Murray–Darling Basin Environmental Water Knowledge and Research Project

Decision Support Tool Strategy

Prepared by: The Murray–Darling Freshwater Research Centre

Final Report

MDFRC Publication 60/2014

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Decision Support Tool Strategy

Final Report prepared for the Department of the Environment by The Murray–Darling Freshwater Research Centre.

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This report was prepared by The Murray–Darling Freshwater Research Centre (MDFRC). The aim of the MDFRC is to provide the scientific knowledge necessary for the management and sustained utilisation of the Murray–Darling Basin water resources. The MDFRC is a joint venture between La Trobe University and CSIRO.

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Report Citation: MDFRC (2014) Murray–Darling Basin Environmental Water Knowledge and Research Project: Decision Support Tool Strategy. Final Report prepared for the Department of the Environment by The Murray–Darling Freshwater Research Centre, MDFRC Publication 60/2014, May 2015, 14pp.

Cover Image:

Photographer: Ben Gawne, MDFRC

Document history and status

Version	Date Issued	Reviewed by	Approved by	Revision type
Draft 1	12/5/15	Ben Gawne	Ian Burns	Editorial
Draft 2	12/5/15	M.Kavanagh	Ian Burns	Copy edit

Distribution of copies

Version	Quantity	Issued to
Draft	1 x Word	Nadia Kingham
Final	1 x PDF	

Filename and path:	g:\she - life sciences\mdfrc\projects\dsewpc\465 mdb ewkr\project management\phase1 milestones_final versions\finalised and versions uploaded\m15_mdb ewkr phase 1 dst strategy final.docx
Author(s):	**The** Murray–Darling Freshwater Research Centre
Author affiliation(s):	**The** Murray–Darling Freshwater Research Centre
Project Manager:	Ian Burns
Client:	Department of the Environment
Project Title:	Murray–Darling Basin Environmental Water Knowledge and Research Project
Document Version:	Final
Project Number:	M/BUS/465
Contract Number:	465

Contents

1 Introduction

The Murray–Darling Basin (MDB) Environmental Water Knowledge and Research (EWKR) project is a 5 year, $10 million project to improve the science available to support environmental water management, and thereby contribute to achieving Basin Pla n objectives. MDB EWKR will undertake research aimed at better understanding:

- The links between ecological responses to flow and medium and long-term changes in condition; and
- The impacts of threats (hydrological, aquatic and terrestrial) which may reduce or prevent the ecological improvement expected through environmental flow regimes.

In turn, this improved understanding will:

- Enhance environmental water management and complementary natural resources management to improve environmental outcomes (predominantly biotic outcomes); and
- Build capacity to report against Basin Plan objectives and targets. The ability to explain ecological improvement within the context of multiple threats will be important in building and maintaining public confidence in the Basin Plan.

The project aims to collaborate with water managers, asset managers, water planners, scientists and relevant community groups to identify research priorities, and undertake research targeted at addressing those priorities. Phase 1, through to mid-2015, is a planning phase to identify research priorities, develop research project plans and agree collaborative arrangements to undertake the work. Phase 2, delivery of the research, will commence in mid-2015 and run through to 2018/19.

The research will support the Commonwealth's collaborative approach to environmental water management in the Basin. A key element in achieving this objective is the process of making knowledge available to support management decisions. The Project will address this challenge through the development and implementation of;

- a Communication Strategy, and
- a Decision Support Tool strategy.

This Decision Support Tool Strategy (the Strategy) outlines the approach for development of Decision Support Tools that will be a key part of the Project's legacy.

2 Purpose

2.1 Project objectives

The research objectives for MDB EWKR are to improve the understanding of:

- How environmental flow management influences ecosystem function and thereby sustains biodiversity;
- How the major drivers of system condition (e.g. environmental flow, land use, invasive species etc.) interact to affect biodiversity, ecosystem function, resilience and water quality;
- How threats (hydrological, aquatic and terrestrial) may reduce or prevent the ecological improvement expected through the application of environmental water;
- How management or delivery of environmental flow influences environmental outcomes achieved over time;

    - What the links are between ecosystem responses to watering regimes (e.g. natural and/or managed events) and incremental changes in ecological condition;
- How complementary water management and natural resource management enhance the outcomes of environmental water management; and
    - What the links are between ecosystem responses to management interventions (water management and natural resource management) and incremental changes in ecological condition.

2.2 Project outcomes

The project is expected to make a significant contribution to the ability to assess and understand incremental changes in ecological condition in the medium to long-term within the context of multiple management interventions, stressors and pressures and will support the following outcomes:

- Improved capacity to predict outcomes of environmental flow allocations and their management over one to five years;
- Development of predictive tools and conceptual models to inform environmental watering regimes;
- Improved water management and complementary natural resource management;
- Built capacity to set realistic objectives and targets for water management and complementary natural resource management as the climate changes;
- Improved environmental water effectiveness through the application of science to the development and operation of environmental works and measures;
- Improved monitoring, evaluation and reporting on progress toward the Basin Plan environmental objectives and targets;
- Built capacity to report against Basin Plan environmental objectives and targets.

The types of predictions that MDB EWKR seeks to improve are;

1. Ecological responses to environmental flows (e.g. timing, duration, depth, rate of recession etc.) and links to incremental changes in condition (short, medium and long term). It is anticipated that these predictions will inform the application of environmental water into the future.
2. The effects of stressors (hydrological, aquatic and terrestrial) that may impede, reduce or prevent the system's response to flow protection or restoration. It is anticipated that these predictions will inform adaptive management and facilitate appropriate threat prioritisation and management intervention (both water management and natural resource management) where possible.

It is anticipated that these predictions would be used to support;

- **Planning**. Planning environmental flows requires an understanding of the system's flow requirements and how these may vary in response to;
    - characteristics of the specific system,
    - condition of the system,
    - the context in which the intervention will occur.

- **Implementation**. The implementation of an environmental water action is subject to a range of influences including the;
    - system's water requirements,
    - flow conditions at the time,
    - constraints on delivery including;
        - channel capacity

  - volumes of water available
  - emerging risks.

  In this context, predictions need to be made about the outcomes of the flow that can be delivered and any risks that may emerge from the action, including damage to the system (e.g. anoxic blackwater, salinity, sediment transport) and initiating processes that can't be sustained (e.g. waterbird breeding and recruitment, tree germination and recruitment).

- **Monitoring**. Designing the monitoring of an environmental flow involves a number of decisions concerning the indicators and variables to be monitored, the intensity and frequency of sampling. Improved predictions of the outcomes of environmental flows will improve the effectiveness and efficiency of monitoring, thereby increasing its value to managers.
- **Evaluation**. The evaluation of environmental flow outcomes requires both a prediction of what would have happened in the absence of the flow, but also consideration of the whether the outcomes could be improved and how decisions could be improved. The latter consideration requires prediction of the factors likely to facilitate or limit the outcomes of environmental flows.

2.3 Project phases

The Project is being undertaken in two phases:

- Phase 1 (June 2014 to March 2015); and
- Phase 2 (2014/15 – 2018/19).

Phase 1 is dedicated to scoping and planning implementation of the research activity to be undertaken in Phase 2. The outputs of Phase 1 include a detailed Scoping Report, Project Plan, Research Methodology and Communications Strategy.

Phase 2 is the implementation phase. During Phase 2 research will be conducted from a whole of Basin perspective at four aquatic asset sites in key geographical locations – the Upper Murray, Lower Murray, Macquarie Marshes and Lower Balonne. Site locations are illustrated in Figure 1 below. The research at these four sites will be segmented into four priority research themes – water birds, fish, vegetation and food webs (Research Themes). The outputs of Phase 2 will include research plans, annual work plans and progress reports.

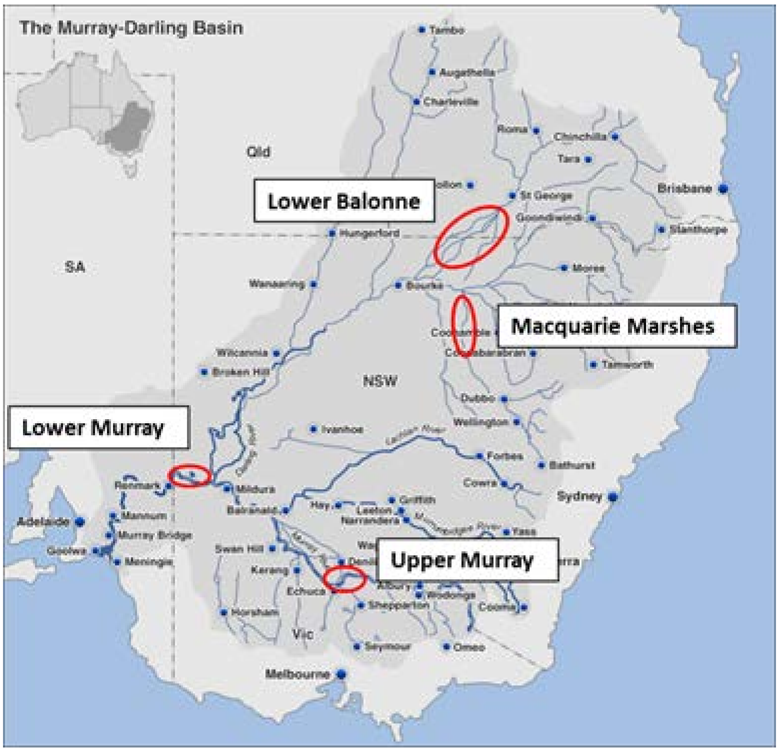

Figure 1: Location of selected research sites

2.4 Scope and purpose of the DST Strategy

The DST Strategy in conjunction with the Communication Strategy describes the process by which the MDB EWKR Project Team will present and share knowledge to support management decisions. The Communications Strategy outlines and guides the full package of communication and engagement activities, whilst the DST Strategy focuses on one key element of the overall package, being decision support tools.

The primary objective of this Strategy is to facilitate the application of ecological knowledge to environmental water and NRM decision making through the production of purpose built tools, or improvement of existing tools.

The main focus of these tools will be the research outcomes (improvements in predictive capacity) that emerge from MDB EWKR, however it is likely the existing knowledge and knowledge developed through other concurrent projects will be incorporated into those tools.

It is expected that the Strategy will support the application of the principles of adaptive management to the management of environmental flows. Along with the Communications Strategy, it may also assist in building relationships between the management and research communities to support ongoing development of decision making processes

The Strategy will provide a direct contribution to the achievement of the project outcomes, described in Section 2.2.

2.5 Context

Decision Support Tools (DSTs) are models that predict the ecological response from the delivery of environmental flows. DSTs may also be called ecosystem response models. The models may be quantitative or qualitative, and predict one or multiple ecological responses. They may enable the assessment of management strategies overlaid on historical flow sequences, or predict the outcomes from future watering scenarios. Numerous decision support tools have been developed over the last 15 years and include (but are not limited to):

- the Murray Flow Assessment Tool (Young *et al.* 2003);
- the 'Blackwater Model' (Howitt *et al*. 2007);
- the IBIS Decision Support System (Merritt *et al.* 2009);
- the Fish in Wetlands Decision Support Tool (Vilizzi *et al.* 2011); and
- Eco Modeller, part of the E-Water Source Toolkit (http://www.toolkit.net.au/Tools/Eco-Modeller).

To gain a robust understanding of how DSTs are currently used to support environmental watering and potential DST opportunities for MDB EWKR, MDFRC commissioned a *Review of Existing Decision Making Processes and Decision Support Tools in Environmental Watering* (the Review). The Review was undertaken by consultants Evaluation and Sustainability Services. The Review provided a number of findings relevant to this Strategy. The Review found that:

- generally DSTs are not a common tool in the environmental water decision making process;
- the DSTs that are applied come in a variety of forms from procedures, to spreadsheets, to hydrographic models to some flow response models. They are also acknowledged as just one input to the decision making process;
- DSTs in the context of quantitative ecological response models are generally not used; and
- environmental water managers consulted in the Review generally thought that the issues are too complex to develop models that can be applied in one location let alone transferred to others.

Through the Review, environmental water managers generally expressed the view that MDB EWKR would do better to focus on addressing the research questions rather than development of DSTs given the budget and timeframes. Also the research questions need to be addressed first as this would inform any tool development. Finally a number of responses indicated that the issues of transparency and application could be enhanced through the development of other tools such as decision support trees.

The MDB EWKR project is committed to facilitating the application of its research outcomes to management decisions, however, the outcomes of the Review would suggest that further investment in the types of DST that have been developed in the past may not represent an effective or efficient means of achieving the project's objectives. The remainder of this section explores some of the factors that may influence the effectiveness and adoption of DSTs.

2.6 Factors influencing the effectiveness and adoption of DSTs

The Review identified a range of factors that influence the use of DSTs. These factors, and others considered to be significant, are discussed below.

2.6.1 Quality of predictions

Predicting the responses of natural systems to interventions is challenging, partly due to the complex nature of those systems. The outcome of a flow is influenced by a large number of interacting factors that interact across scales and the interactions may alter key relationships between components of the system (Schindler & Hillborn 2015). In the broadest terms, the response to an environmental flow is influenced by:

- The characteristics of the system receiving the flow
    - e.g. river channel, wet meadow, deflation basin.
- The condition of the system receiving the flow
    - e.g. vegetation condition, egg bank condition, sediment organic matter content.
- The characteristics of the flow
    - e.g. timing, magnitude, duration, rate of rise and fall.
- The nature of the connection between water source and system
    - e.g. pump, channel, regulator, overbank.
- The characteristics and condition of the broader landscape in which the system is imbedded
    - e.g. fish present in the river, vegetation cover, invasive species.

There is at least some evidence to suggest that each of these high level factors may influence the outcome and within each there are myriad secondary and tertiary factors that may influence the outcome. This complexity raises a number of important issues. The first is that with this level of complexity and our current knowledge, predicting outcomes is going to be associated with high levels of uncertainty.

The second critical issue is that even if we were capable of developing models that integrated all these influences to generate a prediction, managers are never going to have access to all the information required to make anything other than very general predictions.

There are a number of consequences arising from these observations, specifically;

- simplistic models of flow response are more likely to make inaccurate than accurate predictions. This is likely to undermine manager's confidence in the models, particularly in light of the expectations that often accompany the models; and
- complex models may also create barriers to adoption due to perceptions around the cost of both generating the information required to run the model, but also the costs associated with gaining the technical proficiency required to run them.

2.6.2 Lack of monitoring

There have been a number of examinations of monitoring of aquatic restoration (Brooks & Lake 2007, Brooks *et al.* 2002) and environmental flows (Meredith & Beesley 2009) that have revealed that most interventions are not monitored. Without monitoring in place, detailed feedback on the effectiveness of their actions will not be available and in the instances where an action is not entirely effective there will be no incentive or ability to apply the principles of adaptive management.

2.6.3 Application problems

As noted above, there are four situations in which a DST may be applied; planning, implementation, monitoring and evaluation. While the questions managers have in each situation may be broadly similar, the details will vary and, as a consequence, the capacity of a manager to confidently apply a DST will vary among the situations. For example, a habitat preference curve based DST may be appropriate for planning, but will be less suitable for operational decisions and of very limited value to an evaluation of outcomes.

Even within the four situations there can be considerable variation in the;

- levers available to managers;
- constraints imposed on both decisions and flow management;

- flow actions and the regimes of which they are part; and
- environmental objectives.

This variation provides a challenge for the designers of DSTs who are faced with a trade-off between keeping the DST simple and relatively easy to use or complex with as many of the major influences on decisions captured. Even if the designer opts to include a large number of levers, it is unlikely that they would be able to include all variations.

This challenge has two sharp edges, the first is that the lack of relevance to a specific situation is likely to undermine a manager's confidence in the DST's capacity to generate a useful prediction, while keeping the DST simple is likely to increase the likelihood that key influences on the outcome will not be captured, thereby increasing the uncertainty around the prediction and undermining management confidence.

2.6.4 Costs

When considering whether to adopt or apply a DST, managers are likely to consider the costs in terms of purchasing, the initial cost of learning to use the DST and the subsequent time cost of running the DST and interpreting the outputs.

The initial purchase and training costs may not appear significant, but they need to be considered within both the institutional and individual circumstances. For many managers, the investment of time in learning how to use a DST which may only be used for a short period of time each year and would then need to be re-learnt the following year may represent a barrier to implementation.

2.6.5 Development process

The development of DSTs within Australia has tended to be characterised along a spectrum of small boutique tools developed for specific situations or general DSTs designed to be applied to a wide variety of situations. The model relied on for the development and adoption of large generic DSTs is the purchaser-provider model that treats knowledge as a commodity that can be bought and sold. There are a number of issues that arise from this model, including;

- **Trust**. Managers need to trust the knowledge they are using and overcoming this trust issue is a much greater challenge for centrally developed generic DST.
- **Applicability**. Managers are often concerned about the capacity to apply knowledge generated in one area to their own situation. In many cases this concern is well founded even if it may at times appear parochial.
- **Appropriate**. As discussed earlier, there is considerable variation across the Basin in terms of the ecosystems being managed, the processes employed to make decisions and managers preferences in terms of both learning strategy and appetite for risk. It is a major challenge for a centrally developed DST to appear appropriate in all the possible situations.

All these issues could be overcome, but the challenge is exacerbated when the development model is purchaser-provider and the managers are not engaged in the development process which would enable trust to be developed, important features to be adapted and opportunities for adoption identified by the manager.

2.6.6 Role in decision making

In understanding the current use of DSTs, and potential for development of DSTs in MBD EWKR, it is important to understand that multiple lines of evidence support environmental water decision making, and that DSTs (at best) will provide one input to that process. Other lines of evidence that support decision making include:

- corporate knowledge, including experience from past watering events;
- monitoring and evaluation of past watering events, both at the site and from across the Basin; and
- knowledge from past research and monitoring activities, both at the site and from across the Basin.

2.6.7 Summary

The Review revealed that DST are not widely used by managers and the discussion above reveals some of the factors that contribute to this situation. The main issues are;

- capacity to predict outcomes;
- lack of incentive for improving decision making processes;
- issues with application;
- costs;
- development processes; and
- role in decision making processes.

By highlighting these challenges it is hoped that the MDB EWKR DST strategy will identify ways of supporting management decisions through the provision of information in a way that is compatible with their decision making processes. At the same time, the MDB EWKR projects needs to acknowledge that some of factors limiting DST uptake are beyond the control of the MDB EWKR project, but that they should be considered as context or risks for proposed activities.

3 Approach

The Review outlined in Section 2.5 identified that DSTs are not currently used extensively to support environmental water decision making, and that MDB EWKR should exercise caution in developing further DSTs or refining existing DSTs. Findings of the review suggest MDB EWKR should first focus on research to address the research questions and associated knowledge gaps, and then consider the best mechanisms to communicate the research outcomes to support environmental water and NRM decision making.

Accordingly this Strategy presents an approach to further scoping and then developing appropriate DSTs, rather than providing a work plan leading to the production of specified DST products. This approach is described through this section of the Strategy.

The concept of a DST is also broadened in this Strategy, beyond the scope of traditional DSTs to include a range of other products that could support environmental watering and NRM decision making. Potential options are discussed in Section 4. Additional or alternative options may also emerge through the proposed scoping process.

3.1 Step 1: Identify potential improvements in predictive capacity

Phase 1 of MDB EWKR will identify the approach to addressing the selected research questions. Early in Phase 2, the project team will identify the specific outcomes that will likely emerge from this research, particularly the potential cause-effect relationships that may be determined will underpin improvements in predictive capacity. Once this step in the planning process has been completed, the information and the timeline of its availability will inform the development of the DST.

3.2 Step 2: Identify opportunities to support decision making

The Review identified key decision points and decision making processes in environmental watering across the Basin. Step 2 will identify opportunities within this process where research outcomes identified at Step 1 could further support existing decision making. This will occur through engagement with environmental water managers, with the discussion to identify:

- the specific decisions that could be supported by the research outcomes;
- the context and process in which those decisions are currently made, and the information sources currently used to support those decisions; and
- options for presenting the research outcomes to support the specific decisions, including the extent to which other information should be integrated.

3.3 Step 3: Scope potential outputs and activities

Once the project team has integrated information about project outputs and management needs, they will develop a suite of potential outputs and activities that they believe will contribute to achievement of the DST Strategy objectives.

Once the suite of outputs and activities has been developed, managers will be engaged in a process of feedback, refinement and adaptation. The outcome of this process will be a prioritisation of the outputs and activities and the identification of those for which a pilot will be undertaken.

3.4 Step 4: Develop pilot outputs

The objectives of the pilot will be;

1. A proof of concept to identify value and effectiveness from a management perspective.
2. An opportunity for engagement with managers in the development of the output or activity.
3. Opportunities for refinement or adaptation of the output that are easier to adopt in the early stages of development.

The pilots will be overseen by a steering committee comprised of managers and researchers with the development process being undertaken by appropriately qualified personnel who may be sourced from within the project team or from external providers of technical expertise.

In some, perhaps all, instances, the relationships being developed by the MDB EWKR project will not be available for use in the pilot. If this is the case, existing predictive capacity will be used as the foundation for the activity with a view to adapting the output to MDB EWKR research outputs as they become available.

3.5 Step 5: Evaluate pilot outputs

The evaluation process will engage with managers to provide them with an opportunity to provide feedback and propose either improvements or novel outputs or activities. The feedback will be used to refine or prioritise the DSTs to guide those that will be further developed using research outcomes from MDB EWKR.

The prioritisation process will engage with the management community and their needs and feedback will be distilled into Terms of Reference for the final suite of MDB EWKR DST. The final step will be to get approval from the JRG and Project Steering Committee.

3.6 Step 6: Develop MDB EWKR outputs

The Terms of Reference will provide the foundation for development of the DST. Project teams will be assembled that comprise researchers, managers and additional technical expertise who will undertake the development of the DST. In some instances the project teams will include the custodians of existing DST that the MDB EWKR will seek to adapt or modify. The process will be collaborative with the roles of team members broadly being;

- researchers will have responsibility for delivering the ecological outputs, including key relationships, conceptual models or model outputs in a form that is appropriate for the DST;
- technical experts will be responsible for packaging outputs into the DST; and
- managers will be responsible for providing a clear vision of management need and providing input into trade-offs that will inevitably emerge in the development process.

It is anticipated that Beta version DST will be available around six months prior to the completion of the project which will enable time for the remaining two steps of the DST development process.

3.7 Step 7: Evaluate MDB EWKR outputs

Once the draft versions are available, there will be an opportunity for managers to access and use the DST. Feedback will then be sought from managers about the value of the DST and how they may be refined in the future. The process will also seek input on how managers might apply the DST to their decision making processes, either directly or through the integration of DST outputs with other inputs into decision making processes. This feedback will be included in the briefing material that accompanies each DST.

3.8 Step 8: Establish MDB EWKR legacy

The final step in the process will be the lodgement of the DST with an appropriate custodian to ensure that they remain freely available to both managers and those who may wish to adapt them through the incorporation of new knowledge or to use existing knowledge in a new way or within a new context. In some cases it is anticipated that the MDFRC will be the custodian, while in others, there may be institutions that may provide better networks, complementary activities or an interest in the ongoing refinement and adaptation of the DST. In deciding how to manage the DST the following principles will be used as a guide;

- access to DST;
- potential to facilitate adoption; and
- opportunities to modify or adapt DST to improve their value to management.

4 Potential outputs and activities

Below are some initial ideas on potential outputs and activities. As described in Section 3, options will be further scoped with environmental water managers.

4.1 Model visualisations

Many existing DSTs are comprised of a suite of flow response relationships that are imbedded within a software package. The DSTs enable managers to compare outcomes from a range of flow management scenarios. One of the disadvantages of these types of DST is that many of the internal relationships are often opaque to the user, both in terms of the individual ecological response relationships and the integration of outcomes within the DST. This can make it difficult for managers to understand the critical relationships that generate the output and, for operators with limited experience, the capacity to identify when the model is producing spurious outputs.

On the other hand, flow-response relationships in their pure form can seem abstract. For example, fish population models may exist as a mathematical equation, which can be difficult to interpret and may not clearly communicate the influence of different factors such as climate or management levers.

One potential remedy to address these issues would be to develop data/relationship visualisation tools that would make key relationships clear and, where possible, the outcomes of interactions among drivers of ecosystem response. The visualisations could demonstrate outcomes and key relationships over relevant timeframes, and show the influence of different management strategies. Environmental water managers could be engaged in this process by selecting the timeframes and modelled management strategies. In other areas of science, visualisation is a rapidly developing field and there may be value to the MDB EWKR in exploring ways of presenting the outputs of their research through novel, interactive data or model visualisation techniques.

The objective of the visualisation tools would be to communicate the way that key drivers interact to produce outcomes in a way that would support managers either developing their own expected outcomes from planned actions or refining the predictions of a general DST to suit their specific circumstances.

4.2 Wiki for water requirements

Access to reliable information on ecosystem water requirements remains an ongoing challenge for managers. There have been a number of reviews under taken (e.g. Roberts & Marsden 2000, Rogers & Ralph 2010) which provide an excellent resource. These sources are, however, static and opportunities to update information or capture anything other than published information is limited.

The MDB EWKR project could explore the possibility of establishing a Wiki (a web application designed for collaborative modification, extension, or deletion of its content and structure). This facility would summarise the best available information on water requirements, but then also provide access to information on how those water requirements might be expected to vary spatially across the basin in response to local conditions, and over time in response to different climatic conditions.

The capacity of the Wiki to manage information contributed by a range of stakeholders could be explored. The aim of this would be to establish an ongoing communication channel between researchers, managers and stakeholders.

Developing a Wiki of this type would be a significant activity, and the capacity to deliver this within MDB EWKR would require further consideration. The key difference between a 'Wiki' and past knowledge synthesis activities is the capacity for the knowledge to be easily updated over time. This functionality would need support and moderation and so if this tool were to be developed it would need a business case for its ongoing maintenance.

4.3 Library of conceptual models

Management agencies have made significant investments in the development of conceptual models to support their management. While some agencies have committed to making the models publicly available, this commitment has not been universal. These models represent a valuable resource for managers as they encapsulate existing knowledge in a readily accessible format. As a consequence, there may be value in establishing a central library of conceptual models for managers. There are, however, some risks associated with the establishment of a library.

One of the ways that conceptual models are useful is because the process of developing them is an excellent way of getting consensus among stakeholders about how a system functions. "We do not learn much from looking at a model – we learn a lot more from building the model and from manipulating it" (Morrison & Morgan, 1999). If managers were to simply pick a model off the shelf, they would not carry out the development process and this may lead to issues down the track.

A second related issue is that model structure and content is strongly influenced by the system they are modelling and the objectives of the model. It is likely, therefore, that in many instances, managers will need to either adapt or construct their own model to suit their particular needs. This means that, just like DST outputs, many of the conceptual models would need modification before being applied to a specific situation. If a library were to be established it would need to both make it clear that the models provide a starting point for managers and also that the presentation of the models support managers taking them and modifying them to suit their purposes.

A third issue is that the models, once lodged in the library, would be static (unchanging). This runs counter to the principles of adaptive management that recommend that our 'system understanding' should be reviewed as new information becomes available. It is possible that the library could act as a point of engagement among managers and researchers as understanding evolves. Achieving this functionality would require development of appropriate and effective processes for model adaptation.

The provision of a library of conceptual models would;

- reduce duplication of effort among management agencies;
- support application of ecological information to management decisions; and
- provide a focus for information sharing and collaboration among management agencies and researchers.

4.4 Library of ecological relationships

As noted above, many existing DST are comprised of a suite of flow response relationships that are imbedded within a software package. In some instances, managers are interested in these imbedded relationships or have the capacity to adapt these relationships to their needs. If the underlying relationships are of value to managers, then making them available to managers may facilitate their application to management decisions.

One potential use of this type of relationship might be within Bayesian Belief Network (BBN) models. BBNs can use a blend of expert opinion and environmental data to make probabilistic predictions of outcomes that can include estimates of uncertainty. The use of data within models is preferred to expert opinion and so making relationships available for incorporation into models would represent an improvement for these models. A second application is in the analysis of environmental data using Bayesian Hierarchical analysis. This type of analysis compares observed outcomes to the expected values (priors). Defining priors can represent a significant challenge for some analyses. Making relationships available may support development of priors and thereby improving the analysis' reliability.

4.5 'Making your prediction' tools (decision support trees)

There may be value in developing templates that support manager's compilation of information, including model predictions. The templates would then guide managers in;

- modifying the model predictions to suit their situation;
- identifying factors that may influence uncertainty around the prediction; and
- identifying risks associated with watering actions.

These templates would support the adaptive management process by encouraging documentation of:

- information used to develop predictions and support watering decisions;
- assumptions made in making watering decisions; and
- areas of uncertainty.

This process would facilitate evaluation of water actions and the identification of factors that could lead to improvements in the effectiveness or efficiency of water actions.

The templates would build on existing processes used by managers to make environmental flow decisions. The templates would also provide context for predictive model outputs, helping to clarify their role in decision making processes and providing a framework for model predictions to be integrated with other sources of information such as manager's previous experience and local expertise.

4.6 Adaptation of existing DSTs

As noted above, there has been considerable investment in DSTs and these DSTs are used in some management agencies. Where appropriate, MDB EWKR will seek opportunities to incorporate the predictive capacity developed by the project into these DSTs. In some instances this will require incorporation of flow-ecology relationships, in others it will require that relationships are converted into habitat preference curves or estimates of water requirements.

The two major groups of DST are the ecosystem response model library within eWater Source Eco Modeller and the IBIS decision support systems developed for significant wetlands in NSW (Macquarie Marshes, Narran Lakes and Gwydir wetlands). If adaption of existing (or development of new) DSTs is proposed, MDFRC will work with developers of the existing platforms to identify the best model development approach.

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