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Articles

AN ASSESSMENT OF ECOSYSTEM SERVICES: WATER FLOW REGULATION AND HYDROELECTRIC POWER PRODUCTION

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Forest ecosystems in the watersheds of the Yangtze river regulate water flow in the rivers. The value of water flow regulation by ecosystems is usually not realized in situ but may transfer spatially through rivers to another spot out of watersheds where conditions are suitable to realize it. To take into account the transfer of value of biological resources spatially, we developed a process-based simulation model to estimate the capacity of water flow regulation by terrestrial ecosystems, taking into account such major processes as canopy interception, litter absorption, and soil/ground water conservation.

In this study we combined models and a GIS-embodied spatial database to assess the capacity and benefits of water flow regulation by ecosystems in Xingshan County, Hubei Province, China. The capacity of water flow regulation differs substantially among the 90 types of vegetation–soil–slope complexes in the watersheds. The simulation model estimates that in a wet season the watershed can retain ~ 868.07×10^6 m^3 water, which may result in a decrease of water flow by ~111.63 m^3/s in the Yangtze River. The model also estimates that in a dry season the watershed can discharge ~80.74×10^6 m^3 water, resulting in an increase of water flow by ~10.38 m^3/s. As the result of water flow regulation, the Gezhouba hydroelectric power plant increases its electricity production by up to 40.37×10^6 kWh in a year and generates an additional economic value of ~5.05×10^6 RMB/yr (1 US$ = 8.3 RMB, Chinese currency). This value is 0.42 times the annual income from forestry in the county in 1994 and may reach 2.2 times the annual income from forestry when Three Gorges Hydroelectric Power Plant runs. We also proposed a model of economic compensation for the region.

Keywords: assessment, ecosystem services, economic compensation, ecosystem service, GIS, simulation models, water regulation, watershed, Yangtze River

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