Postprint: Effectiveness Evaluation of Environmental Governance Projects in the Shiyang River Basin Based on NPP

Authors: Li Chuanhua, Zhao Jun, Shi Yinfang, Wei Wei

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Abstract

Human activities constitute a significant driver of Net Primary Productivity (NPP) variation. Quantifying the impact of human activities on NPP enables the quantitative assessment of their effects on ecological environments and holds great significance for evaluating the effectiveness of environmental governance projects. This study employs the Shiyang River Basin as the research area, utilizing the coefficient of variation method to calculate anthropogenic influence values of NPP before and after governance, comparing the spatial patterns, changes, and trends of NPP anthropogenic influence values across two time periods, and assessing the effectiveness of ecological environment governance at the administrative region level. The results indicate: The influence of human activities on vegetation NPP covers most regions, with anthropogenic influence values ranging from -588.31 to 653.57 $g \cdot m^{-2} \cdot a^{-1}$ during 2000–2006, and from -644.30 to 673.63 $g \cdot m^{-2} \cdot a^{-1}$ during 2007–2010. In both periods, the positive and negative impacts of anthropogenic effects on vegetation NPP throughout the basin were pronounced, with overall positive influences. The net impact value decreased from 0.37 Tg C a^{-1} to 0.33 Tg a^{-1}. Following governance, NPP anthropogenic influence changed across 60.13% of the basin area, primarily manifesting as weakening of positive impact (36.54%) and weakening of negative impact (12.09%), suggesting a moderation of human activities in directly affected areas. However, directional changes in anthropogenic influence were relatively limited, accounting for merely 5.60%. This demonstrates that while localized governance achievements have been realized, fundamental remediation will constitute a long-term process. Governance effectiveness varies among administrative regions, with Minqin and Liangzhou District exhibiting the most significant results, followed by Gulang, Tianzhu, Yongchang, Sunan, Jinchuan, and other counties/cities.

Full Text

NPP-based Evaluation on Environment Governance Effect in the Shiyang River Basin

LI Chuan-hua, ZHAO Jun, SHI Yin-fang, WEI Wei

College of Geographic and Environmental Sciences, Northwest Normal University, Lanzhou 730070, Gansu, China

Abstract

Human activities are important factors affecting net primary productivity (NPP), and for this reason, the calculation of human-influenced NPP (NPPH) is of vital significance. The effect of human activities on the ecological environment can be quantitatively estimated by calculating NPPH, and it is of important significance to scientifically evaluate the implementation effect of management projects. In this paper, the Shiyang River Basin was selected as the study area, and the variation coefficient method was used to estimate the values of NPPH during the periods of 2000–2006 and 2007–2010, which included the spatial distribution, change in value, variation trend, and effect evaluation for each county. The results are as follows: (1) The effect of human activities on NPP was widespread in the Shiyang River Basin. The values of NPPH varied from -588.31 $g \cdot m^{-2} \cdot a^{-1}$ to 653.57 $g \cdot m^{-2} \cdot a^{-1}$ during the period of 2000–2006 and from -644.30 $g \cdot m^{-2} \cdot a^{-1}$ to 673.63 $g \cdot m^{-2} \cdot a^{-1}$ during the period of 2007–2010. Both the positive and negative human effects on NPP in the whole drainage basin were significant. Holistically, human influence in the Shiyang River Basin was positive; (2) The change of NPPH was significant during the periods of 2000–2006 and 2007–2010, and the NPPH was reduced from 440.65 $g \cdot m^{-2} \cdot a^{-1}$ to 401.26 $g \cdot m^{-2} \cdot a^{-1}$; (3) Human effect in the drainage basin was changed by 60.13%. It could be concluded that human activities were slowed down. Some results were achieved by implementing the management project, but the management would be a long-term and hard task; (4) Management effect was different across counties, and it was the most significant in Minqin County and Liangzhou District.

Keywords: coefficient of variation; human-influenced NPP; management effect; Shiyang River Basin

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Tables

Table 3. Relationship between the change trend and direction of human-influenced NPP and the land use types in two periods

[Table:3]

Table 4. Values of human-influenced NPP in different districts in two periods

[Table:4]

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Note: Figure translations are in progress. See original paper for figures.