

## ***Interactive comment on “Training hydrologists to be ecohydrologists and play a leading role in environmental problem solving” by M. E. McClain et al.***

### **Anonymous Referee #1**

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**Summary:** The manuscript provides a vision for hydrologic science and engineering education that focuses on the emerging area of ecohydrology where ecosystem and hydrologic cycle interactions form the basis of science and problem solving. The authors propose that education in this area be strengthened to better support interdisciplinary solutions to environmental problems.

This manuscript discusses an issue that is arising in higher education in that students need broad interdisciplinary training, while maintaining core knowledge in a discipline (e.g., Newell, 1992; Golde and Gallagher, 1999). Much of their position is not new and has been echoed in many areas of environmental and related sciences (Jones and

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Merritt, 1999; Benda et al., 2002), but the twist in the manuscript is that ecohydrology, by its very nature, provides cross-cutting training. While I agree, I could argue that this cross-cutting training can come from the intersection of many other disciplines and hydrology as well, e.g., water science/engineering and policy, physical hydrology and chemistry, water and land use management (e.g., agricultural or forest management). I am also not convinced that this is not already occurring in the training of undergraduates and especially graduate students (e.g., see National Research Council, 2012). I recommend minor revisions of the manuscript considering some of the concerns described below.

**General comments:** Many hydrology programs exist within other disciplinary units where this cross-cutting training is forced. For example, resource-based programs in agriculture (Paul and Robertson, 1989) or forestry (Sopper, 1970; Ponce, 1979; Swanson, 1998) have had a primary focus on vegetation, nutrient cycling and management, and water (watershed management and/or hydrology). I recognize that the authors are defining ecohydrology quite broadly and I would agree that it is broad. However, I think it is shortsighted to overlook discipline areas that have trained hydrologists in the way the authors advocate – at least to some extent. It would be helpful for the authors to reflect on how the proposed programs differ from existing programs or the authors could draw more direct comparisons to programmatic models that currently exist. For example UC Santa Barbara's Hydrologic Sciences and Policy or Tufts University's Water: Systems, Science and Society seem to capture the level of integration in land management, ecosystem interaction, and hydrologic sciences (broadly as engineering, biophysical sciences, and social sciences), which the authors support. These programs do not use the term ecohydrology, but they seem to integrate many of the same areas that are discussed in the manuscript.

**Section 3.2 – Personal competencies.** This section describes what I believe are critical components of any advanced educational program, especially within areas that area interdisciplinary. However, I do not see this section particularly relevant for this

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article or at least I don't believe it needs to be emphasized as its own section or take such a substantial portion of the manuscript. The competencies discussed are generic and can be applied to just about any program, and thus, I don't believe the emphasis is needed for an article in a hydrologic sciences journal. Rather than including section 3.2, the authors may consider adding some specific examples as case studies of where the type of training they proposal is critical. This would reinforce their point and strengthen the overall manuscript.

Minor comments: Lines 3-18, 1485: In my mind, some of the early foundations of ecohydrology stem from forest hydrological research, e.g., the Hubbard Brook Ecosystem Study (Likens et al., 1977), plant-water relations (e.g., Lange et al., 1976), and vegetation and watershed management (e.g., Colman, 1953; Kittredge, 1948). Stating this will strengthen some of the management and policy connections that are later made by the authors.

The discussion of the 3 spheres of ecohydrology requires some additional thought. The authors recognize that their 3rd sphere is connected to the previous two spheres (line 5, 1490). I would argue that all three are inter-connected. This point should be emphasized. Also, the title for the 3rd sphere really should include fluvial systems since upstream rivers influence downstream rivers and floodplains.

I like the Harte reference in the beginning of the conclusions!

Line 11-13, 1498: Obviously the proposed curriculum and training program is geared toward hydrologists given that it was submitted to HESS and anecdotally it seems that most ecohydrologists come from the hydrologic community rather than the ecosystem science community. I wonder if part of the message for this training in ecohydrology should call for a more balanced from ecosystem science, e.g., faculty involved in ecohydrology programs that consider themselves ecologists rather than hydrologists.

Other programs to include in Table 1, which are not given in Rickwood et al.: University of Idaho: Ecohydrology Science and Management, M.S. University of Arizona:

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#### Watershed Management and Ecohydrology, M.S.

Suggested citations to include: (Clifford, 2002; Rasmusson, 1997; Carpenter and Folke, 2006; Benda et al., 2002; and especially Mackay and Band, 2009)

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