

NUTRIENT CYCLING IN AGGRADING FORESTS: 50 YEARS OF RESEARCH AT PACK FOREST, NEW YORK

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The Charles Lathrop Pack Demonstration Forest, Warrensburg, New York, has been the site of long-term forest fertilization and biogeochemical ecosystem research for over 50 years. It is by far the longest ongoing examination of trends in nutrient cycling in North America. Plots of red pine that were fertilized 50 years ago with potassium were reexamined to determine the changes in forest soil properties after exposure to acid deposition. Subsoil uptake of nutrients by plantation red pine was confirmed by experimental use of tracer techniques with SrCl_2 and Rb/K ratios as a mechanism for improving the soil. K levels in the unfertilized sites did show improved levels of K relative to fertilized stands, improving at approximately twice the rate of the fertilized stand. The pH of unfertilized plots remained the same over time, while the pH of the fertilized plots significantly declined over the 50 years, attributed primarily to initial increase in pH due to the addition of KCl as fertilizer and the increase in forest soil organic matter buildup over time. The results of historical biogeochemical trends, in conjunction with the analysis of lateral fertilizer transport and significant subsoil uptake each clarify distinct aspects of nutrient dynamics in the K-deficient soils of the Pack Forest Plain under fertilized and unfertilized red pine over time. Combined, the pieces of the story tell a greater tale of nutritional improvement of degraded surface soils mediated by the long-term effects of human management practices such as reforestation and forest fertilization, and by the nutrient uptake, conservation and distribution abilities of aggrading forests. The data provides new insights into understanding and modeling the interaction of developing forest ecosystems with subsoil nutrient pools and the dynamics of lateral transport and conservation of nutrients that need to be recognized in assessing impacts of global change on forest ecosystem sustainability.

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