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TITLE: Change in carbon sequestration and water cost after ecosystem restoration on China's Loess Plateau: implications on forestation in the semiarid region

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ABSTRACT BODY: Forests are known to have a large capacity of carbon sequestration and reforestation/afforestation has been recognized as a potential strategy for the mitigation of global warming by reducing CO₂ through the photosynthesis processes. However, due to limited water resources in the semiarid Loess Plateau of China, forest management toward carbon sequestration is facing many challenges. Scientific understanding of carbon sequestration and water relationship is of paramount importance in the semiarid area. We examined regional net primary production (NPP) and water use efficiency (WUE) (NPP/ET, evapotransporation) using remote sensing data over 1999-2007 period representing before and after the a massive afforestation program was implemented. We also examined the tradeoffs between carbon sequestration and water resources with a monthly scale ecosystem model (WASSI-CB).

Both NPP and water use efficiency of the Loess Plateau increased during 2000-2008. Afforestation had significant positive impact on NPP and water use efficiency ($P < 0.0001$). Annual precipitation was the key factor affecting NPP and WUE ($P < 0.0001$, $R^2 = 0.36$). Ecosystems in regions with annual precipitation of 450-550 mm, experienced more prominent increase in NPP and WUE ($P < 0.01$). As a whole, each unit increase in NPP (1 g C m^{-2}) required about an increase of water use by 0.48 mm water.

KEYWORDS: [0428] BIOGEOSCIENCES / Carbon cycling, [9320] GEOGRAPHIC LOCATION / Asia, [4323] NATURAL HAZARDS / Human impact.

