

## COMMENT

**Embodied interdisciplinarity: what is the role of polymaths in environmental research?****THEMATIC ISSUE**  
Interdisciplinary Progress  
in Environmental  
Science & Management

Interdisciplinarity, although difficult to define (Qin *et al.* 1997; Sillitoe 2004), can be interpreted broadly as an active, multi-faceted learning process between researchers from different disciplines ‘creating a common ground for a special purpose’ (Vedeld 1994). Interdisciplinary approaches are regarded as necessary in environmental research, especially in view of global environmental change (Bradshaw & Bekoff 2001; Carpenter *et al.* 2006; Daily & Ehrlich 1999). However, ‘the step from an appealing idea to an operational method is large indeed’ (Karlqvist 1999, p. 379), leading some to argue a lack of genuine interdisciplinarity in environmental research (Bruce *et al.* 2004; Fazey *et al.* 2005). The present commentary draws attention to the potentially important role of polymaths in environmental research. We argue that environmental polymaths can enhance the effectiveness of interdisciplinarity through their knowledge and understanding of different disciplinary languages, epistemologies and methodologies, and as such, should be acknowledged more explicitly in interdisciplinary discussions.

The term ‘polymath’, in use since the Renaissance, usually refers to very learned scholars who were ‘distinguished not only by genius in particular fields of interest, but also by their ability to traverse different fields of specialization and to sometimes recognize their interconnections’ (MacLachlan 2009). An example of such a polymath is Leonardo da Vinci, the archetypal Renaissance man, renowned as a painter, architect, sculptor, musician, mathematician, engineer, inventor, anatomist, geologist, cartographer, botanist and writer. Whilst not arguing that environmental polymaths should have the depth and breadth of expertise of these ‘Renaissance’ polymaths, we build on Anbar’s (1973) characterizations of the ‘bridge scientist’ to define an ‘environmental polymath’ as an ‘embodied’ interdisciplinarian, capable of working across epistemological and ontological gaps to understand and address environmental issues. While polymaths can often act as ‘integrative interdisciplinarians’, in other words single researchers synthesizing different knowledges to address their own research questions (Baumann 2009), we focus on the role such polymaths can play in the wider interdisciplinary context, namely by facilitating interactions between groups of researchers from disciplines grounded in different epistemological backgrounds.

Interdisciplinarity is advocated strongly in environmental research as a means of addressing complex ecosystem and land use issues (Daily & Ehrlich 1999; Marzano *et al.* 2006). The consensus is that interdisciplinarity will advance

a holistic understanding of environmental problems (Janssen & Goldsworthy 1996), leading to practical and sustainable solutions (Kinzig 2001; Bruce *et al.* 2004). Interdisciplinarity is intended to go beyond the coming together of individuals from different disciplines to work on a common problem. According to Sillitoe (2004), it is about allowing the methods and perspectives of others to influence your own thinking and understanding. A key question in interdisciplinary research, however, is: ‘what works, and in what contexts?’

Personality and attitude may impact as much as a broad knowledge base in the success of interdisciplinary research (Bruce *et al.* 2004). As such, a mono-disciplinarian with good interpersonal skills and a curiosity and willingness to engage with different disciplinary perspectives can effectively contribute to or coordinate interdisciplinary research projects (Bruce *et al.* 2004). Yet a key issue impacting on the success of interdisciplinarity is the difficulty in developing mutual understanding between disciplinary researchers. This is due not only to discipline-specific languages (Wear 1999), but also to different epistemological, ontological and methodological backgrounds (Marzano *et al.* 2006; Stevens *et al.* 2007). For example, while the epistemological positioning of some quantitative social and natural sciences might be similar (for example modelling in health sciences and ecology), it may be less compatible with the more interpretivist positioning of many other social science disciplines (such as anthropology and cultural geography) which also may form part of an interdisciplinary research group.

In view of the difficulties linked to mutual understanding in interdisciplinary research, we argue that, together with strong interpersonal skills, the knowledge held by environmental polymaths could address confusion and/or conflicts within and between disciplines (Anbar 1973). As such, polymaths could draw on their understanding of relevant specializations to bring together diverse expertise and perspectives and facilitate the interaction necessary for interdisciplinarity to work (Klein & Porter 1990; MacLachlan 2009). This was evident in an EU FP5 project in which the input of an environmental polymath with knowledge of both natural and social science perspectives led to greater respect, understanding and synergies between researchers within the project (Bell *et al.* 2005). Although equally relevant to other fields that require holistic approaches (such as global health and international development), environmental polymaths could also play a key role in formulating interdisciplinary research questions. Taking the example of biotechnology, Winnacker (2003) argued that in order to achieve good answers

to address challenging problems for which the questions are often unknown, there is a real need to develop into 'truly 'interdisciplinary professionals' in the broadest possible sense'. An example of this is the interdisciplinary framing of the 'Sustainable Development' degree at St Andrews, led by an environmental polymath. MacLachlan (2009) has also pointed out that while multidisciplinary, interdisciplinary and transdisciplinary interactions have broadened research approaches, 'neo-polymaths' can identify how best to use the results of this integration (see also Sillitoe 2004). As such, the polymath's role as a knowledge broker, translator, mediator or coordinator may contribute to the success of many interdisciplinary endeavours in environmental or other wide-ranging scientific fields (Anbar 1973; Klein & Porter 1990).

While the contribution of polymaths to genuine interdisciplinarity could be significant, it does not seem to be widely discussed in interdisciplinary literature. Recent Web of Science searches we conducted turned up no relevant results for 'environment\* AND polymath\*'. When broadened, the search for 'polymath\*' led to articles focused mainly on the learned individuals of the past (for example Robinson 2005). Has the concept of polymaths become outdated or subsumed into other terminology? This may well be the case, with authors referring to such individuals as 'bridge scientists' (see Anbar 1973), multi-disciplinarians (see Bruce *et al.* 2004) or potentially other terminologies. Have researchers become pigeonholed as they take on specific disciplinary roles within projects? Again, disciplinary institutional traditions (Kinzig 2001; Nissani 1997) and a strong drive for disciplinary focus in early career years (Ewel 2001; Rhoten & Parker 2004) may be responsible for leading polymaths to take on specific mono-disciplinarian roles in interdisciplinary projects. Or perhaps the term has become irrelevant as practice and studies into interdisciplinarity have progressed? Indeed, structural changes to science (see Gibbons 2000 for a description of 'Mode 2' knowledge production, and Funtowicz & Ravetz 1993 for post-normal science) may have pushed the concept of polymaths into redundancy. Alternatively, environmental polymaths, while an important feature of the interdisciplinary landscape, have not yet been the subject of research themselves.

We acknowledge that many barriers remain in interdisciplinary environmental research. While structural changes in science may address some of these barriers, the processes involved in the transition to Mode 2 or post-normal science may in fact reinforce the need to capitalize on the skills of environmental polymaths who are already facilitating interdisciplinary endeavours in environmental science. We believe a number of environmental polymaths are currently working effectively in interdisciplinary settings. What is less known, however, is the role of environmental polymaths in interdisciplinarity, including risks and benefits that they and their institutions face. Until more is known about environmental polymaths, the contributions of a group of knowledgeable, adaptable and motivated researchers who

could be key to the interdisciplinarity in environmental research could be missed. As such, we believe future research on the role of environmental polymaths may influence strongly thinking around future academic training, and promote the integration of polymaths in academic settings.

### Acknowledgements

We thank Adam Vanbergen, Liz O'Brien, Chris Quine and two anonymous reviewers for their useful comments on the manuscript.

### References

- Anbar, M. (1973) The 'bridge scientist' and his role. *Research/Development* 24: 30–34.
- Baumann, H. (2009) Don't fence me in ... In: *The Social Embeddedness of Industrial Ecology*, ed. F. Boons & J. Howard-Grenville, pp. 48–64. Cheltenham, UK: Edward Elgar.
- Bell, S., Carss, D.N. & Marzano, M. (2005) Calming troubled waters: making interdisciplinarity work. Final report to RELU (Project No. ESRC: RES-224-25-0110) [www document]. URL [http://www.forestry.gov.uk/pdf/Marzano-RES-224-25-0110.pdf/\\$FILE/Marzano-RES-224-25-0110.pdf](http://www.forestry.gov.uk/pdf/Marzano-RES-224-25-0110.pdf/$FILE/Marzano-RES-224-25-0110.pdf)
- Bradshaw, G.A. & Bekoff, M. (2001) Ecology and social responsibility: the re-embodiment of science. *Trends in Ecology and Evolution* 16: 460–465.
- Bruce, A., Lyall, C., Tait, J. & Williams, R. (2004) Interdisciplinary integration in Europe: the case of the Fifth Framework programme. *Futures* 36(4): 457–470.
- Carpenter, S.R., De Vries, R., Dietz, T., Mooney, H.A., Polasky, S., Reid, R.V. & Scholes, R.J. (2006) Millennium Ecosystem Assessment: research needs. *Science* 314: 257–258.
- Daily, G.C. & Ehrlich, P.R. (1999) Managing Earth's ecosystems: an interdisciplinary challenge. *Ecosystems* 2: 277–280.
- Ewel, K.C. (2001) Natural resource management: the need for interdisciplinary collaboration. *Ecosystems* 4: 716–722.
- Fazey, I., Fischer, J. & Lindenmayer, D.B. (2005) What do conservation biologists publish? *Biological Conservation* 124: 63–73.
- Funtowicz, S.O. & Ravetz, J.R. (1993) Science for the post-normal age. *Futures* 25(7): 739–755.
- Gibbons, M. (2000) Mode 2 society and the emergence of context-sensitive science. *Science and Public Policy* 27(3): 159–163.
- Janssen, W. & Goldsworthy, P. (1996) Multidisciplinary research for natural resource management: conceptual and practical implications. *Agricultural Systems* 51: 259–279.
- Karlqvist, A. (1999) Going beyond disciplines: the meanings of interdisciplinarity. *Policy Sciences* 32(4): 379–383.
- Kinzig, A.P. (2001) Bridging disciplinary divides to address environmental and intellectual challenges. *Ecosystems* 4: 709–715.
- Klein, J.T. & Porter, A.L. (1990) Preconditions for interdisciplinary research. In: *Studies in Interdisciplinary Methods from Business, Government and Academia*, ed. P.H. Birnbaum-More, F.A. Rossini & D.R. Baldwin, pp. 11–19. Oxford, UK: Oxford University Press.
- MacLachlan, M. (2009) Rethinking global health research: towards integrative expertise. *Globalization and Health* 5: 6.

- Marzano, M., Carss, D.N. & Bell, S. (2006) Working to make interdisciplinarity work: investing in communication and interpersonal relationships. *Journal of Agricultural Economics* 57(2): 185–197.
- Nissani, M. (1997) Ten cheers for interdisciplinarity. *Social Science Journal* 32(2): 201–216.
- Qin, J., Lancaster, F.W. & Allen, B. (1997) Types and levels of collaboration in interdisciplinary research in the sciences. *Journal of the American Society for Information Science* 24(10): 893–916.
- Rhoten, D. & Parker, A. (2004) Risks and rewards of an interdisciplinary research path. *Science* 306: 2046.
- Robinson, A. (2005) A polymath's dilemma. *Nature* 438: 291.
- Sillitoe, P. (2004) Interdisciplinary experiences: working with indigenous knowledge in development. *Interdisciplinary Science Reviews* 29(1): 6–23.
- Stevens, C.J., Fraser, I., Mitchley, J. & Thomas, M.B. (2007) Making ecological science policy-relevant: issues of scale and disciplinary integration. *Landscape Ecology* 22(6): 799–809.
- Vedeld, P.O. (1994) The environment and interdisciplinarity: Ecological and neoclassical economical approaches to the use of natural resources. *Ecological Economics* 10: 1–13.
- Wear, D.N. (1999) Challenges to interdisciplinary discourse. *Ecosystems* 2: 299–301.
- Winnacker, E.-L. (2003) Interdisciplinary sciences in the 21st century. *Current Opinion in Biotechnology* 14(3): 328–331.

JULIETTE C. YOUNG<sup>1\*</sup> AND MARIELLA MARZANO<sup>2</sup>

<sup>1</sup>NERC Centre for Ecology and Hydrology, Bush Estate, Penicuik EH26 0QB, UK and

<sup>2</sup>Forest Research, Centre for Human and Ecological Sciences, Forest Research Northern Research Station, Roslin, Midlothian EH25 9SY, UK

---

\* Correspondence: Juliette C. Young Tel: +44 131 445 8522 Fax: +44 131 445 3943 e-mail: j.young@ceh.ac.uk