The Forest Has Stopped Growing. But Why?
Geoff Wilson

The forest has stopped growing. At least that's the conclusion reached by scientists at the Hubbard Brook Experimental Forest (HBEF) in Woodstock, New Hampshire, after following the growth of an entire 32-acre watershed since 1965.

The trees, of course, are still growing. It is the forest's living biomass (all the living organic matter) that is not getting any larger. This means, in short, that growth is now balanced by death. Scientists know this because they measured the watershed's biomass in 1965, and then have repeated this measurement every 5 years from 1977 to the present. At first, biomass accumulated as was expected from a relatively young forest. From these data, along with a detailed look at each tree species' growth and size characteristics, they developed a model to predict how the forest would grow and develop into the future. The 5-year measurements have allowed scientists to assess the accuracy of their model.

Recently the 5-year measurements have begun to contradict the original model, and the scientists are wondering why. To their surprise, the total amount of biomass in the watershed leveled off earlier and at a lower level than was predicted. Like many of our forests in New England, the HBEF watershed was established after the extensive logging in the early 1900s and is a relatively young forest; the scientists predicted that it would continue to accumulate biomass for a long time before leveling off in old age.

There are two basic hypotheses explaining why the Hubbard Brook forest, and presumably others of similar age, has stopped growing. The first is that growth has been reduced due to detrimental changes in soil chemistry wrought by atmospheric pollution, most notably acid rain. Scientists have documented the acidity of the rainwater in the region since the late 1960s, and it is clear that the availability of some nutrients important for tree health, particularly calcium and magnesium, has declined due to this incoming acidity. The second, however, holds that the original model was wrong, and the forest has been behaving more or less normally. Opinions in the scientific community vary, but most agree that the jury, as they say, is still out.

The HBEF scientists developed their original biomass model by taking a detailed look at the characteristics of each species occurring in the forest. This information was then compared with other similar forests which had more old growth stands; it was expected that the biomass of the HBEF forest should behave comparably to other forests with common characteristics. This comparison did rely on making some assumptions, but the best evidence suggested similarity to forests in the southern Appalachians, which reach a maximum biomass of about 150 tons/acre. Computer models relying on similar reasoning supported this, and both suggested that the HBEF forest would accumulate biomass for around 200 years before decreasing slightly and then leveling off. In actual fact, however, the forest accumulated biomass for around 70 years and then leveled off at about 100 tons/acre, much sooner and smaller than expected.

In short, the forest stopped growing. There is still no consensus on the explanation. Despite the appeal of blaming acid rain, many believe the models were incorrect and we need a fuller understanding of forest dynamics before we jump to conclusions. For instance, time has revealed that some of the assumptions behind the comparison of forests were not correct. In addition, the biomass in the Hubbard Brook watershed is comparable to the nearby Bowl Natural Area, which was never logged. These two facts suggest that the current biomass may be normal after all.

On the other hand, a major reason that the model's assumptions proved incorrect is because they projected a higher level of forest productivity than what was later observed. While this lower productivity could be natural, it could also be related to the decreased nutrient status of the soil due to leaching by acid rain. In this view, the expectations were on the right track, but declining fertility due to acid rain caused the forest to "fall short" of expectations.

Are our older, second-growth forests reaching a climax state comparable to the pre-logging era, or have they been stunted by pollution? This is still an open question, and research continues. In any case, even a so-called climax forest is a very dynamic place, with ever-changing levels of pollutants, new diseases like beech-bark disease, and, lately, a changing climate. This makes determining just what "normal" is a tricky question. Given this dynamic context, even if the biomass is at a climax level, it seems likely that the forests will look different after another 80-100 years.

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