Title: Fire and Forest History in the Southern Appalachian Mountains, U.S.A.: Extending the Tree-Ring Record Using Soil-Charcoal Analysis

Keywords: soil charcoal, dendrochronology, fire history, forest composition, Great Smoky Mountains National Park, southern Appalachians

Type: Paper

Abstract: Dendrochronological analyses of fire-scarred pines (Pinus spp.) in Appalachian forests allow detailed reconstructions of the spatial and temporal extent of past fires, including the exact years in which fires occurred. However, the length of these records is limited to less than 400 years by tree ages and the rate of decomposition of dead wood. Our objective is to extend the tree-ring record of fire in mixed hardwood/pine stands in Great Smoky Mountains National Park, Tennessee, using soil-charcoal analysis. Analyses of age structures and fire scars from eight mixed hardwood/pine stands at mid-elevations (487 to 614 m) in the park reveal that fires set by people or lightning occurred frequently in the 19th and early 20th centuries, with a mean fire-free interval of only 3 to 5 years. However, fire frequencies decreased following park establishment in 1934, and forest composition shifted to include more fire-intolerant tree species. Using taxonomic identification and AMS radiocarbon dating of soil charcoal within these stands, we seek to document prehistoric tree-species composition and fire histories that predate the tree-ring record. Forty-eight soil cores were recovered in 10 cm increments to bedrock or a depth of 100 cm, and charcoal fragments ≥ 2 mm were isolated from each of 315 core increments from the eight stands. Southern yellow pine is the source of over 75% of over 500 individual fragments that we have identified to genus (or species). The oldest charcoal fragment is from a fire that burned a southern yellow pine ~2800 years ago.

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