CSIRO PUBLISHING

RESEARCH PAPER
https://doi.org/10.1071/WF25154

International Journal of WILDLAND FIRE
International Association of Wildland Fire

Bridging the gap: integrating scientific research into fire management practices for enhanced organisational and environmental resilience

Shabnam Varzeshi[A,*], Felipe Aires[B], Katharine Haynes[C,D] and John Fien[E]

For full list of author affiliations and declarations see end of paper

***Correspondence to:**
Shabnam Varzeshi
School of Architecture & Urban Design, RMIT University, 150 Victoria Street, Carlton, Melbourne, Vic 3000, Australia
Email: S3941055@student.rmit.edu.au

ABSTRACT

Background. Incorporating scientific evidence into fire management is essential for enhancing resilience to increasing bushfire risk. The New South Wales (NSW) National Parks and Wildlife Service (NPWS), Australia, steward of ~10% of the state's land, seeks to embed research into decision-making. **Objective.** This study identifies organisational barriers and facilitators that shape the uptake of bushfire research within the NPWS. **Methods.** Semi-structured interviews with 12 NPWS staff in planning/operations and two focus groups (knowledge brokers; external researchers). Data were thematically analysed using Knowledge to Action (KTA) and Diffusion of Innovations (DOI). **Results.** Three themes emerged: (1) system and governance conditions – decentralisation created variability that was reduced by visible leadership signals and lightweight shared decision artefacts (e.g. Standard Operating Procedures (SOPs)/decision-brief standards); (2) knowledge flows and brokerage – *ad hoc*, system-fatigued shifted to routine use when a distributed broker network, documented lessons and fit-for-workflow platforms were in place; and (3) workforce capability and routines – time pressure and uneven skills constrained uptake, while targeted professional development, mentoring and protected learning time enabled it. Consistent research use occurred only when these three conditions aligned. **Conclusion.** Formal research integration roles, mainstreamed professional development, stronger communication platforms, refined funding mechanisms and visible leadership can foster an evidence-based culture, enhancing NPWS's capacity to mitigate bushfire risk.

Keywords: bushfire management, evidence-based practice, fire science governance, knowledge translation, NPWS, organisational barriers, qualitative study, research utilisation and implementation.

Received: 23 June 2025
Accepted: 13 December 2025
Published: 19 January 2026

Cite this: Varzeshi S *et al.* (2026) Bridging the gap: integrating scientific research into fire management practices for enhanced organisational and environmental resilience. *International Journal of Wildland Fire* **35**, WF25154. doi:10.1071/WF25154

Introduction

Bushfires (wildfires) are a fundamental and complex part of the Australian landscape. They both sustain many fire-adapted ecosystems and, when fire regimes are mismatched to ecological and social context, they pose significant risks to life, property, cultural values and biodiversity, for example, high-severity fires in systems unsuited to crown fire, or overly frequent/poorly timed low-severity burns near high-value assets (Bradstock *et al.* 2012). In Australia, and specifically in the State of New South Wales (NSW), the frequency and intensity of bushfires have increased largely due to the compound effects of climate change and prolonged drought, rather than fuel accumulation alone (Nolan *et al.* 2020).

The disastrous Australian bushfire season of 2019–2020, commonly referred to as 'Black Summer', highlighted the critical need for improved fire management strategies. Approximately 18.6 million ha were burned nationwide, leading to 33 fatalities, the destruction of over 3000 homes and substantial environmental damage (Boer *et al.* 2020; Nolan *et al.* 2021). In NSW, 5.5 million ha were affected, prompting inquiries that exposed weaknesses in existing fire response plans and underscored the importance of integrating scientific research into operational practices (Royal Commission into National Natural Disaster Arrangements 2020).

Despite extensive scientific research on bushfire behaviour, ecology and risk mitigation, a significant 'research-practice gap' hinders the effective application of this knowledge in real-world situations. Barriers such as organisational silos, communication challenges and the absence of standardised processes prevent operational staff within fire management agencies from fully utilising research findings (Owen *et al.* 2022). Closing this gap is essential for creating evidence-based strategies that enhance fire prevention, preparedness, response and recovery efforts.

The NSW National Parks and Wildlife Service (NPWS) plays a vital role in managing extensive protected areas that are prone to bushfires. Improving the integration of bushfire research into NPWS's operational practices is crucial for protecting both ecosystems and communities. By understanding the barriers and facilitators that influence research utilisation within NPWS, we can develop targeted strategies to enhance the application of scientific insights in fire management.

This study explores how organisational structures, roles and routines affect the integration of bushfire research into NPWS, a decentralised Australian land and fire management agency. We examine what facilitates or hinders research use in incident management and planning, and how to intervene so that uptake becomes routine. Three mechanisms are identified: (T1) system and governance conditions, (T2) knowledge flows and brokerage, and (T3) workforce capability and routines. The alignment of all three (conditional alignment) is essential for consistent adoption. This indicates the need for designed coherence (clear leadership signals and lightweight shared decision-making tools), distributed brokerage (a governed network with practical platforms and documented lessons) and time-allocated learning. Although based in Australia, these mechanisms can be applied to similar decentralised public safety/environment agencies. Results are analysed through both Knowledge to Action (KTA) and Diffusion of Innovations (DOI) frameworks.

Literature review

The research-practice gap in fire management

A persistent challenge for fire agencies is translating scientific knowledge into everyday decisions. The gap presents as delays in adopting new tools and practices, uneven uptake across regions and difficulty in converting complex findings into decision-ready guidance (e.g. prescribed-burn planning, incident operations) (Thompson and Calkin 2011; Hunter *et al.* 2020; Owen *et al.* 2022). Closing this gap is essential for evidence-based prevention, preparedness, response and recovery.

Barriers and facilitators in fire-agency settings

Across public safety and environmental organisations, four clusters consistently influence research applications.

1. **Organisational culture and governance**. Fragmented structures, inconsistent standards and rapid incident response can weaken consistency and learning; visible leadership expectations and straightforward, shared decision-making tools (e.g. decision briefs, SOPs (Standard Operating Procedures)) can align practice (Owen *et al.* 2017; Rawluk *et al.* 2020).
2. **Awareness, access and brokerage**. Practitioners often lack the time or channels to find, assess and translate research into operational decisions. Knowledge brokers are individuals or teams who connect researchers and decision-makers, translate findings into useful formats, and maintain relationships and systems that support the use of evidence. When these brokerage roles are funded and embedded within agencies, they reduce the transaction costs of locating and interpreting research and help tailor outputs to operational needs (Ward *et al.* 2009; Meyer 2010; Kislov *et al.* 2019*a*).
3. **Resources and capabilities**. Budget and staffing constraints restrict protected time for training and updating SOPs and plans; where agencies allocate resources to capability (targeted PD (Professional Development), mentoring, after-action reviews), routine adoption improves (Edmondson 1999; Weick and Sutcliffe 2015; Walsh *et al.* 2019). Limited budget and staff time hinder (i) evaluation of new evidence, (ii) updates to SOPs/plans, (iii) training and drills, and (iv) monitoring and feedback instruments – resulting in decreased compatibility and observability while increasing perceived complexity in terms of DOI (Davis and Davis 1989; Holden and Karsh 2010; Walsh *et al.* 2019).
4. **Collaboration and co-production**. Early and ongoing collaboration between researchers and practitioners enhances the relevance, legitimacy and timeliness of outputs, accelerating the integration of new practices (Lemos and Morehouse 2005; Reed 2008; Reed *et al.* 2014; Van Kerkhoff and Lebel 2015).

These patterns are well-documented in emergency-management organisations and are directly relevant to NPWS: a decentralised, multi-branch mandate increases the need for lightweight shared standards, brokered exchanges and time-managed learning (Hunter *et al.* 2020; Owen *et al.* 2020).

Collaboration and co-production in research translation

Implementation studies consistently demonstrate that co-production and ongoing collaboration enhance 'fit-for-use' knowledge: researchers and practitioners work together to frame questions, iterate formats and schedule delivery to decision points (Cash *et al.* 2003; Reed *et al.* 2014). In this perspective, knowledge brokers are not just messengers; they act as translators and integrators who (i) scan and synthesise evidence, (ii) re-package it into briefs, SOP inputs and training materials, (iii) mediate between professional communities, and (iv) maintain two-way feedback to ensure research agendas align with operational needs (Ward *et al.* 2009; Meyer 2010). Broker networks, with multiple scoped roles, outperform 'lone broker' models by avoiding bottlenecks and guaranteeing coverage across different branches and functions (Kislov *et al.* 2016; Kislov *et al.* 2019*b*).

Why Knowledge to Action (KTA) and Diffusion of Innovations (DOI) frameworks together

We use two complementary frameworks. The KTA framework explains how research becomes practice: knowledge creation (inquiry → synthesis → tools/briefs) iterates with an action cycle – identify the problem, adapt to the context, assess barriers, select, tailor and implement – then monitor, evaluate and sustain – with feedback loops linking each stage (Fig. 1).

The DOI framework explains why people adopt new tools or practices. Adoption is more likely when staff can see that the new approach is clearly superior to what they currently do (relative advantage, for example faster planning, safer decisions or clearer information), when it aligns with existing workflows (compatibility), when it is easy to use or seamlessly incorporated into existing systems (low complexity), when people can test it on a small scale or in a low-risk environment before a full roll-out (trialability, for example table-top or sandbox exercises) and when its use and benefits are visible to others (observability of use or effects) (Greenhalgh *et al.* 2004; Rogers *et al.* 2014; Taylor *et al.* 2014). In fire management, adoption improves when tools – e.g. fire-behaviour modelling outputs, remote-sensing products, risk dashboards and SOP updates – show clear advantage, fit incident workflows, reduce complexity through user-centred integration, can be trialled safely (table-top/sandbox exercises) and are observable via usage analytics and decision artefacts (Greenhalgh *et al.* 2004; Rogers *et al.* 2014; Taylor *et al.* 2014). In a decentralised, incident-driven agency such as NPWS, KTA helps identify where translation stalls, while DOI clarifies which design choices (e.g. decision briefs, brokered exchanges, platform telemetry) enhance adoption.

Gap and objectives

Many fire-agency scholarship catalogues identify barriers and facilitators but do not specify the co-dependencies needed for routine adoption in decentralised systems, nor do they offer auditable indicators for leaders to monitor progress. We address this by proposing a Conditional Alignment Proposition (CAP): routine research use only occurs when system coherence, brokered/documented flows and capability/time embedded in routines are aligned; otherwise, use remains reactive and inconsistent. We operationalise CAP by linking each mechanism

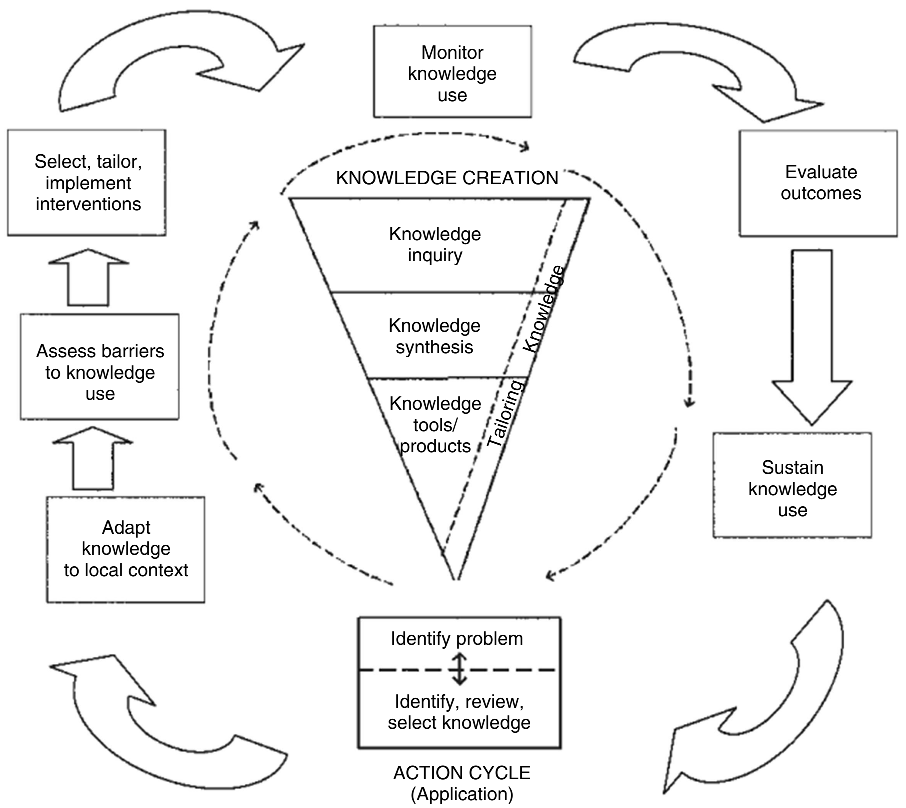

Fig. 1. Knowledge to Action (KTA) framework showing the knowledge-creation funnel (inquiry → synthesis → tools/products) iterating with the action cycle (identify problem; adapt to local context; assess barriers; select – tailor – implement; monitor use; evaluate outcomes; sustain use). Adapted from Graham *et al.* (2006).

to KTA/DOI and by defining design principles and indicators for monitoring (see Tables 2 and 3).

Methods

Study design and context

This study employed a qualitative case-study design to examine how bushfire research is translated into operational decision-making within the NSW NPWS. A qualitative approach was selected for its ability to explore organisational processes and contextual influences that shape research utilisation – dimensions not readily captured through quantitative methods (Creswell and Poth 2016).

NPWS is part of the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) and is responsible for managing fire across approximately 8.57 million ha, about 10% of the state. The agency's decentralised structure includes nine operations branches comprising 37 areas, supported by seven program branches, and a workforce of approximately 2500 staff – 1267 of whom are certified firefighters.

The DCCEEW Science and Insights (S&I) Division serves as NPWS's principal science partner, providing environmental research, modelling, analytics and translation support for conservation and fire-management programs. The interface between NPWS operations and S&I forms the study's focal point, as this is where much of the research-to-practice exchange occurs.

Data collection and analysis

We employed purposive, maximum-variation sampling to capture the key research-to-practice interfaces – frontline/planning (Rangers, Fire Planning Officers), middle management (Team Leaders, Area/Branch Programs Managers) and science/translation (Scientists, Knowledge Brokers), along with variation in tenure (5–20+ years) and involvement in research. Inclusion criteria were: (i) direct responsibility for planning, operations, or producing/translating research used by NPWS; (ii) familiarity with SOPs and/or decision-support tools; and (iii) availability during the study period. Candidates were identified through role descriptions and manager nominations; invitations were repeated to ensure branch and function coverage. We stopped recruiting after the thematic needs were fulfilled.

Twelve semi-structured interviews were conductedbetween June and August 2024 with NPWS staff, including frontline, planning, middle management and program leadership (Table A3.1), supplemented by two focus groups (Table A3.2). The first focus group (FG1, August 2024) involved five Knowledge Brokers from DCCEEW S&I and NPWS Fire & Incident Operations interfaces, while the second (FG2, August 2024) included three external research scientists specialising in fire management and biodiversity . Interviews and focus-group guides (Appendices 1 and 2) explored organisational structures, collaboration, research dissemination, and decision-support tools. All sessions were audio-recorded with consent and transcribed verbatim. Quotations are referenced by role, unique ID and affiliation (internal NPWS vs external), e.g. Fire Planning Officer (P6, NPWS). Participant tenure and role details are provided in Appendix 3 and cited in-text only when analytically relevant.

Preliminary findings were presented during an internal session in October 2024, attended by NPWS staff (including several interviewees), S&I personnel and members of both focus groups (Table A3.3). A subsequent 1-h validation panel consisted of two NPWS Directors, one S&I Knowledge Broker and one Team Leader Science (PD1–PD4) was used to test the clarity, feasibility and perceived transferability of the emerging themes. Feedback from these sessions informed refinement of thematic boundaries without altering underlying transcripts or codes and served as an additional quality check on our interpretations.

Data were imported into NVivo 12 and analysed using reflexive thematic analysis (Braun and Clarke 2006, 2019). The process followed six iterative phases: (1) familiarisation (iterative reading and memoing); (2) initial coding (inductive, semantic, line-by-line); (3) searching for themes (clustering codes into candidate themes); (4) reviewing themes (checking against extracts/full data; actively seeking disconfirming cases); (5) defining and naming themes (writing scope statements; selecting exemplars); and (6) producing the report (linking themes to research questions).

Our analytical logic was abductive (Timmermans and Tavory 2012). After the inductive phases (1–3), KTAstages and DOI attributes acted as sensitising concepts rather than *a priori* categories.

A framework matrix was developed to cross case patterns between (a) KTA action-cycle stages (adapt to context; assess barriers; select/tailor/implement; monitor/sustain), and (b) DOI attributes (compatibility, complexity, trialability, observability, relative advantage). Pattern-matching was used to link operational examples – such as SOP updates, decision-brief templates, or broker exchanges – to these conceptual dimensions. This process enabled systematic comparison across roles and data sources while maintaining interpretive flexibility (Graham et al. 2006; Rogers et al. 2014). For example, decision-brief/SOP standards were interpreted as KTA: adapt/assess/implement and DOI: ↑compatibility, ↓complexity, ↑observability, whereas broker catch-ups were mapped to KTA: select/tailor/implement and DOI: ↑trialability/observability. Sense-checks and the validation panel informed theme consolidation and helped maintain a clear Results/Discussion boundary (evidence/quotes vs interpretation).

Credibility was strengthened through methodological triangulation (interviews, focus groups and a validation panel) and member checks, where participants reviewed brief summaries of their contributions. Dependability and confirmability were enhanced through an audit trail (including codebook versions, memos and matrix iterations) and peer debriefing on theme boundaries and KTA/DOI mapping.

Following Braun and Clarke (2019) and Nowell *et al.* (2017), themes are treated as analytical interpretations co-constructed through researcher reflexivity rather than as fixed 'discoveries'. Detailed contextual descriptions support readers' assessments of transferability (Nowell *et al.* 2017; Braun and Clarke 2019).

The study was approved by the RMIT University Human Research Ethics Committee. All participants received an information sheet and provided written informed consent. Audio-recordings and transcripts were anonymised and stored on secure institutional servers in accordance with ethics requirements.

This single-agency case study examines NPWS during the study period and aims for analytical rather than statistical generalisation to similar decentralised fire-management settings. These boundaries clarify that the findings emphasise mechanisms – namely, the organisational conditions and routines that influence research use.

Ethics

This study was approved by the RMIT University Human Research Ethics Committee (Review Reference: 2024-27293-24239).

Results

Based on interviews, focus groups, and a validation panel, three interrelated themes explain how research is implemented within the NSW NPWS: (1) system and governance conditions, (2) knowledge flows and brokerage, and (3) workforce capability and routines. Each theme represents a different mechanism of research uptake – agency architecture, movement and translation of knowledge, and workforce enactment of evidence.

The validation panel confirmed that leadership signals and knowledge-brokerage mechanisms are essential for bridging the gap between research and operational practice. Table 1 summarises key barriers and facilitators related to each theme.

T1. System and governance conditions

Participants consistently highlighted how NPWS's decentralised structure produces variability in research use. Field and planning officers described a lack of standardisation across branches: – 'We are quite challenged by the sheer breadth of research activities… this complexity complicates our engagement with national parks' (Scientist, FG7, external); 'Each branch can do things differently' (Fire Planning Officer, P12, NPWS). Operational tempo further limits the ability to incorporate new evidence during active incidents: 'When I am at a fire, I do not have time for new research; we must focus on the task at hand' (Fire Planning Officer, P6, NPWS).

In contrast, several participants highlighted the importance of clear leadership expectations and system-wide mechanisms to ensure consistency: 'Incorporating scientific research into our policy frameworks allows us to enhance our operational efficiency' (Fire Planning Officer, P2, NPWS).

The validation panel highlighted the importance of governance for translation – clarity about who owns standards, how decisions are recorded and how updates are communicated. Participants linked short, discontinuous funding cycles to stop – start research priorities and inconsistent follow-through on updates to SOPs and plans. Several called for a clearly nominated owner for translation governance so that standards and responsibilities are recognised across branches (Directors, PD1/PD2, internal). Overall, participants recognised that in a decentralised system, clear leadership expectations, straightforward shared standards and reliable resourcing are essential for consistent research uptake.

T2. Knowledge flows and brokerage

Participants contrasted reactive, *ad hoc* research use with structured knowledge flow facilitated by intermediaries and tools. As one officer explained: 'We often use research reactively… rather than systematically' (Fire Planning Officer, P12, NPWS). Decision-support tools were valued but not always

Table 1. Illustrative barriers and facilitators in research utilisation at National Parks and Wildlife Service.

Theme	Barrier examples	Facilitator examples
T1. System and governance conditions	Decentralised arrangements; variable procedures; limited standardisation; fragmented coordination; short funding cycles	Clear leadership expectations; identified governance owner for research translation; policy and strategy alignment; shared standards (standard operating procedures, decision briefs); multi-year resourcing
T2. Knowledge flows and brokerage	*Ad hoc* or reactive research use; reliance on informal channels; tools not fit-for-purpose; poor documentation of lessons learned; 'system fatigue' from overlapping platforms; short-term partnerships	Dedicated knowledge-broker roles; distributed broker network; structured exchange routines; improved decision-support platforms; systematic lesson capture; co-production during research design
T3. Workforce capability and routines	Time constraints; uneven capability; preference for familiar routines; difficulty locating or appraising research	Protected time; targeted professional development; clear responsibilities; mentoring and peer support; early integration of new evidence into training modules and drills

user-friendly: "Elements[1]' is intended to enhance planning, but its cumbersome nature complicates our processes' (Fire Planning Officer, P2, NPWS). Across interviews and focus groups, knowledge brokers, staff who help connect research and operations by translating findings into usable guidance, were proposed to translate across boundaries and establish connections between teams: 'We'd have these catchups to discuss the latest science and how it applies to the parks… it made it easier to see direct links between research outcomes and day-to-day tasks' (Knowledge Broker, FG1, internal).

Participants emphasised that broker roles require formal resourcing, scope and governance to avoid reliance on a small number of individuals, and that lessons learned should be captured and shared systematically. Many described 'system fatigue' from multiple overlapping platforms and difficulty identifying authoritative, up-to-date guidance. Short-term, project-based collaborations also limited continuity once funding ended.

A strong consensus emerged in support of a distributed broker network – rather than a single role – to reduce bottlenecks and improve reach. Co-production of research with operational staff at the design stage was viewed as vital to ensure outputs are decision-ready and contextually relevant (Director/Team Leader Science; PD1/PD4, internal).

Together, these findings show that structured exchanges, well-designed tools and formalised brokerage roles transform sporadic 'research pulls' into dependable knowledge flows that can inform operational and strategic decision-making.

T3. Workforce capability and routines

The ability to use research depends heavily on workforce capacity and everyday routines. Operational staff described time pressure and role-specific demands that constrain attention to new information:

'When I am at a fire, I do not have time for new research' (Fire Planning Officer, P6, NPWS). Capability differences were evident across levels of experience: 'Being involved in diverse roles… has significantly enhanced my capability to integrate research findings into practical management' (Area Manager, P8, NPWS, Jul 2024). Cultural dynamics also influence adoption: 'There's a palpable divide between seasoned staff and younger staff eager to adopt research-driven approaches' (Senior Project Officer, P1, NPWS).

Participants identified targeted professional development, protected time and clear responsibilities as enabling factors, especially when aligned with operational routines (e.g. preparedness planning, after-action reviews) and supported by mentoring/peer support. Beyond time pressure, staff reported skill gaps in finding and evaluating relevant research for their role. Participants suggested involving training teams early so that new evidence is integrated into routine modules, drills and checklists rather than added as standalone materials (Director/Team Leader Science, PD1/PD4, internal).

These accounts highlight that embedding research within everyday work routines – through training, role clarity and supportive culture – makes research use both feasible and sustainable within operational constraints.

Summary of findings

Together, the three themes demonstrate how organisational structure (Theme 1), information flow (Theme 2) and workforce capacity (Theme 3) collectively influence the use of research within NPWS. The findings indicate that while decentralisation and workload pressures introduce variability, leadership expectations, brokerage networks and embedded learning routines can transform fragmented research use into a more consistent, system-wide practice.

Building on these integrated findings, the Discussion develops the CAP, explaining how these mechanisms operate together to enable (or constrain) routine evidence use in a decentralised fire-management agency.

Discussion

This study demonstrates that the routine, system-wide application of research in a decentralised fire-management agency relies on the alignment of three organisational conditions: coherent system signals, structured knowledge flows, and workforce capability supported by time and routines. We describe this pattern as a CAP: in a decentralised agency, research use becomes routine only when all three conditions are met; when any one of them is weak, adoption remains intermittent despite goodwill or isolated initiatives. In NPWS, stand-alone interventions – such as new portals, a single broker role, or one-off training – were rarely enough on their own. However, when leadership expectations, practical knowledge infrastructures and time-budgeted routines aligned, research advanced more quickly and predictably into planning and preparedness work across branches.

The CAP both builds upon and expands existing implementation frameworks. Within the KTAframework, system and governance conditions (Theme 1) correspond with the initial stages of adaptation to context and barrier assessment, while knowledge flows and brokerage (Theme 2) and workforce capability and routines (Theme 3) relate to choosing, tailoring, implementing and subsequently monitoring and maintaining evidence use (Graham *et al.* 2006). From a DOIperspective, participants evaluated new tools

[1]'Elements' serves as NPWS's internal information system designed for the planning, tracking and reporting of bushfire and hazard reduction activities. Originally created over 10 years ago to fulfil legislative requirements and enhance operational workflows, it continues to play a vital role in coordinating fire management efforts across NPWS operations branches.

Table 2. Mapping of themes → KTA → diffusion → organisational facilitators (with exemplar indicator).

Theme	Most-relevant KTA steps	Diffusion characteristics	Organisational facilitators (what to put in place)	Exemplar indicator
T1. System and governance conditions	Adapt to context; assess barriers; select – tailor – implement; (early) sustain	↑ Compatibility with mandates/workflows; ↓ complexity; ↑ observability (audits/KPIs); trialability (policy/region pilots)	Leadership and governance: clear expectations that decisions are supported by evidence; named translation governance owner; multi-year resourcing; policy/strategies aligned. Shared artefacts: decision-brief/SOP micro-standards; brief templates with evidence-citation fields.	SOP update delay (days from new evidence → approved SOP revision)
T2. Knowledge flows and brokerage	Knowledge creation/ synthesis; select – tailor – implement; monitor use	↑ Compatibility (tacit + formal packaging); ↓ complexity via fit-for-purpose tools; trialability (pilots/sandboxes); ↑ observability (usage analytics)	Brokerage as a network: resourced broker coverage across branches; scheduled CoPs/show-and-tell; co-production/translation sprints. Documentation and platforms: versioned lessons repository; searchable evidence portal; integrated Q&A; decision-support embedded in workflow.	Broker coverage (% units with a named broker)
T3. Workforce capability and routines	Implement; monitor use; evaluate outcomes; sustain	↑ Compatibility with routine work; ↓ complexity via rehearsal; trialability (table-top exercises); observability (field outcomes)	Time and capability: protected micro-learning minutes; targeted PD modules; role descriptions that name evidence use. Routines: preparedness planning; AAR templates/checklists; mentoring pairs.	AAR action-item closure (% closed ≤60/90 days)

KTA, Knowledge to Action; DOI, Diffusion of Innovations; SOP, Standard Operating Procedure; CoP, Community of Practice; AAR, After-Action Review; PD, Professional Development.

and practices mainly based on how well they integrated with existing workflows (compatibility) and how straightforward they were to use (low complexity). Opportunities to test changes safely – through policy or regional pilots, table-top exercises and sandboxes – made benefits more apparent and decreased uncertainty (Greenhalgh *et al.* 2004; Rogers *et al.* 2014). The CAP explains how specific organisational mechanisms activate these KTA stages and DOI attributes together, rather than as separate checklists. These connections are summarised in Table 2 and translated into practical design principles and indicators in Table 3.

Our findings emphasise the importance of designed coherence over tighter central control. NPWS's decentralised structure enables local responsiveness but also results in variability in how research is interpreted and acted upon (Pahl-Wostl 2009; Hunter *et al.* 2020). Participants reported inconsistent standards, fragmented coordination and short funding cycles as barriers to research adoption. At the same time, they recognised clear governance signals, straightforward shared artefacts (such as decision-brief templates and SOP micro-standards) and predictable resourcing as practical solutions to foster coherence. These choices increase the likelihood that new evidence will be considered in planning and review processes without removing local discretion. In CAP terms, this relates to the system-coherence component: when expectations, artefacts and resources are aligned, the 'floor' for evidence use is raised across branches.

A second mechanism involves knowledge flows and brokerage as organisational infrastructure. Staff often found research use to be reactive and reliant on informal networks, especially when tools were poorly integrated into workflows or when lessons were not systematically documented. Where brokerage was supported as a networked function – with resourced coverage across branches, regular exchanges and versioned repositories – research became easier to locate, interpret and utilise. Knowledge brokers in this context serve as intermediaries who link researchers and decision-makers, interpret findings into accessible formats, and maintain relationships and systems that promote the use of evidence (Ward *et al.* 2009; Meyer 2010; Kislov *et al.* 2019*a*). Instead of depending on a single 'champion', participants highlighted the importance of a distributed network of individuals who connect science, planning and operations, supported by platforms that make guidance and lessons accessible and auditable. In DOI terms, these arrangements enhance compatibility and lessen perceived complexity; in KTA terms, they assist in tailoring knowledge to specific decision points and contexts (Greenhalgh *et al.* 2004; Graham *et al.* 2006).

The third mechanism concerns workforce capability and routines. Time pressure and incident tempo heavily restrict real-time engagement with research, so most integration takes place during planning, preparedness and post-incident learning (Cohen-Hatton *et al.* 2015). Participants explained how protected micro-learning time, targeted professional development and role-linked routines (such as preparedness

Table 3. Implications at a glance (design principles, actions and indicators).

Design principle	What it solves (from Results T1–T3)	Minimal viable actions	Example indicators
Design for coherence, not central control	T1: cross-branch variability; low observability	Issue decision-brief/SOP micro-standards with evidence-citation fields; name an owner for translation governance; run a region pilot	% decisions with brief attached; SOP update lag (evidence → SOP, days)
Make brokerage a governed network	T2: *ad hoc* flows; single-broker bottlenecks	Resource a broker network; schedule CoPs/show-and-tell; stand up a versioned lessons repository	Broker coverage (#/branch); median request turnaround; lessons added/month; platform MAU
Budget time into routines	T3: time pressure; uneven capability	Protect micro-learning time; embed evidence in drills/AARs; clarify role responsibilities	Micro-learning minutes/FTE; training completion; AAR action-item closure in 60/90 days
Fit tools to workflow	T2: 'system fatigue'; perceived complexity	Co-design user interface (UI); integrate with existing workflows; sandbox trials before scale	Task success rate; usability (e.g. SUS) score; time-on-task delta pre/post

SOP, Standard Operating Procedure; CoP, Community of Practice; AAR, After-Action Review; MAU, Monthly Active Users; FTE, full-time equivalent; SUS, System Usability Scale.

planning and after-action reviews) made evidence use more achievable (Fernandez and Rainey 2006; Damanpour and Schneider 2009). Cross-functional experience and mentoring seem to develop 'broker-like' skills among staff, indicating that implementation strategies should encompass rotational exposure and peer support, not just formal training. These findings align with research on organisational learning and absorptive capacity but specify the practical routines – drills, checklists, scheduled review points – through which capacity is realised in a fire-management setting (Sutcliffe and Vogus 2003; Argote 2013; Weick and Sutcliffe 2015).

Taken together, the three mechanisms provide an explanation for persistent path dependence in research use. Even where attitudes towards science were positive, new tools or guidelines struggled to gain acceptance when they conflicted with existing performance signals, were not integrated into workflows, or increased workload without freeing time elsewhere. Platforms and routines can reinforce old ways of working as easily as they can promote new methods. The CAP therefore highlights the interaction between technical work (creating tools, repositories, templates) and organisational work (deciding responsibility, resource allocation and defining good performance). This interaction helps explain why isolated interventions often underperform and why multi-component strategies can lead to non-linear improvements in uptake (Kotter 1996; Boin and Hart 2003).

This study makes two main contributions. First, it provides a programme theory for research utilisation in decentralised agencies that advances beyond generic lists of 'barriers and facilitators'. By defining how system coherence, structured knowledge flows and time-enabled routines must align, the CAP clarifies when evidence use becomes embedded and when it remains fragmented. Second, it implements this theory through a series of design principles and indicators. Table 2 aligns the three themes with KTA stages and DOI attributes, while Table 3 translates these insights into practical levers – governance signals, broker-network design, time management and workflow-aligned tools – that agencies can utilise to plan, monitor, or evaluate interventions. Although our focus is organisational, more timely and consistent alignment between fire-management decisions and ecosystem-appropriate fire regimes is also likely to enhance environmental resilience over time (Holling 1973; Walker *et al.* 2004; Folke 2006; Moritz *et al.* 2014).

Implications for practice

For practitioners and managers, the findings suggest four interconnected design principles. Design for coherence without over-centralising control by setting clear expectations that decisions will be evidence-informed, assigning an owner for translation governance and using lightweight shared artefacts (for example, decision-brief templates with evidence fields and SOPS micro-standards). Manage brokerage as a governed network by allocating broker coverage across branches, organising communities of practice and 'show-and-tell' exchanges, and maintaining versioned repositories that make lessons and guidance easily findable. Integrate time into existing routines by reserving micro-learning moments within readiness cycles, incorporating new evidence into drills and after-action reviews, and clarifying role descriptions so that evidence use is recognised rather than seen as extra work. Finally, fit tools into workflow by co-designing interfaces with operational staff, integrating decision-support into existing systems and trialling changes in sandboxes before wider roll-out. These principles, summarised in Table 3, offer a practical starting point for agencies aiming to enhance research utilisation on a larger scale.

Conclusion

This study demonstrates that NPWS's decentralised structure, although complex, can effectively leverage local expertise and diverse fire management approaches if organisational barriers

– such as inconsistent communication and resource gaps – are addressed. By embedding knowledge brokers within operational teams, or by formalising knowledge brokering responsibilities into subject-matter specialists' work programs, involving field staff early in research design and strengthening strategic governance through entities such as the Fire Science Risk Governance Committee (FRisk[2]), NPWS can enhance collaboration and systematically translate bushfire research into everyday practices.

As a qualitative case study focused on a single agency and operational period, this research prioritises depth and contextual understanding over breadth. The findings support analytic rather than statistical generalisation to comparable decentralised public-safety and environmental agencies. Future work could evaluate the CAPin other jurisdictions, using mixed-methods approaches that combine usage telemetry (for example, decision-brief and SOP audits, platform analytics) with ethnographic observation of decision processes. Comparative studies of single-broker versus broker-network models, and of different approaches to time-budgeted learning, would help quantify their impacts on routinisation and coverage. Further research could also investigate how changes in governance signals, tools and routines interact over time to shift established patterns of evidence use and to connect organisational change more explicitly with ecological and community outcomes.

Looking ahead, prioritising structured funding cycles, targeted training programmes, and an inclusive culture of innovation will be critical in fostering continuous learning and operational resilience. These approaches can further align scientific insights with policy frameworks, enabling NPWS to respond more efficiently to bushfire challenges while safeguarding biodiversity, cultural values and community well-being. By advancing a more unified, evidence-based methodology, NPWS is well-positioned to enhance its leadership role in sustainable fire management for the benefit of both present and future generations.

References

Argote L (2013) Organization learning: A theoretical framework. In 'Organizational Learning: Creating, Retaining and Transferring Knowledge'. 2nd edn. pp. 31–56. (Springer: New York, NY, USA) doi:10.1007/978-1-4614-5251-5_2

Boer MM, Resco de Dios V, Bradstock RA (2020) Unprecedented burn area of Australian mega forest fires. *Nature Climate Change* **10**(3), 171–172. doi:10.1038/s41558-020-0716-1

Boin A, Hart P' (2003) Public leadership in times of crisis: mission impossible? *Public Administration Review* **63**(5), 544–553. doi:10.1111/1540-6210.00318

Bradstock RA, Williams RJ, Gill AM (2012) 'Flammable Australia: fire regimes, biodiversity and ecosystems in a changing world.' (CSIRO Publishing: Melbourne, Australia)

Braun V, Clarke V (2006) Using thematic analysis in psychology. *Qualitative Research in Psychology* **3**(2), 77–101.

Braun V, Clarke V (2019) Reflecting on reflexive thematic analysis. *Qualitative Research in Sport, Exercise and Health* **11**(4), 589–597. doi:10.1080/2159676X.2019.1628806

Cash DW, Clark WC, Alcock F, Dickson NM, Eckley N, Guston DH, Jäger J, Mitchell RB (2003) Knowledge systems for sustainable development. *Proceedings of the National Academy of Sciences* **100**(14), 8086–8091. doi:10.1073/pnas.1231332100

Cohen-Hatton SR, Butler PC, Honey RC (2015) An investigation of operational decision making *in situ*: incident command in the UK fire and rescue service. *Human Factors* **57**(5), 793–804. doi:10.1177/0018720815578266

Creswell JW, Poth CN (2016) 'Qualitative inquiry and research design: Choosing among five approaches.' (Sage Publications)

Damanpour F, Schneider M (2009) Characteristics of innovation and innovation adoption in public organizations: assessing the role of managers. *Journal of Public Administration Research and Theory* **19**, 495–522. doi:10.1093/jopart/mun021

Davis F, Davis F (1989) Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly* **13**, 319. doi:10.2307/249008

Edmondson A (1999) Psychological safety and learning behavior in work teams. *Administrative Science Quarterly* **44**(2), 350–383.

Fernandez S, Rainey H (2006) Managing successful organizational change in the public sector. *Public Administration Review* **66**, 168–176. doi:10.1111/j.1540-6210.2006.00570.x

Folke C (2006) Resilience: The emergence of a perspective for social–ecological systems analyses. *Global Environmental Change* **16**(3), 253–267. doi:10.1016/j.gloenvcha.2006.04.002

Graham ID, Logan J, Harrison MB, Straus SE, Tetroe J, Caswell W, Robinson N (2006) Lost in knowledge translation: time for a map? *Journal of Continuing Education in the Health Professions* **26**(1), 13–24. doi:10.1002/chp.47

Greenhalgh T, Robert G, Macfarlane F, Bate P, Kyriakidou O (2004) Diffusion of innovations in service organizations: systematic review and recommendations. *The Milbank Quarterly* **82**(4), 581–629. doi:10.1111/j.0887-378X.2004.00325.x

Holden RJ, Karsh BT (2010) The technology acceptance model: its past and its future in health care. *Journal of Biomedical Informatics* **43**(1), 159–172. doi:10.1016/j.jbi.2009.07.002

Holling CS (1973) 'Resilience and stability of ecological systems.' (International Institute for Applied Systems Analysis: Laxenburg, Austria)

Hunter ME, Colavito MM, Wright V (2020) The use of science in wildland fire management: a review of barriers and facilitators. *Current Forestry Reports* **6**, 354–367. doi:10.1007/s40725-020-00127-2

Kislov R, Hodgson D, Boaden R (2016) Professionals as knowledge brokers: the limits of authority in healthcare collaboration. *Public Administration* **94**(2), 472–489. doi:10.1111/padm.12227

Kislov R, Pope C, Martin GP, Wilson PM (2019*a*) Harnessing the power of theorising in implementation science. *Implementation Science* **14**, 103. doi:10.1186/s13012-019-0957-4

Kislov R, Wilson P, Cummings G, Ehrenberg A, Gifford W, Kelly J, Kitson A, Pettersson L, Wallin L, Harvey G (2019*b*) From research evidence to "evidence by proxy"? organizational enactment of evidence-based health care in four high-income countries. *Public Administration Review* **79**(5), 684–698. doi:10.1111/puar.13056

Kotter JP (1996) 'Leading Change.' (Harvard Business School Press: Boston, MA) [Även utgiven på svenska av Egmont Richter, Malmö.]

Lemos MC, Morehouse BJ (2005) The co-production of science and policy in integrated climate assessments. *Global Environmental Change* **15**(1), 57–68. doi:10.1016/j.gloenvcha.2004.09.004

Meyer M (2010) The rise of the knowledge broker. *Science Communication* **32**(1), 118–127. doi:10.1177/1075547009359797

[2]FRisk is a director-level committee jointly involving representatives from Fire, Research and Standards (FRS), NPWS and the (S&I) Division. It provides strategic oversight of fire-related science, fosters alignment across agencies and formally authorises research-driven changes. By socialising new findings within each agency and coordinating approval processes, FRisk is designed to streamline and accelerate the translation of research into practice. NPWS's participation in FRisk ensures that field-level perspectives inform high-level decisions, enabling robust cross-agency governance that supports consistent, evidence-based fire management.

Moritz MA, Batllori E, Bradstock RA, Gill AM, Handmer J, Hessburg PF, Leonard J, McCaffrey S, Odion DC, Schoennagel T, Syphard AD (2014) Learning to coexist with wildfire. *Nature* **515**(7525), 58–66. doi:10.1038/nature13946

Nolan RH, Boer MM, Collins L, Resco de Dios V, Clarke H, Jenkins M, Kenny B, Bradstock RA (2020) Causes and consequences of eastern Australia's 2019–20 season of mega-fires. *Global Change Biology* **26**(3), 1039–1041. doi:10.1111/gcb.14987

Nolan RH, Bowman DM, Clarke H, Haynes K, Ooi MK, Price OF, Williamson GJ, Whittaker J, Bedward M, Boer MM (2021) What do the Australian black summer fires signify for the global fire crisis? *Fire* **4**(4), 97. doi:10.3390/fire4040097

Nowell LS, Norris JM, White DE, Moules NJ (2017) Thematic analysis: striving to meet the trustworthiness criteria. *International Journal of Qualitative Methods* **16**(1), 1609406917733847. doi:10.1177/1609406917733847

Owen C, Krusel N, Bearman C, Brooks B (2017) From research outcome to agency change: mapping a learning trajectory of opportunities and challenges. *Australian Journal of Emergency Management* **32**(4), 42–46.

Owen C, Krusel N, Bethune L (2020) Implementing research to support disaster risk reduction. *Australian Journal of Emergency Management* **35**(3), 54–61.

Owen C, Krusel N, Bethune L (2022) Assessing models of research utilisation for emergency management practice. *International Journal of Innovation and Learning* **31**(4), 423–442. doi:10.13140/RG.2.2.21326.33600

Pahl-Wostl C (2009) A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes. *Global Environmental Change* **19**(3), 354–365. doi:10.1016/j.gloenvcha.2009.06.001

Rawluk A, Ford RM, Little L, Draper S, Williams KJ (2020) Applying social research: How research knowledge is shaped and changed for use in a bushfire management organisation. *Environmental Science & Policy* **106**, 201–209. doi:10.1016/j.envsci.2020.01.021

Reed MS (2008) Stakeholder participation for environmental management: a literature review. *Biological Conservation* **141**(10), 2417–2431. doi:10.1016/j.biocon.2008.07.014

Reed MS, Stringer LC, Fazey I, Evely AC, Kruijsen JHJ (2014) Five principles for the practice of knowledge exchange in environmental management. *Journal of Environmental Management* **146**, 337–345. doi:10.1016/j.jenvman.2014.07.021

Rogers EM, Singhal A, Quinlan MM (2014) Diffusion of innovations. In 'An integrated approach to communication theory and research'. 2nd edn. pp. 432–448. (Routledge: New York, NY, USA) doi:10.4324/9780203887011-36

Royal Commission into National Natural Disaster Arrangements (2020) The Royal Commission into National Natural Disaster Arrangements: Report. Attorney-General's Department, Barton, ACT, Australia. Available at https://www.royalcommission.gov.au/natural-disasters/report (accessed 23 December 2025).

Sutcliffe KM, Vogus TJ (2003) Organizing for Resilience. In 'Positive Organizational Scholarship: Foundations of a New Discipline'. (Eds KS Cameron, JE Dutton, RE Quinn) pp. 94–110. (Berrett-Koehler: San Francisco, CA, USA)

Taylor C, McCarthy MA, Lindenmayer DB (2014) Nonlinear effects of stand age on fire severity. *Conservation Letters* **7**(4), 355–370. doi:10.1111/conl.12122

Thompson MP, Calkin DE (2011) Uncertainty and risk in wildland fire management: a review. *Journal of Environmental Management* **92**(8), 1895–1909. doi:10.1016/j.jenvman.2011.03.015

Timmermans S, Tavory I (2012) Theory construction in qualitative research: from grounded theory to abductive analysis. *Sociological Theory* **30**(3), 167–186. doi:10.1177/0735275112457914

Van Kerkhoff LE, Lebel L (2015) Coproductive capacities: rethinking science-governance relations in a diverse world. *Ecology and Society* **20**(1), 14.

Walker B, Holling CS, Carpenter SR, Kinzig A (2004) Resilience, adaptability and transformability in social–ecological systems. *Ecology and Society* **9**(2), 5. doi:10.5751/ES-00650-090205

Walsh JC, Dicks LV, Raymond CM, Sutherland WJ (2019) A typology of barriers and enablers of scientific evidence use in conservation practice. *Journal of Environmental Management* **250**, 109481. doi:10.1016/j.jenvman.2019.109481

Ward V, House A, Hamer S (2009) Knowledge Brokering: the missing link in the evidence to action chain? *Evidence & Policy* **5**(3), 267–279. doi:10.1332/174426409x463811 PMCID: PMC3024540

Weick KE, Sutcliffe KM (2015) 'Managing the unexpected: Sustained performance in a complex world.' (John Wiley & Sons)

Data availability. De-identified interview transcripts are stored on a secure RMIT server and can be requested from the corresponding author on reasonable terms, subject to NPWS confidentiality requirements.

Conflicts of interest. The authors declare that they have no conflicts of interest.

Declaration of funding. This research received support from Natural Hazards Research Australia (NHRA) through the NHRA pilot internship programme. The funder played no role in the study design, data collection, or the decision to submit for publication.

Acknowledgements. This research was supported by NHRA and facilitated through the Australian Postgraduate Research Intern (APR Intern) program. We are grateful for NHRA's funding and commitment to advancing practical knowledge, which made this project possible. The APR Intern program provided valuable support by connecting academic research with industry practice, enabling collaboration with the NSW NPWS and the (S&I) Division at NSW DCCEEW. We would like to thank the staff of the NSW NPWS and the DCCEEW (S&I) Division for their participation in this study. Their valuable insights, time and expertise were crucial in enhancing our understanding of the factors that influence research integration in fire management practices.

Author affiliations

[A]School of Architecture & Urban Design, RMIT University, 150 Victoria Street, Carlton, Melbourne, Vic 3000, Australia.

[B]Fire and Incident Operations Branch, NSW National Parks and Wildlife Service, Department of Climate Change, Energy, the Environment and Water, Sydney, NSW, Australia. Email: felipe.aires@environment.nsw.gov.au

[C]Fire and Cultural Science, Science and Insights Division, Department of Climate Change, Energy, the Environment and Water, Sydney, NSW, Australia. Email: kat.haynes@environment.nsw.gov.au

[D]School of Science, University of Wollongong.

[E]School of Architecture & Urban Design, RMIT University, Melbourne, Vic, Australia. Email: john.fien@rmit.edu.au

Appendix 1. Interview schedule

Introduction

Good morning/afternoon, [Interviewee's Name].

The main objective of today's interview is to explore how NPWS integrates scientific research into fire management practices. We'll also discuss any challenges you've encountered and potential improvements.

Please note that everything we discuss today is confidential, and your name will not be used in any reports. With your permission, I would like to record our session to ensure accuracy. Is that okay with you?

If you are ready, we can begin with some questions about your role.

Section 1: role and experience

'Could you briefly describe your role within NPWS, especially in relation to fire management?'

How long have you been involved in fire management at NPWS? Could you discuss any training or experiences that have helped you better understand the needs of bushfire research in your area of work?

Section 2: research perception and engagement

How do you perceive the value placed on research by NPWS?

How does NPWS identify and prioritise research needs? Are there specific processes in place for this?

Could you describe the mechanisms and resources that support effective engagement with academic research at NPWS?

Have you been personally involved in any research projects with the Bushfire and Natural Hazards Research Centre (BNHRC), NHRA, or the Applied Bushfire Science team? Please describe your involvement and the integration of these findings into operational strategies.

Section 3: collaboration, knowledge transfer and implementation

Can you provide examples of how different branches within NPWS collaborate on research projects?

What tools or systems does NPWS use to facilitate the transfer of research into practice?

Describe the process from assessing research relevance to its final implementation and monitoring. What are common challenges encountered?

Section 4: organisational challenges and resource allocation

What primary challenges do you face in integrating new research into NPWS's fire management strategies?

Are specific funds allocated for research within your area, and what are the main obstacles to using these funds effectively?

Section 5: training, culture and governance

How have the culture and training programs within NPWS supported or hindered the use of research in fire management activities?

'What governance processes are in place to ensure the effective implementation of research findings?'

Section 6: feedback, evaluation and leadership

How is the impact of research on fire management practices evaluated at NPWS?

Can you provide examples of how leadership within NPWS has influenced the integration of research?

Conclusion and additional comments

Are there strategies you've found effective in integrating research into fire management at NPWS?

What improvements would you suggest to enhance collaboration between NPWS and research bodies like BNHRC and NHRA?

Is there anything else you'd like to add or anyone else you suggest we speak with?

Thank you for your time and insights. I will send you a copy of your responses for review before proceeding with data analysis and publication.

Appendix 2. Focus group schedule

Good morning, everyone. Thank you for joining today's focus group.

Today, we are here to discuss the engagement between the Science Division and National Parks. Our goal is to identify effective practices and areas for improvement in our collaborative efforts and communication strategies.

Please note that everything we discuss today is confidential, and no personal identifiers will be used in any reports. With your agreement, I would like to record our session to capture our discussion accurately. Is everyone comfortable with that?

If everyone is ready, let's begin our discussion.

Questions

1. Can you describe how your research engages with National Parks? How does this engagement vary across different projects or initiatives?
2. How do you tailor your interactions with different branches within National Parks, such as the Fire and Incident Operations Branch, operational branches, or the Bushfire Risk and Evaluation team? Are there specific strategies that you find more effective with different teams?
3. Discuss the varying approaches the Science Division employs when engaging with different roles or levels within operational branches – from field staff to managers to executives. Which strategies have proven most successful?
4. Can you outline the structured processes the Science Division uses to identify and engage the appropriate experts from National Parks for collaborative projects?
5. What mechanisms are in place to ensure that collaboration with National Parks is sustained, especially when there are changes in personnel or roles within the Science Division?
6. What methods do you use to ensure that research results are actionable and meet the needs of National Parks? Which practices have been effective, and where do you see opportunities for improvement?
7. How does the Science Division communicate with National Parks to ensure research findings are effectively utilised? Are there particular communication tools or methods that have been especially effective?
8. 'What challenges has the Science Division encountered in applying research within National Parks, and how have these been addressed? Are there ongoing challenges that still need to be resolved?'
9. From your perspective, what could enhance the effectiveness of communication between the Science Division and National Parks? Are there new strategies or technologies you believe could improve this process?
10. How do you perceive NPWS's openness to collaboration and research integration? What strengths and areas for improvement have you identified?
11. How does the Science Division gather and incorporate feedback from end-users to enhance the relevance and application of research? How does this feedback influence ongoing and future projects?

That concludes the questions I have prepared. Is there anything else anyone would like to add or discuss further?

Thank you all for your time and valuable contributions today.

Appendix 3. Participant information (Tables A3.1–A3.3)

Table A3.1. Interview participants.

Participant ID	Role	Experience	Involvement in research
P1	Senior Project Officer	5–10 years	Sometimes involved
P2	Fire Planning Officer	More than 20 years	Frequently involved
P3	Team Leader	More than 20 years	Sometimes involved
P4	Branch Programs Manager	More than 20 years	Sometimes involved
P5	Branch Programs Manager	More than 10 years	Sometimes involved
P6	Fire Planning Officer	More than 20 years	Sometimes involved
P7	Ranger	More than 20 years	Sometimes involved
P8	Area Manager	More than 20 years	Frequently involved
P9	Team Leader	More than 20 years	Sometimes involved
P10	Senior Project Officer	More than 20 years	Sometimes involved
P11	Senior Project Officer	5–10 years	Frequently involved
P12	Fire Planning Officer	5–10 years	Frequently involved

Table A3.2. Focus group participants.

Participant ID	Role
First Focus Group	
FG1	Knowledge Broker
FG2	Knowledge Broker
FG3	Knowledge Broker
FG4	Knowledge Broker
FG5	Knowledge Broker
Second Focus Group	
FG6	Research Scientist
FG7	Senior Scientist
FG8	Research Scientist

Table A3.3. Panel discussion participants.

Participant ID	Role
PD1	Director
PD2	Director
PD3	Knowledge Broker
PD4	Team Leader Science