# 1.1 WORKING AT THE BOUNDARY: FACILITATING INTERDISCIPLINARITY IN CLIMATE CHANGE ADAPTATION RESEARCH

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**Summary**

Paradigms for climate change science, mitigation and adaptation research are in flux. Business-as-usual is no longer sufficient. In this article, we reflect on some tools and techniques that have proved effective in the integration of natural and social science approaches to support policy making.

**Introduction**

The study and analysis of the mechanisms of climate change and the responses of the natural system have provided considerable insight (e.g. Hegerl et al. 2006). Further, significant new ideas have been developed in studies of vulnerability and adaptation to climate change (Smit and Wandel 2006). However, this progress is not matched by advancement on practical policy initiatives. In fact, it has been demonstrated that adaptive capacity in any particular instance does not of necessity lead to a successful adaptation (e.g. O'Brien et al. 2006). The problem may simply be a resourcing issue. But we suggest there are additional roadblocks.

An important barrier to effective adaptation programs, particularly at the national level, is the assumption that climate change as a policy problem is, like the natural science problem, irreducibly global (e.g. Brunner and Klein 1999). The global framing of the problem is not supported by experience, which demonstrates that climate change adaptation and mitigation activities operate at a range of both spatial and societal scales, and across the private and public sphere (e.g. Adger et al. 2005).

A second barrier to adaptation is the perception that a call for action in response to climate change represents a "special interest". In contrast to this perception, much new analysis suggests that when climate change is considered in concert with existing decision processes and structures, that is, "mainstreaming" climate change adaptation (Huq et al. 2004; Burton and May 2004; Smit and Wandel 2006), practical implementation is more likely to ensue.

A third barrier to effective adaptation to climate change is the extent to which effective community participation and a functioning democratic process can be brought to bear on the issue. This has proved enormously effective on a range of environmental issues (e.g. Coe-Juell 2005) and such success is similarly evident in the responses to the impacts of climate change (e.g. Berkes and Jolly 2001; Burton et al. 2002; Paavola and Adger 2006). Generally, this mode of participatory research embodies a "bottom-up" approach that focuses on communities of place and attends particularly to issues of context (that is, the specific attributes, vulnerabilities, strategies and values of the community in question; e.g. Dessai et al. 2004; Lynch and Brunner 2006.)

The fourth barrier is a complete characterization of the impacts presented by climate change. It does remain that fundamental

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natural science understanding is lacking in several key areas. Of importance for many activities in Australia, for example, is the detailed understanding of the influence of the El Niño Southern Oscillation on the hydrological cycle of Australia. Such understanding may also be lacking in areas of which we are currently less aware (the "unknown unknowns").

Because many areas of import to climate change impacts require differently targeted research, scientists seeking to have an impact on climate change adaptation, mitigation, and policy development frequently find themselves working with non-scientists in various capacities - as stake-holders, decision-makers, and funders. Many theoretical tools of the social sciences can contribute to making these interactions and collaborations more effective for all parties. In this paper, we review some methods that we have adopted and adapted from the literature of the policy sciences and the sociology of science in the course of our climate change impacts and adaptation research. These can be included in a toolkit of approaches, and include an understanding of the place of frameworks in our methodology, guidelines for knowledge integration, and some key ideas that help to guide our choices. These key ideas are *context*, *perspective*, and *boundary object*. The importance of context to concrete policy and decision making cannot be overestimated - both the context of the biophysical system in question, and the context of the people interacting in the research program. The study of perspectives allows participants to determine the extent to which their understanding of the biophysical system is congruent. Finally, a boundary object provides a common point of reference, a touchstone that can actively promote communication between participants through its ability to create compatible conceptual frames.

**Frameworks for Integrated Assessment**

As an organizing principle many integrated assessment activities employ a structured process, called a framework, which embodies both an *approach* and a *procedure*. As described by Nakamura (1987), any such framework can be described as a set of categories which in the research context "permits and rationalizes a division of scholarly labor".

Lim et al. (2005) describe four basic approaches that may be embodied by any framework; these are:

- a hazards, natural hazards or risk approach;
- a vulnerability approach;
- an adaptive capacity or resilience approach; and
- a policy approach.

Once an approach is chosen, a procedure can be defined which is intended to develop specific adaptation strategies, policies and/or recommendations. There is indeed a broad range of such procedures in the literature, a common recent feature of which is their iterative nature. Two examples will be provided, and it should be noted that these are presented only in summary form, with many (sometime important) details omitted. We seek here only to provide examples, and not to critique or advocate particular procedures. One such procedure is presented by Jones (2001) in an adaptation of the work of Carter et al. (1994) as follows:

1. Identify key climate variables affecting the values ("exposure units") at stake.
2. Create scenarios and/or projected ranges for key climatic variables.
3. Conduct a sensitivity analysis of relationship between projections and impacts.
4. Identify impact thresholds in collaboration with stakeholders.
5. Conduct a risk analysis.
6. Identify feedbacks likely to result in autonomous adaptations.
7. Recommend planned adaptations in consultation with stakeholders.

This procedure explicitly embodies a risk or natural hazards approach. As with many such procedures, the tasks are neither prescriptive nor unique to this particular framework.

A second example is drawn from the conceptual and theoretical tools of the broader policy sciences, and is a classic procedure that was characterized as the intellectual tasks required in the analysis of any policy problem (Lasswell 1971). In this case, we have recast the process somewhat to be specific to the climate change adaptation problem:

1. Clarify the specific goals of the participants in the policy process.
2. Identify the history of trends and changes in policies and decisions, in the natural and built environment, and in the climate, and determine discrepancies between these trends and the stated goals.
3. Conduct an analysis of the factors and mechanisms that have resulted in the observed trends.
4. Project the likely future of goal realization (or otherwise) if past trends continue unchanged.
5. Develop, evaluate and select recommendations for planned adaptations that are most likely to achieve the stated goals.

This procedure embodies an approach which focuses on the goals of the participants, or stakeholders, rather than their risks, vulnerabilities, or resilience. However, the procedure does admit study of all of these factors, and hence represents a rather flexible and powerful tool.

Frameworks are by their nature appropriate for some problems and not others, and yet the diversity of frameworks in use implies an important corollary, which is that the use of a particular framework (that is, approach and procedure) has an impact upon the questions asked, the information generated and the uptake of that information by stakeholders (Næss et al. 2006). This presents the practicing climate scientist with a dilemma. As articulated particularly well by Linder and Peters (2006),

> "Some articles begin, for example, by distinguishing their own new or improved model from a succession of putatively inferior competitors, while others emphasize affinities across a range of models and approaches, including their own. Again, what seems on the surface only a difference in rhetorical styles betrays a more subtle difference in expectations about how other contending models and approaches should relate to one's own…. Whether one finds [one of these two competing images] more compelling would seem to matter far less than *the ability to sort quickly through the relevant models, pick one, and offer a plausible rationale for the choice*" (emphasis ours, p. 20).

Lack of widespread agreement on best practice obstructs progress in the effective formulation of climate change adaptation policies (van Kerkhoff 2005). We hope to offer some practical techniques that can be used to organize work in collaboration with stakeholders and other participants that can be applied in frameworks like the examples provided here. As researchers working in this field, we certainly have our own frameworks of choice, but perhaps more usefully we can provide ideas that are useful in a range of frameworks, along with postulates that might be helpful in choosing a framework for a particular application. In this sense, we view disputes over framework choice as diversionary rather than central to the problems we face in climate change adaptation.

**Integration through Interaction**

There is an extensive literature on the processes and practices of participatory research, or research that requires interaction or even collaboration between natural scientists and various types of stakeholders. Such approaches are particularly prevalent in studies which seek to have natural science understanding make an impact upon practical decision-making – in the fields of natural resource management, agriculture, and conservation, among others. There are good reasons to expect that better decisions can arise from the integration of what may be termed "expert" and "experiential" knowledge (Fazey et al. 2006). However, there are

profound difficulties in "combining expressed human preferences, with all the attendant cultural, emotional, institutional and intellectual frameworks, with the natural science of changes in atmospheric behavior and their direct impacts" (Dessai et al. 2004; p19). The barriers are both practical and theoretical in nature (Tress et al. 2005). Processes to achieve this integration in climate change adaptation studies remain open to question. One such process, often termed "locked door" integration, is probably the most typical of climate applications. The basic premise of this approach is that if one places stakeholders and experts in a room and leaves them there long enough, with a variety of structured or unstructured tools, integration will emerge. Tools include focus groups, citizen's juries, decision seminars and representative surveys. This approach is very often effective (Dessai et al. 2004), although it is time consuming. In some projects, the participative research process itself may also contribute to actual adaptive capacity and change within policy and planning institutions, particularly at the local scale. A typical problem encountered, though, is that the goals are too broad or ill defined. The toolkit we outline in the next section provides some means to ensure focus is maintained.

**Three key concepts**

In any theoretical framework, our experience suggests that *goal realization* (the overriding or primary focus) can be enhanced by keeping three important concepts at the center of the enquiry – context, perspective, and boundary object.

It has been recognized in recent years that sound policies for adaptation to climate change and variability should be adapted to the **context** at hand (Lynch and Brunner 2006). From a practical standpoint, decision-makers are often disinclined to make judgments in the absence of a specific context (Fazey el al. 2006). From a theoretical standpoint, de-contextualized, positivist, or generalist approaches encounter problems of relevance and selectivity, and create the impression of an impossibly large problem.

Hence, the concept of context becomes useful in limiting the size of the problem and the interactions which must be attended. As described by Brunner (2006), "*the significance of any detail depends upon its linkages to the context of which it is a part*" (his emphasis, p. 145.) This can be a difficult concept for a natural scientist (sometimes a temperature is just a temperature) but in fact context is a crucial tool in designing a research program that is feasible and focused. Attending to context further establishes that the policy alternatives explored are appropriate for the intended applications.

The second useful concept is that of **perspective**. The perspective is not about what is included or excluded in the attention frame, but rather about the existence of multiple viewpoints on the same context. The perspective comprises all elements that influence either the interactions between participants or the attribution of meaning by participants as the integrated assessment process unfolds. Relevant elements that can be considered typically include the degree and manner of involvement, fundamental values, preferred strategies, and both special and common interest goals. The mapping of the perspectives of participants promotes an appreciation of the differing desired outcomes of the participants and how these may influence the process.

The third key concept is that of a **boundary object**, originally introduced by Star and Griesemer (1989) building (in a perhaps unexpected direction) on the ideas of Gieryn (1985):

> "This is an analytic concept of those scientific objects which both inhabit several intersecting social worlds… *and* satisfy the informational requirements of each of them. Boundary objects are objects which are both plastic enough to adapt to local needs and the constraints of the several parties

> employing them, yet robust enough to maintain a common identity across sites…. These objects may be abstract or concrete." (Star and Griesemer 1989, p. 393).

Key to the usefulness of the boundary object is that it commands sufficient interest to provide a common point of reference and thence a shared understanding. In our work, we further require that the boundary object is profoundly linked to the goals of the participants. Specifically, we have found that extreme or iconic events that are related in a concrete way to the vulnerabilities of greatest concern serve as an important common focus for scientists and community members even as they embody different meanings. Further, the use of an **iconic extreme** as a boundary object allows the process to engage with the new understanding that extremes often stimulate the political will to invest in climate change adaptation (e.g. Poumadere et al. 2005).

**Concluding Remarks**

We suggest that the complexity of the challenge facing us in developing methods and means to adapt to climate change necessitates a diversity of approaches. This diversity is healthy, and yet it is possible based on recent experience to define some key characteristics and tools that can promote practical outcomes. These include a mapping of contextual circumstances, an appreciation for multiple perspectives, and the importance of an iconic event in forging strong interactions among project participants. Further, any integrated assessment process can benefit from an approach that is intensive, comprehensive and continuous.

Paradigms for the conduct of research into the effects of and responses to inevitable climate change are a subject of considerable interest and debate. However, these paradigms represent more than an effort to turn disciplinarity into functioning multidisciplinarity. The serious challenge that faces us represents an imperative to change our viewpoint in a fundamental way. As noted by Tress et al. (2005) "Rethinking an accustomed disciplinary viewpoint can challenge a researcher's academic identity" (p. 186). As such, it is not to be undertaken without some forethought.

In employing such a paradigm, integrated assessments are more grounded in narrative and reflection, and infused with a "keen sense of humility" (Sanderson 2000: p447.) Understanding of the system must extend to an analysis of how relationships and mechanisms change over time and with place, and how policy problems impact upon one another. This is particularly important as climate change is mainstreamed into the broader policy process. Disturbingly for the natural scientist, the testing of these approaches "will involve a much more eclectic process in relation to both sources and types of evidence, and the forms of judgment employed about the meaning and implications of such evidence" (Sanderson 2000: p447.) Sometimes a temperature is not just a temperature.

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