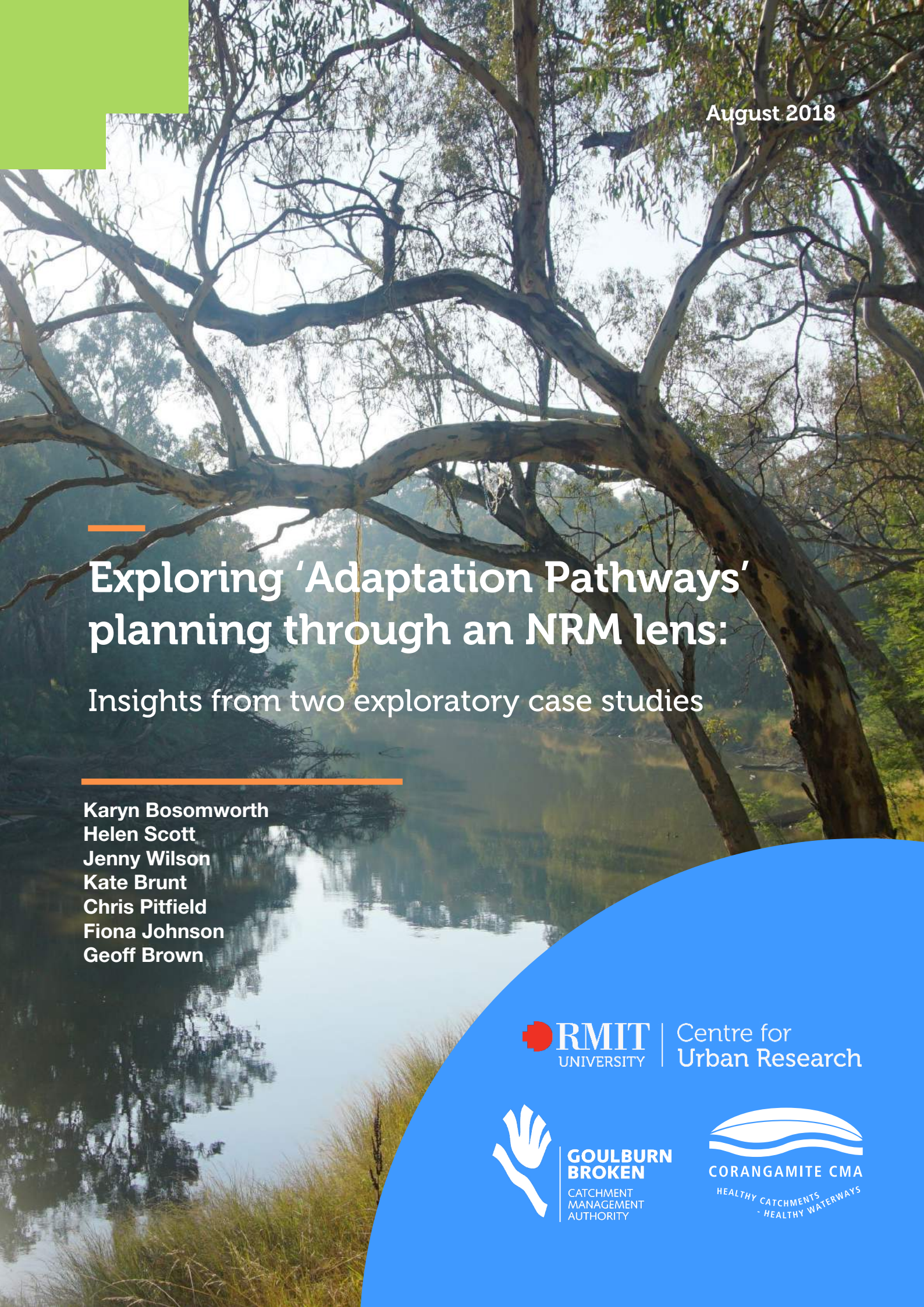

August 2018

Exploring 'Adaptation Pathways' planning through an NRM lens:

Insights from two exploratory case studies

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GOULBURN BROKEN CATCHMENT MANAGEMENT AUTHORITY

CORANGAMITE CMA
HEALTHY CATCHMENTS - HEALTHY WATERWAYS

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Front cover photo credit: Dr Karyn Bosomworth (The Goulburn River. The Taungurung name is Warring).

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Acknowledgement of country

RMIT University acknowledges the Wurundjeri people of the Kulin Nations as the traditional owners of the land on which the University stands. RMIT University respectfully recognises Elders both past and present. We also acknowledge the traditional custodians of lands across Australia where we conduct business, their Elders, Ancestors, cultures and heritage.

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1. Executive Summary

This report summarises a three year (2016-2018) project that sought to progress climate change adaptation in natural resource management (NRM). NRM faces a number of challenges in adaptation planning: decision-making under conditions of uncertainty; dealing with complex, dynamic and interlinked social and ecological systems; contestations around what and whose knowledge and values should guide NRM; addressing existing socio-political drivers of ecological degradation and many social challenges; and enabling adaptation that transforms those underlying drivers to better support sustainable, equitable futures.

Over the past few years, Australian NRM agencies have undertaken significant work to explore the challenge of adaptation planning, including testing concepts such as 'Adaptation Pathways' (AP) planning to help them make decisions under conditions of uncertainty. During a previous project (2013-2016), several Victorian Catchment Management Authorities (CMAs) had found AP planning conceptually useful but in need of further development to be practically useful in NRM (Bosomworth *et al.* 2017). This was because the majority of published examples of AP planning do not explicitly engage with the range of adaptation challenges facing NRM. This project therefore developed and piloted a 'problem-structuring approach' to pathways planning (Bosomworth *et al.* 2017) that sought to engage with these challenges. The approach used the AP concept as its 'backbone' while drawing upon a range of additional theories and methods, particularly those concerned with social-ecological system resilience, and transitions and transformation.

A collaboration among the Goulburn Broken and Corangamite Catchment Management Authorities (CMAs), RMIT University, and two independent facilitators enabled piloting of this approach. Both CMAs recognised the importance of ensuring their plans and activities enable sustainable adaptation of land and water resources, social wellbeing, environmental quality, and productive capacity. Their receipt of funding from the Victorian Government through the 'Our Catchments Our Communities' program presented a significant opportunity to collaborate with the research team in co-producing adaptation plans that met these objectives.

Combining significant expertise and experience, this research-policy partnership has progressed adaptation practice and theory in NRM. Overall, we found that facilitating groups through this problem-structuring approach to pathways planning helped them engage with the uncertainties, and complexities and contestations inherent to adaptation planning in NRM. It also found that a genuine, co-productive approach where all parties are involved in the design, conduct, and evaluation of the planning process is also crucial to engaging with these challenges.

This report presents insights from that project, including how different theories and methods helped apply the AP planning concept in NRM. Details regarding each case study are provided in the Appendices, while the adaptation plans themselves will be found on each CMA's website – where they are being further developed and tested with a wider group of stakeholders.

Our work continues.

2. Introduction

This report seeks to advance the practice and theory of climate change adaptation in NRM. It presents insights from a recent three year project (2016-2018) that piloted an adaptation planning approach combining the concept of adaptation pathways (AP) with a range of additional relevant theories and methods, particularly social-ecological systems thinking, and transitions and transformation (Figure 1 below).

The approach was informed by findings from a preceding three year (2014 - 2016) project known as 'SCARP' – Southern Slopes Climate Change Adaptation Research Partnership (See the reference list). SCARP found that while Adaptation Pathways (AP) planning is conceptually useful in NRM, it needs to be adapted to account for the inherent complexities and contestations of the sector (See Bosomworth *et al.*2017). The project that this report summarises therefore developed and piloted an adapted approach to AP planning that was informed by an understanding of the NRM 'problem' as including: decision-making under conditions of uncertainty; dealing with complex relationships among social and ecological systems; contestations around what and whose knowledge and values should guide NRM; existing socio-political drivers of ecological degradation and many social challenges; and the need for adaptation to transform those drivers to better enable sustainable, equitable futures.

The approach was piloted in collaboration between RMIT University and the Goulburn Broken and Corangamite Catchment Management Authorities (CMAs); specifically in the Strathbogie Ranges in the Goulburn-Broken catchment and the Western District Lakes (or Volcanic Lakes and Plains) in the Corangamite catchment. Combining significant expertise and experience, this research-policy collaboration has progressed adaptation practice and theory. Importantly, the pilots benefited significantly from the involvement of professional facilitators, who are also co-authors on this report.

This report first outlines the project's background, objectives, and theoretical framework for adaptation planning in NRM. It then summarises the approach taken to piloting the framework, before discussing lesson learned from those pilots, next steps for the two cases, and remaining research areas. Details of each case study are provided in the Appendices.

We look forward to continuing our collaborations.

2.1 Context

Over the past few years, Australia's Natural Resource Management (NRM) agencies and stakeholders have built significant momentum in planning for climate change. Their work had identified that planning under conditions of uncertainties associated with climate changing futures, was one of their most fundamental challenges. At the same time, adaptation scholars were developing the concept of 'Adaptation Pathways' (AP) planning as one way of engaging with that challenge:

> 'Adaptation pathways' (AP) is an analytical approach to planning that is receiving increased attention as a means of undertaking planning and implementation that allows for uncertainty and change. It does this by encouraging consideration of multiple possible futures and the robustness and flexibility of options across these futures. Robustness is conveyed because options are 'tested' against plausible futures, and flexibility is conveyed because a diverse array of options have been considered and evaluated to avoid 'lock-in' and to inform future decision-making. Arguably, AP planning enables development of an array of options that work reasonably well across a wide range of circumstances both now and in the future and that provide for inevitable changes in those circumstances. (Haasnoot *et al.*, 2013).

Yet as Lawrence and Haasnoot (2017) recently described, AP planning has been predominantly "applied in a limited number of circumstances, mainly for large infrastructure projects, and at national scales", which also have significant investment in models and technical knowledge (E.g. the Thames Barrier (Reeder and Ranger, 2011), Netherlands water infrastructure

(Haasnoot *et al.,* 2013), and New York City (Rosenzweig and Solecki, 2014)). While there is much to be learned from these generally more technical examples, they are not readily extrapolated to more contested and much less technically tractable issues such as NRM (Bosomworth *et al.,* 2017). This is because, broadly speaking, AP planning has predominantly been applied in situations where everyone agrees on the goals and the means to achieve those goals, and those means are often technically tractable – many of the things that NRM generally is not. Furthermore, where AP planning has been applied in NRM, it has usually occurred at the catchment scale, producing guiding directions or principles rather than a detailed action plan.

Alongside the need for decision-making under conditions of uncertainty, NRM planners face a number of additional challenges in adaptation planning. These coalesce around working with the complexities of dynamic, interlinked social-ecological systems (SES), the inherent contestations around the values and knowledge that direct their management, and the need to ensure adaptation addresses proximate drivers of natural resource degradation and social challenges in order to support transformations towards social-ecological sustainability. In other words, adaptation needs do more than just adapt current systems and processes, because the current situation into which it is argued we should 'mainstream adaptation' is part of what is creating and maintaining our currently unsustainable and inequitable trajectories.

Adaptation planning in NRM therefore requires an understanding of the complex drivers of the current situation (ecological, social, cultural, political, ethical, economic, etc.), to enable us to think, see, and do things differently. This is more than just developing adaptive plans, adaptive management, or even adaptive governance. It is more akin to reflexive (Voss *et al.,* 2006) or transformative governance (Chaffin *et al.,* 2016); reflecting on and possibly changing how we even conceive of the problems. It is about learning to learn, and learning to adapt (Argyris and Schon, 1978, Armitage *et al.*, 2011).

However, current accounts of AP planning have been critiqued for ignoring and thereby providing no guidance on understanding whether current governance and institutional (normative and cultural) contexts would enable the identified pathways. It assumes prevailing governance regimes (Wise *et al.*, 2014), and institutional and socio-cultural contexts (van der Brugge and Roosjen, 2015) are conducive to enabling plan implementation. For AP planning to be practically useful in NRM, Bosomworth *et al.* (2017) argued that a problem-structuring approach is required. This is where the nature of the problem – in the NRM case, involving complex and dynamic interlinked social-ecological systems, and contested ends and means – 'guides selection of 'fit-for-problem' analysis and planning methods to develop practicable AP plans that support efforts towards transformational adaptation' (Bosomworth et al. 2017).

This project therefore sought to undertake such an approach by drawing upon theories and methods that seek to: understand and engage with the complexities of social-ecological systems and their management; understand the underlying socio-political drivers of the current situation; and identify means of engaging with these issues to support transformations towards to social-ecological sustainability. It developed a theoretical adaptation planning framework (Figure 1) that uses AP as its 'backbone' to engage with issues of uncertainty, and combines it with theories and methods from social-ecological systems thinking, transitions management, and transformative adaptation, to engage with issues of complexity and contestations.

2.2 The adaptation planning framework

The adaptation planning framework used in this project (Figure 1) is a diagnostic, problem structuring approach to adaptation pathways planning (Bosomworth *et al.*, 2015, Bosomworth *et al.*, 2017). Because it draws on a range of existing theories and methods, the framework is not really 'new'. Many of the components and techniques will be familiar to anyone involved in any form of strategic planning, particularly those utilising scenario planning.

The main theories and methods drawn upon include:

- Dynamic adaptive pathways planning (DAPP) (Haasnoot *et al.*2013)
- SCARP Adaptation Pathways Planning Playbook (Bosomworth *et al.* 2015).
- Resilience theory (Walker *et al.*, 2002, Walker *et al.*, 2006)
- Theory U (Scharmer, 2009)
- Transformative scenario planning (Kahane, 2012);

- From resilience to transformation (Pelling, 2011)
- Sustainability Transitions (Loorbach, 2007, Roorda *et al.*, 2014)
- Collective Impact (Kania and Kramer, 2011)
- Three Horizons (Sharpe *et al.*, 2016); and
- Designing projects in a rapidly changing world guidelines (O'Connell *et al.*, 2016)

Drawing upon these different theories and methods, the planning approach first aimed to help people better appreciate the complexities and multiple drivers of the social-ecological system for which they were planning, within an improved understanding of the how and the why of the current situation – its socio-political construction. It aimed to help them do this through seeking diverse, even contending, perspectives (and encouraging participants to be open to those), before asking questions about adaptation options. Beginning with this 'problem-structuring', the framework explicitly seeks to do more than just adapt current systems and processes. This is because the current situation into which it is argued we should 'mainstream adaptation' may be part of what is creating and maintaining our currently unsustainable and inequitable trajectories. Using this problem-structuring approach aimed to help people explore adaptation actions that could address the underlying drivers of unsustainability, inequities, etc., in order to support transformations towards social-ecological sustainability.

Like most adaptation planning, AP included, this framework is broadly structured around a standard strategic planning process. Also like most adaptation planning, while Figure 1 depicts the process as somewhat linear and sequential, its application is (and was) necessarily adaptive, flexible, reflexive, complex, and sometimes messy. The basic steps or stages of this planning framework are summarised below:

2.2.1. Establish a convening team

This idea is reflected in a range of theories and practices, including Collective Impact and Transitions Management. The convening team's role is to facilitate the process overall, conduct any necessary background work, provide the leg-work, administration, and advocacy, etc. It would consist of about 3-5 people within the organisation, including the project manager, and might also draw on facilitator/s (Roorda, *et al.* 2014). They "serve as the backbone for the

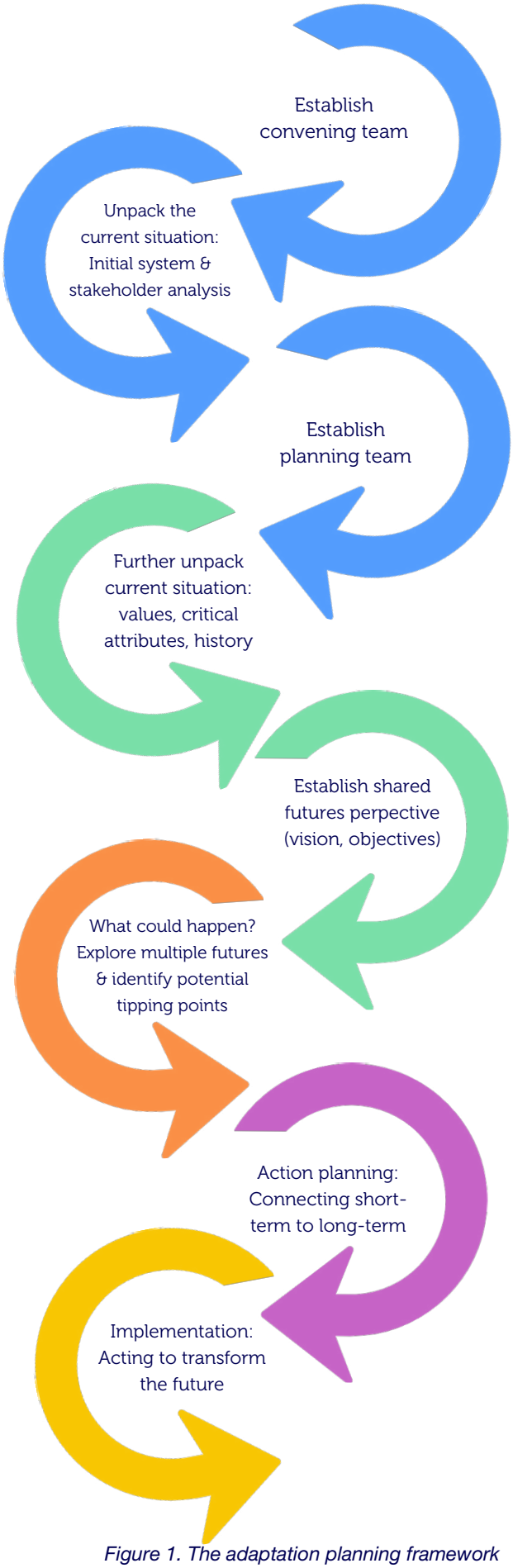

Figure 1. The adaptation planning framework

entire initiative and coordinate participating organizations and agencies" (Hanley-Brown *et al.* 2012). There is a need to make explicit for all participants, in whatever aspects they are involved, that the approach is exploratory and therefore deliberately about enabling learning.

2.2.2. Explore the current situation: Initial system & stakeholder analysis

As outlined in the introduction, in order for adaptation in NRM to support social and ecological sustainability under a changing climate, there is a need to understand and engage with both the socio-political construction of the current situation, and the linked social-ecological nature of the issues (a social-ecological systems perspective). This requires an understanding of the system as a complex, adaptive system – one that is 'more than the sum of its parts". Therefore, an *initial* assessment is conducted to help inform who might be approached to be part of the planning team (workshop participants), and even expanding the convening team.

Most of the theories informing the framework provide guidance on how to undertake such an analysis and they all emphasise a need to undertake both a stakeholder and system analysis. SCARP's Playbook and Information Portal identify six main aspects to consider in assessing the current situation: degree of agreement on goals, extent of uncertainty about the system, scale, capacity, urgency, and the stakeholders. The Transitions Management Manual (Roorda *et al.* 2014) also argues that exploring 'local dynamics' is very much problem-driven. They suggest that examining these dynamics (the current situation) could involve preparing a presentation for an informed kick-off meeting, through to an elaborate baseline study taking into account in-depth knowledge and a wide range of perspectives (p21).

2.2.3. Establish a planning team/group

The planning group are the people that will participate in and help co-produce the outputs and outcomes from the planning process (including the plan!) Several of the theories informing this process highlight that these people need to be insightful, influential, respected leaders, committed, and open to being challenged and open to change. They need to be people (or validly represent those people) with a stake in the future, and there is a need to seek a representative diversity. It is particularly important to give attention to those voices not normally heard in these processes, or those who have a stake but limited ability or capacity to participate. The convening team are also part of the planning team.

There is a need to think about how to invite and engage different people because of different cultural, power, and availability issues (See Section 5. 'What did we learn?'). The possibility of engaging more than one planning group might also be considered.

2.2.4. Further explore the current situation: values, history, and critical attributes

Here is where the workshop process began for this project. Following an acknowledgement of Country, Traditional Owners and Elders, participant introductions occurred. There are many creative processes that can guide this beyond the standard, 'around the room' process – although when a group meets for the first time they may be more comfortable with this 'traditional' approach. There are a number of facilitation methods that can help people engage with the need to think differently, to embrace complexity, and to explore the socio-political and social-ecological construction of the issue. Different methods were used in the different pilots and these are described in the case studies in the Appendices. Brief overviews are provided here.

2.2.4.1. Explore multiple values – informs a plan's "vision" & objectives

In this project, we started with questions about what we love about the system or issue for which planning is being undertaken, why we're here, and our hopes and fears. We deliberately used the word love to get at 'heart values', not just functional, role-related values. There are a range of facilitation techniques and methods to reveal and engage with diverse values. Two are described in the case studies. The greater the diversity of people and organisations, the richer the insights into the current situation – its politics, institutions, functions and dysfunctions, diverse and sometimes contested knowledges and values, inequities and opportunities.

2.2.4.2. Explore history

As highlighted in the introduction, adaptation planning requires us to understand both the socio-political construction of the issue for which we are planning, and it's linked social-ecological nature – how we (and the system) got to be here *and why.* One technique this project used was a 'timeline' method. Participants are given guidance and asked to create a timeline of the events that have led to the system/location being what it is today (See Appendices). Co-creation of timelines was enabled by having a very long piece of butchers' paper up on the wall, with a pre-drawn line through its middle. People were asked to write or draw 'above the line', events that have *occurred* within the system (E.g. European arrival, droughts, increases or decreases in local population), and 'below the line', events that occurred outside the system (in these cases, the Strathbogies or the Western District Lakes) but that had an influence on it (e.g. changes in legislation, start of the Landcare movement). This process was designed to help people both appreciate the dynamic, complex nature of the situation, and to appreciate the multiple pathways that had led to the current situation. In turn, this helped them identify and discuss different factors and perspectives that had influenced and were currently driving the current situation, including current social and ecological challenges. This technique also aims to help people be more strategic and think about institutional and governance issues.

2.2.4.3. Identify 'critical attributes'

Another major challenge in adaptation planning for any social-ecological system (SES), is that such systems function and evolve through complex and dynamic interactions among large numbers of biotic and abiotic variables. Walker *et al.* (2006) suggest that in grappling with trying to understand such systems, a 'rule of hand' can be useful. They argue that *"critical changes in social-ecological systems are determined by a small set of three to five key variables, i.e., the 'rule of hand'. To understand change in systems, it is important to identify this small set".*

Identifying these 'critical attributes', theoretically, will more easily help identify potential tipping points, rather than trying to identify them for the more complex (and difficult) whole system. In turn, this can help target action planning and highlight potential factors to monitor. These critical attributes (or system drivers), also provide the basis for developing and exploring future scenarios. In each pilot, slightly different methods were used to explore the critical attributes.

2.2.5. Establish shared futureS perspective

The 'S' in futureS is capitalised for a reason. The future is uncertain, so multiple future visions need to be explored and discussed. Visions are statements of what we're hoping for in the long term. We write a vision or visions to communicate to others what we are trying to achieve and to provide boundaries for the plan's actions. A long-term vision or the parallels between multiple visions is an anchor point for the plan and therefore can be used to guide actions and communicate with a broader audience (Roorda *et al.* 2014). The envisioning process is crucial to allow participants to get out of the 'dictatorship of the present', and encourage them to develop and exchange perspectives on the future. The process should enable individuals to gain a sense of opportunity (and hope), as they imagine themselves playing an active role in the envisioned future (Roorda *et al.* 2014).

It is important to emphasise that visions are unlikely to remain static. A vision should be a values-rich story that continues to evolve as people experience their emerging future and reprioritise their values over time (Meadows, 1994). It is also worth encouraging people to work with a vision that does not have to be perfectly word-smithed; it can be a collection of words, a diagram a single word, or a statement, around which the planning team can develop a narrative around. This was approached differently in each case.

2.2.6. What could happen? Explore multiple futures and identify potential tipping points

The future is uncertain and any single projection of what the future holds is more than likely to be wrong. Choosing a single future scenario therefore risks developing the wrong options for the long term or even, making matters worse. By developing a range of scenarios we can test existing and proposed options for their robustness and flexibility, or usefully, both. The choice of future analysis methods should be informed by the type of 'problem' that the current situation presents. **Section C6 Futures**

Analyses of SCARP's Portal Report could be useful here as it outlines and provides links to a range of tools and methods for describing potential futures.

Transitions Management scholars suggest the planning group could develop narratives about fundamental changes that need to occur to keep working towards the overarching vision under the different scenarios. This can be done by formulating 'from – to' statements (Roorda *et al.* 2014). E.g. from possessing to using; from centralised to decentralised energy systems; etc.). Naming and describing the 'shifts' that need to occur is useful here; they then have an identity (Roorda *et al.* 2014).

Kahane's (2012) Transformative Scenario planning method involves facilitators encouraging people "to construct scenarios about what they think could happen. Not what people predict will happen, should happen, or believe will happen".

The two pilots in this study used different methods to develop their scenarios. In the Bogies case, people sat in one of three 'climate change scenario groups' to explore what could happen to each of the system's critical attributes. In the WDL case, people worked in groups to develop 2-3 narrative scenarios (with at least one utopian and one dystopian scenario each) based on an RCP 8.5 2070 climate change scenario, using all the critical attributes as their 'palette'.

2.2.7. Action planning: connecting the short-term to the long-term

As the SCARP Playbook (Bosomworth *et al.* 2015) describes, identifying and prioritising options is at the core of adaptation pathways planning. The basic process identifies potential adaptation options, considers how robust these may be across the potential futures developed in the previous stage, as well as their flexibility. Then possible turning, tipping and trigger points are identified. The aim is to identify alternate options that could result in the attainment of objectives. The process draws on outputs from the previous steps. This is a particularly tricky (& slightly messy) bit.

Kahane (2012) suggests that this is the time for shaping the future. Instead of simply adapting to circumstances, people can focus on how to transform the future. This can only be done when informed by a sophisticated understanding of the current situation – the what, how, and crucially, *why* of the current situation – which the preceding activities have been aimed at unpacking. This is where Haasnoot et al's (2013) DAPP approach comes into its own. They and the SCARP Pathways Playbook describe a staged approach to doing this.

Actions might be loosely grouped in terms of:

- Things we want (and 'can') maintain = resilience
- Things we might want to shift towards or back from a tipping point, to enable a transition towards a transformed situation
- Things we might want to transform/ change significantly

There are various ways of classifying actions. In these cases, we turned to options in relation to:

- Research and development
- Advocacy
- Community participation and engagement
- Incentives
- Policy and/or practice change, development, etc.
- On-ground works
- Governance
- Monitoring
- Information and communication (very different to engagement)

The groups also need to document:

- When might decisions have to be made?
- How long might they take to make and implement?
- When do we start talking about them?

Finally, development of pathways does not have to result in a 'train line' diagram, although such diagrams are useful communication tools. A well-structured table can be just as useful.

2.2.8. Acting to transform the future – planning monitoring and implementation

This is a fairly standard step in any sort of planning. It includes identifying who is going to do what by when, resourcing, etc. Planning implementation also requires designing and establishing the monitoring plan and system. An adaptation plan cannot support adaptation without monitoring! As described in the SCARP Playbook (Bosomworth et al. 2015:20):

> Given that the future is not predictable, adaptation depends on learning and responding effectively to lessons learnt, as well as experience, changing circumstance and new knowledge. This means a Monitoring, Evaluation, Reporting and Improvement (MERI) system is fundamental to adaptation, and enabling both adaptive management and governance. Monitoring of key indicators of systems change (e.g. tipping, turning and trigger points) underpins decision-making about adjustments to strategies, operational plans and implementation practices. This includes monitoring the biophysical, social, economic and political systems. MERI can help make successes reproducible. It makes the strengths and weaknesses of different forms of activity, intervention and investment explicit. Improvement may be enabled through formal lessons about what worked and didn't linked back to higher level strategies and policies through good governance across scales.

3. Project aim, objectives & research

3.1. Project aim and research questions

This project aimed to test the preceding adaptation planning framework (Figure 1) and address the following research questions:

1. How does this approach advance adaptation planning in NRM?
2. How were the different methods, tools, or additional theories useful in applying the AP concept in NRM?; and
3. What does all of this tell us about how practical adaptation plans in NRM might best be developed and implemented?

3.2. Project objectives

In conducting this research, the project objectives were to:

- extend the capacities of and foster learning among the participating CMAs, their stakeholders, the facilitators, and the researchers;
- advance the practice of adaptation planning and implementation in NRM;
- support the participating CMAs in further developing and implementing their Regional Catchment Strategies and climate change adaptation plans;
- provide fit-for-purpose approaches to Adaptation Pathways for differing contexts;
- advance theory in adaptation planning and governance through lessons from practice; and
- share those insights with a wide audience through various CMA, government, community, and academic for a (including this report and the case study reports).

4. Methods (Piloting the framework)

4.1. Participatory action-research (PAR)

A participatory action-research (PAR) approach was chosen for this project because of the project's overarching objectives, CMA practice of working with communities and stakeholders, and much theory. Academic scholarship repeatedly emphasises that adaptation requires capacity building approaches that effectively support decision-making, collective action (Campos *et al.*, 2016: 539, Wallis *et al.*, 2017), and learning to learn and be adaptive (Armitage *et al.*, 2011). In addition, understanding and engaging with the social and political drivers of issues and governance requires thinking, seeing, and doing things differently. This requires an appreciation for the diversity of understandings, rather than a striving towards a single comprehensive body of knowledge (Stirling *et al.*, 2018). Involving diverse and even contending perspectives is fundamentally an issue of equity and ethics. It is necessary to reveal how alternative reasonable courses of action appear preferable under different conditions and how these relate to the real, interdependent world of divergent contexts, public values, disciplinary perspectives, and different stakeholder interests (Stirling, 2008:280). It is also pragmatic. Involving diverse perspectives and knowledges can provide greater insights into why the current situation is the way it is – its underlying drivers. This can also help identify a greater array of possible options, which can help confer greater robustness and flexibility to an adaptation plan.

Therefore, while development of 'information products' (workshop reports, data, and a plan) was important, there was a need for equal, if not more, concern with less visible processes and outcomes of action-research, engagement, facilitation, knowledge sharing, and social capital building (Wallis *et al.*, 2017, Leith *et al.*, 2018). Adopting a PAR approach therefore explicitly sought to enable and learn from a reflective, open discussion of diverse values and knowledge. The 'action-research' component was also useful because adaptation needs, objectives, and processes, necessarily vary across contexts, sectors, geographies, and communities, and PAR allows methods to be adapted and changed during the project.

In practice, PAR meant the NRM planners and the independent facilitators were involved in designing and planning the pilots, and they, along with the workshop participants, were also involved in adapting and analysing the approach and its outputs including through co-interpretation of data, and incorporating insights gained along the way. Professionally facilitators were needed because we wanted to ensure that if the process wasn't going to 'work' it was due to the process itself, not limited facilitation skills. Our CMA partners and the facilitators were also involved in the production of workshops reports, this final report, and (eventually) related academic journal articles. In this way, PAR provided all parties, including the researchers, opportunities to learn together.

Initiating the pilots in both cases started with establishing a convening team, then a planning team (the workshop participants), followed by a series of four interactive workshops (eight workshops in total; four per location). Each series of four workshops was broadly designed around the key 'stages' of the planning process in Figure 1. Throughout, it was conveyed to participants this was an experimental approach, and as such we wanted their sincere feedback on both the process and substance. They were encouraged to provide feedback and input during, after and between the workshops. They were able to contact the CMA lead, the facilitators, and/or the researchers directly to discuss any ideas or concerns. Importantly, their feedback influenced the design of subsequent workshops and informed this evaluative report. Participants were also provided an anonymous online (and feedback forms) evaluation and reflection survey after each and every workshop, which asked them:

- What worked well and why?
- What was challenging and why?
- What could the project have done differently in that workshop (and overall)?
- What was new for you?
- What was your "take away" from this workshop (and ultimately, the project)?
- What was your overall feeling about the workshop (and ultimately, the project)?
- Anything they would like to add

4.2. Two case studies

The Goulburn Broken Catchment Management Authority (GBCMA) and Corangamite CMA (CCMA) collaborated with the research team to bring their significant skills and experience to bear on the project. CMAs are the peak NRM bodies in Victoria, Australia. CMAs work to ensure land and water resources are protected and enhanced as well as improving the region's social wellbeing, environmental quality, and productive capacity in a sustainable manner. As Statutory Authorities, part of their obligations include developing and overseeing implementation of 'Regional Catchment Strategies' (RCS) that reflect community and partner agency priorities. They generally develop and implement these plans by working with communities to deliver 'on-ground' works, such as whole farm plans, revegetation, sustainable farming practices, Landcare programs, conservation actions, and knowledge sharing. Recent funding from the Victorian Government through the 'Our Catchments Our Communities' program enabled the two CMAs a significant opportunity to collaborate with the research team and trial the adaptation planning framework.

The Goulburn Broken CMA (GBCMA) Regional Catchment Strategy (RCS) currently uses a resilience approach to planning, which includes consideration of drivers of spatial and temporal change (including climate change) within a social-ecological systems (SES) perspective. This helped inform the project's approach. Corangamite CMA (CCMA) uses an asset based approach to identifying priorities for management in their RCS. However, participants in their case study argued for adoption of a whole-of-landscape perspective that includes the social (see Section 9.2). Hence, the use of social-ecological system (SES) resilience thinking also helped that case.

While each case study broadly followed the planning approach in Figure 1 on page 9, remaining true to the ethic of co-learning meant that the facilitation methods and tools were necessarily different for each case. This was firstly, because insights from the first case (Strathbogie Range) informed the second Western District Lakes (WDL). Secondly, the different facilitators used different methods. Thirdly, the nature of the workshop groups were different – the Bogies is a smaller area, several people already knew each other, and the majority of participants were local landholders. Whereas, the WDL is a much larger area, very few of the participants already knew each other, and the majority of participants were mostly organisational or agency representatives. This also meant that the processes of inviting and including different people also required slightly different approaches.

Table 1 on the next page summarises the approach and methods used in each case study to apply the planning framework. Details on each case study can be found in the Appendices.

Table 1 Comparative summary of methods used in each case study at each 'stage'

CASE	Bogies and Beyond (GBCMA) (Mar – Jun 2017)	Western District Lakes (CCMA) (Jun – Oct 2017)
STAGE/S (from Fig 1)	Establish convening team; initial understanding of current situation; & establish planning team	
Context setting & establishment phase	• Project manager identified a small group of key people to help kick start the project, including GBCMA's comms officer, three local community reps (two female and one male), and the facilitator to be the convening team. • Existing plans, data and maps were gathered. • Expressions of Interest (EoI) for participation were sought using local paper, radio, local newsletters and email groups, and GBCMA website	• Project manager – the NRM planner – got together with the research team and the facilitator to identify as many stakeholder representatives as they could. • Existing plans, data and maps gathered. • Targeted invitations to a wide audience of landholders, organisations with stakes, roles and responsibilities, and subject matter experts
STAGE/S (from Fig 1)	Unpack the current situation & Establish a shared futures perspective	
WORKSHOP 1	• Intro by project manager and facilitator • Developed timeline - including pre-European and current cultural experience and knowledge - by having a very long piece of butcher's paper on a wall, with a pre-drawn line through its middle. They were asked to write 'above the line', events that have occurred within the system's boundary; and 'below the line', events that occurred outside the system but that had an influence on it • To develop a vision, participants were asked to brainstorm in table groups, what they love about the Bogies, & what's changing and why? This built on information participants had included in an Expression of Interest & an existing vision from the Strathbogie Voices project. • Summarised list of key factors/ critical attributes. Four possibilities developed, final agreement at third workshop • Identified critical attributes by developing lists in table groups that were consolidated (sticky dots) to identify themes. 5 themes/critical attributes identified • 3 broad climate change scenarios for the region from CSIRO Climate Futures website were used for an initial discussion of potential implications (brought to Workshop 2)	• Intro to project by project manager and facilitator. Context setting via presentations by representatives of the Eastern Maar Aboriginal Corporation & by a paleo-ecologist from Federation University • Developed a timeline including pre-European and current cultural knowledge. Same method as Bogies case • To identify the system's critical attributes, participants asked to think about the Lakes as a system and identify "what needs attention?" (the things that can have a big impact/ that influence the outcome) Then worked in small groups, using butcher's paper, to explore drivers of the things that need attention. • Drawing on the preceding session, participants were asked, "If the facilitator can see the Lakes in 2050, what would you ask? And why is it an important question for you?" • This enabled a refinement of the vision, and the critical attributes

CASE	GBCMA – Strathbogie Ranges (Mar – Jun 2017)	CCMA – Western District Lakes (Jun – Oct 2017)
STAGE (from Fig 1)	What could happen? Explore possible futures & identify potential tipping points	

WORKSHOP 2	• Refined critical attributes, working in table groups helped newcomers to become quickly engaged.
	• Tipping points/thresholds - Between the workshops, the project manager researched relevant information for each of the key attributes. This was presented to the group and other information that the group was aware of was also captured. Each participant was then provided three dot stickers and asked to vote for the attributes they felt were the most important.
	• Mixed up the groups, and these groups were taken through a facilitated process to identify /refine thresholds.
		• Initial identification of critical attributes and driving forces. Using four different reports and plans, participants worked in small groups to identify what these told us about the WDL landscape, including:
		  • critical drivers or influences in that landscape
		  • trends or status of those drivers; and
		  • any tipping points or thresholds
		• Explored potential implications of climate change via two vulnerability maps produced from previous CCMA work: best case (RCIP 4.5, 2070) and worst case (RCIP 8.5 2070) scenarios. Participants then used the critical attributes & drivers as a 'palette', to develop 3 plausible future scenarios each, with at least one utopian and one dystopian future. After some discussion, participants started noting actions that could help produce narratives closer to the utopian scenarios and away from the dystopian.

STAGE (from Fig 1)	Action planning: Connecting the short term to the long term	
WORKSHOP 3	• Finalised tipping points. Majority of the time was on identifying actions and next steps. Groups were given a set of guiding questions to explore different elements of the critical attributes to be more specific in identifying tipping points • Began action planning: Identify which of the attributes are at or getting close to a tipping point, develop an objective for each of the elements of the critical attribute that is at or close to the tipping point, and identify potential actions to deliver the objective	• Linked the things that 'need attention (from Workshop 1) with the Critical Drivers (Workshop 2) • Used these configurations and the different scenarios as 'touchstones', to start drafting potential adaptation actions. • These were then grouped or classified using themes from CCMA adaptation plan (e.g. Research, on-ground works, incentives, etc.)
STAGE (from Fig 1)	Implementation & MERI: Acting to transform the future	

WORKSHOP 4	• Developed project proposals and action planning for two critical attributes (Water and native vegetation), to which GBCMA would direct OCOC funds. Developed the two projects:
	  • 3B: Bores, Bogies and Beyond', &
	  • Bogies Tree Storey - dieback or grow back
	
	These are now being implemented
		• Refined actions & identified priorities:
		Worked in pairs or groups of three to read single theme of activities/actions drafted in Workshop 3, make notes on how to make the actions clearer and rationales stronger -, what else would we need to know? What things need to be in place for this to happen? Then as a whole group, discussed reflections and suggested edits & additions.
		• Governance review underway

5. What did we learn?

This section sets out much of what we learned from the two pilots. These insights are drawn from participant feedback, including the online survey and observational notes taken during each workshop, alongside facilitator, NRM planner, and researcher reflections and post-pilot interviews. Participant feedback suggests that just by explaining 'adaptation pathways' concepts – robust and flexible actions - and involving people in exploring multiple plausible futures from diverse perspectives, helped stimulate systemic thinking and appetites for collaborative, even transformative actions.

5.1. How did this approach advance adaptation planning in NRM?

Overall, we found the process helped these groups elucidate their shared and personal perspectives, values, and sense of place. The participatory nature of the approach also appears to have helped them appreciate these within a wider understanding of both social-ecological and social-political contexts that drive much of the current situation. The insights and outcomes indicate that this approach helped shift 'adaptation pathways' planning from being conceptually useful to being practically useful for adaptation planning in NRM. It was interesting to note that many argued that while 'good practice NRM' is a solid basis for adaptation action, much of this activity is yet to be as strategic as it should.

> Most actions for coexisting with climate change are the same as (NRM) ameliorative actions
>
> Most of the actions reinforce current best practice although this is being done in a piecemeal way

The approach helped add a temporal, whole-of-system element to what is usually just a spatial approach to planning, and identified a range of practical actions from on-ground works to citizen-science programs, to a seeking of alternative, co-operative governance models.

> [This process, helps us think about] Slow cook issues– on a daily basis, people are planting trees, diverting streams…etc. is this the right stuff or the wrong stuff….how do all these things affect the Lakes?
>
> [It] ensured the things community members value are considered in planning and delivery of departmental programs

One CMA colleague suggested that the approach provided them a more structured way to identify management actions than they have typically used:

> We had a better plan for the workshop process; instead of getting the community together, asking them to provide a shopping list of what they wanted, then going away and writing a plan.

The process helped develop practicable plans; some actions of which seek to address drivers of currently unsustainable, inequitable situations, and even transform current governance. However further work is needed to consider the robustness of many of the actions across multiple futures because of the challenges associated with identifying 'tipping points' or thresholds within social-ecological systems. However, a few participants also suggested that while thinking about some of the complexities and challenges of adaptation has advanced, more work is required to bring that thinking together to complete (and implement) adaptation plans.

> I don't think we've yet really grappled with the change that is likely coming. I think we still do these plans etc. as if things are going to be 'slightly different'

Feedback also consistently highlighted the value they placed on engaging with diverse knowledge and values, in part because, they feel adaptation is only possible through collective efforts. Many suggested their involvement had not only made them inclined to undertake action 'at home' but also to advocate more widely among their community and to governments.

> I've been using my knowledge and the learning from the workshops in discussions within the community, trying to encourage landholders and all interested to participate in projects
>
> For me it's about (small) actions on my own property and within the conservation group that I am involved with. I might say though that perhaps I could and should discuss climate change more with other people who may not have had the opportunity to read much about it. I realise that this conversation can be had without getting too emotional! I may also be more proactive in lobbying Council to get off their backsides on the issue.

The following insights indicate that this project has advanced our collective understanding of what is involved in adaptation planning for NRM, highlighting where it is particularly challenging and where further work is required. While there remain some areas for further development, a solid base has been produced from which most of the participants (including the CMAs and research team) are keen to continue to build. The following sub-sections discuss specific lessons and areas for further work.

5.1.1. Helps engage with complexities and contestations

We found that working through this planning process helped people recognise the socio-political construction of the current situation. Their feedback and the identified actions suggest, participants began to appreciate underlying drivers of the current situation for which climate change holds significant implications. Both groups argued that the current situation is not a preferred future; with several suggesting that the current situation is already a worst case scenario for many communities and ecosystems.

> Managing for stasis is an error of management
>
> We're reducing the adaptive capacity of our landscapes

In turn, these insights into 'the current situation' was crucially important in helping them appreciate this broader context for adaptation, leading to their arguing that adaptation plan and action must engage with and address the thinking, cultures, and practices that have led to the current 'problems'. For example, the WDL group argued that the most urgent priority is to

fundamentally reshape the region's governance arrangements, with particular attention to the relationships with Traditional Owners.

> Cultural knowledge should inform management
>
> Culturally significant species should inform goals
>
> We need to support Traditional Owner sovereignty; use their processes to guide us

Arguments to address current thinking, practices, and institutions reflect those of a growing body of adaptation literature, which argues adaptation needs to transform underlying drivers of unsustainability and inequities. For many participants it seems that exploring multiple possible futures led to their arguing that we cannot keep doing business as usual. Engaging in this adaptation planning process offered a way for people to examine real possibilities for change to avoid entrenching unsustainability and inequities because they were encouraged to consider how what we do now could affect possible futures.

For example, as they learned about the range of concerns and values of others, the Bogies participants identified and described a shared 'sense of place'. Indeed, 'sense of belonging' was identified as one of the critical attributes for this system, and importantly, its maintenance under a changing climate is dependent on the health of the other critical attributes such as native vegetation and water.

> I have a better sense of its complexity and that everyone is still working out what to do. It's the things we value that matter - and that's the easy thing to talk to people about. I don't have to worry about 'the cc science' so much!

Alternatively in the WDL case, participants recognised that a 'sense of place' was not yet shared amongst themselves, nor among many of the different communities of which they are members. This lack was heightened by a recognition that Traditional Owners have a strong sense of place, or rather, Country. This led participants to argue that the adaptive capacity of the region depends on developing a wider 'sense of connection to place'.

> Work with Traditional Owners to enable management of WDL through connection to Country

We found that this understanding of the social and political drivers of the current situation deepened throughout the planning process because of the involvement of diverse perspectives. For example, in the WDL case, a lot of the feedback was about the positive impact of the opening presentations by and discussions with an Eastern Maar Aboriginal Corporation representative (see WDL case study Section 9.2) and a paleo-ecologist from Federation University had on the way participants viewed the Lakes landscape and its potential futures. This impact can be seen in the resultant plan and the actions they identified.

5.1.2. Helps stimulate (social-ecological) systems thinking

The approach has also helped cultivate a greater social-ecological systems (SES) perspctvie through the preceding understanding the history and social contexts, before envisioning different but collective futures for the 'system'. In the WDL case, the project began with a focus on adaptation planning for the WDL wetlands and lakes. However, after working through a number of activities, they argued for "a whole-of-landscape approach that incorporates the social" – a SES perspective.

> We lack a whole of system perspective; Making decisions with the best knowledge we have, but it's fragmented. Risk is that we will lose wisdom and knowledge
>
> The importance of considering the area as an ecological system and all of the strands are interrelated
>
> I had a good general knowledge of the biophysical values of the lakes and the surrounding landscape beforehand, the outcome of the workshops which I really enjoyed, and surprised me, was hearing the diversity of personal perspectives, histories and experiences with the region.

By encouraging people to think long-term and in terms of adaptive capacity of the system as a whole (as a social-ecological system), participants were able to prioritise actions. In part, this was because their concerns and relationship to the system were being included in the plan and their preferences and issues were contextualised with that of others.

5.1.3. Provides a powerful engagement tool

Outcomes from this project (such as ongoing citizen science projects and the seeking of alternative governance models) have underscored that a participatory approach to adaptation planning is a better community engagement approach than just asking people 'what are your adaptation priorities?' Quite often in NRM, workshop participants are asked what NRM actions they would like to see, a 'shopping list' is produced that is difficult to prioritise. For example, one person will think that blackberry control is the most important while others will focus on some other weed, another might want a specific wetland enhanced, yet another some small reserve somewhere, and others are seeking governance or policy change regarding a specific issues. It is not possible to decide which of these is most important in that context, and usually just leads to not being able to achieve any of them. This contributes to people viewing such planning workshops as a waste of time, because expectations are built and then 'nothing happens'. By collaboratively working through (and sometimes co-adjusting) a planning process that begins with attempts to explore the problem and its drivers through multiple perspectives, people were able to identify strategic actions alongside more proximate actions rather than just their own preferences.

> The lesson is that it's knowledge; there is a lot of value in engaging broadly, letting them tell you their story. Getting better outcomes from not being a top down approach, but it is definitely more work. Normally we consult by writing something and going out and consulting. Whereas this process has involved different stakeholders, it's a bit 'ground up'

We also found that being involved in this sort of adaptation planning process fundamentally helped participants feel like adaptation is possible and even that positive futures are feasible.

> [I'm] Less pessimistic about the ability to adapt to climate change
>
> Story telling / narrative perhaps makes us realise it could be a possible future.

As highlighted in the preceding sections, we found that this process helped participants begin to identify and prioritise actions in an informed, manner that considered both the social and ecological context and complexities. Alongside people feeling they had better ideas about adaptation options, many also suggested that the process emphasised the need for a collective response to climate change issues and the inherent challenges therein.

> That tackling climate change and in particular behaviour change is a huge obstacle no matter what the science is telling us. It remains challenging.
>
> Very timely workshop on the serious challenges we all face with regard to climate change. Just how to get this through to the wider community is perhaps the biggest challenge
>
> Not changed my attitude; but now realise the problems we all face with regard to getting practical programmes into the community

One participant was surprised by the degree of agreement amongst the participants; suggesting they may have been expecting greater degree of disagreement more akin to what is expressed above. However, comments about "the wider community" also indicate that participants were perhaps already concerned with climate change and were seeking ways of enabling action. Starting with those who are already concerned and interested is an excellent start, but it leaves the obvious question – what about everyone else? This links to a question about engaging beyond workshops (See Section 6.2.5 below).

5.2. What methods, tools, and additional theories were useful in applying an adaptation pathways approach in NRM?

The following sub-sections discuss some key insights into the value of the methods and additional theories we used in developing and applying this adaptation planning framework.

5.2.1. A participatory, co-learning approach is crucial: 'Who' and how

These pilots highlight that a participatory approach to adaptation planning can help develop collective ownership (at this stage) and eagerness to continue working co-operatively. Overwhelmingly, the participants also expressed appreciation for being able to collaborate with and learn from other perspectives, knowledge, and roles. To a person, participants appreciated the opportunity to meet new people, and hear and discuss different perspectives on the case study, the process, the issue of climate change, and the problem of adaptation.

> The depth of knowledge of the participants and the willingness to share this information.
>
> I enjoyed it - the enthusiasm and camaraderie was great. It would be great if we could keep working on this and implement and measure the things we do as a result of it.
>
> Good to hear from others point of view
>
> Talking to people is useful. Everyone carries some degree of expertise.

Participants also appreciated knowing that there was funding dedicated to begin implementing what they had developed – rather than being involved in (yet another) planning process that produces a lot of good will and a plan, but no support for implementation.

> Immediate funding available to implement the project priority actions was a big plus. The first time I've been involved in a workshop that flowed from ideas to actions. It made the time committed to the workshops worthwhile

Many were appreciative that we had explicitly and repeatedly explained that we were undertaking an experiment in designing and applying a number of concepts, and were therefore genuinely seeking their constant feedback and input into the process. This may well have contributed to their willingness to give us such detailed feedback, from which the team has learned a great deal. Equally, as in any collaborative process, our collective challenge is working with people who think or act differently to ourselves. Some found it challenging but recognised that this is a normal part of any collaborative process.

> As is always challenging - peoples' personal hobby horses
>
> Being patient with different characters...and recognising that I may be one

Importantly, this co-learning, participatory approach was based in a recognition that 'who' is involved is also a question of power: whomever is involved influences the framing of the issue and the planned responses. The WDL case is a useful example. As highlighted earlier, the opening presentations and discussions by a representative of the Eastern Maar Aboriginal Corporation (EMAC) and a paleo-ecologist from Federation University emphasised the interlinked social-ecological nature of the system, and the cultural, personal importance of being in relationship with Country, rather than separate from it.

> The presentations by [EMAC rep] and [Fed Uni academic] were very informative and important in providing good perspective ... focus and context on the lakes... especially to relate the past and future status.
>
> [EMAC rep's] thought-provoking talk was the highlight of the day. I've not stopped thinking of it since. It was novel to hear the indigenous cultural point of view so articulately and dramatically presented.
>
> I can't stop thinking about [EMAC rep's] talk and feel privileged to have heard his point of view

These discussions not only saw participants reflect on how they may be able to live well in a dramatically different landscape, but about how to enable Traditional Owner governance and management of lakes.

Yet despite concerted efforts, representation of all potential stakeholders, including the Traditional Owners was not achieved, and representation was not always consistent across the workshops. This was recognised by those who did participate in both cases:

> Good blend of ideas but probably too narrow a base of participants.
>
> We are a quite alike group, so maybe no major confrontations or differences of opinions
>
> Need more agencies currently involved in the management of the WDLs at the workshops (Southern Rural Water, Parks Vic etc.).
>
> Good to hear a little of the different stakeholder perspectives, albeit a biased sample.

Recognition of this potential 'bias' also led to some discussion around how to engage the rest of their communities and those with an interest in the system beyond the people who participated in the pilots (See Section 6.2.4). Getting good representation, working with different perspectives and ways of working, and allowing for people to feel comfortable in sharing their different perspectives and knowledge is not a new challenge for NRM agencies, but it is a critical one.

5.2.2. Co-developing a timeline to understanding past pathways

Another important part of the conceptual framework guiding this project was an argument that understanding the nature of any adaptation 'problem' depends on understanding its history (the pathways that have led to this point) (See (Fazey *et al*, 2016; Walker 2002). Participant feedback from both pilots suggests that collective development of a timeline (See 2.2.4.2) to do just this, helped them gain a greater understanding of the how and why the SES' current state, the range of stakeholders and values surrounding the SES, and thereby, of the construction of 'the problem'. This process also helped in the process of identifying the critical attributes and issues with which the adaptation plan would need to engage.

> Looking back to look forward gives good context to the work and helps to get people thinking and talking.
>
> It made me think about the relevance of the past when considering the future.
>
> My take away was the message of the past conditions of the lakes and how that has shaped the present condition.

The collaborative, interactive nature of the process provided people a safe space in which to share stories, a range of different knowledge and perspectives, and begin to get to know each other and build a sense of team. One respondent suggested we did not spend enough time discussing the resulting timelines. A challenge in any workshop process is the length of time dedicated to any activity. However, a lesson there is that greater and repeated reference back to the timeline would be worthwhile.

5.2.3. Scenarios – conceptually useful, practically challenging

We found that the use of scenarios helped people explore potential futures and possible tipping points. While each case used different approaches to developing scenarios, it was evident to all involved that scenario use in adaptation planning needs more work in complex SESs. However, it is worth noting that scenario development and use was new to the team, so this may have contributed to their limited impact on the process. Nonetheless, it was clear that many of the participants found the exploration of scenarios, such as they were, quite helpful:

> [I] Better understand the range of NRM impacts and responses to climate change. Able to explain what the impacts on the ground might look like and potential actions to curtail or respond to these impacts.
>
> The common consensus that change was going to occur to varying degrees was refreshing."
>
> Developed a greater overall understanding of the area's natural systems and their vulnerability to climate change.
>
> That the different lakes will behave differently and need different treatments, and that it has all happened before.

There was some debate and discussion during the WDL workshops as to whether the process of developing narrative scenarios was a struggle. For example, some suggested

> It was fun and great. A narrative approach was engaging, and drew on creative talents and storytelling abilities. This group chose a couple of drivers that guided their imagination, and they worked from there.

Others suggested it is easier to draw than to do creative storytelling, while one person found it hard **"because its fantasy; I'm trained in working from data"**. Some suggested a set of key questions might have helped more and that storyboarding might also be a useful technique for developing scenarios.

Equally, in the Bogies case, where participants were shown three climate change scenarios and asked to explore their potential implications, several people found the discussions challenging:

> Understanding the climate change scenarios and what they actually mean - e.g. we had to interpret - and then fit to critical attributes, but it worked out in the end I think. RMIT folk added value, and increased 'acceptance' that we are trying to do this in a structured and meaningful way, and that we will learn from what we do.
>
> Discussing how the three different climate change scenarios would impact on the 5 main attributes was challenging. Could have spent all day on this topic alone.

Scenario development in complex SESs is a crucial aspect that requires more time and detailed guidance to iterate the future scenarios. This was particularly highlighted when exploring potential tipping points – an issue discussed in the next section.

5.2.4. 'Critical attributes' - help 'unpack' the system, and identify 'tipping points' and indicators for monitoring

Identifying each system's 'critical attributes' was helpful in developing adaptation plans on a number of fronts. Firstly, it again helped participants understand the complexity of the social-ecological systems on which they were working without losing a sense of those systems being "more than the sum of their parts". It seems this was because they could grasp the idea of each separate attribute, while also recognising that the attributes are interdependent (see the preceding sections). They were then also able to identify adaptation actions and indicators to monitor for each critical attribute. E.g.

> Dams and springs are drier for longer (with measures of what 'for longer' is)
>
> Streamflow stops more often (as above)

Identifying critical attributes also helped address a previously identified challenge of identifying tipping points in complex SESs. The preceding SCARP project had found that while the concept of tipping points is conceptually useful, it's practical application beyond factors that are readily quantifiable (such as spring flow, groundwater table, etc.), is difficult and contentious at an ecosystem scale. In these pilots however, the identification of critical attributes helped with identifying potential tipping points for some of the critical attributes. Despite this, the situation remained complicated when attempting to correlate any tipping point with a particular 'extent' or time period of climate change such as 2030 or 2050.

> My group got into some pretty intensive discussions during the last session of the day, I was enjoying this challenge but was feeling I needed a short break (glass of wine) and then one last go at the

> exercise of defining the thresholds for extent and quality of native vegetation cover.
>
> Defining or identifying tipping points was challenging, and working out how best to capture or describe them was difficult - it was hard for our table facilitator to capture everything (but they did an excellent job!)

The issue of identifying tipping points was particularly challenging for qualitative critical attributes, such as 'sense of belonging' and 'health of people and Country'. For other attributes, the challenge was exacerbated in part, because we did not have models – they either don't exist or we did not have them at hand.

Identification of SES tipping points and thresholds remains a significant question and area of research for this field, and further examination is warranted. Nonetheless, it was clear that conveying the concept of tipping points was useful in this process.

5.2.5. Workshop-based adaptation planning

As in any workshop-based process, for various reasons, not everyone makes every workshop. For some participants this was disruptive; whereas, for others it was positive because it interjected new thinking at different points in the process.

> The introduction of some new people meant some old ground had to be gone over, but this probably also helped them orientate into the group work.
>
> Having a new person in the room was good - perhaps we should plan for new people to 'strategically interject' throughout the process? Maybe invite different level of people? It brings a different perspective to the thinking

Throughout both case studies, participants made suggestions about the workshop designs and processes, which we addressed as best we could. For example some suggested providing some kind of 'homework' after or pre-reading before each workshop.

> Had to come up with positions that we had not thought about. So they may not have been well thought out. Questions to think about beforehand might have helped/ given different responses?

Another concern raised by a couple of participants was that the detailed thinking and ideas of individual participants may have been lost in the process of asking small groups to agree on topics and report back as a group.

> Approach provided a distillation of most popular actions. However some stakeholders' causes may have got lost in democratic processes.
>
> Some of the 1 to 1 discussion points did not make it through to the final draft. There could have been information lost because of this. There is no way of telling.

These issues, combined with questions of diverse representation and how to engage people, suggests that like any participatory

planning, adaptation planning also needs to think about processes that allow capture of such nuance and detail of individual perspectives, and ways of exploring the potential need to discuss and even negotiate between different values. It also raises questions as to whether workshops are the only or best means of enabling participatory adaptation planning (see Section 6.2.5 for further reflections).

5.3. What does all of this tell us about how practical adaptation plans in NRM might be developed and implemented?

Bringing these insights and our experiences together, suggest that practical adaptation plans might best be developed and implemented with attention to the following:

- The experimental problem-structuring approach to pathways planning used here, and particularly the use of many SES resilience concepts and methods, has helped produce adaptation plans for both SES case studies.
- One key challenge was explaining and encouraging people to 'trust in the process' (and understand the current situation and its underlying drivers), rather than just jumping straight into planning for the worst case scenario [the action-reflection tension discussed in Section 6.2.4 below).
- As part of the initial analysis of the current situation, it is worth analysing the raft of existing strategies, plans, programs, and actions, before undertaking this planning. This can help identify previously identified values, goals, data, and possible actions. The adaptation perspective can then begin to 'test' these against actions and analysis developed through the planning process, and examine their robustness against multiple possible futures. This can help identify those actions we want to keep, those we might want to change, those we might want to honour and stop, and gaps or new actions.
- Who is involved is critical to an engaging process, to unpacking and understanding the problem, to shaping the kinds of adaptation actions, and to questions of equity and engaging in a relationship of sovereignty with Traditional Owners. Seeking to include a diversity of perspectives is as much about 'ownership' of a plan, as it is for understanding the socio-political drivers of the current situation. This is particularly important if adaptation planning is to actually enable sustainable and just futures – because such adaptation needs to address current drivers of social and ecological vulnerabilities, inequalities, and degradation. Adaptation planning cannot simply just deal with the impacts of climate change on those vulnerabilities; or worse, adapt the systems and processes that are maintaining our currently unsustainable and inequitable trajectories.
- Equally important to who is involved (or invited) is how people might be involved – traditional workshop approaches are unlikely to work for everyone we might like to learn from and involve (See Section, Next Steps, below)
- As well as engaging with the challenges of complex SES governance, and the need to understand the socio-political drivers of problems, this approach began to reveal many institutional (normative and cultural) dimensions of current NRM and its governance. This can be challenging for many participants – some may even resist the identification of these factors - so attention must be given to creating a safe space in which people who may be invested in current norms, practices, etc. do not feel 'under attack'.
- The timeline method is particularly helpful for understanding the what and, importantly, the whys of the current problem structure. As soft systems advocates argue, developing a timeline allows participants to arrange important events (E.g. weather events, policy and legislation changes, population shifts, and biophysical changes) and other markers in chronological order, enabling insights into how these different events relate to and have influenced one another to create the pathways that enabled the evolution of the current situation. Developing a timeline for use in AP planning for a social-ecological system can help people:

    - Appreciate that it is a social-ecological system, and how it has changed over time;
    - Understand how the current situation of that system 'came to be';
    - Identify how external factors influence it (and their current context);
    - Provide some insights into underlying drivers of vulnerabilities, inequities, and unsustainability; and
    - Put the adaptation vision and challenges into broader context
    - Help highlight that 'no-one is the expert – that everyone holds insights into the system
- The use of scenario planning (beyond extrapolation of climate change scenarios) is crucial and will likely require specialist support.
- Identifying tipping points and thresholds in SESs is particularly challenging and requires further exploration. The use of the 'critical attributes' concept from resilience thinking appears to hold promise for certain types of critical attributes. Further explorations using models and decision-support tools is warranted.

6. Next steps

6.1. For the two cases

Adaptation work continues in both of the case study SESs, much of which builds upon the project's work. Some of that work is aiming to address issues raised in the preceding section and some of it is about finalising the plans and beginning their implementation.

In the Strathbogies, the two citizen science projects are being implemented, and further exploration of pathways planning is being undertaken in Mansfield. The two citizen science projects are listed below and more information can be found on the gbcma.vic.gov.au website:

- ' '3B: Bores, Bogies and Beyond': this project aims to monitor and learn more about water tables as they are critical in stream flows, keeping bogs wet, and providing residential water. A 'citizen science' bore monitoring project using the latest technology is being established.
- 'Strathbogies Trees: Growback or dieback?: Is a citizen science project that regularly monitors the health of the Bogies' 'big old trees' (as a start) to determine trends, and to help inform revegetation and habitat improvement efforts.

In the Western District Lakes, CCMA is finalising the plan and implementing several of the key identified actions. Primary among these was the need for a review of potential governance models for the region. To this end, they have engaged some 3rd year environmental management students to conduct this review and interview many of the participants. They are also contemplating how to coordinate with the review of RAMSAR criteria and action re climate change.

One issue for practitioners engaging in research is the challenge of extending what has been learned into areas beyond the case study.

> I have not yet had the time or space to properly think through how to utilise the process and the findings from the workshops. This is something that I would desperately love to incorporate into implementation of actions; however it is a symptom of current work places that fewer people are doing more work which ultimately restricts innovation and the opportunity to adapt. This is a broader issue in this sector.

This suggests that the planning process also needs to provide reflection time for participants to consider where and how they might apply what they've learned – the question is, how and when?

6.2. For research

Through developing and applying a co-productive, problem-structuring approach, this project has progressed adaptation planning in NRM. It has also identified a number of remaining questions, which are outlined on the next page.

6.2.1. Adaptation governance in NRM

A participatory, problem-structuring approach helped reveal many institutional dimensions of the governance of the two SES case studies. In the WDL case, the group has commissioned a review of potential new governance arrangements. They identified the need for governance that engages people beyond the project participants as crucial; in particular, learning from and respectfully engaging with Traditional Owners (See next point) and those not directly (or typically) involved in these planning processes. This raises a number of research (and practice questions), including what sorts of governance models might enable implementation and monitoring and evaluation of adaptation plans (such as adaptive, reflexive governance), including governance arrangements within a SES. The governance review being conducted for the WDL may provide some insights into this.

6.2.2. Working in relationship with Traditional Owners

Central to the questions surrounding governance models for SESs in the face of a changing climate, are questions concerned with who defines and is involved in such planning and governance. This project benefited from existing and growing efforts by Traditional Owner (T.O.) Corporations and CMAs to collaborate in NRM. While T.O. organisational workloads precluded their participation in a series of four day-long workshops, their contributions still had significant impacts on the thinking and the subsequent work of the pilots. In the WDL case particularly, the opening presentation and context setting by a representative from EMAC has clearly had a lasting influence upon the WDL project. The WDL participants argued that learning from and collaborating with Traditional Owners could help us (necessarily) transform the way we think about, live in, and be in relationship with Country in pursuit of shared, sustainable regional futures. Respectful and genuine collaboration and working in relationship will require explicitly acknowledging and grappling with the colonial and modernist roots of NRM, regional governance, and planning (adapted from Porter 2007).

6.2.3. Scenario planning

Asking people to contemplate and explore multiple possible futures was one of the most difficult aspect of the process; most just wanted to plan for worst case (and start doing so straight away). Consequently, some remaining questions centre on issues of how to encourage people to work through the process in order to better understand 'the problem' rather than jump straight to action planning. It is understandable that people want to move straight into 'solving the problem', but without understanding the problem, we risk using the 'wrong solutions' for the 'wrong problem', and making things worse. A related question is, what kinds of scenario planning processes encourage people to explore multiple possible futures (particularly in the face of our currently tracking the worst case climate change projections)? And how might we bring in scenario development and planning skills given the need for such methods to also be 'problem' or context specific? Upon reflection, the convening team think the deductive method (by using 2 key system drivers to create four possible future scenarios) is a simpler way of creating scenarios – albeit only four. That said, we will be exploring ways of developing our skills in this area.

6.2.4. Engaging beyond just workshops & sticky-notes

Finally, there was discussion among participants in both pilots about whether a series of four 'all-day' workshops is feasible for all participants with whom we might want to work. It is likely a mix of engagement activities would be best, given the variety of groups that need to 'have ownership' of the governance of any social-ecological system.

> How do you get them here? How do you get them engaged? We need to test actions with different groups --; young farmers, good stewards. Farmers would not want to go through this process. What

about gateways other than Landcare to farmers?

Questions remain as to the efficacy of different engagement methods for such planning, including that different 'problems' will likely need different adaptation planning approaches. This highlights questions as to what sorts of methods might help to genuinely engage a wider group of people than the 'core' workshop participants? One suggestion was to explore the use of different technologies. Consequently, we are exploring other options, such as online, crowd-sourced feedback on the draft plans, the use of models of different critical attributes, and other decision-support tools.

There may also be some value in establishing a number of different planning groups; to ensure representation and a 'safe' space for different participants; and to allow for different and more culturally relevant engagement practices. Doing so may draw out an even greater array of preferred futures, scenarios, and actions, and help better explore synergies and tensions between the different perspectives. See, for example, the work of Offermans *et al.* (2011), who explore a number of different perspectives or preferred adaptation pathways for water management strategies.

Finally, there are always tensions in collaborative processes regarding time. The kinds of people who are willing to engage in such processes are often already engaged in several such activities and/or are often asked to. Equally, the people and organisations with whom we may want to collaborate may simply be too busy. Several participants suggested that we did not take enough time to delve into the details of all the issues. There is a real tension here between our desire (and need) to do so and not over-stepping our imposts on voluntary participants.

None of these are new challenges but all require consideration in any genuinely participatory adaptation planning effort.

7. Conclusion

This report presented insights from a project that sought to test and develop an approach to adaptation planning that engages with the uncertainties, complexities, and contestations of NRM. The project piloted a diagnostic, problem-structuring approach to the concept of adaptation pathways planning (Bosomworth, *et al.* 2017) that drew on a range of additional theories and methods; particularly social-ecological systems resilience, and transitions management. Use of the framework in two social-ecological systems found that facilitating groups through it, including drawing on diverse perspectives, exploring past pathways and multiple possible futures, and identifying 'critical attributes' helped participants:

- Stimulate and appreciate a social-ecological systems perspective
- Begin to understand many of the underlying drivers of NRM issues and then identify actions to address them
- Identify 'critical attributes' to help understand the social-ecological system and practical adaptation actions that contribute to its adaptive capacity, and identify potential indicators for monitoring
- Appreciate the concept and use of potential tipping points, particularly in relation to monitoring

A participatory, co-learning approach that explicitly seeks diverse perspectives and is cognisant of and sensitive to different participation styles and cultures, is fundamental to such planning. One of the case studies showed how the process can help people identify governance and even paradigmatic barriers, and thereby, identify potentially transformative actions (e.g. seek transformative governance arrangements and practices). Overall, the project helped develop some practical adaptation plans for NRM that are informed by an understanding of and engagement with uncertainties, complexities, and contestations.

We look forward to continuing this work.

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9. Appendices

9.1. The Bogies and Beyond case study

The 'Bogies and Beyond' case study used the Goulburn Broken CMA's 'Our Catchments Our Communities' (OCOC) funding to work with the Strathbogie Ranges community to develop an adaptation plan. The Bogies are approximately 150km north-east of Melbourne, north of the Great Dividing Range, separated by the Goulburn and Broken River valleys. The Taungurung are the Traditional Owners of this Country (TCAC., 2016), Taungurung were the first people of the rivers, valleys and mountains in this region. Taungurung people still live on country and are still actively involved in caring for their Country and there is much that can help guide adaptation planning. TCAC's Country Plan can be found here:

https://www.gbcma.vic.gov.au/downloads/Traditional_Owners/Taungurung_CountryPlan_WEB.pdf

9.1.1. Establishing the convening and planning teams

In GBCMA, following an initial stakeholder analysis, a convening team was formed that included key community representatives, the facilitator, and the NRM planner. A Taungurung representative was invited but they were unable to participate because of large, existing workloads. GBCMA worked to keep them in touch with what was discussed. (GBCMA continues to work with the Taungurung). The convening group worked with the research team to design the workshop process, including guidance on how best to engage the Strathbogie community. Invitations for participation in the adaptation planning was through an Expression of Interest (EoI) process that invited people who owned a property in the Bogies to submit an EOI form that was advertised in the local newspaper and on the GBCMA website. This process was thought to be useful as it was known that the area has a highly engaged community in NRM, they generally know each other, and it is a well-recognised landscape with which they all readily identified. Some background information of each participant was provided through key questions in the EOI – such as what do they value about the Strathbogies and what do they see as the challenges. The EOI was explicit about this project being about Climate Change and therefore probably attracted a certain group of people. It was important though that people self-selected instead of being asked or 'told' to attend meetings.

A series of four workshops across four months were conducted to apply the planning framework. The approach and methods used were informed by a range of theory across adaptation planning, sustainability science, and participatory action-research, as well as regular feedback from participants in an ongoing action-research approach. This sought to enable co-learning among the workshop participants, GBCMA, the researchers, and our facilitator, and help build the confidence and skills of us all in planning and decision-making under conditions of uncertainty in environmental and natural resource management under a changing climate. The adaptation pathways planning workshops for the Bogies were held between March and June 2017. Figure 1 (see page 9) depicts the structural framework used to show participants how the various pieces of work conducted in each workshop related to one another. Figure 2 below depicts the focus and flow of the four exploratory workshops. They involved 25 people including local farmers, weekenders, Landcare and Conservation Management Network representatives, a bee keeper, viticulturists, horse breeders, industry representatives, and academics who live in the area. Initially three workshops were identified but the group was keen to have a fourth workshop to further develop projects. A brief overview of each workshop follows.

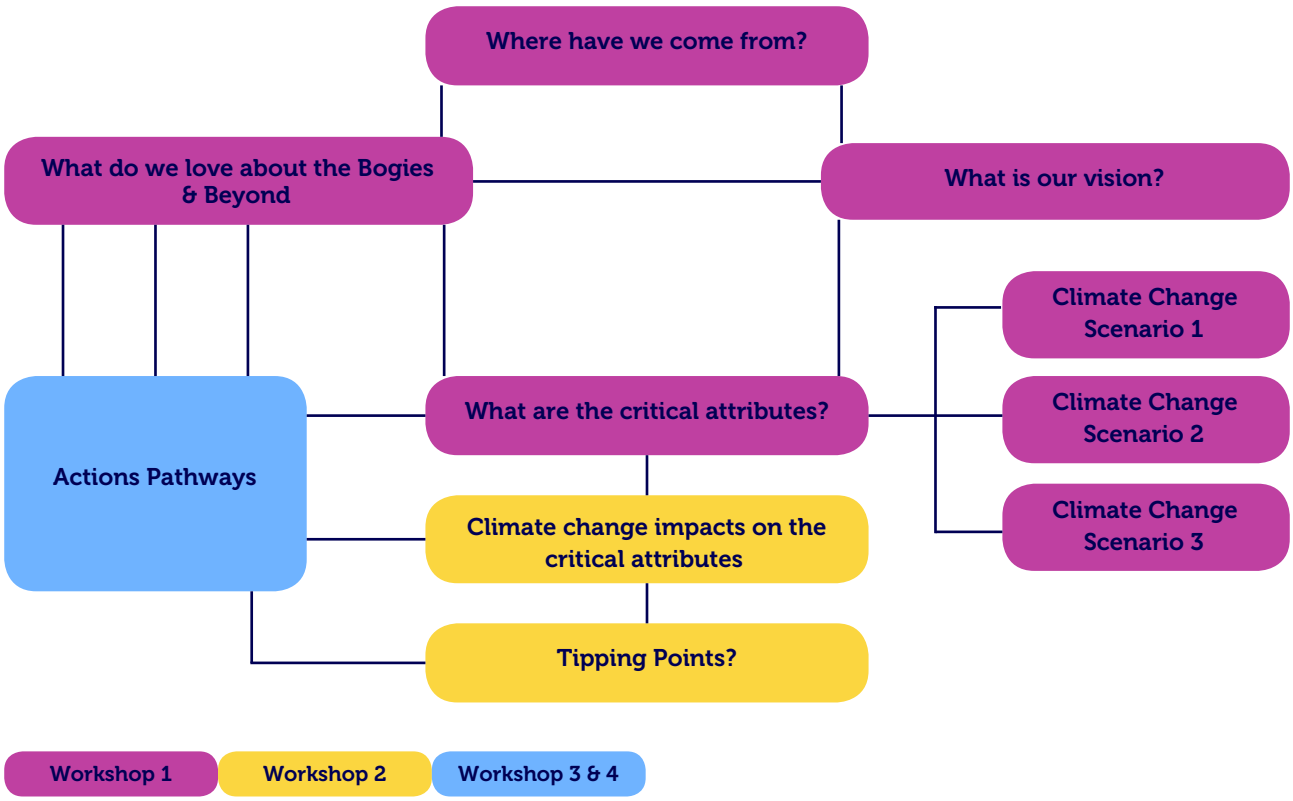


Figure 2 Bogies and Beyond Workshop process & relationships. By Fiona Johnson.

9.1.2 Workshop 1: Establish a shared futures perspective , unpack the current situation, & explore possible futures

After an acknowledgment of Country and a round of introductions, the first step in this workshop was development of a timeline of change. The importance of initially getting the group to develop a timeline was to help get them in a 'change happens' mindset, which is particularly important given the uncertainties surrounding global environmental change. We then discussed their responses to the EOI questions around what they value to ensure that the extent of their 'heart' values had been captured. This created a long list of values, including; the varied landscapes, native vegetation, waterways and spring soaks, the local community spirit, Indigenous and European cultural heritage, proximity to Melbourne, and the relatively temperate climate. From these values they then developed a 'vision': *A sustainable future for the 'Bogies and Beyond' that reflects our sense of place and pride in our engaged and inspired community, diverse landscapes, cultural heritage, and compatible economic development.*

From there, the participants broke into table groups to come up with a list of critical attributes that were then grouped and summarised to provide the following five attributes that they consider 'critical' to the social-ecological system of the Strathbogie Ranges:

- productive land;
- water quality and flows;
- native vegetation extent and quality;
- landscape diversity; and
- belonging.

Identifying these 'critical attributes' enabled the group to discuss what they understood about them. Then, after a presentation on the three likely scenarios for the region using CSIRO's 'Climate Futures Tool', they were taken through a process wherein they discussed how climate change might affect these critical attributes. The three scenarios were:

- Warmer and little change in annual rainfall but increase in intensity
- Hotter and Drier – including a harsher fire-weather climate
- Slightly warmer and wetter

See https://www.climatechangeinaustralia.gov.au/en/climate-projections/climate-futures-tool/introduction-climate-futures/

The participants then broke into three groups taking one climate scenario each. The groups initially described the scenario and then considered the potential impacts of the scenario on each of the attributes. In closing the workshop, everyone was encouraged to speak to their friends, neighbours and other community members about climate change and the workshop, and to take notes about what they heard.

9.1.3 Workshop 2: Further explore potential implications and begin action planning

Workshop 2 continued the discussion of potential implications of climate change with a focus on identifying 'tipping points' at which the different attributes might shift (positively or negatively) to a different state. To begin however, people were asked about whether they had discussed climate change and/or the workshop and what they had heard.

To assist a couple of participants who had been unable to join the first workshop, participants broke into the same table groups from the first workshop with the new participants choosing a table group. Each group was provided with the original notes they developed at the first meeting. The participants found that they had a great deal to contribute to this session and the time was extended to ensure the contributions could be captured. The changes and additions were primarily to bring in the new participants' ideas, flesh out some of the previous input and finish any of the last sections.

The next step sought to identify tipping points - an event (e.g. introduction of foxes), a condition (e.g. soil pH reaches 3.5) or a situation (e.g. drought conditions 5 years in a row) that mean that one or more of the things we love about the regions can no longer be maintained and are changed for ever. This process was informed by an initial presentation of 'relevant literature' by GBCMA aided by the research team.

The participants then broke into three groups ensuring there was a spread of people representing the three climate scenarios across each group. The table took one of the top attributes each, a copy of the tipping point presentation and had one of the organising group as a table facilitator to take notes and guide the conversation. The groups were asked to discuss:

1. What would the tipping point look like for that attribute for the region?
2. How would they tell if you were heading towards it?
3. What information do they think they might need to be able to tell if it was being reached?
4. Who would know that or where would that information be?
5. Will the tipping point be reached under each of the scenarios and if so, an estimate of the time it would be reached.

The timeframe was described as – happening now; 1-5 years; 5-20 years and more than 20 years.

This session was quite challenging as everyone tried to switch their minds from the individual climate scenarios to the tipping point that was independent of the climate scenarios and was just related to the attribute! The groups worked to identify

specific tipping points for each of the critical attributes in order to identify what we need to monitor so we can understand if the region is approaching any of the tipping points and then use that understanding to prioritise the actions we take. We may want to maintain something (resilience), start changing it (adaptability or transition), or we may want to transform our actions entirely.

This process helped identify knowledge gaps and potential tipping points, and from there, priority actions, including proactive ones. This led to identification of priorities within those five critical attributes: ones they could do something about 'now', ones that would be most affected by climate change, and ones that required more work or a 'watching brief'. However, we only managed to get through three critical attributes in the workshop. We then discussed how this process will enable the group to think about priority actions, including how people might proactively adapt. The group identified two critical attributes to develop projects for: 'water' and 'trees'. People then chose which of these two themes they were most interested in participating. They then suggested a fourth workshop to develop up the Bores and Trees projects that would receive the Our Catchments Our Communities funding.

Everyone was again encouraged to take photos of what they love about the Bogies and Beyond between workshops.

9.1.4 Workshops 3: Refine adaptation actions

(Connecting the short term to the long term)

The third workshop aimed to finalise the tipping points and then spend the majority of the time identifying actions and next steps. As the workshop progressed the outputs of all the previous sessions and the ones from this workshop were put up on the wall. In this session the group went back into the attribute groups (water; land/soil & economic productivity; native vegetation) to review what they had completed at the last workshop, what gaps there were and to finalise the tipping points. If they hadn't already, the groups separated out different elements of the critical attributes so they could be more specific in identifying the tipping points.

The same questions from Workshop Two were provided with a bit more detail to assist the discussions. This included splitting 'what we need to do' into three separate activities as follows:

- Activity 1. Identify which of the attributes are at or getting close to a tipping point.
- Activity 2. Develop an objective for each of the elements of the critical attribute that is at or close to the tipping point. An objective embraces two things – the first is that you are wanting to move away from the tipping point and the second is that you want to move towards the things that you love about the B&B.
- Activity 3. Identify the potential actions that would deliver the objective. To do this the groups were encouraged to ask the following questions to help narrow down what change was needed to deliver the objective. The questions were –
    - What has to change?
    - Who has to change? By when?
    - How many have to change? Where in the landscape are they?
    - Why isn't the change happening already?
    - What is in place already?

The groups were encouraged to also ask what change they could influence and what they could not and to focus on what they could influence. Some groups progressed further down the detailing path.

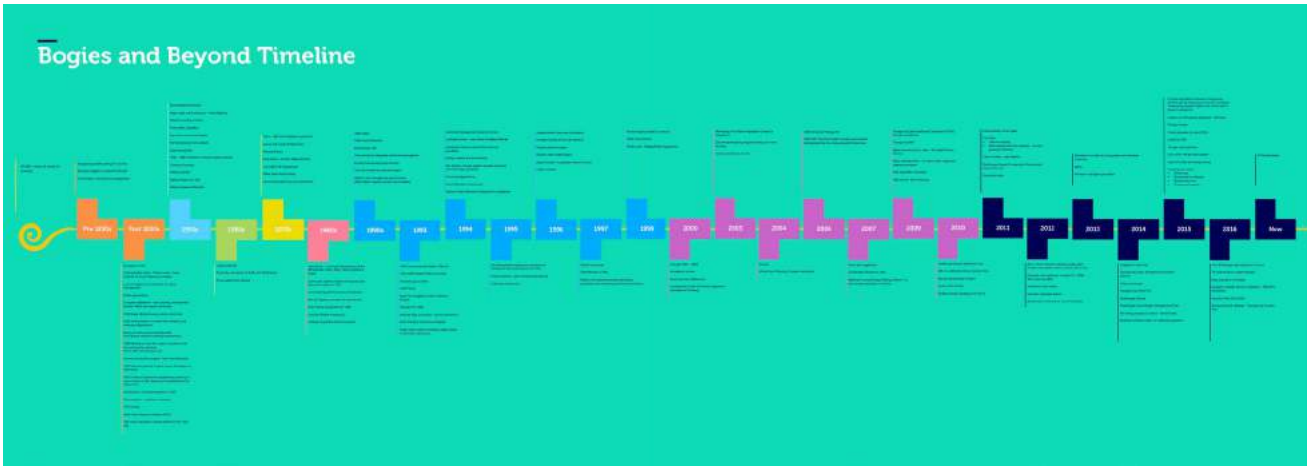
At the end of this workshop, the group was asked how they would like to proceed and most were keen to hold a fourth workshop where they could further develop project plans.

9.1.5 Workshop 4: Implementation

Two projects - one for water and one for 'trees' - were developed in the 3rd and 4th workshops, through refining the tipping points and potential actions. Workshop 4 therefore focused on developing those project plans including smaller working groups for each project to continue to deliver the projects with community input. This ongoing voluntary involvement was one of the great successes of the project. Further commitment to the project was in the general participation of the group who, throughout the process, took photos of places and things they loved about the 'Bogies, and discussed the project and climate change with their neighbours. Several reported back on the concerns other community members had about climate change. Several expressed surprise that many farmers were concerned. They all thought that the project was a great way to begin discussing climate change with others and identifying previously unknown and undefined community concerns.

The two projects are continuing and further work is being conducted to obtain wider community feedback on the draft plan.

See the full version of the Bogies and Beyond Timeline via http://cur.org.au/cms/wp-content/uploads/2017/07/timeline2.pdf



9.2 The Western District Lakes / Victoria's Volcanic Plains

The Corangamite case study was the Western District Lakes (WDL) or Victoria's Volcanic Lakes and Plains region. The WDLs are a large social-ecological system (SES) in south-west Victoria near the town of Colac. The peoples of the Maar Nation are the Traditional Owners of this Country. The Eastern Maar Aboriginal Corporation's (EMAC) Country Plan (2015), which also informed the project, can be found here:

http://www.ccma.vic.gov.au/admin/file/content2/c7/EM%20Country%20Plan%20FINAL%20A4%20Low%20Res.pdf

Past volcanic activity produced the WDL landscape of over 1500 wetlands and lakes from very small, shallow ephemeral systems to large, deep, permanent lakes. Nine of the lakes are Ramsar listed. Lake Colac is the largest freshwater lake in Victoria and Lake Corangamite is Australia's largest permanent saline lake. This SES also includes grasslands, small patches of woodland, and stony rises.

Like the Bogies case study, this case also sought to collaboratively develop Adaptation Pathways options for its area. In doing so it sought to complement Corangamite CMA's (CCMA) Connected Landscapes project, funded through the Victorian Government's Our Catchments, Our Communities. These workshops were held between June and October 2017. Participants included local Landcare members and farmers, an EMAC representative, Colac Otway Shire representatives, state government representatives, two academics from Federation University, and a representative of a neighbouring CMA. 19 people in total variably attended the workshop series (meaning seven people only attended one to three of the four workshops. For example, a representative of EMAC participated in the first workshop and provided feedback on the draft reports of the other workshops. 12 people participated in all four workshops. Participants were asked to take photos between workshops of places and things they loved about the WDL.

9.2.1 Establishing the convening and planning teams

In the WDL case, while there are individual interest groups and clubs, and an array of organisations with recognised roles, stakes, and even responsibilities around the WDL, there has been little 'collective activity' regarding the Lakes as a system. Most participants in this case had never met or worked together, and while they had individual 'senses of place', they argued that the WDL are not (yet) seen as an iconic site. In this context, the convening team consisted of the researchers and CMA planners. Following an initial stakeholder analysis by the convening team (the NRM planner, the research team, and facilitator), invitations were sent to targeted individuals to ensure representation of the different communities and organisations thought to 'have a stake' in the WDL.

Figure 3 below depicts the focus and flow of the four exploratory workshops. Descriptions of the intent and processes used in each follow.

Figure 3 WDL workshop and plan development process

9.1.2. Workshop 1: Unpack the current situation, identify critical attributes, and develop a shared futures perspective

Workshop 1 was structured around three key areas of work: context setting, exploring the current situation, and getting to a shared futures perspective. This first workshop started with a number of small team building exercise that sought to help us appreciate there is no one right answer, and that working in complex spaces requires some creativity. We did this by first standing closest to those with whom we work the closest. We were then asked to introduce ourselves to the group and share the 'gift' we bring to this process. To explore our hopes and fears, we were asked to pair up with someone we didn't know and to play a role of an A or B. 'As' were to present to their partner arguments for why this is a complete waste of time, and 'Bs' were to present to their partner arguments for why it is the time for such a project. It is needed. Bs were then asked; are there hints of truth in what the As said? And then As were asked if they could admit something about what the Bs argued, that there is need for this project? This led to a brief discussion around the fact that the uncertainty issue is not just climatic; different farming, land use processes etc.

To explore the differences between 'simple', complicated, complex, and chaotic situations we then went through a number of interactive group activities guided by the Cynefin framework, which suggests contexts are defined by the nature of the relationship between cause and effect. (Snowden, 1999). Complex situations are those where there is not an obvious, single, or direct link between causes and effects. Finally, we invited people to explore two 'psychological frailties of the human condition': retrospective coherence and sunk cost bias. This set a positive tone for the work and encouraged the group to challenge ideas and processes proposed by the convening team.

We then stepped formally into the planning process. As highlighted in the introduction above, adaptation planning requires us to understand both the socio-political construction of the issue for which we are planning, and it's linked social-ecological nature – how we (and the system) got to be here and why. To explore the current situation of the WDLs, we asked a

representative of the Eastern Maar Aboriginal Corporation (EMAC) and a paleo-botanist colleague from Federation University to talk to us about their perspective on and knowledge about the Lakes.

In listening to and talking with our EMAC colleague, we learned many things, including that Water is sacred; Country is everything; and *"when you have a conversation about Country, it's a personal conversation". "Dreamtime stories are a history of this country, of creation and change. These Dreaming stories are our management plans. The Dreaming is current, living and still creating. It isn't the past alone. It is the past, present, and future. This group will create its own Dreaming." This led the group to discuss how they might meet the need to keep the conversations open for how to manage the land.*

Similarly with our paleo-ecologist colleague from Federation University, we learned that the WDL are "the most significant lakes in the Southern Hemisphere (save maybe for Lake Titicaca)". He showed us how the Lakes had changed over 10s of thousands of years, and how this accorded with Aboriginal knowledge and stories. For example, that only 4,000 yrs ago the landscape was She-Oak from Colac to Mt Gambier: red-tailed Black Cockatoo country. 500 years ago, there was a shift in Lake Colac from plant dominated to algae dominated due to big drought at that time. This correlates with Eastern Maar stories, which say it was marsh, not lake. Inspired by these two discussions the group then started to develop a timeline in order to appreciate the paths we've taken to get here.

These two discussions led the group to argue that although this project was focused on wetland adaptation, it needs a whole-of-landscape approach that includes the social and cultural. As a result, the Adaptation Plan for the WDLs adopted a social-ecological system perspective.

This was done by breaking the participants into pairs and 'interviewing' each other for 10 to 12 minutes. Some went for a walk, others stayed and had coffee, etc. To guide their interviews, they were asked to ask each other:

Q: What is your vantage point/ your perspective?

Q: From that vantage point/perspective…where do we need to focus our attention?

We then gathered in a circle and discussed what we heard and talked about in our pairs. As we raised a point, we were asked to place it with any others that were similar (if at all). We then sat in pods of four and discussed the questions - When you think about the things that need attention, what are their drivers? What are the things that can have a big impact; that influence the outcome? After writing each point/driver on a post-it note, we placed them under social/cultural, technological, economics, environment and politics. The group was then asked to reflect on what patterns they were starting to see. This established some draft critical attributes.

Finally, to develop a shared futureS perspective, we were asked to imagine our facilitator was a clairvoyant and can see everything in 2050. He asked, "When you think about building an adaptive, resilient WDL under climate change what would you ask? And why is it an important question for you?"

9.2.3. Workshop 2: Explore possible futures (What could happen)

We had a couple of 'new' people arrive for workshop2. So we first asked people from the first workshop to talk about some of their reflections on that workshop and for the 'new' people to ask questions. We then broke into table groups and each group went through four different sorts of reports and plans for the WDL, to see what they might tell us about drivers, forces, potential tipping points or thresholds, and therefore, further define the critical attributes. In these groups, we considered four questions in relation to these reports:

- What narrative or story does the report tell us about the WDL landscape?
- What does it tell us about critical drivers or influences in that landscape?
- What does it tell us about the trends or status of those drivers?

- And, are there any tipping points?

Tipping points were defined as akin to thresholds, where when crossed, might shift the WDL landscape into a new domain or form or function. 'Turning points' were used to define points where "a part" of a critical attribute might begin to shift.

Each group was asked to identify five key drivers of the WDL landscape – drawing on their report or plan, the 'what needs attention' and drivers work from Workshop 1, and their own knowledge. We then 'mind mapped' connections and influences between and among these drivers, and clustered like drivers until we identified five key drivers:

- land use and management
- healthy people, healthy country & biota
- hydrology and geomorphology
- people, policy & politics; and
- climate change

Importantly, this process revealed that there is an extensive yet unconsolidated array of data on the Lakes. It was suggested that there is a piece of work just to bring that data together and that it could help a more in-depth exploration of the Lakes and potential tipping points and futures.

To explore 'what could happen' under multiple possible futures, we first had a presentation from the NRM planner of some vulnerability mapping under 3 climatic futures that had been previously undertaken. We then broke into small groups and spent 10-15 minutes reflecting on the kinds of futures we might imagine for the Lakes landscape, and to make some drawings or notes. We were then asked to envisage and develop narratives for three plausible future scenarios for the WDL landscape using the above drivers as our 'palette'. In the timeframe, each group developed one to two utopian and one to two dystopian futures each.

Utopian

- Traditional Owners collaborative management of the Lakes landscape
- Linking policy, land use and people
- Dry climate with integrated, well-functioning policies
- Spatial decision-making
- Landholders paid to manage wetlands on their properties
- United management ('super ministry') for the WDL landscape

Dystopian

- Lakes? What Lakes?
- The Road
- Dried up and dead
- Dry climate with poor policies
- Disunited management

We then reflected on the process to date, and discussed the planned process for workshop 3 – getting into adaptation planning.

9.2.4. Workshop 3: Develop adaptation actions

This workshop focused on questions of things we want (and 'can') maintain (resilience); things we might want to shift towards a tipping point or back from (adaptability); and things we might want to transform/ change significantly. It also explored questions of when might decisions have to be made; how long might they take to make and implement; and what that means for when we start talking about them? It then used the utopian/positive and dystopian/negative future scenarios as potential 'compass points' for the future, against which we considered the robustness of the draft adaptation actions by asking; "are they moving us towards producing more stories we want to see and away from those we don't want to see?" We linked the 'things that need attention (from Workshop 1) with the Critical Drivers defined in Workshop 2, to explore potential actions that might address those needs to develop a major suite of potential adaptation actions. We did this by placing post-its with 'things that need attention' onto a card for each Critical Driver.

After this initial mapping, we were asked for further reflections on the 'things that need attention'. In order to move into action planning, we used the configurations of 'what needs attention' against each critical driver. We were asked to consider the things that need attention and to think about potential actions that might address these. After spending some time describing such actions and our rationales for them, we were then asked to look at the vulnerability maps of the WDL wetlands, which were developed by the CCMA (http://www.swclimatechange.com.au/). Here we discussed some of the potential implications of those futures for the WDL landscape, which sought to help us consider the robustness or need for change/flexibility in our lists of potential actions. Finally, we were shown some example actions from the CCMA Climate Change Adaptation plan for further ideas. In developing our actions, we were asked to provide as much detail as possible and to think about things we want to:

- Keep doing or extend (new ways of doing things that are visible somewhere)
- Change/transform
- Stop, honour, and bury
- Start

This gave us an initial and large bunch of potential adaptation actions, which were then taken into Workshop 4 for refinement, clarification and initial sequence/pathways planning.

9.2.5. Workshop 4: Refining actions & implementation planning

This workshop focused on refining and clarifying actions, identifying potential barriers and enablers of our actions, and an initial form of prioritisation and timing. We did this by first working in pairs or groups of three and reading through single theme of activities/actions that were drafted in Workshop 3. We were asked to:

- Make notes and highlight as we went – on the print outs
- Identify and note down how we would make the actions clearer and rationales stronger
- To consider, if you were handed this set of actions, what else would we need to know?
- To also note down things that need to be in place for this action to happen

Following this pair and trio work, we were then brought back together as a whole group to discuss our reflections and suggested edits, inviting others from the whole group to make further suggestions. This led to the refinement and clarification of most actions and additions of more. We also started to order the actions into various ‘adaptation pathways’. This produced several tables of adaptation actions for each critical attribute, including considerations of what needs to happen to enable the actions, barriers and actions to address those barriers, and existing activities or possibilities that could enable implementation of an action.

The suite of potential adaptation actions identified through this process are being further developed into a strategic framework for CCMA and its partners to guide their future actions in promoting longer-term resilience of the WDL landscape under a changing climate. It will also be used to guide ongoing monitoring and evaluating of the area’s ‘adaptation’ to climate change, and indeed other future impacts. The group is now exploring potential governance models to keep working together to both implement some of the priority actions, monitor actions, and to refine the adaptation plan. Indeed, establishing joint governance amongst all the players was seen as a major priority.

80,000 + years of caring for Country.

Pre 1830s

Maar Nation caring for Country

Geology suggests occasional drought

First Peoples cultural land management

Post 1830s

Colonialisation starts, 'frontier wars'

Distruction of indigenous knowledge and land management

Stolen generations

European settlement - land clearing, feral animals

1836 Major Mitchell survey starts a land rush

Gold mining leads to increase land clearing and waterway degradation

Mining of native grass lands/ species

Farm grants with land clearing requirements

1840s-1850s

Sheep arrive – European land grab

Gold rush

How can we continue to make "invitations to learn how to look after Country"?

Lake Corangamite "nearly dry"

Only fragments remain of our view of landscape

Sheoaks in the landscape

1860s-1890s

Leasehold - freehold

1860 Nicholson Land Act
Eildon Weir and railways built
Internal combustion engine – farm mechanisation

Drainage/diversion scheme proposed "pipeline to the sea"

Lake Corangamite "very full"

Traditional burning begins to decline

1940s-1900s

Dingoes are removed from the environment

WW1 soldier settlement

1903 licences granted to graze crown frontages on waterways
1907 Forestry Department established resulting in more control of tree clearing and establishment of researched.

Introduction of superphosphate in 1929

Wine industry – phylloxera outbreak

CFA formed

Violet Town firewood clearing 1920s

Tree cover reduced to current extent by the 1930-40s

Federation drought

Mostly very dry decades, but some wet years

13 year dry period – WW2 drought
(1939 – 1946)

1939 fires

1944 fires

1950s-1960s

Super phosphate around 1950

1953 Lough Calvert Drainage Scheme

Prevent flooding of agricultural land next to Lake Corangamite and Lake Gnarput - 1959 Drainage and diversion – Woady Yaloak Diversion scheme

Land buy back - Corangamite

Phalaris 1959/60

1969 – Groundwater Act (First groundwater management)

1952 – wettest on record

1952 – 1960ish Lake Corangamite rises 4m. "Creeping Lakes"

1967 Drought

1970s-1980s

Extension of Lough Calvert Drainage Scheme

Tall wheat grass

Water Act 1980 (First Integrated Water Act)

Raised bed crops

Water Plans published

Large colonially nesting waterbird events

1970 – rapid increase in CO2

1977 fires

1982 drought

1982 RAMSAR status

1990s-2000s

1992 Salinity Action Plan "Lakes in Peril"

1992 Mabo/ Native Title

1997 CMAs established

1999 EPBC Act

2000 National Action Plan for Salinity and Water Quality

2001 September 11

2002 Borrell-a-kandelap project

2005 – Second Salinity Action Plan "Lakes in Peril" – not acted on

2009 EPA report - CC impacts on lakes in Western Vic

1997 – Big Dry

2000 – 2010 Millennial drought
Social impacts from drying lakes – saline dust, decreasing recreational opportunity

Decreased water levels and increased salinity in Corangamite, Murdeduke etc. Dry inflow contingency planning

Dusty Lakes study (b'w 2007-2010)

2010s

'Meerreengeeye ngakeepoorryeeyt' - Eastern Maar Country Plan

2010 Victorian Traditional Owner Settlement Act

Sustainable Water Strategies

2012 BAK Project finished

2015 Enlargement of culvert b/w Cundare Pool and Lake Corangamite

2017 Climate Change Policy

2017 Water Plan

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