Multi-Source Data Coordination Mechanism for Land Resource Sharing

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Abstract: According to the evaluation content, land use suitability evaluation can be divided into single-objective evaluation and multi-objective evaluation. The single-objective evaluation only analyzes the suitability of a certain utilization mode in the evaluation area. However, multi-objective land suitability evaluation is a process of selecting different land use types as evaluation targets, and analyzing land suitability according to the differences in land quality and the ecological and social requirements of different land use modes.

1. Introduction

With the aggravation of global environmental change problems such as climate warming, the environmental effects caused by the unreasonable exploitation of human land resources have gradually become prominent. As the direct manifestation of human society's disturbance to the terrestrial ecosystem, the structural change of the land system and the evolution of the land system in pattern succession have also increasingly become the focus of global attention. The evolution of land system is not only closely related to human production activities, but also has an important impact on the biogeochemical cycle of the earth's surface, directly affecting the interaction between human society and ecological environment and restricting the sustainable development of human society. On the other hand, with the rapid development of economy and society and the expansion of population, the demand for land resources is increasing day by day. If the coordination relationship between the land resources to be developed and the whole natural environment is not clearly understood, so that the bearing capacity of the natural environment and the suitability of the land ecology for human behavior are ignored, excessive or improper development behavior will inevitably lead to serious consequences such as the destruction of the ecological system and the excessive occurrence of natural disasters. Land suitability analysis can guide people to develop according to the inherent suitable direction of land, and has important guiding significance for ensuring reasonable and appropriate use of land resources and improving the social value of land.

2. Land Use Suitability Evaluation System

2.1 Evaluation System

The land use suitability evaluation system is based on the land evaluation framework promulgated by FAO in 1976. The framework classifies land suitability into four levels: land suitability class, land suitability category, land suitability subcategory and land suitability unit, as shown in Figure 1.

The land suitability class reflects the suitability for a specific land use pattern, and is divided into two class suitability class and inappropriate class. The suitability program represents that the evaluated land can bring yield and benefit value through sustainable utilization, and does not cause unacceptable infringement on land resources. Unsuitable guidelines indicate that the quality of the land cannot be used in a sustainable way. The land suitability class reflects the suitability degree in the suitability class, and divides the suitability class and the inappropriateness class into several classes respectively, but there is no strict restriction on the classification. The example given by FAO divides the appropriate classes into three types: highly appropriate, moderately appropriate and barely appropriate. High suitability class means that this type of land has no obvious restriction or less restriction on a certain utilization mode, which will not reduce the yield and benefit, nor will

it have excessive investment. Moderate suitability class means that the land is restricted. Long-term use in a certain way will reduce the yield and benefit to a moderate extent and increase the input. Moderate suitability is slightly worse than high suitability, but it still has certain attraction in utilization.

Land belonging to the barely suitable category has great restrictions on certain utilization modes, which may reduce the output or benefit or increase the input cost. For such input-output benefits, land is barely available. Inappropriate classes are divided into two categories: currently inappropriate classes and permanently inappropriate classes. At present, it is not suitable to represent that under the current technical level and acceptable cost input conditions, it is restrictive and not suitable for use at present. However, in the future, when the conditions are met, the technical level will be improved or more cost input can be utilized. Permanently unsuitable class means that the land is severely restricted and there is no possibility of any successful utilization of the given method. Suitable subcategory of land reflects various restrictions, such as water shortage and wind erosion disasters. Subcategory use lowercase letters as mnemonics, such as,, and so on. The number of suitable subcategory is generally controlled at the minimum number that can distinguish restrictive conditions, and the naming is as concise as possible.
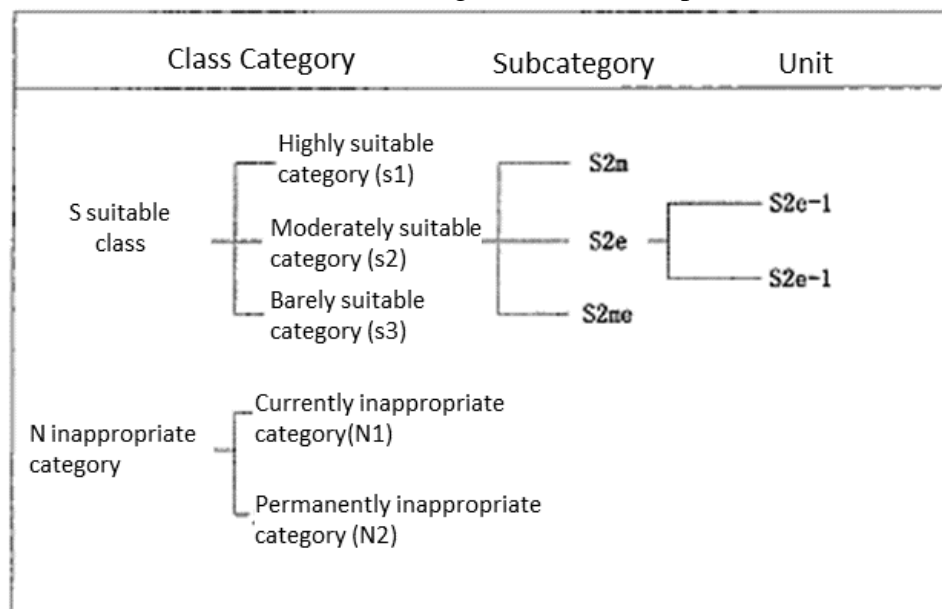

Fig. 1. Map Land Use Suitability Evaluation System

2.2 Knowledge Base Design

In the model tool, the knowledge base is mainly used to store the knowledge of experts, various kinds of rule information, etc. The knowledge base needs to classify all kinds of knowledge first and then store them according to a certain structure. The structure of the knowledge base is shown in Figure 2.

The knowledge base includes two sub-bases, static knowledge base and rule base. The static knowledge base mainly stores some knowledge information with few changes, such as the basic knowledge of land suitability evaluation, land management knowledge, soil hydrology and other professional knowledge, economic knowledge, etc. The rule base stores the rule information that needs to be called in the model, including the selection rules of criteria factors, the division rules of classification thresholds, the selection rules of parameter values and the suitability classification rules.

The most important problem in building the knowledge base is how to properly transform the expert's knowledge into a form that the database can store. This requires a reasonable expression of knowledge and information. In this thesis, the static knowledge base and the rule base in the knowledge base are designed respectively. The representation of static knowledge base information of static knowledge base information mainly stores text information and shows the interrelation

between various data in the form of tree structure view. Each end of tree structure corresponds to one data information. The data is stored in the form of text file or data table, and the addition, deletion, modification and search of data can be realized. The representation of rule base information is similar to the rule structure used for classification rule mining in chapter 5. The knowledge of storing rule base information can also be expressed in the form of one. In the preceding paragraph of the rule, each condition can be connected by or. The conclusion of one rule can be the condition of another rule. Rules can solve the target problem through forward and backward reasoning. According to the knowledge tree formed by connecting all rules, the required reasoning process can be found.
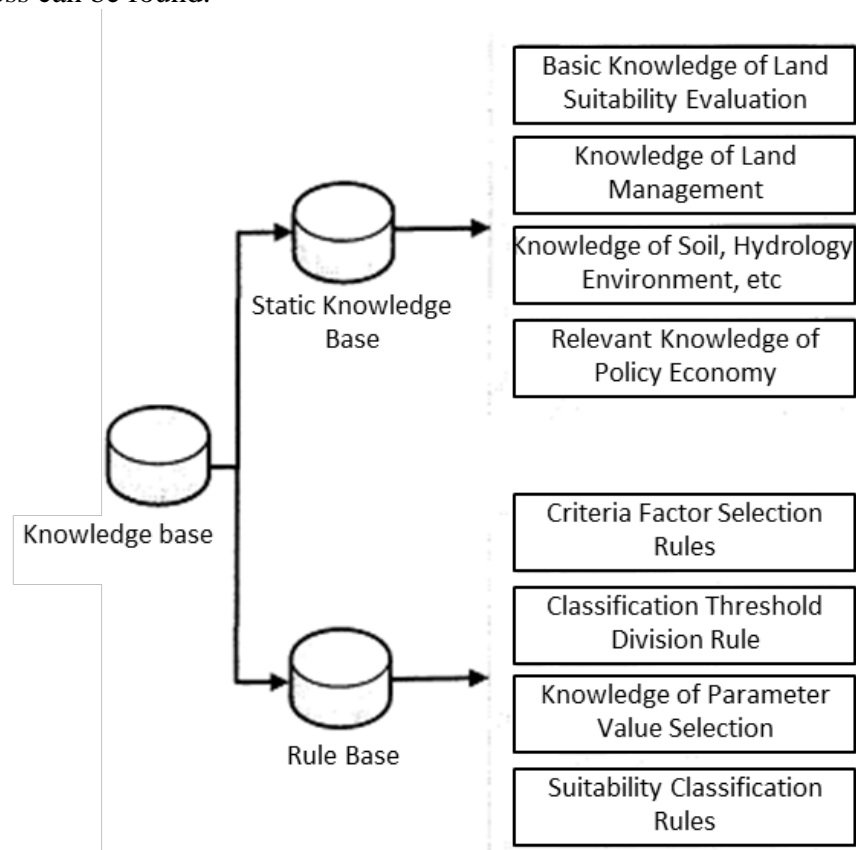

Fig. 2. Structure Design of Knowledge Base

3. Experimental Analysis

For the same research area, we used three different methods to evaluate the suitability of land use. Analytic hierarchy process and ant colony algorithm are used to realize the current suitability evaluation, and cellular automata method realizes the potential suitability evaluation. The distribution of each suitability type of the three evaluation results (Figure 3) is analyzed below. The area percentage of each suitability type is shown in the figure. In the evaluation results of classification rule mining based on concept drift detection, the regions are also mainly distributed on flood plains of rivers. The distribution of the suitability of irrigated agricultural land shows that the high suitability area has no significant influence on the evaluation results. It has obvious influence on the evaluation results. The regions of and are all located in the regions that are set to reach the age of. Soil quality factors also have a great influence on evaluation and classification. The approximate sum area is distributed in areas with good soil quality and medium soil quality. Near and areas are distributed in areas with less slope. The region and the buffer zone in the factor map also have similar spatial distribution patterns, and nearly the region falls within the selected rice buffer zone for surface runoff.
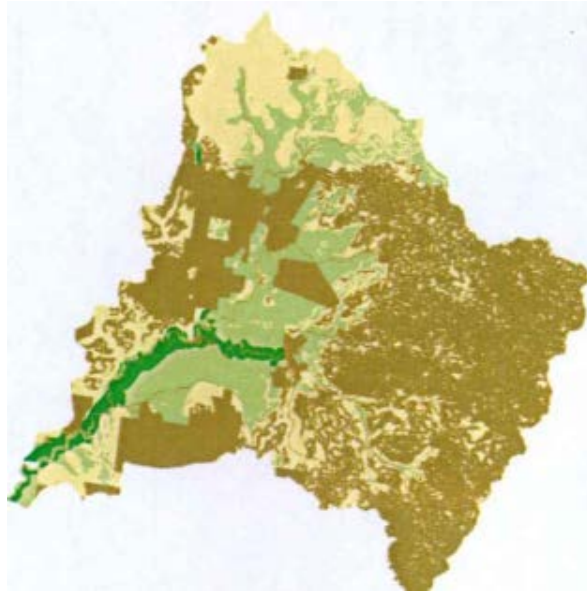
Fig.3. Results of land use suitability evaluation

4. Conclusion

Land use suitability evaluation is of far-reaching significance for scientific, reasonable and effective utilization of limited land resources and realization of sustainable land use. Based on the analysis of the existing commonly used land use suitability evaluation methods, this thesis proposes a new application method of artificial intelligence model in this field, and deeply discusses the theory, method and specific application of the evaluation model. In this thesis, a series of discussions and evaluation models around land use suitability evaluation methods have been established, providing guidance and decision-making basis for land use planning decision makers to carry out land use planning and development. The developed model tool can not only be applied to the research area in this thesis, but also can effectively complete the suitability evaluation of other areas or other land types through simple configuration.

References

[1] Sethi, Singh T, Kantardzic, et al. A grid density based framework for classifying streaming data in the presence of concept drift [J]. Journal of Intelligent Information Systems, 2015, 46(1):1-33.

[2] Henke M, Souto E, Santos E M D. Analysis of the evolution of features in classification problems with concept drift: Application to spam detection[C]// Ifip/ieee International Symposium on Integrated Network Management. 2015.

[3] Losing V, Hammer B, Wersing H. KNN Classifier with Self Adjusting Memory for Heterogeneous Concept Drift[C]// IEEE International Conference on Data Mining. 2017.

[4] Sun Z, Anderson B D O. Formation feasibility on coordination control of networked heterogeneous systems with drift terms[C]// Decision & Control. 2016.