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## Article

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## **Building a Cultural Heritage Corridor Based on Geodesign Theory and Methodology**

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**ABSTRACT.** Geodesign is a type of methodology that integrates dynamic environment modeling based on GIS with planning and design in order to support relevant decision making. It has substantially changed the dominant ways of thinking in planning and design, and has solved spatial issues relating to cultural and natural resources from a new perspective. Taking the Qionglai section of the Southern Silk Road as an example, the present study implemented geodesign theory and methods to investigate the technical approach to building a cultural heritage corridor based on GIS spatial analysis and overlay analysis.

Firstly, we analyzed the various data layers of the cultural and natural features in the planning region. We organized all the data based on the principle of classification, organizing it into categories such as natural, cultural, and recreational data. Therefore, we defined the theme of the Southern Silk Road as a historical cultural heritage corridor. Secondly, based on the background, the heritage corridor boundary was defined according to its natural, cultural, and administrative spatial characteristics, with the three thematic boundaries overlaid in order to define a boundary location area covering about 852 square kilometers. Next, we divided all of the resources into three categories: natural heritage resources, cultural heritage resources, and intangible heritage resources and recreational spaces. The elements which could be used to build up the cultural heritage corridor were selected by evaluation and spatial analysis. In this way, we obtained some conclusive spatial information, such as element structures, the heritage density distribution, and the heritage number distribution. Finally, within the heritage boundary, we connected the tangible and intangible heritage resources to form various kinds of linear spaces, with the aim of obtaining the spatial pattern of the heritage corridor.

**KEYWORDS.** *Geodesign, heritage corridor, heritage recreation spaces, southern silk road, heritage boundary*

## 1. INTRODUCTION

Geodesign is a type of methodology that integrates dynamic environment modeling based on GIS with planning and design in order to support relevant decision making. It is both a form of philosophy and a thinking process, and it is also an effective means by which to integrate traditional disciplines based on information technology to solve the social and environmental problems for humanity from a new perspective (Ma, 2013). As such, geodesign can clearly be regarded as a kind of frontier approach that integrates multiple disciplines and computer technology, one that can solve highlighted urban planning issues through multi-scale analyses based on a its multi-disciplinary study method.

Nowadays, people are paying increasing attention to the issue of heritage conservation, as the concerns of heritage conservation itself are changing from protecting individual relic sites into protecting entire historical blocks and cities, such that the areas considered worthy of conservation are increasingly wide and deep. Therefore, against this background, the United States and various European countries have developed some regional heritage conservation theories, and the heritage corridor research method is one of them. Specifically, the heritage corridor concept comes from America, and was developed based on the “Greenway” theory which arose in the 1960s. Heritage corridors refer to a new approach for the conservation of large-scale cultural landscapes, meaning linear cultural landscapes with the characteristics of special culture clusters. Generally, such a corridor has an obvious economic center and a developed tourist industry, and engages in the reuse of historical buildings, as well as in environmental improvement (Wang, 2001). The concept emphasizes both natural and cultural heritage, and thus aims to pursue multiple objectives, including heritage conservation, regional development, resident activities, cultural tourism, etc. (Li and Yu, 2004).

The study takes the Qionglai section of the Southern Silk Road as an example area to which the geodesign research method has been applied to analyze the construction of a heritage corridor and spatial planning.

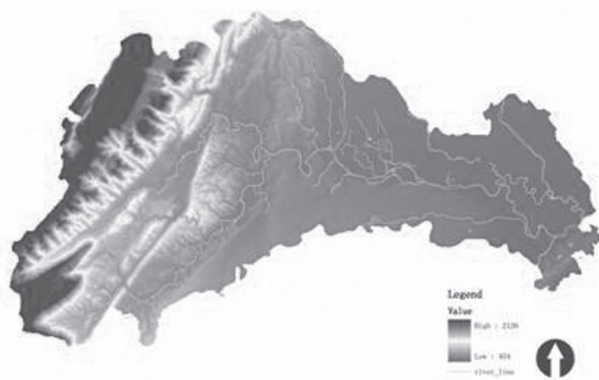
## 2. THE FRAMEWORK FOR HERITAGE CORRIDOR BUILDING

### *2.1. An analysis of the historical cultural background for the Southern Silk Road*

According to historical investigations, the Southern Silk Road is the oldest existing road in China that has consistently been used for private international business. The road can be traced back to before the Han Dynasty, and was called “Shushen yuan drug road” at that time. In those days, the road started from Chengdu city, passed by various other cities (such as Qionglai, Ya’an, Lushan

Xichang, etc.), and then exited from Dehong into Burma, Thailand. Finally, the road arrived in India and the Middle East. The length of the road was about 2000 km (Xu and Wang, 2004).

The Qionglai section is the first station from west of Chengdu. In the Qionglai section, the South Silk Road is divided into two routes, the northern route and the southern route. The northern route arrives in the Ya'an Lushan region, and the southern route arrives in the Ya'an Ming mountain area. Qionglai distributes many southern silk road relics and intangible heritages, and the total length of the road in the Qionglai section is about 94 km, with the northern route being 31.27 km long and the southern route being 55.85 km.



**Figure 1.** The contour analysis for the Qionglai section

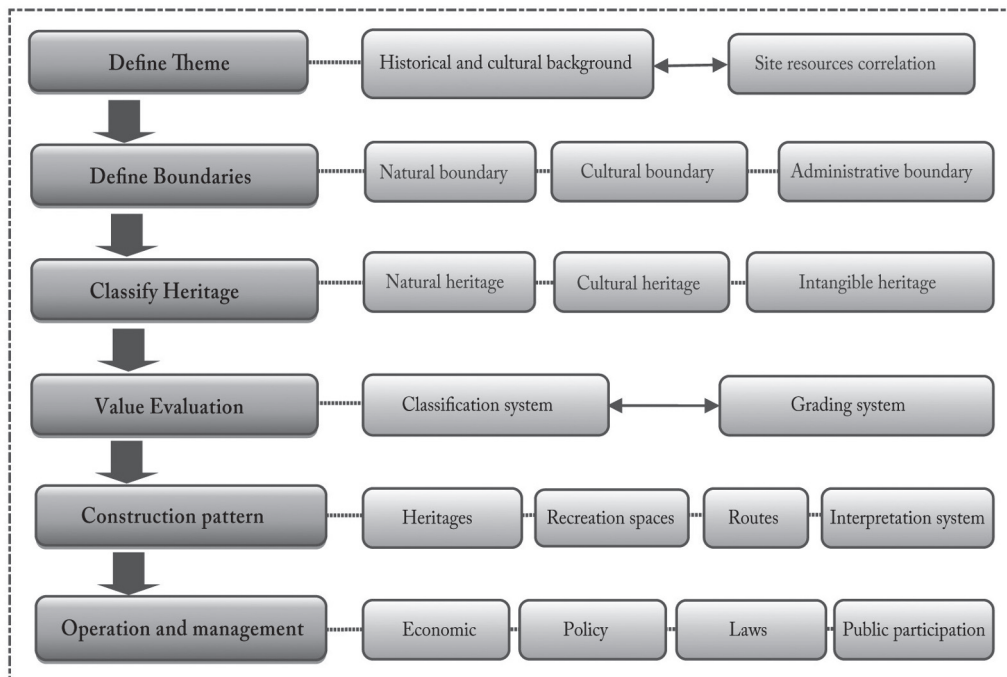
## ***2.2. The whole framework for building a heritage corridor***

The conservation planning of a heritage corridor requires integrity and authenticity. More specifically, we need to protect all the natural and cultural heritage resources within the corridor's boundaries from the surrounding spatial patterns in order to create some recreational spaces which can support opportunities and economic development. The heritage corridor theory stipulates the four main features in the building of a heritage corridor as follows: greenways, travel routes, heritages, and an interpretation system.

The construction of a heritage corridor has no specified steps or criteria. This is due to the target and the relevant national management system. Generally, however, it primarily includes the following steps: define the heritage corridor theme and boundary; clarify the heritage resources and assess related values; plan and design the project (such as by setting heritage conservation targets and determining related projects and traffic organization systems, as well as interpretation and education systems); and conduct heritage management (such as cooperative management schemes for different hierarchy levels).

On the basis of heritage corridor theory, recreation space theory, and the historical and cultural characteristics of the Silk Road in the south, we defined the main factors that determine the Southern Silk Road heritage corridor boundaries as heritage resources, heritage recreation spaces, travel routes, and interpretation systems. The basic thinking and whole framework for building the heritage corridor was as follows:

**Table 1.** The general framework for building the heritage corridor



### 3. BUILDING THE HERITAGE CORRIDOR FOR QIONGLAI SECTION OF THE SOUTHERN SILK ROAD

#### 3.1. The theme of the heritage corridor

First of all, we needed to confirm the theme for the heritage corridor. The theme would not only reflect the character of the heritage resources themselves, but would also correspond to the different aims and the technology path. The heritage corridor theme we decided on was divided into three categories: nature, culture, and recreation. The Southern Silk Road belongs to the

cultural heritage corridor because it has borne witness to 2000 years of economic and cultural exchanges among South Asia, the Middle East, and our country. Therefore, the conservation target consisted of integrating all the various kinds of resources, creating heritage recreational spaces and travel routes, rebuilding historical memories, and promoting local economic interests.

### *3.2. The boundary of the heritage corridor*

#### **THE DEMANDS OF THE HERITAGE CORRIDOR BOUNDARIES**

The definition of a heritage corridor boundary is an important factor in heritage zoning, as every heritage unit should have its own boundaries. Three factors affect a boundary definition:

- (1) The definition should ensure the authenticity and integrity of the heritage.
- (2) The definition of a boundary depends on various technical paths. A linear cultural heritage corridor contains plenty of cultural heritage resources. It covers a large-scale region and thus possesses abundant resource categories. So, we should consider all aspects of theoretical foundations, such as the patch-corridor-matrix theory, watershed management, the national corridor theory, etc. In this paper, guided by the geodesign method, we combined the natural boundary, cultural boundary, and administrative boundary together to obtain the heritage corridor boundaries.
- (3) A boundary should consider implementation issues in terms of economic and administrative targets. A heritage corridor serves as a multi-objective conservation method for heritage clusters, so the related boundary definitions should consider economic, political, and legal decision-making issues, except for those relating to technical support.

#### **THE DEFINITION OF THE QIONGLAI SECTION HERITAGE CORRIDOR BOUNDARIES**

The heritage corridor boundaries of the Qionglai section were mainly considered from the following perspectives: firstly, there are clear natural landscape boundaries, such as ridge lines, water boundaries, etc. Secondly, considering the scope of the cultural influence, there is a whole cultural region. Thirdly, the administrative boundary for public administration also had to be taken into account.

##### **(1) Natural boundaries**

In this paper, we consider the small watershed as a natural boundary. For the extraction process of the watershed boundary, we considered four water grid thresholds: 50, 100, 500, and 1000. Next, we determined the numbers of these four kinds of watersheds to be as follows: 1828 ,

890 · 171 · 90. We chose the 1000 water grid threshold as the natural boundary foundation, so the study area was divided into 90 unit regions. This situation matched the reality well, as shown by the following image.



**Figure 2.** The small watershed of the 1000 water grid threshold

(2) Historical and cultural boundaries

Historical and cultural boundaries determine the scope of the Southern Silk Road's cultural influence.

Firstly, we defined the cultural heritage buffer. We searched for the cultural heritage distribution around the administrative center, and found that the distance ranged from 1 km to 8 km. Therefore, we defined 8 km as the cultural radius based on the cultural heritage evaluation analysis, and used the following table to describe the cultural buffer.

**Table 2.** Evaluation of town and cultural radius

Grade	Town	Cultural Radius
First level town	Linqiong town	8 km
Second level towns	Pingle town, Gaohe town, Tiantaishan town, Huojing town, Shuikou town, Datong town, Mouli town	5 km
Third level towns	Chayuan town, Kongming town, Daozuo town, Jiaguan town, Guyi town	2 km
Fourth level towns	Nanbao town, Youzha town, Sangyuan town, Wolong town, Linji town, Baolin town, Yangan town, Ranyi town, Qianjin town, Gaogeng town, Huilong town	1 km





**Figure 3.** The buffers of cultural influence

(3) Administrative boundary

The Qionglai section contains 23 towns, so in order to implement effective management, we defined the township borders as the administrative boundary.



**Figure 4.** The administrative boundary based on townships

(4) Heritage corridor boundaries

Based on the characteristics of Qionglai, we overlaid the aforementioned three boundaries together, detecting the coincident boundaries as the heritage corridor boundaries via GIS spatial analysis. The total resulting area was about 852.3km<sup>2</sup>, as shown in the following figure.

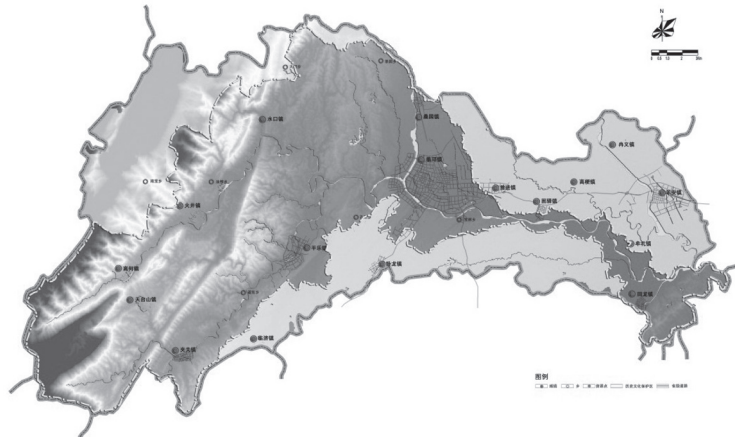


Figure 5. The heritage corridor boundaries

### 3.3. Defining the factors of the heritage corridor

On the basis of the characteristics of Southern Silk Road history and culture, we defined the factors of the heritage corridor’s construction as follows: heritage resources, recreation spaces, routes, and interpretation systems. By combining these factors together, we formulated various node relationships. Next, according to the distribution of the heritage resources and relationships, we defined the four kinds of node categories: regional nodes, composite nodes, basic nodes, and resource isolation nodes. Figure 6 illustrates the relationships of these factors.

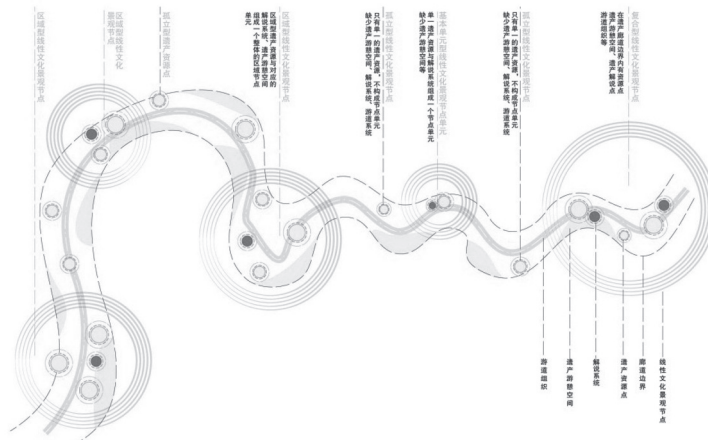


Figure 6. The feature relationships of heritage corridor factors

### THE DEFINITION OF HERITAGE RESOURCES

The Qionglai region has plenty of natural and cultural resources. We evaluated the heritage resources in terms of three categories: natural, cultural, and intangible cultural resources. Then, according to international and national criteria, we made the grade evaluations shown in the following figures.



Figure 7. The classification evaluation of heritage resources

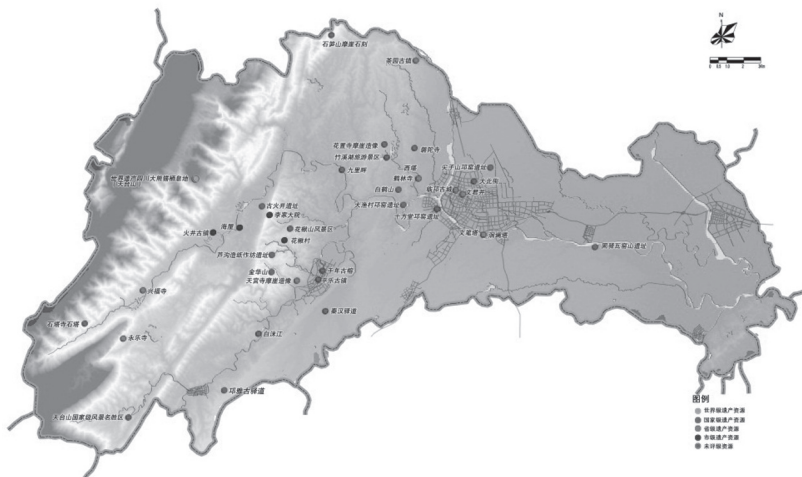


Figure 8. The grade evaluation of heritage resources

### THE SPATIAL ANALYSIS OF HERITAGE RESOURCES

According to the classification and grading evaluation results, by combining the geodesign spatial expression method with GIS spatial analysis, we can get the results of heritage density analysis, quantity grade analysis, and spatial structure.

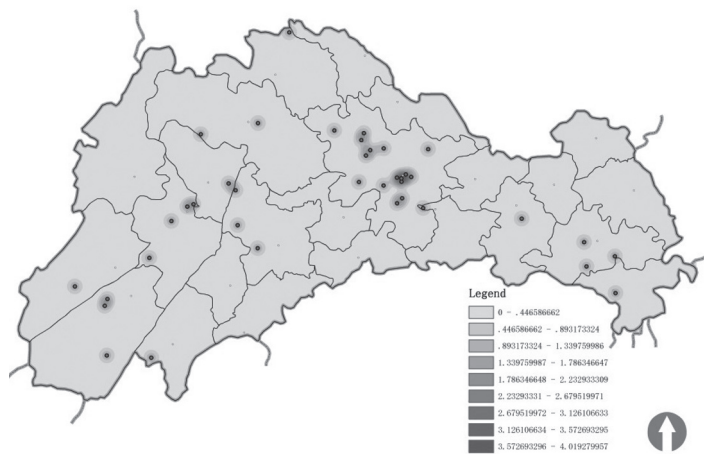


Figure 9. The heritage density analysis

From the heritage density analysis, we reached the conclusion that the heritage resources distributed along the Baimo and Xi River form a linear structure, and that the closer the distance is, the higher the density is.

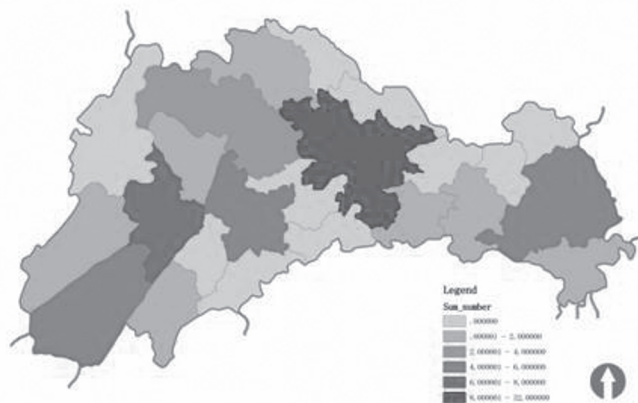


Figure 10. The heritage quantity distribution analysis

Through the analysis of the heritage number grade evaluation, we reached the conclusion that the most resources were distributed in Linqiong town, Pingle town, and Huojing town, and that these three towns were also the nationally and provincially famous historical and cultural towns. According to the Qionglai records, those three towns were built before the Han Dynasty. The records also indicated that the development of these famous towns was dependent on the development of the Southern Silk Road.

### 3.4. The heritage recreational space

Heritage recreation spaces are the important places that support experiences, recreation, and cultural activities. Such spaces have two functional aspects. On the one hand, heritage recreation spaces support the main exhibition places for intangible heritage resources, while on the other hand, they play an important role in developing tourism and promoting local economic interests. At the level of a heritage corridor, heritage recreation spaces must mesh well with local communities, promoting more employment opportunities for local people while simultaneously conserving the heritage resources. So, the heritage of recreation spaces should also be based on the heritage conservational recreation opportunities.

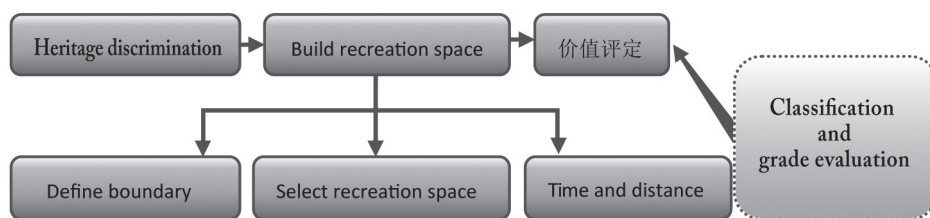
Heritage recreation spaces are also tangible spaces which are tied to conservation spaces. They are built based on the heritage resources, and they emphasize the relationship with conservation spaces. Put another way, they function in parallel with conservation and have an overlapping relationship.



**Figure 11.** The relationship between heritage conservation and heritage recreation spaces

According to the domestic and foreign types of recreation spaces, we categorized the recreation spaces into two categories: A) main intra-regional recreation spaces and B) main extra-regional recreation spaces. Next, each class was divided into point heritage recreation spaces and regional heritage recreation spaces. On the basis of heritage grade evaluations in China, heritage recreation space resources can be divided into world-class, national-class, provincial-class, and local-class resources.

After the definition of the classification and grade evaluation, we could start to build the heritage recreation space pattern. That process consisted of selecting a given recreation space and defining its attributes. In this context, selection and identification were carried out at the same time, with the basic aims being the discrimination of heritage resources – i.e., selecting the factors for constructing recreation spaces – and the assignment of attributes to each space (classification and grade).



**Figure 12.** The technology path for building heritage recreation space

To sum up, we identified the forestry land and constructible land by means of GIS extraction, and then we put them together and selected the coincident space for the recreation spaces.



**Figure 13.** The distribution of heritage recreation spaces

### ***3.5. The heritage travel route organization***

Heritage travel route organizations were an important channel to connect the various heritage resources; meanwhile, these organizations also reflected the relationships between the linear

cultural landscape features. According to the characteristics of heritage in the Qionglai section, we set the selection principles of the organization efforts. The first principle was accessibility – that is, to ensure that the travel routes were clear between heritage resources so that visitors could arrive conveniently. The second principle related to experiences. The experiencing of heritage resources was viewed as a critically important process. So, in addition to considering scenic spots, the experience of travelling should likewise be considered. In other words, when planning the travel routes, we also had to choose landscape effects as well as possible.

According to this principle, we chose the cities and villages along two roads as the travel routes; meanwhile, we also considered beautiful scenery and convenient transportation as the main conditions for the routes. The conclusion we reached was that the structure of the travel routes should be such that “the mainlines connect the regions, while the auxiliary lines connect the nodes”, as shown in the figure below.



**Figure 14.** The route of the Southern Silk Road



**Figure 15.** The road grade evaluation of the Southern Silk Road

### 3.6. *The spatial pattern of the heritage corridor*

Through the theme definition, boundary definitions, heritage resource evaluations, heritage recreation space choices, and travel route organizations, the heritage corridor boundaries of the Southern Silk Road’s Qionglai section were eventually determined. This process also formed the spatial structure which described Linqiong town, Pingle town, and Huojing town as nodes, with the Baimo river and Xi river as the axes.



**Figure 16.** The spatial structure of the heritage corridor



#### 4. CONCLUSION

This paper studied the research method for building a heritage corridor using geodesign on a large regional scale. By means of various forms of spatial analysis, such as contour analysis, slope analysis, heritage density analysis, and buffer analysis, we could determine the heritage grade, heritage density, heritage distribution, and travel route organization. These conclusions could then also be used to identify the characteristics of heritage grade and heritage route, as well as the relationships between heritage resources and their surroundings, and could also serve to guide detailed conservation planning and designs. Therefore, the achievements of this thesis could not only help to realize strategic planning for the detailed physical planning and design of heritage conservation, but could also serve to improve the conservation systems of linear cultural landscapes.

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