Finding integration pathways: developing a transdisciplinary (TD) approach for the Upper Nepean Catchment

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Abstract

The recognition that natural resources and their processes support human society underpins the notion of sustainability. Key players that are engaged with balancing natural resource *protection* and *use* include: Catchment Management Authorities (CMAs); local, state and federal regulators; resource managers and policy-makers; and industrial, agricultural and domestic resource-users. Discipline specialists are often consulted, and research results may be used, in the development and implementation of resource management plans. In Australia and globally, meaningful, effective communication between discipline specialists, resource-users, communities, and resource managers is not the norm. In this study, a team of discipline-specialist researchers used the Upper Nepean sub-catchment as a case-study; addressed a key question raised by the local CMA; and worked together to develop a transdisciplinary (TD) approach that would enhance the decision-making capacity of the CMA. The TD approach addressed information pertaining to the question: W*hat are the risks to maximising the environmental benefits expected from environmental flows?* By analysing information and knowledge for both content and context (the factors influencing the CMA), after a one-year initial phase, we present results that suggest the TD approach is a transformative mechanism for contributing to natural resource sustainability.

Keywords

Transdisciplinary, water resource management, environmental flows

Introduction

In Australia and elsewhere globally, although there is a clear rhetoric of commitment to environmental sustainability, on the ground there is a deterioration in environmental health across many measures (Millenium Ecosystem Assessment, 2005, Beeton *et al*., 2006, Carpenter *et al*., 2006). This is combined with the observation that meaningful, effective communication between discipline specialists, resource-users, communities, and resource managers is not the norm (Roux *et al*., 2006). At the same time there is a proliferating literature on the developing methodologies of trandisciplinarity, and a growing recognition of their usefulness in facilitating natural resource management (Slocombe, 1998, Tress *et al.*, 2001, MaxNeef, 2006, Naveh, (2005), Tress *et al.*, 2005, Cundill *et al.*, 2006, Hadorn *et al.*, 2006, Antrop & Rogge, 2006).

Recognising that substantive transdisciplinary (TD) experience is rare (Depres *et al.*, 2006, Tress *et al.*, 2005); that devolution of natural resource protection responsibilities to local government institutions is common (Hawkesbury-Nepean River Management Forum, 2004); and that practical solutions are required that take account of ecological, social and economic complexity (Cundill *et al.*, 2006): a group of interested discipline specialists from the University of Technology Sydney (UTS) set out to become a transdisciplinary research team. This endeavour had many of the characteristics listed as common in TD studies: limited time, funding, experience (Tress *et al.*, 2005), and at the end of the first phase of the project (one year) the team has a functional identity and has made a contribution to a substantive natural resource management issue. This paper is the first step in the iterative reflection and evaluation integral to the TD approach.

Responses to complexity
Natural resource management is inherently complex – requiring knowledge and understanding of bio-physical, social and economic sphere's, each of which is functionally responsive to scale (Cundill *et al.*,

2006, Hadorn *et al.*, 2006). Key avenues of development have emerged out of specific needs. 1) The need to increase knowledge and grow in understanding drives research (Slocombe, 1998, Hadorn *et al.*, 2006). 2) The need for good decisions to emerge from policy-law-institutional development-management interfaces drives the move from the static to the dynamic process of adaptive management (Palmer, 1998, Hillman & Brierly, 2002, Palmer *et al.*, 2004). 3) The need for integration in every dimension and across scales drives the development of transdisciplinarity (Hadorn *et al.*, 2006). As understanding is translated into problem solving, the challenges of risk, uncertainly and variability are addressed (Hughes, 2004, Potschin & Haines-Young, 2006, and Wickson *et al.*, 2006)

Upper Nepean case study

In this study, the emergent TD team initially comprised three discipline-based "drivers", each with experience in natural resource management - specifically, sustainability issues, water and catchments. The discipline fields were: 1) design and visual communication (with specific experience in natural resource management planning and reporting, 2) water demand management and economics (with grounding in TD approaches and facilitation), and 3) water resource management and aquatic ecology (with grounding in applied multi-disciplinary studies and water policy development). Each discipline included experienced and early career researchers. As the study proceeded, a social historian and environment educator joined the research team and two members of the CMA participated throughout. During this process we encountered the "emergent" nature of TD methodologies, and a dynamic interaction between three concurrent experiences was critical. Firstly learning about TD methods and approaches occurred through a discussion-based interrogation of the TD literature. Secondly the language and conceptual basis of other disciplines was initiated through engagement with each discipline's literature and team discussions. Thirdly, new skills and insights were engaged through engagement with a case-study.

Aim

The aim of this paper is to describe the emergence and development of a TD research team, to provide an outline of initial results (from the first phase [one-year] of the project), and to suggest TD as a key method for Australian stream management.

Methods

Engaging with TD literature – an emerging methodology

Table 1. Repeatedly used TD methodology applied in this study.

Method	Mode of application in the Upper Nepean	Reference
- Problem solving - Interface between human and natural contexts - Interpenetration of epistemologies - Collaboration	- use of CMA question - focus on environmental flows and institutional context - evolving integrated methodology - between disciplines and with CMA	Wickson *et al.*, 2006
- Identification of a problem field - Nature of sustainable practice - Top-down and bottom-up methodology - Articulation of types of knowledge and voice	- use of CMA question - focus on environmental flows and institutional context - evolving integrated methodology - recognition of content and context & the 'lens' model	Hadorn *et al.*, 2006
- Recognition of substantive and procedural goals	- recognition of content and context& the 'lens' model	Slocombe, 1998
- Articulation of types of knowledge and voice - Collaboration	- recognition of content and context & the 'lens' model - between disciplines and with CMA	Depres *et al.*, 2006
- Top-down and bottom-up methodology - Articulation of types of knowledge and voice	- evolving integrated methodology - recognition of content and context & the 'lens' model	Tress *et al.*, 2005

The TD literature informed the team in two phases, firstly Depres *et al.*, 2004, MaxNeef, 2006, underpinned by

Habemas, 1981, Renn, 1999 and Wilber, 2001; and then later Slocombe, 1998, Tress *et al.*, 2001, Naveh, 2005, Tress *et al.*, 2005, Cundill *et al.*, 2006, Hadorn *et al.*, 2006, Antrop & Rogge, 2006, Potschin & Haines-Young, 2006, and Wickson *et al.*, 2006. Each member of the team read the papers and selected meetings were devoted to discussions of the content, concepts and relationship to the Upper Nepean question. Engagement with the TD literature through critical discourse exposed the team to a unifying set of concepts as well as diverse application examples. Through this process the team identified common and divergent understandings and moved towards the level of integration described in Wickson, (2006) and as a result experienced an increasing capacity to read and engage more widely and with greater understanding. Core, repeatedly-used aspects of TD methodology included in this study are provided (Table 1).

Team development

The activities that drove team development were anchored in a commitment to regular meeting. During the period of the study (February – December 2006) the team met for 2 hours every two weeks. In addition to this, pairs, and small groups met in-between, and individuals worked alone. Meeting time was divided between critical discussions of the literature (TD and discipline-based), focus on the case-study question, and the development of a novel TD model. Minutes were circulated regularly and an on-line discussion board was used to facilitate access to data and literature. Team members alternated functions including facilitator and note taker. Core discipline-based literature included: Baker *et al.*, 2004, Hughes, 2004, Hillman & Brierley, 2002, Donahue, 2003, Loch, 2003, Corangamite Catchment Management Authority 2003. Inclusion of design researchers in the team throughout the project underpinned the depth of the resultant project images (Donahue, 2003, Loch, 2003).

Two aspects of the TD methodology were identified as necessary at the start of the project, but were not systematically implemented in the first phase: reflection in an ordered manner (Wickson, 2006) and evaluation in a formal framework (Guba & Lincoln, 1989). However the project evaluation shows the interactive meeting framework and planning for specific activities involved both reflection and evaluation.

Upper Nepean case study

Contact was made with the Hawkesbury-Nepean Catchment Management Agency (CMA). The CMA provided readings specific to the case-study (Sydney Catchment Authority, 2000, Hawkesbury-Nepean River Management Forum, 2004, Hawkesbury-Nepean Catchment Management Authority, 2005, Land and Water Australia, 2005, and Sydney Metropolitan Water Plan, 2006). After a period of engagement, a case-study plan was developed to collect data, information, and knowledge about Upper Nepean environmental flows (content) and about CMA decision-making (institutional context). This involved taking into account both top-down "expert-based" information and bottom-up "local" knowledge (Table 1), and a decision to use a facilitated workshop method to address the core question (King & Lowe, 1998)

Results

Contributions to the TD methodology

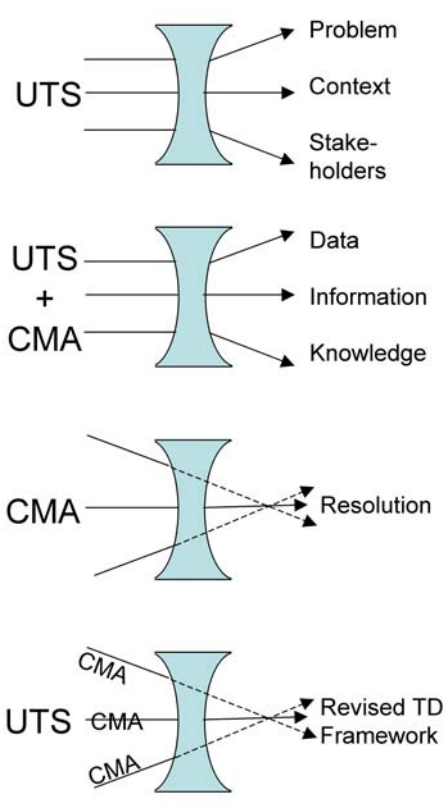
1. Directions for path-finding: through engagement in the project the team developed "rules of engagement", or a guide to an inter-linked suite of behaviours that facilitated rather than impeded understanding and engagement in the case study (Table 2). It was not enough just to know that these were relevant, it was the development of skills to recognise boundaries and follow often unspoken protocols, that was critical to achieving the aim of the engagement process: to reach a richer understanding and decisions with achievable outcomes.
2. A new TD model: through engagement in the case study question, the notion of the TD methodology facilitating new ways of seeing, and of enabling the development of new visions emerged. The metaphor of the "lens" or "prism" evolved, and a draft methodology was formulated (Figure 1). The workshop process revealed that the "lens" resided in the participant and that engagement of each person's whole suite of "ways of knowing" provided the resultant insights. In an iterative set of workshops each participant addresses the case-study question individually, with specialist knowledge, in their role within an associated institution, and as a stakeholder.
3. Team composition: inclusion of visual design discipline specialists was innovative and exerted a profound influence on knowledge interpretation and the project results. (Visual images paper in preparation)

Upper Nepean case study

Environmental flows in the Upper Nepean were recommended on the basis of hydrological surrogates where a proportion of base flow and of high flows is released from impoundments (Hawkesbury-Nepean River Management Forum, 2004). Although this is a more simplistic approach that those including hydraulics and ecologically motivated flow components (Hughes, 2004), it does provide for the natural flow variability on which stream ecosystems are dependent (King & Lowe, 1998, Palmer, 1998, Hughes, 2004).

Table 2. An inter-linked suite of behaviours that facilitated rather than impeded understanding and engagement in the case study

- Tolerate discomfort and unresolved tensions as they are often a gateway to a new level of knowledge, understanding, and trust.
- Be sensitive to "aha" moments (insights), they emerge out of irritation as often as from consonance.
- Engage with balanced generosity: enquiring, listening and sharing. Managing contribution and constraint is closely linked to listening.
- Practice tolerance and trust – exploring the nature of conflict before making judgements.
- Be sensitive to "arrivals" physical and meta-physical - ideas, opportunities and people "arrive"
- Create and use reflective opportunities
- Manage discontinuities (e.g. time intervals, purpose, discipline focus, team composition).
- Sustain enquiry – engage in the concrete question, sustain reading, discourse and attention.
- Remember everyone involved in the research is a "real person", with the potential to engage with the whole self and many ways of knowing.



1. Evaluation: UTS researchers use the TD lens to view the case study from each collaborating CMA. We generate a changed image in terms of the nature of the problem, the context, and the stakeholders

2. Diagnosis: UTS and collaborating CMAs together use the TD lens to identify what qualitatively different data, information, and knowledge is necessary for better resolution of the problem. Wilber's framework informs this, using the dimensions of individual to collective, and objective to subjective, to extend the types of data, information, and knowledge to include both formal and informal domains.

3. Resolution: Now, collaborating CMAs, with partnering from UTS, use the TD lens to translate the new data, information, and knowledge into different starting points that lead to revised actions and adoptions that in turn give focus to a new resolution of the problem.

4. Evaluation: UTS uses 4th generation evaluation (Guba and Lincoln, 1989) to reflect on the TD framework, the process of using it with CMAs, its strengths and weaknesses from all perspectives, and revises it for use with other problems and with other CMAs.

Figure 1. The metaphor of the "lens" or "prism" evolved as an innovative, iterative TD model (UTS – University of Technology Sydney TD team; stakeholders – institutions connected to the CMA through the case study).

After field work, mapping, and exploring a range of bio-physical data, information and knowledge, workshop participants recognised that the main *risks to maximising the environmental benefits expected from environmental flows* were: ***political*** (that the flows would not be released) and ***institutional*** (that investments allowed by the scope of CMA responsibilities were limited, so that unless partner-institutions worked in consonance the investment could be wasted). For example – an important investment that needs to be made to ensure maximum benefit for environmental flows is appropriate monitoring, so that the adaptive

management loop can be closed. However, the CMA may not invest in monitoring, and the responsibility for, and funding of monitoring, and subsequent data curation and distribution, is unclear and patchily implemented. Another example - clearly it is not worth investing in improving the estimation of environmental flows required for specific ecological outcomes until at least the institutional risks have been reduced. At the next stage of method development each of the identified risks will be ranked, evaluated and practical solutions identified.

Discussion

The Upper Nepean sub-catchment and the associated Catchment Management Authority (CMA) were selected as the TD case-study, and a specific key question emerged from iterative engagement with the CMA: W*hat are the risks to maximising the environmental benefits expected from environmental flows?* Through engagement with this question, outcomes have been described in terms of the key responses to complexity. 1) The team increased knowledge and understanding. 2) Obstacles to sound decision-making in an adaptive management context were identified with the CMA. 3) The TD quest for integration translated into problem solving that took account of risk, uncertainly and variability. Despite this, the feeling of the team and the CMA at the end of the first stage was disappointed hopefulness (much in the spirit of Tomas Mann as quoted in Wickson (2006): *"A great truth is a truth whose opposite is also true"*. We did not make the progress and produce the products we had aspired to – but we are set to use the results of this first stage to produce more directly useful products and to become methodologically confident.

From a theoretical perspective, Guba and Lincoln's (1989) evaluation criteria were met at least to some level and can be met at a deeper level in the next phase: prolonged engagement (one year); persistent observation (regular meetings with records and ongoing critical interaction); peer debriefing (informal conversations between and during meetings, and a formal process after each workshop); negative case analysis (regular identification of problems, 'what did not work and why); and progressive subjectivity (a commitment to going forward, noting shifting understandings); and member checks (regular engagement with and feedback from the CMA). This revealed an imperfect process – many contributions were overlooked and re-emerged, and we have still to return to find gems that went un-noticed and could be reclaimed at a stage of greater understanding. Greatest comfort came in meeting, to differing degrees, the criteria Wickson *et al.,* (2006*)* identify for quality TD research: responsive goals, broad preparation, an evolving methodology, significant outcomes, effective communication and communal reflection.

Conclusions

This paper in based on a 12-month pilot research study. During that time the team aimed to develop a TD approach that could contribute effectively to Catchment Management challenges. The TD method required practical grounding so the team engaged with the CMA, which responded with a pertinent question. However the CMA required an outcome the team was not ready to deliver in time, despite awareness of the importance of trust and delivery. This does not detract from the contribution to TD method development but does warn of the reality to time challenges inherent in the development phases of TD approaches. The major research contributions will follow in subsequent publications.

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