

# Investigation on Open Space Distribution in Mountainous Counties of Hunan based on Perceptual Characteristics and the Recreational Behavior of Citizens

H Xiong<sup>1,2,\*</sup> and H Huang<sup>1</sup>

<sup>1</sup>Hunan Agricultural University

<sup>2</sup>Orient Science&Technology College of Hunan Agricultural University

Corresponding author and email: H Xiong, 30124755@qq.com

**Abstract.** By taking open space of Chenxi County, Luxi County and Yuanling County in western Hunan as research objects, this paper carries out an investigation and study on the open space distribution of the three mountainous counties and the field perception of respondents, the time and behavioral characteristics of them reaching the open space, and the use group construction with the methods of behavioral observation and questionnaires. The following conclusions are drawn: 1) Citizens prefer facet or band shapes of open space with large area, extensive covering scope and beautiful environment; 2) the distance of open space for everyday casual purpose should be within 20 minutes of walking; 3) The middle-aged are the main body using various open space. It is suggested establishing open space based on the landscape pattern of cities and towns in mountainous counties and building the connection among open space via greenways.

## 1. Introduction

In Hunan, the mountains and hills cover 66.62% of the total area [1], four tributaries (Xiang River, Zi River, Yuan River, Li River) run through the province, there are 71 counties, only 4 are inaccessible to river flows, and the mountains are widely distributed in southwestern Hunan. Despite a number of towns or townships within this region, they are small-sized and distributed near rivers like dots, due to steep mountains and underdeveloped economy. Recently, the continuous development of counties has stimulated the growing demand of citizens for open space construction. However, because the location of open space is selected irrationally in practice, it is difficult to exercise the essential environmental and ecological function [2], and the utilization rate by citizens remains at a low level. Targeting at users and their needs is the core of open space construction, the design, construction and management of parks will be cemented by closely observing the recreational behavior of users and know their needs [3]. In order to gain a good knowledge of the perceived characteristics of mountain county residents in aesthetics, psychology, event time, and event type of open spaces. This thesis focuses on mountain counties in the west of Hunan, attempts to reflect the specific needs of small town residents for recreational behavior objectively through behavioral observation [4] and questionnaire survey, so as to provide a basis for the selection of green space layout in small towns.

## 2. Research approach

### 2.1. Subjects

This survey was carried out on existing open spaces of Chenxi County, Luxi County and Yuanling County, which are mountain counties located in the west of Hunan, where the main stream of Yuan River flows, the specific locations are shown in Table 1.

**Table 1.** Open space distribution of Chenxi County, Luxi County and Yuanling County.

County	No.	Open Space	Events
Chenxi County	01	Sheng Li Park	Commemoration, balls, fitness walks
	02	Liu Xiao Forest Park	Square dances, assemblies, mountaineering
	03	Yuan River Park	fitness walks
	04	Xiong Shoushan Forest Park	Mountaineering
	05	City East Square	Square dances, assemblies, fitness walks
Luxi County	01	Xin Nv Park	Commemoration, fitness walks, Excursions
	02	Yuan River Park	Strolling, recreation activities
	03	Ju Song Square	Fitness walks, assemblies
	04	Xin Nv Square	Fitness walks, assemblies
	05	Qu Wang Island	Excursions
Yuanling County	01	Sheng Li Park	Commemoration, balls, fitness walks
	02	Feng Huangshan Forest Park	Strolling, recreation activities
	03	Yuan River Park	Strolling
	04	Dragon Boat Stand	Square dances, assemblies, fitness walks
	05	Zhang Shu Park	Fitness walks

### 2.2. Survey method

Here, the surveys of characteristics of civic events are divided into questionnaire survey and observation survey. In order to ensure that the information collected cover all aspects, the questionnaire survey was not limited to open space users, but combined the random interception survey and the interview in towns, 900 copies were issued in each town, were basically distributed among all age groups on average, 880, 720 and 690 copies were returned and the number of respondents in individual age groups was relatively even; in the survey of civic events, the number of users were counted within the same five time (6:30-9:00am, 9:00-11:00am, 11:00-14:00pm, 14:00-18:00pm, 18:00-20:00pm) frames on a daily basis for seven consecutive days in July-October 2014, in order to observe how these event venues were used.

### 2.3. Data processing

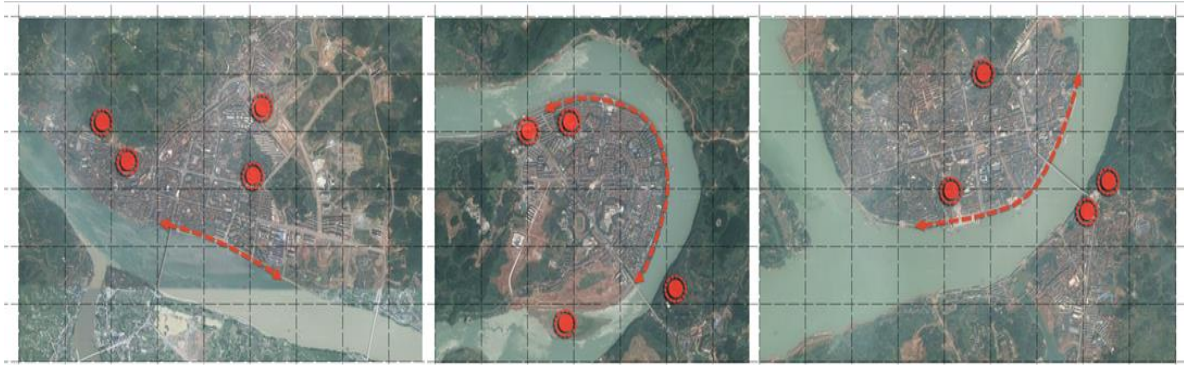
SPSS and Excel2010 are used to make statistics and sorting of the data collected, and draw graphs.

## 3. Results and analysis

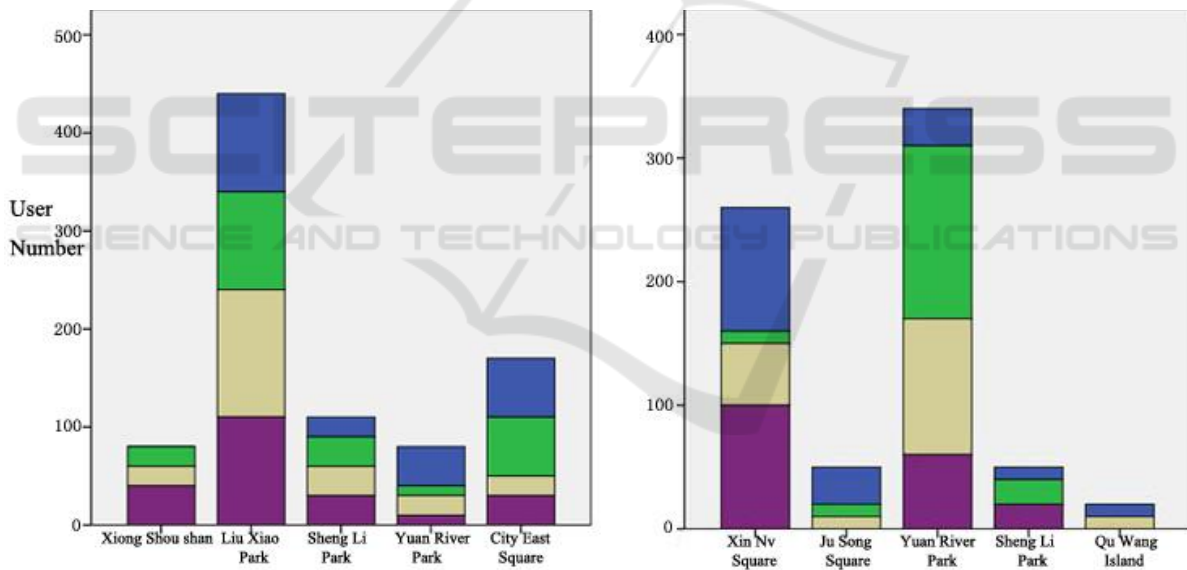
### 3.1. Analysis of respondents' perceived venues

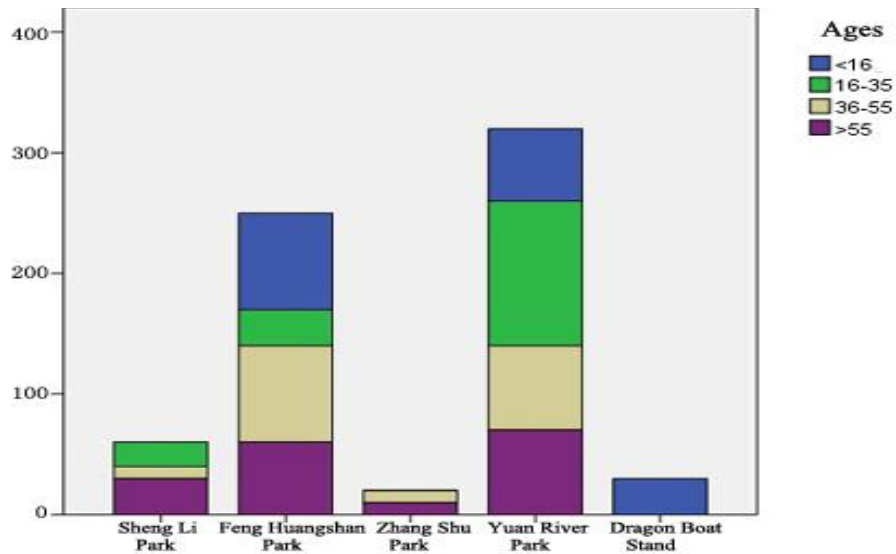
According to the sampling survey of the three counties, the popularity of open space varies significantly. The layout of Chenxi County is band-shaped, except for Yuan River Scenery Belt, the other four existing open spaces are distributed along mountains, and the open spaces with dot-shaped layout have no connection; in contrast, the layout of Luxi County and Yuanling County is cluster-shaped, the four dot-shaped open spaces of the former are distributed along rivers to integrate with the Scenery Belt, the three dot-shaped open spaces of the latter are distributed along rivers, and its one dot-shaped space is distributed along mountains. (Figure.1)

According to the survey results, of the three counties surveyed, the most popular open spaces are Liuxiao Forest Park, Yuan River Scenery Belt, and Yuan River Scenery Belt (Figure.2), which were mostly selected by young and middle-aged users; of the factors which can be used to determine whether the open space is popular or not, citizens focus on environment, trees, rivers, rest sites, comfort level of road, forests and wilderness, accessible transportation and a complete set of facilities in a descending order.



**Figure 1.** Satellite layout and spatial distribution of development spaces for Chenxi County, Luxi County, Yuanling County (Graphs were drawn with Google earth, the grid size is 500\*500m).



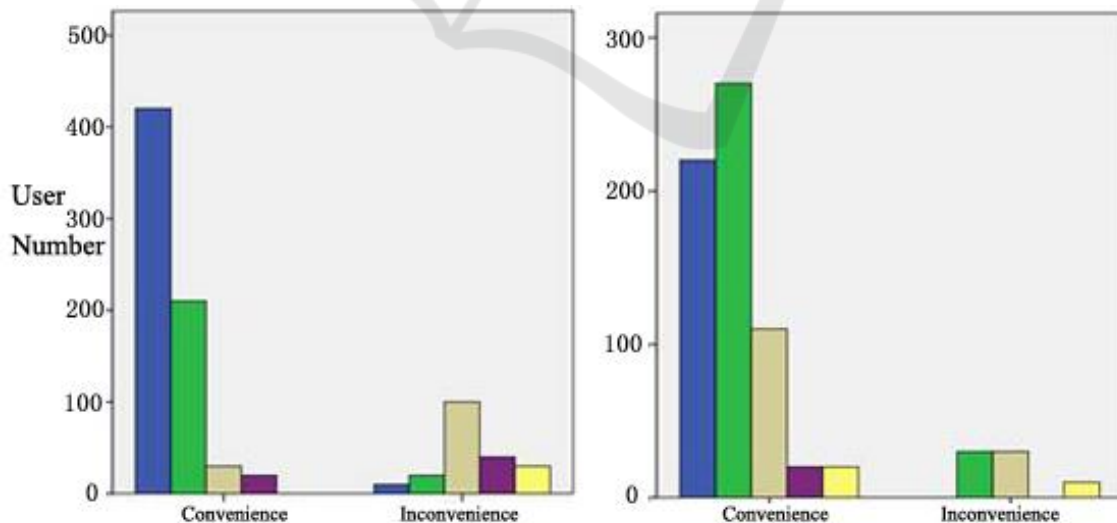


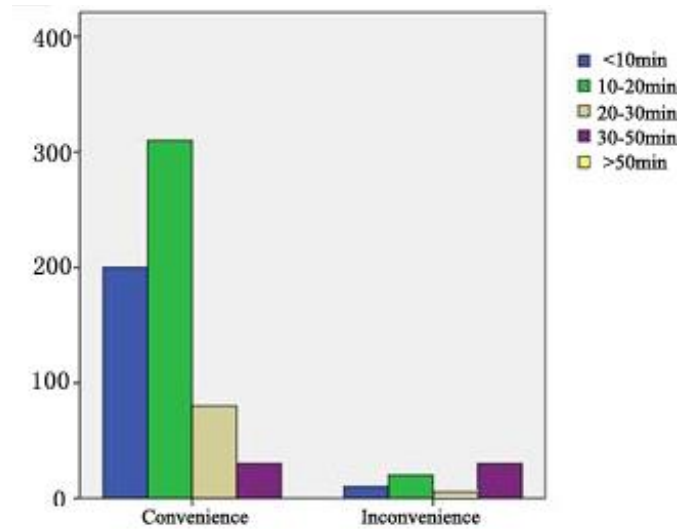
**Figure 2.** Preferences of citizens for existing open space in counties.

3.2. Analysis of respondents' temporal characteristics and behavioral characteristics

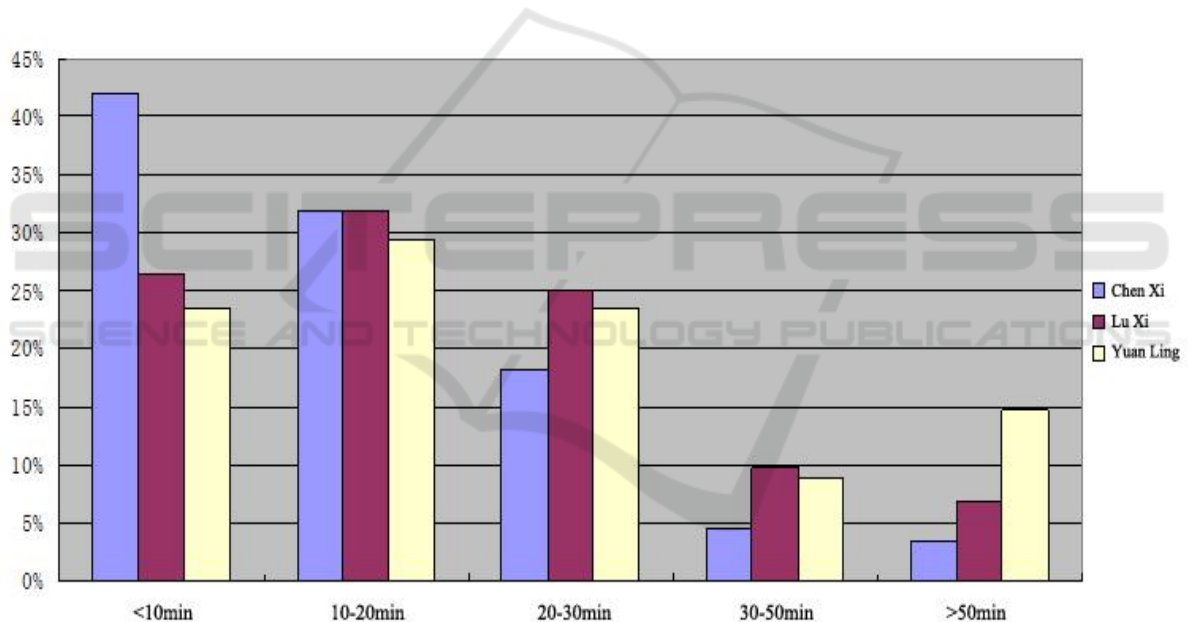
3.2.1. Analysis of respondents' walking time before arriving at the open space.

In the questionnaire setting, the psychological susceptibility of respondents about walking time before arriving at the open space was counted, according to the survey data, the walking distance that enables them to arrive at the destination within 20 minutes was considered as convenient, while 20-30 min was considered as the psychological turning point of marking perceived convenience and inconvenient ( Figure.3), the citizens of the three counties drew the same conclusion. This is consistent with the survey conclusion on walking distance before arriving at the favorite open space ( Figure.4).





**Figure 3.** Relationship between the time required to arrive at the open space and the perceived convenience.



**Figure 4.** Walking time required to arrive at the favorite open space.

*3.2.2. Analysis of respondents' main event behaviors and staying time characteristics.*

Based on the responses from respondents, the main events in which the citizens of the three counties engage are daily leisure, exercises, entertainments, and interpersonal communication in a descending order (Figure.5). With a view to the staying time in open space, the vast majority of citizens chose to stay in the venue for 30-60 min, just followed by less than 30 min, and 1-2 hours, and only a few citizens stay in the venue for more than 2 hours (Figure.6).

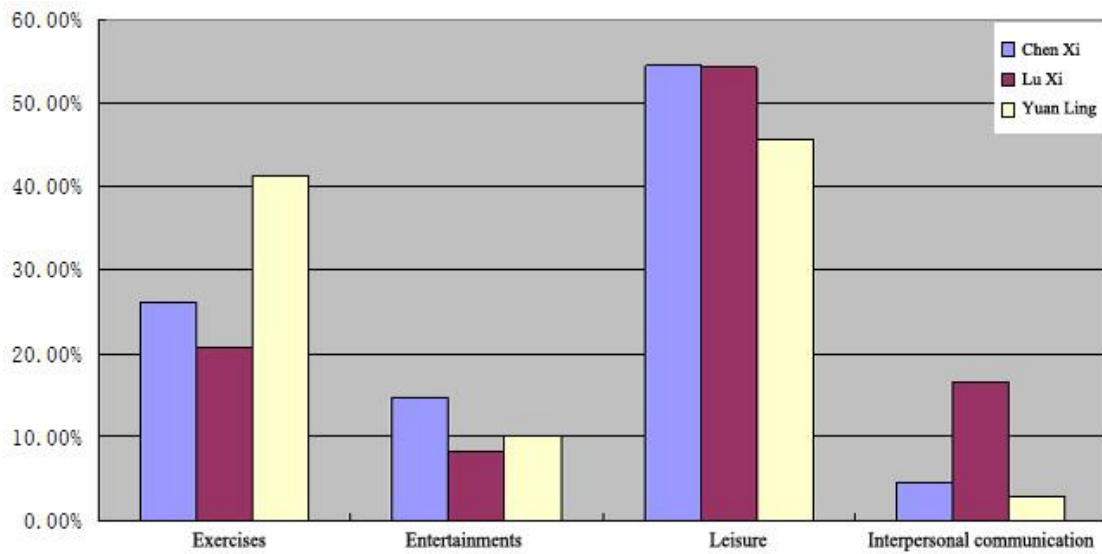


Figure 5. Activity Type.

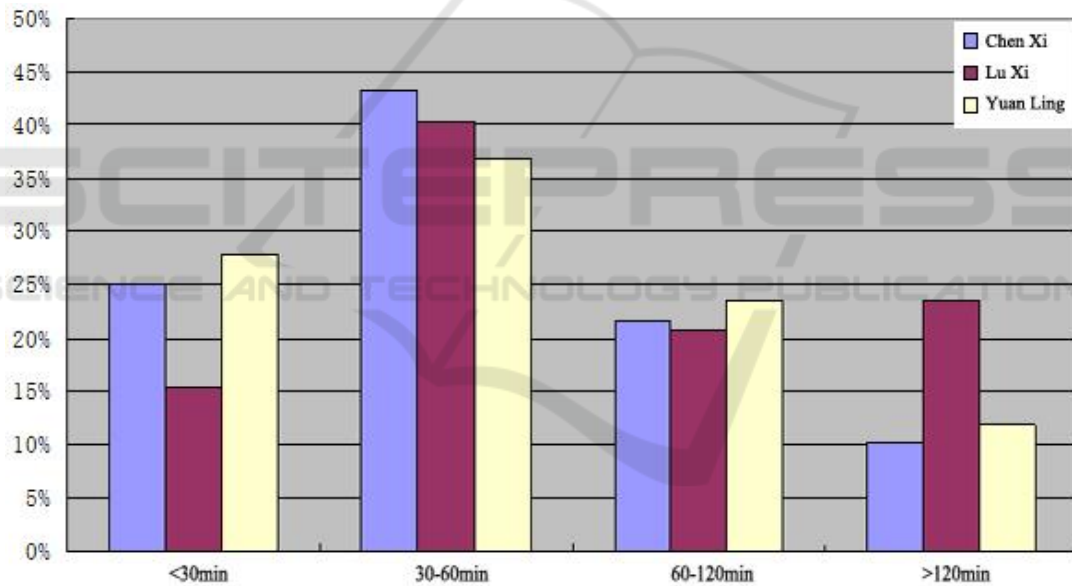


Figure 6. Residence Time.

### 3.3. Analysis of user groups

In order to understand the event characteristics of county residents in respect of venue utility and experience, the flow of visitors in the riverfront and main open spaces of the three counties was counted using the fixed-point statistical method. The survey of Chenxi County was carried out in July 14-20 of 2014, with sunny days in that week, at the temperature of 26-32 °C; the survey of Luxi County was carried out concurrently with that of Yuanling County in October 20-27 of 2014, in which October 20 and 21 were cloudy, at the temperature of 20-24 °C; in the afternoon of October 22, the temperature dropped to 15 °C, until the weather was cloudy then drizzling in October 24, at the temperature of 14-20 °C, until the weather turned sunny on October 27 at the temperature of 19-23 °C. During this survey, the citizens in selected points of open space were counted by grouping with



different places at the same time, the data was taken as the weekly average value and the results are listed as follows: the time frames selected by citizens are relatively consistent, except for special holidays, the civic events are carried on in 6:30-9:00am and 18:00-20:00pm, and the utility time frames in summer are obviously concentrated; the middle-aged users (in 36-55) are the major group of using various open spaces in the counties; in terms of utility venues, the flow of visitors in morning or evening in riverfront green spaces of the three counties was more than that in any other open space, the number of users in Riverfront Belt in Chenxi County was against the favorite venues as indicated in the questionnaire survey, while that of the other two counties was consistent with the survey conclusion.

## 4. Conclusions and discussion

### 4.1. Conclusions

- According to the statistics on use of open spaces by mountain county citizens in Hunan, citizens prefer selecting spacious venues with a large area and a wide coverage, and the beautiful environment of open space is the priority factor for citizens to accept open spaces.
- Most respondents selected the open spaces at which they can arrive within 20 minutes as the daily leisure venues, and they often stay within 30-60 min.
- In terms of the composition of user groups, band-shaped spaces and linear spaces were mainly used for strolling, square spaces and planar spaces were mainly used for group dances, Tai Chi and other exercises and parents with children, in which the middle-aged is the largest user group for various venues.

### 4.2. Discussion

- For the county with undeveloped economy, the open venue that is constructed by landscape structure allows for a better result at a lower cost, if the county is not large-sized, we don't have to construct too many small green open spaces in the downtown, but rather construct open spaces along rivers and at the foot of mountains which are accessible to good resources and environment, helping protect the landform characteristics of mountains and rivers, and forming the large spaces with good environment.
- Focus on the construction of road and green belt, construct county greenways in the setting of mountains and rivers. Subject to geographical factors, the existing open spaces of mountain counties in Hunan are distributed with obvious regularity. Exactly speaking, the spatial layout of these open spaces is extended along riverfronts, at the foot of mountains and in the residual hill patches. In subsequent construction works in towns, we may connect reasonable greenways in towns to peripheral open spaces.
- The conclusions in data form which are drawn from the questionnaire survey and the observation record in respect of the three counties were basically consistent, prior to the site selection for a new open space, we are required to collect the specific needs of citizens through questionnaire survey. And we should further survey the events in which adolescents and elderly persons are engaged, in order to explore the green space layout that suits its utility characteristics.

## Acknowledgement

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## References

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