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Divergence of ecosystem services in U.S. National Forests and Grasslands under a changing climate

Ge Sun (1), Kai Duan (2), Shanlei Sun (3), Peter Caldwell (4), Erika Cohen (1), Steven McNulty (1), and Yang Zhang (2)

(1) gesun@fs.fed.us, (2) yzhang9@ncsu.edu, (3) ppsunsanlei@163.com, (4) pcaldwell02@fs.fed.us

The 170 National Forests and Grasslands (NFs) in the conterminous United States are public lands that provide important ecosystem services such as clean water and timber supply to the American people. This modeling study investigates the potential impacts of climate change on two key ecosystem functions (i.e. water yield and ecosystem productivity) using the most recent climate projections derived from 20 Global Climate Models (GCMs) of the Coupled Model Intercomparison Project phase 5 (CMIP5). We find that future climate change may result in a significant reduction in water yield but an increase in forest productivity in NFs. On average, gross ecosystem productivity is projected to increase by 76 $\sim$ 229 g C m-2 yr-1 (8% $\sim$ 24%) while water yield is projected to decrease by 18 $\sim$ 31 mm yr-1 (4% $\sim$ 7%) by 2100 as a result of the combination of increased air temperature (+1.8 $\sim$ +5.2 [U+2103]) and precipitation (+17 $\sim$ +51 mm yr-1). The notable divergence in ecosystem services of water supply and carbon sequestration is expected to intensify under higher greenhouse gas emission and associated climate change in the future, posing greater challenges to managing NFs for both ecosystem services.