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# Comments on 'connectivity between landscapes and riverscapes – a unifying theme in integrating hydrology and ecology in catchment science?' by D Tetzlaff, C Soulsby, PJ Bacon, AF Youngson, C Gibbins, and IA Malcolm

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**Tetzlaff *et al.* (2007) wrote a relevant and opportune commentary that highlighted some challenges in hydrological sciences. They addressed important key issues such as:**

- ***Inter-disciplinarity*** **– integration of disciplines (e.g. hydrology and ecology) in catchment science. They emphasized very well the difference between *multi-disciplinary* and *inter-disciplinary* studies. The latter require a real complicity of all team members working 'in an atmosphere of mutual respect and with willingness to learn'; and**
- ***Holistic*** **approach (ecological problems require *holistic* solutions), that takes into account the whole problem, in identifying and assessing environmental processes.**

**Tetzlaff *et al.* (2007) also recognize and stress the relevance of performing 'studies that explicitly examine connections across scales and examine the role of connectivity among non-contiguous as well as contiguous areas' as recommended by Peters *et al.* (2007).**

**However, other imperative key issues (e.g. *stakeholder* engagement/public participation, *ethnosciences*[1]), recognized as vital by the scientific community with respect to natural resources management, were not taken into account in their commentary. (*Ethnoscience* is a scientific branch devoted to understanding how humans – in spite of their fragmented and limited interactions with the world – are developing different forms of knowledge and beliefs. It is essentially cross-disciplinary, based on increased collaboration between social sciences and humanities with natural sciences (e.g. biology, ecology, agronomy, climatology) (Atran, 1991; Osgood, 1967; Testart, 1977; Rist and Dahdouh-Guebas, 2006)). A number of works (see, e.g. Pahl-Wostl *et al.*, 2000; Pahl-Wostl, 2002; Mata-Lima, 2006; Matta and Kerr, 2006; Rist and Dahdouh-Guebas, 2006; Giordano *et al.*, 2007; Kingwell *et al.*, 2007; Rezaei-Moghaddam and Karami, 2007) have shown that a participative (shared) decision process in natural resource management (including watershed planning and management), at local or regional scales, is a requisite that must take place among all project phases.**

**I believe that since the Girnock catchment is a relatively undisturbed system (see Tetzlaff *et al.*, 2007, p. 1388), studies related to it can be carried out without a participatory process that takes into account the *stakeholder* concerns and knowledge. But in common situations (disturbed systems subjected to human pressures), especially in developing countries, a *trans-disciplinary* rather than *inter-disciplinary* approach must be used because it allows a *holistic* solution. As Rist and Dahdouh-Guebas (2006, p. 467) note, 'integration of indigenous knowledge and *ethnoscientific* approaches into contemporary frameworks for conservation and sustainable management of natural resources will become increasingly important in policies on an international and national level, both in countries that are industrialized and those that have a developing status'.**

Giordano *et al*. (2007, p. 213) highlighted that 'the importance of shared decision processes in water management derives from the awareness of the inadequacy of traditional–i.e. engineering–approaches in dealing with complex and ill-structured problems'.

The definition of ecology (Moore, 1920; Briggs *et al*., 2006; Martínez *et al*., 2006; Agrawal *et al*., 2007; Cadenasso *et al*., 2007) implicitly alleges active public involvement since it describes ecology as a science that studies the interrelationships between community (including the local human community–not only the scientific community!) and the surrounding environment. The participative decision process allows the consideration and integration of different knowledge and perspectives (World Commission on Dams, 2000; Mata-Lima and Vasconcelos, 2006; Giordano *et al*., 2007; Herrick and Sarukhán, 2007; European Union Water Framework Directive, 2000/60/EC) as a condition to reach *sustainability*.

The *inter-disciplinarity* concept argued by Tetzlaff *et al*. (2007) was introduced a long time ago (e.g. Moore, 1920) and should be replaced with a *trans-disciplinarity* concept which is more broad and suitable. While *inter-disciplinarity* stands for (Rist and Dahdouh-Guebas, 2006, p. 471–472) 'interaction between basic and applied sciences on the one hand, and social and human sciences on the other, which can be termed *inter-scientific inter-disciplinarity* (i.e. scientific *inter-disciplinarity* that transcends the science fields) the *trans-disciplinarity* aims for a shift from disciplinary-based scientific to a more societal mode of knowledge production by integrating everything that is between, across and beyond disciplines (Hurni and Wiesmann, 2004).

Therefore, besides integrating hydrology and ecology, to be really *holistic* and *trans-disciplinary*, the approach used in catchment science must engage the *stakeholder* (e.g. local community and others relevant actors) in the whole process under appreciation.

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