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Editorial

Research and Review of Forest Ecological Security in the Yangtze River Economic Belt

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Editorial

The paper, the assessment of forest ecological security and its determining indicators: A case study of the Yangtze River Economic Belt in China, written by Dr. Xu Tang et al., focuses on forest ecological security issues. Forest ecosystem is the largest and the most important natural ecosystem in terrestrial ecosystem. The forest ecosystem has multiple functions: it produces oxygen to supply human beings and all kinds of animals and plants; it absorbs carbon dioxide to reduce the earth's greenhouse effect; it provides various nutrition, food, and habitats for all kinds of animals and plants to maintain biodiversity; it also helps to shield against wind and sand, protects soil and water, and prevents rocky desertification. Compared with other ecosystems such as wetlands, deserts, and oceans, forest ecosystems have the most biological species, the most complex structures, and the strongest ecological benefits. However, along with the development of human society, forests have been destroyed dramatically by human activities making forests overwhelmed and forest ecosystems increasingly fragile. Excessive deforestation, wasteland cultivation, and overgrazing by humans have led to a continuous reduction in forest area and forest volume. This decline will inevitably lead to serious consequences such as the greenhouse effect, soil erosion, climate anomalies, disappearance of endangered species, and ecological imbalances. The continuous decline in the quantity and quality of forests will negatively affect the health of the forest system in the short term, and it will threaten the survival of humans and other creatures in the long run; eventually, it will threaten the sustainable development of human beings. Therefore, in this context, it is of practical significance to establish an evaluation index system to monitor the security of forest ecosystems.

Assessing the vulnerability of forest ecosystems can use the concept of forest ecological security. Forest ecological security refers to the integrity and health of the forest ecosystem under human pressure, that is, the ability of forests to self-regulate and self-repair, and it is generally measured by using the forest ecological security index. A high forest ecological security index shows a high level of integrity and health of the forest ecosystem and a strong human capacity for sustainable development. Conversely, A low forest ecological security index shows a weak ability of forest ecosystems to ensure sustainable human development. The evaluation of forest ecosystems must consider not only the forest ecosystem itself, but also human activities. As human activities are complex and changing, the forest ecological security index is also considered to be changing dynamically. From the aspect of spatial scale, different forest ecosystems in different places are facing various threats; therefore, forest ecological security also has regional characteristics.

In recent years, the high frequency of forest ecological security incidents has gradually attracted people's attention to forest ecological security issues, but the concept of forest ecological security is relatively new and corresponding researches are still in preliminary stage. Existing researches on forest ecological security mostly focus on human interference, fire, and other influencing factors. However, few scholars have established comprehensive evaluation index systems. In terms of research scope, most researches focus on the national, provincial, and river basin level, while literatures on forest ecological security index from the county level are scarce. In terms of research methods, scholars mostly use PSR models or system dynamics models to study ecological security. In addition, ArcGIS is also widely used in evaluating ecological security.

The paper, the assessment of forest ecological security and its determining indicators: A case study of the Yangtze River Economic Belt in China, takes the Yangtze River Economic Belt as the scope of study. The paper measures the forest ecological security index of 1086 districts and counties and analyzes the corresponding influence factors. The Yangtze River is China's largest river and the third longest river in the world. The Yangtze River is one of the regions which maintain most abundant water resources and biodiversity in China. It provides a suitable environment for the local people to live and develop. With these conditions, the Yangtze River

Economic Belt was formed. Although Yangtze River Economic Belt accounts for only one-fifth of the country's area, its GDP accounts for nearly half of the country's total GDP. However, in recent decades, with the over-exploitation by people, the vegetation on both sides of the Yangtze River has gradually decreased and the forest has gradually degraded, these have resulted that the forest volume per unit area in the region is far below the national average. The scarce forest resources have caused frequent natural disasters such as soil erosion, drought and flooding in the region, which have seriously affected the sustainable development of local people and society. To reverse this trend, the Chinese government has successively initiated the construction of the Yangtze River shelter-belt system and plain greening projects; the government has implemented key ecological projects such as natural forest protection, returning farmland to forests, desertification control, wetland protection, wildlife protection, and nature reserve construction. The latest monitoring report shows that the decline of forest resources in the region has been reversed, forest quality and structure have been continuously optimized, the total area of wetlands has remained stable, the expansion of decertified land areas has been curbed, and rock desertification control is being actively promoted.

In order to comprehensively evaluate the degree of forest ecological security in the Yangtze River Economic Belt, the research group has undergone the first test, the second test, and the third test with the support of the government. The whole research lasted 5 years .In the first test, 15 counties in five provinces were covered; in the second test, all counties in five provinces were covered; in the last test (the third test), all counties in 11 Provinces and municipalities along the Yangtze River were covered. The difficulty of data collection was increasing along with the expansion of the experiment region. The process of data collection started from 2000 and ended at 2015. Due to the lack of data before 2010, this paper only selects data collected from 2010 and 2015. In order to collect data, the research team held data training meetings in Wuhan, Nanchang, Nanjing, Chongqing, and Kunming to assign data collection tasks. At the same time, in order to calculate the forest ecological security index, the research team organized several expert meetings which included forestry and ecology experts in Beijing to finally determine the index system and index calculation method.

Due to the difficulty of data collection, the research group reduced the initially identified 32 indicators to 17 indicators. At the same time, due to the different degrees of difference in the index data, the index calculation method has also been adjusted from the original entropy weight method to a comprehensive method that places equal emphasis on the entropy weight method and the expert method. The improvement of the index system and the adjustment of the index calculation method have been recognized by the expert group. In terms of field investigation, the object group was divided into three groups, the data of which were surveyed in 33 typical counties (3 typical districts and counties in each province or municipality were selected) and a large amount of first-hand information was obtained. On this basis, according to the evaluation from the expert group, the calculation results obtained by the research group are basically in line with the actual situation of the forest. The index system and index calculation method established by the research group is able to provide several useful references for other ecological security studies.

In this paper, Xu Tang et al. first reviewed the research development of forest ecological security, established a comprehensive index evaluation system, and calculated the forest ecological state index, the forest stress index, and forest ecological security index of the Yangtze River Economic Belt by entropy weight method, expert method, and geometric mean method. This paper analyzes the distribution characteristics of the forest ecological state index, pressure index, and comprehensive index from the perspective of the whole region by using ArcGIS, and then compares and analyzes the forest ecological security index of the eight major tributaries from the perspective of the whole tributaries. In addition, Xu Tang et al. also divided the areas with lower forest ecological security index values into 5 categories: Forest Quantity Lagged Problem Areas, Forest Quality Problem Areas, Intense General Pressure Problem Areas, Intense Behavioral Pressure Problem Areas, Comprehensive Lagged Problem Areas. For each type of problem area, distribution range and basic features are analyzed, and corresponding improvement suggestions are proposed. Finally, Xu Tang et al. used the spatial lag model (SLM), the spatial error model (SEM), and the ordinary least square (OLS) method to analyze the influencing factors of the forest ecological security index. The research found that: i) The lower reaches of the Yangtze River Economic Belt are the most problematic area; ii) Natural factors are the fundamental conditions for building forest ecological security; iii) population structure positively influences forest ecological security and Economic growth negatively influences forest ecological security; iv) The proportion of secondary industry negatively influences the forest ecological security.

Although this paper has some shortcomings, it has established a practical analysis framework for forest ecological security assessment and the analysis of influencing factors. Subsequent research can modify the evaluation indicators based on this or increase influencing factors to improve the robustness and interpretability of the model. In addition, the identification of problem areas in this paper can serve as a reference for the forestry department to take corresponding measures to improve the local forest ecological security.

After studying the forest ecological security in the Yangtze River Economic Belt, the research scope of this research group will be expanded to all counties in the country. Therefore, the next goal is to collect data in all provinces, municipalities and autonomous regions in China to comprehensively analyze and assess the state of forest ecological security in China . In addition, due to China's large population, low per capita natural resources, and greater pressure on ecological protection, the Chinese government is considering delineating ecological protection red lines to ensure sustainable social and economic development. In this context, the research group will conduct in-depth research on forest ecological security and combine it with ecological carrying capacity to provide

more scientific basis for the delineation of the ecological protection red line. At the same time, due to the low efficiency of forest land use, farmers and the government have less benefit from forestry, so local governments are actively taking measures to improve the efficiency of forest land use. To this end, the research group will study the issues of forest protection and forest land use at a micro level to better coordinate the relationship between humans and natural resources.

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