Geophysical Research Abstracts
Vol. 14, EGU2012-1269, 2012
EGU General Assembly 2012

Linking Terrestrial and Reservoir-related Economic Services at Regional Scale: A Case Study in the Soyang Watershed of South Korea

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Sustainability challenges are transforming science and its role in society. Achieving sustainable use of resources that best supports human well-being requires wise planning of land use and management practices at landscape to regional scales. At regional scale, supportive services from natural resource use are of two types: locally derived via ecosystem production processes (cf. agriculture and forest products, etc.) and integratively derived via regional landscape response (cf. water supply). Research in the International Biological Program (IBP) demonstrated that modification in local ecosystem services (accompanying altered land use, due to agricultural intensification, or due to climate change) are associated with changes in land-surface to atmosphere gas exchange (water, carbon and trace gas emissions), in nutrient cycles and turnover, in the seasonal course of soil resource stores, in resource use efficiencies, and in the export of nutrients and carbon into river systems. Researchers at the Coweeta Hydrologic Laboratory in North Carolina summarized integrative changes in services that accompany land use and climate change, stating that "the quantity, timing, and quality of streamflow provide an integrated measure of the success or failure of land management practices."

The international consortium project TERRECO (Complex Terrain and Ecological Heterogeneity; www.bayceer.uni-bayreuth.de/terreco) focuses on linking (1) spatial patterns in local ecosystem performance in complex terrain of the Soyang Lake Watershed, the largest reservoir system in South Korea, with (2) integrated ecosystem services derived from Soyang Lake, and with (3) economic evaluations of the services supplied. Field-based meteorology, plant production, soil physics, solute and sediment transport, hydrology, social behavior, and economic assessments are used to parameterize a suite of models that describe landscape and regional level flow networks for carbon, water, and nutrients, but in addition monetary flows associated with gains and losses in ecosystem services. The description is embedded within a framework which examines the trade-offs between agricultural intensification versus yield of high quality water to reservoirs for drinking water supply. The models also quantify hypothetical changes in flow networks that would occur in the context of climate, land use and social change scenarios.

The research is viewed as a critical step in shaping the context for interactions between environmental scientists and resource managers. A project partnership is currently being built with agencies that have the mission to carry out land use planning and to advise in policy making. A common interest is found among TERRECO project participants and agency planners in evaluating scenarios to quantify the effects of land use decisions possibly made in compliance with stakeholder demands.