Evaluation of Forest Landscape Resources of National Forest Park in Typical Area of China

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Abstract. The Scenic Beauty Evaluation (SBE) method is used to access multi-dimensionally landscape beyond forests multi-dimensionally in different seasons and classify different kinds of forestry landscape. 14 landscape elements including plants color, landscape uniformity and so on to build the landscape model: $Y=0.17+0.039X1\text{-}1+0.249X1\text{-}2+0.487X1\text{-}3-0.322X3\text{-}1+0.027X3\text{-}3+0.165X4\text{-}1-0.228X4\text{-}2-0.237X6\text{-}1+0.129X6\text{-}3+0.066X10\text{-}1-0.214X10\text{-}2-0.35X11\text{-}2+0.615X11\text{-}3+0.09X11\text{-}4+0.543X12\text{-}1+0.229X12\text{-}2-0.151X13\text{-}1-0.562X13\text{-}2-0.01X13\text{-}3-0.08X14\text{-}2$ As we can know from the model, the state of the water has the greatest influence on the value of landscape, and the smallest influence is the skyline of the landscape; the richness of plant color has positive influence on it, while the slope of the mountain and the whole vegetation are negatively affected. In the end, analysis are conducted based with different people grouped by age, education background, living area tourism aims.

1. Introduction

With the rapid growth of urban population, the lack of urban leisure space is becoming increasingly prominent. Exploiting a new recreational space has become an urgent need. With the increase of income and leisure time of the urban population, coupled with the smooth urban and rural transport and the beautiful landscape view, forest in the suburban has become a tourist destination for more and more urban population [1]. Previous studies have made some exploration in the forest parks like forest ecology [2], landscape security pattern [3], forest landscape pattern evolution law [4], forest park spatial heterogeneity [5] and so on, which greatly enriched the research system of forest landscape. But the use of Scenic Beauty Assessment (SBE) to distinguish between different groups of forest landscape differences, and quantitative research, rarely reported.

The psycho-physical method is considered to be the most objective evaluation method. The SBE is one of the most maturity methods to evaluate the landscape [6-8]. The study shows that the response

of the different viewers to the same landscape is different. Results of the evaluation according to different classes of people can make the evaluation results more scientific.

2. Materials and methods

2.1. Research methods
Days with typical weather were selected to monitored the data in spring, summer, autumn and winter, during the study period. Observation time are 7: 00, 9:00, 11:00, 13:00, 15:00, 17:00, 19: 00. The monitors were set with the height of 1.2 ~ 1.5 m, and 3 times were repeated at each observation point.

2.1.1. Landscape sample acquisition. In order to be more truly reflect the aesthetic characteristics of forest landscape, we took the photo abide by: ①high visibility conditions; ②front lighting conditions; ③ showing the main vision. About 31 photographs were selected which can reflect typical regional forest landscape resources in China.

2.1.2. Landscape evaluation. We used on-line questionnaire to evaluate and used 7 points system to score the photos by 3,2,1,0, -1, -2, -3 (3 means very good, -3 means very bad, 0 means neither good nor bad) [9-10].

2.1.3. Landscape factor decomposition. In order to determine the relationship between the landscape evaluation score and the landscape elements reflected in the evaluation photographs, the elements were extracted, and these landscape elements were decomposed into different categories according to the same standard (see Table 1).

Table 1. Forest landscape factors decomposition table

No.	Landscape Elements	Category				Category Number
		1	2	3	4	
X_1	Number of plant color	1 kind	2 kinds	3 kinds	>3 kinds	4
X_2	Number of colors	3 kinds	4 kinds	5kinds	>5 kinds	4
X_3	Scene Cleanliness	Mess	General	Tidy		3
X_4	Crop Uniformity	Mess	General	Tidy		3
X_5	Haruhana or Autumn Leaves	No	Yes			2
X_6	Landscape texture	Steel	Soft	Mixed		3
X_7	Water surface	Yes	No			2
X_8	Building style	New style	Ancient	No		3
X_9	Building color	White	Red	Brownish yellow	No	4
X_{10}	Water	dynamic	Static state	No		3
X_{11}	Water surface occupy	<5%	5%~15%	15%~30%	>30%	4
X_{12}	Skyline	Gentle	General	Steep		3
X_{13}	Gradient of the mountain	0~30°	30°~45°	45°~60°	>60°	4
X_{14}	Plaque definition	Clear	No Clear			2

2.1.4. Data analysis. We use standardized calculation to reduce error, the calculation formula is as follows:

$$Z_{ij}= (R_{ij}-R_j)/S_j \quad [11\text{-}12] \tag{1}$$

Z_{ij} is the normalized value for the i-th photograph of the j-th responder; R_{ij} is the SBE score of the j-th judge for the i-th photograph; R_j is the average of the j-j judge for all photographic values; For the j-j judge on the standard deviation of all photo beauty values.

3. Result and analysis

3.1. Over view

A total of 303 responders were issued to meet the sample requirements of the Factor Analysis Experiment Questionnaire [13-14] by statistics, the proportion of men and women in the overall sample was balanced (134 males, 49.1% and 139 females, accounting for 50.9%); The majority of the population under the age of 40, 20 to 30 years old; occupation composition, the company staff or self-employed groups are more than the student group. In the questionnaire collection, the number of respondents reached 30 or more, in line with statistical requirements [15], indicating that the survey data is representative, can reflect the public and most of the population of aesthetic and psychological reactions. In the data analysis, it was found that almost all respondents (95.5%) thought that the beauty of the forest landscape was of great significance to the construction of the forest park, which could enhance the construction level of the forest park. Most of the respondents (73.2%) yearn for the forest The park has a high view of the forest landscape, and is willing to visit it. It is worth mentioning that 91.9% of the respondents believe that the enjoyment and relaxation of the forest landscape for the important social function.

3.2. Model establishment and analysis

According to the results of the calculation, the partial correlation coefficient was tested by T test, and the items with different coefficients were not significant and the partial correlation coefficient was smaller. Then, the results were compared with those of the selected ones. The remaining items continue to operate, and so on, a total of 6 operations. Get the forest park forest landscape resource model:

$Y=0.17+0.039X_{1\text{-}1}+0.249X_{1\text{-}2}+0.487X_{1\text{-}3}-0.322X_{3\text{-}1}+0.027X_{3\text{-}3}+0.165X_{4\text{-}1}-0.228X_{4\text{-}2}-0.237X_{6\text{-}1}+0.129X_{6\text{-}3}+0.066X_{10\text{-}1}-0.214X_{10\text{-}2}-0.35X_{11\text{-}2}+0.615X_{11\text{-}3}+0.09X_{11\text{-}4}+0.543X_{12\text{-}1}+0.229X_{12\text{-}2}-0.151X_{13\text{-}1}-0.562X_{13\text{-}2}-0.01X_{13\text{-}3}-0.08X_{14\text{-}2}$

Forest Landscape Evaluation Model Overview It can be seen from Table 2 that the linear relationship between the landscape factor and the predicted value of the preference is strong, and the regression model is better and has high prediction accuracy.

Table 2. Evaluation modeling results of forest landscape

Item Number	1th		2th		3th		4th		5th		6th	
	P-value	t-value	P-value	t-value	P-value	t-value	P-value	t-value	P-value	t-value	P-value	t-value
X1	0.43	1.90	0.47	2.20	0.469	2.26	0.54	2.80	0.53	2.80	0.57	3.18
X2	0.075	0.30	0.077	0.32	0.099	0.42						
X3	-0.182	-0.74	-0.189	-0.79	-0.197	-0.85	-0.216	-0.96	-0.232	-1.07	-0.246	-1.16
X4	0.236	0.97	0.232	0.98	0.229	1.00	0.218	0.98	0.228	1.05	0.192	0.90
X5	-0.116	-0.47	-0.13	-0.55	-0.138	-0.59	-0.131	-0.58				
X6	0.611	3.09	0.61	3.18	0.61	3.27	-0.608	3.33	0.599	3.34	0.62	3.66
X7	0.193	0.79	0.193	0.81	0.189	0.82	0.205	0.91	0.159	0.72		
X8	0.054	0.22										
X9	-0.066	-0.27	-0.039	-0.160								
X10	-0.36	-1.54	0.561	-1.58	-0.358	-1.63	-0.381	-1.80	-0.364	-1.75	-0.583	-3.29
X11	0.556	2.68	-0.357	2.80	0.563	2.89	0.592	3.20	0.687	4.23	0.691	4.38
X12	0.567	2.76	0.566	2.83	0.568	2.93	0.576	3.07	0.586	3.23	0.57	3.12
X13	0.4	1.74	0.397	1.78	0.404	1.88	0.411	1.96	0.476	2.42	0.47	2.46
X14	0.283	1.18	0.28	1.20	0.279	1.23	0.268	1.21	0.244	1.12	0.198	0.93
R	0.881		0.881		0.881		0.879		0.877		0.874	
R²	0.581		0.605		0.626		0.642		0.654		0.662	

From the comparison of the size of each factor class regression coefficient, we can see the following rules: ① In the forest landscape, the more colorful the plant color, the higher the degree of its landscaping; ② the higher the scene cleanliness, the higher the landscape evaluation value, In order to create a forest park forest landscape should try to enhance the forest environment cleanliness, such as: reasonable planning telecommunications tower, high-voltage cable, high-altitude cable car, etc .; ③ plant uniformity, in the forest to view the forest from the perspective of the landscape, more neat The effect of different landscape texture on the evaluation of forest landscape also has a certain impact,

the overall view of the steel landscape in terms of the contribution rate of the landscape to show a negative value, while the soft landscape has a certain extra points, indicating that the soft forest The landscape is more attractive to the visitors; ⑤ whether the forest landscape contains the surface, is the impact of its beauty assessment of the key factors, and static water features tend to have a strong role in the forest landscape, and the size of the water area on the judge The scale also has a certain impact; ⑥ the size of the mountain slope so that visitors have a certain impact on the observation of the skyline The higher the slope of the skyline showed a rolling state, the mountain slope is small when the mountain showed a gentle change also affect the landscape beauty value, generally about the gentle landscape is the higher the value; ⑦ plaque clarity on The overall landscape has a certain impact, the more clear the patch is the higher the landscape beauty value, see Table 3.

Table 3. Score of the forest landscape evaluation items

Item	Category	Parameter	Score	Rate of contribution%
Number of plant color	1	0.039	0.448	10.47
	2	0.249		
	3	0.487		
Scene Cleanliness	1	-0.322	0.349	8.15
	2	0		
	3	0.027		
Uniformity of plant	1	-0.165	0.393	9.18
	2	-0.228		
	3	0		
Landscape texture	1	-0.237	0.366	8.55
	2	0		
	3	0.129		
Water	1	0.66	0.874	20.42
	2	-0.214		
	3	0		
Water surface occupy	1	0	0.965	22.55
	2	-0.35		
	3	0.615		
	4	0.09		
Skyline	1	0.543	0.314	7.34
	2	0.229		
	3	0		
Gradient of the mountain	1	-0.151	0.563	13.15
	2	-0.562		
	3	-0.01		
	4	0		
Plaque definition	1	0	0.008	0.19

3.3. Analysis of Landscape Preference of Different Forest Landscape by Different Groups
The results showed that different people exhibited difference in the aesthetic preferences. From the data point of view, different groups of different types of forest landscape response has a certain difference, and to age, education, permanent residence, the purpose of different groups of people on the forest landscape evaluation value difference is more obvious.

As shown in Figure 1-a, gender differences in forest landscape evaluation of the difference is less obvious; age group is reflected in: in addition to the age of 18 people over the age of the remaining segments of the population is more similar to the aesthetic, and 18 years of age, The landscape shows

great appetite and the relative lack of interest in the familiar environment may be related to its growing environment and life experience.

There are significant differences between the scoring system of junior middle school group and doctor group and the other groups, which also shows that the two groups have great differences in aesthetic attitude and aesthetic orientation. In high school, undergraduate and master group, There was no significant difference between the two groups, indicating that the aesthetic differences of these three groups were small.

The sub-grouping to the Forest Park once a quarter to show the aesthetic trend of the seasonal change of the forest park landscape is not obvious, and the quarterly go to the Forest Park more than 2 times the group, the spring flowers, autumn leaves and winter scenery preferences Level higher than the other two groups. The results show that the number of forest parks is more sensitive to the seasonal changes in forest landscape, and the number of forest parks per season is higher, indicating that people who are more interested in forest landscape are more willing to visit Forest Park.

From the resident to the city, suburban, county, township, rural and life attitude for the positive, general, not actively different groups of people to analyze. The results showed that there was no significant difference in the preference of the forest population.
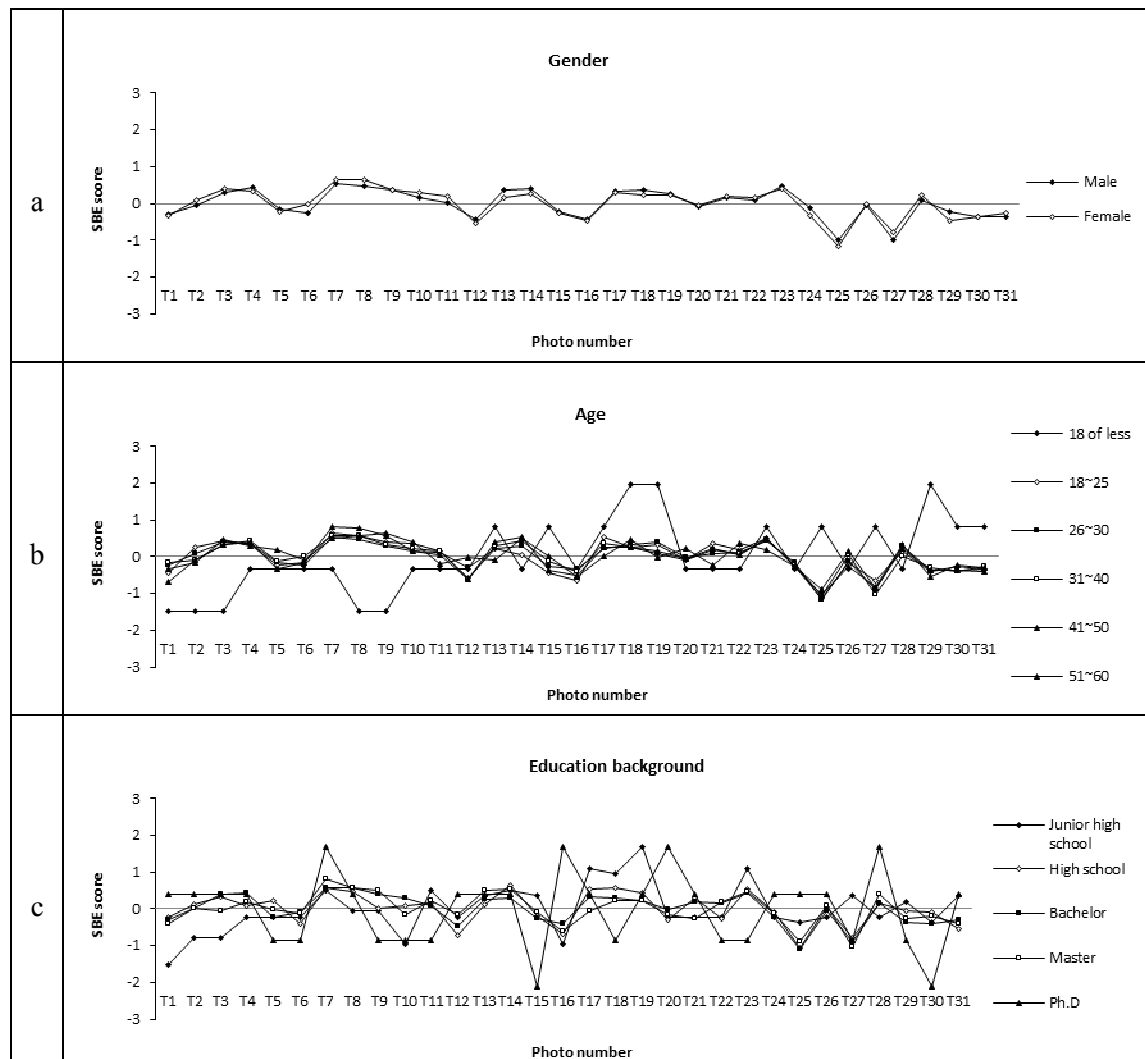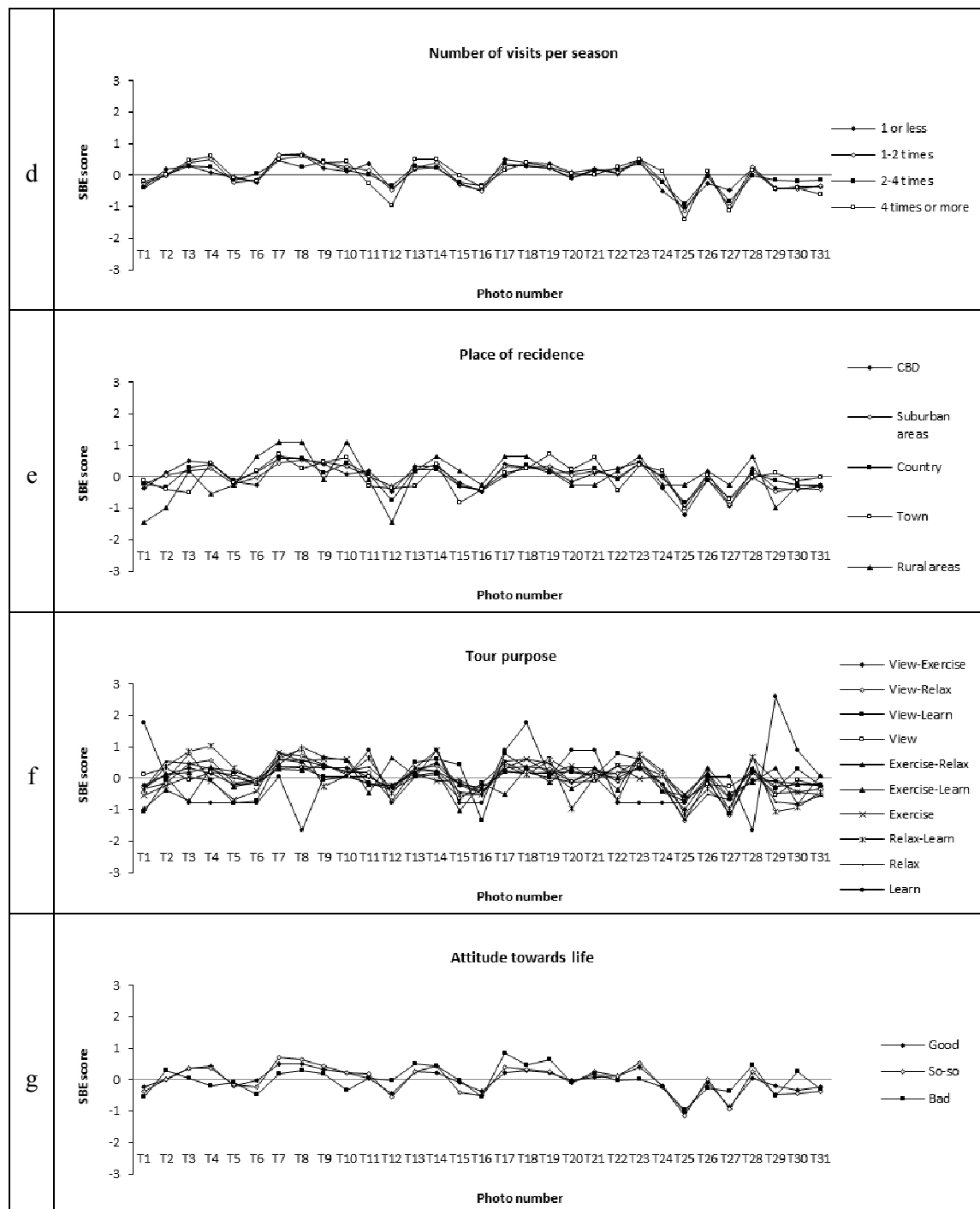
Fig. 1 Preference analysis of different groups for different forest landscapes

a: Gender; b: Age; c: Education Background; d: Number of visits per season; e: Place of recidence; f: Tour purpose; g: Attitude towards life

4. Conclusion

The visual landscape of the selected national forest parks was evaluated and compared with each other. The results show that there is a great preference for the different landscapes of the same place of

residence, and the relative lack of interest in the familiar environment may be related to its growth environment and life experience.

Forest Park in the construction of the forest landscape should be considered: 1) the appropriate construction of the forest landscape seasonal changes, so rich colors, the scene clean and tidy, to enhance the overall landscape of the forest; 2) transformation process, more gentle or too steep mountain Should be based on the needs of the field, increase or decrease the height of the tree planting, so that the slope of the mountain contours in the 45 ° and 60 ° between, to enhance the comprehensive landscape quality; 3) appropriate planting spring flowers, autumn leaves plants to enhance the seasonal changes in the mountain: the construction process Should be peach, pear, lime and other fresh and have some economic functions of plants as a spring plant selection, and autumn leaves plants should be selected in the subtropical common fruit chestnut, persimmon, etc., both to enhance the aesthetic quality of the mountain can increase the villagers income.

Compared with the previous studies [16-18], SBE data analysis and different groups of people to compare the data, enrich the evaluation results, make the data more objective and more practical. Evaluation method has a strong operability, with the promotion of significance.

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