PAIRED FORESTED WATERSHED EXPERIMENTS IN THE PIEDMONT OF NORTH CAROLINA

Johnny Boggs, Ge Sun, Steven McNulty[1]

Understanding how regional-specific water resources respond to disturbances can serve as useful information to land managers as they aim to set flow targets needed to maintain ecological integrity in surface waters or to design riparian buffers for water quality protection. There are three distinct land provinces across North Carolina: the Mountains, Piedmont, and Coastal Plain. Population density, topography, and distribution of major forest landscapes are unique to each region, resulting in a range of different water resource needs and responses to land management practices. Experimental forests in the Mountain and Coastal regions of North Carolina offer a long history of watershed hydrology and water quality data related to sustainability of forest and water resources following silvicultural activities. Little data is available for the Piedmont portion of the state. This study addressed this spatial knowledge gap through a series of paired watershed studies in the Piedmont at Hill Demonstration Forest: control watersheds (HF2 and HFW2) and treatment watersheds (HF1 and HFW1) and Umstead Research Farm control watershed (UF2) and treatment watershed (UF1). We quantified changes in discharge, water quality, riparian buffer stand dynamics, and buffer tree water use after a clear-cut harvest where best management practices (BMPs) were installed to protect water quality. We found that discharge in treatment watersheds increased dramatically, averaging 240 percent in HF1 and 200 percent in UF1, and 40 percent in HFW1 during the postharvest period, 2011-2013. Total suspended sediment export in the treatment watersheds also increased significantly after harvest due to the increase of discharge quantity and movement of in-channel legacy sediment. Stormflow peak nitrate reached its maximum concentration during the first two years after harvest in treatment watersheds then declined due to nitrate uptake by the rapid regrowth of woody and herbaceous plants. We found that 36 percent of the UF1 streambank trees were blown down due to opening of the canopy during harvest, but caused no measurable increase in mean daily stormflow sediment concentration. HF1 residual trees in the buffer used 43 percent more water in growing season postharvest (314 mm) than growing preharvest (220 mm) period. This resulted in an 8 percent change in stream discharge due to an increase in buffer stand transpiration. Our results align with forest management studies in the Mountains and Coastal Plain where temporary increases in discharge were accompanied by increased in-channel sediment transport and nutrient exports but were not sufficiently disruptive to impact aquatic life and ecological integrity. However, percent change in discharge and peak nitrate concentrations tended to be higher in the Piedmont when compared to the Mountain and Coastal Plain regions.

[1]Johnny Boggs, Biological Scientist, USDA Forest Service, Eastern Forest Environmental Threat Assessment Center, Raleigh, NC 27606
Ge Sun, Research Hydrologist, USDA Forest Service, Eastern Forest Environmental Threat Assessment Center, Raleigh, NC 27606
Steven McNulty, Ecologist, USDA Forest Service, Eastern Forest Environmental Threat Assessment Center, Raleigh, NC 27606

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