Geophysical Research Abstracts
Vol. 17, EGU2015-15709, 2015
EGU General Assembly 2015

Evaluating the contribution of Sustainable Land Management to climate change adaptation and mitigation, and its impacts on Mediterranean ecosystem services.

Joris de Vente (1), Cecilia Zagaria (2), Pedro Pérez-Cutillas (1), Maria Almagro (3), Maria Martínez-Mena (1), Jantiene Baartman (2), and Carolina Boix-Fayos (1)

(1) Centro de Edafología y Biología Aplicada del Segura, Soil and Water Conservation Department, Spanish National Research Council (CEBAS-CSIC), Spain, (2) Wageningen University, the Netherlands, (3) Department of Sustainable Food Production, Universita Cattolica del Sacro Cuore, Piacenza, Italy

Changing climate and land management have strong implications for soil and water resources and for many essential ecosystem services (ES), such as provision of drinking and irrigation water, soil erosion control, and carbon sequestration. Large impacts of climate change are expected in the Mediterranean, characterized by a high dependence on scarce soil and water resources. On the other hand, well designed Sustainable Land Management (SLM) strategies can reduce the risks associated with climate change, but their design requires knowledge of their multiple effects on ecosystem services under present and future climate scenarios and of possible tradeoffs. Moreover, strategies are only viable if suited to local environmental, socio-economic and cultural conditions, so stakeholder engagement is crucial during their selection, evaluation and implementation.

We present preliminary results of a catchment wide assessment of the expected impacts of climate change on water availability in the Segura basin (18800 km2) southeastern Spain. Furthermore, we evaluated the impacts of past land use changes and the benefits of catchment wide implementation of SLM practices to protect soil and water resources, prevent sedimentation of reservoirs and increase carbon sequestration in soil and vegetation. We used the InVEST modeling framework to simulate the water availability and sediment export under different climate, land use and land management scenarios, and quantified carbon stocks in soil and vegetation. Realistic scenarios of implementation of SLM practices were prepared based on an extensive process of stakeholder engagement and using latest climate change predictions from Regional Climate Models for different emission scenarios.

Results indicate a strong decrease in water availability in the Segura catchment under expected climate change, with average reductions of upto 60% and large spatial variability. Land use changes (1990 – 2006) resulted in a slight increase in water yield (3.3%), a decrease in sediment export (21%) and organic carbon stock (1.7%). Headwaters showed on average a decrease in water yield, while downstream water yield increased, while changes in carbon stocks showed the opposite trend. Under present day land use, headwaters show highest carbon stocks and generally provide most ES per hectare. Yet, rainfed arable land located mainly in downstream parts of the catchment accounts for about 20% of the total carbon stock. Implementation of reduced tillage in combination with green manure results in an increase of the total carbon stock of the Segura catchment by about 3.3%, while sediment export reduces by 28% and water yield increases by 2.15% with an adoption rate of 10%. Under higher adoption levels decreasing water yield was found possibly indicating decreased water stress for crops. Overall, reduced tillage-green manure was found to lead to an increase in ES provision with important spatial variability and strongly affected by local environmental conditions.

These results allow us to compare the effectiveness and efficiency of land use versus land management changes on protection of ecosystem services, tradeoffs and disparities between sub-catchments of the Segura River. This study's value lies in providing stakeholders with quantitative information upon which SLM strategies result in greatest catchment wide ecosystem service provision and tradeoffs, and thus greatest resilience to expected climate change impacts.