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A 105-year-old plantation in Grand Rapids, Minnesota established by Prof. H. H. Chapman before he came to Yale, is an extraordinary example of long-term follow-through in forest research. Photos are courtesy of Brian Palik, USFS, NCRS.

Long-term Forest Research Underappreciated and Underfunded


By Lloyd Irland and Ann Camp

Our current understanding of the ways that managed and unmanaged forests develop comes from detailed forest and ecological measurements in dedicated research plots over periods of many decades. If foresters, biologists and land managers are to understand how to manage forests sustainably, there is no substitute for long-term studies that can verify predictions underlying management choices.

In long-term studies, selected plots or stands of trees are thoroughly measured, tallying species, diameter and condition of trees and shrubs, often including ground cover and young seedlings. The data are carefully recorded and the individual plants and trees may be mapped. Plot centers and individual trees are marked so technicians revisiting the sites in five to ten years can quickly relocate them for re-measurement. Over time, scientists use results of such repeated measurements to understand the effects of drought, insect

outbreaks, air pollution and cutting practices on forest growth, regeneration and health. These studies can help us learn whether forest growth and ecological health are being affected by acid rain, nitrogen overloading and even overgrazing by deer. Such questions cannot be resolved by single studies lasting just a year or two.

Several major long-term forest research programs are having anniversaries during this decade. Hubbard Brook Experimental Forest in New Hampshire celebrates its 50th anniversary this year. The project, originally designed to measure the hydrologic and biogeochemical effects of harvesting in northern hardwoods, has become even more famous for its insights into acid rain, nutrient cycling and other long-term ecological processes. The Yale School of Forestry & Environmental Studies played a prominent role in this work, led by Herb Bormann, Oastler Professor Emeritus of Forest Ecology, teaming with U.S. Forest Service



workers and Gene Likens, then of Cornell. The Harvard Forest in Petersham, Massachusetts, turns 100 in 2007.

But changing scientific interests and budget cuts by federal agencies and state universities have made it difficult to sustain some of these programs. For example, the U.S. Forest Service's Experimental Forests and Ranges began shortly after 1900 as the agency created its research branch. Its purpose at the time was to learn the best methods of growing timber and regenerating forests and to understand "forest influences"—how forests affect water flow and growth conditions for nearby farm fields. Other experiments were undertaken over the years to study long-term changes in wildlife habitat. Over the years, the Forest Service has been the nation's leading forest science agency.

With changing future climates and the potential for altered weather and storm intensities, it is vital that long-term studies such as these be continued. They form a baseline against which to compare effects of forest cutting practices and of practices to reduce or offset the effects of air pollution and other stresses.

But the number of these sites managed by the Forest Service shrank from 110 in 1990 to only 77 today. And not all of those remain active. Concerned with the uncertainty of maintaining and continuing these long-term studies, we teamed up with Forest Service scientist John Brissette to convene a one-day program at a recent regional forestry conference. The session was well attended and well received; many of those in attendance encouraged us to seek papers from researchers across North America that highlighted some important findings that resulted from long-term re-measurements. This fall, Yale's Global Institute of Sustainable Forestry will publish a research paper containing essays describing the importance of selected long-term forest studies.

Some of the lessons learned include:

Long-term measurements can detect effects of management treatments that only occur with a lag. As an example, an experiment in Pennsylvania attempted to see if offsetting soil acidity by using lime would improve tree growth. In the first few years, nothing happened. A short-term study would conclude that liming had no effect. But the measurements were continued, and in just a few more years, the trees began to respond.

Studies originally established with narrowly focused objectives have enabled scientists to shed light on new problems. For instance, scientists in Wisconsin used long-term plots to test different harvesting methods for timber production. These plots were measured for this purpose for over 50 years. There has been concern about how forest-cutting affects vulnerable understory plants. So, scientists studied these stands to assess understory plant responses to these treatments. They found little difference in plant composition between the treatments, indicating that harvesting by these methods does not significantly change plant composition in the understory.

Long-term studies by federal research agencies are only the tip of the iceberg. In Connecticut, for example, the Agriculture Experiment Station, located in New Haven, has undertaken periodic re-measurements in unmanaged forest stands since the 1920s, yielding important ecological insights. By periodically re-measuring the same stands, they showed how the stands were affected in composition and growth by infestations of the gypsy moth and, in one instance, how the stand was affected by a wildfire.

"The scientific asset represented by these projects is incredibly valuable," noted Chad Oliver, Pinchot Professor of Forestry and Environmental Studies. "Yet, in too many instances, decisions about their future are being made on the basis of momentary budget or personnel issues. The U.S. Forest Service has upgraded its management focus on its 77 experimental forests and rangelands. But nobody is keeping track, in a systematic way, of the needs of hundreds of little-known long-term studies by states, companies and

nonprofit organizations. We need better ways to fund these long-term re-measurements that are not funded by the typical two- to three-year project-funding approaches."

David M. Smith, Morris K. Jesup Professor Emeritus of Silviculture, noted: "The time scale of the necessary repeated observations is longer than the active career of one observer. This means that such investigations generally require the commitment of continuing entities such as research agencies, corporations or professional groups with an interest in learning about responses to silvicultural treatments or natural disturbances. One critical ingredient is retention of old plot records that sometimes fall victim to overzealous housecleaning!"

The current generation of forest scientists and research administrators must develop new sources of support and show the wider science community why these long-term studies are important. If we fail to do so, more and more of these studies will fall by the wayside, and our ability to respond to new questions and concerns in the future will be compromised.

We would very much appreciate hearing from YEN readers who know of re-measured forestry or ecological plot experiments around the world that have been in place for 50 years or more.

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