Science for Saving Species

Research findings factsheet

Project 1.2.3

Threatened Species Recovery Hub

National Environmental Science Programme

A horizon scan for setting research priorities for effective management of alpine and sub-alpine peatlands across Australia

In brief

The threatened Australian ecological communities comprising Alpine Sphagnum Bogs and Associated Fens (alpine peatlands) support unique and threatened species and provide valuable ecosystem services, yet they face many threats.

To restore and conserve this ecosystem into the future, we need to focus our research effort towards the most critical knowledge gaps. Hence, we sought to identify which knowledge gaps and management needs are currently limiting conservation efforts with the idea that these would guide future research efforts. We used a horizon-scan approach to identify the top 25 research questions whose answers will enhance our capacity to conserve alpine peatlands. To identify these questions, we brought together 36 experts from across research, land management and policy advising.

The knowledge gaps identified fit five themes: climate change; wildfire; introduced species; effectiveness of management interventions; and understanding ecosystem function.

Our novel approach to cooperatively developing a research agenda for Australian alpine peatlands with key stakeholders is valuable for identifying key priorities and fostering stronger collaborations to support future conservation efforts.

An intact Australian alpine Sphagnum *bog and associated fen. Image: Joslin Moore*

MONASH University

Background

Australian Alpine Sphagnum Bogs and Associated Fens (alpine peatlands) are a type of wetland. Alpine peatlands are characterised by layers of partially decomposed organic matter (peat) that form as plant matter builds up in distinctive, waterlogged conditions. Specialised species occur in alpine peatlands, and these wetlands support valuable ecosystem services, such as the provision of freshwater and fuel and climate regulation. Yet, these ecosystems are threatened by various persistent and emerging pressures such as climate change, introduced species and wildfire.

Alpine peatlands are listed as threatened under the federal *Environmental Protection and Biodiversity Conservation Act 1999* and under state and territory legislation – where they are found in the ACT, New South Wales, Victoria and Tasmania. Alpine peatlands are also found within several Ramsar sites, which are wetlands identified to be of international importance for conservation. While a national recovery plan has led to a range of conservation efforts, uncertainties remain about how best to manage this vulnerable ecosystem.

Knowledge gaps about the ecology of alpine peatlands and the effectiveness of management actions are impediments to effective conservation.

Horizon scans can effectively bring together groups of stakeholders from across sectors and jurisdictions to provide a unified view of what is needed to improve management outcomes, to identify research priorities and collaboratively shape conservation approaches.

Horizon scanning is the process of systematically identifying potential threats, opportunities and/or developments for a specific field. This approach has been used to identify priorities for understanding environmental change and informing national conservation strategies but has not so far been widely used for the conservation management of threatened ecosystems.

*The alpine water skink (*Eulamprus kosciuskoi*) in an alpine peatland in Bogong High Plains. Image: James Kidman*

Research aims

Using a horizon-scan approach, we aimed to identify priority research questions that, if answered, would enhance capacity to conserve alpine peatlands.

Alpine peatland degraded from trampling by introduced hard-hooved herbivores. Image: K. Batpurev

What we did

Our horizon scan used structured expert elicitation to gather information and identify research priorities from 36 Australian alpine peatland experts. We chose the participants for their expertise in threats to, and/or management of, Australian alpine peatlands, either through active management, policy or research.

We conducted one-on-one interviews with 24 participants to gather information about existing challenges to effective peatland management.

We asked participants about:

1. the key threats to peatlands;
2. their personal experience and perceptions of the effectiveness and relevance of management interventions in Australia;
3. their perceptions of the key management challenges;
4. their insights into overcoming these challenges; and
5. the sources of information they use to inform their management.

We collated the information into three topics: current and emerging threats; existing management issues; and emerging management issues. We then used this information to identify key knowledge gaps limiting effective conservation and used it to formulate the research questions.

Over the course of three virtual workshops each of three-hours duration, participants revised the list of management needs and brainstormed knowledge gaps – to identify priority research questions to support conservation management. Priority research questions were refined and selected through several rounds of group discussion and editing, followed by anonymous voting to rank questions.

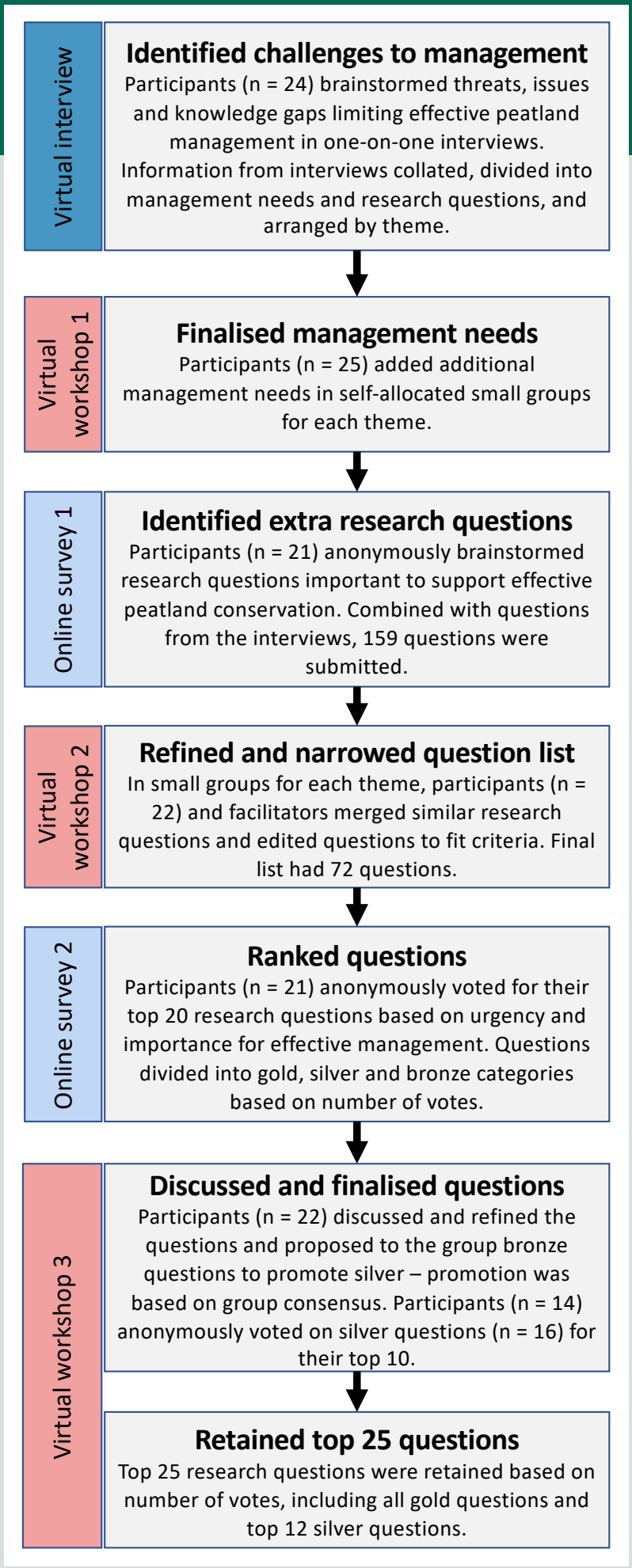

Figure 1: *The process for identifying research priorities. Participant numbers varied over the stages due to differences in participant availability.*

Key findings

Our horizon scan identified 25 research questions (Figure 2) to address knowledge gaps and management needs that fit within the following five themes:

1. **Climate change** is a major long-term threat to alpine peatlands. The research questions revealed uncertainty about which aspects of the ecosystem are most vulnerable to climatic changes, and which peatlands may better withstand climatic changes. We lack understanding of the longevity of peatlands under projected climate change scenarios, and which interventions may increase the resilience of alpine peatlands to climate change.
2. **Wildfire** is a growing threat to alpine peatlands. The frequency and intensity of fires are expected to increase under climate change. We identified knowledge gaps about methods for suppressing peatland ignition and/or minimising burn damage before and during a wildfire. We also need to determine how to enhance post-fire recovery, and how the severity of a fire and the interval between fires influences peatland recovery.
3. **Introduced species** such as cattle, horses, deer and weeds have devastating impacts on peatlands. The research questions identified the need to create effective management strategies to control hard-to-eradicate species and measure the impacts of hard-hooved animals at different densities. We also need to identify the introduced and range-shifting species and pathogens most likely to invade peatlands under climate change scenarios.
4. **Interventions** can be vital for effective conservation. The horizon scan revealed the need to identify the barriers hindering management and knowledge-sharing. We also need insights from social science to increase the public and political will to value and manage peatlands. Enhancing knowledge about the effectiveness of management, particularly hydrology and active revegetation, is also a priority, along with identifying which features are key indicators of peatland condition that are crucial for triggering management interventions.
5. **Ecosystem understanding** is important for effective management. Priority research questions identified key gaps associated with the classification and characterisation of alpine peatlands. These included a need for a common set of metrics to describe peatland condition, and a need to identify which techniques are most useful to measure peatland condition and ecological baselines. Such metrics could be used to inform long-term monitoring and a national peatland classification. We also found gaps in our understanding of the composition and function of soil biota, the magnitude of carbon storage, peatland hydrology and the interacting effects of threats.

Societal factors also affect our capacity to manage peatlands. The lack of community awareness about the value and functions of peatlands limits public understanding about their threats and conservation requirements. This can impede suitable management actions, for example, threats posed by feral horses. Therefore, raising public awareness and understanding of peatland value through effective communication is critical.

Dry alpine peatland. Image: James Kidman

Climate change

1. Which ecosystem processes and functions are likely to be vulnerable to changes in temperature and water availability under climate change?
2. How will changes in water regimes affect the amount of soil water and groundwater and under peatlands?
3. Which (if any) peatlands may be able to withstand the impacts of climate change better than others?
4. How long will environmental conditions be suitable for peatlands to persist?
5. What interventions could increase peatland resilience to climate change and under what circumstances (if any) should management occur under a changing climate?

Wildfire

6. What are the most effective and practically feasible techniques to protect peatlands pre-fire and during fires in particular contexts in Australia?
7. What interventions (if any) are most effective for peatland recovery after a wildfire?
8. How does fire severity and intervals between fires affect the recovery time and capacity to recover of peatlands?

Introduced species

9. For hard-to-eradicate species, what alternative methods are there for managing and reducing introduced ungulate populations and what are the impacts of these interventions on the ecosystem?
10. What is the relationship between ungulate density and impacts on peatlands?
11. Which native and introduced fauna and flora species are likely to invade or colonise (and thus negatively affect) peatlands under climate change?

Interventions and management

12. What are the capacity building needs required by people and institutions responsible for peatland management to effectively conserve and restore these ecosystems? In particular, what systems need to be in place to support knowledge retention and transfer across agencies?
13. How can marketing and social drivers be used to improve the public's and decision makers' understanding of the importance of peatlands and of managing threats in these landscapes?
14. How effective are different rewetting techniques at keeping peatlands sufficiently wet during a dry period to minimise loss of peat?
15. Which plant species require active revegetation after a disturbance and which techniques are effective in recovering those species?
16. Which peatland features and keystone species should be used to prioritise specific peatlands in conservation planning?

Ecosystem understanding

17. Which variables are important indicators of ecosystem health, and how can the prime and poor conditions (i.e., ecosystem states) for ecohydrological function of peatlands be defined?
18. Which remote sensing and direct measurement techniques are most useful for land managers to monitor changes in peatland condition and extent?
19. What level of change in the key indicators of peatland health constitutes a red flag, and could initiate management response?
20. How can we create a national classification system and map of Australian alpine and sub-alpine peatlands relevant for management?
21. How does the soil biota influence peatland health (i.e., for peat formation processes) and can these relationships be used to support peatland restoration?
22. What is the carbon storage and sequestration capacity of peatlands in their current condition and under a range of future scenarios of restoration and degradation?
23. How does water move between and within peatlands in alpine and montane landscapes?
24. What parts of the hydrological groundwater network (beyond and within peatlands) are critical to maintaining the peatlands, how do we maintain those, and which are the highest priority to support peatlands?
25. What are the synergistic effects of different threats?

Figure 2: *The top 25 research questions identified to support alpine peatland conservation. Other themes that a question could belong to are shown using the associated symbols.*

Researchers taking water quality samples at a peatland in the Bogong High Plains. Image: Joslin Moore

Further Information

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Research implications

Our horizon scan provides a research agenda co-designed by researchers, conservation managers and policy advisers. It can be used to inform research funding and inspire research projects aimed at addressing these critical knowledge gaps and so deliver the knowledge to enhance the conservation of the threatened alpine peatlands. We revealed that large gaps in understanding about key threats, the effectiveness of management actions and peatland dynamics are limiting capacity to effectively manage alpine peatlands.

Our findings highlight an urgent need for research to inform conservation under climate change and related changes to water and fire regimes. Many of the research questions were driven by the need to understand the impacts of climate change and responses to manage these risks. Questions often spanned multiple themes, demonstrating the need for an integrated strategy for conservation and threat management. While not exhaustive, the research questions reflect the priorities identified by workshop participants working across the ecosystem's entire geographic distribution.

The horizon scan identified several barriers to peatland conservation, particularly the lack of proactive management of alpine peatlands and long-term funding for research and monitoring. This stems partly from low levels of community awareness about the value of peatlands and degradation being caused by manageable threats such as feral horses. The horizon scan also revealed a clear need for more active collaboration among concerned organisations such as government departments, land management agencies and university research groups. This could enhance the sharing of information and fast-track the development of a unified approach to peatland conservation. A publicly accessible database of information on the effectiveness and use of interventions may also support improved decision-making and drive future research. An example of this is the recently developed annotated bibliography of conservation interventions on the Atlas of Living Australia's BioCollect platform.

The outcomes of our horizon scan emphasise that a whole-systems approach is needed to manage diverse ecosystem responses in alpine peatlands to various threats. Finally, our approach can be used as a framework to identify knowledge gaps to improve the conservation management of other threatened or high-priority ecosystems.

A healthy alpine peatland bog. Image: Joslin Moore

Cited material

Rowland, J. A., Walsh, J., Beitzel, M., Brawata, R., Brown, D., Chalmers, L., ... Moore, J. L. (In prep.) Setting research priorities for effective management of threatened ecosystems: A horizon scan for Australian alpine and subalpine peatlands.

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