VEGETATION CONTROLS ON CARBON AND NITROGEN CYCLING AND RETENTION: CONTRASTS IN SPRUCE AND HARDWOOD WATERSHED BUDGETS

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Anthropogenic sources of nitrogen (N) have altered the global N cycle to such an extent as to nearly double the rate of N that enters many terrestrial ecosystems. However, predicting the fate of N inputs continues to present challenges, as a multitude of environmental factors play major roles in determining N pathways. This research investigates the role of specific vegetation and subsequent soil and forest floor characteristics in the production and export of C and N within two adjacent watersheds at 730 to 850 m elevation in the Fernow Experimental Forest, near Parsons, WV. These watersheds have identical management histories, varying only in vegetation cover, where one watershed is a planted monoculture of Norway spruce (*Picea abies*) following clearcut felling 40 years ago and the other has regenerated to native Appalachian hardwood also following clearcut felling 40 years ago. Long-term stream chemistry indicates that the hardwood stand has approached N-saturation, with a very large stream export of N (15 kg NO^{3-}-N/ha/yr), whereas the spruce stand exhibits virtually no export of N to the stream. Soil lysimeters were installed at two depths and at several distances from the streams to investigate spatial and temporal patterns of soil solution chemistry and the dynamics of dissolved C and N. Water chemistry throughout the primary stream length in each watershed was analyzed monthly, along with multiple soil and forest floor characteristics, including C and N pools, N mineralization rates, pH, and exchangeable base cations. Stream, soil water, and soil chemical analyses indicate that pH, NO^{3-}, and total N are much lower in the spruce watershed than in the hardwood watershed. Soil aluminum (Al^{+3}) is significantly higher in the spruce watershed, though calcium (Ca^{+2}) concentrations in spruce soil are nearly a third that of the hardwood watershed (110 mg Ca/kg soil vs 290 mg Ca/kg soil, respectively). The forest floor in the spruce watershed has accumulated nearly twice the biomass and N per ha compared with the hardwood watershed. Thus, the forest floor in the spruce watershed may be a large sink for both C and N, through either biotic uptake of N or abiotic immobilization into humic compounds. The differences in C and N cycling observed within these two contrasting forest systems, which experience high N loads, may have implications for native spruce ecosystems at high elevations in the central Appalachians. These results suggest that spruce plays an important role in regulating water quality in high elevation forests impacted by high N deposition.

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