Setting ecological targets for river systems: a framework to support multi-stakeholder groups

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Abstract

A framework to Set Ecological Targets (SET) was developed as a tool for stakeholder groups involved in setting environmental targets. The framework was designed to incorporate current scientific information and reach agreement about trade-offs between environmental, social, and economic requirements of river systems to achieve ecological outcomes. The framework and a support program of Internet-assisted activities, blended with face-to-face workshops, was developed and trialed with a multi-stakeholder group who provided recommendations for environmental flow management. Strategic decision-making requires rigorous analysis of the implications of decisions or how a series of decisions can lead to a desired ecological outcome. Moving from a reactive to a strategic decision-making situation may prove difficult if stakeholders lose touch with the immediate relevance of the task. Volunteer (non-government) stakeholders can find the effort and workload required for strategic decision-making difficult without genuine support and reactive decision-making may result. The trial demonstrated that the framework required support for adoption and implementation in a regional natural-resource-management situation where the group members may focus on reaching consensus about action, rather than the outcomes of actions.

Keywords

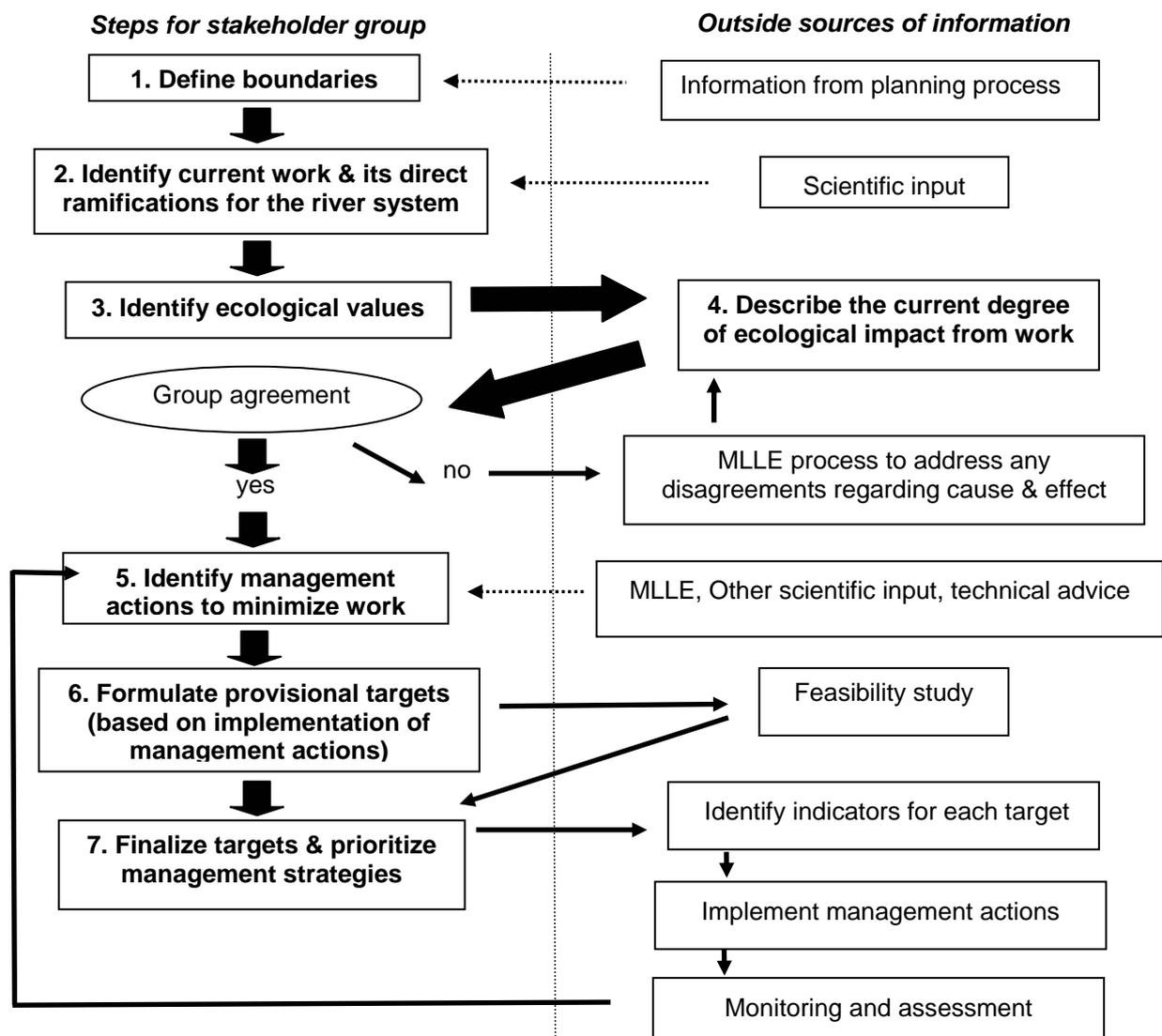Ecological values, strategic decision-making, working rivers

Introduction

A shift to greater regionalization and inclusion of stakeholders in natural resource management (NRM) has occurred across Australia in recent years. This is reflected in the establishment of the Natural Heritage Trust (NHT). Granting of NHT funding, and National Action Plan for Salinity and Water Quality funding is dependent on adherence to principles of active participation of stakeholders (Whelan & Oliver, 2005). One of the factors driving the move to regionalization and greater stakeholder involvement is that many NRM problems are intractable to "traditional" regulatory and legislative measures associated with centralized administration (Whelan & Oliver, 2005). The promise of regional arrangements and the move to a collaborative culture is that sustainable management decisions are reached through a greater sense of ownership, legitimacy and consideration of the diversity of values and opinions within societies (Bloomfield *et al.,* 1998).

The move to regionalization and collaborative approaches has been criticized by some that say the process represents governments devolving responsibility to the community; decisions are unaccountable and not transparent; and decisions lack scientific input (Bryan, 2004). The Healthy Rivers Commission (2003) in their framework for setting catchment goals noted that: "decisions which balance human and natural values are likely to be contentious. It is therefore important that a decision support process be open, credible, objective and repeatable". Existing decision support tools that can be applied to ecological target-setting such as Multiple Criteria Analysis (Romero & Rehman, 1987) and Ecological Risk Assessment (Hart *et al.,* 2005) have not generally been designed for use by multi-stake holder groups while others have been developed for managing high conservation value systems (HRC, 2003). This paper describes a framework for setting ecological targets which aims to address some of these gaps, and the outcomes of its trial with a supporting water management program.

Description of the framework to Set Ecological Targets (SET)

The SET framework describes a series of steps by which multi-stakeholder groups can develop ecological targets for river systems that are directly linked to management actions and ecological values (Fig. 1). It has been developed for application in systems where activities in the catchment (such as urban development and river regulation) have resulted in large-scale and irreversible changes to aquatic ecosystems. The Multiple Lines and Levels of Evidence (MLLE) method (Norris *et al.,* 2005) is incorporated to explore cause and effect relationships.

Steps for stakeholder group   *Outside sources of information*

1. Define boundaries ◂┈┈┈┈┈┈ Information from planning process

2. Identify current work & its direct ramifications for the river system ◂┈┈┈┈┈┈ Scientific input

3. Identify ecological values ➤ **4. Describe the current degree of ecological impact from work**

Group agreement

yes / no → MLLE process to address any disagreements regarding cause & effect

5. Identify management actions to minimize work ◂┈┈┈┈┈┈ MLLE, Other scientific input, technical advice

6. Formulate provisional targets (based on implementation of management actions) → Feasibility study

7. Finalize targets & prioritize management strategies → Identify indicators for each target

Implement management actions

Monitoring and assessment

Figure 1. Steps involved in setting ecological targets for healthy working river systems with thick arrows linking the key steps and dotted arrows showing external inputs.

Step 1. Define boundaries
Setting the spatial and temporal boundaries for target-setting helps structure and define the scope of the group's discussions. Boundaries may also provide focus for the range of issues at hand. For example, are we only considering the wetland or the river up and downstream of it also? Temporal boundaries will likely be dictated by existing planning instruments.

Step 2. Identify work the river system currently does
Work is what the river system is currently "doing for us" that potentially places stress upon it. It includes provision of products, functions and services (adapted from CSIRO 1992 - Table 1). Identifying the current work the system does is necessary so that stakeholders can determine means of reducing it to give positive ecological outcomes. The direct ecological implications of work also need to be broadly identified. Key ecological implications will relate to the requirements for healthy river systems (DNRE, 2002) such as: a)

hydrological connection; b) flow regime / hydrology; c) water quality; d) geomorphology; e) habitat; f) aquatic biota; g) riparian vegetation; h) ecological processes; and i) ecosystem resilience. It is recommended that scientific input be sought to help define the ecological implications of work.

Table 1. Some common examples of work expected of aquatic ecosystems.

Categories of work		Examples that may have different outcomes for the river system
1. Extractive use	Providing water	a) Directly pumped out b) Extracted using dam, weir, levee
	Providing biota	a) Commercial fisheries b) Recreational fishing c) As part of cultural practices
	Providing materials	a) Sand and gravel extraction
2. Non-extractive use	Providing a venue/ supporting resources	a) Floodplain/wetland agriculture b) Urban development on floodplain c) Aquaculture d) Recreation, tourism, education
3. Adding new elements to the system	Transport water	a) Delivered for irrigation b) Delivered for hydro power c) Stormwater d) Inter-basin transfer
	Transport/treat contaminants	a) Sediments from gully erosion b) Nutrients from sewage effluent c) Toxicants from industry d) Salts from agricultural practices d) De-oxygenated or cold water from dams
	Support exotic species	In-stream & riparian fauna & flora

Step 3. Identify ecological values
Ecological values need to be articulated as a focus for why the group is setting targets. Ecological or environmental values are elements or attributes of the river system that we are trying to protect or improve. 'Environmental values' have been defined as "particular values or uses of the environment that contribute to public or private benefit, welfare, safety or health. There may also be particular environmental qualities which the community wishes to preserve" (ARMCANZ /ANZECC, 1994). Ecological values here only refer to the latter and are likely to be biological endpoints (flora and fauna).

Step 4. Describe the current degree of ecological impact from work
This step describes how the current work may be affecting ecological values. This provides the baseline for management actions i.e. maintaining or improving the system from current condition. A semi-quantitative approach may be preferred (e.g. low, moderate, or high rankings), or it may be more appropriate to indicate presence or absence of impact. Input from independent scientists, preferably with knowledge of the region and with reference to existing data, should be sought at this step (O'Connor & Nichols, 2006). It is also recommended that a conceptual model is drafted using the work and values identified by the stakeholder group. The conceptual model provides a platform to review Steps 1-4. If there is disagreement about the effect of a particular type of work on an ecological value it can be addressed by the Multiple Lines and Levels of Evidence (MLLE) process (Norris *et al.,* 2005).

Step 5. Identify management actions to minimize work
This step seeks to reach agreement about what work can be minimized. Actions for minimizing work need to be considered for all the aspects of work that affect ecological values. Possible actions are listed first and then the group decides which of these are acceptable. Where an action is unacceptable an explicit reason needs to be recorded (Table 2). Recording these reasons is critical for transparent decision-making. MLLE can be used where there is doubt about the ecological benefits of a management action (Fig. 1).

Step 6. Formulate provisional targets for a healthy working river system
First the group needs to elucidate which ecological values would benefit from management actions by combining the outputs from Step 4 (current degree of impact) and Step 5 (acceptable management actions). The links between acceptable management actions and positive outcomes for ecological values would need to be confirmed and elucidated with technical input (potentially through a feasibility study, O'Connor and Nichols 2006). This would also consider factors potentially limiting the success of management actions, multiple benefits of management actions, etc. Targets are then formulated for each ecological value based on a reduction in the current level of work through implementation of management actions (Step 5).

Table 2. Example showing assessment of management options to minimize work.

Work	Ecological implications	Possible actions	Accept?	Reasons unacceptable
Water from dam	Changed flow regime	E-flow regime	yes	
	Loss or change to aquatic habitat	Periodically release large volumes	no	Don't think it will restore critical habitat
	Changed water quality	Multi-level off-take	yes	
	Reduced hydrological connection	Fish ladder	yes	
Floodplain agriculture	Changed vegetation communities	Re-plant key areas	yes	
	Changed nutrient dynamics	Remove levees	no	infrastructure losses
	Changed inundation patterns	Remove levees	no	infrastructure losses

Step 7. Finalize targets and prioritize management strategies with stakeholders
Provisional targets need to be assessed in terms of their feasibility (e.g. infrastructure limitations, resource limitations, ecological limitations). A number of scenarios and trade-offs should be presented to the group to decide upon. Final targets should have a measurable value, be bounded spatially and have a timeframe for their achievement (Table 3). The reasons for particular choices need to be clearly articulated and documented for future reference and reporting.

Table 3. Example of final targets based on implementation of management actions.

Ecological implications	Acceptable actions	Final targets
Changed flow regime	E-flow regime	Fish: Conditions for Catfish breeding provided each summer
		Waterbirds: Frequency of conditions necessary for breeding increased by 25%
		Wetland veg: Conditions necessary for lignum recruitment provided every 3 years
etc		

Trial of the framework

The Macquarie-Cudgegong Regulated Rivers Environmental Flow Reference Group (the EFRG) trialed the framework from January to May 2006. The EFRG were formed under the auspices of the local water-sharing plan. The stakeholder groups represented in the EFRG are stipulated in the plan and include landholder groups, conservation groups and government organizations. Their role as a group is to provide advice to the relevant Minister about management of planned environmental water allocated to that system. Use of the framework in situations where the group is not pre-defined would require some form of stakeholder analysis to identify appropriate participants.

A web-based water-management program incorporating the SET framework, blended with various face-to-face activities, was trialed for use in support of the SET framework (Nichols & Norris, 2005). Fourteen members of the EFRG participated in the trial by attending two face-to-face workshops and accessing the program website. Data were gathered using: 1) online and paper evaluation surveys; 2) notes taken during face-to-face sessions; and 3) statistics collected when participants accessed the on-line resources.

Results

The EFRG completed Steps 1 – 3 but stalled at Step 4 (describing current condition). A sub-group of three of the government representatives then completed the framework out of session. The evaluation and other feedback indicated areas that require improvement in the implementation of the SET framework and elements that worked well.

Areas requiring improvement

1. <u>Creating and maintaining motivation</u> Seven out of 12 respondents to the initial evaluation chose the word "relevant" as a word to describe the first 3 steps of the framework. In contrast, low levels of motivation were evidenced by: a) Low frequency of access to the website. Most of the group logged on less than once a week; b) under-utilization of support materials provided. Only two accessed the briefing materials the group themselves had requested; c) direct responses to evaluation questions.

2. <u>Improved facilitation</u> Three key areas were highlighted in the evaluation and wrap-up discussions: a) The need to pull together the inputs at a given step, summarize and move on to the next one; and b) facilitators needing to recognize gridlocks early and look for alternate strategies such as breaking down steps into manageable tasks (see point 4 below).

3. <u>Better articulation of expectations and outcomes</u> The ultimate purpose of applying the framework remained unclear to some participants in the final evaluation. The group had become focused on consensus and the nature of water delivery, so the relevance of the initial SET steps (i.e. addressing the drivers of these decisions) was not always clear. There was also an unstated expectation of the facilitators that all group members would participate equally. However, this expectation was not shared by the group.

4. <u>Complexity of individual steps</u> Many participants felt Step 4 (current condition) was too complex to deal with. The sub-group who completed the steps did so by only dealing with a subset of management actions and work. These were actions the group had direct control of and had sufficient knowledge about, and values that might act as an umbrella for others.

Elements that worked well

Positive response to the SET framework was that it allowed documentation of the discussion and decisions reached at each step, and a logical approach to target setting, "... I think the framework shows real promise in allowing us to approach target setting in a logical way". The group also responded positively to the use of conceptual models.

Discussion

The initial trial of the SET framework indicates potential to deal with criticisms of group decision-making in NRM, namely transparency and accountability (Bryan, 2004). The steps of the framework provide a record for justifying decisions made by multi-stakeholder groups. The Internet discussion forum used in the trial is one means by which results and discussion can be recorded. The SET framework also provides mechanisms for accessing scientific knowledge and the support program has the potential to provide groups with easier access to experts. However, these were only partially tested in the trial and more strategic science input may have prevented the process stalling.

Feedback from the trial suggested the steps involved were logical. The challenge is in motivating and assisting multi-stakeholder groups to work through it successfully. This can be addressed at least in part by support for implementation of such target-setting systems (Nichols & Norris, 2005), and by involving credible, skilled collaboration broker(s) to facilitate the process (Whelan & Oliver, 2005). However, we cannot assume all stakeholders will want an equal level of knowledge and understanding in every field or need to put in equal effort in all steps. Mature groups such as the EFRG may trust subsets of members with particular expertise to perform tasks and make recommendations to the group. Another issue in motivation and support is a clear link between the SET framework and a group's terms of reference. A simulated situation (scenario) at the beginning of the program would have provided a practical situation to demonstrate relevance of the framework.

Conclusion

The trial of the SET framework illustrated the difficulties of the task facing multi-stakeholder NRM groups dealing with complex natural systems. The trial also showed that development of frameworks and similar tools to assist in this process is not enough. To achieve their goal of well-informed and transparent decision making requires support from appropriate facilitators, clear definition of the expectations of all participants, and relevant illustrations of how the framework applies to the day to day tasks and objectives of the group.

Tools such as the SET framework and appropriate support for implementing them are priorities if the government is truly committed to the success of collaborative natural resource management in a regional context.

Acknowledgments

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