MULTITROPHIC EFFECTS OF CALCIUM AVAILABILITY ON INVASIVE ALIEN PLANTS, BIRDS, AND BIRD PREY ITEMS

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ABSTRACT

Acid rain alters forest soil calcium concentrations in two ways: (1) hydrogen ions displace exchangeable calcium adsorbed to soil surfaces, and (2) aluminum is released to soil water by acid rain and displaces adsorbed calcium. This increases the absorption of aluminum by plant roots, and decreases the absorption of calcium, causing calcium to be more readily leached from the soil.

The effects of acid rain on soil calcium concentrations have been demonstrated in forest ecosystems in the U.S., including Hubbard Brook Experimental Forest in New Hampshire. Less is known about the response of invasive plant species to acidified soils and the effects of acidification on post invasion competition. Highly disturbed ecosystems are susceptible to invasion, and post invasion effects have been the focal point of several studies. This study is designed to evaluate the direct and indirect impacts of calcium availability on invasive plant success, snail abundance, and avian reproductive success in forest ecosystems in the Mid-Atlantic United States. We sampled soil, litter, and snails from three sub-sampling locations at each site to estimate soil chemistry, litter arthropod biomass, and gastropod abundance. We also recorded the vegetation cover type (non-native, native, open) immediately over the soil/litter collection site to determine if there were any patterns between vegetation cover and soil chemistry. We used Berlese Funnels to separate litter arthropods and dry the litter, then sifted the litter to collect the gastropods. A time-constrained search for snails was conducted in a 2.5-m-radius area centered on the soil samples. We sampled forest breeding birds by using three visits to 58 sites during the 2008-2009 breeding season (May-July).

We defined six avian guilds based on forest habitat requirements, nesting and foraging locations, and migration status. This consolidated the breeding community into functional groups. We used linear regression with pH and snail abundance to determine if there were patterns among these predictor variables and the six avian guilds. We found that more ground gleaner species were detected at sites with high pH. We also saw a significant relationship between ground cover types (native plant, non-native plant, and leaf litter) and mean pH; pH was highest under the non-native plant, *Rosa multiflora*. We did not detect a significant relationship between snail abundance and any avian guild, but did see a pattern between snail abundance and precipitation on the sampling day.