Impact of Nitrogenous Air Pollutants on Vegetation Communities Across the Snake River Plains

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Anthropogenic nitrogen (N) emissions have been increasing in the Snake River Plains of southern Idaho due largely to agricultural sources, especially confined animal feeding operations (CAFO) and fertilizer use and production. This sagebrush steppe community is being invaded by *Bromus tectorum* and other exotic plants which can increase the size and frequency of wildfires. This experiment measured atmospheric concentrations and bulk deposition of reactive N species at 10 sites within Craters of the Moon National Monument and Reserve (CRMO), Hagerman Fossil Beds National Monument (HAFO), Minidoka National Historic Site, and City of Rocks National Reserve (CIRO). Vegetation transects across the study area were used to determine if there is a correlation between increased nitrogen deposition and the structure of the vegetation community.

The dominant form of atmospheric N in passively collected samples was NH_3 (1.33 – 15.3 μg m^{-3}), with the highest values recorded in summer near urban areas with adjacent CAFOs. Peak HNO_3 values (0.83 – 1.32 μg m^{-3}) were also measured in summer with the highest values measured in the city of Pocatello near a fertilizer plant. NO_x concentrations peaked in winter (5.04 – 10.8 ppb) with the highest concentrations near agricultural zones. At low deposition sites, the bulk deposition of NH_4^+ and NO_3^- were similar, but at high total N deposition sites, NH_4^+ was the dominant form of N. To correct for contamination from birds in bulk deposition samplers at some sites, atmospheric concentrations were regressed with uncontaminated bulk deposition sites to calculate N deposition rates. On average, measured deposition values exceeded CMAQ-modeled values by 75%, leading to calculated values over 11 kg ha^{-1} yr^{-1} at HAFO, the site with highest N deposition. Based on measured and calculated N deposition values of 3 to 11 kg N ha^{-1} yr^{-1} from CIRO, CRMO, and HAFO, there was an increase in exotic grass cover from 4% in low deposition areas to 62% under high deposition. At these same sites there was a concomitant decrease in native shrub and bunch grass cover as N deposition increased.

An increase in cover of invasive plants decreases the quality of the rangeland for grazing, wildlife, and biodiversity conservation, while increasing the likelihood of large fire events. Additional vegetation surveys and N deposition measurements are needed to establish a critical load for N impacts of invasion of the Snake River Plains, with consideration for variable grazing histories and precipitation regimes.

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