Spatiotemporal Change Analysis of Water, Energy and Food Resources in Yellow River Basin

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The Yellow River Basin is rich in land, energy, and mineral resources, which is an important energy base and major food producing area in China. However, water shortages have become a key factor restricting the development of the basin. With the economic and social development and population growth, resources demand of water, food and energy in the river basin has been further increased under the drive of national energy security and food security strategies. The conflict between resource supply and demand has become more prominent. This paper selected 9 provinces of the Yellow River Basin as the study area, and collected 16-year time series data, and quantitatively describes the temporal and spatial coordinated changes of water, energy, and food through methods such as MK test and synergetic evaluation system. The results show that in the nine provinces of the Yellow River Basin, the water supply has increased slightly, and energy and food production have increased significantly. The spatial differences of water supply and food production have little change and are relatively stable, while the change of spatial differences in energy production are more obvious with a downward trend, indicating that regionalization of energy production areas is becoming more and more obvious. According to the synergetic evaluation system, the coefficients of synergy for all of the nine provinces are gradually increasing. The evaluation coefficient of Henan is relatively high, indicating that Henan has a positive synergy of water, energy, and food resources. And the Ningxia province has the lowest evaluation coefficient. According to the results, the water energy and food system reconfiguration should be carried out for key provinces, and the allocation of water energy and food resources should be optimized to maximize the utilization of the three resources and achieve sustainable use. First of all, adjusting the energy structure among the provinces with poor synergy. For example, raw coal is still the core resource of energy consumption which is water-intensive. Reduce the investment in coal chemical industry and other high water-consumed energy industry to have a better synergy coefficient. Also, develop more clean energy, for example, hydro-power, nuclear power and wind power. Nowadays, the environment-friendly and resource-saving clean energy portion is less than 10% of the total energy consumption. The waste resources can be reuse to provide green energy. Last, high-end production technology in energy production is important to guarantee the water and energy safety.

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