

Resolution of Respect



F. Herbert Bormann
1922–2012

Frederick Herbert Bormann, co-founder of the Hubbard Brook Ecosystem Study and one of the leading ecosystem ecologists in the twentieth century, died at the age of 90 on 7 June 2012 in North Branford, Connecticut. Born on 24 March 1922 in New York City, the son of Carl Bernhardt Bormann and Gertrude Anna Andle, immigrants from Germany and Austro-Hungary, respectively, Herb grew up in Westwood, New Jersey. Like so many other prominent, inquisitive, and insightful biologists, his early love of nature was nurtured by his parents, particularly his mother.

Herb began his undergraduate education at the University of Idaho, but then enlisted in the Navy, in 1942, shortly after Pearl Harbor. He was a shipfitter petty officer and a welder on submarines in Hawaii. From there, he attended officer candidate school on the Princeton University campus until the end of World War II.

After the war Herb continued his undergraduate studies at Rutgers University in New Brunswick, New Jersey, where he had the privilege of being mentored and befriended by two of the most inspirational

ecologists of the time, Murray and Helen Buell. He received his Ph.D. at Duke University, working with Henry Oosting, whom he greatly admired. These early formative years helped him see the value of integrating knowledge along a continuum from species to the ecosystem. Herb's first faculty appointment was at Emory University, starting in 1952. He moved to Dartmouth College in 1956, and 10 years later he moved to Yale University, where he remained for the duration of his career. Herb retired in 1992 but continued working for many years.

A major turning point in Herb's career occurred when he was a young professor at Dartmouth. He was working successfully on experimental studies of root grafting in white pine (*Pinus strobus* L.), but having been exposed to watershed studies at the Coweeta Hydrologic Laboratory in North Carolina while a graduate student, he saw great potential in expanding the watershed-based ecosystem approach at the newly established U.S. Forest Service Hubbard Brook Experimental Forest (HBEF) in the White Mountains of New Hampshire. He believed there would be new ecological insights gained by combining hydrologic and nutrient studies at the watershed scale.

When I joined the faculty of Dartmouth College in 1961 as an aquatic ecologist with strong interests in ecosystem ecology, Herb and I spent many hours talking about the exciting possibility of doing ecosystem studies in the gauged watersheds of HBEF. Robert S. Pierce, Project Leader at HBEF, and Noye M. Johnson, a new geologist at Dartmouth College, also enthusiastically joined our team at the beginning. The diverse expertise of this group blended strongly and we initiated on 1 June 1963 what was to become the long-term Hubbard Brook Ecosystem Study. The conceptual design for this study, based on the small watershed–ecosystem approach, was described in detail in *Science* (Bormann and Likens 1967). This conceptual model provided a rigorous foundation for our long-term studies on the complicated interactions among air, land, and water in these northern hardwood forest ecosystems. Herb and I had an unusually productive and collegial partnership for more than 50 years.

Bormann's best known research findings with his colleagues of the Hubbard Brook Ecosystem Study were first, that disturbing the forest ecosystem, for example by clear-cutting, would dramatically alter the nitrogen cycle and nutrient economy of the ecosystem. While it was expected that such disturbances would change the hydrology, it came as a surprise that the experimental manipulation also changed nutrient cycles. Secondly, he co-discovered acid rain in North America.

Herb had an unusual talent for thinking big about big ecological systems. Perhaps his most important scientific contribution was the development of an ecosystem-based approach to understanding forests and their role in biogeochemical cycles. Also, by explicitly including the influences of human activities, he made major contributions to our understanding of ecosystems across diverse subdisciplines that included natural history, nutrient cycling, biogeochemistry, plant physiology, and environmental sustainability. His most cited publication was a book, *Pattern and Process in a Forested Ecosystem* (Bormann, F. H., and G. E. Likens), published in 1979 by Springer-Verlag. By the end of April 2013, it had been cited 1455 times. This book was very influential in shaping present-day thinking about forest ecosystems and how they recover following disturbances.

Herb's strong interests on the relation of ecology and social issues inspired the publication of two other books that demonstrated the breadth of his interests and vision: *Redesigning the American Lawn*,

published in 1993 with two of his students, D. Balmori and G. Geballe, and *Ecology, Economics and Ethics: the Broken Circle*, published in 1991, co-edited with Steve Kellert. He also greatly appreciated the value of social interactions for enhancing scientific communication and productivity. We applied this approach in the initiation and development of the Hubbard Brook Ecosystem Study. He was renowned for his love of games and walks, and believed that strong social bonds made for strong collegial interdisciplinary science. Herb was an inspiring teacher, challenging students to think bigger and deeper. He was most effective (and happy) when he could do this in the field. A bit of his personality is revealed by the following quotation, which was part of an invited essay he wrote in 2000 for the autumn newsletter of the Northern Rockies Conservation Cooperative:

Today when I visit a forest, there is still the beauty and magnificence I saw as a youth, but now there is something more . . . a sense of being surrounded by an enormous dynamism: thousands of gallons of water and tons of chemicals streaming upward through tree trunks, photons of energy absorbed by leaves and put to work evaporating water through leaves and fixing energy in organic compounds, food manufactured in leaves streaming to growing points, insect predators quietly nibbling away, rocks being broken down into useable nutrients, microbes disassembling organic compounds and freeing nutrients for reuse, all species playing out their roles in reproduction, the forest ecosystem grudgingly restocking the forest stream with water, and a million other things.

Herb, a dear colleague and mentor to many, is survived by his wife of 60 years, Christine Williamson Bormann, four children (Dr. Bernard T. Bormann, Dr. Rebecca E. Oehlert, Amelia E. Bormann-Smitka, Dr. Lincoln H. Bormann), and six grandchildren.

—Gene E. Likens

AWARDS AND HONORS

National Academy of Sciences, 1973

American Academy of Arts and Sciences, 1972

President, Ecological Society of America, 1970–1971

Blue Planet Prize, The Asahi Glass Foundation (with G. E. Likens), 2003

- For pioneering an approach that has become a model for the scientific world, and for comprehensive understanding of ecosystems through long-term measurement of the flows of water and chemical substances in watersheds.

International St. Francis Prize for the Environment, 1992

Eminent Ecologist Award, The Ecological Society of America (with G. E. Likens), 1995

- For outstanding contributions to the science of ecology.

National Wildlife Foundation, National Conservation Achievement Award in Science, 1995

- For outstanding contributions to the wise use and management of the nation's natural resources.

Tyler Prize, The World Prize for Environmental Achievement (with G. E. Likens), 1993

- For creating the premier model for ecosystems study in the world utilizing the small-watershed technique for the study of the biogeochemistry of whole forest ecosystems, which changed American law and forestry practice and resulted in recognition of acid rain as a major environmental problem in North America.

Yale School of Forestry and Environmental Studies, Excellence in Teaching Award, 1989

Rutgers University, Distinguished Alumni Award, 1988

USDA Forest Service, 75th Anniversary Award, 1980

American Motors, Conservation Award, 1969

Ecological Society of America, George Mercer Award, 1954

And, most recently, the Aldo Leopold Award from Yale University, which had been awarded only one time previously in the history of the university.

PROFESSORSHIPS

Adjunct Professor, School of Natural Resources, University of Vermont 1994–.

Professor Emeritus and Senior Research Associate, Yale University, 1992–.

Oastler Professor of Forest Ecology, Yale University, 1966–1992.

Professor of Botany, Dartmouth College, 1962–1966.

Associate Professor of Botany, Dartmouth College, 1959–1962.

Assistant Professor of Botany, Dartmouth College, 1956–1959.

Assistant Professor of Biology, Emory University, 1952–1956.

EDUCATION

University of Idaho, 1941

Princeton, USN V-12, Class of 1947

Rutgers University, B.S., Agricultural Science, 1948
Duke University, Ph.D., Plant Ecology, 1952

PUBLICATIONS

Bormann was the author or co-author of more than 200 scientific publications, and was author, co-author, or editor of five books, including:

- Burch, W. R., Jr., and F. H. Bormann, editors. 1976. *Beyond growth, essays on alternative futures*. Yale University, School of Forestry and Environmental Studies Bulletin 88, New Haven, Connecticut, USA. 228 pp.
- Likens, G. E., F. H. Bormann, R. S. Pierce, J. S. Eaton, and N. M. Johnson. 1977. *The biogeochemistry of a northern hardwood forest ecosystem*. Springer-Verlag, New York, New York, USA. 146 pp. (Likens G. E., and F. H. Bormann. 1995. Second edition)
- Bormann, F. H., and G. E. Likens. 1979. *Pattern and process in a forested system*. Springer-Verlag, New York, New York, USA. 253 pp. (Translated into Chinese).
- Bormann, F. H., and S. R. Kellert. 1991. *Ecology, economics and ethics: the broken circle*. Yale University Press, New Haven, Connecticut, USA. 233 pp. Reprinted in paperback, 1994.
- Bormann, F. H., D. Balmori, and G. Geballe. 1993. *Redesigning the American lawn, a search for environmental harmony*. Yale University Press, New Haven, Connecticut, USA. 166 pp. Reprinted in paperback, 1995.
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