GC31B-1174: Regulations of evapotranspiration and ecosystem productivity from biophysical and human drivers in drylands Northern Eurasia

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The concept of coupled human and environmental systems (CHES) has been a dominant framework in the past decade for understanding the cohesive connections between natural and human systems. Here we focus on how socio-ecological services may be regulated by the regional and local water cycles and by ecosystem production in the drylands of Northern Asia (>40 degree N), which includes Inner Mongolia of China, Kazakhstan, Kyrgyzstan, Mongolia, Tajikistan, Turkmenistan, and Uzbekistan. Total precipitation and evapotranspiration are used as the primary drivers to explain ecosystem production (e.g., GPP) and indicators of social function and structure (e.g., GDP, population) using the data collected from 1980 through 2010 of these seven areas. We hypothesize that the changes in the regional and local water cycles in these contrasting regions and socioeconomic settings significantly affect CHES functioning. Institutional changes, including shifts in policy, can play a much stronger role than those caused by the physical changes in determining the relationships between water cycle and CHES functioning. The complex connections among the biophysical and socioeconomic variables are analyzed through structural equation modeling (SEM) at country and regional scales. The highest water use efficiency (GPP:PET=0.57) was found for Uzbekistan, which also had the highest GDP:GPP (0.66) among the seven areas. In contrast, Mongolia exhibited the lowest values during the study period despite its very high GPP:Population value (45.8). The low population in Mongolia appeared responsible for its rank within the dryland region. Regional institutional changes with global ramifications, such as the collapse of Soviet Union and China joining the World Trade Organization, appears to have affected the CHES of the study areas.