LUCC study under different geological conditions in Nanjiang district, Sichuan Province

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Abstract. With the development of the times, more and more people begin to pay attention to land use change. This paper analyses the influence of different geological background conditions on the dynamic change of land use in Nanjiang County, Sichuan Province, and attempts to establish a land use model that meets the geological conditions of each region. According to different geological conditions, the purple soil of Cretaceous and Jurassic tilted single-sided low mountains and eroded terrace like narrow valley low mountains in the south is suitable for planting and breeding; the yellow soil of Jurassic and Triassic single-sided low and middle mountain purple soil in the middle is suitable for developing multi economic crops dominated by forest land; the limestone of yellow brown soil of Triassic, Sinian, Cambrian and middle mountain yellow soil in the north can be used for forestry and animal husbandry Industry.

Keywords: Nanjiang district, Geological condition, LUCC, Dynamic change.

1. Introduction

As the basis of human survival and development land, more and more people begin to pay attention to its use and change, which is also one of the main causes of global change [1]. Since the "land use / Land Cover Change Program" (LUCC) was jointly proposed by IGBP and IHDP in 1995, land use change research has entered a rapid development stage. With the deepening and development of this research, the focus of LUCC research has gradually transformed into regional and local land use change [2]. In the process of land use and development, geological background can be used as the basis of land cover and land use. It covers all geological characteristics and related issues related to land use and development, including sedimentary characteristics, land characteristics, parent rock composition, topography and geomorphology, geochemistry, hydrology and water resources, geological structure and other factors. Therefore, within a certain area, we can identify the geological background of all the factors (composition) related to or having influence on land use change and land cover, as well as internal and external geological processes [3].
In economically developed southern regions and ecologically fragile areas, China has carried out a large number of regional land use change research projects, but in the relatively backward economy and relatively good ecological environment in Northeast Sichuan, the work is rarely carried out. At present, the research on land use change in this area is mainly based on remote sensing image interpretation, government research report, combined with social and economic data to carry out relevant spatial and quantitative analysis, rarely combined with geological background conditions to carry out land use change research [4-7]. Therefore, this paper intends to study the land use change under the geological background in Nanjiang County, Northeast Sichuan Province. This study can provide useful reference and basis for LUCC research and government decision-making of land sustainable development in local and other similar areas.

2. Study area and geological background

2.1. Overview of the research area
Nanjiang county is located in Bazhong City, Sichuan Province. It is located in the northeast edge of Sichuan Province, at the south foot of Micang mountain, adjacent to Tongjiang River in the East, Bazhou in the south, Wangcang in the west, and Nanzheng County in Shaanxi Province. It is located in 106°26′-107°07′E and 31°52′-32°44′N, covering an area of 3382.8 square kilometers. It has a long history and has a history of 1500 years. In the sixth year (525) of Emperor Wu of Liang Dynasty, Nanjiang county was established, which was named as "the river is difficult to pass through"

2.2. Geological background
The geotectonic location of Nanjiang county belongs to the northern margin of Yangtze paraplatform. The northern margin of Sichuan platform and the fold belt of central Sichuan depression have extremely complex geological structures and many faults are developed in the northern area. From south to north, the main geological structures are as follows: Noetherian structural system, Micangshan East-West structural system and paleocathaysian system (including Shangliang and tiechuanshan fold fault zone). The lack of regional strata is less, and almost all strata of Proterozoic, Paleozoic, Mesozoic and Cenozoic are developed, only Devonian and Carboniferous strata of Late Paleozoic are missing, and the strata are well preserved [8]. In the northeast of Nanjiang County, Proterozoic metamorphic rock series, with a total thickness of more than 3000 meters, are exposed. Slate, dolomite, schist and marble with different degrees of compilation are developed. Around the Proterozoic metamorphic rock series, the Paleozoic strata are developed in a ring shape. The main sedimentary environment is coastal marine facies. The main lithology is shale, siltstone and carbonate rock. A large number of animal and plant fossils are developed in the rocks. The total thickness of the whole stratum is more than 3000 meters. The Mesozoic strata are mainly terrigenous deposits, the main lithology is terrigenous elastic rocks, and marine sedimentary strata are locally developed, mainly distributed in the central and southern part of the study area, with a total thickness of more than 7000 meters. The thickness of Cenozoic strata is less than 50 meters, and it is distributed sporadically on planation surface, valley terrace and Intermountain basin. The outcrop in the south is mainly Cretaceous and Jurassic strata, and the northern strata are older and mostly Proterozoic strata.

3. Analysis of land use dynamic change

3.1. Data acquisition
The data of this study mainly come from the topographic and geomorphic map of Nanjiang County, 1:20 geological map, soil type and distribution map, DEM map, social and economic data, government work report, literature review and other channels. By combining and integrating the above information, we can extract useful data.
3.2. Analysis of land use dynamic change

According to the data obtained by the research, land use and land cover data of Nanjiang County in 1989, 2000 and 2012 are sorted out, and further data analysis and spatial extraction are carried out. Combined with the actual situation of Nanjiang County, on the basis of the original secondary classification of land use types, the unified extraction is divided into six first class land types: cultivated land, woodland, grassland, construction land, water area and unused land (Table 1).

| Land use types          | 1989         | 2000         | 2012         |
|-------------------------|--------------|--------------|--------------|
| Cultivated land         | 117887.93    | 118247.67    | 89900.46     |
| woodland                | 193494.22    | 179066.36    | 190656.63    |
| grassland               | 29179.7      | 43225.11     | 46237.5      |
| waters                  | 481.75       | 481.76       | 613.62       |
| land used for building  | 368.74       | 391.65       | 11598.75     |
| Unused land             | 0            | 0            | 92.16        |
| total                   | 341412.34    | 341412.55    | 339099.12    |

According to the analysis of Table 1, the area of unused land in the study area was 0 in 1989, only 5 land use types were distributed. The forest land occupied the largest area and the largest number, mainly deciduous broad-leaved forest and evergreen broad-leaved forest. The main planting area was the high-altitude area in the northern part of the study area, distributed in strip or area, accounting for nearly 60% of the total area of the study area in that year, with a total of 193494.22 hm². The cultivated land area was the second, mainly distributed in the South and middle of the study area with low altitude, accounting for more than 30% of the total area of the study area in that year, with a total of 117887.93 hm². Grassland, water area and construction land cover less than 10% of the total area, and most of them are scattered.

In 2000, the unused land area of the study area was still 0, only 5 land use types were distributed, and the forest land area was still the largest. The vegetation type and distribution range were the same as those in 1989, which were deciduous broad-leaved forest and evergreen broad-leaved forest, but the proportion decreased to about 52%, with a total area of 179066.36 hm². The area and proportion of cultivated land increased slightly, and the distribution area was still concentrated in the south of the study area with low altitude. Compared with 1989, the total area of grassland increased by 14045 hm², accounting for 12.6%. The water area and construction land area changed little, accounting for 0.2%.

By 2012, the number of land use types will increase to 6. The area of forest land increased slightly compared with that in 2000, and recovered to the level of 190656.63 hm² in 1989, and the proportion increased accordingly. The vegetation type and distribution scope remained unchanged. The cultivated land area decreased a lot, only 89900.46 hm², the proportion decreased, the distribution scope remained unchanged, and concentrated in the southern valley area with gentle terrain. The area of grassland increased slightly compared with that in 2000, and the distribution range was between cultivated land and forest land, with a distribution of 46237.50 hm². The area of construction land has increased significantly, with a large distribution area, which has increased by 29.6 times compared with that in 2000. This shows that the local economic development level is growing rapidly, and people's demand for construction land is increasing sharply. However, from the perspective of distribution range, it is relatively scattered, indicating that it is effective to form a scale. The water area covers an area of 613.62 hectares, accounting for 0.3% of the total area. The new type of unused land was added, but it accounted for only 0.1% of the total area of the study area.

4. Response of geological background conditions to land use dynamic change

In the northern part of the study area, the elevation fluctuates greatly, ranging from 1500 to 2800m. The landform is mainly monocline and fold. The main lithology is limestone, and the erosion is serious. The main developed soil types are yellow soil and yellow brown soil with mild climate. In Taoyuan
mountainous area where karst (erosion) monoclinic gully is more developed, the vast majority of land use types are woodland, which mainly produce wood and related forest by-products, and cultivated land is scattered in gentle low-lying areas; in Xinmin, Shaba and Guangwu mountain areas where erosion fault blocks are developed, the main forest areas are primary forests and secondary forests, which are also the main forest areas in the study area, rich in medicinal materials In Pinghe, Yangba, Qiaoting and Guimin areas where erosion folds (folds) are developed, they are mainly economic forests, which are rich in economic crops such as medicinal materials and dried fruits, and a small amount of agricultural products such as corn. Due to the large elevation fluctuation in the northern part of the study area, the traffic is inconvenient, and the influence of geological background, the overall land use change range, speed, land use change rate and land use comprehensive degree index change degree are small, only grassland and garden land relatively change greatly.

The central part of the study area is relatively smooth, with an altitude of 800-1000m. The landform is mainly monoclinic, mainly developed with conglomerate, siltstone and mudstone, belonging to fluvial facies. The main developed soil types are purple soil and yellow soil with mild climate. There are a certain area of paddy field and dry land in this area, which mainly produces wheat, corn and other economic crops, such as sweet potato and tea, and is also the main production area of these crops. Compared with other regions, the central region has a higher degree of comprehensive land use, a faster rate of land use change and a higher dynamic rate of land use. In particular, the areas of original land, forest land and unused land have been greatly reduced, and the area of construction land has increased rapidly, which reflects the acceleration of local economic development and the continuous improvement of local living standards.

The southern part of the study area has low altitude and medium topographic relief, which is in the shape of erosion platform. Monoclinic structure is mainly developed. Siltstone and mudstone are the main sedimentary strata. Purple soil is the main developed soil type with warm climate. In Pinggang, Gaoqiao, Renhe, xialiang, Heitan, Huqiao, Fengyi, Zhengzheng and Yuantan, the gentle slope syncline is mainly developed. In this area, tea and other economic crops are mainly planted, and the land use is mainly dry land; in Shuangliu, Heping, Hongguang, Changchi, Yanshan, Dahe and Xingma, the eroded platform terrain area is developed. Because of the abundant water in this area, it is the main paddy field distribution area and mainly produces rice Lotus root and other crops. Compared with the above two regions, the regional economic development is faster, and the comprehensive utilization of land is higher. The specific performance is that the change of various land use types is faster, the grassland and unused land are less, the rate is fast, and the increase range of cultivated land and construction land is high.

The above studies show that the dynamic change of land use is closely related to the geological background. In the southern and central regions with better geological conditions, the transportation is relatively convenient, the economic development is rapid, the secondary and tertiary industries are relatively developed, the land use mode and the land use change efficiency are significantly higher than those in the northern region; in the northern region of the study area, the altitude is higher, mainly mountainous areas are dominated, and the geological conditions are relative It has a great impact on land use pattern and structure, and also affects economic development. Therefore, the regional geological background is the premise of land use, but also the basis of land use. The impact of natural conditions and socio-economic conditions under different geological conditions on land use change is obviously different in different regions. On this basis, socio-economic conditions and traffic conditions have a significant impact on regional land use pattern and structure in a short period of time.

5. The establishment of land use model should accord with local geological conditions

5.1. Developing farming and breeding in the South
The Cretaceous and Jurassic strata are mainly exposed in the south of the study area, with relatively low terrain and medium topographic relief. It is suitable for the development of planting and breeding. On the basis of actively exploring the development mode of agricultural circular economy, we should improve the use efficiency of chemical fertilizer, reduce the use of highly toxic and refractory pesticides
and non-degradable plastic film, vigorously develop organic agriculture, green agriculture and facility agriculture, and provide agricultural modernization level. At the same time, closely around the work idea of "building a new countryside with industry as the support", the development models of "fruit medicine animal husbandry", "fruit grain wood", "fruit medicine vegetable" and "fruit and vegetable tree" are carried out, and the characteristic industries such as tea, nut, medicinal materials, rice and breeding industry are given priority to, and the advantageous planting and breeding industry is regionalized, the regional planting and breeding industry is characterized, and the characteristic planting and breeding industry is large-scale Standardization, accelerate the formation of tea, dried fruit industry, medicinal materials, animal husbandry, grain and oil, Chinese herbal medicine and other characteristics of agricultural belt.

In addition, efforts should be made to strengthen the construction of farmland and water conservancy infrastructure, do a good job in regulating the canal system at the end of the river, do a good job in the construction of river embankments, reservoirs and danger elimination and reinforcement, so as to improve the water delivery quality and water storage capacity. In accordance with the requirements of comprehensive management of mountains, rivers, fields, forests and roads, we should pay attention to the comprehensive development of agriculture, strengthen the transformation of medium and low yield fields, do a good job in land consolidation, and improve land production capacity. At the same time, we should speed up the construction process of towns and ecological villages with beautiful environment, and carry out the projects of integrating ecological public welfare forest, comprehensive environmental improvement, ecological enriching people and ecological village construction.

5.2. Developing economic crops in Central China

Jurassic and Triassic strata are mainly exposed in the central part of the study area, with gentle terrain and medium altitude. On the premise of protecting forestry structure and ecology, we should gradually adjust forestry industrial structure, adjust forest species, quantity and distribution, improve forest quality, protect biodiversity and ecological rationality, ensure sustainable development and utilization of forest, and promote ecological forestry industry development. At the same time, we should also pay attention to the characteristic agricultural industry, formulate the development of nut, medicinal materials and animal husbandry three major economic industries, construct the policy ideas of green ecology and green development, and realize the transformation from single forestry to multi industry. In addition, we must take science and technology as the support to develop forestry industry, demonstrate and promote the development of forest ecological models such as forest grass livestock and forest fruit medicine, vigorously build farmland shelter forest and rural four side forest, and restore and maintain a good agricultural and animal husbandry ecological environment.

5.3. Developing forestry and animal husbandry in Central China

The northern part of the study area is mainly exposed in Triassic, Sinian and Cambrian strata, and the altitude changes greatly and high. At the same time, ecological tourism should be vigorously developed, focusing on the development of "Guangwu mountain national key scenic spot", "Micangshan National Forest Park", "Guangwu Mountain Provincial Nature Reserve" and "xiaolangou provincial nature reserve" It is the development direction of the rural economy in this region to lay down mineral resources, set up various related enterprises with mining as the main body, and promote the comprehensive development of the ten major industries in rural areas.

6. Conclusion

From the perspective of geological background, combined with natural factors and socio-economic conditions, this paper forms a comprehensive understanding of the driving forces of land use change in the study area.

The dynamic change of land use is closely related to the geological background. The area with simple geological structure and gentle landform is suitable for the development of diversified industries, and the land utilization rate and types are relatively diverse. In the northern mountainous area with complex
geological conditions, the land use efficiency is low, the land use types are single, and the socio-economic and traffic conditions are relatively poor.

We should adjust measures to local conditions and poor geological conditions, deeply cultivate eco-tourism, focus on the development of all kinds of national key scenic spots, national forest parks, nature reserves and other tourism industries, and develop underground mineral resources, set up various related enterprises mainly focusing on mining industry, and promote the comprehensive development of ten major rural industries.

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