

Responses of carbon sequestration services to multiple soil and water conservation projects in Yanhe Basin, Loess Plateau

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Abstract

Ecosystem carbon sequestration services (CSSs) are the most important ecosystem services (ESs) to mitigate global warming. Multiple soil and water conservation projects (SWCPs) have been implemented to restore disturbed ecosystems on the Loess Plateau, China. However, responses of CSSs to SWCPs are unclear due to trade-offs between CSSs and other ESs. Here, we quantified key ESs (i.e. carbon sequestration, water yield, soil conservation and crop production) and the spatio-temporal trade-off relationships by using RS/GIS techniques and ecosystem modeling in the Yanhe Basin, Loess Plateau, during 1990-2020. Additionally, the structural equation model (SEM) was used to estimate the direct and indirect influences of multiple SWCPs including check dams, terraces and Grain for Green (GFG) on CSSs. Results show that CSSs has improved to 457 t/ha in 2020, which was twice compared to 1990. Here in, 57% of CSSs changes were explained by ESs and SWCPs. That is, water yield (-77%), soil conservation (76%), crop production (22%), GFG (80%), check dams (16%), and terraces (-72%), respectively. In order to balance trade-offs among ESs, GFG project with a focus on vegetation protection need to be prioritised, followed by check dams, and non-agricultural terraces such as [reverse-slope level terrace](<http://search.ebscohost.com/login.aspx?direct=true&profile=ehost&scope=site&authtype=crawler&jrnl=10019332&asa=Y&AN=63484555>) and fish-scale pits. Our results provide a mechanistic understanding of how interacting processes of human activities at small catchments scales to influence carbon sequestration, and promote sustainable utilization of ESs in hill and gully regions of the Loess Plateau.

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