

A Review of Cultivated Land Space Change

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ABSTRACT

This paper comprehensively reviews the research on cultivated land space change. It elaborates on the background and significance of the research on cultivated land space change, and systematically analyzes the main research contents, including the driving factors of cultivated land space change, the methods and models for its analysis, and the impacts on the ecological environment. Through a summary and analysis of relevant research, it is found that the research on cultivated land space change has important theoretical and practical significance for ensuring food security, optimizing land use, and promoting sustainable development. Finally, the existing problems in current research are pointed out, and prospects for future research directions are put forward.

KEYWORDS

Cultivated Land, Ecological Environment, Food Security.

1. INTRODUCTION

In the context of global population growth, urbanization, and industrialization, the change in cultivated land space has become a crucial issue attracting extensive attention from the academic community and relevant departments. Cultivated land is the foundation of agricultural production and an important guarantee for human survival and development. Understanding the change rules and influencing factors of cultivated land space can provide a scientific basis for rational land use planning, food security maintenance, and ecological environment protection.

With the continuous progress of society and the development of the economy, the demand for land for various purposes such as urban construction, industrial development, and infrastructure construction has been increasing. This has led to a series of changes in the quantity, quality, and spatial distribution of cultivated land. For example, in many developed areas, large - scale urban expansion has occupied a large amount of high - quality cultivated land, while in some underdeveloped areas, due to the abandonment of rural areas and the transformation of agricultural production methods, the spatial pattern of cultivated land has also undergone significant changes.

2. RESEARCH CONTENTS

2.1. Driving Factors of Cultivated Land Space Change

2.1.1. Natural Factors

Natural factors play a fundamental role in the change of cultivated land space. Climate change is one of the important natural factors. For instance, rising temperatures, changing precipitation patterns, and an increase in extreme weather events such as droughts and floods can all affect the quality and productivity of cultivated land. In some arid and semi - arid regions, the expansion of desertification due to long - term drought has led to the degradation and reduction of cultivated land. Soil quality is also a key factor. Soils with different textures, fertility levels, and drainage conditions determine the suitability of land for cultivation. Poor - quality soils may be gradually abandoned or require more intensive management measures to maintain their productivity, which in turn affects the spatial distribution of cultivated land.

2.1.2. Socio - economic Factors

Population growth is a major driving force for the change of cultivated land space. As the population increases, the demand for food, housing, and other resources also rises. This often leads to the conversion of cultivated land into residential areas, industrial parks, and infrastructure. For example, in some densely populated areas in Asia, the rapid growth of the urban population has forced the expansion of cities into the surrounding rural areas, resulting in the occupation of a large amount of cultivated land. Economic development policies also have a significant impact. For instance, the implementation of policies to encourage industrialization and urbanization in some regions may lead to the large - scale transfer of agricultural land to non - agricultural uses. In addition, the development of the agricultural economy itself, such as the adjustment of agricultural product prices and the improvement of agricultural production technology, can also affect farmers' decisions on land use, thus causing changes in the spatial distribution of cultivated land.

2.2. Methods and Models for Analyzing Cultivated Land Space Change

2.2.1. Remote Sensing Technology

Remote sensing technology has become an important means for monitoring cultivated land space change. Through satellite - borne or aerial - borne sensors, a large amount of land - surface information can be obtained, including the distribution, area, and vegetation cover of cultivated land. Different remote sensing data sources, such as Landsat, Sentinel, and GaoFen series satellites, have their own characteristics in terms of spatial resolution, spectral bands, and time - series coverage. High - resolution remote sensing images can accurately identify the boundaries and types of cultivated land, and time - series remote sensing data can be used to monitor the dynamic changes of cultivated land over a long period. For example, by comparing the remote sensing images of the same area in different years, it is possible to clearly observe the expansion or reduction of cultivated land areas, as well as the conversion between cultivated land and other land use types.

2.2.2. Geographic Information System (GIS) Technology

GIS technology is widely used in the analysis of cultivated land space change. It can integrate various spatial data related to cultivated land, such as land use maps, topographic maps, and soil maps. Through spatial analysis functions such as overlay analysis, buffer analysis, and network analysis in GIS, the relationships between cultivated land and other factors can be explored. For example, overlay analysis can be used to analyze the relationship between cultivated land distribution and terrain, soil type, and water resources, so as to better understand the spatial pattern and change mechanism of cultivated land. In addition, GIS - based spatial modeling can also be used to predict the future trend of cultivated land space change, providing a scientific basis for land use planning.

2.2.3. Mathematical Models

Mathematical models are also important tools for studying cultivated land space change. The cellular automata (CA) model is a commonly used model. It simulates the change of land use types based on local rules and neighborhood relationships. In the study of cultivated land space change, the CA model can be used to predict the expansion or contraction of cultivated land under different scenarios. The Markov model is another model often used to analyze the transition probability between different land use types. By establishing a Markov transition matrix, the future change trend of cultivated land in terms of quantity and spatial distribution can be predicted.

2.3. Impacts of Cultivated Land Space Change on the Ecological Environment

2.3.1. Impact on Ecosystem Services

Cultivated land space change has a significant impact on ecosystem services. Cultivated land itself provides important ecosystem services such as food production, soil conservation, and water regulation. When cultivated land is converted into other land use types, these ecosystem services will be affected. For example, the conversion of cultivated land into urban areas will lead to a reduction in food production capacity. At the same time, the loss of cultivated land vegetation cover may increase soil erosion, reducing the soil conservation function of the ecosystem. In addition, the change in the spatial distribution of cultivated land may also affect the water cycle and water - holding capacity of the ecosystem, thereby affecting the water - regulation function.

2.3.2. Impact on Biodiversity

The change in cultivated land space can also have an impact on biodiversity. The expansion of cultivated land may lead to the destruction of natural habitats such as forests, grasslands, and wetlands, which is not conducive to the survival and reproduction of many wild plants and animals. On the other hand, the abandonment of cultivated land may also cause a series of ecological problems. For example, in some mountainous areas, the abandonment of cultivated land may lead to the invasion of some alien plants, which will disrupt the original ecological balance and reduce biodiversity.

3. CONCLUSIONS

In general, the research on cultivated land space change is of great significance for understanding the relationship between human activities and land use, ensuring food security, and protecting the ecological environment. Through the analysis of driving factors, it is clear that both natural and socio - economic factors jointly affect the change of cultivated land space, and the influence of socio - economic factors is becoming increasingly prominent in the context of rapid economic development.

In terms of research methods, the combination of remote sensing technology, GIS technology, and mathematical models provides a powerful means for accurately monitoring and analyzing the change of cultivated land space. These methods can not only describe the current situation of cultivated land space change but also predict future trends.

Regarding the impact on the ecological environment, the change of cultivated land space has a profound impact on ecosystem services and biodiversity. Therefore, when formulating land use policies, it is necessary to comprehensively consider the balance between economic development, food security, and ecological protection.

However, there are still some limitations in the current research. For example, the research on the complex interaction mechanisms between different driving factors is still insufficient. In addition, the accuracy and applicability of some prediction models need to be further improved. In the future, more in - depth research can be carried out from the following aspects: strengthening the research on the coupling mechanism of multiple driving factors, improving the accuracy and universality of

prediction models, and strengthening the research on the ecological compensation mechanism under the background of cultivated land space change.

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