



Romeo Lahey Memorial Lecture 2024

Climate change: How should National Parks prepare for the changes and challenges this will bring?

Professor Kerrie Wilson

Queensland Chief Scientist



Credit photos: nytimes.com



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Romeo Lahey Memorial Lecture 2024

- The role of protected areas
- The impact of climate change on national parks
- Adapting to change – strategies for resilience
- Action and advocacy
- Our collective role and responsibility



Artist: Albert Namatijira
**Image: courtesy of National
Gallery of Victoria**



What is the role of a protected area?



What's the role of a protected area?

A “Pleasuring ground for the benefit and enjoyment of the people”?



What's the role of a protected area?

*“A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the **long-term conservation of nature** with associated **ecosystem services** and **cultural values**” - IUCN*



What's the role of a protected area?

Queensland's protected areas are world-class for *people*, *culture* and *nature*

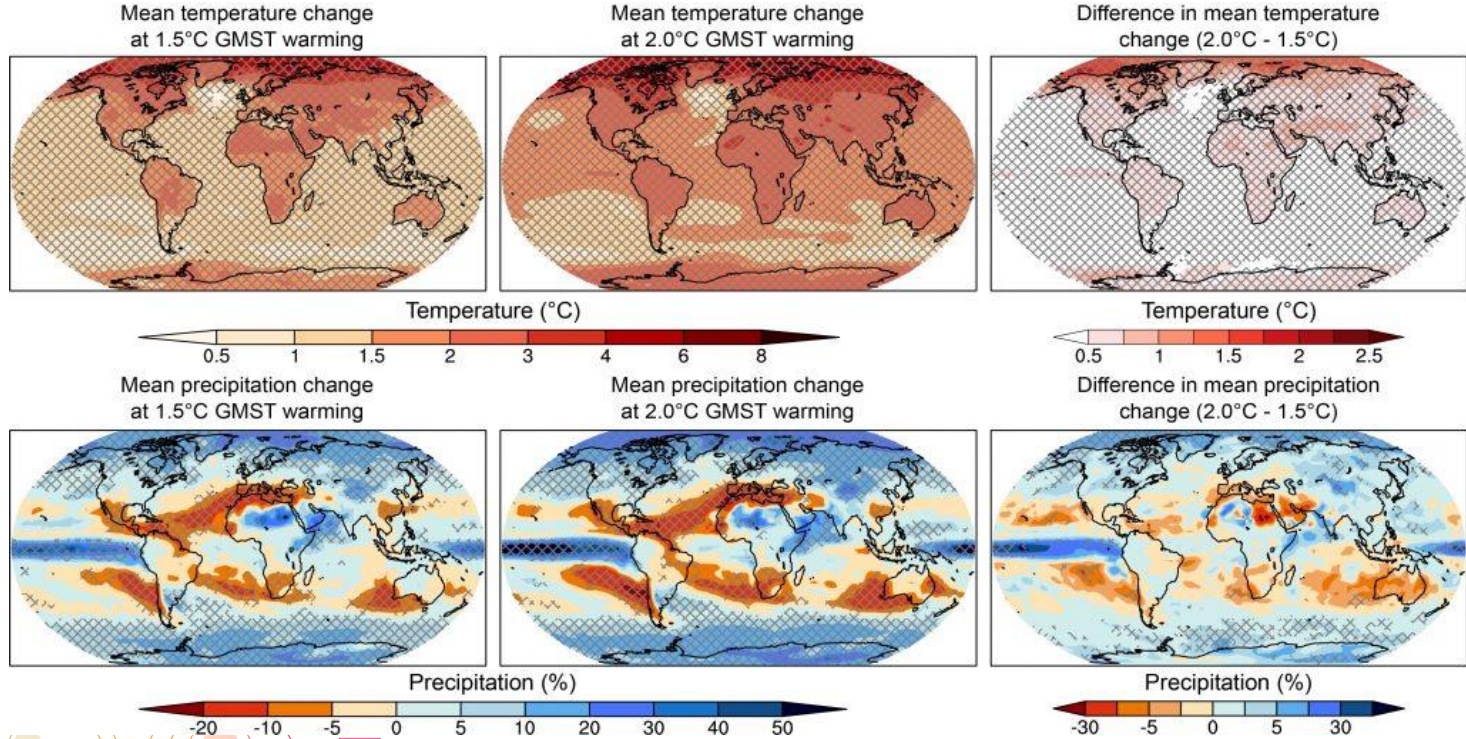
Queensland's
Protected Area Strategy
2020–2030



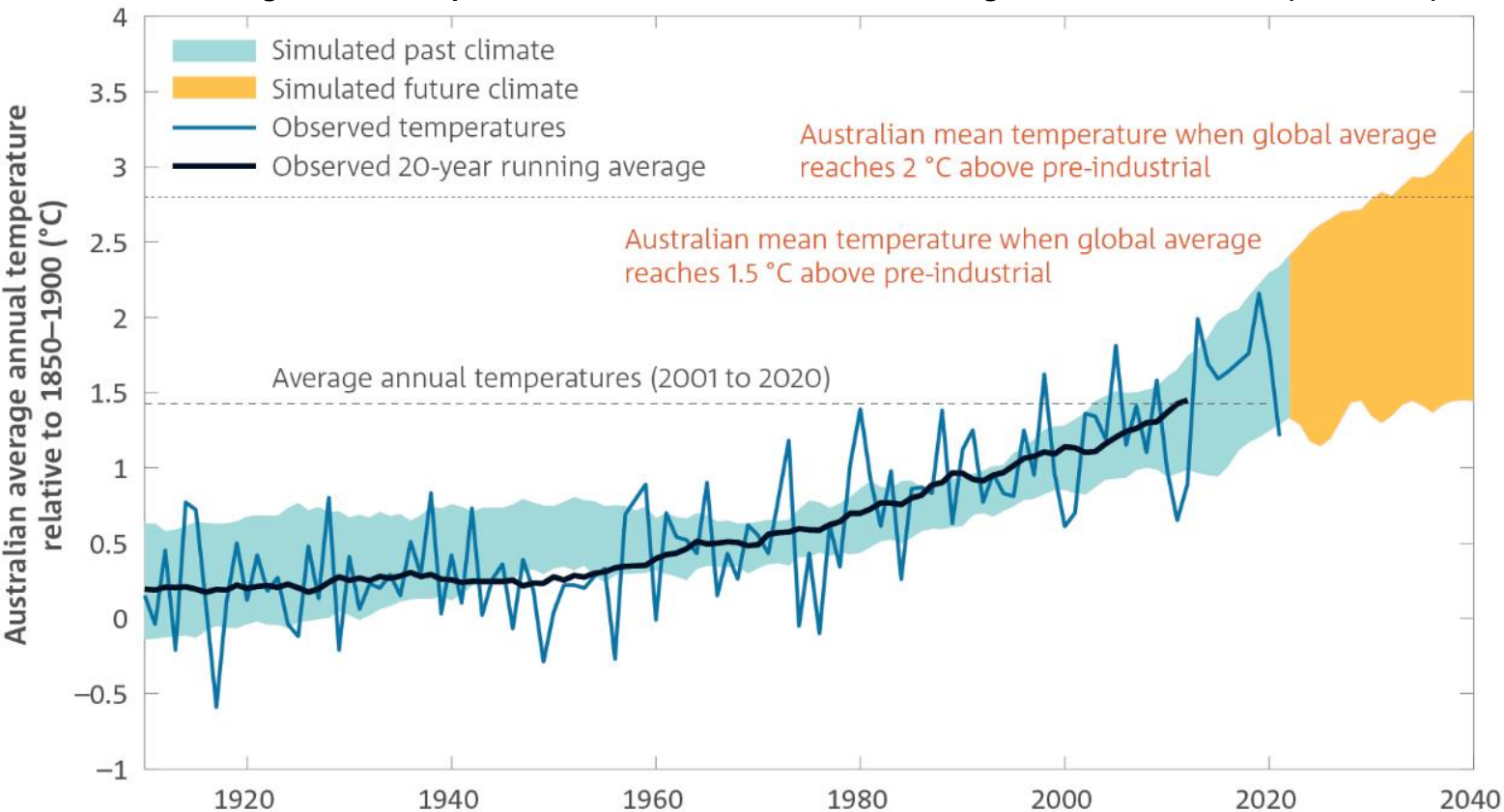
The impact of climate change on National Parks



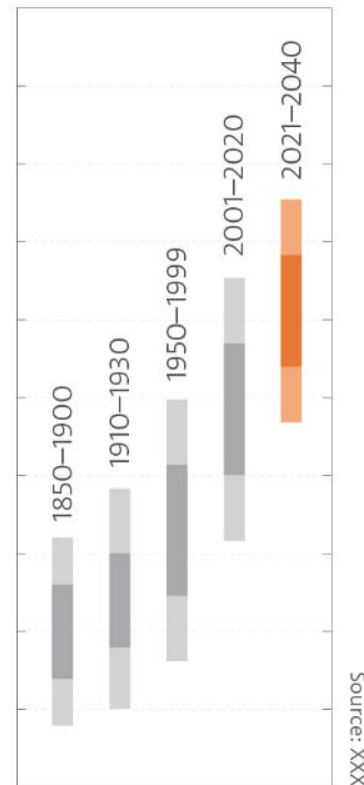
Global warming trend



Australian average annual temperature, observed and simulated from global climate models (1910-2040)



Temperature range through time



2020 bushfire event

K'gari (Fraser Island) World Heritage - Great Sandy National Park



Smoke from bushfires along the coast of K'gari. Photograph: Twitter / QFES

Species	Common Name	Status	Impact by Bushfire
<i>Pezoporus wallicus wallicus</i>	Ground Parrot	Vulnerable	>10%
<i>Crinia tinnula</i>	Wallum Froglet	Vulnerable	>10%
<i>Litoria longburensis</i>	Wallum Sedgefrog	Vulnerable	>10%
<i>Esacus magnirostris</i>	Beach Stone-curlew	Vulnerable	>10%
<i>Acacia baueri</i> subsp. <i>baueri</i>	Tiny Wattle	Vulnerable	>10%
<i>Thelypteris confluens</i>	Marsh Fern	Vulnerable	>10%
<i>Phaius australis</i>	Swamp Orchid	Endangered	>10%

Changes in rainfall patterns

Drought in Currawinya National Park, Queensland, Australia

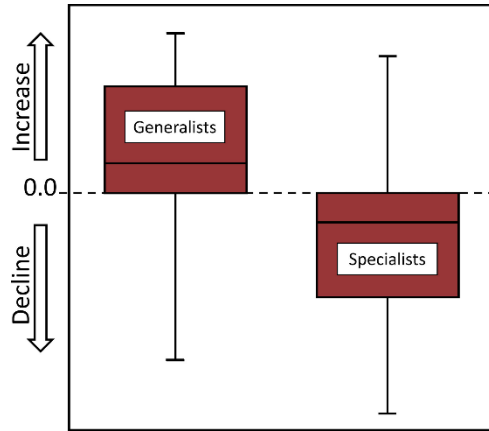


Extreme weather events



Species on the move

Wet tropics



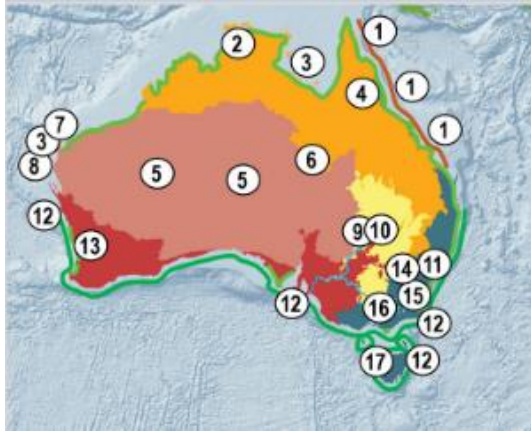
Upward elevation shifts



Williams et al. (2016); Hoffman et al. (2018)



Regime shifts and ecosystem collapse



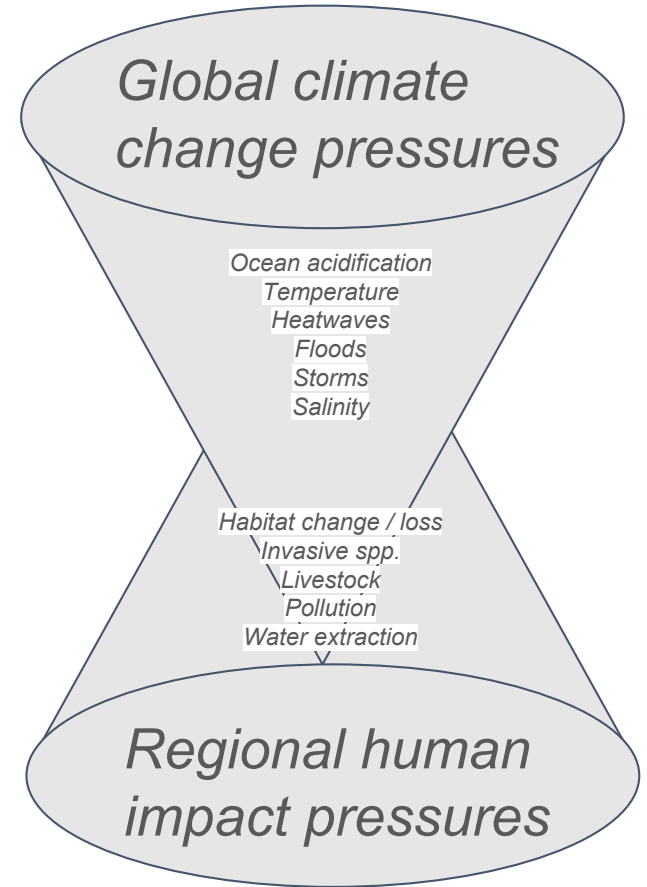
Bergstrom et al. (2021)

1. Great Barrier Reef

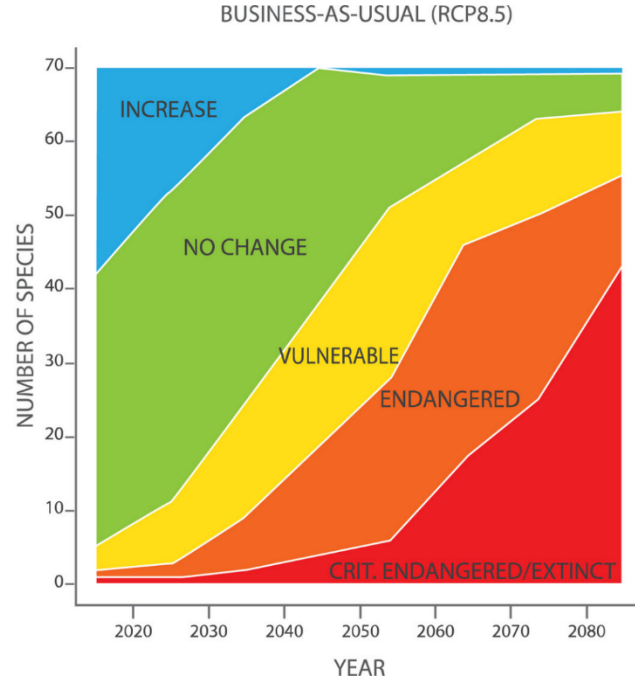
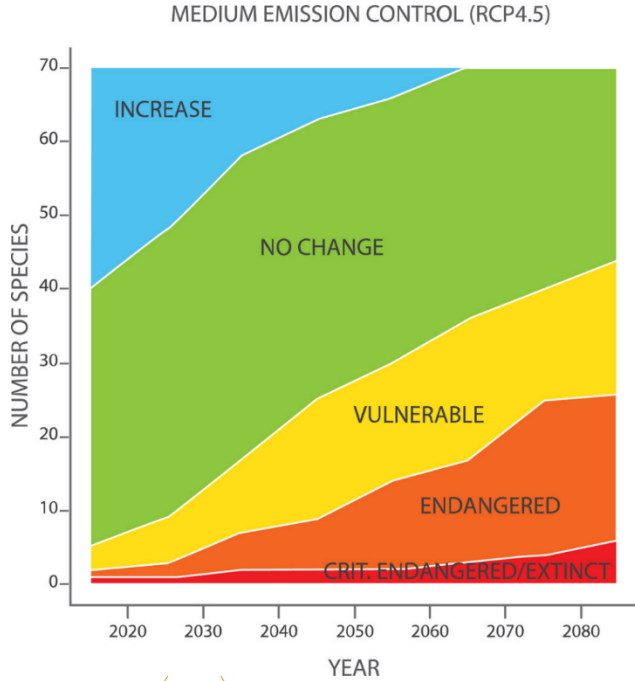
3. Mangrove forests

4. Wet tropical rainforest

6. Georgina Gidgee woodlands



Future population change projections













Williams & de la Fuente (2021); Hoffman et al. (2018)



Multiple, interacting impacts...

In the future, the state can expect:

-  higher temperatures
-  hotter and more frequent hot days
-  harsher fire weather
-  fewer frosts
-  reduced rainfall in the south-east
-  more intense downpours
-  less frequent but more intense tropical cyclones in the north
-  rising sea level
-  more frequent sea-level extremes
-  warmer and more acidic seas

*Climate Change in Queensland Summary Report 2019,
Department of Environment and Science, Qld Government*



Adapting to change – Strategies for resilience





Design

Management



The CARE-C fundamental principles of conservation

Comprehensive: Every biodiversity feature is reserved

Adequate: Conserves the represented features indefinitely

Representative: Biodiversity features are typical or representative

Efficient: Has minimal cost

Connectivity: Flow of genes, organisms, and energy between and among locations.

✓ Increased resilience to climate change through a connected landscape that provides refugia for native wildlife

Qld PA Strategy

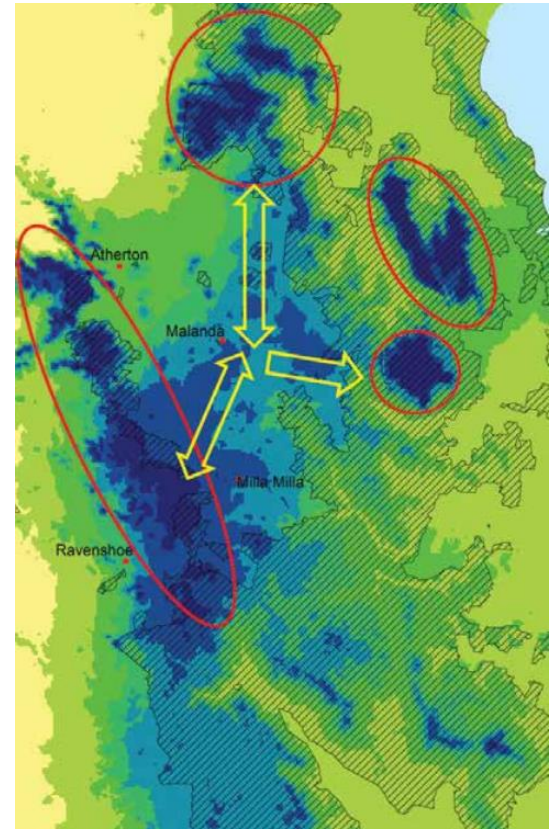
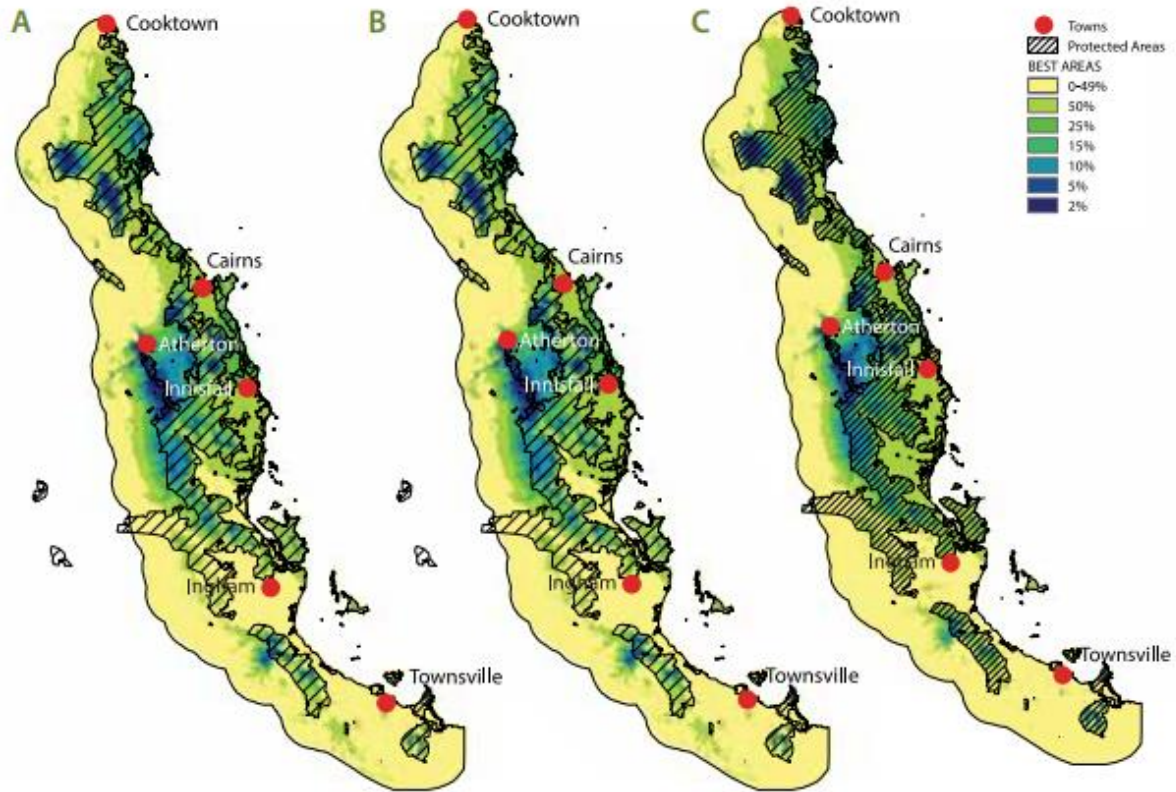


Five approaches to 'climate smart' planning

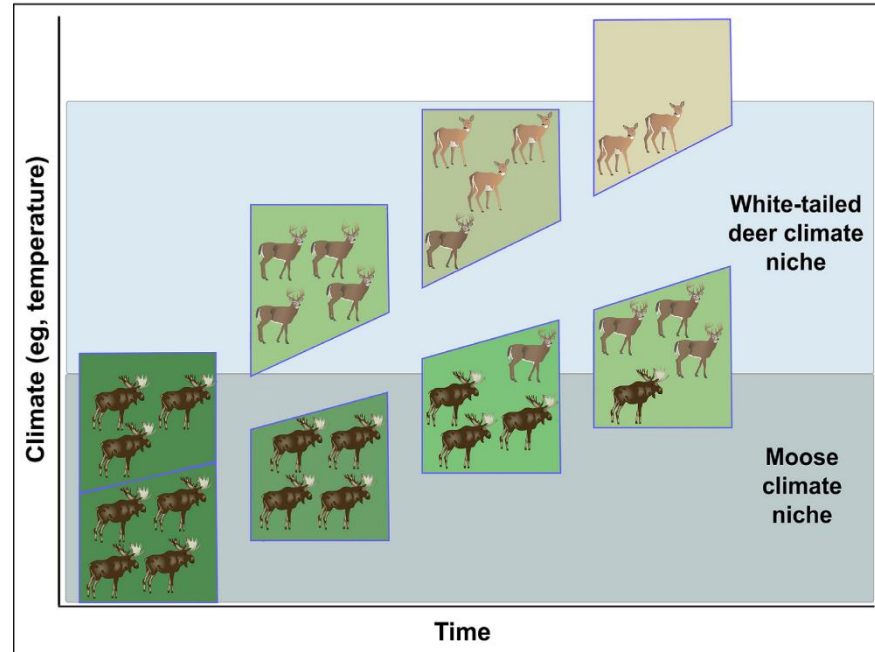
- Conserving geophysical diversity
- Protecting climate refugia
- Enhancing regional connectivity
- Sustaining ecosystem process and function
- Capitalising on opportunities emerging in response to climate change

Groves et al. (2012)





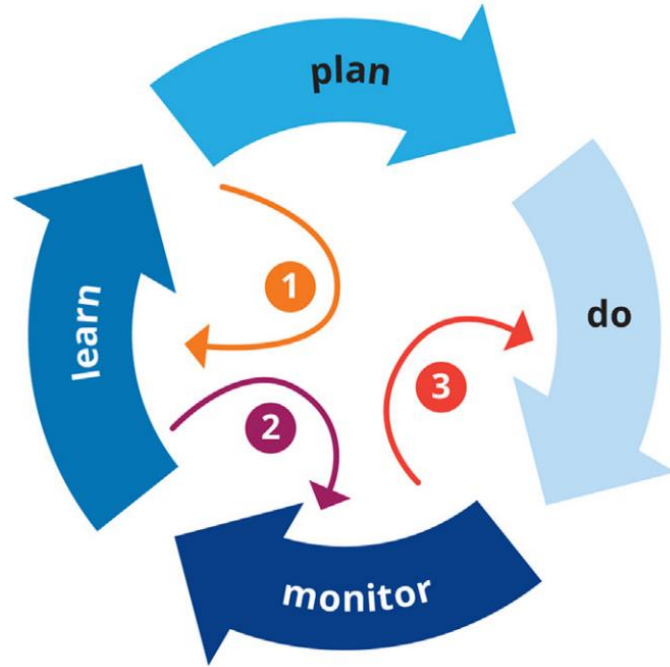
Example: Climate-change refugia



Morelli et al (2020)

Climate-change refugia create a “**slow lane**” that enables the long-term persistence of species despite climate change.

Adaptive management



Queensland's
Protected Area Strategy
2020–2030

**'Values-Based
Management Framework'**

Webb et al. (2017)



Managing for climate resilience



World first: trials begin to seed the threatened Great Barrier Reef with thousands of healthy baby corals

Australian Geographic



Credits: Christian Miller, RRAP



Direct intervention - how far will we go?



Credit: Matthew Abbott/New York Times/Redux/eyevir

Bouma et al. (2020)



Protecting multiple values Delivering multiple benefits

- Co-management
- Land and Sea Indigenous Rangers



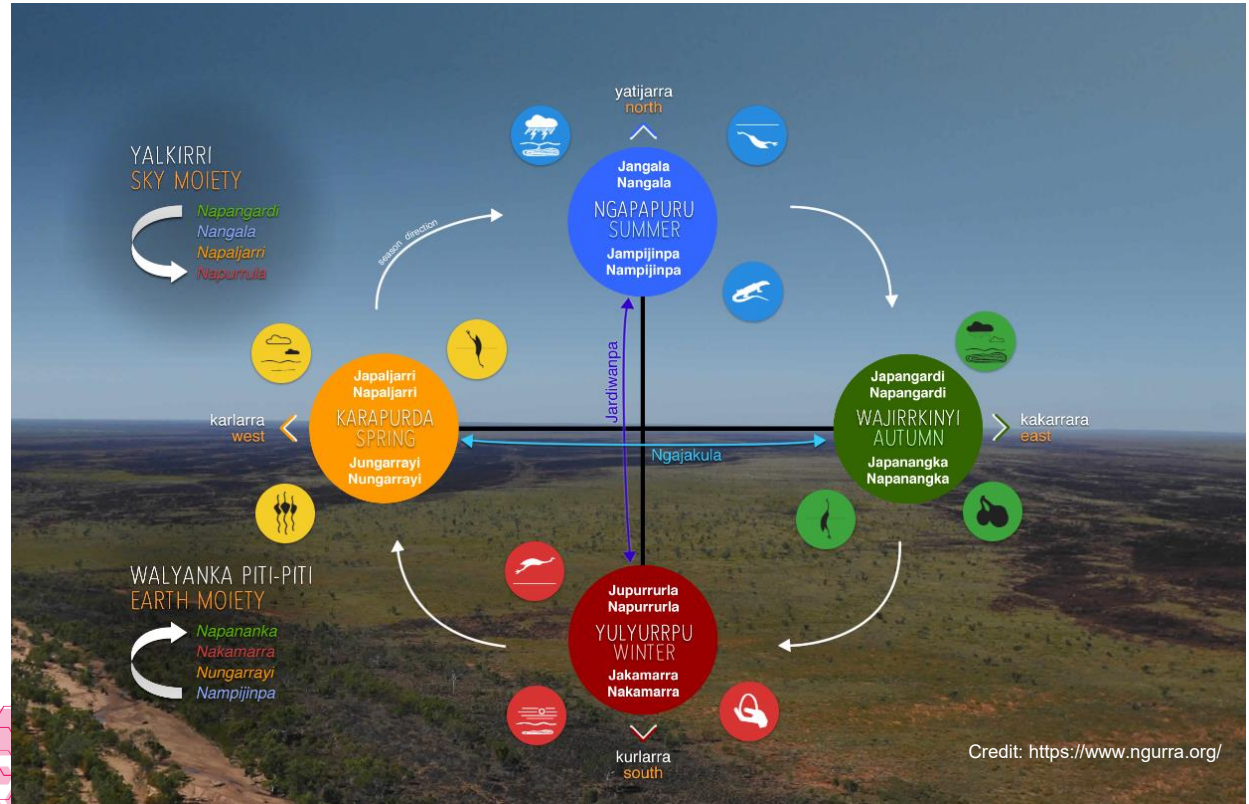
Bunya rangers are reviving 'Rightfire' practices



Butchulla rangers on K'gari survey for black-breasted button-quail



Warlpiri - seasonal knowledge



Beyond public protected areas



Artist: Albert Namatijira - Image courtesy of National Gallery of Victoria

“Other effective area-based conservation measures”

- ✓ Special Wildlife Reserves established on private land
- ✓ Support for the protection of natural and cultural values on private land

Qld PA Strategy

*2022 Qld PA Report Card:
4 million ha land managed
as private protected areas*



Flexibility in conservation plans

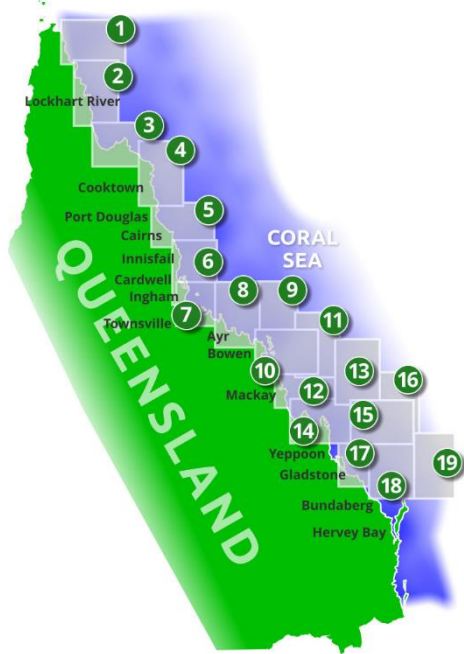
“Building flexibility into conservation plans to adjust over time in response to unforeseen events or new information”

- **Procedural flexibility:** Adapting the conservation decision-making process itself over time
- **Resource flexibility:** Changing conservation resource availability over time
- **Action flexibility:** Changing conservation actions over time

Rhodes, J. R., Armsworth, P. R., Iacona, G., Shah, P., Gordon, A., Wilson, K. A., Runting, R. K., & Bryan, B. A. (2022). Flexible conservation decisions for climate adaptation. *One Earth*, 5(6), 622-634



Flexibility in conservation plans



Queensland Department of Environment and Science

Great Barrier Reef Marine Park Authority



Action and advocacy



Global protected areas database





Global

- United Nations Convention on Biological Diversity
- International Union for the Conservation of Nature World Commission on Protected Areas
- United Nations Declaration on the Rights of Indigenous Peoples



National

- Australia's Strategy for Nature
- National Reserve System
- Reef 2050 Long-Term Sustainability Plan



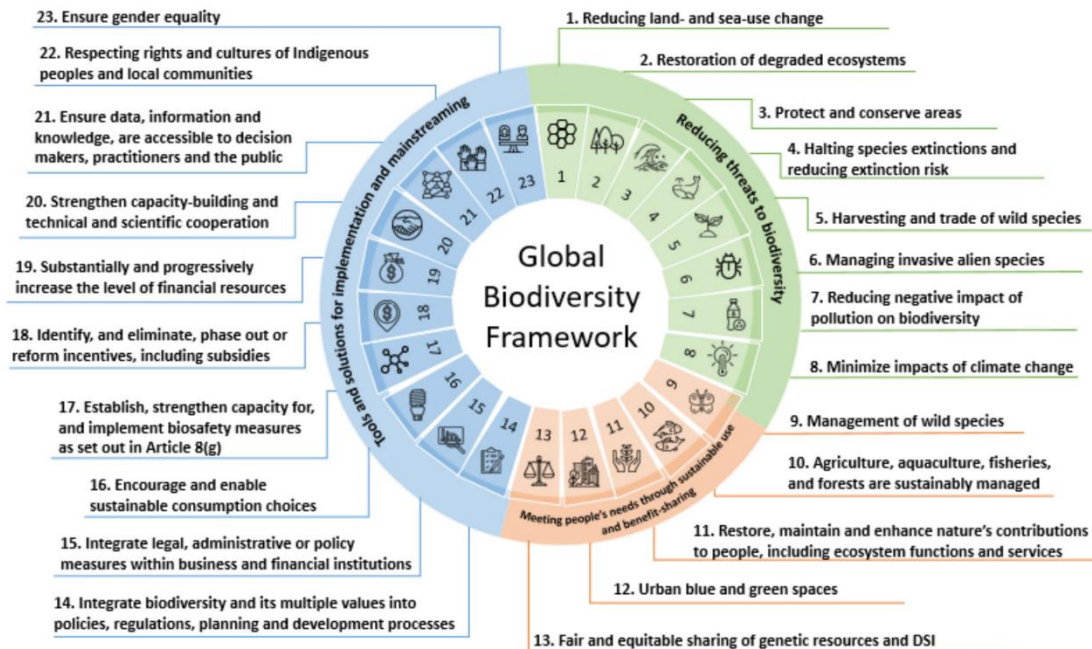
State

- Advancing Queensland's Priorities
- Queensland Human Rights Act 2019
- Queensland Climate Transition Strategy
- Queensland Climate Adaptation Strategy
- Queensland Biodiversity and Ecosystems Climate Adaptation Plan
- Tracks to Treaty
- Queensland Biosecurity Strategy
- Queensland Walking Strategy
- Land Restoration Fund
- Queensland Ecotourism Plan
- Activate! Queensland
- Queensland State Disaster Management Plan
- SEQ Koala Conservation Strategy
- Environmental Offsets Framework
- Advancing Tourism Strategy
- Engaging Queenslanders in Science Strategy
- Queensland Citizen Science Strategy
- Conserving Nature—A Biodiversity Conservation Framework for Queensland
- Gurra Gurra Integrated First Nations Framework
- Threatened species program
- Master Plan for Queensland's parks and forests

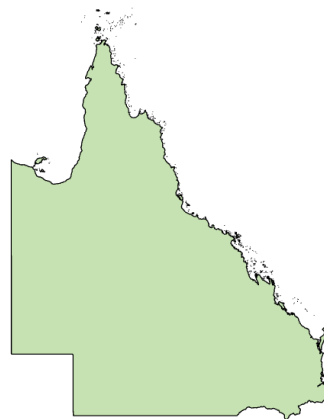
By 2030 at least 30 percent of terrestrial are effectively conserved and managed

30 X 30 Design

Kunming-Montreal Global Biodiversity Framework Themes and Targets



	Progress measure (from the Protected Area Strategy)	Progress in year 2 (2021–22) as at 30 September 2022
GR1	The number of investment partnerships to grow the protected area system.	Two investment partnerships contributed to growing the protected area system in 2021-22.
GR2	Proportion of Queensland's land area secured in protected areas.	8.2 per cent of Queensland's land area is secured in protected areas.
GR3	Extent of lands managed as private protected areas.	4,474,543 hectares of lands are managed as private protected areas.*
CA1	Number of partnerships and collaborations to care for protected areas.	As at 30 September 2022, 31 formal partnerships and collaborations were in place to care for protected areas.**
CA2	Number of public protected areas being managed under the Values-Based Management Framework.	226 protected areas have an approved values-based management framework management instrument or Key Value and Level of Service Assessment guiding the management of park values.
CA3	Extent of private protected areas participating in NatureAssist small grant programs for effective conservation management.	In 2021–22, 79 private protected areas received small grants funding for effective conservation management through Nature Refuge Landholder Grants.
CO1	Increased social media engagement about protected areas.	<p>Between 1 October 2021 and 30 September 2022, 517 posts were published on Queensland National Parks social media platforms, which reached a combined audience of more than 15.5 million people. As at 30 September 2022, Queensland National Parks Facebook and Instagram channels have over 239,000 combined followers.</p> <p>The Wet Tropics Management Authority (WTMA) has over 13,000 followers across its social media channels (Facebook, Instagram, LinkedIn and Twitter).</p>
CO2	Upgraded visitor infrastructure and information at key visitor sites on public protected areas.	<p>Major national park visitor infrastructure and information projects undertaken in 2021–22 included:</p> <ul style="list-style-type: none"> • \$3.3 million to complete the new Castle Rock Campground upgrade at Girraween National Park. • Completion of Mount Archer National Park Zamia track walking upgrade at \$615,556 over three years.
CO3	Increased number of protected areas with published values-based management instruments.	30 protected areas have published values-based management instruments.



Queensland's Protected Areas Strategy - Progress Measure (2022)

Spending to save: What will it cost to halt Australia's extinction crisis?

Wintle et al. (2019)

Supporting our National Parks in a changing climate

- **Habitat restoration:** Protect our National Parks from cumulative impacts through targeted restoration inside and outside park boundaries
- **Strategic monitoring:** Grow our baseline data, contribute to shared knowledge
- **Scientific research:** Support projects that provide a scientific understanding of climate change's impacts and ways to build resilience
- **Share the love:** Recognise that National Parks need to be valued to be preserved in perpetuity



Summary

- Changing and expanding purpose of parks
- Balancing objectives over space and time
- Pro-active and adaptive management
- Bringing local communities along for the ride



Further reading

- **Araujo**, M. B. and C. Rahbek (2006). "How does climate change affect biodiversity?" *Science* 313(5792): 1396-1397.
- **Game**, E. T., Watts, M. E., Wooldridge, S., & Possingham, H. P. (2008). Planning for Persistence in Marine Reserves: A Question of Catastrophic Importance. *Ecological Applications*, 18(3), 670-680.
- **Groves**, C. R., Game, E. T., Anderson, M. G., Cross, M., Enquist, C., Ferdaña, Z., Girvetz, E., Gondor, A., Hall, K. R., Higgins, J., Marshall, R., Popper, K., Schill, S., & Shafer, S. L. (2012). Incorporating climate change into systematic conservation planning. *Biodiversity and Conservation*, 21(7), 1651-1671.
- **Rhodes**, J. R., Armsworth, P. R., Iacona, G., Shah, P., Gordon, A., Wilson, K. A., Runting, R. K., & Bryan, B. A. (2022). Flexible conservation decisions for climate adaptation. *One Earth*, 5(6), 622-634
- **Wilson**, K., Cabeza, M., & Klein, C. J. (2009). Fundamental concepts of spatial conservation prioritization. In A. Moilanen, K. A. Wilson, & H. Possingham (Eds.), *Spatial Conservation Prioritization : Quantitative Methods and Computational Tools* (pp. 16-27). Oxford University Press.
- **Wintle**, B.A., Cadenhead, N.C., Morain, R.A...Garnett, S.T. 2019. Spending to save: What will it cost to halt Australia's extinction crisis? *Conservation Letters*, 12(6).

Thank you, questions?

Romeo Lahey Memorial Lecture 2024

Presented by Queensland Chief Scientist, Kerrie Wilson

Thank you very much, Susanne. Thank you, everybody. I'll start by acknowledging the traditional owners of the land where we meet today, the Turrbal and the Yagarra people, and recognise the traditional owners of the lands where you have all come from to join us today for this event.

I guess in more detail, I acknowledge the deep relationship, the connection and responsibility to land, sea and sky country as being an integral element of First Nations identity and culture. And I'm grateful for our traditional owners for their stewardship and protection of land, waters and sky for thousands of generations and continuing to the present day.

On a less formal note, I'm an environmental scientist trained here in Brisbane. I was born in North Queensland, grew up partially on a property near Millaa Millaa, adjacent to the Wet Tropics World Heritage Area, and spent the rest of my life in Hervey Bay, adjacent to K'gari. So, I have a long, personal interest and involvement in nature conservation in Queensland.

And I've worked for a couple of the universities here in Brisbane, but also for the Nature Conservancy when they were setting up the Australia program here as well. I love Queensland's national parks. I spend most of my spare time... in them. Last weekend, Sunday morning, my family and I were dragging our very tired bodies up for a dawn sunrise on the top of Mount Maroon, which was spectacular. And so, I'm grateful for the Association's work and advocacy for national parks.

So, the topic today that I've been asked to talk on is around climate change impacts.

And if you followed the Parliamentary events this week, you'll know that this has been a significant week in Queensland around our emissions targets and improving those and making them more ambitious. So, it's a timely opportunity to speak on this topic here with you all. For those that like to have a little bit of guidance on what's going to be covered, these are the main kind of points that I'm going to step through in this lecture. And at the end, I'm looking forward to discussion around some of these points.

So we're in a beautiful location here, Brisbane City Hall. There's some art on the way in.

And I guess I'll just ask you to just stop for a minute and imagine, just for a brief moment, that a possible way to think about our protected areas is as a painting in an art gallery.

Like this beautiful painting here. So, when I look at this painting it provides a snapshot in time of a beautiful place that's been framed and left there for our enjoyment and preservation into the future. But then I ask you to imagine for a moment also that it turns out that the gallery's

atmospheric controls are in fact malfunctioning. And there's unfortunately a small fire on the fourth floor of this art gallery.

So what if the subject of our painting here is changing? Does it become an inaccurate representation of the place the painter sat and pondered and preserved for us all?

How do we incorporate the management of such a place when the values for which it was painted are changing and the new values it represents aren't there yet?

So, these are some of the questions that I want to explore today with you all. But first I think it's important to take a step back and just ask ourselves, well, what is the role of a protected area? Why do we even have them? I'm sure this is a question you've asked yourselves. So, let's just go through some of the kind of background reasons.

The world's first protected areas were declared a pleasuring ground for the benefit and enjoyment of the people. Not quite. Not today. And as Mark (Hockings) would know, we've changed that definition and we define it primarily as a place for the long-term conservation of nature. And in Queensland, in Queensland's protected areas strategy, we recognise it in practice as a place for people, culture and nature. And not necessarily in that order for all people. But the people part is here because we need to foster these connections to nature in our growing population. And I'll return to that at the end of this lecture.

Culture, as I said at the beginning, Indigenous Australians have unique connections to country. And they must be preserved by them to continue a legacy of land care and cultural practice. And nature, of course, because we have to provide places for our wildlife to replenish and be at less risk of the threats predominantly of human nature. So, our view that protected areas protect and enhance multiple values has really developed over time. And that's recognised in Queensland legislation and regulations. But it's still... The question remains, how do we protect these values when the house is on fire?

And as the earth gets warmer, our national parks are facing significant challenges.

These important, beautiful places that we all value, full of different plants and animals that surprise us when we see them at different times, are feeling the effects of climate change.

Weather changes are affecting water sources in these parts and temperature shifts are impacting where our plants and animals live. So today we're going to look at how these changes are affecting our national parks estate.

I think it's always important to kind of step back and think about the issues at hand. And at a big picture level, the evidence is clear that we're experiencing changes in the earth system that are caused by anthropogenic activities. There's no debate. These modelling projections are based

on comprehensive reviews of the data. They're not based on any particular policy or political agenda. They highlight the urgent need to address the impacts of climate change. And we will continue to refine our knowledge of these impacts and these trajectories, they will play an important role in guiding our international and national and state level efforts to mitigate and adapt to these changes. And we saw that play out this week in the Queensland Parliament.

As we know, the recent warming of the earth can only be explained by human-caused greenhouse gas emissions. The line chart here is an important data set and it shows Australian average annual temperature observed and also simulated from global climate models. The observed changes are consistent with those that would be expected given changes in greenhouse gas concentrations in other natural and human climate forces.

And importantly, what I notice here is the simulated temperatures from 2020 to 2040 are higher than the average annual temperatures from 2001 to 2020. And we're paying for it already in our national parks. For example, each year we're seeing an increase in the severity of bushfires. And that's impacting the outstanding values of K'gari, a place close to all of our hearts including mine. And it's affecting the values to which K'gari was listed on state, national and world heritage lists.

In 2020, I think we were all shocked to see the wildfires cross K'gari. And over 10% of the range of many vulnerable species was impacted by the wildfires. In other locations, we're seeing the impacts of drought. In Currawinya National Park, the drought is impacting the wetland ecosystems that are a crucial habitat to many water birds. And I know Hugh (Possingham) gave this lecture last year and he would unpack those impacts, no doubt. But during periods of drought, important water bodies in this national park dry up, become saline, and not usable. You may also recall the massive mangrove die-back events that occurred in the Gulf of the Carpentier in 2015 and 2016. Now, these are related to unusually low sea levels at the time due to El Nino events. So, this dieback of mangrove forests, and I'm just going to unpack this one a little bit further, is directly related to climate change because of the fluctuations in temperatures that occurred at the time associated with the El Nino and the temperature of the tropical eastern Pacific Ocean and the air pressure of the tropical western Pacific. So, in turn, these phenomenon are affecting the frequency of extreme weather events such as this. Now, the stats behind this event are staggering.

40 million mangrove trees, across 2,000 kilometres of northern Australia's Gulf region perished during this event, releasing close to a million tonnes of carbon. This event led to a loss of 76,000 square kilometres of mangrove forests, marking it, and this is not a record we want to see in our state, but as the most severe instance of climate-related mass tree dieback ever recorded worldwide. Importantly, the increased severity and timing of these extreme weather events

means that ecosystems like our precious mangrove forests aren't able to recover fast enough.

Another change we're seeing in our national parks is that our species are moving. So, in the wet tropics, air temperatures and frequencies of heat waves are increasing and the extent of cool, moist, high-elevation refugia is decreasing. And in response, our species are shifting. One study found that many species of ring-tailed possum are occupying their high-elevation habitat more and seldom being found at the lower-elevation habitats. And we're also seeing a decline in rainforest specialist bird species, many of which are endemic to the region and were underlying reasons as to why the area was listed as World Heritage. These specialist, rainforest-obligate endemic species are suffering the greatest declines in our wet tropics. And these changes are playing out at the scale of entire ecosystems.

One study by Dana Bergstrom, who was an academic at UQ and Australian Antarctic Division mapped the nature of ecosystem collapse across Australia.

Each of these numbers on the map of Australia relate to a particular type of ecosystem. There are four in Queensland. None of them would be a surprise to you, I'm sure. But these collapses were identified by the authors of this particular body of research, to be related to both climate change and also regional-scale human impacts of habitat change and pollution.

And just going back then to the wet tropics, the collapses that are predicted are due to the longer dry season, more variable rainfall, more frequent cyclones and floods. And under a business-as-usual scenario, up to 90% of regionally endemic vertebrate species that were studied could become vulnerable to extinction and over 50% could become critically endangered.

So, in a nutshell, there's a lot going on. Multiple, interacting impacts at our national parks and the nature that they contain have to contend with. What are we going to do about all of this? And how do we build resilience into our protected areas network?

When we think about strategies for resilience, we can class them into two main categories, one around design and one around management. And the first group being design is related to how do we identify new protected areas, new protected areas that we can add to an existing network in order to enhance the resilience of that entire network to the greatest possible extent. I'm going to give a couple of examples on the design side to start off with.

We've had about three decades of research now on the design side of protected areas planning. And they're underpinned by ecological theory, island biogeography theory, for example, and

some core principles. I'm sure these are familiar to you, and I probably don't need to unpack them much further. But getting as much as we can represented in our protected area network in a way that they will persist, doing so at the least possible cost, opportunity costs inclusive, so that we can do more overall. And these principles are picked up in Queensland's protected areas strategy also. So increased resilience to climate change through a connected landscape that provides refugia for native wildlife are an expression of these core principles. And our colleagues that work in this area have taken it further by identifying succinct steps for climate smart protected areas planning.

Conserving the underlying sources of diversity, the geophysical diversity through which all diversity eventually arises, to protect refugia, to enhance connectivity, to sustain both ecosystem processes and function, and also to capitalise on the opportunities and new ways of thinking that are emerging in response to climate change, such as nature-based solutions and ecosystem services. And we can use the data that's collected in our national parks from monitoring and citizen science projects to design for ecological resilience.

Here the authors have used species distribution models in the wet tropics area to predict biodiversity hotspots into the future, taking into account the dispersal abilities of different species. And we can use those maps such as this, and there's Mila Mila, where our farm is located, to identify future corridors for connectivity.

And this is an Australian example, it's a moose, so thankfully we don't have moose here, watch this space. But this is mapping out the role that climate change refugia can play in transitioning movements, in the process, move movements of moose in this case, so that they remain in their climate niche for longer. I've researched protected areas design, and I appreciate that they look really great in theory. Implementation is more problematic because we often don't get a clean slate to work with. But there are important facets that I'm sure you will all appreciate for climate resilience is on-ground management of our protected areas and Mark Hockings being a leader in this space of course brings a lot of knowledge to this.

So just to think back to why this is important and think about that painting again, the context in which our beautiful landscape painting is changing, we need to be thinking about these principles of adaptive management. And as you'll know, the principles of adaptive management has been agreed on by Queensland government through their values-based management framework. And it aims to target management towards the most important values in our protected areas and national parks estate. But in practice, adaptive management requires a lot of monitoring, it costs money, and sometimes the management will also have to be prioritised

for its potential to help us to learn, and that's challenging to achieve in practice when budgets are tight and there's a lot of management to do.

Shifting gears a little bit, I want to talk now about direct management for climate resilience because that can entail varying degrees of active intervention. There's a large research program that's occurring in Queensland at the moment, called the Reef Restoration and Adaptation Program, the RRAP Program. And it's showcasing different approaches for reef protection that really have to be tested now in advance of them being required. Some approaches aim specifically at enhancing resilience through habitat restoration.

But a lot of the approaches are really complex, both ecologically, and also socially, such as genetic translocation, cryo-preservation, assisted evolution, and also big-ticket items, such as geo-engineering approaches with fog creation and cloud brightening. The RRAP Program is exploring all of these technologies, and there will be different levels of appetite for some of these interventions.

So, a challenge that I think we all here and beyond these doors need to grapple with is how far shall we go, should we go, to intervene to protect our precious species and our ecosystems? And a controversial example also is assisted migration. It's been proposed and debated for probably about 40 or 50 years. And it's actually being used now to manage over 40 vertebrate species in Australia. But only so far to mitigate the impacts against habitat destruction and also invasive species. But we do have an example from Western Australia of assisted migration due to climate change. And that was with the Western Australian swamp tortoise, which were released into wetland reserves about 300 kilometres south of their natural distribution. This is because their wetland habitat had basically dried out. The action of assisted migration is generally thought to as being a last resort action because of the potential, as you can imagine, for perverse outcomes.

We're actively intervening and shifting species around the landscape. But we do need to continue to research these approaches, understand their costs, benefits, and risks, like the program on the Great Barrier Reef, so that we are well prepared when we have to pull the trigger on these. But also, such that society is prepared. And importantly, that our regulatory environment can keep up because that's going to be, I guess, where a lot of the obstacles will exist as well.

On a more positive note, we're seeing, and I'm sure you're observing too, much greater recognition of Indigenous knowledge in protected areas management.

In Australia and also in Queensland, including the co-management of traditional lands

and important programs such as land and seal Indigenous ranger programs, one of which was recognised by the King of England last year, so, you know, to global acclaim. Protected areas management can greatly benefit from that deep understanding that exists of country and also, importantly, help restore connections to country where it's been lost.

And co-management recognises that Indigenous landowners have the right to determine their priorities for land and action management based on their knowledge of country. I just wanted to use an example of this. Here you can see the different seasons based on ecological cues rather than strictly modern-day science, meteorological patterns. There's an opportunity to take this knowledge and use that to help us prepare for climate change into the future and also climate variability. Integrating such knowledge with modern scientific ways of thinking can provide a localised, context-specific strategies for adaptation to climate change. And there's co-benefits. It doesn't just support environmental adaptation but will also preserve our cultural heritage and knowledge in our country.

If we go back to the painting metaphor that I used at the beginning, this painting doesn't just sit by itself, isolated, alone, separate from the rest of the world. There are other paintings nearby in this gallery and they are not that it sits there. So just as protected areas sit within and interact with a complex and ever-changing landscape, we are recognising increasingly that we need to manage beyond our protected area boundaries in order to best protect our protected areas. And that includes enhancing corridors, as I spoke to about before, but also partnering with other land managers around the boundaries of national parks. And we saw significant announcements this week, a new protected area in Queensland that is a reflection of those types of partnerships and a major support from philanthropy as well.

One of the best ways to be more inclusive beyond the boundaries of protected areas is what the IUCN calls other effective area-based conservation measures. There's a lot of debate and discussion recently about how these can be accounted for and supported. In Queensland, they include special wildlife reserves, which are a voluntary agreement between the Queensland government and landholders.

We have over four million hectares under that class now in Queensland. But it also means training and supporting landholders in ways of effective conservation management and ways to better fund these activities also. It's a lot for some landholders to take on.

Into the future, there may also be a need to build in more flexibility, and this is a piece of work that one of my colleagues, Jonathan Rhodes from UQ, led, which I was involved in, and it was a really great opportunity to think laterally about what we need to do in the face of climate

change. We came down to this notion of flexibility. Humans aren't always good at flexibility. Bureaucracies aren't always good at flexibility. But we're thinking about flexibility in our procedures, flexibility in how our resources are allocated, and flexibility of the actions that are undertaken. This has similarities to the notion of adaptive management, but... It's different. It's reacting and responding to events as they occur in a way that achieves the best outcome for those values that we're seeking to protect. And in fact, we have a good local example of this with the zoning of the Great Barrier Reef Marine Park.

We have the ability to rapidly rezone the park in response to events, and this was built into the Act for the Great Barrier Reef Marine Park, allowing managers to restrict activities in certain areas based on current events. So, it's not impossible.

I'd like to finish this lecture with this final section on action and advocacy, and in particular, the importance of international cooperation and local cooperation to address the impacts of climate change on our protected areas. Just as a reminder, our protected areas here in Queensland are part of a much bigger... of a much bigger network of global protected areas. And that is really just to position the work that we're doing here in Queensland in a bigger international context and our global commitments to biodiversity conservation, which is a reminder as to preserve at least 30% of terrestrial areas by 2030, and importantly, that they are effectively managed. So, when we look locally, we know that the current status of Queensland's protected areas strategy, as stated in the 2022 report card, gives us an indication of the progress that we're making in policy and planning at expanding and better managing our protected areas. And it's been pointed out by this association and others that progress has been slow toward the target of protecting 17% of our protected areas.

So, we're moving forward, and you can see the recent announcements that are contributing to that. But from my perspective as a researcher, many of our progress measures actually don't have targets. So, we can't measure performance, and we have limited potential to assess are we actually on track. But regardless of where we are, several of my colleagues, this paper here by Brendan Winters for example, have shown that we need to significantly increase our funding for threatened species management fundamentally and protected areas at large if we are able to have a chance at managing them and avoiding the extinction process due to climate change.

So going forward, caring for our national parks will mean better, being more strategic with our time and effort. That's what it boils down to. Where we can, we need to be working in collaboration across government, non-government, research, industry, and community sectors. Our efforts inside national park boundaries like habitat restoration and weed management just

have to continue in order to build that resilience in. Strategic monitoring, inclusive citizen science projects, usefully inform how we're progressing, but I would ask people to consider is that monitoring contributing to a bigger picture understanding of how we're progressing and where we need to be taking action, and where you can try and link it in, link in your monitoring efforts to that bigger picture. Similarly, there are opportunities to be involved in active research and prioritising your involvement in the research that leads to improved knowledge of how we can make our system more resilient is important.

And finally, our population is only continuing to grow in this state, in particular in the southeast corner. And so, maintaining our own society's connection with national parks has to continue to be a priority so that they are valued by everyone. I have the pleasure of working with Peter Cochrane on the Australian Heritage Council and having a yarn to him yesterday. He mentioned that that was the main flavour of his lecture to the association several years ago was around people's connection to parks. And I reiterate that point.

So, in summary, our protected areas already serve multiple purposes, there are multiple tensions as a result of that, and we have to balance often competing objectives both in space and time. And given that context, proactively managing, adapting, and building in flexibility where we can will serve the purpose of enhancing the resilience of our system.

We need to ready the public for rapid and possibly quite invasive interventions. Our researchers are already looking at these and understanding their risks and benefits. And as we learn, we need to be able to do that. And we understand what those risks and benefits are. We'll need to bring our public along for the ride as well. My family is based predominantly in Cairns. And just watching their knowledge grow of what needs to happen on the reef has been really interesting. And it's just seeing where their knowledge gaps are and how we need to fill in those knowledge gaps so that they understand why these interventions are taking place.

It's a weekend, so you might want to do some further reading. There's some of the literature that I referred to in developing this talk. Many written by Queenslanders, actually. We lead the way in Queensland research within the environmental sciences. And we have examples here in this room. So, thank you very much for all your work. And thank you for your time. It's been a pleasure.

It's been a real honor to give this lecture.
Thank you.