DETECTING AND MONITORING ACIDIC DEPOSITION EFFECTS ON SOIL CHEMISTRY AND FOREST GROWTH ON THE MONONGAHELA NATIONAL FOREST

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The Monongahela National Forest (MNF) lies downwind from many sources of acid deposition (AD) pollution. Therefore, managers are concerned about the possible deleterious effects of AD on the forest ecosystem. To address the needs of MNF managers, we used Forest Inventory and Analysis (FIA) sites to evaluate forest growth patterns on the MNF to determine the relationship between growth and key indicators of soil acidity. We then used those relationships to create a map of site resistance to acidification across the MNF. To develop a monitoring protocol, we assessed several sampling approaches for their suitability for monitoring AD-related changes in soil and foliage chemistry. Across all FIA sites on the MNF, periodic mean annual volume increment (PMAVI) ranged from -9.5 m^3 ha^{-1} yr^{-1} to 11.8 m^3 ha^{-1} yr^{-1}, suggesting lower-than-expected growth on two-thirds of the sites. Growth was compared to soil indicators of acidity on 30 FIA sites. In the surface horizon, effective base saturation (+), Ca concentration (+), base saturation (+), K concentration (+), Fe concentration (-), Ca/Al molar ratio (+), and Mg/Al molar ratio (+), were correlated with PMAVI ($p \leq 0.1$). Site resistance to acidification was mapped based on site parent material, aspect, elevation, soil depth, and soil texture. There was a significant ($p \leq 0.1$) positive correlation between PMAVI and a resistance index developed using these soil and site factors. Mapped resistance index was also compared with key soil indicators of AD-induced decline on 28 sites across the MNF, and pH, effective base saturation, and Al content were found to be the best indicators related to resistance index. Across the MNF, 14 percent of land area was highly resistant ($RI \geq 0.7$), 57 percent was moderately resistant ($0.7 > RI > 0.45$) and 29 percent was slightly resistant ($RI \leq 0.45$). Soil pH, effective base saturation, Ca/Al molar ratio, and sum of bases varied significantly when sampled by soil horizon versus fixed depths. Sampling by horizon was the better method. A second monitoring approach evaluated the relationship between foliar and soil chemical indicators. Across FIA plots, nutrient concentrations varied by tree species. Results from a potted-seedling study suggest that soil acidity influences growth and foliar concentrations are related to growth rates. This evaluation of the effects of AD on the MNF can be used to develop adaptive management plans and a monitoring program that will meet the AD-related objectives of the 2006 Forest Management plan.

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