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Reflecting on stakeholders' perceptions in an Ecological Risk Assessment workshop: Lessons for practitioners

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Abstract A new form of Ecological Risk Assessment aims to improve environmental decision-making through strong stakeholder engagement, often in workshop situations. This wider focus increases interaction between workshop practitioners and stakeholders for reflecting on, and learning from, each others perceptions. In this article, we analyse and discuss a one day workshop that was concerned with trialling this method of deriving an Ecological Risk Assessment. We found that stakeholders had issues with some elements of the workshop process. The decision problem was formulated prior to the workshop and without consultation among all the stakeholders. Consequently, the original decision problem was rejected for a mutually derived broader focus and this resulted in a loss of clarity and purpose. Stakeholders did not wholly concur with the prioritising of ecological values over social and economic values and some stakeholders objected to defining assessment endpoints, because it implies a reductionist approach that doesn't capture significance and understanding of systems. Ecological Risk Assessment workshops are complex and require significant practitioner and stakeholder development to provide useful and mutually derived outcomes.

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1 Introduction

Ecological Risk Assessment (ERA) is a process designed to support decision-making by providing a basis for comparing and ranking ecological risks, so that managers can attend to the most significant risks. It provides a framework for trading off management alternatives so that risks to ecological values are minimised. ERA is finding wider application in catchment contexts, where focus is on assessing and managing risks that link multiple hazards with multiple ecological values (Hart et al., 2005).

ERA has four stages in which key stakeholders are involved: planning the ERA; formulating the problem; analysing the risks; and characterising the risks. Outputs from this process inform a decision making process, which involves the development of a risk management plan and monitoring the implementation of the plan to facilitate evaluation. For catchment management issues, the risk assessment and risk management processes should engage stakeholders who share the burden of the risks.

The problem formulation stage of ERA is commonly undertaken with stakeholders in a workshop situation. One of the initial steps is the identification of ecological values, which are the basis for the following steps in the process. This stage can lead to passionate discussion and is important for developing widely shared objectives for the decision problem. In ERA, these objectives are called assessment endpoints.

The first, second and third authors of this article have participated in a number of ERA problem formulation workshops and it is apparent that stakeholders find difficulty with, or objection to, parts of the process. Therefore the aim of this research is to reflect on these issues, so that practitioners can learn from them. For the purpose of this article, we define practitioners as those who have a role in planning, preparing, facilitating and/or conducting ERA workshops.

This research focuses on an ERA conducted for the wetlands of the Lower Burdekin. Section 2 of the article outlines the management, hydrology and values of these wetlands and introduces the ERA workshop. Section 3 details how results were gathered, Section 4 presents observations of the process, and Section 5 discusses these observations in the context of the literature and provides recommendations for practitioners.

2 Case study

2.1 Wetlands of the Lower Burdekin—management, hydrology and values

The wetlands of the Lower Burdekin are situated between a vast area of irrigated agriculture and the Great Barrier Reef in Northern Queensland, Australia (Fig. 1). There is a close link between irrigated agriculture and many of the wetlands. Dry season river flows in the Burdekin River are released from the Burdekin Falls Dam and are pumped into wetlands, such as Sheep Station Creek, to deliver water for irrigation. Prior to the construction of the dam, water in the river was only turbid during

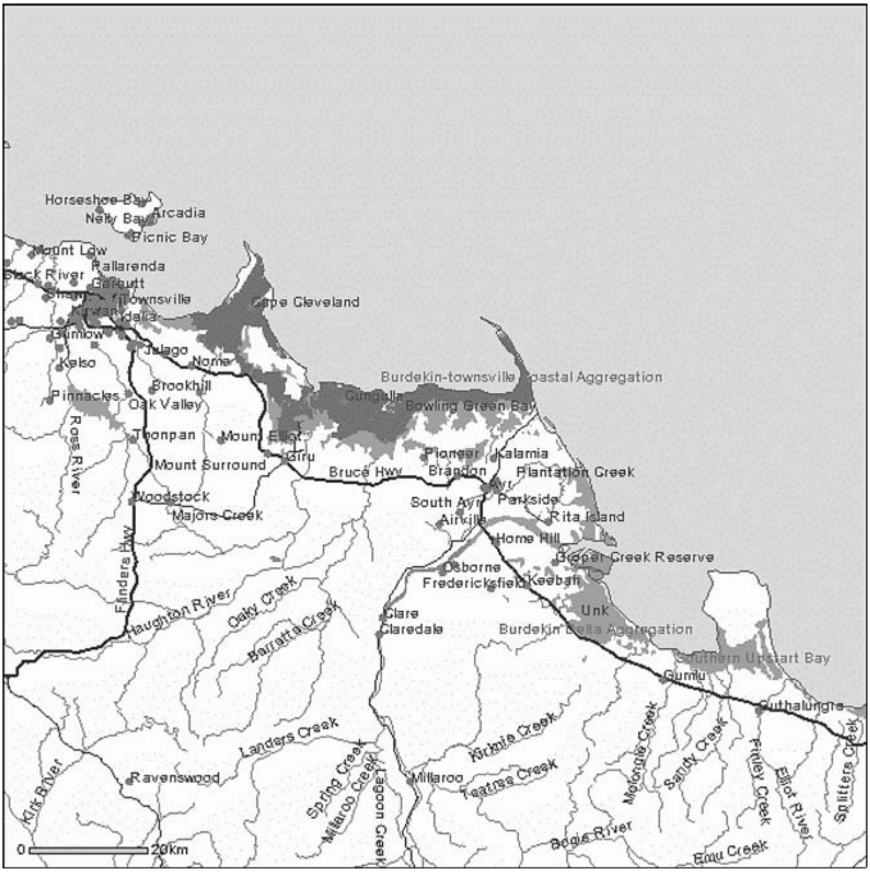

Fig. 1 Map of the Lower Burdekin, Northern Queensland, Australia, showing major streams, RAMSAR wetlands and other important wetlands. (Source: Department of Environment and Heritage Protected Matters Search Tool: http://www.deh.gov.au/erin/ert/epbc/index.html, Data sets: RAMSAR Wetlands; Important Wetlands; Rives and Lakes; Towns, Date accessed: April 2005)

periods of high flow, but dam and river water now typically remain turbid throughout the year. This means that wetlands used for water delivery, such as Sheep Station Creek, maintain elevated flows with higher sediment and nutrient loads (Perna and Burrows, 2005). Some wetlands of the Lower Burdekin receive irrigation tail water, and therefore also maintain elevated flows. Loads of nutrients, pesticides and sediment received by these wetlands have increased since the development of irrigation. The Barratta creeks, The Haughton River, and Horseshoe Lagoon all receive irrigation tail water. For five or six months of each year the Haughton River flows into Bowling Green Bay. During more extreme flows, water breaches the banks of the Haughton and Burdekin Rivers and passes into the RAMSAR-listed saltpans and swamps of Bowling Green Bay National Park. During these events, large sediment plumes can be observed extending kilometres offshore. In the Burdekin Delta, water is pumped from the Burdekin River into recharge pits to maintain a high water table so that groundwater can be drawn for irrigation. This high water table also prevents sea water from intruding inland. Sand dams in the Burdekin River are used to maintain practical operating levels at river pump stations. Salt water barrages allow irrigation and grazing closer to the coast by maximising the reach of freshwater into what were once intertidal zones.

Some community members express the view that the wetlands of the Lower Burdekin protect the reef lagoon from sediments, nutrients and other land derived contaminants. The wetlands are also valued by community as habitat for plant and animal life, providing opportunities for fishing, hunting and other forms of recreation. Further, the significance of the Bowling Green Bay wetland aggregation as habitat for plant and animal life has gained international recognition through RAMSAR listing.

2.2 The Ecological Risk Assessment workshop

The Ecological Risk Assessment workshop was held in Townsville, North Queensland, in 2005. This was one of a series of workshops for scoping the potential application of Ecological Risk Management to the Australian irrigation industry. It also constitutes research to progress the development of the Northern Australia Irrigation Futures Sustainability Framework, which aims to improve robust debate and transparent decision making regarding irrigation in Northern Australia. From a catchment management perspective, the workshop was conducted to develop knowledge on the interaction between irrigated agriculture and wetlands in the Lower Burdekin. Clearly, the workshop was complicated by more than one agenda on the part of the practitioners.

Prior to the workshop, a flyer and background document were developed and emailed to a broad range of stakeholders. The workshop attracted good representation from the local irrigation industry, as well as representation from a series of state and regional natural resource management agencies and bodies. Indigenous people and members of conservation and community groups were invited, but did not attend. The workshop agenda included four main stages: problem formulation involving value elicitation; risk analysis involving the identification of assessment endpoints and hazards, and quantification of risks that link them; an overview of conceptual models for risk analysis; and an overview of decision-making and uncertainty.

At the time of the workshop, there were feelings of uncertainty and anxiousness within the Lower Burdekin community over two issues associated with the regional water planning process. First, there were polarised views over the adequacy of a surface water plan that was pending release, and second, there was concern among irrigators over increasing rural water prices.

3 Methods

The study reflects on stakeholders' perceptions in an ERA workshop and identifies issues for practitioners to consider. The first and second authors facilitated and evaluated the workshop. As facilitators, the authors assisted stakeholders develop assessment endpoints from ecological values and analyse ecological risks. As evaluators, the authors observed and took notes on interactions and dialogue.

Qualitative evaluation methods were used in our analysis (Patton, 2002) to understand the dynamics of the ERA process, particularly from the viewpoint of the stakeholders during problem formulation in the workshop. The focus on process supports the idea that what is done is no more important than how it is done. The process itself is an end, and not just means to some more concrete end, such as a reported ecological value. Therefore, we focus on stakeholders' perceptions and experiences as observed in the workshop.

4 Results

The problem formulation stage of the workshop extended well beyond the allotted time, because some stakeholders' had strong concerns about the decision problem and as a result, there was lengthy discussion on stakeholders' broader social, environmental and economic values.

Decision trees were developed by practitioners and introduced at the workshop to facilitate problem formulation. The decision trees focussed on irrigation tail water as a hazard to wetland ecosystems and its links with two ecological values: habitat for plants and animals; and a buffer that protects the Great Barrier Reef from sediment, nutrients and other contaminants. There was displeasure with, and objection to, using irrigation tail water as a focus hazard, because stakeholders, including those from the irrigation industry, suggested that 'good irrigators operate efficiently and don't produce tail water' and 'sediment and bound nutrients discharged during high flow events, particularly from the Burdekin River, is a more significant hazard for the reef.' Even though it was explained that one objective of ERA is to look at the broader context in terms of hazards and consequences, some stakeholders still felt that the focus on irrigation tail water would not adequately address other, possibly more significant hazards.

This led to an extensive discussion regarding values and value identification. One stakeholder from the irrigation industry suggested that irrigation benefits need to be considered as well as irrigation impacts. Another suggested that only those who are associated with the conservation of the wetlands of the Lower Burdekin attended the workshop, and therefore values identified will not correctly reflect the values of the broader community. Several stakeholders felt that commercial valuation is a precursor to a useful risk assessment, while others argued that it is a disadvantage for the environment. Where the reef is concerned, tourism was suggested as a possible valuation method, while natural capitalism was identified as a possible method for any non-commercial entities. The land managers' perspective, based on commercial valuation, was advocated by some, because it results in assessments which can seem more practical.

The time element of the risk assessment attracted significant discussion. Practitioners proposed a time scale of 50 years, starting now and assuming a continuation of the *status quo*. Some stakeholders thought that the focus on the *status quo* was nonsensical given the changes expected in the short term future associated with national water reform and specifically the water planning process that is underway for the Burdekin catchment. Some also said that the risk assessment must take into consideration the large water management changes that have occurred in the Lower Burdekin in the past, such as the construction of the Burdekin Falls Dam and expansion of irrigation development in the late 1980s. Practitioners argued that the risk assessment must first focus on the *status quo* to provide a baseline against which the outcomes of possible scenarios can be compared.

The next stage of the ERA was to identify specific ecological values for specific environments. There was agreement that the outer reef is not impacted by land based activity and was omitted for the purpose of the risk assessment. A satellite image of the Lower Burdekin and map depicting its wetlands were used to continue the discussion on the values of the wetlands. Stakeholders agreed that the ERA must be based on an understanding of the different wetland types. After much deliberation, six broad wetland bio-geographical types were identified. All stakeholders were requested to record their values for each wetland type on pieces of paper that were posted on the wall. Some stakeholders did not participate in this task, because they thought it was reductionist or did not make sense.

Stakeholders were divided into four groups to conduct a semi-quantitative risk analysis. A first step in this analysis is the development of assessment endpoints. Each group selected an ecological value attributed to their wetland type as a basis for developing an assessment endpoint. Assessment endpoints are developed to provide more specific and measurable attributes of ecosystems. Assessment endpoints should be ecologically, socially and politically relevant, sensitive or known to the potential stressors, amenable to measurement, and relevant to the management goals (Sutter, 1993). In the discussion prior to the group risk analysis, many stakeholders expressed discomfort with undertaking a risk analysis based on assessment endpoints. Some thought that this approach neglected significance and understanding of the whole system. Nevertheless, assessment endpoints were derived and used, including 'maintain fish abundance and diversity' and 'number of migratory bird species is maintained.' This was followed by risk analysis, which involved using previous workshop deliberations to construct a Bayesian Network model. This model transformed the values identified in the workshop into an analytical tool for scientists to describe possible risks to the wetlands of the Lower Burdekin. This was the last activity that involved active stakeholder participation during the workshop.

5 Discussion and recommendations

5.1 Level of stakeholder support for the definition of a decision problem

Some stakeholders from the irrigation industry perceived that using irrigation tail water as a focus hazard attributed blame for ecological risks to them. Pre-determining decision problems requires constant triangulation from multiple sources in order to avoid this type of difficulty. Ideally, problem definitions are mutually derived with the stakeholders who will be involved in the workshop. Relationships between risk, risk acceptability and blame are analysed by Douglas and Wildavsky (1982) in a theory that distinguishes three cultural types. This theory is important for practitioners, because it reveals inherent inhibitions and sensitivities that certain stakeholders may act on in a risk assessment context, understanding of which may help practitioners plan to avoid conflict and prepare flexible workshop processes. This theory identifies market individualists, hierarchists and sectarians, who judge risks differently according to their own culturally learned assumptions and weightings. The market individualists, including irrigators and water service providers, are most concerned about risks of economic collapse; the hierarchists, including agency and government representatives, are anxious about risks to established structures of power and authority; and the sectarians, including members of conservation and environmental groups, are distrustful of technology and fear risks to society and the environment (Douglas and Wildavsky, 1982).

5.2 Implicit prioritisation of ecological over social and economic values

Stakeholders expressed a broad range of values that guided the formulation of the problem. For example, the value 'benefits of irrigation' extinguished irrigation tail water as the focus hazard. Hart et al. (2005) suggest that economic, social and political aspects should be incorporated into the early stages of the ERA process, but do not explain how. It was clear in the workshop that the stakeholders were uncomfortable when they realised that social and economic values would not be explicitly used. Hart et al. (2005) distinguish risk assessment from risk management and identify that economic, social and political aspects should also be incorporated into the risk management phase as criteria to aid in the evaluation of risk management actions, which are selected earlier in the process based on ecological values. By using different sets of values at different stages, the process appears to prioritise ecological values in the problem formulation stage, and this could be one of the reasons why stakeholders in the workshop wanted the inclusion of more than just ecological values. As practitioners, we acknowledge the complexity of accounting for all values in every workshop and suggest that some of the stakeholders' concerns would have been alleviated if the ERA was understood as an overall strategic contribution to the management of the Lower Burdekin. Then the identification of social and economic values and their respective assessment endpoints could be addressed within a catchment management context, allowing the workshop to focus on just ecological values.

5.3 No decision or problem to guide value identification

Values represent what matters in the context of a specific decision or problem (Gregory et al., 1993), while ecological values are those that community places on a region's or catchment's natural resources and indicate what people want to see protected (Hart et al., 2005). Values are not commonly explicit in everyday language, but are identified by asking what people want in a particular context (Gregory et al., 2001). Some stakeholders found value identification objectionable or difficult, possibly because the workshop did not focus on a particular decision or problem. It is noted in the results that stakeholders rejected irrigation tail water as the focus hazard and suggested events including water reform or even the development of the Burdekin Falls Dam to guide the investigation. However, because there was an opportunity to introduce and trial a risk assessment modelling framework important to the practitioners, they were persuasive in the workshop pursuing the problem formulation stage of the process without a particular decision context in mind. In retrospect, it was at this point in the workshop that the multiple agendas diverged and remained unresolved. This was despite acknowledgment by those present that the overall practitioner intent of building a basis, from which a range of alternative scenarios could be assessed in terms of ecological risk, was a worthwhile outcome. This lack of a suitable focus for the investigation meant that there was no decision or problem to guide value identification and the remaining parts of the ERA process. This experience affirms the importance of ERA practitioners being open and willing to negotiate decision problems not only during workshop planning, but also during the workshop in the problem formulation stage.

5.4 Assessment endpoints versus systems

Some stakeholders, particularly land and water managers, expressed concern about the necessity of defining and using assessment endpoints for risk analysis, because the scope of assessment endpoints is so limited. One manager suggested that the focus should have been broadened to include "river systems, wetlands, mountains and catchment–our dynamic and interdependent system." This conflict may represent the opposing ideologies of the scientist and the manager. The scientist has a tool to reduce the system to something measurable and definable, such as an assessment endpoint. The scientist's tool engages stakeholders so that the assessment endpoint is socially mandated and accepted as an appropriate approximation of an ecological value. Findings from the risk assessment based on the assessment endpoint are then used in the wider 'system' context to make recommendations for management. However, the manager's intuition gives preference to an upfront consideration of a system, which is a complex combination of 'assessment endpoints' and relationships. Separating the assessment endpoints from the system goes against the grain of systems theory, which suggests that a system is more than the sum of its parts: knowledge of a system's parts cannot fully explain the system. The significance of the opposing ideologies may lie with the issue of credibility. Any management recommendation that arises from an assessment based on a series of assessment endpoints may have little credibility for those who manage systems. We recommend that this kind of debate is healthy for a transparent ERA, and plenty of time should be allowed for such an important part of the process. This issue also points out that there is an opportunity for ERA to be applied within a social-ecological systems theory framework (Berkes et al., 2003). This would require the use of a multiplicity of perspectives, where qualitative knowledge of stakeholders is captured as dialogue and description to support, qualify, and/or refute (and to be transcribed intact, and annotated alongside), rather than be translated into, risk models and risk magnitudes.

6 Conclusion

Learning and respecting the perceptions of stakeholders is essential for adapting a new and more interactive form of ERA. In this paper we have identified a series of issues that stakeholders had with the process in an ERA workshop and have suggested ways to prevent or mitigate these issues for future applications.

In an ERA workshop there are multiple stakeholders, each with their agenda and each at a different level of commitment for, and awareness of, ecological risks, but each representing real world values that need to be considered. It is in this context that we have made the following recommendations for practitioners: it is important to triangulate problem formulation across a spectrum of stakeholders prior to and during workshops so that decision problems find stronger support; ERA must be clearly introduced and applied as one of many research processes that contribute information for catchment management; and the workshop process needs to be flexible, allowing debate over issues such as 'assessment endpoints don't capture systems', where multiple perspectives are not only heard, but used for supporting, qualifying and/or refuting qualifying risk models and risk magnitudes.

As well, it is important that practitioners acknowledge that there are also multiple agendas among their colleagues. Transparency of purpose can alleviate misunderstandings and clarify desired outcomes. It is important to have real scenarios for the testing of new risk assessment tools, and equally important that the real scenarios are acknowledged as having a context beyond a particular experimental assessment process for the different practitioner agencies involved.

Participatory processes are clearly multi-faceted and require extensive stakeholder and practitioner development in order to provide useful and mutually derived outcomes. At the outset it is important that practitioners and stakeholders have agreed goals and a staged framework that allows the development and understanding of the ERA workshop and provides an on-going strategy for assessing outcomes from the particular workshop to the larger regional context.

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