1 Introduction

Evaluation of tourism resources is a process to evaluate the value of region tourism resources in order to achieve the best benefits of economic, social and ecological. The contents mainly include the evaluation of tourism resources quality, size and regional conditions, etc [1]. The evaluation of tourism resources plays the role of connecting hub in the development and planning of region tourism. It is the decisive factor whether the tourism resources in the region should be exploited.

The evaluation of tourism resources began in 1950s in foreign. Some scholars evaluated tourism resources from the perspective of the visual quality and introduced quantitative analysis of the mathematical model and established a standardized model of visual quality assessment. With the development of the audio-visual technology, computer technology and network technology, “3S” technology, the Internet and virtual reality technology are widely used in evaluation studies. The modern advanced technology and integration of multi-disciplinary research as an innovation power of the theory and methods [2-4].

Evaluation of tourism resources in the domestic rapidly developed responding to domestic requirements in the late 1970s. At present, “3S” technology, internet technology, virtual reality and other modern evaluation technique are in exploration. Most application of GIS refers to the process of map editing. GIS is a computer-assisted cartography in the planning and makes it from the traditional to save a great deal of human and material resources. For example, He Huachun discussed the integration of RS and GIS technology in the planning of Jiubujiang beauty spot in Hunan Province. It generated many different planning maps using ArcView such as master plan map, landscape distribution of resources map, infrastructure plan map, service facilities plan map, and so on [5]. Another example is Jin Lifang and Liu Xueping protracted the general plan map of beauty spot using 3S technology and GIS software, so that scenery resource information can be queried, analyzed, processed, displayed and updated at any moment [6]. Lin Shaohua also designed the tourist map symbols using the current common GIS platform and proposed solutions respectively after comparing the advantages and disadvantages [7], Yan Hanbing
Hangzhou described the founding method and process of Gushan tourism map \cite{8}. In a word, the comprehensive study on the spatial structure, quality, functionality and other aspects of region tourism resources is still lack.

This paper firstly tries to evaluate the abundance, quality and dimensional distribution of the tourism resources according to the data from the general survey of tourism resources during 2005 to 2006 in Hami region, and then makes it visualization using GIS mapping technology, so as to provide the necessary scientific basis for the regional tourism planning and sustainable development in Hami region.

2 Study methods

2.1 Evaluation of tourism resources

2.1.1 Total factor comprehensive evaluation

Total Factor Comprehensive Evaluation is an understanding and assess on the value of object of tourism resources in accordance with the basic types of tourism resources in the common factor \cite{9}. This assessment is based on common factors other than on personality factors of 155 basic types of tourism resources. These factors must reflect the characteristics of tourism resources. In order to play the role of these factors, some similar types of them may be united and became a combination factor, for example it can unite the visual value, the recreation value and the use value into a “visual recreational use value”. It can judge these combination factors on the evaluation of tourism resources accord to all factors or the 1st and 2nd factors. In addition to the value of resources, there are also some other elements that can be a factor on the evaluation of tourism resources such as fame popularity, influence and time for travelling.

2.1.2 Total factor evaluation system

It can evaluate the object of tourism resources according to the classification system of GB/T 18972-2003 “classification, investigation and evaluation of tourism resources”. At first, the system can be divided into two administrative level, they are evaluation project and evaluation factor. “Value of resource elements”, “influence of resources” and “added value” belongs to the evaluation project. The evaluation factors are as following: the “value of resource elements” including “value of visual, recreational and use”, “value of historical, culture, scientific and artistic”, “degree of rare and fancy”, “size, abundance and frequency” and “integrity”; the “influence of resources” including “fame popularity and influence” and “time for travelling or range of application”; the “added value” including “environmental protection and environmental safety” and so on (Table 1).

2.1.3 Approach of evaluation

(1) Judge. The key point is to judge a tourism monomer belongs to which grades of every evaluation factor based on tips from the actual requirements and evaluation basis of valuation factors. For example, if the value of viewing, recreation and using of a tourism monomer belongs to the third grade (all or one of with high aesthetic value, recreation value, using value) and the integrity belongs to the first grade (the intact of shape and structure) and so on. Another principle also should be noticed that when a tourism monomer belongs to “factors of value combination”, it can score when it meets all the evaluation of content or it meets one or two of evaluation content.

(2) Score. Decide a tourism monomer belongs to a grade and determine the assignment scores of a factor evaluation. When a tourism monomer belongs to “factors of value combination”, it can improve the score when it meets all the evaluation of content and scores can be relatively lower when it meets one or two of evaluation content.

(3) Determine the level of tourism resources. Then it obtained scores of the comprehensive evaluation of the object of tourism resources based on the evaluation of object of tourism resources. The third, the indicators of evaluation of tourism resources is divided into five levels based on total scores of the comprehensive evaluation of the object of tourism resources. They are as below from senior to junior:

5 levels tourism resources, score value ≥ 90,
4 levels tourism resources, score value ≥ 75-89, 
3 levels tourism resources, score value ≥ 60-74, 
2 levels tourism resources, score value ≥ 45-59, 
1 level tourism resources, score value ≥ 30-44, 
Tourism resources has not been graded, score value ≤ 29.

Among which, the 5 level tourism resources are often called “special class tourism resources”; the tourism resources that advanced to the 3 level tourism resources are referred to as “good-class tourism resources”; and all the other tourism resources known as “ordinary tourism resources”.

2.2 GIS mapping technology

GIS mapping technology can greatly enhance the efficiency and accuracy of mapping compared with the traditional mapping technology, especially when it is combined with RS, GPS technology to produce beautiful, accurate, useful maps. So, GIS mapping technology is using more and more in tourism research. For example, Ma Yingxian proposed using geographic information system transmission to guide the graphic design “Discuss several issues on the updates of tourism map” [10]; Shen Yuanbao et al investigated the possibilities of GIS technology in the tourism map production [11]; Xue Liang et al studied the tourism resources mapping of Shanxi Province according to GIS mapping process engineering and in support of ArcGIS software to integrate GIS and GPS, study results showed that the combination of GIS and GPS technology provided a convenient for tourism resources mapping [12]; Wen Zijin et al discussed the

<table>
<thead>
<tr>
<th>Evaluation projects</th>
<th>Evaluation factors</th>
<th>Evaluation and scoring methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of resource elements (85 points)</td>
<td>Value of viewing, recreation and using (30 points)</td>
<td>All or one with ornamental value, recreational value, using value. Divided them into four grades and scoring from high to low in a certain range. Firstly one can determine it belong to which grade, then given a certain score within this grade in accordance with its actual situation. It should be given favorable consideration if the value projects are more.</td>
</tr>
<tr>
<td></td>
<td>Value of history, culture, science and arts (25 points)</td>
<td>All or one with historical value, cultural value, scientific value, artistic value. Divided them into four grades and scoring from high to low in a certain range. Firstly one can determine it belong to which grade, then given a certain score within this grade in accordance with its actual situation. It should be given favorable consideration if the value projects are more.</td>
</tr>
<tr>
<td></td>
<td>Degree of rare and peculiar (15 points)</td>
<td>The degree of species rare and landscape unusual. Divided them into four grades and scoring from high to low in a certain range. Firstly one can determine it belong to which grade, then given a certain score within this grade in accordance with its actual situation.</td>
</tr>
<tr>
<td></td>
<td>Size, abundance and probability (10 points)</td>
<td>It according to size if the monomer is independent; it according to the structure and density if it is collection; it according to its frequency if there is an activity cycle. Divided them into four grades and scoring from high to low in a certain range. Firstly one can determine it belong to which grade, then given a certain score within this grade in accordance with its actual situation.</td>
</tr>
<tr>
<td></td>
<td>Integrity (5 points)</td>
<td>The integrity of shape and structure. Divided them into four grades and scoring from high to low in a certain range. Firstly one can determine it belong to which grade, then given a certain score within this grade in accordance with its actual situation.</td>
</tr>
<tr>
<td>Impaction of resource (15 points)</td>
<td>Popularity and influence (10 points)</td>
<td>The popularity and influence of monomer in which range. Divided them into four grades and scoring from high to low in a certain range. Firstly one can determine it belong to which grade, then given a certain score within this grade in accordance with its actual situation.</td>
</tr>
<tr>
<td></td>
<td>Tour of suitable (5 points)</td>
<td>The time length of appropriate visit after Monomer developed. Divided them into four grades and scoring from high to low in a certain range. Firstly one can determine it belong to which grade, then given a certain score within this grade in accordance with its actual situation.</td>
</tr>
<tr>
<td>Additional points</td>
<td>Environmental protection and environmental safety</td>
<td>It has been seriously polluted, or the existence of serious security risks. Divided them into four grades and scoring from high to low in a certain range. Firstly one can determine it belong to which grade, then given a certain score within this grade in accordance with its actual situation.</td>
</tr>
</tbody>
</table>
application of object-oriented thinking to design and implement tourism map symbol library\[13\].

3 Results and discussions

3.1 Abundance of tourism resources

According to standard of GB/T 18972-2003 “the classification, investigation and evaluation of tourism resources”, tourism resources are divided into 8 main classes, 31 subclasses, 155 base types. There are 175 objects of tourism resources, respectively belonging to 8 main classes, 25 subclasses and 60 base types in Hami region based on investigation. We can know that the main classes of tourism resources is complete, the subclasses reached 81% of the total subclasses and the base types accounted for nearly 40% of the total base types in Hami region. It has rich tourism resources such as buildings and facilities, physiographic landscapes, ruins and relics water area landscapes and so on, on the other hand, the quantity of scenic spots have a higher proportion (Table 2). On the whole, the human resources are dominant, the object of tourism resources accounted for 62% and the scenic spots reached 66.1%.

3.2 Quality of tourism resources

There are 175 representative objects of tourism resources in Hami region, among which it includes 5 ones of 5 levels, 23 ones of 4 levels, 38 ones of 3 levels, 53 ones of 2 levels and 56 ones of 1 level. The special class resources accounted for 2.9%, the good-class resources accounted for 37.7% and the ordinary resources accounted for 62.3%. All these reflected that the quality of tourism resources in Hami region is general and it was absence of top level tourism resources, which go against creating the best tourism products. It's weak for the leading and influence in the tourism development of entire Hami region and the ability into the larger regional cooperation is also limited. On the other hand, we found the number of humanity tourism resources is dominant and the grade is higher, the number of natural tourism resources is relatively little but most of the special grade tourism resources were the natural tourism resources and accounted for 80% in all special grade tourism resources in Hami region, which showed that the natural tourism resources in Hami region have great potential for development and the development, construction of tourist attractions and the arrangement of the main tourist routes should distribute around these resources.

3.3 Spatial analysis on the tourism resources

3.3.1 The spatial distribution of object tourism resources

Among 175 object tourism resources in Hami Prefecture, 21 belong to prefecture, 79 belong to Hami City, accounting for 50.6%; 58 belong to Barkul county, accounting for 37.7%; 18 belong to Yiwu County, accounting for 11.7%. It showed the largest proportion of tourism resources existed in Hami City, which formed a distribution feature of tourism resources as Hami City a center and radiation Barkul County and Yiwu County and laid a good foundation for tourism development.

<table>
<thead>
<tr>
<th>Main classes</th>
<th>Quantity of base types</th>
<th>Proportion of the total base types</th>
<th>Quantity of scenic spots</th>
<th>Proportion of the total scenic spots</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physiographic landscapes</td>
<td>10</td>
<td>17%</td>
<td>24</td>
<td>13.6%</td>
</tr>
<tr>
<td>Water area landscapes</td>
<td>7</td>
<td>12%</td>
<td>18</td>
<td>10.2%</td>
</tr>
<tr>
<td>Biology landscapes</td>
<td>4</td>
<td>7%</td>
<td>14</td>
<td>9.2%</td>
</tr>
<tr>
<td>phenomenon and climate</td>
<td>2</td>
<td>3%</td>
<td>4</td>
<td>1.2%</td>
</tr>
<tr>
<td>Ruins and relics</td>
<td>7</td>
<td>12%</td>
<td>31</td>
<td>17.6%</td>
</tr>
<tr>
<td>Buildings and facilities</td>
<td>21</td>
<td>35%</td>
<td>60</td>
<td>34.1%</td>
</tr>
<tr>
<td>tourist commodities</td>
<td>3</td>
<td>5%</td>
<td>13</td>
<td>7.3%</td>
</tr>
<tr>
<td>humanity activities</td>
<td>6</td>
<td>10%</td>
<td>12</td>
<td>7.1%</td>
</tr>
</tbody>
</table>
According to the distribution of the eight main categories, we found that the main categories reached 8 in both Hami City and Barkol County; Yiwu County was relative weak for only 5, which lacked “D-phenomenon and climate”, “G-travel goods” and “H-human activities”; “F-Buildings and facilities” and “E-Ruins and relics” have more distribution in Hami City and Barkol County. According to the distribution of sub-categories, the sub-categories of Hami city was 24 which was the most abundant, Barkol County was 22 and Yiwu County was only 9 (Table 3). The species of Base type can objectively reflect the quantity difference of base type and the richness of tourism resources in cities and counties. Therefore, it can get the richness of tourism resources by natural classification method of ArcView GIS (Fig.1).

### Table 3
Regional structure of the types of the tourism resources in Hami region

<table>
<thead>
<tr>
<th>City/County</th>
<th>Main class</th>
<th>Subclass</th>
<th>Base type</th>
<th>Proportion of the base types of GB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hami City</td>
<td>8</td>
<td>24</td>
<td>43</td>
<td>27.7%</td>
</tr>
<tr>
<td>Barkol County</td>
<td>8</td>
<td>22</td>
<td>37</td>
<td>23.9%</td>
</tr>
<tr>
<td>Yiwu County</td>
<td>5</td>
<td>9</td>
<td>13</td>
<td>8.4%</td>
</tr>
</tbody>
</table>

Fig.1. Abundance distribution of the tourism resources in Hami region

According to the distribution of the eight main categories, we found that the main categories reached 8 in both Hami City and Barkol County; Yiwu County was relative weak for only 5, which lacked “D-phenomenon and climate”, “G-travel goods” and “H-human activities”; “F-Buildings and facilities” and “E-Ruins and relics” have more distribution in Hami City and Barkol County. According to the distribution of sub-categories, the sub-categories of Hami city was 24 which was the most abundant, Barkol County was 22 and Yiwu County was only 9 (Table 3). The species of Base type can objectively reflect the quantity difference of base type and the richness of tourism resources in cities and counties. Therefore, it can get the richness of tourism resources by natural classification method of ArcView GIS (Fig.1).

#### 3.3.2 The spatial distribution of development potential of tourism resources

In order to analyze the spatial distribution of object tourism resources, it can superimpose the Hami Administrative Region map, the Hami traffic map and the tourism resources distribution map in the GIS software. Then we can get the comprehensive evaluation of the spatial distribution of tourism resources in Hami Prefecture through the spatial analysis of GIS.

It showed clear differentiation of the geographical and spatial of tourism resources development potential by superimposed the Hami Administrative Region map, the Hami traffic map and the tourism resources distribution map and analyzed the relationship between distribution point and the polygon in GIS. The distribution of tourism resources is relatively wide and studied with every city and county in Hami Region. Taken together, the richness and level of tourism resources in Hami City and surrounding Barkol county was much stronger than that in Yiwu County, and Hami City was the strongest among them because which had more high quality resources. On the other hand, most of the tourism resources are located in or near towns or along the vicinity of traffic line, so it's convenient for development (Fig.2).

### 4 Conclusions

On the base of the analysis and evaluation of tourism resources in Hami region, we found that the type of tourism resources is rich, with 8 main categories, 25 sub-categories and the number of basic type accounts for over half of GB; the spatial distribution of tourism resources is not balanced that is relatively intensive in Hami City and Barkol county and is relatively poor in Yiwu County, which is not conducive to integration; it's also disadvantage to create competitive tourist products because the lacking of the special grade of tourism resources; the number of humanity tourism resources is dominant and the grade is higher, the number of natural tourism resources is relatively little but there is still more room for development.
GIS is widely used and has a strong spatial analytical ability, which combined with the evaluation of tourism resources can give full play to its map-based performance and spatial analysis capacity [14]. This study made an application of GIS technology for the evaluation of tourism resources, which expressed the attribute data of tourism resources in the two-dimensional space and fully reflected the difference characteristics of regional tourism resources in abundance, quality, spatial distribution and so on. All of these hope to provide a necessary scientific basis for the protection and reasonable utilization of tourism resources in the region and offer an important reference for tourism decision-making.

Acknowledgements

This paper is supported by “211” Key Discipline Construction Project of Shihezi University.

References