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Climate-ready biodiversity management

A tool to help design biodiversity projects in the face of climate change

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Capacity for resilient futures

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Foreword

Sydney Coastal Council Group (SCCG) commissioned CSIRO to develop a tool to help councils consider the needs of long-term climate adaptation as they developed biodiversity conservation projects to be funded within their Sydney's Salty Communities Program, funded by the Australian Government. Developing the tool was an opportunity to implement with local government two key adaptation innovations developed by CSIRO. The 'climate-ready' approach to adaptation emphasises the inevitability in the long-term of significant levels of ecological change, and the need to consider impacts of multiple different aspects of biodiversity that are valued by the community (Dunlop M, Parris H, Ryan P & Kroon F (2013) *Climate-ready conservation objectives: A scoping study*, National Climate Change Adaptation Research Facility, Gold Coast, 102 pp. https://www.nccarf.edu.au/sites/default/files/attached_files_publications/Dunlop_2013_Climate-ready_conservation_objectives.pdf). The 'values-rules-knowledge framework' is used to identify interventions to overcome potential barriers to future biodiversity and adaptation decisions that arise from the societal context within which projects and strategies are developed and implemented (Gorddard R, Colloff M, Wise RM, Ware D, Dunlop M (2016) *Values, rules and knowledge: Adaptation as change in the decision context*. Environmental Science & Policy, http://dx.doi.org/10.1016/j.envsci.2015.12.004).

The tool was developed for use by local government officers undertaking biodiversity conservation initiatives that might need to consider climate change, such as on-ground projects or strategies. However, it will be applicable to other people and natural resources management agencies who are seeking to incorporate long-term adaptation into their programs.

The tool is presented here as a stand-alone product that can be used within local governments and other natural resource management agencies. The tool has been developed, prototyped and trialled with SCCG member councils and other partners, and the documentation reviewed by council and SCCG officers, to help make it as accessible as possible to people who are initially unfamiliar with the key adaptation concepts upon which the tool is based. However, reflecting the nature of adaptation, the tool does deal with some complex issues. As such, it may be more effective to work through the tool with the assistance of people who are familiar with the concepts being used. With use of the tool these skills could be rapidly developed, and shared, within local government and other natural resource management agencies.

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1 Introduction

1.1 Purpose

The climate-ready biodiversity management tool is designed to facilitate the process of assessing conservation initiatives and revising them so they better incorporate climate adaptation. It can be applied to existing and proposed initiatives, and to on-ground projects as well as plans and strategies. The focus of the tool is helping biodiversity planners and managers understand the nature of long-term adaptation and the implication for near-term initiatives. The tool introduces key adaptation concepts and provides opportunities for people to work with them to build their capacity to use the concepts in planning biodiversity management.

Using the tool will provide you with a process to re-assess the assumptions that are explicit and implicit in existing biodiversity management initiatives and to evaluate the extent to which they may remain sound in the face of significant climate change. The process will suggest changes to the nature of objectives and actions, and how various stakeholders might be engaged to ensure conservation initiatives consider and incorporate short- and medium-term climate adaptation.

1.2 Key concepts

The key adaptation concepts used in the tool have been developed and refined from the scientific literature on the impacts of climate change on biodiversity, the literature on climate adaptation, and experience developing new ideas about adaptation and applying them to natural resource management planning with multiple agencies in Australia. The concepts represent a minimal set of ideas that can be effective in improving how planners approach adaptation and incorporate it into biodiversity management. The two primary concepts are *climate-ready conservation* and *decision context*.

1.2.1 Climate-ready conservation

Conservation programs should seek to preserve aspects of biodiversity that are valued and not subject to inevitable change.

This proposition is based on two observations: “climate change is expected to lead to significant ecological change” and “biodiversity is valued in multiple ways”.

- While the ecological impacts of climate change that have been observed to date and can be expected in the next decade may be relatively isolated and small, as the climate continues to change, it can be anticipated that impacts on species and ecosystems will become significant and widespread. This could include change to the abundance and distribution of many if not most species, the extinction of many species, and changes in the composition, structure and function of ecosystems. The date of any specific changes will depend on the future rates of greenhouse gas emissions and climate change. Very significant changes are inevitable without a dramatic curtailing, or reversing, of the rate of climate change.

- Multiple aspects of biodiversity are important to and valued by society: species, ecosystems and other natural features are valued; the diversity of these features is valued; and multiple aspects of any one feature can be valued. For example, individual species can be valued for their existence, the enjoyment seeing or hearing them brings, the things they do (e.g. providing shade or pollination). Native ecosystems can be valued for the services they provide (e.g. local climate mediation), in their own right, as a contrast to human-modified landscapes, for aesthetic and cultural reasons, because they are a key characteristic of places to which people are attached. The list is endless, and different people value different aspects of biodiversity, and the benefits arising from it that are sometimes not articulated or understood.

As climate change has greater impacts, some aspects of biodiversity will be affected much more than others. For example a species may continue to exist, even if it does so in populations in different locations; specific places may continue to be occupied by native ecosystems, even if the composition, structure and function of the ecosystems change. This means that as the climate continues to change it will remain feasible to hope for, and manage for, the persistence of some aspects of biodiversity (existence of a species and presence of a native ecosystem at a location); however, it may become increasingly ineffective to try to prevent change in those aspects that are most likely to change, such as the current locations of species and compositions of ecosystems. Indeed, in some circumstances it might be necessary to facilitate changes in some aspects to ensure persistence of others; e.g. persistence of a healthy native ecosystem might depend on the colonisation of native species from elsewhere.

While the timing of such changes is impossible to anticipate accurately, it is feasible to anticipate the aspects that might change and those that might persist, and to consider the implications of this for biodiversity and the ecosystem benefits and services that society enjoys. And in the medium to long term it is likely to become necessary to focus management on those aspects of biodiversity that have some chance of persisting, while allowing other aspects to change naturally *even if they are valued*. While this change in focus may occur in the future, it does have implications for how biodiversity management is planned and carried out in the near term: current management can be hoped to have a long legacy; future decisions will be best informed by decades of forward-looking adaptive management and research; and future preferences will be shaped by the experiences of change and innovation encountered in the near term.

1.2.2 Decision context

Societal and organisational factors constrain and enable the ability of decision makers to conceive, plan and implement adaptation actions.

This proposition recognises that a range of societal factors enables conservation decision makers to make some decisions, but they also constrain the range of options that can realistically be chosen and implemented; decision makers have the ability and freedom to choose among certain options, but others may not be feasible for them, even if they believe they may be effective. This applies to managers, when making choices about developing and implementing projects, and those developing policies and strategies. Barriers to change can include: lack of knowledge about how to implement certain decisions or about the consequences of implementing them; lack of community endorsement and complex trade-offs; or the strictures of legislation, broader organisational policy, guidelines, accepted practice and social norms. Importantly, the nature of

these barriers means that it is typically not within the power of decision makers to directly make the changes needed to overcome them: preferences are held and expressed by stakeholders; new knowledge may come from researchers or other managers; legislation is made by parliaments; guidelines might be drafted by professional bodies; and so on. These factors can be summarised as spanning knowledge, values and rules (Figure 1). In essence, changes in them are a product of society rather than the decision maker or their organisation.

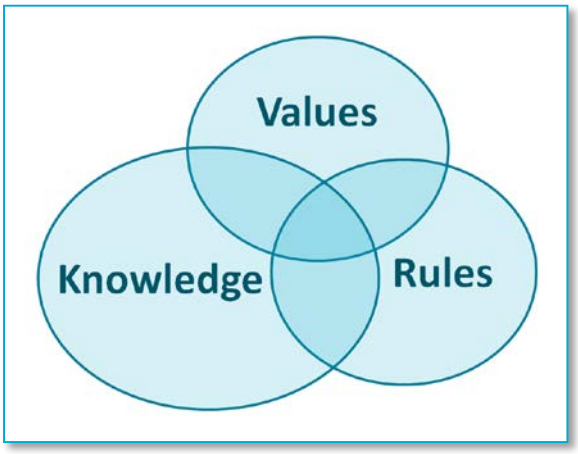

Figure 1. The VRK framework for exploring the decision context[1]. The values (V), rules (R) and knowledge (K) that shape decision making are the product of many processes and people in society. Decision makers have agency to choose among options where V, R and K intersect. Options outside the intersection would require changes in the decision context to make them become available.

When these factors align sufficiently, they enable decision makers to choose among multiple effective options, supported by tools such as cost-benefit analysis. And these factors often do align for familiar problems. This is because the elements within them (expressed preferences, specific guidelines, understanding of a phenomenon) have been designed or evolved in response to society being faced with similar problems in the recent past. Bush regeneration officers are able to design and implement bush regeneration projects because they know how to, society wants them to, and they are supported by legislation, strategy and guidelines. Knowledge, values and rules may not align for novel problems: driverless cars may take some years to be adopted as we all have to work out if they are safe and effective, whether we want to drive or be driven and if we want other road users to be at the mercy of their machines, and as legislators and insurance companies work out how to govern their design and use. Climate change will present many problems that conservation decision makers, their organisations and society have not had to face before. How do we manage a potential mass extinction? Or that of iconic species? How do we manage widespread changes in species populations? How do we manage changing ecosystem types? The decision context that supports current conservation decision making might not be well suited to addressing these and other new ecological problems. Not only does decision context restrict the options that decision makers can readily implement, it affects how problems are

[1] Gorddard R, Colloff M, Wise RM, Ware D, Dunlop M (2016) *Values, rules and knowledge: Adaptation as change in the decision context*. Environmental Science & Policy, http://dx.doi.org/10.1016/j.envsci.2015.12.004

approached, the 'tool kit' brought to the problem, assumptions about what success should look like and the set of actions that might be relevant.

While decision makers might not be able to alter their decision context directly, they will frequently be able to affect it indirectly and start the process of overcoming barriers. For example, they may be able to design activities into projects that provide specific opportunities for those that can more directly affect the decision context to learn about the changes needed to manage biodiversity effectively as it responds to climate change. Targets for this learning could include the community, industry sectors, scientists, legislators, others in their organisations, and so on. By involving these influential stakeholders in the learning from projects, conservation decision makers can start deliberatively and collaboratively exploring how preferences might change and the information and rules needed to support future changes in management.

1.3 Overview of the climate-readiness assessment process

Combining these two concepts suggests a structured format for describing adaptation:

- current approaches become less relevant and the need for new ones emerges
- it may be hard for decision makers to change now
- they may not have to rush, but it could take a long time and they should not delay too long
- they can start enabling future changes in management by looking ahead and trialling different approaches with stakeholders to reveal new information, preferences and changes to rules.

This format provides the basis for the elements of the climate-ready biodiversity management assessment process. The tool has the following stages (Figure 2):

1. Start with an initial biodiversity strategy or project, and unpack the thinking behind it
2. Explore the issue using the key climate-ready concepts ('significant ecological change' and 'multiple values'), assess the extent to which new conservation management and strategies might be needed in the long term, and scope long-term climate-ready objectives
3. Assess barriers that a decision maker (in a council or other organisation) may currently face if seeking to adopt the new objectives, and scope interventions that could be incorporated into near-term projects to start overcoming the barriers
4. Develop a synthesised 'climate-ready issue statement' reflecting the long-term objective, and interventions to remove barriers to implementing it
5. Consider the implications of the climate-ready issue statement for the design and implementation of projects in the near term.
6. Review how the climate-ready concepts have: changed participants' thinking about adaptation, been incorporated in new project proposals, and lead to learning from the implemented projects that might enable future adaptation.

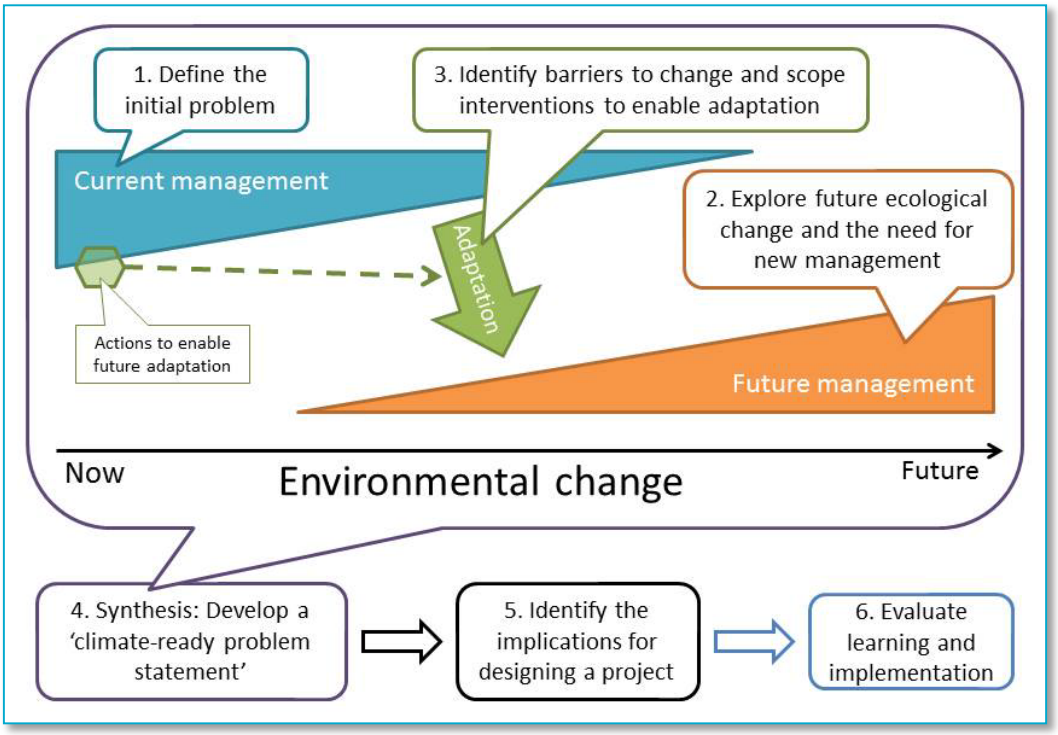

Figure 2. A schematic representation of the elements of the climate-ready biodiversity management tool

1.4 Development of the climate-ready tool

The climate-ready tool was developed in partnership with Sydney Coastal Council Group and their member councils, and with input from their Expert Reference Group. The process of translating the key adaptation concepts into a tool for councils included workshops and meetings with partners, a prototyping workshop to test key elements of the tool, and three full-day workshops with councils using a preliminary version of the tool to assess and reframe biodiversity projects being developed for a funding program. Elements of the tool were also used in a 90 minute teleconference with additional councils. Following this trialling the tool was revised, documented and reviewed by SCCG and councils and by scientific peer reviewers.

1.5 Use of the climate-ready tool

The tool will be suitable for officers in local government or other natural resources management agencies, who are undertaking biodiversity conservation initiatives that might need to consider climate change, including on-ground projects or strategies. Use of the tool will require some knowledge about how climate change might affect the biodiversity or issue of interest, and the implications of this for different stakeholders. While some knowledge is required, lack of knowledge should not be a barrier to using the tool, as experience gained with it will help planners and managers understand what types of additional information might be most useful for them to seek out, from the literature, assessments, peers, experts or through the design of their projects.

The tool was developed with the expectation that it will be used in a group of people working on a project. Doing so in a workshop could be expected to take a day, although this could be done in several sessions spread out over a number of days. The tool could also be completed by an individual.

The tool was developed to guide planners and mangers through some complex adaptation issues. The process is broken down and structured for users who are unfamiliar with the key adaptation concepts being introduced, however use may be most effective if facilitated by people with some experience with the concepts.

2 Climate-ready tool steps

Preliminary

Participants need to come to the process with an existing or proposed biodiversity conservation initiative that is addressing a conservation issue. This could be an on-ground project, a plan or a strategy; henceforth we'll refer to it as the *initial project*. This initial project should have clear biodiversity conservation objectives[2]. It need not already consider climate change, but participants will have to have *some* knowledge about how climate change might affect the issue the project is addressing or its context, including ecological impacts and possible community responses[3]. Such information can be drawn from impact and vulnerability analyses, which have been done by most local governments and state agencies, and from many other sources. While some working knowledge of the implications of climate change is required, exhaustive information is not required, and using the tool should provide insights into what additional information might be useful for future planning[4].

Most critically, participants need to come into the process with a willingness to explore and question the future effectiveness of the initial project, how it might need to be changed in the long term, and the implications of those changes for how it is scoped and implemented in the near term.

The process can be implemented iteratively, as it is likely that additional information and ideas, council personnel, partners and other stakeholders may be relevant to any eventual re-scoping of the project.

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[2] By objective we mean a desired result of the project. Ideally this would be described in terms of the desirable state of the biophysical system or the benefits arising from it. Where objectives are currently expressed in terms of reducing threats, it will be useful to try to articulate the desired outcome for native species and ecosystems that is sought by reducing the threat, i.e. in terms of the thing that is threatened. Multiple objectives are OK. Objectives could be expressed as aspects of the status quo that a project seeks to preserve or a different state that the project seeks to create.

[3] Information about climate change and its ecological impacts can be found at:
http://www.climatechangeinaustralia.gov.au/en/
http://www.ozcoasts.gov.au/climate/Map_images/Sydney/mapLevel2.jsp
http://adaptnrm.csiro.au/about-adaptnrm/
http://www.climatechange.environment.nsw.gov.au/

[4] Lack of knowledge about climate impacts rarely limits the ability to start exploring the implications of climate change for management and policy. Like all planning, adaptation planning will be iterative; it will be repeated in the future. The planning done in the near term with limited information can provide valuable insights about the knowledge and other factors that are needed by decision makers and the community to enable the next cycle of planning and project development. Further, the nature of climate change means decision makers will never have the quality or amount of knowledge they might like about future climate impacts; climate adaptation is about making decisions with the information at hand, not waiting till 'enough' information is delivered. Therefore, iterative planning with available information, and learning from it, will be a critical part of adaptation to global change.

The tool is arranged in six stages, each with a rationale and instructions. The document includes templates, with example answers, to assist completing the stages of the tool. The tables could be completed electronically or on butchers paper or a whiteboard. The examples tend to focus on various aspects of managing native vegetation, which reflects the topics raised by councils during development and testing of the tool; a wider range of conservation issues can be assessed with the tool. Additional explanation of key terms is available in the glossary at the end of the tool.

Stage 1. Explore the initial project

This stage helps clarify the issues and thinking behind your initial project. Unpacking the current issue will help you explore future climate impacts and reframe the project in later stages.

Step 1.1

- Identify and document the following elements of the initial project and issue in Table 1:

1. The threats to biodiversity: what is leading to biodiversity decline?
2. The values[5] that are at stake: what aspects of biodiversity and benefits to society are threatened?
3. The desired ecological outcome: what are the aspects of the status quo the project is seeking to preserve or the ecological changes being sought? As far as possible record this in terms of the condition or specific attributes of the ecological system that are important, valued or give rise to benefits.
4. The source of that objective: where does the mandate for the objective come from (community, council, government)?
5. The proposed actions: what interventions are being proposed (planning, on-ground, assessment, communication)?
6. Any contextual factors[6]: who needs to be consulted about the implementation of the project (e.g. due to any potential conflicts or trade-offs); who has the knowledge to design and implement the project (e.g. in council, consultants, researchers, community); are policy changes or special permissions needed to allow it happen?

[5] See glossary for discussion of values.

[6] See glossary for discussion of decision context.

Table 1 Key characteristics of the initial project

PROJECT CHARACTERISTICS	EXAMPLE	YOUR PROJECT
Threats to biodiversity	Invasion of remnant bushland reserves by weeds, particularly garden escapees, leading to declines in native plant and animal populations within reserves.	
Values at stake	Loss of abundance and diversity of native species in urban remnant bushland reserves. Loss of amenity and recreational values.	
Desired outcome (objective)	To maintain (and where needed, restore) the current diversity of native species in small urban remnant reserves by reducing the impact of weeds.	
Source of the objective	State government and Council policy.	
Proposed actions	Mechanical and chemical control of weeds in priority areas within reserves. Replanting with indigenous species with seed collected from within the reserve.	
Contextual factors	Some of the weeds are native species whose ranges appear to be extending further south with climate change. Some residents unknowingly plant invasive species within reserves for amenity or screening so object to removal of these species from their adjoining bushland reserve.	

Stage 2. Explore the issue using a climate-ready framing

This stage uses the key climate-ready concepts of 'significant ecological change' and 'multiple values' to explore how climate change might affect the issue.

This stage will help you develop a long-term[7] perspective on the issue (as it might be perceived by a manager or the community in 20 or 50 years) that might complement the perspective that was used to develop the initial project proposal.

Step 2.1. Large ecological change

- Discuss the ecological changes that might be expected to affect the issue in the longer term.
  - Focus on changes resulting from climate change, including how these might exacerbate other pressures. Identify different *types* of ecological change that are relevant, rather than different amounts of change. Focus mainly on changes that are big enough to lead to significant changes in management. These could include "most significant" or "worst case" changes, but don't get too distracted with catastrophic magnitudes of change (such as 5 metre sea level rise).

[7] See glossary for discussion of timeframes.

- Where relevant consider impacts on[8]
  - *species and ecosystems*, which might move with climate change, and
  - *places*, which might experience changes in the species and ecosystems present, but obviously can't move.
- Brainstorm and summarise in Table 2.
- Note any uncertainties or contingencies that might affect how climate change affects the conservation issue. Record them in Table 3.

Table 2 Future ecological changes affecting the issue

EXAMPLES	YOUR PROJECT
Shifts in the distribution of species and ecosystems due to climate.	
Shifts in the distribution of species and ecosystems due to sea level rise.	
Decline in local abundance of key species.	
Change in the species composition and structure of the vegetation leading to change in ecosystem type at specific locations.	
Increased frequency of bushfires.	

Table 3 Uncertainties

EXAMPLES	YOUR PROJECT
Unsure which species might persist within their current distributions.	
Unsure which species might disperse and successfully colonise in new locations.	
Unsure if saltmarsh will expand with sea level rise without planting.	
Unsure how ecosystems will change, e.g. woodlands getting shrubbier or grassier.	
Unsure if changes in vegetation will support more or less intense bushfires.	
Unsure how much people value particular (current) native species and communities compared to other native species and communities that might establish in the future.	

Step 2.2. Multiple valued aspects of biodiversity

➢ Discuss the different aspects of biodiversity and natural features that are relevant to the issue and are important or valued by the community.

[8] See glossary for discussion of biota vs place.

- Be sure to include aspects and features that might be important to all relevant stakeholder groups, including future generations.
- Think about why they are important or valued.
- Where relevant consider species, ecosystems and places.
- Brainstorm and summarise the different aspects of biodiversity or natural features that are valued in column 1 of Table 4.
- You can add to this list or refine it as the assessment progresses.

Step 2.3. Changing and persisting attributes of biodiversity

- Discuss how climate change might and might not affect the different aspects of biodiversity or natural features that are valued.
  - Discuss how each aspect of biodiversity that is valued (rows in Table 4) might be affected by future ecological changes resulting from climate change. Refer to Table 2 for types of change.
  - Discuss how each aspect of biodiversity (column 1) might be expected to change with climate change. For each aspect, note the attributes that might change in column 2.
  - Discuss the attributes of each aspect of biodiversity that could feasibly persist in the face of climate change. Include attributes that might need some management to help them persist. Summarise in column 3.
  - Add any additional key uncertainties in Table 3.
- *Discussion point: are any values likely to be lost completely? Could contest or trade-off between values increase?*

Table 4 Valued aspects of biodiversity and the attributes of them that can be expected to change and might feasibly persist

1. ASPECT OF BIODIVERSITY / NATURAL FEATURE	2. … ATTRIBUTES OF THIS ASPECT THAT MIGHT CHANGE	3. … ATTRIBUTES OF THIS ASPECT THAT COULD PERSIST
Example		
Populations of key local species	Populations of key local species in places they are currently found within the region.	Those species occur in populations elsewhere. The region continues to support a diversity of species as new ones colonise from elsewhere.
Intertidal ecosystems	The type, composition and structure of ecosystems at each place (change with seal level rise and warming).	Ecosystems, regardless of their type, are healthy and dominated by native species.
Headland vegetation	Type of vegetation (change with CO_2, warming, rainfall).	Coastal view. Native vegetation and diversity of native animals.
End of Road Park	Species composition and vegetation structure, leading to change in ecosystem type (change with CO_2, warming, rainfall).	Park remains native bush and available for conservation, enjoyment and recreation.
Your project		

Step 2.4. A long-term objective for the issue

- Discuss which attributes of biodiversity are most valued and have the potential to persist in the long term as climate change results in significant ecological change. Form a long-term conservation objective based on these attributes.
  - Reflect on the attributes of biodiversity and natural features that might inevitably be affected by climate change (column 2 in Table 4), and those that could feasibly be preserved in the long term (column 3).
  - Discuss which attributes are most valued by yourselves and different stakeholders. Highlight or underline them, using different colours for different stakeholders.
  - Discuss what ecological change you might be able to just let happen.
  - Discuss which valued attributes (highlighted) you might want to seek to preserve. Emphasize these in bold font or by circling.
- Focusing on the attributes that you want to preserve and that could feasibly persist (the ones you have emphasized in column 3), draft an objective for the issue that accommodates the inevitable changes (column 2) and is feasible to achieve in the long term. It may be convenient to draft different objectives for different attributes.

Step 2.5. Long-term changes in management

- Discuss the possible long-term effectiveness of existing management actions or strategies
  - To what extent do existing/proposed management actions or strategies focus on attributes that might inevitably change (Table 4, column 2)? Are these likely to remain effective in the long term? If not they may need to be phased out or changed at some time. Record these in Table 5, column 1.
  - Might any existing/proposed management actions and strategies help preserve selected attributes that could feasibly persist (Table 4, column 3), especially the highlighted ones (i.e. help achieve the new long-term objective)? Record these in Table 5, column 2.
- Discuss the need for any new actions or strategies, in the long term.
  - Identify any new actions or strategies that might need to be adopted to help achieve the new long-term objective. Record these in Table 5, column 3.
  - Include any changes in how existing management actions are implemented.
  - Consider actions that might facilitate ecological change when and if it does happen, rather than forcing it.

Table 5 Possible long-term changes in management actions and strategies

1. CURRENT ACTIONS AND STRATEGIES TO POSSIBLY PHASE OUT OR CHANGE	2. CURRENT ACTIONS TO MAINTAIN IN THE LONG TERM	3. NEW ACTIONS AND STRATEGIES TO CONSIDER IN THE LONG TERM
Examples		
Revegetation with local species and provenances.	Avoid soil and vegetation disturbance.	Revegetate with species that might survive better in future climates, especially long lived habitat species.
Controlling non-local native species.	Controlling exotic species.	Use a diversity of species to cover the uncertainty in climate change.
Your project		

Stage 3. Assessing the decision context

This stage introduces the idea of the decision context, explores the range of barriers to long-term adaptation and identifies near-term actions that might be effective in enabling future adaptation.

Overcoming barriers to adopting new approaches to conservation management and strategies could take many years. By identifying potential barriers to long-term adaptation early, councils may be able to develop strategies and projects that can initiate the process of learning that will lead to the barriers being overcome. Barriers can potentially arise in many different sectors of society, including the expectations of voters and rate payers, knowledge provided by researchers, consultants and other partners, and the legislative and policy environment set by governments at all levels. The learning from council projects could therefore be targeted at a wide range of different societal sectors.

Step 3.1. Barriers and enablers

- Identify barriers you might face in adopting the new climate-ready conservation objective or implementing different conservation actions and strategies in the long-term.
  - Discuss the following questions:
    - *Could the new objective be readily adopted?*
    - *Could new actions be readily implemented?*
    - *Could actions that are likely to be decreasingly effective be readily phased out?*
  - If any answers were 'no', identify and record the reasons in Table 6 (column 1).
  - Discuss and record any other barriers to adopting a climate-ready approach?
  - Consider any assumptions that might need to be tested, changes in beliefs or attitudes that might be required, trade-offs between preferences that need to be characterized and managed, and necessary institutional changes (legislation, policy, best practice guidelines, and informal rules such as accepted practices).
  - Consult the list of uncertainties and contingencies in Table 2.

- Discuss and note (in column 2) if each barrier is predominantly about values (preferences, V), rules (both formal and informal, R) or knowledge (the understanding and beliefs of the decision makers, and of experts and other parties, K). Note if the barrier can be identified as a link or interaction between two or more of V, R and K (e.g., there may be no mechanism to readily update rules to reflect changing values).
- Discuss and note (in column 3) who 'owns' the barrier: who has the ability to directly address the barrier, should they be so inclined (e.g. having learnt about long-term adaptation from the project!).

Table 6 Barriers to adopting the new objective, management and actions or strategies in the long term – examples

1. BARRIER	2. V, R, K OR LINKAGE	3. WHO 'OWNS' THE BARRIER?	4. INFORMATION OR EXPERIENCE TO HELP THEM UNDERSTAND / CHANGE	5. POTENTIAL PROJECT ACTIVITIES
Example				
Lack of knowledge about the impacts of climate change on local plant communities	Knowledge	Scientists, plant regenerators, contractors, community	Data and information about the survival and growth rates of various locally indigenous and other native species during extremes and in other places.	Establish trials in partnership with knowledge providers and local knowledge holders
Legislation preventing planting of non-locally indigenous species into threatened communities	Rule	State agencies	Knowledge sharing about the implications of legislation on the capacity to manage ecosystems and species in the face of climate change. Knowledge about the impacts, positive and negative, of new native species in existing communities.	Liaison between state agencies, bushland regenerators and managers about the emerging barrier. Establishment of a working group to address the issue. Small scale trials of planting with non-local native species.
Volunteers' strong preference for planting local species	Value	Community	Knowledge about the inevitability of change. Positive experiences with regeneration non-local natives	Document mortality of local species during drought. Small scale trials of planting with non-local native species.
Your project				

Step 3.2. Near-term actions to enable change

- Discuss what information or experiences might lead to better understanding of the need for changes in conservation objectives, management and strategies? Record in column 4, Table 6.
- Discuss what activities councils could initiate or facilitate within projects or strategies to provide the necessary lessons to start enabling change in the barriers. Record in column 5, Table 6.
    - Include actions to address values (elicit or stimulate change in preferences through consultation, interpretation, deliberative processes), rules (trialing new incentives or

programs, proposing and analyzing new rules) and generation and sharing of knowledge (trialing new actions, monitoring, publicity, sharing with other councils, partnering with stakeholders).

- *Discussion point: might any additional partners and other stakeholders need to be involved in implementing the activities or in learning from them? This will be revisited in Stage 5.*

Stage 4. Climate-ready issue statement

This stage summarises the unpacking you have done in previous stages in terms of a revised statement of the issue. The new statement will be structured to include the long-term climate-ready objective, management actions to be taken in the long term, and steps that can be taken in the near term to enable the long-term objective.

This revised statement represents a possible or ideal climate-ready reframing of the initial issue and project. It may not be possible for you to fully implement this climate-ready objective in your revised project.

Step 4.1. Building blocks of a reframed issue statement

- Document the key elements of the new climate-ready issue statement recording the items in the following list.
  - Record your answers in Table 7.
  - Draw on your previous discussions, and copy/paste or summarise your answers from the previous tables.

A. Desired ecological outcome (thing to conserve): an ecological outcome that is desirable and feasible to achieve in the long term (Step 2.4; Table 4, column 3).

B. Inevitable ecological change: expected ecological changes (relevant to the issue), which should not inhibit achieving the objective, and need not be resisted. Implicitly these changes are being accepted, even if they may be undesirable (Step 2.3; Table 4, column 2).

C. Long-term management actions: the management activities to be done in the long term to achieve the outcome (Step 2.5; Table 5, columns 2 and 3).

D. Near-term management actions: activities that can be adopted it the current project to deliver on the long-term objective (Step 2.5; Table 5).

E. Near-term enabling actions: activities that can be implemented in the current project to help enable adoption of the long-term actions by leading to changes in the decision context (see below) (Step 3.2; Table 6, column 5).

F. Changing decision context: the key learning and experiences that will enable long-term adaptation through increased understanding of the imperative for change and the nature of long-term adaptation. Include learning among partners and stakeholders as well as within councils. Capture who learns or does what. Where relevant include learning or changes in about values, rules and knowledge. This represents a key part of the legacy of the project (Step 3.2; Table 6, columns 3 and 4).

Table 7 Components of a climate-ready issue statement

COMPONENTS	*EXAMPLE*	*YOUR PROJECT*
A. Desired ecological outcome (thing to conserve)	A1. A diversity of native plant and animal species. A2. Restore and maintain ecosystem health (condition) in key places.	
B. Inevitable ecological change	B1. The mixture of species present changes, including loss of some locally iconic species. B2. Changes in the type of ecological communities in areas of native ecosystem.	
C. Long-term management actions or planning approach	C1. Facilitating colonisation of new native species. C2. Restoring ecosystems with species from a diversity of climatic zones.	
D. Near-term management actions	D1. Cease removing/discouraging non-local native plant and animal species that are colonising.	
E. Enabling actions	E1. Interpretation and community consultation about eventual significant ecological change, and impacts of new, 'future-adapted', native species. E2. Trialling restoration with a diversity of non-local species.	
F. Learning and changing decision context (who and what)	F1. Community understands the inevitability of some ecological change and develops preferences for ecological outcomes and support for management on that basis. F2. State government develops new policies and priorities based on an understanding of future change and changing community preferences.	

Step 4.2. A climate-ready issue statement

- Draft in long hand a new, climate-ready, statement of the issue.
  - Use the syntax below, replacing the red text, drawing on the elements in Table 7.

*The long-term goal is to conserve **[A: persisting attributes of biodiversity]**, as **[B: inevitable ecological changes]** gradually occur, by **[C: long-term management or planning]**. The project will start implementation of **[D: near-term management actions]**, and will implement **[E: enabling actions]** to help council officers and **[from F: partners and stakeholders]** learn more about conservation in the face of inevitable ecological changes and the need for **[from F: changes in preferences, policy, knowledge]** to enable long-term adaptation.*

- *Discussion point: how different is your reframed issue statement from the initial project description? Compare Table 1 and Table 7.*

- *Discussion point: Might you need to consider other objectives and actions that specifically target aspects of biodiversity that are likely to change in the long term, but which your council is not ready to stop managing?*
  - This could be because there are barriers to stopping or there is no current need to stop as there is clear benefit in managing the features in the near-term and they are not yet adversely affected by climate change.

Stage 5. Considerations for developing and implementing the reframed project

This stage explores the factors councils may need to consider if they wish to revise their projects to reflect, in part or whole, the new climate-ready issue statement.

Your project has (potentially) been re-cast to address a different objective, include some new management actions and achieve some specific learning to enable future adaptation. These changes may have implications for how the project is developed and implemented. In particular, you may need to include additional expertise and partnerships to ensure that the information and experiences built into the project connect with their target audiences.

Step 5.1. Implications for developing and implementing the project

- Discuss the following questions to explore the implications of the climate-ready reframing for developing and implementing the project
  - Do you have the time, capacity, information and support needed to adopt the reframing of the project?
  - Is it feasible for you to include the new or changed on-ground or planning actions in the project, either now or progressively in future projects?
  - What monitoring, interpretation, communication and evaluation needs to be undertaken during and after the project to maximize the learning opportunities?
    - Can it include assessing if new values and preferences are revealed? Are institutional barriers and opportunities identified? Is new knowledge about ecological outcomes created and recorded?
  - Is it feasible for you to include new activities that are designed to provide learning to enable future adaptation?
  - Who needs to be involved in developing and approving the project within council, and in the community and other agencies?
  - Which new partners need to be included in the project development and implementation to assist with new activities or to maximize the effectiveness of the learning opportunities?
  - Are there other imperatives that need to be included, such as managing some aspects of biodiversity that are currently valued but can be expected to change in the long term? When and how might you phase out such management?

Stage 6. Evaluation

This stage helps consolidate participants' understanding of the concepts they have been using, and assesses how they have been incorporated into their projects.

The stage consists of a series of reflection questions to help assess your understanding of the climate-ready approach and how it can be used to frame a project. They will help you assess the extent to which the approach is captured in your project proposal, and how it is reflected in the implementation of the project. Self evaluation, immediately and as the project is developed and implemented, will help consolidate your understanding of the approach and how it can be used, and underpin continual learning about adaption.

Step 6.1. Evaluation after doing the climate-ready assessment

- Discuss how your understanding of long-term climate adaptation has changed as a result of the workshop or completing the tool.
  - Has the process changed your understanding of:
    - the implications of future ecological change for conservation management and strategies
    - the need to change management to accommodate inevitable change, rather than seeking to resist change
    - societal barriers to changing practice, including knowledge, values and rules
    - near-term actions that can lead to change and enable future adaptation?

Step 6.2. Evaluation after developing the project proposal

- Discuss how the climate-ready approach has been implemented in the project proposal.
  - To what extent does the proposal now:
    - accommodate inevitable long-term ecological change
    - include modified or new management actions in to address long-term change
    - include actions or processes to stimulate change in the decision context (values, rules, knowledge) that will facilitate future changes in management?
  - If the project does not reflect the climate-ready objective, have you considered how and when you might include it in projects? Have you included activities in this project to make that easier?
  - Specifically, if the project is continuing to manage aspects of biodiversity that are expected to change in the long term, do you know when and how such management might be phased out? Is the project seeking to overcome barriers to phasing it out?

Step 6.3. Evaluation on completion of the project

- Discuss how the project enables the learning needed to overcome societal barriers to long-term adaptation.

- Long-term results from the project and associated learning and societal changes may take many years and cannot be expected in the lifetime of the project, but indications that such learnings are likely may be present.
  - Has the project led to debate or reflection in council, with partners, or among other stakeholders, about the need to respond to the inevitability of significant ecological change in the long term?
  - Has the project increased the understanding of this change and its implications for management and society more broadly?
  - Has the project led to reflection or debate about the extent to which future adaptation might not be possible without changes in the decision context?
    Specifically, has the project highlighted:
    - new trade-offs or clashes between preferences
    - the need for changes in rules
    - uncertainties and knowledge gaps that restrict implementation of new approaches?
  - As the outcomes of the project continue to unfold in coming years, is it likely the project will provide more information about how the system may respond to climate change and the effectiveness of current and alternative approaches? For example, will the project enable learning as the system responds to climate extremes and as climate change impacts become more apparent?

3 Glossary

3.1 Values

The term value is used to mean many different things. However, when thinking about what is valued or why something is valued, it can be useful to distinguish between biophysical things (aspects of biodiversity or natural features) with multiple different attributes (that people may like or dislike), and the reason that people like them. For example, a tree is a physical thing; it has a type, it may be healthy, cast a large shadow on a sunny day, be home to many birds, insects and fruit bats, and it may drop large branches. The tree might be valued by someone because they *like* trees or that type of tree, or have a *special connection* with that specific tree, or they *appreciate* the shade, or the birds, but they may *dislike* the smell of the fruit bats and *fear* the falling branches. The physical attributes are independent of the person; the reasons it is valued are all specific to the individual (although they may be shared by other people).

3.2 Decision context / VRK

When confronted with a decision choice, the options available to the decision maker are shaped (constrained and enabled) by the individual and societal context as well as by biophysical factors. The values-rules-knowledge framework can be useful for exploring this decisions context. For example, for an option to be available a decision maker needs to have some knowledge about how to implement it and the likely outcome, the outcome needs to be desirable to them and or their stakeholders, and implementing the decision needs to sanctioned legally and by their organisation.

These factors are experienced by an individual decision maker, but they arise more broadly from society—change in them requires other people, possibly not directly connected to the decision maker, to do things differently.

Choosing among available options is important, and it is what decision makers do daily, often with the help of tools such as risk assessment or cost-benefit analysis. But when faced with a novel problem, such as conserving biodiversity in the face of climate change, the options currently available to managers are not necessarily effective and many of the options that have been suggested by scientists are not readily available to decision makers due to the societal decision context. In this case adaptation strategy and practice may need to focus on shifting the decision context to make more options available in the future, rather than facilitating choices among the current set of options.

3.3 Timeframes

Long term: when ecological change is significant enough to force changes in the way councils other agencies and the community manages or interacts with ecosystems.
Medium term: when ecosystem changes are clearly noticeable but major changes in management

are not pressing.
Near term: the current project or strategy planning horizon; relatively small climate-change driven ecological change expected, but societal awareness and expectation may be increasing.

Decisions whose outcomes are needed in the long term can be relevant in the medium or near term where those decisions take a long time to be made (e.g., developing a new approach to prioritising investment that accommodates widespread changes in species populations), a long time to implement (e.g., revegetating large areas), or the outcome takes a long time to arise after implementation (e.g., the formation of tree hollows after planting).

3.4 Separation of biota and place

Where considering an ecosystem or the biodiversity of a place, for example thinking about how it is valued by society or likely to be affected by climate change, it is useful to think separately about the biota that *currently* occur at the place, and the fixed place with a *constantly changing* biota. The *species and ecosystems* that currently occur at a place might disappear from the place as a result of climate change, but they could be found occurring in other locations where they have newly established; their existence is not tied to the current place. The *place* itself will not disappear or move with its (current) biota, rather it can be expected to be host to a gradual but constantly changing set of species and types of ecosystems. Conservation can legitimately be focussed on either or both entities, but it is important to recognise they are different. For example, preventing the extinction, elsewhere, of species that once occurred at a place does little to conserve the natural values of that place; and maintaining the health of the (changing) ecosystem at a place may not help preserve a once-resident species whose suitable climate has moved.

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