



## Designing environmental research for impact



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### HIGHLIGHTS

- This paper explores how environmental research can be more influential.
- Transdisciplinary research means researchers working with end users.
- Funders, researchers and end users have a shared stake in successful outcomes.
- Research is most likely to be influential when all three groups have shared goals.
- Mutual trust, continuity of personnel and adaptive capacity are key success factors.

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### ABSTRACT

Transdisciplinary research, involving close collaboration between researchers and the users of research, has been a feature of environmental problem solving for several decades, often spurred by the need to find negotiated outcomes to intractable problems. In 2005, the Australian government allocated funding to its environment portfolio for public good research, which resulted in consecutive four-year programmes (Commonwealth Environmental Research Facilities, National Environmental Research Program). In April 2014, representatives of the funders, researchers and research users associated with these programmes met to reflect on eight years of experience with these collaborative research models.

This structured reflection concluded that successful multi-institutional transdisciplinary research is necessarily a joint enterprise between funding agencies, researchers and the end users of research. The design and governance of research programmes need to explicitly recognise shared accountabilities among the participants, while respecting the different perspectives of each group. Experience shows that traditional incentive systems for academic researchers, current trends in public sector management, and loose organisation of many end users, work against sustained transdisciplinary research on intractable problems, which require continuity and adaptive learning by all three parties. The likelihood of research influencing and improving environmental policy and management is maximised when researchers, funders and research users have shared goals; there is sufficient continuity of personnel to build trust and sustain dialogue throughout the research process from issue scoping to application of findings; and there is sufficient flexibility in the funding, structure and operation of transdisciplinary research initiatives to enable the enterprise to assimilate and respond to new knowledge and situations.

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### 1. Introduction

Human society faces a number of 'grand challenges', several of which arise from the relationship between people and the environment. These include climate change adaptation and mitigation, food security,

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**Table 1**

A framework to guide co-reflection on progress in transdisciplinary research programmes that incorporates the accountabilities of funders, researchers and end users (after Roux et al., 2010).

Functional domain	Accountability indicators
Funders of research	Strategic planning and leadership Continuity and scientific competency Discourse between funders, providers and users to ensure effective programme goals and model Flexibility to adjust programme model and goals to meet research provider and user needs
Providers of research	Adaptive learning Professionalism Knowledge sharing Relevance to end-user needs Capacity building Research excellence
Users of research	Capacity for adoption Adaptive decision-making and policy revision Continuity of personnel Co-location of personnel Capacity to build upon emerging research

energy and water security, habitat loss and species extinctions, pollution, and the spread of weeds, pests and diseases.

These and other ‘wicked problems’ (Brown et al., 2010) are characterised by technical complexity and often uncertainty, large scales in space and time, a mix of social, economic and biophysical drivers, abundant but disparate and heterogeneous data, and contested issues among diverse stakeholders. The nature of such contest is itself important: it may be rooted in conflict over values and norms, and/or uncertainty in the data. Notwithstanding complexity, uncertainty, risk and conflict, on such issues there is nevertheless typically a need for governments, industries and communities to make a choice, reflected in decisions and actions. Such choices are often negotiated, often messy rather than clear-cut, and for most environmental issues the choice to do nothing (whether made actively or by default) also has environmental consequences.

A key response to such environmental challenges is to invest in applied research, which the Australian Bureau of Statistics (1998) defines as ‘work undertaken primarily to acquire new knowledge with a specific application in view’. The nature of these challenges is such that they can rarely be comprehended satisfactorily within a single scientific discipline, or indeed by science alone. There is a significant literature on the conceptual challenges associated with multi-, inter- and trans-disciplinary research (Fry, 2001; Klein, 2008; Gibbons et al., 2008; Bammer, 2013), and on the imperative for new ways of organising research – e.g. ‘Mode 2’ research and ‘Post-normal science’ (Funtowicz and Ravetz, 1993). Less has been published about the practice of working with end users to design and organise multi-institutional environmental research to tackle large scale, long-term environmental problems, based on analyses of current and past experience (Campbell and Schofield, 2007; Tress et al., 2005a, 2005b).

Australia has invested significantly over the last twenty years in organising applied research collaborations at national scale, including the Cooperative Research Centres programme (Allens, 2012), Rural Research and Development Corporations (Productivity Commission, 2011), and Centres of Excellence funded by the Australian Research Council and the National Climate Change Adaptation Research Facility (NCCARF, 2014).

This paper briefly reviews what we mean by transdisciplinary research, then discusses the findings of a participative, ‘structured reflection’ involving researchers, funders and end users of successive national environmental research initiatives in Australia, adapting an analytical framework developed by Roux et al. (2010).

## 2. Transdisciplinary research

Roux et al. (2010) propose a “framework for participative reflection on the accomplishment of transdisciplinary research programs”. They distinguish between post-normal science (Funtowicz and Ravetz, 1993; Francis and Goodman, 2010), sustainability science (Clark and Dickson, 2003; Burns and Weaver, 2008), and interdisciplinary studies (Newell, 2001; Repko, 2008), while noting ‘considerable overlaps of purpose’ between these approaches and the key point that all purport to complement, rather than replace traditional disciplinary research. Transdisciplinary studies incorporate elements of all these approaches in applying insights and tools from different disciplines, explicitly embracing complexity and uncertainty, acknowledging multi-stakeholder perceptions and values, in addressing problems that are ‘user inspired and context driven’ (Roux et al., 2010). A key feature of transdisciplinary research thus defined is the engagement of non-scientist stakeholders – in particular the end users of research – in the research enterprise (Roux et al., 2010):

*“A key characteristic of transdisciplinary research is that the domains of science, management, planning, policy and practice are interactively involved in issue framing, knowledge production and knowledge application.”*

Accordingly, Roux et al. (2010) suggest that there are three key groups of stakeholders in transdisciplinary research: researchers, end users of research, and funders of research. While all three groups may have shared broad goals to *acquire new knowledge with a specific application in view* they are likely to have different perspectives on those goals and how to achieve them, and to define success in different ways. Roux et al. (2010) propose a framework that sets out different accountabilities for the three ‘functional domains’ of funders, researchers and end users, as in Table 1 below.

More detail explaining each of these accountabilities is set out in Roux et al. (2010) who caution that these are not proposed as definitive or comprehensive, but to serve as a departure point from which this framework could be modified in the context of a specific research initiative.

## 3. Australia's national environmental research programmes

The Roux et al. (2010) framework was seen to be ideally suited for use as an analytical lens to distill lessons for the design and management of collaborative, multi-institutional applied environmental research from the experience of national environmental research programmes sponsored by the Australian government.

The key process in the application of the Roux et al. (2010) framework was a ‘structured reflection’ workshop such as the one involving the authors of this paper in April 2014. The workshop participants between them had well over one hundred person years of experience in leading and/or funding multi-institutional, transdisciplinary research programmes, with total investment exceeding \$500 m. The workshop was further informed by an on-line survey of 500 participants with experience in the programmes. Each respondent was asked to self-identify as a researcher, research funder or end-user/stakeholder. A response rate of around 9% was obtained, of whom 57% claimed to be researchers, 11% research funders, and 32% were end-users and/or stakeholders. Several respondents identified with more than one role.

The two research programmes analysed in depth at the workshop were the Commonwealth Environmental Research Facilities (CERF) programme, which was initiated by the Australian government environment ministry in 2006, and subsequently evolved into the National Environmental Research Program (NERP) from 2010. The \$160 m CERF programme was evaluated by Urbis (2010). The \$154 m NERP programme is described by DEWHA (2010) and was evaluated by Spencer et al. (2014). Both programmes were designed to meet the perceived

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