DELIVERY OF ENVIRONMENTAL WATER UNDER CONTENTIOUS WATER REFORM. LEARNING BY DOING TO IMPROVE WATER DELIVERY AND GOVERNMENT-MANAGER-COMMUNITY-SCIENTIST WORKING RELATIONSHIPS

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Water management in the Murray Darling Basin in Australia is continuing into a new era where the environment is recognized as a legitimate user of water, and water reform is occurring to allow this transition. Due to water being already fully allocated, water reform includes the acquisition of water for the environment (water buybacks) that was originally used for consumptive purposes. Although the buying back of water is conducted under a voluntary basis, conflict is still occurring between stakeholders where irrigation communities feel that the buying back and delivery of environmental water is leading to unacceptable social (and sometimes ecological) consequences at local-regional levels. Stakeholder engagement based on trust and ownership, and evidence-based adaptive management will be key during the implementation phase of environmental water, but it is not fully explicit how either will occur. This paper presents results from the delivery of environmental water under a Strategic Adaptive Management (SAM) framework in the Edward-Wakool river system, a semi-arid dryland anabranch system of the Murray River in Australia, over the last 5 years. The focus of this paper is on the ability of the responsible natural resource managers facilitating SAM to manage two key concepts within SAM: stakeholder engagement (relationships and aspirations); and the incorporation of best available science (evidence-based management) and subsequent learnings from monitoring before and after each delivery year.

1 INTRODUCTION

Freshwater resource management in Australia and other developed countries is undergoing significant change, where traditional, centralized, top-down, expert-driven governance is no longer economically viable or considered acceptable by local communities that want to have more say in the management of their local areas [1]. Therefore, within Integrated Water Resource Management (IWRM), frameworks that view freshwater systems as coupled social-ecological systems, are stakeholder driven and use ‘learning by doing’ evidence-based management approaches, are repeatedly being advocated for [2]. Adaptive Management, often described as a ‘learning by doing’ is theoretically able to deal with these complexities, and should be applicable to freshwater resource management, including environmental flow (eflow) programs. Although logical and forward thinking, adaptive management has failed to become the dominant management strategy within freshwater resource management, suffering from the ‘knowing-doing gap’. Traditional methods and even adaptive management often fail to appropriately integrate social-ecological value driven aspirations into decision making, with adaptive management too often viewed as a top-down technical science based-tool, as opposed to a framework that encompasses both social and ecological aspirations (derived from social values) of the target system. So although adaptive management is integral within freshwater resource management it has often been applied ineffectively [3].

Strategic Adaptive Management (SAM) is based on adaptive management principles, but has an explicit focus on integrating social aspirations, management strategies and scientific experimentation into decision making, rather than exclusively concentrating on scientific experimentation to form the basis of the process (Figure 1) [4]. It looks at management through a social-ecological lens and attempts to understand the relationships between social, biotic, and abiotic drivers within a system to drive management decision making. An important component of SAM is the development of an objectives hierarchy, which commences with an overall Vision (or future desired state), using the criteria of VSTEEP (Values; Social; Technical; Environmental; Economic; Political). This Vision is then broken down into objectives and sub-objectives with increasing focus and rigour, culminating in explicit and measureable end-points known as Thresholds of Potential Concern (TPCs) (Figure 1). These TPCs are used in the planning, auditing, and evaluation-learning (including communication) phases of SAM. The above process involves collaboration between all stakeholders and this sets up the implementation and evaluation phases of SAM. Monitoring against the TPCs, and implementation of TPC-associated adaptive feedbacks helps guide management in complex social-ecological situations characterised by uncertainty. A key principle of adaptive management, and explicit within SAM is that appropriate management actions should be implemented, even if based on imperfect knowledge, because a complete understanding (especially ecological thresholds) is never realistically attainable [4].

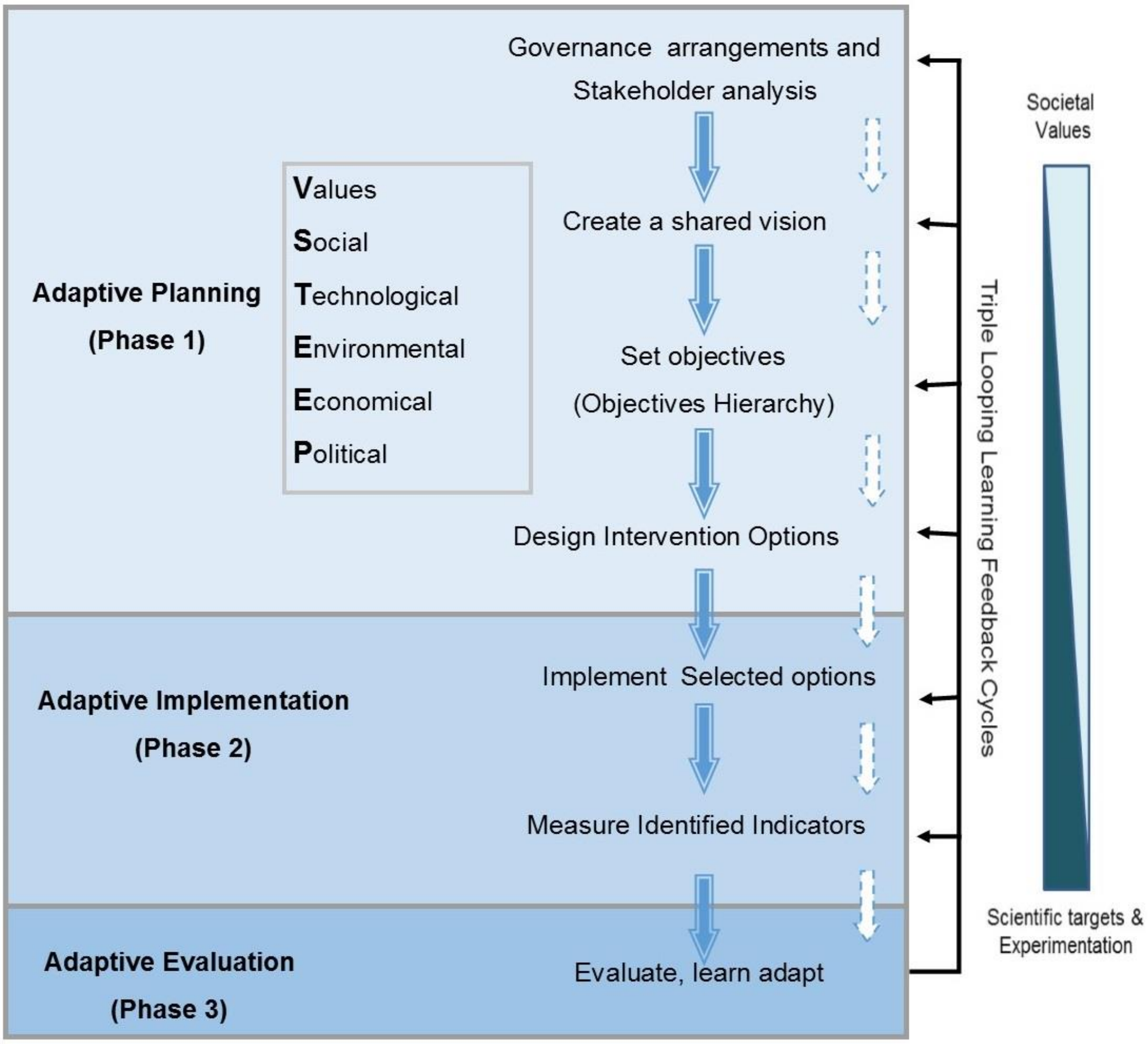

Figure 2. Three main phases in Strategic Adaptive Management. VSTEEP is integral in Phase 1. Solid arrows show steps, and broken arrows show engagement (at different levels) is needed throughout whole process. Feedback loops centred around learning is integral. The level of involvement of social values and science-experimentation is highlighted in the diagram on the right (adapted from [4]).

Within the Murray-Darling-Darling Basin of Australia where significant water reform is occurring, two common management challenges are (re)-occurring within the adaptive management programs being implemented; 1, The government's (in)-ability to devise principle based, meaningful engagement strategies between different stakeholder groups involved in the decision making, and 2, the ability to utilize science (both formal and informal) at appropriate levels for different stakeholders, so that the evidence based approaches are understood and agreed upon going forward. These have in-turn hampered the ability to build the trust and ownership needed for successful partnerships and long-term outcomes. The inability to gain trust and ownership during implementation is contributing to opposition of some eflow programs being initiated in the Murray-Darling Basin.

The Edward-Wakool system within the Murray- Darling Basin is used as a case study to explore adaptive management and social acceptability of eflow management further within a complex social-ecological system currently experiencing significant water reform.

2 CASE STUDY

The Edward-Wakool (E-W) system is a semi-arid anabranch of the Murray River within the Murray-Darling Basin of Australia. The system contains approximately 2000 km of permanent and ephemeral rivers, creeks and flood runners. Water and its associated management is one of the major drivers of both the social and ecological components within the system. Up until mid-2010 the system was experiencing a severe decade long drought which was having a severe impact on both the social (e.g. irrigation, livestock industry) and ecological (e.g. fish kills, wetland drying-acidification) values within the system. It was evident that there was a lack of an appropriate management framework, and understanding of the risks associated with delivery of water from a social-ecological systems perspective, especially in relation to knowing when to deliver water for which purpose. This lack of an appropriate framework was limiting the ability of water managers, scientists and community to collaborate on delivery of water within the system. The lack of a suitable framework culminated in conflict between different water user groups, mostly between the uses of water for social or ecological purposes, with a perception that the two were in conflict with each other. Therefore, water management authorities, (including both State and Commonwealth), in collaboration with community groups, were looking for a suitable framework. The framework would have to enable water managers and stakeholders to work through the inherent complexities of social, economic and ecological interactions, to achieve the desired social-ecological outcomes within the E-W system and devise appropriate flow regimes within a pragmatic forward thinking framework [5].

In 2010, the Murray Catchment Management Authority (now Murray Local Land Services), the locally-based natural resource management authority, in partnership with State and Commonwealth agencies, and target community groups, initiated a SAM process to inform freshwater management, including eflow delivery within the E-W system. This was convened under a steering committee (Edward-Wakool Steering Committee) to make decisions together on what and when eflow actions would occur in the system. It was envisioned that by using a SAM framework, management actions such as flow delivery would be a multi-stakeholder driven, evidence-based process, and that trust and ownership of the programs would be attained by the various stakeholder groups. In addition, it would potentially enable a process to link the social and ecological values together and link these to the management, monitoring and research occurring in the system, all under one framework.

Under the SAM framework, fish communities (native and alien) were identified by the steering committee as the target social-ecological indicator expected to respond to both regulated and un-regulated flows (e.g. natural flooding). Fish communities are highly valued by local E-W community stakeholders for recreational and cultural purposes. From a scientific point of view, different fish species and lifestages are affected by varying temporal and spatial aspects of a flow regime management, and water managers could easily relate to how water delivery affected them, and how this affected their normal operations. Fish communities were also important from a legislative perspective as some species were listed under various threatened species programs. Therefore, fish communities could act as an adequate social-ecological indicator group to inform all stakeholder groups about current and future water delivery management, and how these management actions influence the fish communities within the system negatively or positively [5]. As part of the SAM process a stakeholder-agreed upon local vision was created that encompassed the social-ecological aspirations within the system; namely, "A Self-sustaining native fish community within a vibrant rural community". Although catchment management wide focused, one of the key attributes identified was water delivery (both consumptive and eflow), and its effect on both the E-W rural and native fish community. The vision was then split into two lines 1. Ecological line - Self-sustaining native fish communities, and the Social line –Vibrant rural communities. This initially resulted in devising an objectives hierarchy that followed the SAM framework for the ecological line as a starting point, culminating in first generation TPCs for different native fish groups. The TPCs were designed to be an initial starting point to enable all stakeholders to be able understand, make informed decisions, and disseminate results of sampling to other members within their wider interest groups for further discussion and input into the decision-making process.

Environmental water has now been delivered every year since 2010 to aid in meeting various objectives related to the system vision described above. Engagement of community groups within SAM has been a key focus of the different government based management organizations, which has led to collaborative processes occurring with joint decision making as one of the outcomes. Monitoring of flow-ecological responses has also been a key component of the evidence-based approach within SAM, with data collected in each year to enable learning from each targeted eflow event, and to guide actions in future years. However, in some instances stakeholder engagement-communication has failed to meet some stakeholder group expectations, and this has decreased the government's ability to collaborate and build long-term meaningful relationships. Another continuing challenge and source of conflict is the incorporation, use, and communication of both formal (monitoring, best available science) and informal (local anecdotal) knowledge in a meaningful and timely manner into the SAM process

3 DISCUSSION

Trust and ownership are essential when it comes to forming long-term relationships, and needed for engagement and successful implementation of eflow programs. Engagement becomes a complex process in situations where different stakeholder groups of varying political, philosophical and power levels need to work together to meet shared outcomes. Social capital, (i.e. networks/relationships among people), of the different groups can either aid in or prevent effective collaboration. Three main types of social capital exist; bonding - single group bonded together over a shared interest, bridging - multiple groups brought together by a common goal, and linking - multiple groups connected at different hierarchical levels [2]. As no single stakeholder group has the mandate or adequate resources to implement eflow programs, social capital is needed to harness the strengths of the different groups, increasing collaboration across groups, and influence within the decision making process. Champions (individuals or groups), who have high social capital are essential within different stakeholder groups to allow linkages to occur, enhance understanding, and help build trust and ownership (Figure 2) [2].

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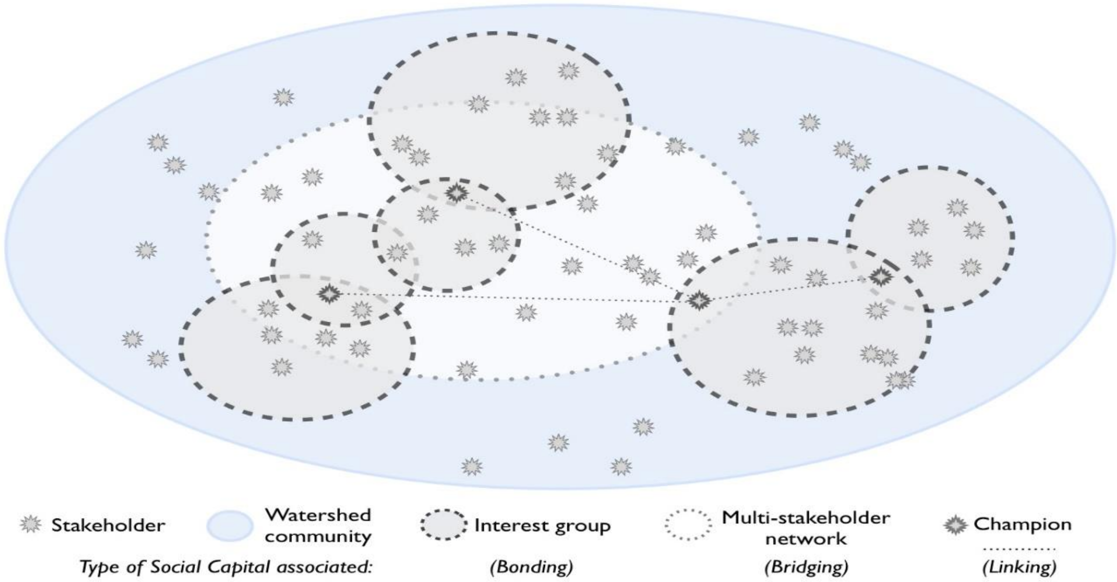

Figure 2. Catchment stakeholders are associated with different interest groups, some closely connected (Bonding), while others are not. Bridging and linking social capital is needed if stakeholder groups are to succeed in working together for a common vision and set of objectives. Borrowed with permission from [2]

One of the continuing challenges for engagement within the E-W system is the identification of roles and responsibilities of the different stakeholder groups, and the social capital each stakeholder group brings with them. In the E-W system two dominant community groups (Wakool Rivers Association, Edward-Wakool Angling Association) do not see themselves as passive stakeholders, only to be informed of what government water holders are proposing, but as active participatory catchment organizations (PCOs), with the ability to be able to make well informed decisions on what they think will be of the highest benefit to the social-ecological system at a local-regional scale. They do not view eflow delivery as a purely for ecological benefits, but contextualize it within the broader social-ecological system of the E-W system. The two groups see themselves as bridging multi-stakeholder groups as they are made up of groups of people with a diversity of backgrounds from science to business.

In addition, these two stakeholder groups want to be involved in the formal scientific process, and wish to have informal science incorporated into the ‘science’ currently used in decision making. These aspirations were originally to be facilitated through the steering committee and establishment of first generation TPCs within the SAM process. The development of TPCs likens them to ‘decision’ thresholds’ not purely ‘ecosystem’ thresholds.

Here 'decision' thresholds are seen as an optimisation of both 'ecological' (scientific/model-based) and 'utility' (value/objectives-based) thresholds. Thus, TPCs are not purely ecological thresholds but a culmination of both ecological (e.g. fish recruitment) and social drivers (e.g. fish harvest) of the target indicator. They provide a path to link management, monitoring and research. If TPCs are exceeded, or close to being exceeded, this sets in motion a decision-making process of investigation as to the reasons why the TPC is being exceeded. However, in the E-W system, conflict has arisen between scientists and community in the use of these first generation TPCs due to the scientific credibility of the TPC process. Scientists think the 'dumbing' down of the complexity of the situation undermines the evidence based approach, whereas the community feels reducing the complexity allows them to have decision making abilities from the same data. This highlights a bottleneck when implementing programs that try to seek a balance between formal and informal knowledge integration within decision making, and the use of 'best available science' also highlighted in other management programs [6]. In addition, PCOs voice frustration as they see the formal science (through monitoring) that is being generated, ineffective at informing decision making in a timely or understandable manner, and orientated towards reporting-auditing rather than to adaptive management and communication. Another concern is the data collected is unavailable to them in a digestible format for further relay to their stakeholders, and not available to them to use for their own purposes.

The current E-W SAM framework would be improved and able to work past the current bottlenecks discussed above if an appropriate principle based engagement strategy was developed that recognizes the social capital within each groups and defines the roles and responsibilities of the different groups. This will require the integration of more social aspects into what is predominately a natural science orientated process for now. Formal scientific data collected through monitoring programs should be available to all groups in a timely manner in a format that is accepted and understandable by all, so that decision making from collected data becomes a multi-stakeholder process, not simply a scientific expert process. Just as important, the program needs to find a way for informal knowledge to be adequately incorporated, and citizen science valued and used at a decision making level.

4 CONCLUSION

The E-W system provides a real working example of environmental flow delivery under contentious water reform and the ability of frameworks such as SAM to work through the complexities of both the social and ecological system where water is being delivered. Although the process has led to a lot of positive outcomes at both the social and ecological level, challenges remain that are undermining the trust and ownership of different stakeholder groups. As stated in Knight *et al*. 2011 [7] "effective conservation planning is a social process informed by science, not a scientific process which engages society". Finding appropriate principle based engagement strategies and the use-communication of science and monitoring data remains a challenge for environmental water delivery in much of the developed world, as it tries to adapt itself from top-down technocratic based management regimes into more localized participatory based programs informed by a range of formal and informal knowledge. In the Murray-Darling Basin this is being termed 'localism', and is heralded as the way forward. Whether this can become a reality is yet to be seen. Within freshwater management there is a real need to address the bottlenecks that occur when traditional top-down governance is challenged by bottom-up locally-based needs looking to have an equal say in the management of what they consider to be their system.

ACKNOWLEDGMENTS

This is a continuing working relationship between community based PCO's; Edward-Wakool Angling Association, Wakool Rivers Association, state based departments; Murray Local Land Services, Office of Environment and Heritage, NSW Office of Water, NSW National parks and Wildlife, and Commonwealth based agencies; Commonwealth Environmental Water Office, and Murray Darling basin Authority.

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