The adjustment strategy of ecological land use in the process of urbanization in the suburbs of big cities: A case study of Jizhou District, Tianjin

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Abstract. With the rapid development of rural urbanization, ecological problems have become increasingly serious, so the protection of ecological land is very important. Using vector images from 2010 to 2014 in Jizhou District, Tianjin City, supported by GIS technology, the land use types in Jizhou District, Tianjin City are divided into three categories: cultivated land, construction land and ecological land, and the ecological land is divided into three categories. It is divided into five categories: plantation land, forest land, grassland, water area and water conservancy facility land, and unused land, using methods such as ecological land area change rate and land use transfer matrix model to conduct research and analysis. Studies have shown that the ecological land in Jizhou District of Tianjin has been decreasing year by year in the past five years, and most of the ecological land has been transformed into construction land; the amount of woodland has changed the most drastically, the land for plantation has changed the fastest, while the amount of unused land has shown an overall upward trend.

1.Introduction
Rural urbanization has always been a hot topic that the country pays attention to in order to keep up with the pace of social and economic development, and advances in science and technology have also made great contributions to the advancement of rural urbanization. At the same time, rural urbanization as its transitional model is also accelerating. In the process of rural urbanization, land use types are gradually changing, and construction land expansion has become the main feature of regional land use changes. The rapid spread of construction space and the continuous shrinking of natural ecological space often bring complex social, economic and environmental consequences, especially the phenomenon of urban ecological land represented by forests and wetlands being occupied by construction land expansion, which not only destroys the city. At the same time, it also reduces its ecological service function (Guo Qiang et al., 2015) [1]. Therefore, in recent years, the issue of ecological land under the influence of rural urbanization has gradually attracted the attention of domestic scholars related to land resources, and academic reports, papers, and journals on ecological land have also been increasing. However, the measures to solve the problem of ecological land reduction in the process of rural urbanization are still at the exploratory stage. This paper mainly focuses on the research of ecological land in Jizhou District, Tianjin, and explores strategies or countermeasures to solve the problems.

Today, with the rapid development of urbanization, first of all, in order to meet the steady development of the social economy, gradually improve the quality of life of the people, and human needs for living space, the use area of construction land also continues to occupy most of the urban
area. Secondly, in order to adhere to the red line of 1.8 billion mu of arable land and ensure the food security of the people, the area of arable land also has a place in the planning of urbanization construction, which makes the planned area of other land relatively tight, especially the excessive reclamation and occupation of ecological land has severely damaged the resources and environment, resulting in frequent ecological and environmental problems. Such acts of occupying and misusing ecological land obviously conflict with the purpose of harmonious coexistence between man and nature that mankind has always advocated.

This paper takes Jizhou District of Tianjin City as the research area. Firstly, it analyses the current situation of land use in the research area under the situation of rapid rural urbanization; Secondly, by using ArcGIS software and combining the land use change rate, land use transfer matrix and other methods to process the data, the change situation and direction of ecological land use within the research scope in recent years are analysed to find the existing problems of ecological land use; Finally, this paper proposes feasible adjustment strategies from the perspective of ecological civilization construction and rural planning.

2. Literature review and theoretical development

2.1. Ecological land research
Domestic scholars have carried out research on ecological land from different angles, and certain achievements have been made, which has enabled future generations of scholars to have a certain understanding of the relevant knowledge of ecological land, and in the future research on the road to provide a theoretical basis. In view of the impact of changes in ecological land use on the value of ecological services, Yu Kaiqin (2018) considered that among all types of ecological land use[2], woodland ecosystems and aquatic ecosystems have a greater impact on the value of ecosystem services, as for the performance evaluation of the spatial pattern of ecological land use, An Chao (2019) believes that improving the performance of the spatial pattern of ecological land use, in addition to the need to protect and allocate different types of ecological land, there is also the need to effectively guide the economic and social factors within the scope[3]; Li Jian (2018) and others put forward the plan and suggestion of optimizing the layout of construction land by constructing the ecological security pattern of a certain region, which has a strong guiding role for regional spatial planning and ecological protection[4].

2.2. Research on Suburbs of Big Cities
Research on the impact of land use changes in the suburbs of big cities on the value of ecological services (Chen Dan et al., 2018) pointed out that rapid urbanization should also take into account the relative share of water, woodland, and garden areas in the total land area[5]. The total value of ecological services does not decline, so that the land can be used sustainably. Water areas and gardens are positively related to the value of ecological services. Therefore, water areas and gardens should be protected to avoid their transfer to other types of land.

The layout planning of recreational ecological farms in the suburbs of large cities should be based on the analysis and sorting out the ecological relationship among the five major functional modules, and scientifically and rationally design the ecological chain with the recycling of materials and water resources as the core, so that land use and function The layout of the district and road network and water system conforms to the ecological law and realizes the recycling of resources (Luan Chunfeng et al., 2017)[6]. The change of rural land use function in the suburbs of big cities is comprehensively affected by natural factors, location conditions, industrial transformation, regional policies and land use subjects. In the process of rural revitalization, the multi-functional attributes of land use should be fully utilized to promote the enhancement of rural value (Zhu Lin et al., 2019)[7].

There are also many research results on ecological land abroad. Regarding the construction of ecological infrastructure, the American scholar Honachefsky (1999) believes that overemphasizing the potential economic value of land and underestimating its ecological value, leading to the disorderly
spread of cities and the degradation of land ecology, suggested the service function of ecological infrastructure. It should be effectively combined with land use decision-making; for ecological land planning and management, Kareiva (2007) first proposed "ecosystem service clusters", a term that regards nature as a whole that includes different types of ecosystem services[8]. Research by Raudsepp-Hearne (2010) found that related categories of "ecosystem service clusters" and "social-ecological" subsystems have a certain potential relationship in spatial distribution[9], and based on this, they define "clusters" as multiple The spatial agglomeration of ecosystem services.

3. Methodology

3.1. Research Method

3.1.1. Change rate and dynamic degree of ecological land area
The ecological land area change index refers to the quantitative change of ecological land within a research area within a certain period of time. It can intuitively reflect the change range and speed of the ecological land area in the research area. The following is the calculation formula of the change index:

\[ K_T = \frac{U_b - U_a}{U_a} \times 100\% \]  

\[ K = \frac{U_b - U_a}{U_a} \times \frac{1}{T} \times 100\% \]

In the formula, KT represents the rate of change of ecological land area, K represents the dynamic degree of ecological land area; Ua and Ub respectively represent the area of the ecological land type at the beginning of the study and the end of the study; T is the time period of the study, generally set It is calculated on a yearly basis.

3.1.2. Land Use Transfer Matrix Model
The land use transfer matrix model can express the mutual conversion relationship of land use types in different time periods in the same area. It is an application of Markov model in land use change. This model is derived from the quantitative description of the state of the system and its state transition in system analysis. It is used by many domestic and foreign scholars when conducting research on the change and transition of land use. The mathematical expression of the land use transfer matrix model is as follows:

\[ S_{ij} = \begin{bmatrix} S_{11} & S_{12} & \cdots & S_{1n} \\ S_{21} & S_{22} & \cdots & S_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ S_{n1} & S_{n2} & \cdots & S_{nn} \end{bmatrix} \]

In the formula, S represents the area of the land type; n represents the number of types before and after the land type transfer; i and j represent the land use types at the beginning and the end of the study respectively; Sij represents the conversion of the i type land use type to the j type land use type Area; Snn represents the area where the i-type land use type remains unchanged from the beginning of the study to the end of the study.

3.2. Procedure
The data processing used in this article is mainly based on the ArcGIS 10.1 software and the Excel table in the Office software. Firstly, import the vector layers from 2010 to 2014 in Jizhou District, Tianjin City into ArcMap, open the attribute list, and export it as text data named by year. Then import the text data into the Excel table, filter according to land use types and find the area of all ecological land in each year, and finally summarize them to get the ecological land use area change table in
Jizhou District, Tianjin from 2010 to 2014. Secondly, in accordance with the calculation methods of Formula 1 and Formula 2, the ecological land area of each year is calculated in an Excel table, and after summing them, the dynamic degree and area of ecological land use in Jizhou District, Tianjin City from 2010 to 2014 can be obtained. Change rate table. Finally, in the ArcMap software, the vector maps of Jizhou District in 2010 and 2014 were exported, and the land use types in Jizhou District were divided into three categories: cultivated land, construction land, and ecological land according to the classification of land names. Unified representation of its land type code field. Use the fusion tool to fuse and export the vector diagrams of the two years according to the geographical code field, and then use the overlay analysis in the analysis tool to calculate the intersection of the two newly exported vector diagrams and output them as intersecting vector diagrams. Add an area field to its attribute list and calculate the area of the patch, and then export it as a text file. Finally, import the text data in the Excel table, modify and delete unnecessary columns, select all valid data, insert the pivot table, drag the 2010 field into "Column", the 2014 field into "Row", and the area field into "Value", after sorting, the required land use transfer matrix in Jizhou District, Tianjin City from 2010 to 2014 can be generated.

4. Results

4.1. Analysis of the change speed of ecological land

According to the above data processing method, the change rate of ecological land use area in Jizhou District, Tianjin from 2010 to 2014 is shown in Table 1

| Area change (Hectares) | Rate of change (%) | Dynamic (%/year) |
|------------------------|-------------------|-----------------|
| Total ecological land  | -488.85           | -0.66           | -0.13           |
| Plantation land        | -216.47           | -1.41           | -0.28           |
| Woodland               | -271.95           | -0.68           | -0.14           |
| Grass                  | -0.16             | -0.02           | 0.00            |
| Water area             | -95.01            | -0.55           | -0.11           |
| Unused land            | 94.74             | 19.48           | 3.90            |

It can be seen intuitively from Table 1 that from 2010 to 2014, the change rate of the total ecological land area in Jizhou District decreased by 0.66 percentage points as a whole, and the dynamic degree also decreased by 0.13 percentage points; Both garden land and woodland showed a continuous downward trend, and the area of plantation land changed the most intensely. Its change rate dropped by 1.41 percentage points, and its dynamic degree also dropped by 0.28 percentage points, which was twice the dynamic degree of forest land; forest land area change rate Decreased by 0.68%, the dynamic degree is -0.14; the water area and water conservancy facility land show a trend of first decline and then increase, the overall change rate has dropped by 0.55 percentage points, and the dynamic degree has dropped by 0.11 percentage points, which is almost the same as that of forest land.; Unused land shows a positive growth trend, the area change rate has increased by 19.48%, and the dynamic degree is 3.90, its absolute value is much higher than that of ecological land; while the area change, change rate and dynamic degree of grassland are close to zero. Therefore, there is basically no change.

4.2. Analysis of ecological land transfer

Use ArcGIS 10.1 software to visualize the 2010 and 2014 vector diagrams processed in accordance with the above data processing method, and use different colours to indicate cultivated land, construction land, and ecological land, and then reprocess the vector graphics Export, you can get the land use type maps of Jizhou District, Tianjin in 2010 and 2014, as shown in Figure 4-7 and Figure 4-8; according to the above data processing method, you can get the following 2010- The land use transfer matrix in 2014 is shown in Table 2
Table 2: 2010-2014 Land Use Transfer Matrix in Jizhou District

|          | 2010 Arable Land | 2014 Construction Land | Ecological Land | Total |
|----------|------------------|------------------------|----------------|-------|
| Arable Land | 38338.25         | 5851.47                | 8293.98        | 52483.71 |
| Construction land | 6535.10          | 19905.35               | 5892.74        | 32333.19 |
| Ecological land | 8228.35          | 5507.17                | 59161.84       | 72897.36 |
| Total        | 53101.70         | 31263.99               | 73348.56       | 157714.25 |

It can be seen from Table 2 that from 2010 to 2014, the area of ecological land without land use change and transfer was 59,161.84 hectares; the area of ecological land converted to cultivated land and construction land was 14186.72 hectares, of which the main land was converted to cultivated land; However, the main source of ecological land transfer is also cultivated land. According to the calculation of the area of ecological land, the area converted from ecological land to cultivated land is only 65.63 hectares; while the area converted to construction land is 385.57 hectares, which is much higher than the area converted to cultivated land, which is 5.9 times that of cultivated land. It can be seen that in the past five years, ecological land was mainly converted to construction land.

5. Discussion

5.1. Adjustment strategy based on the construction of ecological civilization

Carry out special publicity activities on the construction of ecological civilization to build an ecological consciousness civilization. Nowadays, people who know the concept of ecological civilization account for only a small number of people except workers or scholars in related fields and industries. Therefore, it is necessary to ideologically enhance the ecological awareness of the people, so that people can deeply understand the importance of ecological safety, in order to achieve the purpose of reducing the destruction and pollution of ecological land. This requires intensified publicity and education on the construction of ecological civilization, and the form of publicity and education must be able to attract the people and meet their interests, so as to obtain more supporters; for young people, you can conduct campus lectures, Organize activities such as ecological safety knowledge contest to achieve the purpose of publicity and education.

5.2. Adjustment strategy based on the perspective of rural planning

Coordinate the layout of ecological land. In the planning process, combining the requirements of ecological environment protection and maintaining the continuity of the natural landforms, the plantation land will be concentrated in the barren slopes and hilly areas with suitable site conditions, and the woodland and grassland will be rationally distributed in space, with emphasis on natural protection Forests, shelter forests, water and soil conservation forests and other important forest land resources maintain and maintain the natural forms of rivers and lakes, and guarantee the growth and migration of animals and plants.

6. Conclusion

This article mainly uses ArcGIS 10.1 software, based on the five-year land use vector data and land use type data from 2010 to 2014 in Jizhou District, Tianjin City, and uses GIS technology to reclassify land use types and extract different The ecological land type data, borrowing GIS analysis tools, using the method of land use change rate, dynamic degree and land use transfer matrix, carried out quantitative change analysis of each ecological land type, and proposed Tianjin Jizhou based on the problems reflected by the analysis results The adjustment strategy of ecological land in the district. The main research conclusions of this article are as follows:

The regional division of land use types in Jizhou District of Tianjin is obvious. Ecological land is mainly distributed in the northern region; agricultural land is mainly distributed in the southern region; construction land is concentrated in the middle of the study area. According to the topography and geomorphology of Jizhou District, Tianjin, ecological land is mainly distributed in areas with
relatively high altitudes such as middle mountains, low mountains, and hills. Therefore, this concentrated area of ecological land will be developed and utilized to transform it into construction land. It is relatively difficult to implement; on the contrary, agricultural land is distributed in flat terrain areas such as plains and depressions, making it easy to plan the implementation of the project. In summary, this has led to continuous expansion of construction land to the southern part of the agricultural land concentration area in five years.

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