2-12-1998

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February 12, 1998
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ORONO, Maine -- A new view of the constant struggle going on in the Maine woods between trees, diseases and weather has emerged from several years of painstaking research by a team of University of Maine students and faculty. Working in the Big Reed forest preserve in northern Piscataquis County, one of the largest remaining stands of old growth forest in New England, researchers have described patterns of life and death over the past 200 years with an unprecedented level of sophistication and detail.

Studies of old growth forests in Maine are about as rare as the forests themselves. The study cites only four previous projects between 1966 and 1997. The 5,000-acre Big Reed preserve is owned by the Maine Chapter of the Nature Conservancy and is located north of Baxter State Park in the Reed Brook watershed. The research was funded by the Maine Agricultural and Forest Experiment Station.

"There are increasing public demands that forests be managed as naturally as possible," says Alan White, an advisor on the project and an
associate professor in the Dept. of Forest Ecosystem Science. "This study provides some important background information regarding forest conditions and processes in the absence of direct intensive human intervention. The patterns and processes detected in this study may help in designing appropriate conservation and management strategies for similar forest types and landscapes."

The project was led by Unna Chokkalingam, a Ph.D. student and a native of India. She received her undergraduate education at the University of Madras in India and her masters degree at the University of Massachusetts in Amherst. At UMaine, she received guidance from White as well as faculty in biological sciences and spatial information science and engineering.

Numerous UMaine undergraduate students worked with Chokkalingam to establish research plots and collect detailed information about every standing tree, dead as well as living, and fallen trunks. They also mapped the locations of every tree and obtained increment cores to better understand the actual dynamics of the forest over time.

Dendroecology and geographic information system (GIS) technology were used to generate statistics about areas affected by natural disturbances such as severe winds, droughts and insects.

As a result, Chokkalingam was able to describe natural patterns of new growth and deaths of trees as far back as the late 18th century. Her thesis paints a picture of small but frequent forest disturbances, primarily the slow death and decay of standing trees, opening up sunny spots where small clusters of young trees grow quickly. Over the years, such clusters accumulate to dominate the forest community.

In contrast to western U.S. forests where fires can create huge openings covering thousands of acres, gaps in the mixed and hardwood forests of the Maine woods range in size from a few square yards up to about a sixth of an acre. They vary in frequency on a 60 to 70 year cycle. In each plot, the average sizes of natural gaps was small, on the order of 46 to 69 square yards.

Landscape-level analysis of the preserve using GIS suggested that catastrophic disturbance was not a major sculpting force at the landscape scale. The predominantly small-scale single-tree disturbance regime resulted in

maintain the same dominant species.

Her thesis, titled Spatial and Temporal Patterns and Dynamics of Old Growth Northern Hardwood and Mixed Forests of Northern Maine, was completed in October. Among the most significant findings of the project are the following:

•Catastrophic disturbances in northern Maine may indeed have long return intervals. Within the last 200 years, the mixed and hardwood forests of the Big Reed forest preserve were influenced primarily by small-scale gap dynamics that determined stand composition and structure.

•Dominant known disturbance agents were insect and disease outbreaks. The small-scale gap disturbance events were frequent, however, and synchronously affected large areas, though only a small proportion of any given area. Such a disturbance regime could
perhaps be related to the diverse species composition of the Mainewoods and thus the multitude of potential disturbance agents.

•The peak disturbance periods with many small single-tree gaps and few larger gaps served as primary venues for recruitment of the dominant shade-tolerant species at regular intervals. Age distributions of species were indicative of synchronous, episodic recruitment.

These results will be published in peer-reviewed scientific journals and presented at meetings and seminars. Future studies are planned by White and his students to analyze additional areas of the preserve and other old-growth stands. They hope to shed new light on how the types, frequencies and spatial scales of disturbance have varied over time and how they have influenced the composition and structure of Maine's forests.

"This study confirms earlier hypotheses that there are long intervals between major stand-replacing disturbances and that small-scale gap dynamics play a prominent role in shaping forest structure in Maine," says White. "However, the episodic and extensive nature of small-gap formation is an unexpected finding."

"Our results suggest silvicultural guidelines for species regeneration, optimal growth, harvesting, and other factors for forest managers interested in mimicking natural processes. For researchers and foresters, this study suggests incorporating the elements of space, time and scale, rather than dealing with just average stand measures which could be misleading."