THE BEAR BROOK WATERSHED IN MAINE – DECADAL RESPONSES TO WHOLE FOREST ECOSYSTEM MANIPULATIONS

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The Bear Brook Watershed in Maine (BBWM) is a long-term, paired, forested, ecosystem study examining the effects of a changing physical and chemical climate. The East Bear watershed (11.0 ha) serves as the reference watershed. The West Bear watershed (10.3 ha) has been treated bimonthly with ammonium sulfate ($(NH_4)_2SO_4$) starting in November 1989 and continuing to the present. Granular $(NH_4)_2SO_4$ has been aerially applied at approximately 28.8 kg S/ha/yr and 25.2 kg N/ha/yr. The chemical manipulation is designed to investigate the effects of atmospheric deposition of N and S.

The BBWM is on International Paper land under a long-term agreement with The University of Maine. The study is a collaboration among the University of Maine, International Paper, the USDA Forest Service, the U.S. Geological Survey, and Plymouth State University. Continuous measurements of precipitation and stream hydrology and chemistry provide input-output budgets for the treated and reference watershed while studies of soil chemistry and biology, soil solutions, fine root dynamics, soil respiration, vegetation chemistry and physiology, litter and litterfall, and stream and sediment processes define mechanisms of ecosystem response. The study has resulted in over 100 scientific publications and is recognized internationally for its contributions to forest ecosystem sciences.

After 15 years of whole-watershed chemical manipulations treatments have resulted in soil base cation depletion and metal mobilization, developing N saturation, changes in forest physiology and chemistry, and progressive acidification of soils and streams. Mechanisms of response to treatments that emerge on a decadal time scale are different than those that were evident during the initial years of treatments, underscoring the critical importance of long-term research in defining forest ecosystem response to environmental stressors. The BBWM program of research also focuses on the response of the reference watershed to long-term changes in ambient atmospheric deposition, and the interaction between climate and biogeochemical processes in both the treated and reference watershed.