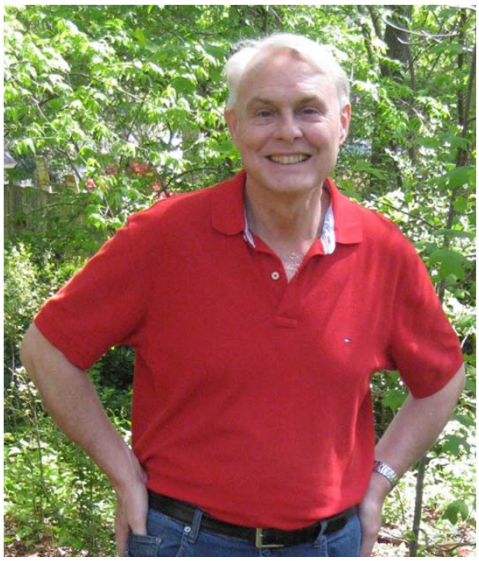
Spatial and Temporal Heterogeneity: Implications for the Ecology and Bioassessment of Blackwater Streams



2011 ESE Distinguished Alumnus Award Winner

Leonard A. Smock

Professor of Biology and
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0001 Blue Cross Blue Shield Auditorium
12:00 pm

ABSTRACT

Heterogeneity of the physical environment is a well known factor affecting the structure and dynamics of aquatic communities. The effects of spatial heterogeneity on stream-dwelling aquatic macroinvertebrate communities have long been studied in high gradient streams, where the primary expression of that heterogeneity is the varying water flow rates and resulting variety of sediment particle sizes in a stream's riffle-pool geomorphology. The majority of streams flowing on the Coastal Plain physiographic province throughout the southeastern U.S., however, have been considered as being spatially homogenous given their relatively low flow, extensive beds of sandy sediment and a lack of a riffle-pool geomorphology. Studies in eastern Virginia and South Carolina, however, have shown that these streams, often termed blackwater streams because of their high dissolved carbon content, actually are quite spatially heterogeneous when examined from broad to fine spatial scales and that this heterogeneity has important implications to the structure and dynamics of stream macroinvertebrates at both the population and community level. In particular, a three dimensional spatial perspective of these streams that includes their floodplains and hyporheic zones must be taken to fully understand community organization and secondary production. Temporal heterogeneity, focusing on changes in the stream environment over time, also is an important driver of macroinvertebrate communities, having differing effects over periods from days to centuries. This spatial and temporal heterogeneity also has broad implications for the bioassessment of the water quality of blackwater streams by regulatory agencies, affecting field sampling design, the metrics chosen to assess water quality, and data analysis.

BIO

Dr. Leonard A. Smock received his B.S. and M.S. degrees from the University of Illinois and his Ph.D. in 1979 from the Department of Environmental Sciences and Engineering at the University of North Carolina - Chapel Hill. He has been a faculty member in the Department of Biology at Virginia Commonwealth University since 1979, having the rank of Professor and serving as the department's Chairman from 1990 to 2009. Dr. Smock presently is the Director of VCU's Rice Center for Environmental Life Sciences, the university's biological field station situated on the James River. His primary areas of expertise are aquatic ecology and water pollution biology, in particular the ecology of invertebrates in rivers, streams, and wetlands and their use for biological monitoring and assessing water quality. He teaches courses on stream ecology and water pollution biology. He has served as elected President of the North American Benthological Society, the foremost scientific society focused on the ecology and assessment of streams and rivers and is a Fellow of the American Association for the Advancement of Science.

Dr. Smock has conducted extensive research, funded primarily by the National Science Foundation and the National Park Service, on the ecology of the streams, rivers, and floodplains of Virginia and North and South Carolina. Included among his research are analyses of the biological structure and food webs of the communities that inhabit these environments, the productivity and energetics of aquatic ecosystems, and the interconnections between rivers and their floodplains. He also has conducted research on the effects of changing land use practices on water and habitat quality in streams through assessment of the impacts on macroinvertebrate and fish communities.