CC/NUMBER 36
SEPTEMBER 7, 1981

This Week's Citation Classic

Likens G E, Bormann F H, Johnson N M, Fisher D W & Pierce R S. Effects of forest cutting and herbicide treatment on nutrient budgets in the Hubbard Brook watershed-ecosystem. *Ecol. Monogr.* **40**:23-47, 1970. [Depts. Biol. Sci. and Earth Sci., Dartmouth Coll., Hanover, NH; Sch. Forestry, Yale Univ., New Haven, CT; US Geological Survey, Washington, DC; and Northeastern Forest Exp. Station, Forest Serv., US Dept. Agriculture, Durham, NH]

Experimental deforestation of a watershed in the White Mountains of New Hampshire resulted in increased streamflow and increased fluvial losses of dissolved and particulate matter. Nitrate concentration in stream water increased by 56-fold and pH decreased from 5.2 to 4.3 after cutting. Absence of transpiration and accelerated nitrification were responsible for the changes. [The *SCI*® indicates that this paper has been cited over 120 times since 1970.]

Gene E. Likens
Section of Ecology
and Systematics
Division of Biological Sciences
Cornell University
Ithaca, NY 14850

July 21, 1981

"Our long-term studies of natural forested ecosystems are based on a quantitative evaluation of ecological interactions between air, land, and water. The culmination of this approach was to conduct experiments at the ecosystem level of organization. Thus, in cooperation with the US Forest Service, we experimentally deforested an entire watershed in the Hubbard Brook Experimental Forest in the White Mountains of New Hampshire in 1965-1966.

"Our paper described the biogeochemical responses of this experiment. We think the main reason the paper attracted so much attention was that this study was the first attempt to test experimentally the effects of vegetation removal on the ecology, chemistry, hydrology, soils, erosion, and micrometeorology of a large forested area. Following destruction of the vegetation and with minimal disturbance of the forest floor, large increases in streamflow, dissolved substance concentration in stream water, and erosion were observed. At the time of our studies, hearings before the Senate Subcommittee on Public Lands of the Committee on Interior and Insular Affairs were being held on 'clearcutting practices on National Timberlands.' Our results were discussed during these hearings as they illustrated the kinds of information needed to develop sound, sustained yield forestry. Subsequently, these findings have been incorporated into a wide range of standard forest practices.

"Our study was done as an experiment, not as a test of a management practice, but the early 1970s was a period of intense environmental activism and controversy abounded. Interestingly enough, we did not become personally involved in the debate about the practice of clearcutting, and the experimental study persisted as a model for quantitative study of natural terrestrial ecosystems.

"Another reason for the interest in our paper was its multidisciplinary approach. Foresters, ecologists, hydrologists, geochemists, soil scientists, and meteorologists all were provided bits of information, but more importantly, the pieces were related to the whole landscape through our small watershed approach to quantitative study of complex natural ecosystems. A recent review on the subject of our paper is *Pattern and Process in a Forested Ecosystem."*[1]

1. **Bormann F H & Likens G E**. *Pattern and process in a forested ecosystem.* New York: Springer-Verlag, 1979. 253 p.