
Department of Planning and Environment

dpie.nsw.gov.au



Research Strategy to Support the Cumberland Plain Conservation Plan

November 2022





Acknowledgement of Country

This strategy acknowledges more than 60,000 years of continuous Aboriginal¹ connections to the land that makes up NSW. We acknowledge and pay our respects to Elders past and present.

This strategy recognises that, as part of the world's oldest living culture, traditional Aboriginal owners and custodians share a unique bond to Country and the plants, animals, waterways and landforms it contains. This relationship has been forged through thousands of years of living with the lands and waters and engaging with them for ceremony, religion, trading and seasonal migration.

The area covered by the Cumberland Plain Conservation Plan (Figure 3) has been traditionally cared for by 3 Aboriginal groups: the Darug, Dharawal and Gundungurra. Others, such as the Eora, Darkinjung, Wiradjuri and Yuin may also maintain trade or other obligatory care relationships with the area. The Deerubbin, Gandangara and Tharawal local Aboriginal land councils also have local land holdings and contemporary responsibilities towards all the Aboriginal peoples and communities living in the area. This strategy recognises that there are many Aboriginal and Torres Strait Islander peoples today who are connected to Country that is now largely known as the Cumberland Plain.

This strategy recognises the need to integrate Aboriginal knowledge, practices and perspectives into conservation approaches, and seeks the active leadership, participation and engagement of Aboriginal groups and practitioners.

Published by NSW Department of Planning and Environment

dpie.nsw.gov.au

Research Strategy to Support the Cumberland Plain Conservation Plan

First published: November 2022

Department reference number: DOC22/422837-1

Copyright and disclaimer

© State of New South Wales through Department of Planning and Environment 2022. Information contained in this publication is based on knowledge and understanding at the time of writing, November 2022, and is subject to change. For more information, please visit dpie.nsw.gov.au/copyright

¹ The term 'Aboriginal' is used in this strategy to recognise those who identify as Aboriginal Australian peoples (and are recognized by their communities as such) with traditional and/or contemporary connections to the lands now known as the Cumberland Plain. We recognise that labels such as Aboriginal fail to recognize the vast diversity of nation, language, clan and tribal groups now understood to be Aboriginal and/or Torres Strait Islander peoples. Please see [Practice resource - Working with Aboriginal people and communities \(PDF 1.16 MB\)](#) for more detail.

Contents

Executive summary	5
1 About this strategy	7
1.1 The Cumberland Plain Conservation Plan.....	7
1.2 Why is research needed?.....	7
1.3 Strategy aims.....	8
1.4 Strategy themes.....	8
2 Integration of Aboriginal knowledge and perspectives	12
2.1 The importance of Aboriginal peoples to the Cumberland Plain.....	12
2.2 Aboriginal consultation	12
2.3 Principles underpinning engagement.....	13
2.4 Identifying Aboriginal priorities	13
3 How the strategy was developed	15
3.1 Review of existing knowledge	17
3.2 Consultation with Aboriginal stakeholders about priorities	17
3.3 Consultation of conservation stakeholders about knowledge gaps	17
3.4 Identification and prioritisation of research options.....	18
3.5 Drafting the strategy	18
3.6 Online survey of the broader community	19
3.7 Wider community consultation.....	19
4 Research strategy	20
4.1 Theme 1: Supporting Aboriginal connections.....	21
4.2 Theme 2: Engaging with peoples and cultures	22
4.3 Theme 3: Conserving threatened species and ecosystems	23
4.4 Theme 4: Restoring and reconstructing ecosystems	24
5 Implementation of stage 1 of the research program	25
5.1 Objective I: Strengthening Aboriginal knowledge and practices.....	25
5.2 Objective II: Prioritising sites for shared cultural, conservation and restoration values.....	26
5.3 Objective III: Enhancing the health and resilience of ecosystems.....	26
5.4 Objective IV: Improving management of climate change risks.....	27
5.5 Objective V: Identifying cost-effective management practices to enhance biodiversity.....	28
5.6 Delivery of stage 1 projects	29
6 Governance	30
6.1 Steering committee.....	30
7 Monitoring, reporting and evaluation	32
7.1 Strategy review and evaluation	32
7.2 Stage 1 research program reporting and evaluation.....	32
8 Acknowledgements	33

Appendices	34
Appendix 1: Threatened species and ecological communities in the Cumberland Plain.....	34
Appendix 2: Organisations consulted	38
Appendix 3: Knowledge gaps and supporting information	38
Appendix 4: Prioritisation process table of information	38

Executive summary

The vision of this strategy is to guide high-quality research to support the effective delivery of the Cumberland Plain Conservation Plan to 2056.

The development of the strategy involved targeted consultation with stakeholders and research partners. The strategy recognises that local Aboriginal knowledge and collaboration must be an integral part of the research program.

The research program guided by this strategy will address critical knowledge gaps and deliver the knowledge needed by stakeholders working to conserve the plants and animals of the Cumberland Plain.

The Cumberland Plain Conservation Plan (CPCP) supports biodiversity conservation and restoration in the Cumberland Plain over the long term (to 2056) as the region grows. A key action identified in the CPCP is the creation of an ongoing research program to directly support the CPCP's key commitments.

This research strategy was developed by a team from Western Sydney University (WSU) in collaboration with the NSW Department of Planning and Environment. Its purpose is to guide research needed to support the delivery of the CPCP. We consulted with a wide range of local stakeholders and land managers to identify research priorities and key knowledge gaps that are impeding the desired outcomes of conservation and restoration efforts.

The strategy recognises that Aboriginal knowledge of land management, landscape features and cultural practices in the Cumberland Plain are critical for the success of the CPCP and are integral to the research that will support it.

This strategy matches the long-term time frame of the CPCP but also prioritises research for an initial 4 years of funding (Figure 1). It provides a framework for interdisciplinary, collaborative and applied research.

The strategy identifies research priorities within 4 core themes:

1. Supporting Aboriginal connections
2. Engaging with peoples and cultures
3. Conserving threatened species and ecosystems
4. Restoring and reconstructing ecosystems.

These research themes are interconnected with shared objectives and research priorities to address critical knowledge gaps cut across multiple themes (see Figure 1). The strategy advocates an adaptive management approach, integrating research into conservation management to allow the effectiveness of management actions to be routinely assessed and improved as new information emerges.

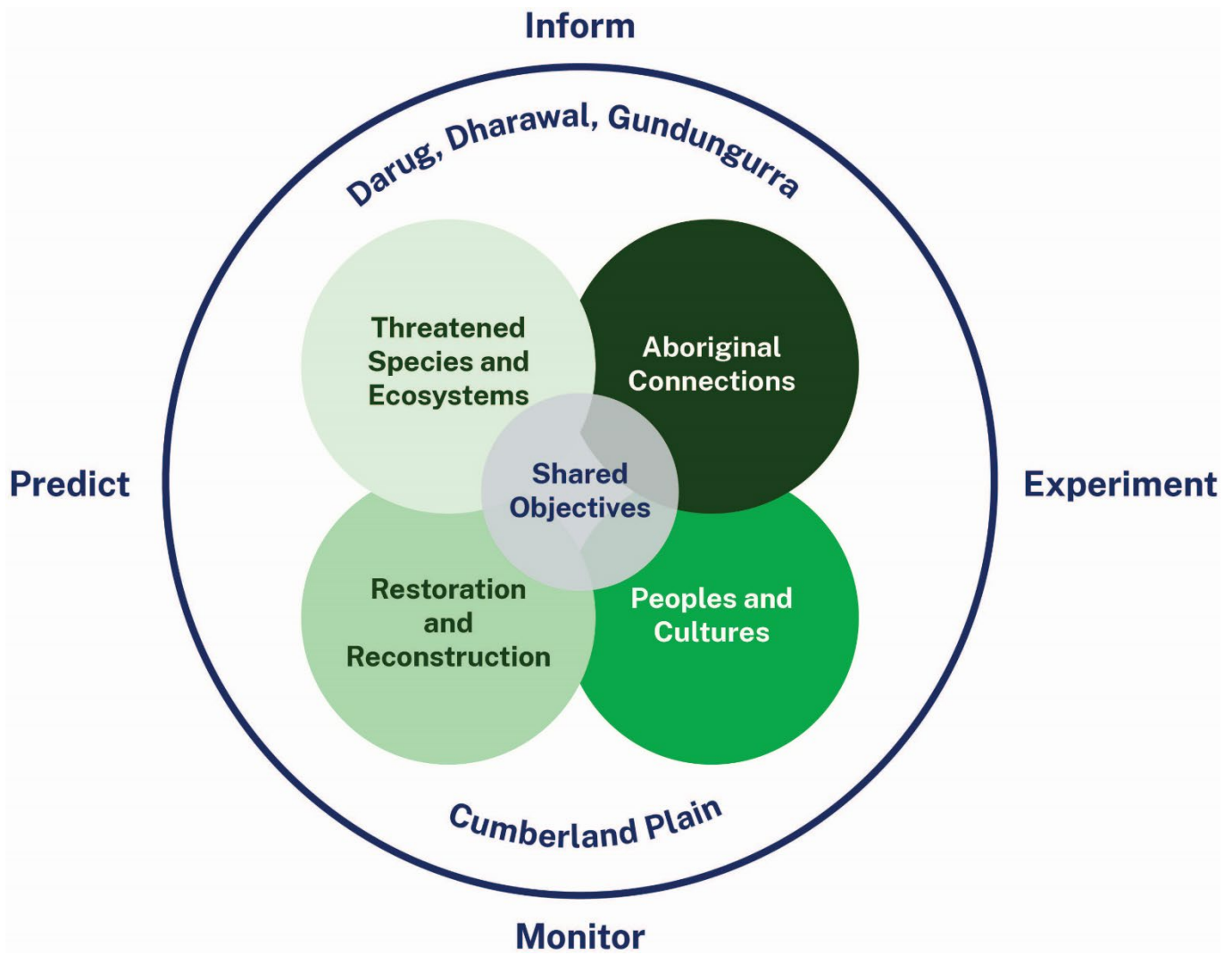


Figure 1. Research themes highlighting the cross-cutting approach to support the CPCP.

1 About this strategy

The vision of this strategy is to provide high-quality research to support the effective delivery of the CPCP. The strategy will guide research investment and knowledge generation over the period of the CPCP to 2056. It will also identify priority research for an initial 4-year, \$1.8 million research program (stage 1). The research will inform the conservation and restoration of threatened species and ecosystems in the Cumberland Plain. The strategy will also support community connection to Country.

1.1 The Cumberland Plain Conservation Plan

The Cumberland Plain Conservation Plan (CPCP) will support conservation and protect biodiversity in the Cumberland Plain over the long term. The region is predicted to grow from 740,000 people in 2016 to over 1.5 million by 2056. The CPCP identifies important biodiversity areas within the Cumberland Plain that can be used to offset the biodiversity impacts of future urban development.

‘Sub-Plan A: Conservation Program and Implementation’ supports the CPCP by providing the framework for implementing the CPCP’s conservation program and includes details of the commitments and actions needed to realise the CPCP’s vision. When we refer to the CPCP in this strategy, we include Sub-Plan A.

1.2 Why is research needed?

There are hundreds of native species and ecosystems in the Cumberland Plain. This includes 49 threatened species and 8 threatened ecological communities (see ‘Appendix 1: Threatened species and ecological communities in the Cumberland Plain’) that will likely be impacted by future development in the region. These native species and ecosystems are already under pressure from threats such as climate change, invasive plants and animals, and habitat fragmentation and loss. There are still many gaps in our knowledge of these species and ecosystems and about the best ways to conserve and restore them.

A key action identified in the CPCP is to undertake research to directly support the CPCP’s commitments. The NSW Government committed \$1.8 million in funding to Western Sydney University (WSU) to develop this research strategy and to implement stage 1 (the first 4 years) of the corresponding research program.

1.3 Strategy aims

This strategy aims to guide research investment and knowledge generation to support the effective delivery of CPCP actions and outcomes. Figure 2 describes how the strategy will achieve this.

The strategy matches the long-term timeframe of the CPCP (to 2056) and identifies research priorities for stage 1 of the research implementation program. A steering committee appointed by the Department of Planning and Environment will oversee the implementation of the strategy. The strategy is dynamic and will be reviewed, evaluated and updated at 5 yearly intervals as part of the independent external review process of the CPCP.

By guiding what research is undertaken, the strategy will ensure that the resulting research will:

- help to improve knowledge about the area's threatened species and ecosystems and our ability to manage, restore and monitor plant, animal and ecosystem responses to our efforts
- deliver the data and new knowledge needed by the different stakeholders working to conserve and restore the native plants and animals of the Cumberland Plain.

The research and its findings will be integrated with relevant programs for mutual benefit wherever practical. For example, research on koala feed trees would integrate with the [NSW Koala Strategy](#) and threatened species research would integrate with the [Saving our Species program](#).

1.4 Strategy themes

The research priorities follow 4 key themes (see Figure 1):

1. **Supporting Aboriginal connections** – partnering with Aboriginal peoples on research to help maintain Aboriginal peoples' cultural, spiritual, physical and economic relationships with their lands and waters in the Cumberland Plain
2. **Engaging with peoples and cultures** – understanding the attitudes and behaviours of the community towards biodiversity and conservation values found in the Cumberland Plain and how these can be positively influenced
3. **Conserving threatened species and ecosystems** – understanding the ecology, habitat requirements, geographic distribution and genetic diversity of species and ecological communities and their likely responses to changing land use and climate
4. **Restoring and reconstructing ecosystems** – understanding how to successfully restore degraded ecosystems and reconstruct functional ecosystems to enhance the extent and value of conservation areas in the Cumberland Plain.

This strategy has a focus on understanding and managing the impacts of climate change on biodiversity values, which is relevant across the research themes, especially themes 3 and 4.



Photo plate 1. WSU's EucFACE climate change experiment in the Cumberland Plain Woodlands – Photo by Paul Rymer



Figure 2. Research program logic to achieve the CPCP's vision.

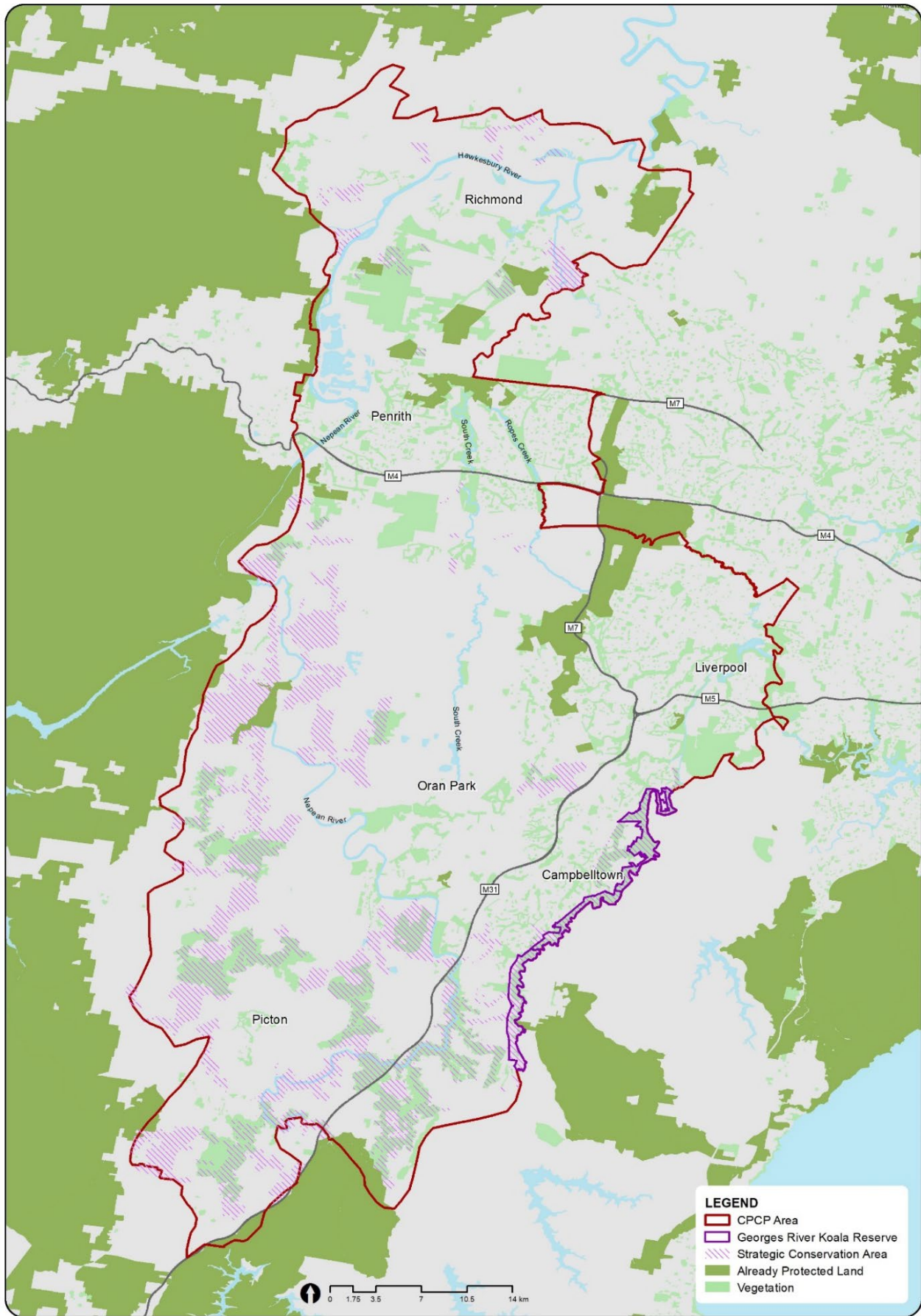


Figure 3. Map of the Cumberland Plain showing existing vegetation and strategic conservation area.

2 Integration of Aboriginal knowledge and perspectives

The Cumberland Plain is the Country of the Darug, Dharawal and Gundungurra peoples. However, Aboriginal and Torres Strait Islander peoples from many other groups also live in or have care relationships with the area.

This strategy recognises the need to undertake research to support Aboriginal peoples in maintaining their cultural, spiritual, physical and economic relationships with the lands and waters in the Cumberland Plain.

Aboriginal knowledge of land management, landscape features and cultural practices in the Cumberland Plain is important to the success of the CPCP. Aboriginal knowledge and practices will be integrated into research approaches.

2.1 The importance of Aboriginal peoples to the Cumberland Plain

More Aboriginal people live in Western Sydney than anywhere else in Australia, with many families originating from homelands in wider NSW and throughout Australia. We recognise that engaging and partnering with Western Sydney's diverse Aboriginal communities is an important component of implementing the CPCP.

One of CPCP's outcomes is to support participation for Aboriginal peoples, promote Aboriginal knowledge and help Aboriginal communities maintain their relationships with land and waters in Western Sydney. To achieve this, the department is co-developing a 10-year 'Caring for Country – Aboriginal Outcomes Strategy' (the Caring for Country Strategy) with Western Sydney's Aboriginal communities.

Research priorities in the 'Supporting Aboriginal connections' theme (see section 4.1) will help deliver the actions in the Caring for Country Strategy and the outcomes for Aboriginal peoples described in the CPCP.

2.2 Aboriginal consultation

During the development of the CPCP, the department consulted with the Aboriginal community and stakeholders. In 2019–20, targeted consultation focused on understanding Aboriginal priorities for the CPCP (Marcia Elling Consulting 2019). Activities included 12 community workshops, on-Country walks and face-to-face and online meetings (see section 3.2).

An outcome of the engagement was a commitment from the department to develop the Caring for Country Strategy under the CPCP. Since June 2021, we have been working with Aboriginal stakeholders, including Traditional Custodians, Aboriginal land councils, local communities, businesses and service providers in Western Sydney, to understand the opportunities and priorities for the Caring for Country Strategy. We have held more than 32 meetings with over 250 participants.

In 2021, WSU consulted with a broad range of conservation stakeholders, including Aboriginal stakeholders, to identify knowledge gaps that people felt were barriers to effective conservation action and outcomes (see section 3.3).

2.3 Principles underpinning engagement

The research implementation program will work with Western Sydney's Aboriginal communities under the following principles:

- Respect Aboriginal connections and sovereignties of the Countries in the area identified as the Cumberland Plain.
- Ensure research that concerns or impacts Aboriginal peoples or their knowledge, lands and waters, including native plants and animals, is led or co-developed by Aboriginal peoples.
- Incorporate a 2-way approach (Aboriginal knowledge and western science) to provide new and productive opportunities to more effectively Care for Country.
- Ensure Aboriginal peoples maintain control over when, how and why traditional ecological knowledge and Aboriginal data may be gathered, analysed, accessed and used (as per the guidelines from the Australian Institute of Aboriginal and Torres Strait Islander Studies and the NSW Government's Aboriginal Cultural and Intellectual Property Protocol).
- Locally co-develop Aboriginal research methods, ethics and protocols.
- Build partnerships based on mutual respect and promote a culturally safe environment.
- Communicate effectively to keep the broader community informed of research, support equitable access to opportunities and translate findings back to communities.
- Ensure theme 1 (Supporting Aboriginal connections) research benefits Aboriginal communities and Country.

2.4 Identifying Aboriginal priorities

The consultations identified a strong desire from Aboriginal stakeholders to deliver research in partnership with universities. They believed there should be opportunities for Aboriginal peoples to work within formal research programs. We will continue to collaborate with local Aboriginal land councils, Traditional Custodians and Aboriginal Elders and knowledge holders in the region to determine the priorities for research and how these groups want to be involved.

Initial priorities from the consultations underpin the research identified in theme 1 (Supporting Aboriginal connections – see section 4.1). An Aboriginal researcher will oversee theme 1 research

and provide guidance to project teams that work with Aboriginal partners in other themes. An Aboriginal 'Theme Leader' will work closely with Aboriginal and non-Aboriginal researchers to promote opportunities for the broader engagement of Aboriginal Custodians and stakeholders and the integration of Aboriginal knowledge and caring for Country approaches across the research program.

Aboriginal groups will have the opportunity to actively participate in and lead research, providing a platform for the integration of approaches to develop a greater understanding of the unique species, ecosystems and landscapes in the Cumberland Plain. This will inform conservation and restoration in the future.



Photo plate 2. Aboriginal connection to Country – Auntie Fran Bodkin on Dharawal land. Photo by Paul Rymer

3 How the strategy was developed

The development of this strategy focused on identifying knowledge gaps that form barriers to effective conservation actions and outcomes. Potential corresponding research options were prioritised based on cost, time and anticipated benefits.

The process built on existing knowledge and involved extensive consultation with stakeholders and research partners from the government, universities, industry, conservation groups, the community and Aboriginal groups (Figure 4). This process ensured the research identified will provide the greatest benefit in the delivery of the CPCP.

This strategy responds to research needs that are important to the delivery of the CPCP. The department prepared the CPCP and identified that research was needed in 4 key areas to support the CPCP. These areas are the organising themes within this strategy.

A key aim of this strategy is to identify the specific knowledge gaps and research priorities within these themes that will be most useful in achieving the commitments made in the CPCP.

The development of the strategy focused on:

- reviews of existing research and consultation with stakeholders
- identifying knowledge gaps that form barriers to effective conservation action
- prioritising knowledge gaps to determine those of greatest importance to stakeholders
- identifying research approaches that could address the most important knowledge gaps
- evaluating and prioritising which research approaches represent the best use of research investment, considering resources, time and expected benefits.

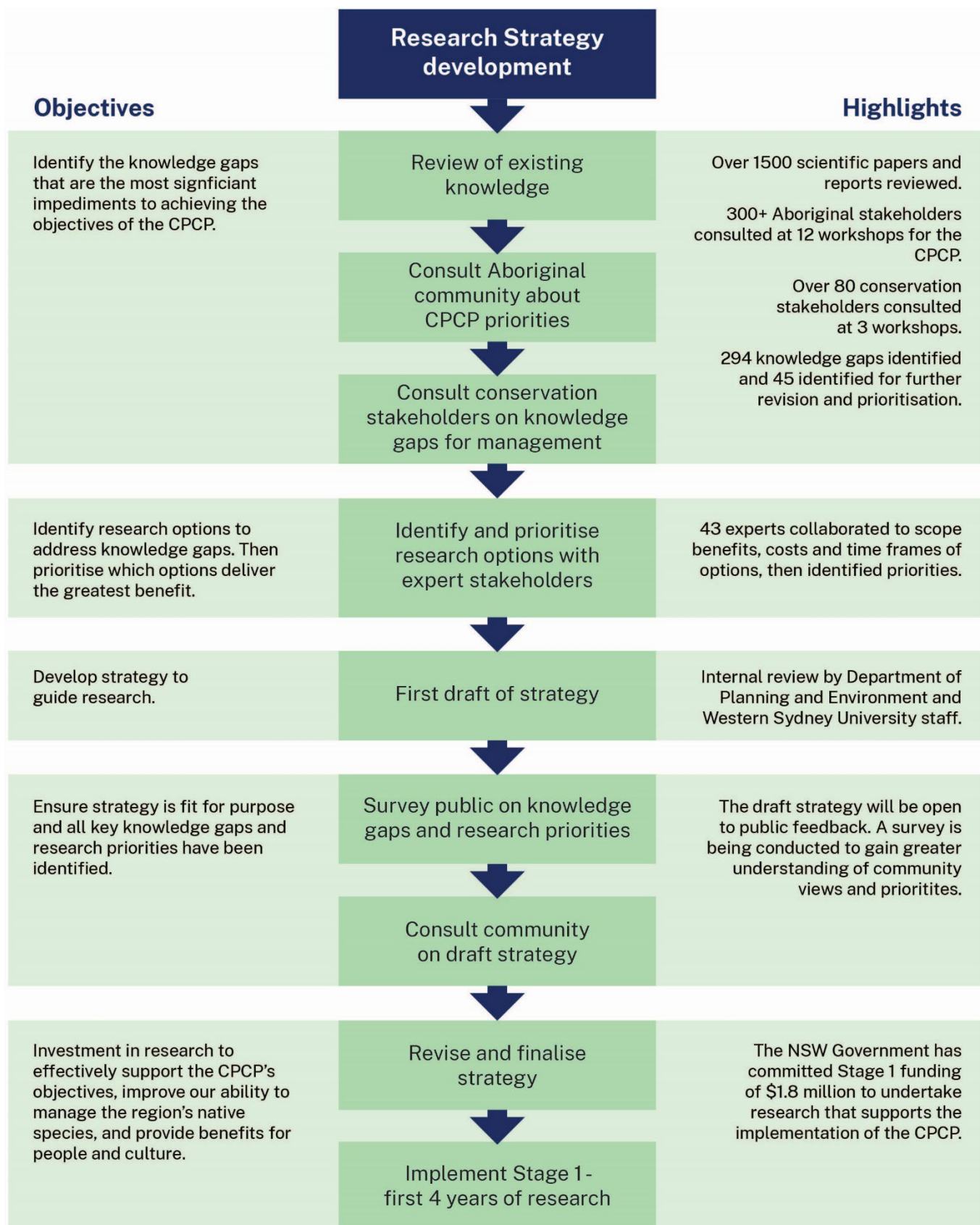


Figure 4. How the strategy was developed. Key steps in the process of developing the research strategy are shown in pale green boxes while key objectives of the steps and some of the highlights are shown either side.

3.1 Review of existing knowledge

The strategy recognises the expertise and knowledge held within the community, industry and the government, including a wealth of work completed and consolidated within the department (Biosis 2020 Draft Cumberland Plain Assessment Report). It is important that new research programs use and benefit from existing knowledge and avoid duplication. We created an inventory of relevant knowledge to establish what is already known.

The strategy development team collated over 1,500 scientific papers plus reports from government agencies and programs and industry and community groups. The team summarised and analysed the information, recording what is known and highlighting any knowledge gaps.

The team presented their findings to stakeholders during workshops to provide a starting point for discussions. We also used the findings to inform development of the draft of this strategy.

3.2 Consultation with Aboriginal stakeholders about priorities

We undertook extensive consultation with Aboriginal stakeholders when developing the CPCP (see section 2.2). The research priorities identified through that process directly informed the development of the areas listed under theme 1.

Aboriginal knowledge, practices and perspectives are also important to the objectives of other strategy themes. We included Aboriginal stakeholders in targeted consultation workshops for the development of those themes.

3.3 Consultation of conservation stakeholders about knowledge gaps

There are many groups with knowledge of the Cumberland Plain's unique ecosystems and species and the area's connections with people. We consulted closely with these groups to ensure that the strategy benefits from existing knowledge and that the resulting research will deliver the knowledge needed by the different stakeholders working to conserve and restore the plants and animals of the Cumberland Plain.

Stakeholders consulted included local communities, Aboriginal groups, conservation practitioners, industry, universities, government and non-government institutions (see 'Appendix 2: Organisations consulted' for a full list). Consultation methods included workshops, individual emails, phone calls, video conferences and face-to-face meetings.

The key objectives were to identify:

- knowledge gaps that are barriers to effective management
- the desired outcomes from filling these gaps
- which knowledge gaps are considered the most important by stakeholders.

The workshops were hosted by WSU in October and November 2021. A total of 79 participants attended the workshops, with between 20 and 37 participants at each workshop.

Participants were given an overview of existing knowledge (see section 3.1) and asked to identify key knowledge gaps. They were also asked to identify potential research activities to address these gaps and comment on any challenges and opportunities.

There were 294 unique knowledge gaps identified and more than 900 potential activities to address them (see 'Appendix 3: Knowledge gaps and supporting information'). Many of the knowledge gaps cut across multiple themes.

Participants voted for the knowledge gaps they believed were the most important to address. This resulted in a shortlist of 45 high-priority knowledge gaps.

3.4 Identification and prioritisation of research options

We held an additional workshop with 43 expert stakeholders to further scope and prioritise potential research approaches to address the 45 high-priority knowledge gaps.

For each research activity, the experts estimated the:

- timeframe – how long it would take to complete the research
- costs – how much the research would cost
- benefit – what the estimated benefit was for the delivery of the CPCP.

The experts then used these estimates to prioritise research options.

Finally, the experts voted to confirm which projects they considered most important. This step also allowed experts to highlight opportunities to collaborate and leverage new or additional resources for the implementation of research, such as through integration with other research programs.

'Appendix 4: Prioritisation process table of information' gives a list of all research approaches that were developed for the 45 highest priority knowledge gaps, their estimated timeframes, costs and benefits and the percentage of experts that voted in favour of each research approach.

3.5 Drafting the strategy

Research priorities that were assessed as of 'very high' or 'high' importance by stakeholders were incorporated into the strategy and organised around the key themes. As a wide variety of research priorities were identified by stakeholders within each theme, the research team further grouped similar topics into subthemes.

The department supplied the theme 1 research priorities (see section 4.1), which were developed in response to Aboriginal community and stakeholder consultation for the CPCP (see section 2.2).

This strategy was prepared by a team at WSU in collaboration with the department.

3.6 Online survey of the broader community

To obtain a broader understanding of community values and opinions that are relevant to this strategy, an online survey was developed and is being administered by WSU with ethics approval (HREC Approval Number: H14634). Key findings will be used to inform the final strategy.

3.7 Wider community consultation

This draft strategy is open for public feedback to allow interested stakeholders and community members to provide input into the identified priorities. In particular, we encourage people involved in conservation activities in the Cumberland Plain to review the strategy and provide feedback. The feedback will be used to inform the final strategy.



Photo plate 3. Water body surrounded by threatened ecosystems (Shale Sandstone Transition Forest, River-flat Eucalypt Forest) located in Bents Basin, Western Sydney

4 Research strategy

Research priorities are presented as knowledge gaps and organised around 4 themes. Understanding and managing the impacts of climate change on species and places is an important focus that cuts across multiple themes within the strategy.

'Appendix 4: Prioritisation process table of information' gives details on the prioritisation process for themes 2 to 4.



Photo plate 4. Close-up of flowers known as duwabili in Dharawal language and commonly called Australian indigo (*Indigofera australis*). Photo by Paul Rymer

4.1 Theme 1: Supporting Aboriginal connections

Theme 1 will deliver research to help Aboriginal peoples maintain their cultural, spiritual, physical and economic relationships with the lands and waters in the Cumberland Plain (see Table 1). The development of the research approaches in theme 1 will be led by Aboriginal researchers in collaboration with Aboriginal stakeholders. The research will provide new knowledge and tools to support the delivery of both the CPCP and the Caring for Country Strategy.

Table 1: Theme 1 research priorities (see section 2.4 for how priorities were identified for this theme)

Subtheme	Knowledge gap/questions to be answered
1.1 Improved management of culturally significant species and places	<ul style="list-style-type: none"> • What sites, places and species are culturally important to Traditional Custodians and Aboriginal groups in the Cumberland Plain? How can these be mapped or better understood? • How can Traditional Custodians lead and be involved in the management of culturally significant sites, places and species? • How do we embed Aboriginal knowledge and practices into conservation policy and land management in Western Sydney?
1.2 Maintaining and providing for Country	<ul style="list-style-type: none"> • How can traditional fire management practices enhance policies and practices to protect biodiversity and minimise risk to assets and lives? • What are the barriers for Aboriginal peoples to accessing employment and training pathways in the environmental sector and to growing Aboriginal businesses and organisations that deliver environmental services? • What role can Traditional Custodians and Aboriginal groups play in managing cultural resources such as bush food and medicine to support the cultural ecosystem and personal use of different species? • How can Aboriginal-led tourism support conservation and economic outcomes in the Cumberland Plain? • How can caring for Country enhance the mental and physical health of Aboriginal peoples and their ability to pass on knowledge?
1.3 Revive language and culture	<ul style="list-style-type: none"> • How can Aboriginal languages be revived to support outcomes? • How do song lines, stories, and Aboriginal trade trails relate to important connectivity values in the Cumberland Plain and how can these inform connections in the landscape and natural ecosystem?
1.4 Cultural waterways management	<ul style="list-style-type: none"> • Understand cultural water sites and the hydrogeology of the water systems in the Cumberland Plain from an Aboriginal perspective. • How can Traditional Custodians' and other Aboriginal groups' knowledge and experiences inform the management of waterways and riparian areas in the Cumberland Plain?

4.2 Theme 2: Engaging with peoples and cultures

Theme 2 will deliver research to understand and positively change the attitudes and behaviours of the community towards biodiversity and conservation values found in the Cumberland Plain (see Table 2).

Table 2: Theme 2 research priorities

Subtheme	Knowledge gap/questions to be answered
2.1 Values	<ul style="list-style-type: none"> • We lack an understanding of how stakeholders (such as residents, landowners, Aboriginal groups and conservation practitioners) value biodiversity and conservation. • How does the community value biodiversity offset sites on private land compared to publicly accessible conservation reserves?
2.2 Changing attitudes through engagement	<ul style="list-style-type: none"> • How can the values of the community in Western Sydney be shaped over time to respect and appreciate native plants, animals and ecological communities? • How can the community be involved in monitoring conservation outcomes, both to enhance community appreciation and ensure long-term adaptive management and conservation success? • What is the role of storytelling and the media in changing community values over time and how can this be used and improved upon?
2.3 Land use conflict	<ul style="list-style-type: none"> • How can landowners be encouraged to participate in conservation, restoration and Caring for Country? • What are the key areas of conflict between community access and public use of conservation areas and managing these areas for conservation and restoration? • What are the possible governance approaches for delivering the CPCP in terms of the responsibilities of state and local governments and community groups and how does the current model compare?

4.3 Theme 3: Conserving threatened species and ecosystems

Theme 3 will deliver research to support the conservation of threatened species and ecosystems by allowing us to better understand the ecology, habitat requirements, geographic distribution and genetic diversity of species and ecological communities and their likely responses to changing land use and climate (Table 3).

Table 3: Theme 3 research priorities

Subtheme	Knowledge gap/questions to be answered
3.1 Areas of importance	<ul style="list-style-type: none"> • What locations within the Cumberland Plain have high diversity at the community, species and genetic (endemic/unique) level relevant for conservation or sources for restoration? • What locations and habitat features within the Cumberland Plain may act as climate/habitat refugia (or are areas of high exposure)?
3.2 Population size and connectivity thresholds	<ul style="list-style-type: none"> • How can we enhance connectivity and habitat extent and suitability in the Cumberland Plain?
3.3 Diversity and ecosystem function and resilience to stressors	<ul style="list-style-type: none"> • What is the importance of species and/or functional diversity for ecosystem resilience? • What will the impacts of climate change be on ecosystem diversity, structure and function in the Cumberland Plain (including habitat and resources for native species)?
3.4 Vulnerability to climate change	<ul style="list-style-type: none"> • How do threats (including fragmentation, habitat degradation, altered fire patterns and climate change) interact? • What is the sensitivity to extreme weather events of threatened species and dominant species in threatened ecological communities within the Cumberland Plain?
3.5 Fire history and burning practices	<ul style="list-style-type: none"> • How do you effectively manage fire in the Cumberland Plain to enhance conservation outcomes and minimise risk to assets and lives? How can fire be introduced to long unburnt areas in this peri-urban environment?

4.4 Theme 4: Restoring and reconstructing ecosystems

To enhance the extent and value of conservation areas in the Cumberland Plain, theme 4 priorities will deliver research to support the restoration of degraded ecosystems and determine how to successfully reconstruct functional ecosystems (see Table 4). Theme 4 research will also work with restoration sector stakeholders, including local Aboriginal, community and industry groups, to explore how to develop and secure the capacity needed to undertake the projected levels of reconstruction and restoration required to support the CPCP's commitments.

Table 4: Theme 4 research priorities

Subtheme	Knowledge gap/questions to be answered
4.1 Principal barriers to success	<ul style="list-style-type: none"> • What are the main physical, chemical and biological barriers related to the soil that limits restoration success? • How can these barriers be overcome in the near and longer term through different management options?
4.2 Cost-effective management options	<ul style="list-style-type: none"> • What management actions can be implemented to cost-effectively manage invasive or pest species? • What role does the seed bank play in bush regeneration and how do we assess when it is valuable to maintain this resource in situ? • What is the role of succession in restoration projects and how can we use this as a tool to promote restoration outcomes?
4.3 Enhancing ecosystem function and resilience	<ul style="list-style-type: none"> • What level of diversity from genetic to species aboveground and belowground is needed to enhance capacity to adapt to future conditions in restoration projects given likely future climate scenarios?
4.4 Ensuring capacity	<ul style="list-style-type: none"> • How do we develop and secure the capacity of the restoration sector (including Aboriginal and community groups) to undertake the projected levels of reconstruction and restoration needed to support the CPCP outcomes, including access to seed/propagule sources, facilities to grow material and the know-how and capacity to implement in practice? • How can soil microbes be used to enhance the production, establishment, growth and resilience of key plant species used in restoration?
4.5 Prioritising sites for restoration and reconstruction	<ul style="list-style-type: none"> • How do we prioritise where restoration is undertaken, considering ecological constraints, spatial position, connectivity, local ecological and broader societal/cultural outcomes, Aboriginal knowledge and cost-effectiveness of management options?

5 Implementation of stage 1 of the research program

The NSW Government has provided funding to implement the first stage of this strategy. Stage 1 is a 4-year program that will undertake high-priority, collaborative research to support stakeholders in the Cumberland Plain to deliver CPCP objectives.

We have identified the most important knowledge gaps from the 4 themes in the strategy as high-priority initial activities. Stage 1 will deliver cross-cutting research that touches on multiple strategy themes. Stage 1 priorities will address 5 shared objectives: strengthening Aboriginal knowledge and practices, prioritising sites for shared cultural, conservation and restoration values, enhancing the health and resilience of ecosystems, improving the management of climate change risks, and identifying cost-effective management practices to enhance biodiversity.

Stage 1 will deliver research that begins to cost-effectively address priorities identified during the development of the long-term strategy. It includes research priorities that can be achieved in the short-term and also longer-term research that is critical to meeting CPCP commitments.

A focus of stage 1 is establishing inclusive and collaborative research projects that bring together people with critical expertise and know-how. Specifically, programs and the projects within them will be organised to enable researchers from different institutions to work with policymakers, conservation managers, restoration practitioners, Aboriginal groups and local communities to deliver high-quality research that supports the achievement of CPCP objectives.

5.1 Objective I: Strengthening Aboriginal knowledge and practices

Connection to Country for Aboriginal peoples is important for cultural, social and environmental reasons. Aboriginal practices have been developed over a long history of living with, managing and serving the land. It is critical to reconnect to the knowledge and practices belonging to Country through the revival of Aboriginal languages and song lines, and enhancing knowledge of and respect for Aboriginal practices with people on the lands. This objective delivers research prioritised in strategy subthemes 1.1 to 1.4, 2.3, 3.1, 3.2 and 4.4 (see section 4)

High-priority activities include:

- interviews with Aboriginal peoples conducted following the Aboriginal and Torres Strait Islander ethics and protocols – AIATSIS and NHMRC – to understand knowledge systems, language and song lines

- yarning, storytelling and similar Aboriginal-led approaches to highlight the importance of relatedness to species, places and Country
- examination of archival materials, genetic analysis of plants and animals and analysis of charcoal deposits to fill key knowledge gaps in Aboriginal practices, including trade and fire management
- cultural burns led by local Aboriginal groups undertaken to reconnect people to Country and monitored for cultural, social and environmental benefits
- trials of natural harvesting by local Aboriginal groups for cultural, social and environmental benefits, including seed collection for ecological restoration.

5.2 Objective II: Prioritising sites for shared cultural, conservation and restoration values

Social and cultural research is needed to align the conservation and restoration work with the shared values of Aboriginal groups and the local community. Basic research is needed on the distribution and abundance of diversity within and surrounding the Cumberland Plain to determine where to prioritise conservation and restoration efforts. This will also allow us to benchmark good-condition habitats to inform restoration outcomes and produce clearer guidelines on how to prioritise sites to meet cultural and social needs as well as conservation and restoration goals. This objective delivers research prioritised in strategy subthemes 1.1, 1.4, 2.1 to 2.3, 3.1 to 3.3 and 4.5.

High-priority activities include:

- local community surveys and focus groups to understand how much the community appreciates the natural environment and unique plants and animals in the Cumberland Plain
- citizen science approaches integrated with biological assessment surveys to explore and establish a baseline of shared values for conservation and restoration
- new flora and fauna surveys to complement existing records and fill critical gaps, including a soil's physical, chemical and biological properties for target species and ecosystems
- genetic analysis of target species to assess levels of genetic diversity within remnant populations and historic patterns of connectivity across the landscape in the Cumberland Plain
- development of guidelines for the prioritisation of sites and species that consider ecological, social, cultural and economic values.

5.3 Objective III: Enhancing the health and resilience of ecosystems

Healthy ecosystems are more likely to be self-sustaining, resist global changes, require less human intervention and be more valued by the local community. The specific ways in which biological diversity creates healthy, functioning and resilient ecosystems are still uncertain. Research is needed to define, measure and achieve this and to inform conservation, restoration and land

management. This objective delivers research prioritised in strategy subthemes 1.1, 1.2, 2.2, 2.3, 3.2, 3.3, 4.2 and 4.3.

High-priority activities include:

- defining and quantifying factors that make healthy and self-sustaining remnant and restoration sites
- experimental plots controlling diversity and stressors to test diversity-function relationships and characterise thresholds for the reconstruction of resilient natural ecosystems
- establishing a monitoring network where standardised approaches within conservation and restoration sites are used to benchmark reference sites, measure change through time, assess climate impacts and evaluate management practices
- modelling and simulation studies to test the level of species and functional groups required to provide different ecosystem functions and levels of resilience to disturbance
- engaging the community and raising awareness of ecosystem diversity, function and resilience.

5.4 Objective IV: Improving management of climate change risks

The vulnerability of species to climate change is determined by their innate sensitivity and exposure to changing conditions. This includes the frequency and intensity of extreme events such as floods, heatwaves and droughts. Information on threatened species' vulnerability to climate change is limited to climate-niche predictors (for example, maximum temperatures experienced across a species) and life-history (for example, time to reproduction) predictors. There are still major gaps in our understanding of how climate change will impact species. Filling these gaps will help us establish adaptation and mitigation strategies to build community resilience under climate change. This objective delivers research prioritised in strategy subthemes 1.1, 1.2, 2.2, 2.3, 3.3, 3.4, 4.2 and 4.5.

High-priority activities include:

- engaging with local Aboriginal communities to identify social and cultural impacts from climate change and understand how Aboriginal practices may improve climate change resilience
- field and laboratory studies of the tolerance in threatened and dominant species in ecosystems to extreme weather events such as floods, heatwaves and droughts
- monitoring natural populations to assess climate sensitivity of the landscape and over time using remote sensing (such as satellite imaging), on-ground sensors and citizen science observations
- modelling to predict species and areas most vulnerable to climate change
- genetic analyses of natural populations of animals and plants across geographic and climate space to predict adaptive capacity.

5.5 Objective V: Identifying cost-effective management practices to enhance biodiversity

Cost-effective management is key to enhancing conservation and restoration outcomes. However, the effectiveness of current practices, including those associated with fire regimes, suppression of pests and restoration and reconstruction of degraded land, is not well documented. Evaluating the effectiveness and cost of current and novel practices on private and public land is key to improving the management of the Cumberland Plain's biodiversity. This objective delivers research prioritised in strategy subthemes 1.1, 1.2, 1.4, 2.2, 2.3, 3.3, 3.5 and 4.1 to 4.5.

High-priority activities include:

- collating existing data and filling critical gaps through targeted field surveys (including on public and private land) to assess the outcomes of current management practices and identify practices that require further field assessments
- field- and laboratory-based experiments to identify physical, chemical and biological barriers to successful restoration and techniques to effectively overcome them
- field trials to assess current and novel management practices (such as topsoil removal and cultural burns) to identify cost-effective approaches to managing weeds, pests and target plant species and encourage ecosystem recovery
- evaluating the role of succession (the order that species establish) in conservation and restoration programs to identify opportunities to allow 'natural' or improved (through management) successional trajectories in restoration projects
- a feasibility study to assess the capacity to implement management at appropriate scales (spatial and temporal) and reasonable costs (financial and social)
- developing sector-wide guidelines for conservation and restoration including propagule collection, propagation and access to support the proposed works.

5.6 Delivery of stage 1 projects

WSU was awarded the lead role in delivering research for stage 1 (in the first 4 years) of the program through a competitive grant process. The university will call for expressions of interest for research partners. A priority of the program is establishing collaborative projects that enable researchers from different institutions to work with policymakers, conservation managers and restoration practitioners. This process will leverage existing programs and resources and allow specific projects to be undertaken by researchers based in several key institutions.

All projects within stage 1 of the research program require the approval of the CPCP's steering committee, which includes representatives from the department and WSU (see section 6.1). The committee will review and assess project proposals and consider whether they:

- cost-effectively deliver high-quality research promptly to address key research priorities and deliver desired outcomes
- address knowledge gaps in multiple research themes and contribute to stage 1 objectives
- support effective delivery of CPCP commitments
- have multiple partners and foster meaningful collaboration
- are Aboriginal led or co-led and/or engage and inform local Aboriginal stakeholders
- leverage additional co-funding, such as grants and partnerships
- effectively manage risks.

6 Governance

The development and implementation of the research strategy are overseen by a steering committee and supported by the existing governance framework of the Cumberland Plain Conservation Plan.

6.1 Steering committee

Development and the first 4 years of implementation of the research strategy will be overseen by the CPCP Research Program Steering Committee. The steering committee includes representatives from the department and WSU. The department's Executive Implementation Committee, which is responsible for oversight of implementation of the CPCP, will receive regular updates regarding the research program.

The objectives of the steering committee are to:

- achieve outcomes – it will ensure funded research helps to achieve the social, economic and environmental outcomes identified in the CPCP
- ensure cost-effectiveness – it will work closely with the department and other research partners to deliver a cost-effective research program and leverage additional funding from sources such as grants and partnerships wherever practical
- provide quality research products for stakeholders – it will ensure research outputs are relevant, based on the best available evidence and readily available in forms that end users can access, understand and use
- build capacity – it will foster the transfer and integration of skills and knowledge to the department and between research institutions, government agencies and the local communities of the Cumberland Plain.

Implementing and delivering research projects may also need support and knowledge exchange between WSU, CPCP working groups such as the koala and restoration groups, as well as the department's Knowledge Sharing Panel which will be established to support the implementation of the Caring for Country Strategy.

The overarching governance framework is shown in Figure 5.

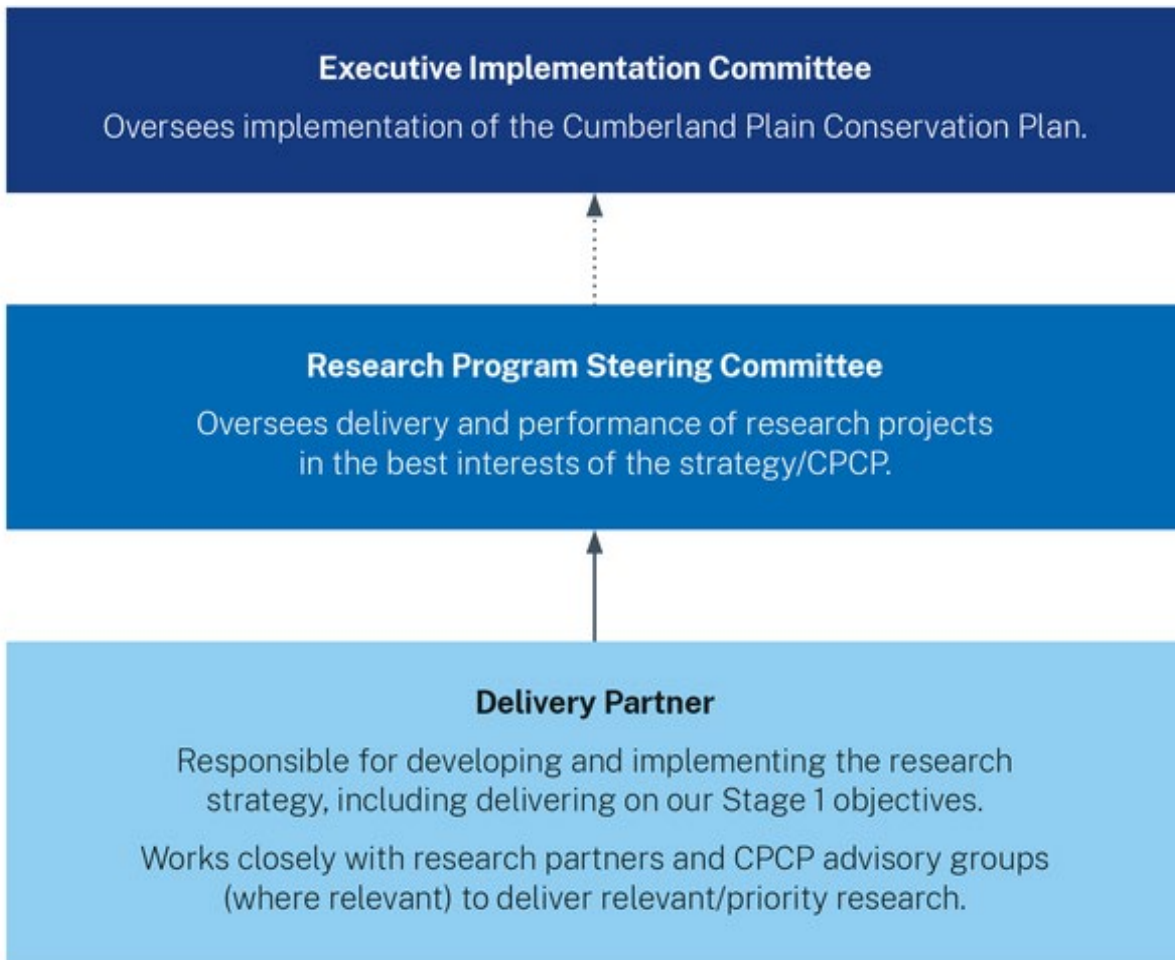


Figure 5. Governance framework for the research program.

7 Monitoring, reporting and evaluation

Monitoring, reporting and evaluation processes are in place to ensure that the strategy and research program delivers relevant high-value information to support the CPCP objectives. A regular review process will ensure the strategy is updated as new knowledge and priorities emerge over the life of the CPCP to 2056.

7.1 Strategy review and evaluation

The strategy will be adapted over time and as knowledge, practices and priorities evolve. While we can reasonably predict certain aspects of management in the region, it is less certain how individual species and ecosystems will respond to emerging pressures and how community values will change over time. Furthermore, actions undertaken to deliver the CPCP's objectives will change conditions and, therefore, influence priorities.

The strategy and research implementation program will be reviewed on a 5-year cycle as part of the independent external review of the CPCP. The strategy will be refined and new stages of the implementation program are developed in response to those reviews.

7.2 Stage 1 research program reporting and evaluation

To assess the progress and effectiveness of the stage 1 research program, WSU must provide quarterly reports to the steering committee. The reports must show:

- how programs are meeting objectives, deliverables and other milestones
- that the research is delivered within budget and leverages other funding/resources
- that there is broad collaboration in projects, including with other institutions
- how data is being shared with the public and the government (such as through BioNet and SEED)
- that information is translated for policy and management
- that programs support CPCP objectives and detail any other impacts.

8 Acknowledgements

The development of this strategy was led by WSU with support from the Department of Planning and Environment. Experts and stakeholders from many organisations and the community of Western Sydney generously contributed their time, ideas and knowledge to the development of this strategy. Table 5 lists the writing and subject matter experts who contributed to this strategy.

Table 5. Writing and subject matter experts

Name	Affiliation
Laura Babian	Department of Planning and Environment
Blake Edwick	Department of Planning and Environment
Elizabeth Irwin	Department of Planning and Environment
Dr Ian Oliver	Department of Planning and Environment
Linda Smith	Department of Planning and Environment
Prof Gawaian Bodkin-Andrews	Western Sydney University
Prof Matthias Boer	Western Sydney University
Dr Yolima Carrillo Espanol	Western Sydney University
Jaana Dielenberg	Western Sydney University
Associate Prof Ben Moore	Western Sydney University
Associate Prof Uffe N Nielsen	Western Sydney University
Dr Rachael Nolan	Western Sydney University
Prof Elise Pendall	Western Sydney University
Associate Prof Neil Perry	Western Sydney University
Prof Jeff Powell	Western Sydney University
Prof Markus Riegler	Western Sydney University
Dr Paul Rymer	Western Sydney University
Prof Juan Francisco Salazar Sutil	Western Sydney University

Appendices

Appendix 1: Threatened species and ecological communities in the Cumberland Plain

Table 6. Vegetation communities and threatened ecological communities

PCT no.	PCT name	BC Act TEC name	NSW status	EPBC Act TEC name	EPBC status
724	Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion	Shale-Gravel Transition Forest	Endangered	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	Critically endangered
849	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Cumberland Plain Woodland	Critically endangered	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	Critically endangered
850	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	Cumberland Plain Woodland	Critically endangered	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	Critically endangered
725	Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion	Cooks River Castlereagh Ironbark Forest	Endangered	Cooks River/Castlereagh Ironbark Forest	Critically endangered
781	Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	Freshwater Wetlands	Endangered	Freshwater Wetlands	Not listed
835	Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	River-flat Eucalypt Forest	Endangered	River-flat eucalypt forest on coastal floodplains of southern NSW and eastern Victoria	Critically endangered
830	Forest Red Gum - Grey Box shrubby woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	Moist Shale Woodlands	Endangered	Western Sydney Dry Rainforest and Moist Woodland on Shale	Critically endangered
1395	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Shale Sandstone Transition Forest	Critically endangered	Shale Sandstone Transition Forest in the Sydney Basin Bioregion	Critically endangered
1800	Swamp Oak open forest on river flats of the Cumberland Plain and Hunter valley	Swamp Oak Forest	Endangered	Coastal Swamp Oak (Casuarina glauca) Forest of NSW and South East Queensland ecological community	Endangered

Table 7. Threatened species

Species name	Common name	Credit class (BC Act)	Type	EPBC Status	BC Status
<i>Acacia bynoeana</i>	Bynoe's wattle, tiny wattle	Species	Shrub	Vulnerable	Endangered
<i>Acacia pubescens</i>	Downy wattle, hairy stemmed wattle	Species	Shrub	Vulnerable	Vulnerable
<i>Allocasuarina glareicola</i>	-	Species	Shrub	Endangered	Endangered
<i>Anthochaera phrygia</i>	Regent honeyeater	Species / Ecosystem	Bird	Critically Endangered	Critically Endangered
<i>Botaurus poiciloptilus</i>	Australasian bittern	Ecosystem	Bird	Endangered	Endangered
<i>Callocephalon fimbriatum</i>	Gang-gang cockatoo	Species / Ecosystem	Bird	Not listed	Vulnerable
<i>Calyptorhynchus lathami</i>	Glossy black-cockatoo	Species / Ecosystem	Bird	Not listed	Vulnerable
<i>Cercartetus nanus</i>	Eastern pygmy-possum	Species	Mammal	Not listed	Vulnerable
<i>Chalinolobus dwyeri</i>	Large-eared pied bat, large pied bat	Species	Mammal	Vulnerable	Vulnerable
<i>Cynanchum elegans</i>	White-flowered wax plant	Species	Epiphytes and climbers	Endangered	Endangered
<i>Dasyurus maculatus</i> (SE mainland population)	Spotted-tail quoll, spot-tailed quoll, tiger quoll (southeastern mainland population)	Ecosystem	Mammal	Endangered	Vulnerable
<i>Dillwynia tenuifolia</i>	-	Species	Shrub	Not listed	Vulnerable
<i>Epacris purpurascens</i> var. <i>purpurascens</i>	-	Species	Shrub	Not listed	Vulnerable
<i>Eucalyptus benthamii</i>	Camden white gum, nepean river gum	Species	Tree	Vulnerable	Vulnerable
<i>Grevillea juniperina</i> subsp. <i>Juniperina</i>	Juniper-leaved grevillea	Species	Shrub	Not listed	Vulnerable
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Small-flower grevillea	Species	Shrub	Vulnerable	Vulnerable
<i>Haliaeetus leucogaster</i>	White-bellied sea-eagle	Species / Ecosystem	Bird	Not listed	Vulnerable
<i>Heleioporus australiacus</i>	Giant burrowing frog	Species	Amphibian	Vulnerable	Vulnerable

Species name	Common name	Credit class (BC Act)	Type	EPBC Status	BC Status
<i>Hibbertia fumana</i>	-	Species	Shrub	Not listed	Critically Endangered
<i>Hibbertia puberula</i>	-	Species	Shrub	Not listed	Endangered
<i>Hieraaetus morphnoides</i>	Little eagle	Species / Ecosystem	Bird	Not listed	Vulnerable
<i>Lathamus discolor</i>	Swift parrot	Species / Ecosystem	Bird	Critically Endangered	Endangered
<i>Litoria aurea</i>	Green and golden bell frog	Species	Amphibian	Vulnerable	Endangered
<i>Lophoictinia isura</i>	Square-tailed kite	Species / Ecosystem	Bird	Not listed	Vulnerable
<i>Marsdenia viridiflora</i> subsp. <i>viridiflor</i> *a - endangered population	Marsdenia viridiflora subsp. Viridiflora - endangered population	Species	Epiphytes and climbers	Not listed	Endangered
<i>Maundia triglochinoidea</i>	-	Species	Herbs and forbs	Not listed	Vulnerable
<i>Melaleuca deanei</i>	Deane's melaleuca	Species	Shrub	Vulnerable	Vulnerable
<i>Meridolum corneovirens</i>	Cumberland plain land snail	Species	Invertebrate	Not listed	Endangered
<i>Micromyrtus minutiflora</i>	-	Species	Shrub	Vulnerable	Endangered
<i>Myotis Macropus</i>	Southern myotis	Species	Mammal	Not listed	Vulnerable
<i>Ninox strenua</i>	Powerful owl	Species / Ecosystem	Bird	Not listed	Vulnerable
<i>Persicaria elatior</i>	Tall knotweed	Species	Herbs and forbs	Not listed	Vulnerable
<i>Persoonia bargoensis</i>	Bargo geebung	Species	Shrub	Vulnerable	Endangered
<i>Persoonia hirsuta</i>	Hairy geebung, hairy persoonia	Species	Shrub	Endangered	Endangered
<i>Persoonia nutans</i>	Nodding geebung	Species	Shrub	Endangered	Endangered
<i>Petauroides volans</i>	Greater glider	Species	Mammal	Vulnerable	Not listed

Species name	Common name	Credit class (BC Act)	Type	EPBC Status	BC Status
<i>Petaurus norfolcensis</i>	Squirrel glider	Species	Mammal	Not listed	Vulnerable
<i>Phascolarctos cinereus</i>	Koala	Species / Ecosystem	Mammal	Vulnerable	Vulnerable
<i>Pimelea curviflora var. curviflora</i>	-	Species	Shrub	Vulnerable	Vulnerable
<i>Pimelea spicata</i>	Spiked rice-flower	Species	Shrub	Endangered	Endangered
<i>Pomaderris brunnea</i>	Rufous pomaderris	Species	Shrub	Vulnerable	Endangered
<i>Pommerhelix duralensis</i>	Dural land snail	Species	Invertebrate	Endangered	Endangered
<i>Pseudophryne australis</i>	Red-crowned toadlet	Species	Amphibian	Not listed	Vulnerable
<i>Pteropus poliocephalus</i>	Grey-headed flying-fox	Species / Ecosystem	Mammal	Vulnerable	Vulnerable
<i>Pterostylis saxicola</i>	Sydney plains greenhood	Species	Orchid	Endangered	Endangered
<i>Pultenaea parviflora</i>	-	Species	Shrub	Vulnerable	Endangered
<i>Pultenaea pedunculata</i>	Matted bush-pea	Species	Shrub	Not listed	Endangered
<i>Rostratula australis</i>	Australian painted snipe	Ecosystem	Bird	Endangered	Endangered
<i>Tyto novaehollandiae</i>	Masked owl	Species / Ecosystem	Bird	Not listed	Vulnerable

Information sourced from Appendix D in the CPCP.

Appendix 2: Organisations consulted

Biodiversity Conservation Trust	Blacktown City Council,
Blue Mountains City Council	Botanic Gardens & Domain Trust
CSIRO	Cumberland Bird Observers Club
Australian Bird Study Association	Deloitte
Ecolearn	Ecological Consulting
Ecological Society of Australia	Environmental Defenders Office NSW
Fire Sticks	Greater Sydney Commission
Greater Sydney Landcare	Greening Australia
Hawkesbury City Council	Hawkesbury River County Council
Kalbar operations	Landcare
Liverpool City Council	Local Land Services
Macquarie University	NSW TAFE
Penrith City Council	Pollination group
Southern Cross University	Thismia Consulting
Toolijooa	Total Earth Care
University of NSW	University of Technology Sydney
University of Wollongong	Western Sydney Aboriginal Landcare Group
Western Sydney Parklands	Western Sydney University
Westerns Sydney Regional Organisation of Councils	Yarrabin
Youth Action NSW	

Appendix 3: Knowledge gaps and supporting information

Available [online](#).

Appendix 4: Prioritisation process table of information

Available [online](#).