GIS APPROACH TO STUDY TOURISM POTENTIAL OF THE RUSSIAN ALTAI

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ABSTRACT- *Spatial analysis tools available in GIS can be effectively applied for automating evaluation of tourism potential of a territory. The Russian part of the Big Altai was selected as model area tor study tourism potential of the Big Altai. In the framework of this project the indicators of tourist attractiveness of the territory were selected and according to these indicators the evaluation of tourism potential by means of GIS was carried out. As a result of the analysis evaluation maps were created for the Russian part of the Big Altai. The spatial database developed for this project can be used for computing other complex indicators of tourist attractiveness of the territory, what opens up new opportunities for further analysis.*

Keywords: *territory's attractiveness, tourism potential, geographic information systems (GIS), spatial analysis*

SUBJECT AND GEOGRAPHICAL SCOPE OF ANALYSIS

The whole area of the Big Altai is unique, both in natural and in the cultural and historical aspects. There are many interesting natural attractions and a wide variety of cultural and historical monuments of different epochs there. Many of these objects have received a special protection status of federal, regional or local significance. There are several UNESCO World Heritage Sites in the territory of the Big Altai.

In the framework of the present study we set a task to estimate the tourism potential of the cross-border area of the Big Altai using GIS analysis.

As criteria for evaluation of the tourist attractiveness of the area in natural aspect the following indicators have been chosen:

- presence and significance of unique natural sites and attractions;
- diversity of natural sites and attractions (multiplicativity by natural factor).

For estimating tourist attractiveness of the area in cultural and historical aspect the following criteria were used:

- presence and significance of cultural and historical monuments and sites;
- diversity of cultural and historical monuments and sites (multiplicativity by cultural and historical factor).

For evaluating the natural potential of the Big Altai, protected areas and natural monuments (PAs) were considered, as well as other interesting natural sites, which are the most popular among tourists. To estimate the cultural and historical potential of the area, monuments of history and culture were considered as well as different sites where traditional cultural and sportive events took place.

As a model area, Russian part of the Big Altai was selected, since it was possible for us to obtain the most comprehensive spatial and attributive database for this territory for analysis.

Thus, the subject of analysis in this study was the tourism potential of the Big Altai on the selected indicators of territorial attractiveness. The geographical scope of the analysis was the Russian part of the Big Altai territory which includes:

- several districts of the southern part of the Altai Krai situated in the foothills of the Altai Mountains;
- Republic of Altai.

SPATIAL DATABASE FOR EVALUATING TOURISM POTENTIAL OF THE RUSSIAN PART OF THE BIG ALTAI

Spatially distributed data are the basis for spatial analysis in GIS. To estimate the tourism potential of the Big Altai in the model area, an integrated spatial and attribute database developed on the earlier stage of given research for this territory was used. This database was updated to include the following changes:

updated data:

- spatial and attribute data on protected areas and natural monuments, according to their present borders and status;

added data:

- new cultural and historical monuments and sites for which their geo-reference was defined
- archaeological sites of the plateau Ukok according to NGO "Transparent World".

EVALUATION METHOD

To assess the tourism potential for the selected model area, methods of spatial analysis were applied. We used the ArcGIS 9.3 for this purpose. The evaluation was carried out on the basis of the indicators described above.

The aim of the study was to obtain a distribution of these indicators along the model area and to create corresponding evaluation maps.

To calculate the significance of the area on the indicator of the presence of attractive and unique natural sites, a classification of these sites based on their protection status, which in fact determines their significance, was carried out. For computing, instead of the nominal status category a numerical characteristic - «significance level» was introduced for all considered natural sites.

The correspondence between the values of status category and numerical values of the significance level is shown in the Table 1:

Table 1. Significance level of natural sites

Status of natural site	Significance level
Federal	3
Regional	2
UNESCO World Heritage site which wasn't designated protected area status in Russian Federation	2
Local	1

For the model area the indicator of the presence and significance of natural sites was calculated as the density of the significance level, which was equivalent to the calculation of the weighted density of natural sites, where values of the significance level were used as the weights. In the created spatial database natural sites were represented with two geometric data types: point features and polygonal features. To take into account both types of the data in the analysis, we needed to convert them into one feature type (points).

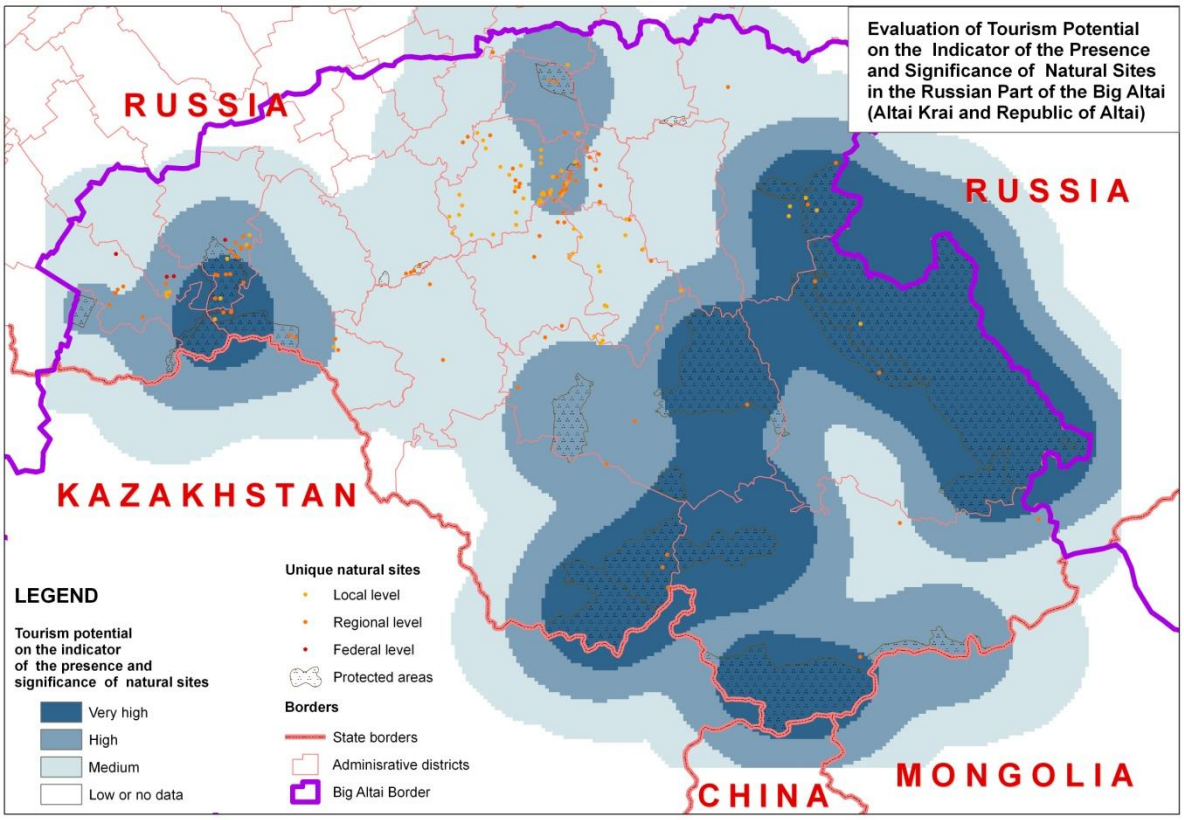

Fig.1 Evaluation of tourism potential on the indicator of presence and significance of natural sites in the Russian part of the Big Altai

To calculate the density a standard operation of GIS spatial analysis DENSITY was used, with the following parameters: search radius equal to 50 km, cell size of the output raster equal to 2 km. The search radius was chosen so that the estimates obtained using spatial analysis in GIS could be compared with the results of the preliminary analysis based on expert assessment, in which a partition of the territory into the cells of size 100 x 100 km was used each of which had got its estimate.

Based on the obtained output raster dataset for the density, Based on the obtained output raster dataset for the density of the presence and significance of natural sites, the model area was classified into the 4 classes. Classification was executed by the method of geometric intervals which gives the best results for data containing many close values, and the resulting evaluation map was created. This map is shown in Fig.1.

The indicator of the presence and significance of cultural and historical sites was calculated the same way as the indicator of the presence and significance of natural sites.

But historical and cultural sites are often situated in populated areas too close to each other to be mapped as separated points within the given map scale. Therefore when it was necessary several close sites were generalized into one point feature which got a significance level, summarized from all the joined points. Thus the significance level varied from 1 to 44. On the next step the density of the indicator was calculated using the same parameters as in the previous case (search radius equal to 50 km, cell size of the output raster dataset equal to 1 km).

Classifying density values into four classes, we created an evaluation map of tourism potential on the indicator of the presence and significance of unique cultural and historical sites. This map is shown on the Fig. 2.

For calculating indicator of diversity for natural sites the classification of these sites by their type was used. This classification is shown in the Table 3.

Since "a complex type" for a natural site means the presence of several simple types, and for the Russian Southern Altai the presence of all 3 simple types, each point with a type code 4 was replaced with 3 points with type codes 1, 2 and 3 correspondingly. Thus in fact only three simple types of natural sites were considered for the studied model area.

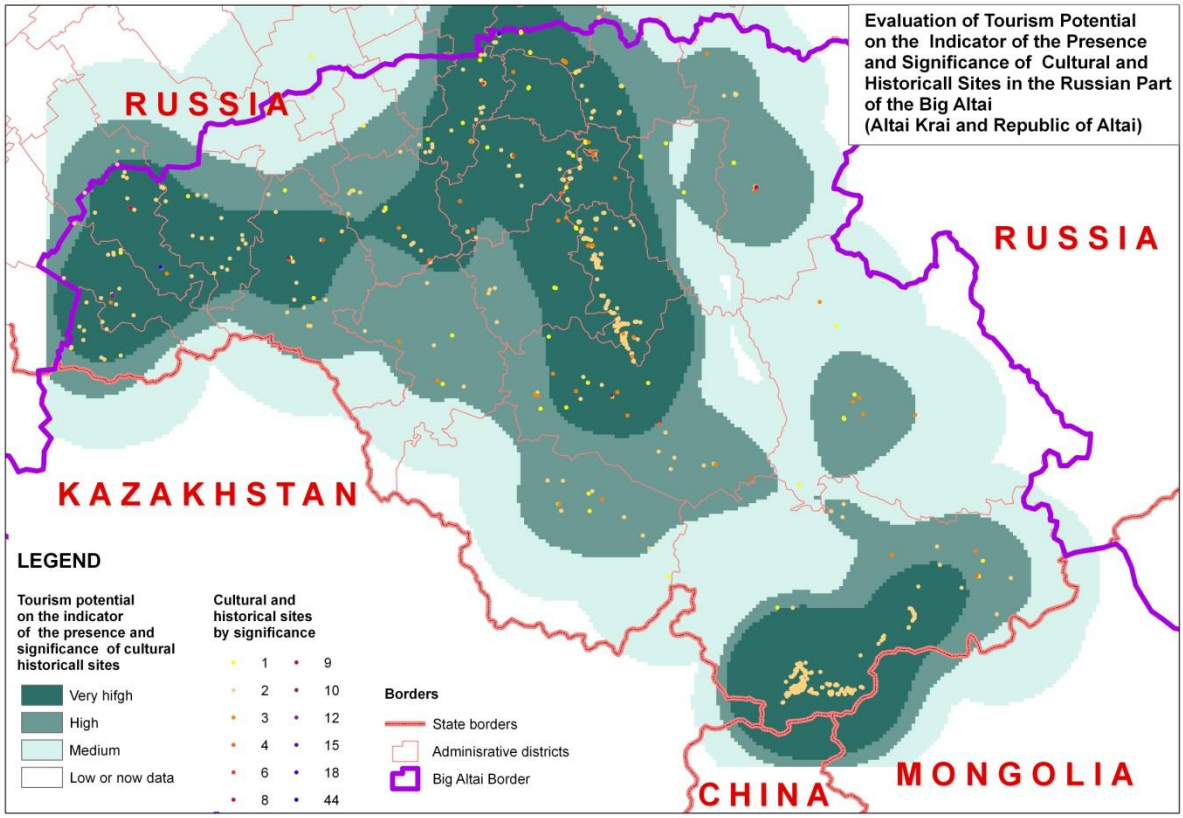

Fig.2 Evaluation of tourism potential on the indicator of presence and significance of cultural and historical sites in the Russian part of the Big Altai

Table 3. Types of natural sites

.Type	Type code
Geological	1
Water	2
Botanic	3
Complex	4

The indicator of the diversity of natural sites was calculated in GIS with the help of the neighborhood analysis toolset. Aggregation function VARIETY was used.

As a result of the operation a raster data set was obtained, in each point of which a number of unique types of natural sites situated within the specified search radius from this point was calculated. The parameters of the operation, search radius and output raster cell size were the same as for the previous two maps.

Based on the cell values of the variety raster dataset the model area was classified into 4 classes, and as a result, an evaluation map of the model area in terms of the diversity of natural sites was created, where each value from 0 to 3 (the number of unique object types found) was replaced with a category of the tourism potential assess: "high", "medium", "low" "no unique natural sites or no

data" correspondingly. Splitting into classes was executed by the method of natural intervals. The map is shown in Fig.3.

According to the map obtained, almost the entire model area falls into the category of high recreational potential on the indicator of the diversity of natural objects.
A similar method was used to calculate the distribution of the indicator of the diversity for cultural and historical sites, where the classification of sites by their type was used. For historical and cultural sites 6 types were identified. For convenience of computing, a numeric code has been assigned to each type. Matching between type categories and their numeric codes are given in Table 4:

Fig.3 Evaluation of tourism potential on the indicator of diversity of natural sites in the Russian part of the Big Altai

Table 4. Types of cultural and historical sites As a result of the spatial analysis operations, an evaluation map demonstrating the tourism potential on the indicator of the diversity of cultural and historical sites was obtained for the model area (See Fig. 4).

Type	Type code
Architectural monuments	1
Museums, theaters, galleries, showrooms and other objects of socio- cultural infrastructure	2
Places of worship	3
Traditional festival and competition venues	4
Interesting industrial objects	5
Archaeological sites	6

Thus during the research a series of maps for evaluating tourism potential on the selected indicators was created. These maps can be used as a basis for the perspective development of different kinds of tourism (sportive, educational, recreational, cultural and entertainment, pilgrimage tourism) in

the Russian part of the Big Altai, and also for the development of the transboundary tourism in the future.

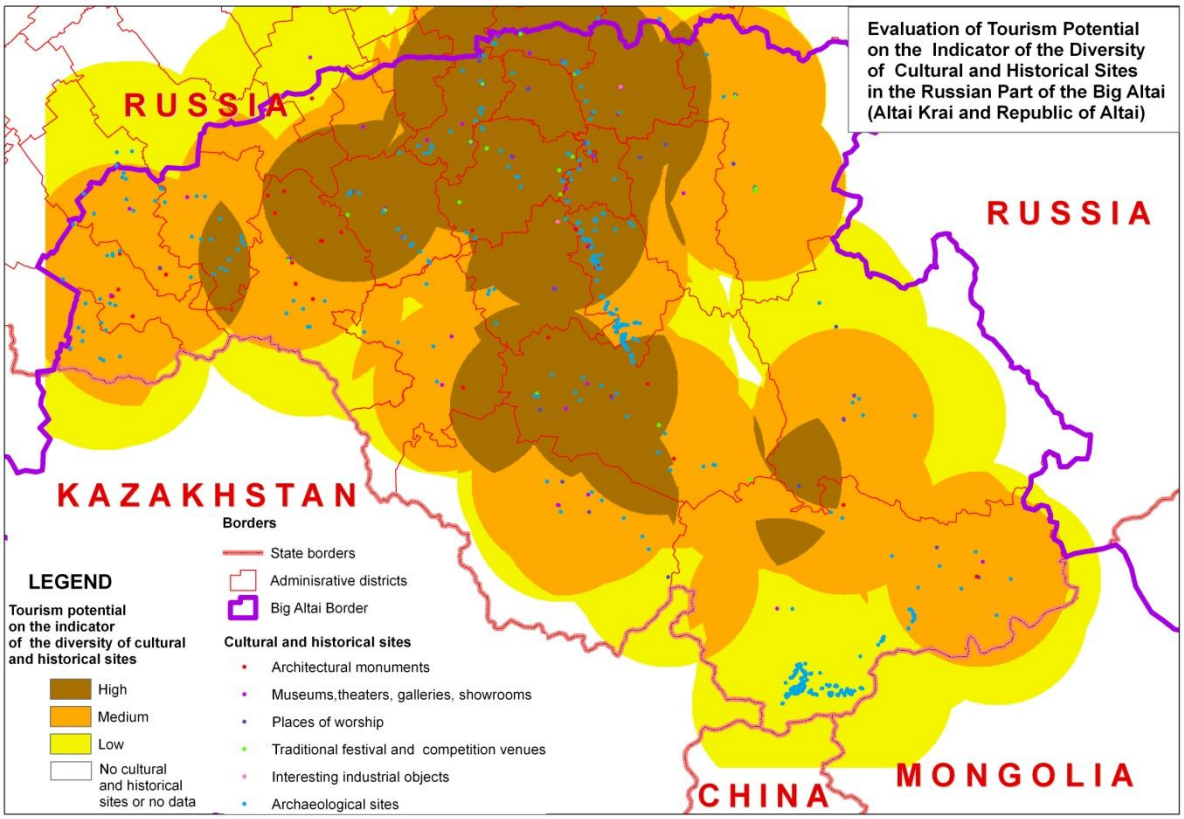

Fig.4 Evaluation of tourism potential on the indicator of the diversity of cultural and historical sites in the Russian part of the Big Altai

CONCLUSION

The experience in the use of GIS technology for the evaluation of the attractiveness and tourism potential of the territory has shown that it is very effective for this purpose and provides a rich material for decision makers, regional authorities and designers to help them making the right decisions regarding the development of recreation and tourism in the region.

Available in GIS specific spatial analysis tools greatly automate the calculation of tourism potential estimates for the selected area.

Applying GIS technology to the task of evaluation of the area on the selected indicators, we not only created specific evaluation maps for the Russian part of the Big Altai, but also provided a good database for further analysis of the whole area of the Big Altai.