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Forest landscape patterns dynamics of Yihe-Luohe river basin

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Based on the information from forest resources distribution maps of Luoning County of 1983 and 1999, six indices were used to analyze spatial patterns and dynamics of forest landscapes of the typical region in the middle of the Yihe-Luohe river basin. These indices include patch number, mean patch area, fragment index, patch extension index, etc. The results showed that: (1) There was a rapid increase in the number of patch and total area from 1983 to 1999 in the study area. The fragment degree became very high. (2) The area of all the forest patch types had witnessed great changes. The fractal degree of each forest patch type became big from 1983 to 1999. The mean extension index of Robinia pseudoacacia forest, non-forest, shrub forest, sparse forest, and Quercus species forest increased rapidly, but that of economic forest became zero. The fractal dimension each showed that forest coverage has been promoted. (3) The changes of landscape patterns were different in different geomorphic regions. From 1983 to 1999 the vegetation cover area, the gross number and the density of patch, diversity and evenness of landscape were all reduced greatly in gullies and ravines, but the maximum area and the mean area of patch types were increased. In hilly region, both the forest cover area and the number of patch increased from 1983 to 1999, but the mean area of patch was reduced greatly. In mountain region, even though the area under forest canopy reduced from 1983 to 1999, the patch number was increased greatly, the mean area of all patch types was reduced, the extension index, diversity index and evenness index of landscape were all increased. Furthermore, because of different types of land use, human activity and terrain, the vegetation changes on northern and southern mountain slopes were different. According to these analyses, the main driving forces, such as the policies of management, market economy, influence of human activities etc. are brought out.

Forest landscape patterns dynamics of Yihe-Luohe river basin DING Shengyan¹, SHANG Fude², QIAN Lexiang¹, CAO Xinxiang¹, LI Shuang¹, LI Haomin¹ (1. College of Environment & Planning, Henan University, Kaifeng 475001, China; 2. College of Life Science, Henan University, Kaifeng 475001, China) Forest landscape pattern is a spatial arrangement and combination form of various forest landscape elements, which varies in size and shape. It is not only the detailed embodiment of forest landscape heterogeneity, but also the result of all kinds of ecological processes in different scales. Forest landscape pattern is determined by the distribution and constitutes of forest resource and environment, as well as changes that affect energy flow, material cycling and species moving inside forest (Xiao et al., 1997; Hong et al., 1994), so it has a tight relationship with the abilities of anti-disturbance and restoration, the stability degree and biodiversity of forest ecosystem (Fu, 1995). The landscape pattern of forest is in the constant development and changing processes, today's pattern takes shape based on the past landscape flows (including natural, social, economic and various kinds of ecological processes). Therefore, by analyzing the dynamics of forest landscape pattern with the elapse of time, we could understand forest landscape ecological processes, find out succession mechanism of forest landscape, predict future variation tendency of the forest landscapes and suggest theoretical base for the sustainable utilization of forest resource at last (Olsson et al., 2000; Reid et al., 2000; Pan et al., 1999; Nagasaka et al., 1999). The forest landscape pattern dynamics had attracted numerous scholars' attention (Jiang et al., 2002; Yang et al., 2001; Jian et al., 2001; Shao, 1991; Matthias Burgi, 1999), but the traditional studies about forest landscape pattern dynamics mostly had focused on the quantitative analysis, and a little on corresponding principles analysis of dynamics, what was more, many researchers only had paid a little attention to mountains, but much to river basins. So this paper, taking the typical region of central Yihe-Luohe river basin as an example, with the help of ARC/INFO software, based on the information from forest distribution maps, analyzed the dynamics of forest landscape pattern

ns and that of different types of geomorphic regions from 1983 to 1999, and probed into the possible reasons of its dynamics from many aspects, such as the policies of management, the economic industrial structure of forestry, human disturbances etc. Some reasonable suggestions on sustainable development, eco-security and sustainable utilization of resources in Yihe-Luohe river basin were put forward.

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- 2 Study methods
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- 4 Conclusions and discussion

Through the analysis of the changes of forest landscape's space pattern, we could expound the basic law and process of trends of forest landscape effectively and announce the reason why the landscape pattern of forest changes so greatly. (1) The patch number of forest landscape increased very quickly in the study area, from 556 in 1983 to 1,494 in 1999. Transforming the low-quality woodland constantly and planting economic trees cosmically, which had made their largest area increased and the smallest area decreased, which reflected that the fragment degree of landscape of the whole study area was increasing constantly. (2) The fractal dimension of all forest landscapes of the whole county changed from 1.28 in 1983 to 1.33 in 1999, which indicated that the status of Luoning County's forest landscape had been already improved. And the policy of "closing hillsides to facilitate afforestation" had obtained a good effect. The ecological environment had developed very well, barren hillside areas decreased, the area of woods increased and its distribution tended to be complex. (3) The reflection performed on the space characteristics of the interference intensity and landscape succession. As the intensity of human interference increased, the diversity of landscape declined. Even though the area of Robinia pseudoacacia forest, economic forest, and Quercus species forest increased, the types of dominant patch were still the non-forest land and deserted meadow. So the forestry centre should increase the area of forestland and adapt to local conditions in management policy and measurement. With the increase in the degree of artificial interference, the fragment degree of landscape was strengthened. But it was not contradictory between the landscape fragment and increasing dominant degree, because human conscious selection leads to the fact that a lot of landscape elements deplete or disappear. At the same time, human activity makes the natural landscape divided into landscape patch of different kinds again. (4) The dynamics of forest landscape pattern were different in different geomorphic regions. From 1983 to 1999 vegetation cover area decreased greatly in gully region, but the patch type and mean patch area increased; in hilly region, vegetation coverage increased greatly and mean patch area decreased; in mountain region vegetation coverage increased and vegetation types kept unchanged. What was more, vegetation dynamics on northern and southern mountain slopes were different for land use types, human activity and terrain were different. According to these analyses, the main driving forces, such as the policies of management, market economy, man-induced influence, were brought out.

关键词: forest; landscape pattern; dynamics; geomorphic zone; Yihe-Luohe river basin; Luoning County