

## Symposium Outcomes— Guiding Principles

Core to the agenda for natural resource management (NRM) is the imperative for integration of environmental, social and economic considerations in research, policy and management, and for integration of stakeholder interests. Nevertheless, the meaning of integration is often unclear and existing initiatives are scattered and uncoordinated (Dovers, 2002).

Land and Water Australia has a unique position in NRM, “with its potential to define problems, straddle organisational and sectoral boundaries, influence R&D beyond its own specific portfolio, and to drive the leveraging, coordination and communication of lessons and capacity from scattered experiments in integration” (Dovers, 2002).

Accordingly, in May 2004 Land and Water Australia hosted an Integration Symposium in Canberra attended by 50 critical thinkers from the academic, policy and natural resource management delivery sectors across Australia. As this volume testifies, the Symposium admirably achieved its aims of fostering the exchange of research, ideas and experiences to enhance mutual learning and improve capacity in integrating the important elements and dimensions of NRM.

The foundation for the symposium was the 24 pre-circulated papers prepared by invited participants and the keynote address by Gary Jones. The papers were organised into four key integration themes — *Theories and methods*; *Diverse interests and knowledge bases*; *Policy development and regional implementation*; and *Organising for integrated research in natural resource management*. The symposium involved synthesis and discussion of papers in each theme, followed by small group discussion about the implications of the papers for six key topic areas: policy, evaluation, management, communication and adoption, organisational groups, and emergent research themes. Geoff Syme, Ruth Lane, Allan Curtis and Ronnie Harding undertook the task of synthesising the papers in the four themes, with Catherine Mobbs providing an oversight of Day 1 and Gabriele Bammer developing the set of guiding principles, included below, as an overall workshop synthesis.

Two weeks after the Symposium the Australian Academy of Science Fenner Conference on the Environment addressed the issue “Understanding the population–environment debate: Bridging disciplinary divides” (<http://www.science.org.au/proceedings/fenner/index.htm>). Julie Thompson Klein was the plenary speaker and described a set of guiding questions for integration in research, which are a superb complement to our guiding principles and which are also included below.



## GUIDING PRINCIPLES FOR INTEGRATION IN NATURAL RESOURCE MANAGEMENT (NRM) AS A CONTRIBUTION TO SUSTAINABILITY

### 1 The value of integration in NRM

Integration in NRM aims to improve both understanding of complex systems and the ability to enact effective policy and practice. Numerous cases show that integration is effective in achieving those aims and there is considerable optimism about the future of integration in enhancing NRM.

A particular strength is that integration is adaptable to specific NRM contexts. It can have diverse objectives and be undertaken in numerous ways. Common themes, methods and learnings are emerging from this multiplicity, illustrating that continuing support for the development of integrative theory, methods and practice is warranted and required.

### 2 Ways of thinking about integration in NRM

Integration is a means to an end, not an end in itself and it is defined by the NRM problem or outcome of interest.

Three key ways of thinking about integration are:

- re-aggregation of fragments that have been intensively studied by reductionist methods
- beginning with and studying whole systems contexts, using a plurality of approaches. In the case of NRM, landscape context including people, place and resource base, is central
- as an approach or practice inherent or developed in individuals and organisations.

These three forms of integration are not interchangeable. All are necessary and require considerable intellectual and practical development, as well as supportive institutional structures.

### 3 Approaches to integration in NRM

Disciplines, policy and practice are homes of valuable knowledge. One key challenge of integration is harnessing and adapting, rather than re-inventing, that knowledge. Approaches drawn from multi-, inter-, and trans- disciplinary and multi-, inter-, and trans-sectoral activities are essential for integration.

Integrative practice and research would benefit from systematic reporting on and evaluation of six dimensions of integration. This will provide a basis for comparison across different approaches and contexts, as well as for 'quality-control' and accountability. The six core dimensions of integration are:

- integration **for what and for whom**, in other words what is the integration aiming to achieve

- integration **of what**, in other words what is being integrated and which actors are involved
- the **context** in which the integration is occurring, ranging from political and other drivers for action to the scale at which integration is planned
- integration **by whom**, in other words what is the integrative decision-making process
- **how** is the integration being undertaken, including the theoretical underpinning, the starting point, the methods used, transparency and accountability
- the **impact** of the integration, in other words did it achieve its aims and were there other positive and negative outcomes.

#### 4 Realistic expectations of integration in NRM

Expectations of integration must be realistic. Not all NRM problems require or are amenable to an integrative approach. In addition, integration does not produce ‘perfect’ solutions to complex problems. Integration is a process that allows more factors to be considered, trade-offs to be more transparent and compromises to be more explicit.

Innovation benefits from pluralism, competition and conflict. Smothering these is not an aim of integration. Instead integration aims to maximize the benefits and minimize the costs of these forces. Integration practice and research requires negotiation of numerous paradoxes and complexities. These include the requirement to act under time pressure and with incomplete information, the ability to deal effectively with political exigencies, skill to sensitively handle power and cultural differences, the ability to develop on-going relationships in environments of rapid staff turnover, capacity to compensate for loss of corporate memory, as well as to effectively distill masses of complex information, the ability to integrate at small and large scales, and balancing logical analysis and discursive interpretation.

#### 5 New institutions and networks for enhancing integration in NRM

Integration relies on individual relationships and can be greatly enhanced when these are supported by structural relationships. Effective links between strategic policy, strategic planning and regional implementation can substantially boost integration between different levels of government and on-the-ground action. These need to inform and be informed by the best quality evidence. High levels of competence are necessary to achieve the best possible outcomes. Issues of leadership and culture are critical to successful integration.

Distributed networks with institutional research, policy and practice nodes would be an asset to the practice of integration and can provide opportunities for those with an interest in integration to learn from each other. Such networks would benefit from:

- being open to the full range of academic disciplines as well as practice-based experience and local knowledge
- an awareness of historical developments in NRM and in integration
- developing the ability to research in more depth skills involved in integration and in working with adaptive learning frameworks

- supporting and encouraging partnerships that bring together Indigenous and non-Indigenous knowledge systems in relevant Australian NRM contexts
- encouraging the development and application of appropriate techniques for evaluating integration processes and outcomes, as well as openness to discussing and learning from mistakes
- the building of intellectual capital in NRM integration in network nodes.

The continued flourishing of the practice and study of integration requires passion and the development of a critical mass of policy makers, practitioners and researchers committed to improving the quality of integration. Such a critical mass is also essential for appropriate recognition and rewards for integration.

Integration in NRM is firmly grounded in practice, which is intense and demanding. Policy makers, practitioners and researchers recognise the value of deep reflection that can stimulate further innovation in theory, method and practice and the importance of institutionalised opportunities for such reflection. In addition, short-term secondments to other sectors provide opportunities to acquire skills helpful in integrating across sectors. Further, building the capacity to practice and study integration by both existing and up-coming young practitioners, policy makers and researchers requires enhancing existing teaching programs and the development of new ones.

There is also a role for skilled people to act as facilitators or “knitters” in integration. Their skills include empathy; being adaptive, with the ability to fill a number of roles and to know which is appropriate and when; and the ability to listen, to disintegrate and then re-integrate different perspectives, and to analyse and synthesise.

## 6 Funding to enhance integration in NRM

Integration has a number of transaction costs (particularly upfront) but if well managed can lead to better results overall. For example, trust and other aspects of relationships are enhanced by face-to-face meetings and often require longer timeframes. In addition, a common language is required to facilitate communication, and integrators need opportunities to escape isolation and meet with each other. Funding for transaction costs is essential for integrative research, policy and practice. Transaction costs can be minimized through experience, attention to targeting the right questions through effective scoping, and developing efficient processes. The relationship between investment in integration and return on investment requires monitoring to ensure that the field is progressing.

There are three particular challenges for funders:

- the adaptive learning foundation of much integration means that requirements can change as the project progresses. An ability to be flexible in providing top-up funding and in adjusting outcomes is extremely helpful.
- the interstices between policy, practice and research are often hard to find funding for and there is a vicious cycle between underdevelopment in these areas and lack of funding. Adoption of research findings in policy and practice is an area that requires particular development.

- critique is essential for the improvement of quality and the development of theory, method and practice. The close interrelationships fundamental to integration can make critique risky both to undertake and to fund.

## GUIDING QUESTIONS FOR INTEGRATION IN RESEARCH

(reproduced, with slight modifications and with permission, from Klein, 2003)

The following checklist, culled from the wisdom of practice, provides categories of questions that may serve as touchstones for discussion and assessment at all points of a project's lifecycle.

### Category A: Initial phase

The initial phase is crucial. Individuals with different disciplinary languages and worldviews need to arrive at a common conception of their work. Commonality does not mean uniformity, rather a shared understanding of the task at hand. Without it, results will be either multidisciplinary or a collection of disciplinary inputs at best. The key action is collaborative definition of the research problem and research questions, the project's goals and objectives, a spectrum of work that is neither too narrow nor too broad for the task at hand, and relevant approaches, tools, and partners.

1. Has the research problem or project been defined collaboratively?
2. Have goals, objectives, and research questions been determined collaboratively?
3. Have relevant variables and categories been identified? (e.g., disciplinary, professional, interdisciplinary, cultural)
4. Has the spectrum of relevant disciplines, professions, and interdisciplinary fields been identified and their relationship been clarified?
5. Is the spectrum of too narrow or broad for the task at hand?
6. Have relevant approaches been identified? (e.g. concepts, theories, methods, tools)
7. Have partners and the audience for research been identified in pertinent research communities and public and private organisations? Will their role be a collaborative or contracting mode?

### Category B: Organisational and conceptual framework

Every interdisciplinary project constitutes a hybrid community based on a mutual design that is both comprehensive and feasible. State-of-the art knowledge is required from not only pertinent disciplines but also pertinent professions and interdisciplinary fields. Interdisciplinary work is neither linear nor predictable. It is complex, with feedback loops to different stages of the work. Hence, flexibility is important, allowing for refining the framework as needed and any shifting groupings of individuals and approaches.

8. Is the program or project design a mutual plan?
9. Has the problem been defined with regard for what is significant, on the one hand, and possible, on the other hand? Is the scope comprehensive enough to address major aspects but still feasible given the material and human resources?
10. Are selected approaches appropriate to the problem, and do they reflect state-of-the-art knowledge in participating disciplines, professions, and interdisciplinary fields?
11. Is there flexibility to allow for shifting groupings of individuals and approaches?

### Category C: Social learning and communication

Mutual learning is crucial. Because participants do not bring the same expertise, they must clarify their differences and their roles. Conflict is inevitable and must be used creatively, rather than ignored. Language is crucial. Projects generate a common lingua franca that is typically a hybrid of specialized terms and everyday vocabulary. Provision for ongoing communication is essential, in order to capture the knowledge production that is occurring and to support consultation with other groups.

12. Have participants engaged in role clarification and negotiation, to define what they need from each other and can contribute?
13. Have participants clarified differences in their disciplinary assumptions, language, methods, tools, concepts, theories, epistemologies, and ideologies?
14. Has provision been made for time to learn from other team members?
15. Is there a plan for regular in/formal communication and exchange of data? (e.g., electronic communication through email and listservs, face-to-face meetings, interactive video conferencing, collaborative research and fieldwork)
16. When conflicts arise, are they ignored or used creatively to refine and advance work?
17. Has the group or team created a “pidgin” (interim language of communication, “local colloquial,” or “trade” tongue)? Does a “creole” evolve (a new subculture or native language)?
18. Is there communication with other teams in the same project, program, or local/region/national initiative, in order to share ideas, techniques, and results?
19. Is the knowledge that is produced captured? (e.g. conceptual papers and reports; instrumental products such as graphs, data matrices; ephemeral products such as representations, whiteboard diagrams, flip charts, transcripts, notes; results of tools used for managing data and decision making such as computers, shared text editors and drawing media, audio and/or video recording devices; email and postal exchanges).

### Category D: Collaboration and integration

The heart of interdisciplinary process is integration, and in teamwork, collaboration. Young teams, Anthony Stone suggested, lean toward the model of secondary-group relations that is protective of the individual. Older teams move toward primary-group

relations that reflect dedication to a common task and shared cognitive framework, shifting from the consciousness of “I” to “we.” Integration should not be delayed but be ongoing throughout all phases of a project, with sustained interaction, coordination, and reflection. Synthesis unfolds in patterning and testing the mutual relatedness of materials, ideas, and methods to the task at hand. Ultimately, both individuals and the conceptualisation of a project change as a result.

20. Do the structure and work plan facilitate interaction?
21. Has attention been paid to how tasks will be coordinated in the timetable? Will participants work jointly or in separate, serial fashion?
22. Will integration be on-going, not delayed to a final phase?
23. Does the team engage in joint activities (e.g. co-authorship of working papers and publications; presentations, workshops, and seminars; interim and final reports to funders and other groups; joint patent or legislative work, practical applications)
24. Does the team work with common instruments? (e.g. data-reporting forms, data gathering and analysis, procedures, equipment, facilities)
25. Is iteration used to achieve common assessments and products? (e.g. peer reading, editing, critiquing of each other’s work components; reviewing initial assumptions on a recurring basis and returning to earlier stages to appraise individual contributions and collective resolution of differences; revisiting of provisional conclusions)
26. Are known interdisciplinary techniques utilised? (e.g., Delphi method, scenario analysis, general systems theory, brainstorming; models of interdisciplinary process)
27. Has the synergy of “teamness” evolved, moving from the secondary-group relations of the self-protective “I” to the primary-group relations of the common “we”? Have collegiality and trust been established, defined by honesty, openness, consistency, and respect?
28. Is the disciplinary/professional balance of power equal, or are some disciplines or individuals subordinated to a reductive role (data supplier or “findings,” an additive but not an integrative partner, or explanatory background or context)?
29. Is the outcome an interdependent, collaborative synthesis or multidisciplinary compilation of separate inputs on different phenomena, or only data sharing?
30. Is there a unifying principle, theory, or set of questions that provides coherence and/or unity? Are salient concepts and global questions used to foster integration?
31. Is there collective reflection on the interdisciplinary and collaborative nature of the work, including the kind of interdisciplinarity that is being practiced?
32. Are depth, breadth, and synthesis triangulated in an organic process?
33. Have participants changed as a result of the process, beginning to think in a new way?
34. Did the conception of the project shift over time?

## Category E: Evaluation, innovation, and dissemination

Evaluation is the most neglected aspect of interdisciplinary projects. Like integration, it should not be delayed but must be continuous. The task of evaluation is compounded by the presence of multiple disciplines. Each carries specific and sometimes conflicting assumptions about quality. The presence of non-academic stakeholders introduces added variables. Multiple methods and perspectives are also required, both quantitative and qualitative. Ongoing evaluation provides for feedback loops that improve the research process and, the conceptual framework. Dissemination of results and implementation of new models of research and education are crucial to the long-term sustainability of project goals and outcomes.

35. Has provision been made for evaluating interdisciplinary, collaborative aspects of the work?
36. Were criteria defined collaboratively? Is evaluation ongoing, not delayed to the final phase?
37. Does the project lead to development of new knowledge, research topics, models and processes, curriculum, and action plans?
38. Are gaps between academic, non-academic, and public discourses bridged?
39. Are integrative partnerships forged with stakeholders outside the university?
40. Will results be articulated in public spheres through all possible means?
41. Will pilot projects and bridging mechanisms have long-term impact?
42. Will results be articulated to pertinent disciplines, professions, and interdisciplinary fields?
43. Will results of research be shared with the public and pertinent community groups?

## REFERENCES

- Dovers, S. "The integration imperative in NRM: issues and options for Land and Water Australia" Scoping paper prepared for Land and Water Australia, November 2002; Included in this volume.
- Klein, J.T. "Thinking about Interdisciplinarity: A Primer for Practice." Colorado School of Mines Quarterly, 103, No 1 (2003): 101–114.