RESEARCH ON METEOROLOGICAL DIVERSITY SCENERY AND TOURIST PREFERENCES IN YANGMINGSHAN NATIONAL PARK IN TAIWAN

[1]SANG XIAOLEI, [2]CHIH-HONG HUANG

Student at the Design college of National Taipei University of Technology and a lecturer in Landscape Architecture Department of the School of Architecture at Huaqiao University. PHD professor at the Design college of National Taipei University of Technology
E-mail: t106859401@ntut.edu.tw, huangch@ntut.edu.tw,

Abstract - The meteorological diversity scenery of Yangmingshan National Park in Taiwan, characterized by lively colors and lights, varied climate conditions and dynamic changes, and outshining that of urban parks in terms of vitality and attractiveness, is its most important tourism resource and the most critical environmental component of its natural ecosystem. The research on tourism meteorological diversity scenery is especially relevant as the devastating impact of abnormal climate changes resulting from fluctuations in the balance of the earth's thermal radiation in recent years has become an inevitable reality confronting the entire globe. In this paper, the existing tourism meteorological resources in Yangmingshan National Park are taken as the research object. Based on the literature research on the cause of formation and type classification of the meteorological diversity scenery, this paper discusses the ways of constructing the landscape from the perspective of the gestalt perception theory and applies the questionnaire law and statistical correlation coefficient test method to quantify the tourist's landscape preferences and tourist expectation, and further elaborate from the tourists perspective on cognitive factors and experiential needs of the meteorological diversity scenery, It is proposed that 1. the existing meteorological diversity scenery resources in Yangmingshan National Park can be classified by four aspects of vision, state, perception and influence; 2. Meteorological diversity scenery enhances the scenic aesthetics and value in the park by direct, indirect and concealed scenery composition; 3. Tourists have clear preference and great touring expectation for the diversified and special meteorological diversity scenery. This study can serve as the basis for the development of thematic tourist products of meteorological diversity scenery by the relevant administrative departments. Under the premise of ecological conservation, the study can strengthen the advantages of natural resources for tourism in parks and maximize the recreational value.

Index Terms - Climate change; Meteorological diversity scenery; Tourists' preference; Tourism resource

I. INTRODUCTION

The 5th assessment report of the IPCC (Intergovernmental Panel on Climate Change) in 2013 concludes that the warming of the global climate system is clear (Change, 2014). Climate change featured by an acceleration of global warming is one of the biggest problems the entire mankind is facing today (Hall, 2008). Blackwell Science's (2002) study of the Canadian National Park System confirms that continued, cumulative climate change will have a direct impact on biomes in the park and will have an impact on system planning and park use and play a decisive role on travel time and the quality of leisure activities to some extent while the study of the effects of global climate change on the ecology and tourism of national parks has only been valued and evaluated recently (B.J.D Scott. 2006). In recent years, tourism has become an important part of the global economy (D. L. Scott, C., 2010). Tourism climate is a macro-dominant factor affecting industrial systems and interacts with other elements of tourism resources. It is even deemed as a featured natural resource to be appreciated and expected in certain destinations, as particular climatic phenomena and phenological landscape are developed and utilized as primary landscape resources (Yu, 2009). Dong Xiaofeng (2006) pointed out that all physical phenomena and processes in the atmosphere, such as cold, heat, dryness, warmth, wind, cloud, rain, snow, frost, fog, thunder, electricity and light, can be taken as a type of meteorological diversity scenery and travel experience. In a broad sense, meteorological diversity scenery is concerned with time series, astronomical phenomena, climate and weather, as well as certain phenological phenomena related to it. It is the primary component of meteorological diversity scenery resources in the ecosystem and has a high ornamental value and development value (Ai Dingzeng, 1982). As early as in 1935, the Yangmingshan area was designated as the presumptive area of National Park for its unique volcanic geological resources, the pretty spring landscape of Datun and the adjoining Taipei metropolitan area (Planning and Design Department, the Ministry of the Interior, 1885). The alpine terrain in the area is rather complicated, making it hard to obtain accurate data at various weather stations. Cui Shangbin (1965) proposed to study the meteorological data of the Datun Mountains in terms of five climatic zones. Chen Wengong and Cai Qingyan (1983) conducted a systematic up-front analysis on the meteorological data of the park as a preliminary support for the establishment and development of Yangmingshan National Park. Adopting a

psychological cognitive model, Zhu Nianci (1989) investigated the preferences for atmospheric phenomena on the part of recreational groups using SBE scenery beauty assessment, and explicitly indicated that the change of atmospheric factors will definitely affect tourists' visual preferences. Cao Zheng and Zhu Nianci (1992) identified the temporal and regional distribution of atmospheric phenomena resources and devised a guideline for their development and management, but didn't probe into the classification and formation of scenery patterns as well as tourists' preferences regarding the meteorological diversity scenery in Yangmingshan National Park.

II. FORMATION AND CLASSIFICATION OF METEOROLOGICAL DIVERSITY SCENERY IN YANGMINGSHAN NATIONAL PARK

A. Formation

Taiwan Island has a typical insular climate, exhibiting various climatic forms and diverse meteorological diversity scenery subject to such factors as dimension, topography, direction of mountain ranges, monsoons and ocean currents (Yu Chuanxin, 2004). Located at the northern tip of Taiwan Island, 25 degrees north latitude, Yangmingshan National Park has a very complicated temporal-spatial layout of its mountainous environment with an elevation variation of nearly 1000m from the bottom of Taipei Basin to the top of Qixing Mountain (Dobrowski, 2009). Temperatures vary greatly in valleys, mid-slopes and ridges at the same elevation (Barry, 1992). Mountains, valleys, lakes, waterfalls, flat roofs, basins and other terrains present rich and varied landscape changes. The park displays apparent characteristics of a subtropical monsoon climate, with a cold winter and a cool summer. In particular, due to the southwest monsoon, it is mostly sunny in summer with few clouds, ample sunshine, and occasional thunderstorms in the afternoon, coupled with frequent mist flow and rainbow arising from abundant water vapor pervading the mountains after a rainfall; whilst in winter, as the northeast monsoon heads southwards, it becomes humid and rainy with an annual rainfall of up to 4000 mm, a low temperature and a high humidity, in addition to dense clouds. Such conditions can give rise to a variety of mist flow (Cao Zheng, Zhu Nianci, 1992).

B. Classification

Owing to the above-mentioned factors such as location, topography and monsoon, the Yangmingshan National Park is endowed with a reservoir of meteorological diversity scenery which can be classified from different research perspectives (see Table 1). Among others, it can be broken down to celestial phenomena and weather phenomena in terms of visual form, or gaseous, liquid, light and solid landscape in terms of expression style (Zheng Lin, 2000), or rather, when the decisive impact of tourism climate on tourism comfort is taken into account, it may fall into any three of the following categories: the regional climate, the climate in the field, and the local microclimate, in term of the role of regional planning, land use and on-site perception. Jacques (1980) pointed out that in a climatic environment, the scenery process is proved to be a part of the climatic system. Zhu Kezhen and Wan Minwei (1973) held that related phenological landscape refers to ecological physical changes of plants with day and night, season, and year, as well as the behavioral and phenomenal changes of animals in foraging and migration at different periods of the year. The meteorological diversity scenery in the park in the broad sense, therefore, also includes such phenomena affected by climatic factors, namely plant phenology and animal phenology.

Table 1 Meteorological diversity scenery classification of Yangmingshan National Park

Classification basis	Content		
Visual form	Celestial phenomena	General celestial phenomenon	Sunrise and sunset, wax and wane, stars
		Special celestial phenomenon	Solar eclipse, lunar eclipse, meteor shower, meteorite and so on.
	Weather phenomena	Weather phenomenon	Sun and moon, clear sky, mist flow, rains, wind, rosy clouds, rainbow, cloud sea, thunder and lightening, winter snow and so on.
		Whether process	Conversion process of different weather states as time goes by
Manifestation state	Gaseous state		Cloud sea, mist flow, wind
	Liquid state		Rainfall, morning dew
	Light state		Sun and moon, rosy clouds, rainbow, clear sky
	Solid state		Winter snow, ice
Perception scale	the regional climate		Sun and moon, clear sky, rosy clouds, cloud seas
	the climate in the field		Thunder, mist flow, rainbow
	the local microclimate		Rain, wind, mist flow, winter snow and so on
Phenology impact	Plant phenology		Manifestation of plant growth, seasonal aspect
	Animal phenology		Animal foraging, migration rules

III. THE COMPOSITION OF METEOROLOGICAL DIVERSITY SCENERY IN YANGMINGSHAN NATIONAL PARK

Every landscape is a particular cognitive or symbolic ordering of space (Ingold, 1993). In the complexity of time and space in the national park, various types of meteorological diversity scenery are directly or indirectly involved in the group scene. The figure-ground relationship highlighted by the gestalt perception theory shifts with time and place to produce different tones of landscape, which is an indispensable link in the aesthetic process of natural scenery.

A. Direct scenery formation:

Landscape value is a personal and subjective assessment of aesthetic satisfaction derived from a landscape type (Jacques, 1980). As opposed to fixed landforms and static natural materials, meteorological diversity scenery is a large-scale, dynamic and constantly changing landscape. In a natural aesthetic process, meteorological diversity scenery often serves as a critical foreground in the landscape composition, or even as the subject of the picture to show an overall atmosphere different from that in the past. Drifting mist, sunrise, rainfall, and winter snow, among the eight representative sights of Yangmingshan as depicted in the phrases “drifting mist over warm currents, sunrise with a rainfall, and snow on the wintery mountains”, are examples of a landscape composition themed at meteorological diversity scenery and are the primary objects for landscape aesthetics. Moreover, rosy clouds, a picturesque combination of light and color produced by the interplay of atmospheric factors and sunlight at dawn and dusk, also constitute a thematic landscape to be appreciated under a particular space-time layout, as they are eye-catching for their huge scale and gorgeous sight and can therefore exert an effective visual impact on tourists.

B. Indirect scenery formation:

Elements of meteorological diversity scenery play a secondary role or even show as a background in the landscape composition, functioning as a blurring support of the subject or key links and rendering them with significance. For instance, in two theme images of “overlooking Pingyang” and “appreciating the lights at night", the sky serves as the bright or dark compositional background during different time periods of day and night, and forms the key base-layer, against which the foreground figure of "landscape of urban Taipei" is fully demonstrated within the scope of high visibility and long-distance vision, constituting a contrasting, multilayered and hierarchical picture of profound effect. Under certain weather conditions, the light color generated by the Tyndall effect can often be juxtaposed with, merged with, or even transformed into the main scenario itself, creating a dramatic and stunning light color landscape.

C. Hidden clues:

When it comes to hidden clues, the elements of meteorological diversity scenery do not appear in the composition or at least not as concrete images, but are implicit in the landscape of phenology in the form of changes, which may lead to direct or indirect tourist experience. This is the case for the view of "Rhododendron Rhino and Cherry Blossoms" in which seasonal phenomena are created by hidden time clues, that is, seasonal features such as bright sunshine, a warm breeze, and brilliant spring flowers are presented through symbolic plant phenology. Another example is the "thunder" in the view of "a great thunder in a huge waterfall", which implies the landscape change in a sudden heavy rainfall accompanied by a sudden and dynamic change of water shapes and a consequent strong auditory effect. Other similar circumstances include the swirling Neelum under a strong wind on the grassy hills of Qingtiangang Scenic Area and the rainfall over Zuzihu Lake.

IV. A SURVEY ON TOURIST PREFERENCES FOR METEOROLOGICAL DIVERSITY SCENERY IN YANGMINGSHAN NATIONAL PARK

In addition to differences in tourism resources and facilities, meteorology and climate are the most primary factors contributing to the imbalances in temporal-spatial distribution of tourist flow (Yang Shangying, Li Ling, 2007). In this study, tourists' preferences and expectations on 11 common types of meteorological diversity scenery are investigated using randomly issued questionnaires. A total of 122 questionnaires were sent and 110 were collected. Among the 105 valid questionnaires, 46 were online ones and 59 on-site ones. The following results were obtained through a qualitative evaluation and a quantitative statistical analysis in terms of tourists’ group structure, landscape preferences and touring expectations.

A. Cross-analysis of tourists’ group structure

Table 2: Cross-statistic table of tourists residence, gender, age and number of tours

Residence	Gender		Age				Number of tours				Total
	Male	Female	5—20	21—40	41—60	61or more	One	Two	Three	Three or more	
Taipei	32 (47.76%)	35 (52.24%)	1 (1.49%)	33 (49.25%)	29 (43.28%)	4 (5.97%)	16 (23.88%)	12 (17.91%)	4 (5.97%)	35 (52.24%)	67 (63.81%)
Other parts of Taiwan	7 (46.67%)	8 (53.33%)	3 (20%)	7 (46.67%)	5 (33.33%)	0(0%)	8 (53.33%)	2 (13.33%)	0 (0%)	5 (33.33%)	15 (14.29%)
foreigner	9 (39.13%)	14 (60.87%)	1 (4.35%)	20 (86.96%)	2 (8.7%)	0(0%)	20 (86.96%)	2 (8.7%)	1 (4.35%)	0 (0%)	23 (21.9%)
Total	48 (45.71%)	57 (54.29%)	5 (4.76%)	60 (57.14%)	36 (34.29%)	4 (3.81%)	44 (41.9%)	16 (15.24%)	5 (4.76%)	40 (38.1%)	105 (100 %)

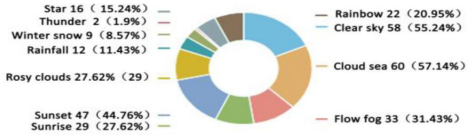
As shown in Table 2, the number of tourists who live in Taipei is 67, accounting for 63.81% of the total number of respondents. The number of those who live in other parts of Taiwan and foreign tourists is 15 (14.29%) and 23 (21.9%). The proportion of women in the three dwelling areas is slightly higher than that of men. The age groups of tourists are mainly between the ages of 21 and 60, and the number of tours is mostly one (for tourists from Taipei and other places) or more than three (for tourists from Taipei). Our analysis shows that compared with the other two categories, tourists from Taipei have more positive regional affection for the Yangmingshan National Park and are the largest tourist group, while the expected contrast of natural scenery and urban landscape is one of the important reasons why Taipei tourists have long-term interest in sightseeing.

Fig. 1: Statistic analysis of preferred recreation spots of tourists



B. Correlation analysis of landscape preferences

Fig. 2: Statistic analysis of preferred meteorological diversity scenery of tourists



1) Correlation analysis of recreational attractions:
According to Figure 1, Qingtiangang is the most favored tourist attraction (60.95%), followed by Xiaoyoukeng (39.05%) and Dream Lake (26.67%). With reference to the data in Figure 3, only Tianxiyuan Park and Dream Lake have a significant positive correlation (.314 **) among the many scenic spots in the natural ecosystem of Yangmingshan National Park. Qingtiangang with both natural ecological tourism and cultural factors is markedly positively related (-3.448 **) with Grass Mountain Chateau and has a significant negative correlation with other attractions (-.332 **), indicating that when Qingtiangang is chosen by tourists as a directional touring destination, it is treated as mutually exclusive to other alternatives for various reasons.

2) Correlation analysis of meteorological diversity scenery:
Cloud sea (57.14%), clear sky (55.24%) and sunset (44.76%) are the top three favorite tourist attractions (see Figure 2). These data are slightly different from those proposed by (Zhu Nianci, 1989) in order, the latter list being the dawn & dusk, sunny day and cloud & mist. Yet they are of the same overall structure and thus reflect the same types of meteorological diversity scenery favored by tourists which choices are not prone to the influence of time or sensible form. Meanwhile, tourists also feel a big difference in the correlation among different types of meteorological diversity scenery. To be specific, ordinary clear sky is not significantly related with other meteorological diversity scenery, but significant positive correlations are found between many other pairs of variables, especially between lightning and winter snow which is the maximal value among them (455 **), with the remaining ones arranged in descending order. These results show that tourist interest is related to the occurrence and familiarity of meteorological diversity scenery, so special weather landscape tends to get more attention.

3) Correlation analysis of recreational attractions and meteorological diversity scenery:

Fig3 ： The Correlation Analysis of Recreation Sites and Meteorological Landscapes

**. At the 0.01 level (double tail), the correlation was significant
*. At the 0.05 level (double tail), the correlation was significant

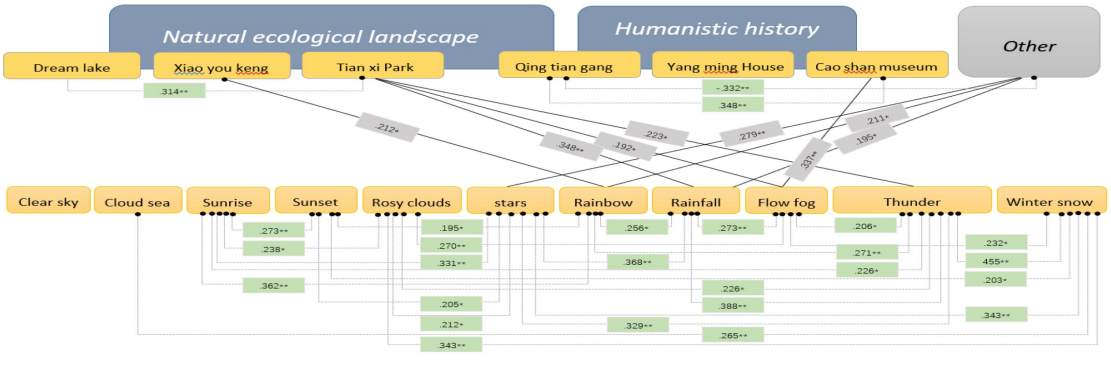


Fig. 4 Statistic analysis chart of expected leisure activities of tourists

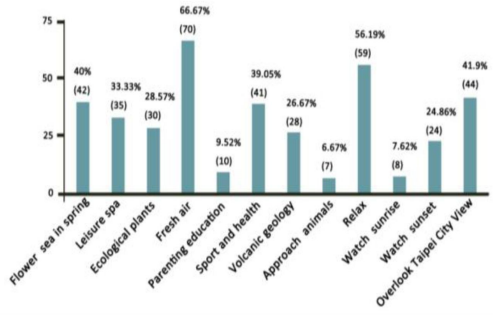
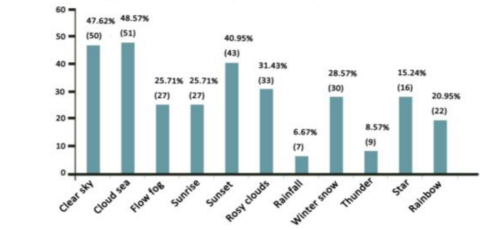


Fig. 5 Statistic analysis chart of expected meteorological diversity scenery of tourists

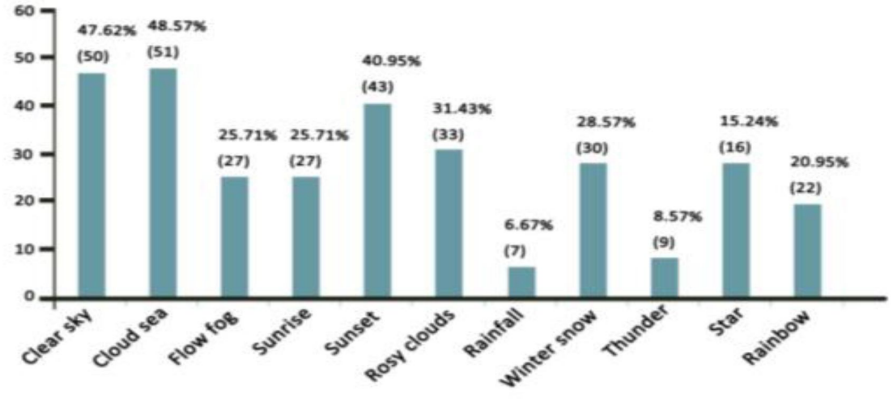


The statistical results (Figure 3) are aligned with the conclusion based on tourists' past cognitive experience: with more than 200 days throughout a year when rainy and foggy landscapes are expected in the central mountainous and northeastern parts of the island (Chen Wengong, Cai Qingyan, 1983), rainbow and lightning landscape usually appear after a thunderstorm in summer or occasionally after a rainfall in winter without certainty in timing, which is an important source of novel experience for tourists. Therefore, rainfall, rainbow, mist flow, thunder and lightning are more correlated with recreational attractions. Tianxi Park, Xiaoyoukeng, Grass Mountain Chateau and other attractions are favorite areas for watching rainfall, rainbow, mist flow, thunder and lightning. The correlation between Xinghe River and other scenic spots is significant, which is related to the fact that there is no corresponding resource support for appreciation of the Xinghe River scenic spot. It also shows that the theme development of meteorological diversity scenery resources has not yet satisfied tourists' relevant demands at the present stage.

C. Correlation analysis of touring expectations

Tourism attraction is the degree of excitement aroused in tourists by the richness of tourist resources. Data (Figure 4) show that fresh air is identified by tourists' as the primary source of tourist attraction (66.7%), followed by relaxation (56.19%), overlooking the landscape of Taipei City (41.9%) and enjoying the gallery of spring flowers (40%) and so on. This means that tourists highly recognize and expect the function of pressure relief of the healthy natural environment. To be more specific, the most anticipated types of meteorological diversity scenery (see Figure 5) include mostly clear sky, cloud sea, and sunset, which are in line with the findings in previous survey on tourists' preferences of meteorological diversity scenery, indicating that after tourists' security demand is satisfied, a large-scale meteorological diversity scenery in a broad area constitutes a stronger sensory stimulus for them as the aesthetic behavior of "overlooking" fully meets their travel expectations. As supported by statistical results (Figure 6), tourists hold a positive attitude towards the novelty and unexpected effects created by meteorological diversity scenery as well as its involvement in landscape composition during their touring experience.

Fig. 5 Statistic analysis chart of expected meteorological diversity scenery of tourists



At the same time, they are cautious about the thunderstorm landscape that may cause meteorological disasters. It is hoped that more stimuli from diversified meteorological diversity scenery can be introduced in the future planning of the National Park so as to effectively increase relevant value of leisurely tourist experience therein.

CONCLUSION

1) In this study, the types of existing meteorological diversity scenery in Yangmingshan National Park are summarized and classified in terms of visual form, manifestation, perceived size and phenological influence in an effort to illustrate the uniqueness and richness of relevant resoucrse which are to be specially considered in the sustainable management and development of the said park.

2) The formation of meteorological diversity scenery is discussed in light of the figure-ground theory of Gestalt Psychology. It is pointed out that the meteorological diversity scenery is a special structural element arising from the overlapping of certain time and space as well as a unique form of natural landscape aesthetics, which greatly enhance the aesthetic value of the national park.

3) There is a significant variation correlation among recreational scenic spots, among meteorological diversity scenery, and between recreational spots and meteorological diversity scenery in the park. The existing recreational facilities require great improvement since they apparently do not fully consider tourists' recreational needs. It is recommended to adjust the orientation of future planning according to tourists' actual preferences and demands and then develop tourism plans on its basis.

4) Appreciation of different types of meteorological diversity scenery is a great expectation harbored by visitors participating in various recreational activities in the park. Such scenery has a unique tourism attraction and a great potential for development. It is suggested that relevant authority, in addition to guaranteeing tourists' safety in sightseeing activities, should further develop the meteorological diversity scenery in scenic spots as a themed series of tourism product in the future.

Our follow-up study in this regard will be about conserving and enhancing the existing features of meteorological diversity scenery resources in the Yangmingshan National Park in the context of global climate change, and undertaking reasonable and effective exploitation while maintaining the integrity of ecosystems, so as to achieve the overall sustainable development of tourism resources of the park.

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