# Adaptive management intentions with a reality of evaluation: Getting science back into policy

Hasselman, L.[1]

[1]Institute for Governance and Policy Analysis, University of Canberra, Australia

**Abstract:** Adaptive management was initially proposed to address system uncertainty in natural resource management. In theory, adaptive management integrates scientific experimentation in policy planning and implementation to discover and gather knowledge from across a system's stakeholders. It systematically tests hypothesis with the results redirecting or improving policy, applying a paradigm of scientific problem solving.

This paper uses a case of water management in Australia's Murray-Darling Basin. Water reform has been contentious as government attempts to reconcile historical over allocation of water to irrigation with the use of water to protect and restore wetlands of international biodiversity significance. In areas scientific knowledge of the system is either imperfect, incomplete or system responses are unpredictable. In this case there are legislative requirements for both adaptive management and evaluation. Evaluation looks to achievement of policy objectives, as determined through monitoring of system response and value judgements, in a structured framework of action, outputs, outcomes and objectives.

The intentions for adaptive management are compared to the reality, as determined through legislation, public speeches, government reports and semi-structured interviews with government policy makers and implementers. The findings demonstrate contradiction between intent and reality, with adaptive management subsumed by evaluation. The loss of adaptive management as a distinct concept is seen as a loss of science and discovery from the policy process. Despite intentions for adaptive management, the dominance of evaluation is discussed as limiting innovation, a 'muddling through' process of improvement and meeting political and accountability needs.

**Key words:** adaptive management, evaluation, science, uncertainty, politics, conflict, accountability

## 1. Introduction

Adaptive management is now widely accepted as a necessity in the management of natural resources, such as water, soil and biodiversity (Allan, 2009; Dovers, 2009; Pahl-Wostl, 2009; Pahl-Wostl, Conca, Kramer, Maestu, & Schmidt, 2013). In theory, adaptive management integrates scientific experimentation in policy planning and implementation in order to develop new knowledge and gather knowledge from across a system's stakeholders (C. J. Walters & Holling, 1990). It uses a systematic process of hypothesis testing with the resulting scientific discoveries redirecting or improving policy, applying a paradigm of scientific problem solving. However, in practice empirical examples of adaptive management are scarce (Eberhard et al., 2009), and the very meaning of adaptive management remains debated (Allen, Fontaine, Pope, & Garmestani, 2011; Scarlett, 2013).

In the 1990's, with the lack of evidence of adaptive management, Lee suggested that adaptive management needed to be included in legislation to ensure it actually occurred (Lee, 1993) and these calls for prescription in legislation have continued since (see (Dovers, 2009). The argument is that

adaptive management as a legal requirement will provide the additional impetus for organisations to overcome implementation challenges. In addition, a legislated definition of adaptive management could be expected to provide clarity and direction to what has become a confused and misunderstood enigma. The reasons for adaptive management being theoretically championed while being rare in practice are discussed in this article.

In 2012 adaptive management became a defined term in Australian water legislation in the Murray-Darling Basin Plan (Basin Plan), providing a fit case to examine the differences in intention and reality of adaptive management. This article uses the case of the Basin Plan, to test the argument that prescription in legislation is required to overcome the challenges to adaptive management.

First, a brief literature review of adaptive management is provided, followed by a description of the method used and an introduction to the case. The intentions for adaptive management in the Basin Plan, as provided by legislation and policy documentation, are compared to the reality as determined through semi-structured interviews with government policy makers and implementers and published government reports. In analysis and discussion of the results, it is demonstrated that the true barrier to adaptive management is not the absence of legal mandate, but confusion of adaptive management with evaluation, with this further marginalising science from policy development and implementation.

## 2. Literature review

### 2.1 Adaptive management

Adaptive management emerged from the field of ecology in the late 1970s. Over time its meaning has been debated, with adaptive management referred to as 'experimental management' (C. Walters, 1997), 'learning by doing' (for example, see Schreiber et al. 2004) and 'structured decision making' (Allen & Gunderson, 2011; Gunderson & Light, 2006). Forms or types of adaptive management distinguish between active adaptive management, with multiple hypothesis testing, statistically sound experimentation and technical modelling, and passive adaptive management that looks to observation and response in single treatments. The label of passive adaptive management was first used by Walters & Holling (1990) but does not imply a lack of effort or resourcing requirements. It is planned, participatory and requires monitoring and analysis to test a single best hypothesis with a single treatment. Over time, the role of partnerships to bring together socially-held knowledge has been increasingly emphasised, further highlighting the misnomer of the label 'passive'.

Active and passive adaptive management both emphasise systematic and planned hypothesis testing, involve stakeholders working across knowledge disciplines, and remain strongly motivated by the need to increase knowledge of system function and address uncertainty (Hasselman, forthcoming). However, there are three broadly recognised types of uncertainty (Bru(Berkes, 2007)gnach, M. et(Brugnach, Dewulf, Pahl-Wostl, & Taillieu, 2008) al. 2011; Pahl-Wostl 2007; Walker et al. 2003). This includes uncertainty that results from imperfect knowledge (undiscovered science), incomplete knowledge (knowledge that cannot be held by an individual but is collectively held across stakeholders), and unpredictability (unforeseeable futures with unknown society and ecosystem responses). In addition to these three types of uncertainty, Pagan and Crase (2005) also note unforeseen changes to community preferences and government objectives over time.

Active adaptive management seeks to reduce imperfect knowledge with experimentation to discover new knowledge and determine the optimal solution (Walters & Holling 1990), viewing knowledge as absolute and uncertainty as something to remove. In comparison, passive adaptive management seeks responsiveness to unpredictability. Management is seen as experimentation with socially-held

knowledge, applying an approach that accepts unpredictability (Berkes 2007; Brugnach, Marcela et al. 2008; Huitema et al. 2009).

The context to which adaptive management is applied is important; influencing which form of adaptive management is most suitable. These differences mean that adaptive management is hardly a single thing or panacea, but a pluralist concept and practice. The evolving history of adaptive management with its varying emphasis on experimental management, learning by doing and structured decision making, along with the varied contexts to which policy makers and implementers have sought to apply adaptive management has contributed to confusion about the meaning of adaptive management (Allen et al., 2011; Loftin, 2014). Following an extensive review, Hasselman (forthcoming) has proposed a definition of adaptive management that acknowledges the different types of underlying uncertainty that may be motivating adaptive management. This definition accepts the need for pluralism and context specific application and can be applied to the different forms of adaptive management.

> *Adaptive management is a systematic process for improving policy and its implementation. It seeks to address at least one type of uncertainty with varying emphasis on experimentation to discover new knowledge; deliberative processes to engage multiple perspectives in decision making; and monitoring of outcomes and changes with responsive adjustment of decisions and implementation.*

In this definition adaptive management remains a scientifically based activity to increase collectively held knowledge and experience, in order to make better management decisions. The essence of adaptive management remains applied science with the learnings used to gain ecological outcomes. The ability to change decisions based on new information is just as critical to adaptive management as the ability to gain new knowledge or gather knowledge.

### 2.2 Evaluation

In natural resource management there are other approaches to learning, such as evaluation that play a significant role in policy implementation and development. Evaluation has been described as an appraisal or systematic assessment of merit and/or worth (Guba & Lincoln, 2001). It is considered applied social research that is both transdisciplinary and an autonomous discipline (Scriven, 2013). The purpose of evaluation has been variably identified as performance improvement, organisational learning, accountability, learning about persistent social problems and how to address them, informing decision making and to democratise decision making (Alkin, 2013; Greene, 2013).

Evaluation involves evidence collection, often referred to as monitoring, and a process of applying judgement to an evaluand; or the subject of the evaluation. Evaluations can be formative to improve a program with feedback gained on processes and factors that may affect achievement of objectives, done during a program or policy implementation. In comparison, summative evaluations seek to determine a program's merit and worth, taken as the extent to which objectives have been achieved and the contextual factors that have affected the results, often done after completion of a program or policy (Patton, 2013). Regardless of the timing, both formative and summative evaluations look to achievement of stated policy or program objectives.

Scrivens (2013) argues that a widely held misunderstanding is "that the difference between evaluation and research is that *research* is aimed at the acquisition of new knowledge whereas *evaluation* is aimed at developing information for decision making." Scrivens instead draws a distinction between evaluative research and non-evaluative research, focusing on the distinction of value judgements used in evaluation.

### 2.2.1 Evaluation in Australia

In Australia, evaluation has been shaped strongly by public administration reforms in the 1980s, including the 1988 Evaluation Strategy (Rogers & Davidson, 2013). Australian evaluations have been described as concentrated to ongoing management of programs, commonly using theory driven approaches such as program theory or program logic, with emphasis on stakeholder participation (Rogers & Davidson, 2013). Program theory and program logic approaches to evaluation work within frameworks of causal pathways that articulate how program and project activities lead to achievement of desired outcomes, with these in turn leading to achievement of objectives (Funnell, 2000). Assumptions underpinning the causal relationships may be stated, with monitoring and evaluation seeking to test these assumptions. In the testing of assumptions, causal pathways are confirmed, achievement or contribution to achievement of outcomes is deduced, and eventually objectives are proven as being met.

Inclusive participation in the evaluation process from planning through to final judgement is seen as having a role in validity and credibility, not just to promote use and implementation of findings. The result is a close integration between evaluation and management with an expectation for program evaluation as driven by performance improvement and accountability, with results often structured as outputs and outcomes, as evidenced by indicators.

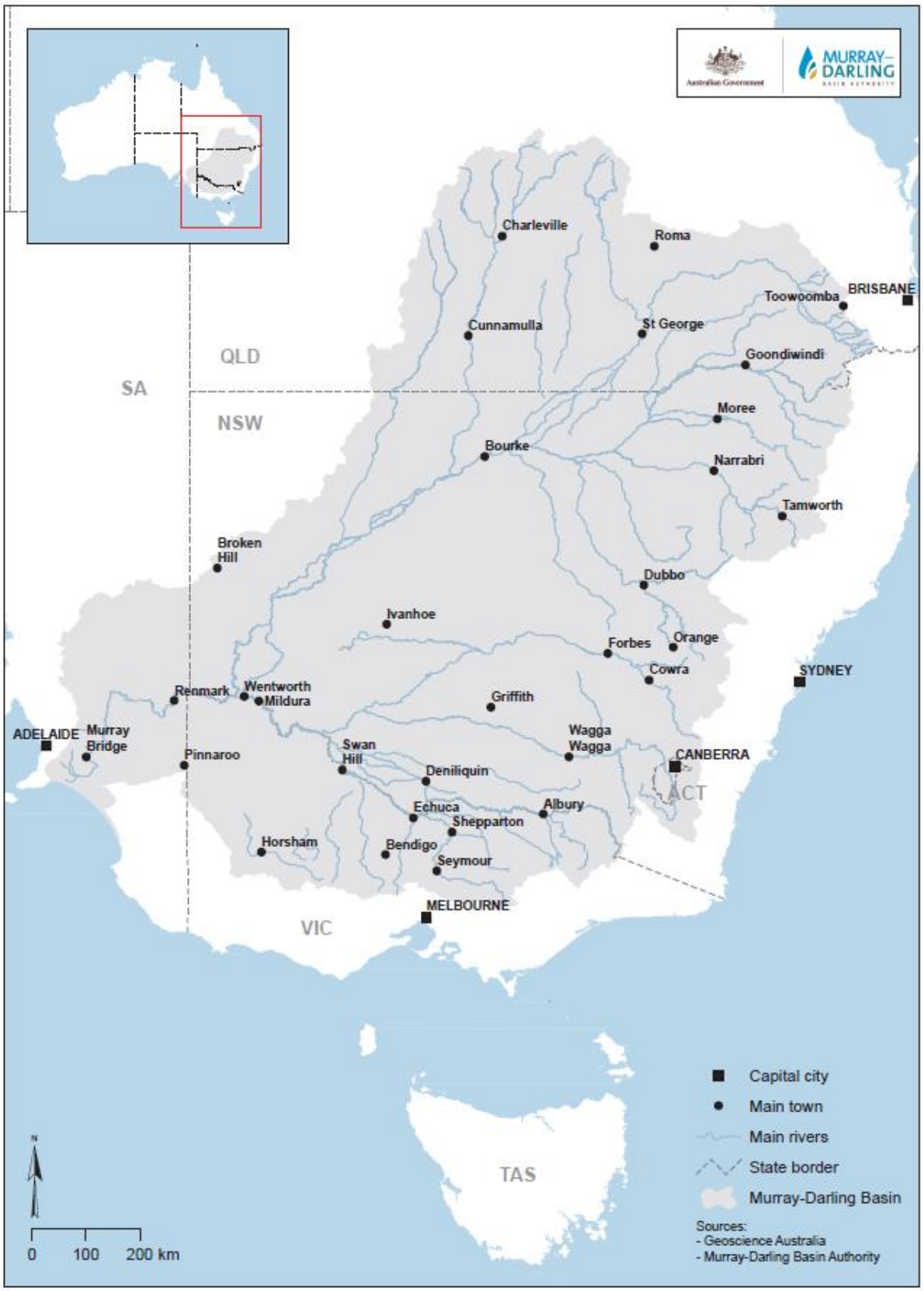
The performance improvement and accountability view of evaluation is most notable in the Australian Government's Caring for our Country Program, as commenced in 2007. This nationwide large scale investment introduced mandatory requirements for monitoring, evaluation, reporting and improvement (MERI) and has significantly influenced government natural resource management since. MERI has become an accepted part of the evaluation lingo. MERI is defined as "*simple concepts that, when applied, help us understand what is being achieved and help identify possible improvements, for projects and programmes*" and evaluation specifically as "*analysing the monitoring data and assessing what it means. Based on this, informed judgements can be made about the success of a project or programme and improvements can be identified*" ('Monitoring, Evaluation, Reporting and Improvement Strategy', 2014). This has further established evaluation as performance management and accountability, as structured by generally linear program logics of input-output-outcome level indicators. Evaluation is readily accepted as a part of good governance, serving a managerial mandate and providing accountability for the use of public resources.

## 3. Method

### 3.1. Case study – The Murray-Darling Basin

In 2012 adaptive management became a defined term in Australian legislation with the passing of the Murray-Darling Basin Plan (Basin Plan). At over 1 million square kilometres or 14% of Australia's land mass, the Murray-Darling Basin is Australia's largest water catchment and river system. It supplies drinking water to over 3 million people, contains wetlands of national and international importance, including 16 Ramsar sites and a World Heritage site. The Murray-Darling Basin also contains 40% of Australia's farms and produces over a third of Australia's food, valued between $10 billion and $15 billion. Water reform has been contentious as government attempts to reconcile historical over allocation of water to irrigation with the use of water to protect and restore wetlands of international biodiversity significance. The following overview of governance arrangements of the Murray-Darling Basin is brief and focused to key points necessary for this paper. Others have elsewhere published more

detailed accounts of the governance history, ecological and social challenges and conflict ( see (Connell, 2007)).



Source: http://www.mdba.gov.au/sites/default/files/cartographicmapping/8_Murray-Darling_Basin_Boundary.pdf, accessed 31/5/2016

Currently water governance and management is done by six jurisdictions, being each of the four States and the Territory that the Murray-Darling Basin spans and the Commonwealth. The Basin Plan determines the maximum volume of water that can be sustainably extracted for urban, industrial and agricultural use (sustainable diversion limits), provides the latest reform on water trading rules and sets a framework for the planning and use of environmental water. The Basin Plan is said to be based on the "best available science", with this also recognising that there remain unknowns in the system. In parts of the Murray-Darling Basin, scientific knowledge of the system is either imperfect, incomplete or system responses are unpredictable. In particular, the ecological, social and economic responses to the Basin Plan are uncertain, and remain points of contention and debate. To some, the very idea of setting sustainable diversion limits for the Basin as a whole, and assigning contributing volumes to parts of the Basin in this context of uncertainty is "folly" (Crase, 2012).

The State and Territory governments administer water licences that provide irrigators with a share of the water resource (also called entitlement), with the actual volume determined (share allocation) based on seasonal conditions. Water use and trade is governed through rules established in 36 regional scale Water Resource Plans, as developed by the State governments. These Water Resource Plans must align with the Sustainable Diversion Limits set by the Basin Plan and require accreditation by the Commonwealth. State and Commonwealth governments also hold water licences, as purchased from the market. This water is held by government in order to supply water to environmental assets such as wetlands, and is referred to as environmental water. The use and trade of environmental water is governed by the States' Water Resource Plans and State and Commonwealth level Annual Environmental Watering Plan and Long-term Environmental Watering Plans.

### 3.2. Method

The research was qualitative, using document analysis and interviews. Document analysis included legislation, planning documents, published reports, policy statements and published speeches. Documentation provided insight into government intentions for adaptive management, outlining commitments, processes and projects underway.

Interviews were conducted with Commonwealth and NSW policy makers and implementers to understand the reality of adaptive management, under the framework set by the Basin Plan and associated governance arrangements. The interviewees included past government employees involved in the development of the Basin Plan and those currently involved in its implementation. Regional stakeholders with roles within the governance arrangements for developing and implementing the Basin Plan and associated State planning instruments were also interviewed. In total, 30 interviews were conducted, with this sample covering different aspects of water reform within the Murray-Darling Basin. Saturation point, when no new themes were emerging was reached. The interviews were semi-structured and explored views and experiences of adaptive management in water management. The interviews included questions on the definitions of adaptive management, example cases of adaptive management in practice and challenges to adaptive management. The interviews were transcribed before being thematically coded using Nvivo software. The research takes a constructivist view and applies an inductive logic, with examples used to infer broader principles, meaning the research is descriptive.

## 4. Results

### 4.1. Intentions for adaptive management

The intentions for adaptive management have been determined from government document, including the Basin Plan and reports published by the Murray-Darling Basin Authority, and public speeches by the Chair of the Murray-Darling Basin Authority.

With the passing of the Basin Plan, "adaptive management" became a defined term in legislation for the first time in Australia[1]. In the Basin Plan *"**adaptive management*** is taken to include the following steps:

(a) setting clear objectives;

(b) linking knowledge (including local knowledge), management, evaluation and feedback over a period of time;

(c) identifying and testing uncertainties;

(d) using management as a tool to learn about the relevant system and change its management;

(e) improving knowledge;

(f) having regard to the social, economic and technical aspects of management." (Section 1.07 Basin Plan 2012, Cth)

With respect to the differences between active and passive adaptive management, the Basin Plan definition is taken here as predominantly passive, due to the statement of 'management as a learning tool', the use of evaluation as feedback in a context of set objectives, identified uncertainties and acknowledged social, economic and technical 'aspects'. The definition makes no reference to modelling or experimentation; it states 'objectives' rather than hypotheses and 'evaluation' rather than science or research; and emphasises local knowledge. While it can be argued that in doing several of the steps a) to f) experimentation and other active adaptive management processes can be used, it is not required by the definition. While there is some ambiguity, the definition points towards passive forms of adaptive management. In looking at how the term is applied to confirm this interpretation as passive, adaptive management as a defined term is used nine times throughout the Basin Plan. It is found in the:

- objectives for the Basin Plan[2;]

1 Other legislation, such as the NSW Water Management Act 2000 ambiguously refers to the "principles of adaptive management" (Section 5 Water Management Act 2000 No 92 Chapter 2 Water management planning Part 1 General Division 1 Water management principles), "objectives of adaptive management" (NSW Water Sharing Plans made under the Water Management Act 2000) or "an adaptive management framework" (Murray-Darling Basin Amendment Act 2002 – Schedule 1 http://www.austlii.edu.au/cgi-bin/sinodisp/au/legis/qld/bill_en/waolab2010362/waolab2010362.html?stem=0&synonyms=0&query=%22adaptive%20management%20%22)

2 "to establish a sustainable and long term adaptive management framework for the Basin water resources" (Section 5.02 Basin Plan Cth)

- purpose of Chapter 8 - Environmental Watering Plan[3];
- objectives of environmental management framework[4] with a note that "the application of adaptive management will enable various triggers to be responded to" (Section 8.11 Basin Plan 2012 Cth);
- principles of environmental watering, stating that "adaptive management should be applied in the planning, prioritisation and use of environmental water" (Section 8.40 Basin Plan 2012 Cth); and
- Chapter 13 – Program for monitoring and evaluating the effectiveness of the Basin Plan with monitoring and evaluation to include adaptive management processes[5];
- principles of monitoring and evaluating the effectiveness of the Basin Plan as "monitoring and evaluation findings, including in respect of progress towards meeting targets and trends in the condition and availability of the Basin water resources, should enable decision-makers to use adaptive management" (Section 13.04 Basin Plan 2012 Cth); and
- key evaluation question "to what extent has the program for monitoring and evaluating the effectiveness of the Basin Plan contributed to adaptive management and improving the available scientific knowledge of the Murray-Darling Basin?" (Section 13.06 Basin Plan Cth)

Across these references, adaptive management is intended to contribute to decision making, evaluation is to contribute to adaptive management and adaptive management will be evaluated. Adaptive management is about responding to triggers and applying a management process, confirming the passive interpretation. The relationship between science and adaptive management is not apparent, instead, monitoring and evaluation of the Basin Plan is seen to both contribute to adaptive management and to improving scientific knowledge.

The Murray-Darling Basin Authority describes the Basin Plan as an adaptive plan that "*is dynamic, and will be refined and updated with the knowledge gained from ongoing monitoring and evaluation framework*" (A Guide to the Murray-Darling Basin Plan, 2016). In a speech to the United Nations, the Chair of the MDBA described the Basin plan and its implementation as "*based on adaptive management*" because "*it's meant to be a flexible plan because in nature, things change. As we discover better ways to do things, we need to respond. Equally, we need to be ready to adjust to things like seasonal and climate changes*." In this speech the Chair also stated "*but, it's not just a 'science experiment'…the plan recognises the need to make judgements and decisions based on social and economic impacts*" and "*not everything happens in one day…communities need time to adjust to change and, for scientifically valid reasons, introducing a plan over time allows us to monitor, evaluate and adjust based on the new knowledge and evidence that confronts us as we move into the future*." (MDBA Chair Speech to UN, 2016). This managerial and passive interpretation is repeated in other public speeches and corporate documents, such as annual reports and provides insight into the organisation's internal view of adaptive management. The organisation and leadership has provided a strong rhetoric of adaptive management as necessary and intended.

---

3 "enabling adaptive management to be applied to the planning, prioritisation and use of environmental water" (Section 8.02 Basin Plan 2012 Cth)

4 to "enable adaptive management to be applied to the planning, prioritisation and use of environmental water" (Section 8.11 Basin Plan 2012 Cth)

5 "processes for reviewing and evaluating the Basin Plan, conducting audits, and assessing the condition of the Murray-Darling Basin, contributing to adaptive management" (Section 13.01 Basin Plan 2012 Cth)

Despite adaptive management as a defined term in legislation and strong public leadership level support for adaptive management the Basin Plan itself can be viewed as limiting adaptive management. For example, the legislated process for adjusting the Sustainable Diversion limits is widely viewed by policy makers and implementers as a great example adaptive management provisions. The Basin Plan acknowledges that the figures used to determine the Sustainable Diversion Limits were based on river management infrastructure expected to be in place and "*the level of scientific understanding of the Basin hydrology and ecology at that time*." As a result of these limitations, Chapter 7 of the Basin Plan outlines how the Sustainable Diversion Limits can be adjusted, with the process regarded as enabling adaptive management. However, for surface water the Basin Plan only permits adjustment on the basis of improved efficiency and supply of water. There are no provisions for new information on river systems, ecology or unpredicted negative impacts (social, economic or environmental). In addition, any experiential learning gained by river operators and Basin Plan implementers is not recognised as cause for change. The final limitation on adaptive management of the Sustainable Diversion Limits is that the net adjustment, Basin wide cannot be greater than 5%[6].

Lastly, and possibly most significantly, the coupling of adaptive management and evaluation in the Basin Plan can be viewed as limiting to adaptive management. Chapter 13 describes adaptive management as making a change as a result of an evaluation, effectively limiting adaptive management to occurring at a set time of the five and ten year reviews or through a political process as raised by a State Minister. Changing the Basin Plan requires an amendment to the legislation, or as one interviewee bluntly stated *"the bloody Act of course has to go through Parliament so it's not a trivial manner to change the Basin Plan."*

### 4.2. Reality of adaptive management

In interviews with policy makers and implementers of the Basin Plan, adaptive management was widely espoused as necessary and important. The reasons included demonstrating the success of the plan, improving implementation and to provide accountability. Statements of importance and support included *"It's really important, it's expensive to collect, but it would be just irresponsible not to do it"* and *"You obviously have to do it, and you have to do it as well as you possibly can. It's part of the accountability*".

However, in interviewing those involved in developing and implementing the Basin Plan for their definitions, the interviews confirmed its lack of meaning in reality. Adaptive management was described as *"more of a buzz word and an ideal rather than reality*" and *"It's a bit of an overused term, and I don't think we do it particularly well. I guess it's so overused I'm a bit over it to be honest*." One interviewee even stated *"the difficulty is though it's very, very, very hard to define. Nearly everybody you talk to, and you will probably find this, has got a different idea of what it is."* The definitions provided by interviewees commonly referred to learning by doing, checking progress to objectives, monitoring, review and management. One interviewee used the word hypothesis, but in a passive adaptive management way stating *"adaptive management is about coming up with probably a hypothesis, and then putting things in place to review that and adapt accordingly from the management outcomes."* In this, there was no discussion on putting experiments in place to test any hypotheses. Some interviewees acknowledged the difficulties of implementing large scale, replicated experiments in a varied landscape noting *"when you start talking about social-ecological systems, it becomes much*

[6] See Basin Plan, Section 7.19 "Note: This section allows a supply contribution or an efficiency contribution of more than 5% of total surface water SDL to each be given full effect in an adjustment, provided that the net effe ct across the Basin is within the 5% limit"

*more difficult, and you can't avoid your approach to adaptive management being more passive."* Evaluation language featured strongly, with some specifically noting efficiency and effectiveness with a typical definition provided by the interviewees being *"continuing to review, monitor, evaluate and rethink about how things should go and then adapt according to how you monitor things."*

Adaptive management, despite its definition and prescription in legislation remains an enigma in reality. In both intent and reality there is a dominance of passive forms of adaptive management, a loss of experimentation to gain scientific knowledge and a dominance of monitoring and evaluation language. The prevailing understanding of adaptive management by those implementing the Basin Plan is that adaptive management is part of or follows from an evaluation. Adaptive management is about achieving the policy's objectives, not changing or testing objectives; "*Adaptive management works on the basis of seeking to achieve the outcomes that were originally set, and having a robust and transparent process in place to make adjustments along the way, if needed to achieve those outcomes."*

#### 4.2.1. Examples of adaptive management and implementation challenges

To further understand adaptive management, the interviewees were asked for good examples of adaptive management. Several interviewees responded that they could not think of a good example of adaptive management and the same example was mentioned by a number of interviewees, confirming a shortage of adaptive management in practice. For those that could identify actual examples of adaptive management, in some contrast to the prevailing passive view of adaptive management, the examples also included active adaptive management. These examples mentioned experimentation at a site scale, for example to understand fish spawning. The presence of active examples is incongruent with the passive definitions. Others gave examples of passive adaptive management with adjustment of policy instrument or methods used to achieve a set objective, for example adjustments through efficiency projects or a scenario planning approach looking at what happened last year and current conditions to make decisions for the coming year. Passive adaptive management experiments that involved applying single treatments at a time to test a single hypothesis, such as weir pool height manipulations were also noted.

In seeking explanation for the limited availability of good examples of adaptive management, the challenges to adaptive management were questioned. The challenges identified by interviewees largely confirmed the literature. The 'usual suspects' of cost, unclear responsibilities, lack of information, organisational culture, time, data complexity, landscape differences and scale of implementation were identified (See Carter & Ross, 2013). For example, landscape differences and scale were seen to limit replication and transferability, with statements such as *"There are rivers where we are relaxing constraints, but we're not setting up an experiment. Could you compare, say, the Lachlan to the Gwydir? I just don't know if you could do it effectively"* and *"The bigger the area, the more the people, the less active it can be and the more you move into a passive."*

In describing challenges, evaluation featured strongly in responses. For example, cost was identified on the basis that *"in a tight fiscal environment, the monitoring and evaluation programs are the ones that tend to get dropped off, unfortunately."* Similarly, challenges associated with data complexity and quality of information was described as *"Having good data and information that's feeding into that. You've got to have a good monitoring program on the ground. You've got to be able to have an effective way of evaluating the outcomes from that."* In these cases evaluation is seen as adaptive management, in line with the noted merging of the concepts.

In addition to the usual suspects, or easy scape goats, conflict and politics were raised as challenges to adaptive management. These challenges surfaced as public support for decisions and cross jurisdiction

politics and accountabilities. For example, public support for decisions were seen as changing over time, creating a time limit or lifespan on legitimacy, *"even if you can accurately reflect community values and take them broadly into SDLs and you put it in, even if you could get that right, the following day you would be wrong, because community values are always changing."* and *"if you think some of the information maybe comes from the scientists then you've got to translate that information into a way that can win the public and bring the public along. We shouldn't underestimate the role of that, I don't think, in adaptive management in the long term being successful because ultimately you don't do anything unless you get the social licence to do it."*

When the Basin Plan was in development, it was argued that centralised governance of water resources will prevent local management and flexible responses (Crase, O'Keefe, & Dollery, 2011). Interviews with those working to implement environmental watering have confirmed that this is now a reality. To overcome the time lags and other difficulties with gaining departmental and ministerial approval for environmental watering, the Annual Watering Plans are drafted as options papers, outlining a number of possible environmental scenarios ranging from dry to wet. This enables some flexibility to be retained by environmental water managers.

The interviewees also commented on how conflict over water use restricts adaptive management, particularly when such a specific detail, such as a volume for Sustainable Diversion Limits is negotiated and then legislated. For example, *"I think it's also at odds with our political process and also what the community expect when they want finite outcomes to be clearly defined and delivered."* In this context, adaptive management becomes limited and any change to policy is a point of conflict; *"anytime those policies, particularly the ones that are legislated, that they need to be changed there's always going to be conflict. In the sense that you may wish to change policy because of learnings that have occurred over the past 3 or 4 or 5 or a decade, then yeah I reckon conflict is inevitable and it will make it a bit more difficult to get it through"* and *"There are too many people, too many vested interests who don't want to change things and they always take longer, hugely longer than you expect."*

Conflict and politics were also identified as impacting on cross jurisdiction politics and accountabilities. Recent government changes to responsibility for conducting external review and audit of Basin Plan implementation were described as reducing the imperative for the State's to respond and change, *"There needs to be a reporting process that both the states and the Commonwealth are committed to. The National Water Commission was a product of a COAG decision. The Productivity Commission isn't. The State's don't necessarily have buy-in to the Productivity Commission. … there's nothing to oblige the State's to actually make changes as a consequence of the Productivity Commission's reporting."* Here, a weakening of political will to change, through a loss of accountability, is seen as curtailing adaptive management.

## 5. Discussion

The definition of adaptive management provided by the Basin Plan connects adaptive management to evaluation. The prevalence of adaptive management as passive, initially in the legislated definition and most certainly in interpretation and implementation of adaptive management lends the concept to redefining as evaluation. This connection or redefining was echoed by the interviews. It could be regarded that linking to evaluation is a broadening of adaptive management, in line with that implied by the more recent references to adaptive management as structured decision making.

### 5.1. Adaptive Management and Evaluation in the Basin Plan

Adaptive management, perceived as evaluation in a performance improvement cycle has some compatibility to the Basin Plan's definition. In both passive adaptive management and evaluation the results of the policy are monitored and results used to inform a management response. In the Basin Plan, adaptive management is the change that occurs following an evaluation of progress towards the policy objectives. This is problematic on two fronts, firstly the loss of knowledge discovery and secondly value judgements.

Adaptive management, as a decision that follows an evaluation, reinforces the passive approach of monitor and respond, as the reaction to monitoring data. The policy or program itself becomes the single hypothesis that is being tested, limiting adaptive management to resolving unpredictability. The adaptive management ideals of scientific discovery to address uncertainties of incomplete and imperfect knowledge remain incongruent with evaluation. The role of knowledge discovery in adaptive management and evaluation differs significantly. Evaluation is not regarded as generating new scientific knowledge on ecosystems or natural resources. Instead evaluation seeks to confirm or refute the results of policy or program, with respect to the effectiveness, efficiency or appropriateness, of its intended objectives. In evaluation, science may be used to confirm an assumption underlying a causal link from action to outcome or outcome to objective, whereas in adaptive management, knowledge on system functioning is explicitly sought.

The role of value judgements differs significantly between adaptive management and evaluation. Adaptive management, taken as a process for improving policy and implementation through increasing knowledge of system behaviour does not involve passing judgement or assessing merit. In stark contrast, and as noted by Scrivens as a key distinction between research and evaluation, value judgements are central to evaluation that assesses the merit or worth of a policy or program. Particularly within the Australian culture of natural resource evaluation, evaluation focuses performance assessment and is managerial. In the dominant approach of program logic or program theory, the only role for new discovery is in the testing and confirmation of assumptions with monitoring used to confirm and gauge expected policy results. One interviewee noted this difference in evaluation and the scientific discovery of adaptive management, stating "*Data can kind of provide some of the script for the thinking about those choices, but the choices are so inherently a value choice. To suggest that its adaptive management gives it a scientism which I think isn't there."* Adaptive management, interpreted as following from evaluation, dramatically changes the role of science in the policy making process.

### 5.2. Implications to the role of science in policy

Both adaptive management and evaluation seek to learn, with the ultimate purpose being to gain improved policy outcomes. Adaptive management takes a view of scientific hypothesis testing to discover new knowledge while evaluation focuses to the experience gained in policy implementation to identify recommendations. In evaluation, and it could be argued also in passive forms of adaptive management, monitoring seeks to confirm existing beliefs of system operation. Monitoring does not aim to explore alternatives. Instead, it is structured to a confirmation and validation bias. The misinterpretation or reinterpretation of adaptive management to evaluation, redirects adaptive management to a performance management concept, as a managerial tool. It also means a weakening of scientific inquiry, with incremental improvement of policy towards its objectives. The reinterpretation of adaptive management to evaluation may merely be reflective of the most recent adaptive management pseudonym of 'strategic decision making'. However, in effect, the result is a marginalisation of science from the policy making process.

Whether or not this marginalisation is intentional, accidental or through ignorance remains somewhat debateable. It could be argued that the logistical challenges associated with adaptive management have steered adaptive management towards evaluation. It could also be argued that the conflict and political challenges have made evaluation a much more attractive prospect. The risk associated with science providing proof of poor or incorrect decision making by government may to too great. A few interviewees specifically spoke about the role of science, stating *"we've got to get the science out of it"* and explaining the passive approach to adaptive management in the Basin Plan as "*the talk here about experiment and science, it wasn't unacceptable.*" To these interviewees politics and science were not compatible, and as a result only certain forms or applications of adaptive management were palatable.

A fuller approach to adaptive management that systematically seeks to address more than just unpredictability through monitoring of outcomes is needed or policy development will be limited to incrementalism and first loop learning. The scientific testing associated with adaptive management that seeks to experiment to discover new knowledge and deliberative processes to engage multiple perspectives in decision making pushes towards, questioning objectives and values. In the absence of science, exploration and innovation of alternative solutions is limited.

## 6. Recommendations

A refinement to both adaptive management and evaluation practices is required to reinforce their respective contributions to policy planning and implementation. This solution recognises that scientific problem solving and performance improvement are both essential to governance of natural resources. For this adaptive management must remain as a distinct concept to evaluation, as both can generate significant knowledge and learning, with the findings ultimately used to improve policy. The common step of changing policy or making decisions based on findings is not an adequate reason to merge these concepts. That management may change or in other words, adapt, on the basis of findings, merely draws attention to the poor and ambiguous naming of the concept of adaptive management.

To overcome this, clear statement of uncertainties at the outset of policy design is required, as originally intended in the Basin Plan's definition of adaptive management. The most appropriate form of investigation can then be used to address each uncertainty. Imperfect knowledge is most likely to require some form of experimentation, incomplete knowledge to require some form of social inquiry and learning, while unpredictable response to policy may be best addressed through evaluation to test if expected causal impacts occurred and indeed, contributed to achievement of objectives.

However, the politics remain most challenging to the practice of adaptive management and inclusion of science in policy. The political risks associated with 'being wrong', particularly in a high conflict context such as water, are significant. There remains a strong political need to remain accountable to highly negotiated and specific outcomes, such as a volume of Sustainable Diversion Limit, making change unlikely. In addition, the bipartisan support for the Basin Plan, passing through parliament with 95 for and only 5 opposing along with the review and amendment processes required to adjust the legislation, makes any significant change unlikely. In this political environment, the science involved in adaptive management represents risk. To overcome this significant challenge to adaptive management requires a change in governance structures and practices, particularly to maintain accountability alongside adaptive management.

## 7. Conclusion

Adaptive management and evaluation are two distinct concepts and practices. Despite the differences there has been a coupling or merging of the two, both in intent and reality. The dominance of evaluation and its paradigm of performance improvement designed to test the achievement of set objectives, acts to confirm policy choices and contributes to decision accretion and 'muddling through'. It fails to test alternative hypotheses and overlooks questioning the underlying values that contributed to initial decision making. Over time, it leads to a narrowing of choices, with incremental muddling through.

There are a number of logistical challenges that may have contributed to the merging of adaptive management and evaluation, but the underlying causes are conflict and politics. In the conflict context of the case study, adaptive management poses a political risk, with science having the potential to question the wisdom of past decisions. Prescription of adaptive management in legislation may provide adequate impetus for organisations to overcome the logistical challenges to adaptive management, but fails to address the underlying conflict and politics of the policy in focus. An evaluation focus on validating objectives remains preferable, confirming policy choices and providing accountability. As a result science is being marginalised from policy, with significant implications to discovery and innovation.

**References**


Alkin, M. C. (Ed.). (2013). *Evaluation roots: a wider perspective of theorists' views and influences* (2nd ed). Los Angeles: SAGE Publications.

Allan, C. (2009). Reviewing adaptive management through a wicked lens. *Contested Country: Local and Regional Natural Resources Management in Australia*, 215.

Allen, C. R., Fontaine, J. J., Pope, K. L., & Garmestani, A. S. (2011). Adaptive management for a turbulent future. *Journal of Environmental Management*, *92*(5), 1339–1345. http://doi.org/10.1016/j.jenvman.2010.11.019

Allen, C. R., & Gunderson, L. H. (2011). Pathology and failure in the design and implementation of adaptive management. *Journal of Environmental Management*, *92*(5), 1379–1384. http://doi.org/10.1016/j.jenvman.2010.10.063

Basin Plan 2012 Cth Accessed 2016, May 31. Retrieved from https://www.legislation.gov.au/Details/F2012L02240

Berkes, F. (2007). Understanding uncertainty and reducing vulnerability: lessons from resilience thinking. *Natural Hazards*, *41*(2), 283–295. http://doi.org/10.1007/s11069-006-9036-7

Brugnach, M., Dewulf, A., Pahl-Wostl, C., & Taillieu, T. (2008). Toward a Relational Concept of Uncertainty: about Knowing Too Little, Knowing Too Differently, and Accepting Not to Know. *Ecology & Society*, *13*(2).

Carter, R. W. (Bill), & Ross, H. (2013). Tyrannies of effective monitoring and evaluation. *Australasian Journal of Environmental Management*, *20*(4), 263–269. http://doi.org/10.1080/14486563.2013.860872

Connell, D. (2007). *Water politics in the Murray-Darling basin*. Federation Press.

Crase, L. (2012). The Murray–Darling Basin Plan: An Adaptive Response to Ongoing Challenges. *Economic Papers: A Journal of Applied Economics and Policy*, *31*(3), 318–326.

Crase, L., O'Keefe, S., & Dollery, B. (2011). Some observations about the reactionary rhetoric circumscribing the guide to the Murray–Darling Basin Plan. *Economic Papers: A Journal of Applied Economics and Policy*, *30*(2), 195–207.

Dovers, S. (2009). Normalizing adaptation. *Global Environmental Change*, *19*(1), 4–6.

Eberhard, R., Robinson, C. J., Waterhouse, J., Parslow, J., Hart, B., Grayson, R., & Taylor, B. (2009).

Adaptive management for water quality planning–from theory to practice. *Marine and Freshwater Research*, *60*(11), 1189–1195.

Funnell, S. C. (2000). Developing and using a program theory matrix for program evaluation and performance monitoring. *New Directions for Evaluation*, *2000*(87), 91–101.

Greene, J. C. (2013). Making the World a Better Place Through Evaluation. In *Evaluation roots: a wider perspective of theorists' views and influences* (pp. 208–217). Los Angeles: SAGE Publications.

Guba, E. G., & Lincoln, Y. S. (2001). Guidelines and checklist for constructivist (aka fourth generation) evaluation. *Retrieved June*, *18*, 2008.

Guide to the Murray-Darling Basin. (2016, April 10). Retrieved from http://www.mdba.gov.au/basin-plan/plan-murray%E2%80%93darling-basin

Gunderson, L., & Light, S. S. (2006). Adaptive management and adaptive governance in the everglades ecosystem. *Policy Sciences*, *39*(4), 323–334. http://doi.org/10.1007/s11077-006-9027-2

Lee, K. N. (1993). *Compass and gyroscope*. Island Press, Washington, DC.

Loftin, M. K. (2014). Truths and governance for adaptive management. *Ecology and Society*, *19*(2), 21.

MDBA Chair Speech to UN. (2016, April 10). Retrieved from http://www.mdba.gov.au/media/mr/mdba-chair-speech-un

Monitoring, Evaluation, Reporting and Improvement Strategy. (2014, July 1). Australian Government. Retrieved from http://www.nrm.gov.au/publications/meri-strategy

Pahl-Wostl, C. (2009). A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes. *Global Environmental Change*, *19*(3), 354–365.

Pahl-Wostl, C., Conca, K., Kramer, A., Maestu, J., & Schmidt, F. (2013). Missing links in global water governance: a processes-oriented analysis. *Ecology and Society*, *18*(2), 33.

Patton, M. Q. (2013). The Roots of Utilization-Focused Evaluation. In *Evaluation roots: a wider perspective of theorists' views and influences* (2nd ed, pp. 293–303). Los Angeles: SAGE Publications.

Rogers, P. J., & Davidson, E. J. (2013). Australian and New Zealand Evaluation Theorists. In *Evaluation roots: a wider perspective of theorists' views and influences* (2nd ed, pp. 371–385). Los Angeles: SAGE Publications.

Scarlett, L. (2013). Collaborative adaptive management: challenges and opportunities. *Ecology and Society*, *18*(3), 26.

Scriven, M. (2013). Conceptual Revolutions in Evaluation: Past, Present and Future. In *Evaluation roots: a wider perspective of theorists' views and influences* (2nd ed, pp. 167–179). Los Angeles: SAGE Publications.

Walters, C. (1997). Challenges in adaptive management of riparian and coastal ecosystems. *Conservation Ecology*, *1*(2), 1.

Walters, C. J., & Holling, C. S. (1990). Large-scale management experiments and learning by doing. *Ecology*, *71*(6), 2060–2068.