131.00	124.22	74.00	74.00	0.000 ***
People	128.00	103.71	98.00	98.00	0.000 ***
Needleleaf forest	100.50	110.90	106.87	96.50	0.139
Broadleaf forest	112.50	113.54	94.28	93.00	0.060
Mixed forest	94.00	91.85	120.85	130.00	0.000 ***
Unknown	113.50	106.49	101.06	101.00	0.122
Fallen trees	104.50	104.50	107.06	107.00	0.380
Close up view	107.00	103.28	103.56	111.00	0.230
Sideways view	92.00	110.16	109.63	102.50	0.130
Bird's-eye view	127.50	102.20	98.74	101.00	0.003 **
Distant view	67.50	155.80	64.50	67.00	0.000 ***
Single object	107.00	104.00	109.12	104.00	0.117
Objective scene	21.00	122.58	118.32	126.00	0.000 ***
Surrounding place	188.00	89.00	89.00	89.00	0.000 ***
Scenic place	106.50	106.92	103.50	103.50	0.445
Forest structure	85.00	85.00	190.00	85.00	0.000 ***
Ecological system	84.50	84.50	84.50	189.50	0.000 ***
Scenic view	65.50	156.80	65.50	65.50	0.000 ***
Recreational space	190.50	88.50	88.50	88.50	0.000 ***
Symbolic place	110.00	105.14	104.00	104.00	0.121
Natural resources	101.50	107.21	109.18	101.50	0.167
Forestry operation	105.50	105.50	105.50	105.50	1.000
Life world	111.50	105.92	102.50	102.50	0.087

Significance: ** $p < 0.01$; *** $p < 0.001$. No significant variables are not shown.

Table 3. The pairwise comparisons of each cluster.

	Clusters 1 and 2 (a Recreational Space and an Idealized Homeland)		Clusters 1 and 3 (a Recreational Space and an Untouched Forest)		Clusters 1 and 4 (a Recreational Space and a Utopian Forest)		Clusters 2 and 3 (an Idealized Homeland and an Untouched Forest)		Clusters 2 and 4 (an Idealized Homeland and a Utopian Forest)		Clusters 3 and 4 (an Untouched Forest and a Utopian Forest)	
	Std.Test Statistic	**Adj.Sig.**	**Std.Test Statistic**	**Adj.Sig.**	**Std.Test Statistic**	**Adj.Sig.**	**Std.Test Statistic**	**Adj.Sig.**	**Std.Test Statistic**	**Adj.Sig.**	**Std.Test Statistic**	**Adj.Sig.**
Herbaceous plants	1.524	0.766	−2.771	0.033 *	−3.028	0.015 *	−5.008	0.000 ***	−5.346	0.000 ***	−0.251	1.000
Sky	-	-	-	-	-	-	-	-	-	-	-	-
Creatures	0.606	1.000	2.601	0.056	−6.538	0.000 ***	2.547	0.065	−8.682	0.000 ***	−9.542	0.000 ***
Terrain	−8.679	0.000 ***	0.254	1.000	0.256	1.000	9.491	0.000 ***	9.570	0.000 ***	0.000	1.000
Water	−6.395	0.000 ***	2.238	0.151	1.208	1.000	9.506	0.000 ***	8.305	0.000 ***	−1.086	1.000
Brightness	-	-	-	-	-	-	-	-	-	-	-	-
Trails	9.126	0.000 ***	9.289	0.000 ***	9.340	0.000 ***	1.732	0.499	1.747	0.484	0.000	1.000
Artificial objects	0.708	1.000	5.135	0.000 ***	5.164	0.000 ***	5.545	0.000 ***	5.591	0.000 ***	0.000	1.000
People	4.513	0.000 ***	4.809	0.000 ***	4.836	0.000 ***	1.121	1.000	1.130	1.000	0.000	1.000
Needleleaf forest	-	-	-	-	-	-	-	-	-	-	-	-
Broadleaf forest	-	-	-	-	-	-	-	-	-	-	-	-
Mixed forest	0.260	1.000	−2.797	0.031 *	−3.770	0.001 **	−3.703	0.001 **	−4.911	0.000 ***	−0.999	1.000
Unknown	-	-	-	-	-	-	-	-	-	-	-	-
Fallen trees	-	-	-	-	-	-	-	-	-	-	-	-
Close up view	-	-	-	-	-	-	-	-	-	-	-	-
Sideways view	-	-	-	-	-	-	-	-	-	-	-	-
Bird's-eye view	3.286	0.006 **	3.223	0.008 **	2.986	0.017 *	0.474	1.000	0.166	1.000	−0.265	1.000
Distant view	−8.659	0.000 ***	0.254	1.000	0.043	1.000	9.470	0.000 ***	9.287	0.000 ***	−0.222	1.000
Single object	-	-	-	-	-	-	-	-	-	-	-	-
Objective scene	−12.260	0.000 ***	−10.136	0.000 ***	−10.997	0.000 ***	0.544	1.000	−0.441	1.000	−0.839	1.000
Surrounding place	13.014	0.000 ***	11.231	0.000 ***	11.293	0.000 ***	0.000	1.000	0.000	1.000	0.000	1.000
Scenic place	-	-	-	-	-	-	-	-	-	-	-	-
Forest structure	0.000	1.000	−10.936	0.000 ***	0.000	1.000	−13.403	0.000 ***	0.000	1.000	11.464	0.000 ***
Ecological system	0.000	1.000	0.000	1.000	−10.897	0.000 ***	0.000	1.000	−13.393	0.000 ***	−11.360	0.000 ***
Scenic view	−8.995	0.000 ***	0.000	1.000	0.000	1.000	9.513	0.000 ***	9.593	0.000 ***	0.000	1.000
Recreational space	13.247	0.000 ***	11.432	0.000 ***	11.495	0.000 ***	0.000	1.000	0.000	1.000	0.000	1.000
Symbolic place	-	-	-	-	-	-	-	-	-	-	-	-
Natural resources	-	-	-	-	-	-	-	-	-	-	-	-
Forestry operation	-	-	-	-	-	-	-	-	-	-	-	-
Life world	-	-	-	-	-	-	-	-	-	-	-	-

Significance: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. No significant variables are not shown.

Table 4 shows the characters of four forest landscape types.

Table 4. The characters of four forest landscape types.

	Cluster 1 (a Recreational Space)	**Cluster 2 (an Idealized Homeland)**	**Cluster 3 (an Untouched Forest)**	**Cluster 4 (a Utopian Forest)**
Linguistic knowledge	Recreational facilities ('trails,' 'artificial object') Tourists ('people')	Hills ('terrain') Rivers or lakes ('water') A house with a jerkin-head roof or chimney ('artificial object')	Flowers and plants on the forest ground ('herbaceous plants') Various tree species ('mixed forest')	Fauna and flora ('creatures') Flowers and plants on the forest ground ('herbaceous plants') Various tree species ('mixed forest')
Spatial view	The broadness of the forest was perceived from a medium distance ('bird's-eye view').	Two sceneries combinations were perceived, including a 'sideways view' as foreground and a 'distant view' as background.		
Self-orientation	The forest was perceived as a subjective place ('surrounding place').	The forest was perceived as an objective scene ('objective scene').		
Social meaning	The forest was perceived as a recreational space ('recreational space').	The forest was perceived as an idealized homeland with an aesthetic appreciation for idyll scenery ('scenic view').	The forest was perceived as an untouched forest filled with lush vegetation ('forest structure').	The forest was perceived as an idealized (utopian) wildlife habitat ('ecological system').

3.2.2. The Different Characteristics in the Typology of Forest Landscape

The forest landscape type of 'a recreational space'. The results demonstrated that the mean ranks of 'trails' (r = 174.50) and 'people' (r = 128.00) in the first cluster were significantly highest than others. The mean rank of 'artificial object' in this cluster (r = 131.00) was significantly higher than in the third and fourth clusters. In addition, the mean ranks of 'bird's-eye view' (r = 127.50), 'surrounding place' (r = 188.00), and 'recreational space' (r = 190.50) in this cluster were significantly highest than others (see Table 3).

Linguistic knowledge of the landscape images of forests was characterized by detailed descriptions of the recreational facilities ('trails,' 'artificial object') and tourists ('people') in the forest. The respondents were significantly different from others in their positive attitudes toward recreational facilities (human-influenced landscapes) in the forest. The spatial view of the respondents focused on descriptions of the broadness of the forest with a 'bird's-eye view.' In oral descriptions, the majority of respondents in this cluster stated that the recreational facilities ('artificial objects' and 'trails') in forests, such as aerial cable tramways, contribute to providing a broad bird's-eye view and the landscapes with open spaces. Self-orientation of the respondents differed from others in strong perceptions of 'surrounding place,' which describing of the subject's activities in the natural surroundings, especially recreation activities. In addition, the social meaning of the respondents concentrated on the subject's recreation activities in the forest and the recreational function of the forest ('recreational space'). The oral descriptions of the respondents showed that they usually perceived forests as recreational landscapes and places (e.g., forest parks, national parks, and recreation parks), which provide recreation opportunities and provide recreation activities through the provision of recreation facilities.

The forest landscape type of 'an idealized homeland.' The results demonstrated that the mean rank of 'artificial object' in the second cluster (r = 124.22) was significantly higher than in the third and fourth clusters. The mean ranks of 'terrain' (r = 156.30), 'water' (r = 151.09), and 'distance view' (r = 155.80) in this cluster were significantly highest than others. The mean rank of 'objective scene' (r = 122.58) in this cluster was significantly

higher than in the first cluster. In addition, the mean rank of 'scenic view' (r = 156.80) in this cluster was significantly highest than in others (see Table 3).

Linguistic knowledge of the respondents was characterized by frequently detailed descriptions of the combination of landscape elements, including a hill ('terrain'), a river or lake ('water'), and a house with a jerkin-head roof or chimney ('artificial object') in the forest. This image of a house with a jerkin-head roof or chimney is the principal icon or symbol of Chinese traditional rural landscape for many. In addition, hill and water elements in the sketches were preferred under the Chinese aesthetic appreciation. The spatial view of the respondents was in makeup of two sceneries, which always included a 'sideways view' as foreground and a 'distant view' as background ('terrain'). This was in line with the fundamental style of Chinese scenery painting. Self-orientation in the sketches was a strong perception of 'objective scene,' which was described by a combination of various landscape elements constructing a place as scenery without spatial continuity from the viewpoint. In addition, the social meaning of the sketches was characterized by the idyll view of the forest ('scenic view'), and the landscape combination of a hill, water, and a house with a jerkin-head roof or chimney were described with a high frequency in idyll natural scenery. However, the house ('artificial object') wasn't drawn in the center of the frame to describe the subject's standpoint or activities in the forest, which only represented a relationship between landscape elements. These respondents expressed an aesthetic appreciation for idyll scenery and constructed idealized imaginative homelands in idyllic scenery to show the forest provided them with relaxation and tranquility to it allowing them to step away from the pressures of city life.

The forest landscape type of 'an untouched forest.' The results stated that the mean ranks of 'herbaceous plants' (r = 130.76) and 'mixed forest' (r = 120.85) in the third cluster were significantly higher than in the first and second clusters. The mean rank of 'objective scene' (r = 118.32) in this cluster was significantly higher than in the first cluster. The mean rank of 'forest structure' (r = 190.00) in this cluster was significantly highest than in others (see Table 3).

Linguistic knowledge of the respondents fully presented the forest ground ('herbaceous plants') and the variation in tree species ('mixed forest'). This cluster typically had the lowest perceptions of a variety of landscape elements than other clusters. The social meaning of the sketches was characterized by detailed descriptions of vegetation structure ('forest structure') without any representation of the viewer's activities and usages in the forest. These respondents expressed that they viewed the forest as a sustainable area of plants and adhered to an authentic untouched or wild image of the forest in their oral descriptions, which reflected the respondents placed a higher value on the protection of forest wilderness or naturalness rather than on forest utilization aspects. However, the spatial view of the respondents had no significant difference from others, and the self-orientations of the second, third, and fourth clusters were quite equal in their perceptions of the 'objective scene.'

The forest landscape type of 'a utopian forest'. The results demonstrated that the mean ranks of 'herbaceous plants' (r = 133.50) and 'mixed forest' (r = 130.00) in the fourth cluster were significantly higher than in the first and second clusters. In addition, the mean rank of 'creatures' (r = 174.00) in this cluster was significantly highest than in others. The mean rank of 'objective scene' (r = 126.00) in this cluster was significantly highest than in the first cluster. In addition, the mean rank of 'ecological system' (r = 189.50) in this cluster was significantly higher than in the others (see Table 3).

Linguistic knowledge of the respondents focused on detailed descriptions of fauna and flora ('creatures'), flowers and plants on the forest ground ('herbaceous plants'), and the variation in tree species ('mixed forest'). The social meaning of the sketches was characterized by emotional expressions of a dynamic system with fauna and flora ('ecological system'). These respondents considered the forest as a wildlife habitat (a place where wild, uninhabited, or relatively untouched by human activity) and appreciated a harmonious forest ecological environment, reflecting the respondents' concern over the impending

threats to the environment and wildlife and supported wilderness (naturalness) value of forest landscape. In addition, the spatial view and self-orientation of the respondents had no significant difference from those of other forest landscapes perceived.

4. Discussion

In this study, we explored a typology of forest landscape based on individual perception in a cultural context of China, which could be divided into 'a recreational space', 'an idealized homeland,' 'an untouched forest,' and 'a utopian forest.' These findings demonstrated numerous parallels to the dimensions of some earlier studies concerning the degree of human influence, historicity, imageability, and naturalness, which were identified as influential classification dimensions for the forest landscapes typology [18,26,58,64]. Specifically, the results indicated that 'a recreational space' landscape dominated by recreational facilities and activities had a higher degree of human impact than others. Most respondents significantly preferred 'an idealized homeland' landscape as a spiritual home, characterized by an icon cultural element (a house with a jerkin-head roof or chimney). In addition, 'an untouched forest' and 'a utopian forest' landscape perceived by the respondents presented with the structural integrity of vegetation and ideal wildlife habitat could be considered as the manifestation of the dimension of naturalness. The classification of forest landscapes in this paper is consistent with some previous studies [65–67]. For instance, Bauer et al. (2009) put forward the 'nature lovers,' 'nature sympathizers,' 'nature connected users,' and 'nature controllers' landscape according to the human–nature relationship [65]. Van den Born et al. (2001) classified the public perception of nature into six different categories, including utility nature, wild and arcadian [66]. Additionally, Gehring (2006) found three landscape preference types in Switzerland, which were the arcadian, wilderness, and utilitarian landscape [67].

These results also indicated that 'a recreational space,' 'an idealized homeland,' 'an untouched forest,' and 'a utopian forest' landscape reflected the subject's perception of recreational, aesthetic, spiritual, and wilderness values, indicating that the forest landscape was known to have high aesthetic, recreational, spiritual, and wilderness values [18,45,57,68]. For instance, Beverly et al. (2008) found that the most important values of forest landscape identified by the respondents were recreational, wilderness, and aesthetic in Alberta, Canada [56]. Lee and Kant (2006) stated that the most prominent forest value was environmental, spiritual senses, and recreation in North-western Ontario. These results also revealed that the aesthetic, spirituality, and wilderness values were highly associated with forest landscapes by most respondents, whereas only a small number of respondents valued the recreational value [68]. Previous studies, however, showed that the tangible and objective values of the forest landscape, e.g., recreation and aesthetics, were usually concentrated [2,69]. It is possibly attributed to a broader concept of the forest conducted by this research rather than a perception of specific forest ecosystem services, e.g., urban forests and forest parks. In addition, this result reflected that the intangible and subjective values (e.g., aesthetic, spiritual, and wilderness values) were highly appreciated by the respondents from 'a vision of the invisible' in a Chinese cultural context [11].

The results revealed that the respondents related with qualities and characteristics of the landscape with the values of the forest in accordance with the previous findings [56,68]. The landscape of 'a recreational space', which had a higher degree of impact and visible traces of human activities, was associated with the recreational value by respondents. However, the landscape of 'an untouched forest' and 'a utopian forest,' which had higher naturalness than others, was associated with the wilderness value of the forest, consistent with the findings of Brown et al. (2012) and Beverly et al. (2008), suggesting that higher accessibility of landscapes was associated with the perception of recreational value, which was considered as a value format with a requirement of accessibility, while lower accessibility of landscapes was associated with the perception of wilderness values [18,56]. The results also demonstrated that humans who preferred the wilderness image of landscapes

were sensitive to the way of human impact in nature and preferred natural landscapes without the trace of human activities [19,70].

The results demonstrated that 'an idealized homeland' landscape with historicity and imageability was associated with the aesthetic and spiritual values of landscapes, which was consistent with the fact that humans tended to link the aesthetic and spiritual values of landscapes with traditionally rural landscapes [71]. Furtherly, the historical elements of a house with a jerkin-head roof or chimney were perceived as some special symbols concerning the respondents' spiritual feelings. This result corresponded with the findings of Fyhri et al. (2009) and Ishii et al. (2010), proposing that the special historical landscape elements, such as forest temples, cabins, traditional hamlets, old and remote farms, were usually romanticized as specified spiritual symbols or places [26,27].

5. Conclusions and Implications

Based on Landscape Image Sketching Technique, this article explored dividing the forest landscape into 'a recreational space,' 'an idealized homeland,' 'an untouched forest,' and 'a utopian forest' and constructing a cognitive formation model of residents' perceived-based forest landscape typology in Changsha, Central China. The results demonstrated that people preferred to treat nature through their own cultural lens in China. Chinese traditional culture and cultural beliefs played an important role in the classification of forest landscapes and identification of aesthetic, spirituality, and wilderness values perceived by the young generation. In addition, the results found that the typology of forest landscapes and value orientation in China could be characterized by natural friendliness, indicating that the individual fully acknowledged the intrinsic and instrumental value of nature and its subsequent right to exist irrespective of its functions for humankind.

Our results provided guidance for forest education and more effectively engaged audiences in discussions on how to promote forest education and forest protection strategies in a way that was aligned with the public interest. In practice, it is necessary to strengthen the public's awareness—especially for children and teenagers—of the objective entity of forests and the knowledge of inter-forest attractions, forest structure and system, forestry management, traditional utilization, and so on, depending on a variety of protected areas in China. Forest education should focus on providing science-based curricula, including basic and applied knowledge, and integrating social, economic, and ecological sciences to help students understand and apply forestry science. The results demonstrated that there existed a deep understanding of subjective forest scenery instead of a place for environmental knowledge for the public. Moreover, guidelines on forest education and recreation for the whole of society should be constructed to direct them to embrace the forest by developing various education modes, such as outdoor recreation, forest school, forest kindergarten, and environmental interpretation. In our study, the typology of 'a recreational space' was an important forest landscape type perceived by college students, which suggested that there was high public awareness of forest tourism. Thus, forest-based educational recreation was an effective means of information and entertainment, which can provide extended direct forest experience to the public and contribute to the realization of practical forest knowledge. In addition, a variety of forest experiences should be encouraged to make the public acquire social and ecological knowledge and skills in the forest, with the rise of the frequency and quality of their experience in the forest.

Meanwhile, there are some limitations to this article. First, there exists a difference in the individual perception of a forest landscape image, focusing on young people. Second, the limited samples of respondents, mainly living in Changsha, Central China, do not adequately represent the whole of China with the diversity of forest landscapes. Third, some respondents could not precisely paint the scenery in their minds due to their limited drawing skills, which possibly resulted in the failure to represent some landscape elements and hence caused some bias in the results. Finally, previous studies showed that the perception of the forest could be changed between inter-generations due to age, education, place attachment, recreational experience, and so on [36,37,39]. Future research is needed

to explore the conceptual model of the forest for different generations, with emerging techniques, for instance, eye tracking and brainwave measurement.

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