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Readers' Forum/

Comment on 'Ecohydrology—Why Hydrologists Should Care'

by Raymond W. Talkington[1]

I read the editorial "Ecohydrology—Why Hydrologists Should Care" by Randall J. Hunt and Douglas A. Wilcox (May–June 2003) and said to myself, "We have been trying to address the questions asked by virtually all of the municipal boards, interest groups, private individuals, and regulators in the states of New Hampshire and Massachusetts regarding the effect of ground water withdrawals on flora and fauna in wetland resource areas for a number of years. Why is there now an editorial on this topic?" Hayashi and Rosenberry (2002, *Ground Water* 40, no. 3) also suggest that this is a new and/or emerging area of interest.

There are no "black box" answers for municipal boards, interest groups, private individuals, and state regulators. Instead, we have had to develop are "wetland and ground water resource" monitoring programs that begin to address some of the questions asked by these groups. These programs typically consist of baseline data collection, including vegetation, soil types, soil moisture content, presence of vernal pools, inventory of potential habitat areas for endangered/environmentally sensitive species, installation of multilevel piezometers in rivers, ponds, vernal pools, and stream gauging. The approval of a permit for ground water withdrawal may be tied to defining critical water levels in the pumping well. If the critical level is reached, the pumping rate of the well must be reduced by a certain percentage so as not to cause an adverse impact to the wetland resources. These monitoring programs typically continue for years after the well is put into service. The data are reported to the regulators, municipal officials, and interest groups.

I am currently working on seven to 10 ground water supply projects throughout New England that require ecohydrologic information before the wells can be permitted. These wells range from public water supply wells (up to 2600 gallons per minute [gpm] pumping rate), to irrigation wells for golf courses (25 to 150 gpm), to residential wells (individually 5 to 10 gpm) in a proposed 61-lot subdivision. The wells are finished in both bedrock and sand and gravel. Most of these wells are in proximity to wetlands or wetland areas that lie directly above bedrock fracture systems.

We have not applied the term "ecohydrology" to our investigations. However, at a recent meeting with a local planning board, I used the term and explained its meaning. The term was then used by the members of the planning board and the public for the rest of the meeting!

I applaud this editorial and want investigators/scientists to know that there is a lot of ecohydrologic data being collected from many hydrogeologic and ecological settings as part of the permitting process for ground water supply wells.

Authors' Reply by Randall J. Hunt[2] and Douglas A. Wilcox[3]

While we agree with Dr. Talkington that the concept of interactions between hydrology and ecology is not new, a primary point of the editorial may have been misunderstood. Although "monitoring programs" are indeed a necessary step for understanding ecohydrology, they are not sufficient in and of themselves to answer many of society's questions. Using the example of Dr. Talkington, how does an allowable ground water decline in a pumping permit get assigned? What is the scientific basis for deciding how much decline causes an "adverse" impact? Whether stated explicitly or not, there is an element of "black box" to many of the answers scientists give to the public.

Two examples provided by Hayashi and Rosenberry (2002) further illustrate the black box. In their macrophyte example, two studies "found a clear" but opposite "correlation between ground water discharge and macrophyte growth, but both failed to identify the specific chemical or physical process determining macrophyte distribution." Hayashi and Rosenberry (2002) conclude this example by observing, "such conflicting results point out a need for

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interdisciplinary studies." In their eutrophication example, a reduction in nitrate was "attributed" to a microbially mediated process, but the process and microbial community composition were assumed, not measured. These examples underscore how monitoring of hydrology and ecology can yield useful insight, but the *processes* that link the abiotic to the biotic commonly are not well understood or uniquely characterized. It is this understanding of process, however, that gives a scientific basis for our assessments. Using the example in Dr. Talkington's response, such an understanding would be crucial for accurately quantifying how much ecological degradation would be expected given a specified ground water level decline. With such a quantitative understanding, the public can more easily decide if the benefit of the pumping is worth the cost to the resources of interest. It is our opinion that the state of current understanding is not at this level.

In summary, our editorial was written because the term "ecohydrology" has come to the forefront in the past few years. True ecohydrology in practice, however, is hard to attain and requires more than monitoring. Despite the recent interest in ecohydrology, there is a shortage of investigations that thoroughly combine process-oriented research from both disciplines. Moreover, the collaboration should encompass the study-design phase through fieldwork and publication of results. In general, hydrologists still study hydrology, and ecologists still study ecology—then they present at meetings and publish their respective results. Instead, we believe hydrologists and ecologists need to interact frequently to maximize the results of their investigations and to shrink the "black box" that limits our understanding. Inclusion of some ecological data in a hydrologic report (or vice versa) is not sufficient to develop a true understanding of the interactions that bind hydrology and ecology. This assertion notwithstanding, we wholeheartedly agree with Dr. Talkington that a broad range of ecohydrologic data sets (regardless of who collects them) will be vital for advancing our understanding and making "ecohydrology" more than just a buzzword.

Note: The opinions expressed herein are those of the authors and not of the U.S. Geological Survey.