Post-wildfire management actions for fauna: a survey of Australian conservation practitioners and managers

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Main cover image: In some fire affected areas artificial cover has been installed to reduce the impact of feral predators on surviving small native animals. Image: Nicolas Rakotopare

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In some regions actions included supplementary feeding of surviving animals. Image: Nicolas Rakotopare

Summary

Forty-one conservation practitioners, from seven Australian states and territories, participated in our survey. Respondents represented various levels of government, non-government, and not-for-profit organisations, and acted in roles that included on-ground implementation through to senior management.

Purpose for post-wildfire management action: the most common reasons given for post-fire management actions for fauna were to preserve and/or maintain habitat, and control introduced predators. Other management actions included animal welfare and rescue, supplementing resources (e.g. food, water, shelter), managing competitors, and controlling disease and weeds.

Targeting of actions: Actions primarily targeted mammals, followed by birds and reptiles. Actions were implemented across all fire-prone vegetation communities but with a focus on forest and woodland vegetation.

Monitoring of actions: Most of the individual management actions described were monitored, and the majority of respondents considered that the action was effective in meeting the primary objective. However, there were some actions that were either not currently monitored or in the early stages of monitoring, and only a minority of respondents reported that monitoring had fed into management decisions in a way that led to changes in actions taken. Ongoing monitoring will be important to evaluate the long-term effectiveness of different actions.

Indirect impacts: Survey respondents raised a range of potentially perverse outcomes from actions designed to support fauna (such as supplementary feeding) and from actions taken for other reasons (such as removal of trees for safety, or hazard reduction burning in adjacent areas).

Effectiveness of actions: Respondents cited a range of actions they felt likely to support species following wildfire, from direct actions such as predator control and habitat protection, to improved governance and decision-making. However, there remains much uncertainty around the effectiveness of many actions. Respondents highlighted the need for more guidance on the most beneficial management actions and more secure funding to implement and monitor actions undertaken.

This report is a supplementary report to the National Environmental Science Program Threatened Species Recovery Hub report "Conserving fauna in fire-prone landscapes: A review of fire-associated management actions that affect fauna conservation and recovery".
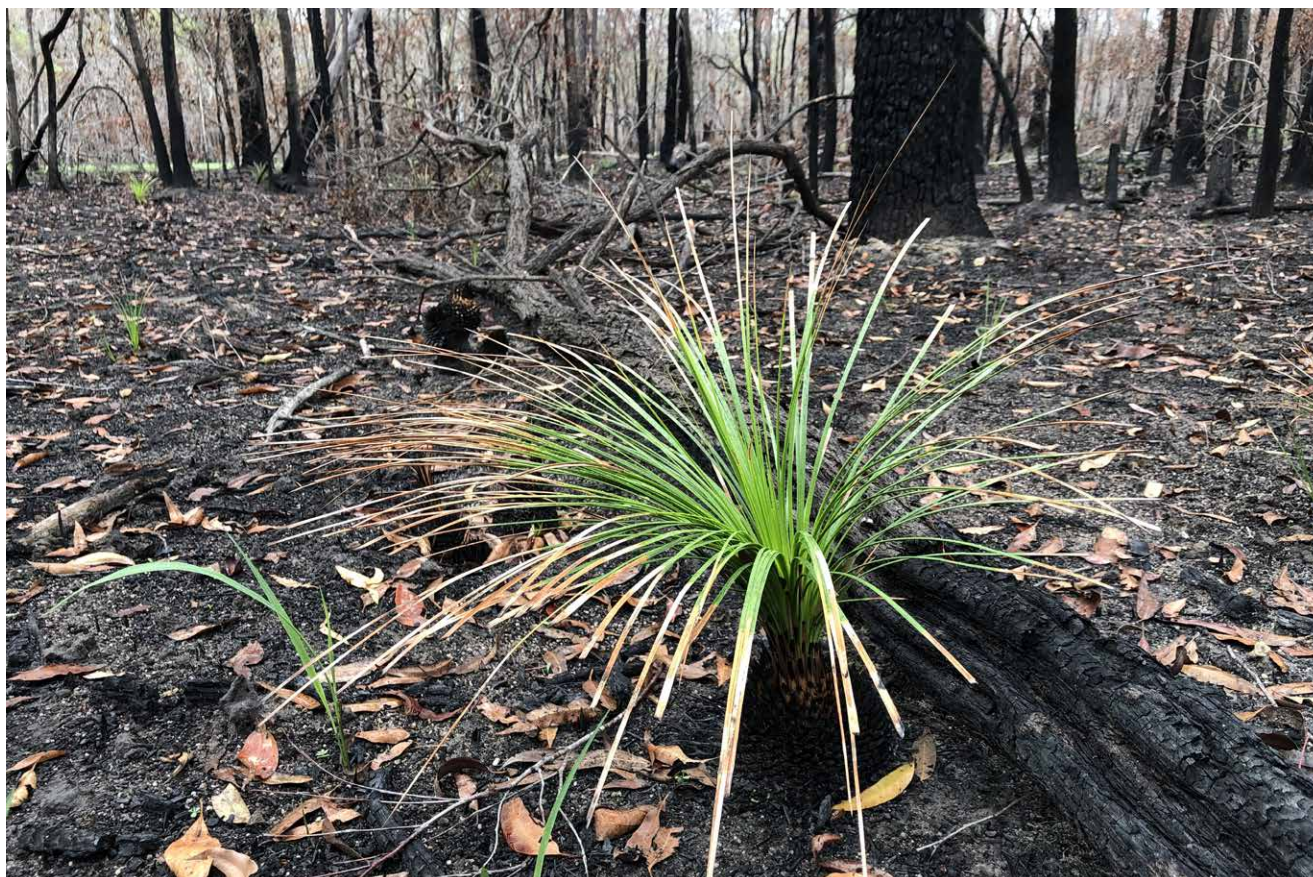
Recently burnt forest near Childers QLD. Image: Jaana Dielenberg

Introduction

Fire is a natural occurrence in many Australian ecosystems, with native plants and animals exhibiting various responses to ensure persistence in the landscape. However, changing fire regimes and other disturbances, such as habitat modification and introduced predators, have compromised the ability for many animals to survive and recover post-fire, and for populations to persist. In recognition of this, conservation practitioners and managers implement various post-fire management actions to assist with fauna recovery. We undertook an online survey to gauge the range of actions that are implemented, specifically following wildfire, and their effectiveness in achieving fauna conservation and recovery. Responses were limited to actions that occur within one year of a wildfire, and with an intent to benefit fauna. Thus, the survey did not request information on actions associated with planned burning, or other wildfire associated management actions that could affect fauna but are not intentionally designed to assist with fauna recovery (e.g. post-fire salvage logging).

This assessment was prompted by the scale and severity of the Australian wildfires of 2019-20, the recognised significant impacts of those fires on fauna, the perceived need for conservation actions post-fire in order to maintain populations that survived fire and to aid their recovery, and the lack of a relevant catalogue of potential post-fire conservation actions and of any previous comparative assessment of the effectiveness and applicability of potential actions. The project sought especially to provide a brief compilation of what post-fire conservation actions have been undertaken, the extent to which practitioners evaluated those actions, and some assessment of the extent to which the actions achieved their objectives. Such a compilation is important to improve preparedness for any future comparable catastrophic event.

Methods

We designed an online survey to understand the range of management approaches that have been implemented for fauna following wildfire within Australia, and the effectiveness of these actions in supporting fauna conservation and recovery post-fire (see Appendix 1). Our questions were targeted to management actions that are implemented less than one year following a wildfire, with the intention of benefitting fauna conservation and recovery. Questions were designed as either multiple choice, or short answer, with certain questions allowing multiple responses. Respondents could skip questions if they were not relevant.

Our target group for the survey was conservation practitioners and resource managers from across Australia, including practitioners from within government, non-government organisations, and private organisations, and those working on public or private land. We sent our survey to 220 email addresses, representing 53 organisations, government departments and councils.

In distributing our survey, we combined it with another complementary but separate survey. The complementary survey addressed planning and decision making related specifically to the 2019/20 wildfire season for the National Environmental Science Program Threatened Species Recovery Hub research project 8.5.1. The surveys were combined as we had a similar target audience and wanted to minimise approaching this target group with separate survey requests.

Results

Respondent demographics

Eighty-four practitioners, representing 28 different organisations, responded to our survey but only half (n=41) completed the survey. Some respondents indicated that the survey was not relevant. In other cases, the survey was commenced but not completed. Respondents who completed the survey represented all states and territories, except Northern Territory specifically (Fig. 1).
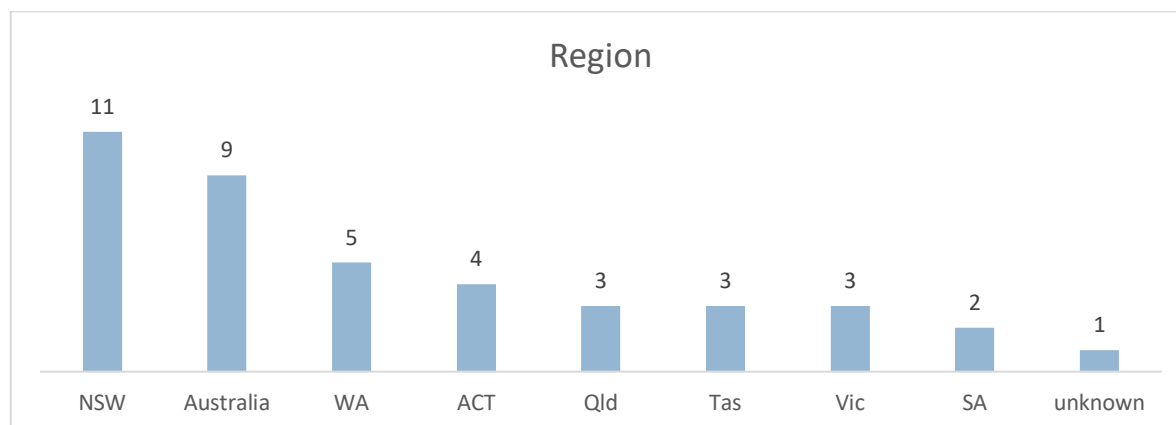
Figure 1. Number of respondents, indicated by number above each bar, from different regions across Australia (n=41).

Half of respondents identified as being from government (Fig. 2). A substantial proportion were from Indigenous organisations, NGOs and not-for-profit organisations.
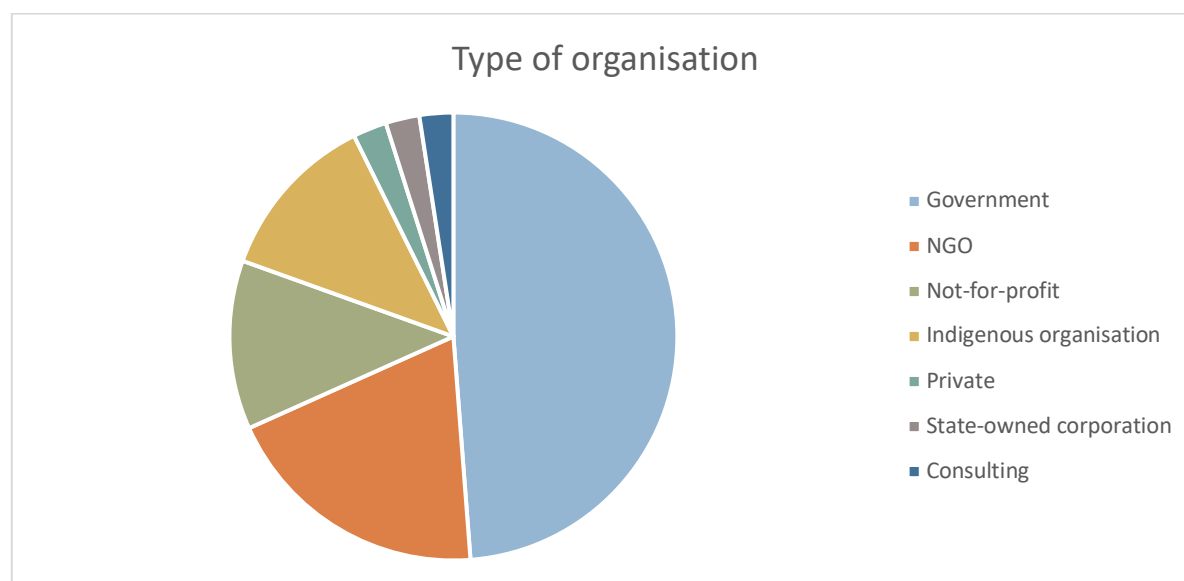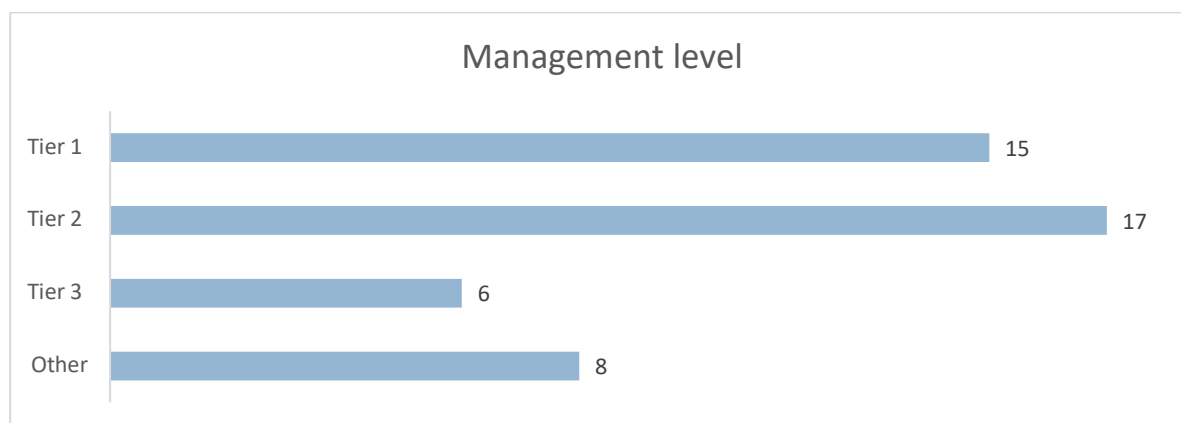

Figure 2. Number of respondents from different types of organisations. Government is represented by local council, state or territory, and federal governments.

Practitioners were asked to describe their fire response role in terms of a management category, defined as follows:

- Tier 1 responsibilities include the supervision of teams within sections, and implementation of actions in line with plans.
- Tier 2 is responsible for the management of sections and or departments, and planning to meet strategic directions.
- Tier 3 is responsible for the management of an organisation, and for setting strategic directions.

Respondents represented all three tiers of management, from on-ground implementation, to planning and high-level leadership (Fig. 3). Some respondents did not fall into any of the three management tiers, and were categorised as 'other'. The 'other' category identified as being either volunteer (n=2), researcher (n=3), advisor (n = 3), or providing a service and/or information (n=2).

Figure 3. Number of respondents, indicated by number next to each bar, at different levels of management (n = 41). Tier 1 responsibilities includes the supervision of teams within sections, and implementation of actions in line with plans. Tier 2 is responsible for the management of sections and or departments, and planning to meet strategic directions. Tier 3 is responsible for the management of an organisation, and for setting strategic directions. Respondents could select up to two options that represented their management level, resulting in a difference between the number of respondents (n=41) and the total number of responses (n=46).

Organisational patterns and decision-making for wildfire management actions

Respondents (n=41) described many different groups of people involved in planning, approving and implementing post-wildfire actions for fauna (Fig. 4). People involved included all levels of management, researchers, Indigenous groups, external groups, local community and on ground operators. Certain groups such as Tier 3 managers were more responsible for specific roles such as "Approval", while other roles were shared more evenly across all groups, though on-ground operators were less likely to be involved in planning or approval.
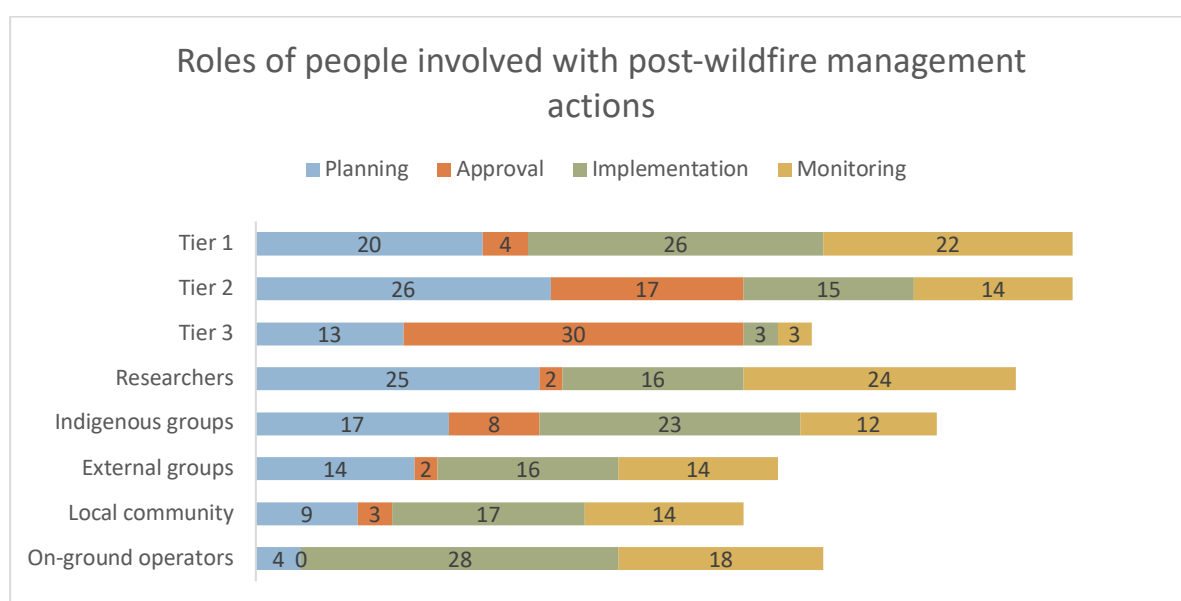
Figure 4. The roles of people involved with post-wildfire management actions. The numbers within each bar indicate the number of responses. Respondents could pick all categories that applied to their organisation.

From a list of actions provided, respondents (n=41) identified a variety of post-wildfire management actions that were undertaken within their organisations (Fig. 5). The most common types of actions included habitat preservation, restoration and or augmentation (n=35), and predator management (n=25). Other reasonably common actions reported included animal rescue, resource preservation and supplementation, and competitor management. Respondents also reported myriad other reasons for actions, such as cultural burning or visitor management.

Post-wildfire management actions

Action	Value
Animal welfare / rescue	13
Habitat preservation / restoration / augmentation	35
Resource preservation / supplementation	13
Predator management	25
Competitor management	13
Disease related (control / spread)	4
Weed management	4
Monitoring / assessment	7
Other	12
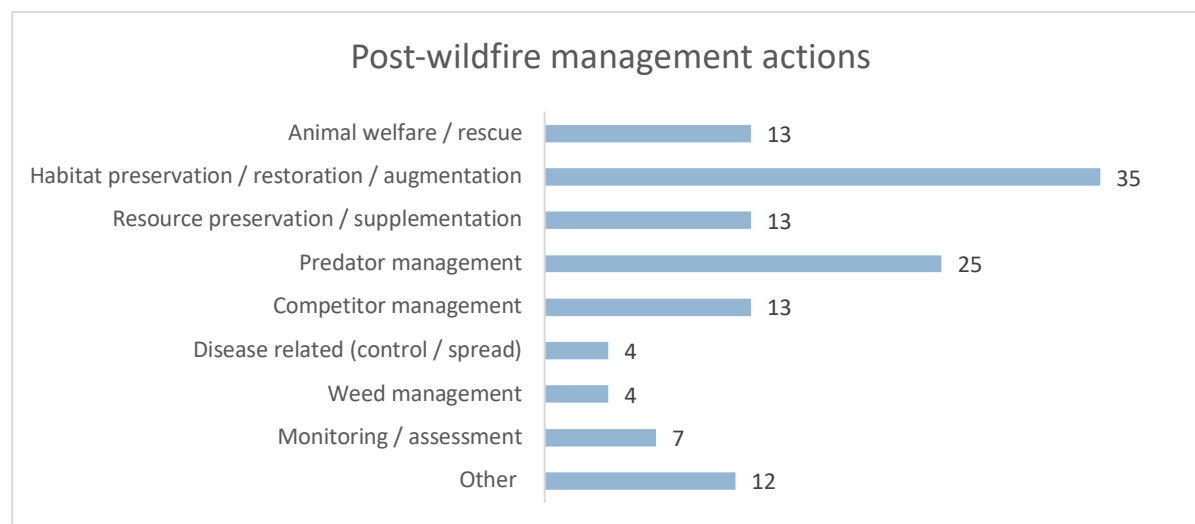
Figure 5. The range of post-wildfire management actions. Respondents could select up to seven responses, with the number next to each bar indicating the number of responses.

Specific actions

In addition to providing general information on fire-associated actions, respondents were able to describe up to three specific post-wildfire management actions. Twenty-five respondents described up to 3 actions each, for a total of 41 actions. The actions described included:

- Deer control
- Predator control (e.g. fox, cat)
- Supplementary food and water
- Supplementary habitat (e.g. refuges, nestboxes)
- Wildlife rescue, treatment and care
- Monitoring and assessment (e.g. flora, fauna, fire severity, pests)
- Weed control
- Habitat protection from further impact (e.g. streams, hollow-bearing trees)
- Restoration of river flow and water quality
- Habitat restoration (e.g. re-planting, erosion control, river flow and water quality

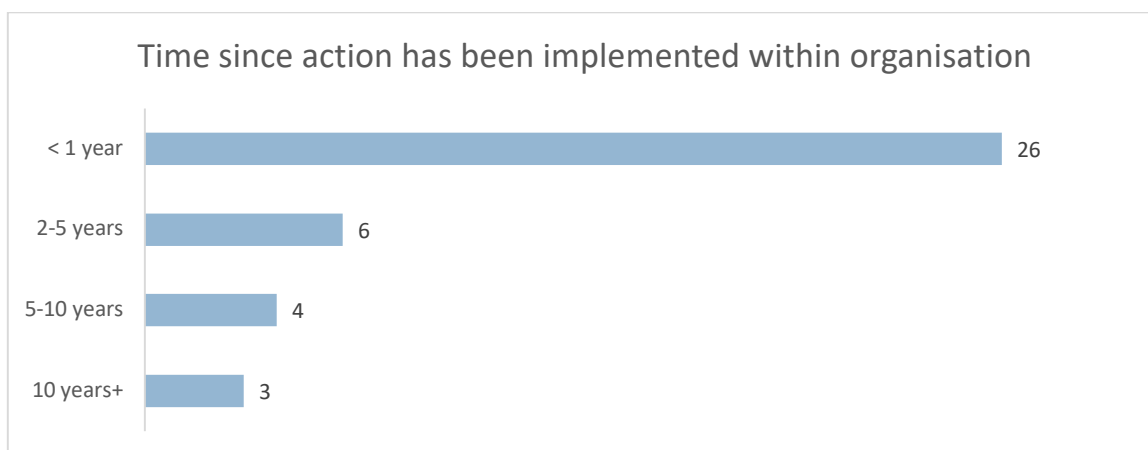Respondents were asked to select the primary and, if applicable, secondary objective of each action described. Again, the most common primary objective for these actions described in depth was habitat preservation, restoration and or augmentation (n=23), followed by predator management (n=8, Fig. 6).

Management action objectives

■ Primary intent or purpose   ■ Secondary intent or purpose

Objective	Primary	Secondary
Animal welfare / rescue	4	5
Competitor management	1	5
Habitat preservation / restoration / augmentation	23	7
Predator management	8	3
Resource (e.g. food) preservation / supplementation	4	5
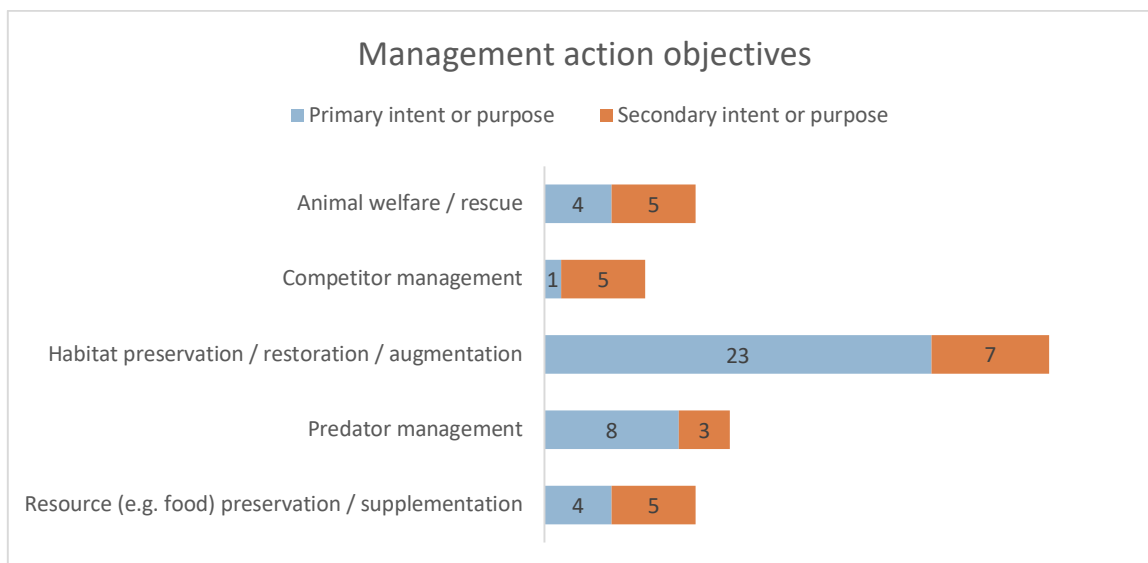
Figure 6. Primary and secondary objectives for each post-wildfire management actions (n=41). Numbers within each bar indicate the number of responses.

Actions described were mostly done following wildfire only (n=28) but some actions were conducted following wildfire and planned burning (n=11). Actions were conducted within a week of fire (n=7), within 3 months (n=20) or within 1 year (n=11).

Some actions had been in place for more than five to ten years (n=7), but most of the actions described had been implemented only in the last year (n=26, Fig. 7), indicating that the action was relatively new, possibly in many cases initiated in response to the recent 2019/20 wildfire events.

Time since action has been implemented within organisation

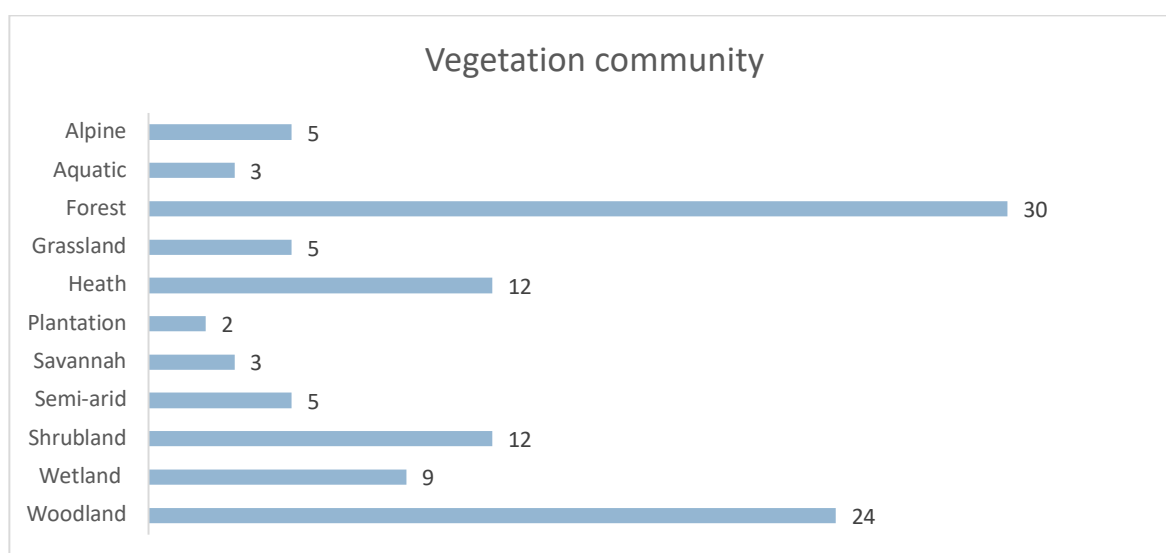| Period	Responses
< 1 year	26
2-5 years	6
5-10 years	4
10 years+	3

Figure 7. Period of time since the action has been in use within the organisation. Number next to each bar indicates the number of responses.

Actions could be attributed to supporting more than one group of fauna. Actions were targeted mainly to mammals (n=38), birds (n=23) and reptiles (n=20, Fig. 8), with a much more limited number of actions targeted to support fish, amphibians and invertebrates. Actions were implemented across 11 vegetation communities, mainly in forest (n=30) and woodland (n=24, Fig. 9).

Target fauna

| Fauna	Value
Bird	23
Mammal	38
Reptile	20
Fish	4
Amphibian	10
Invertebrate	6
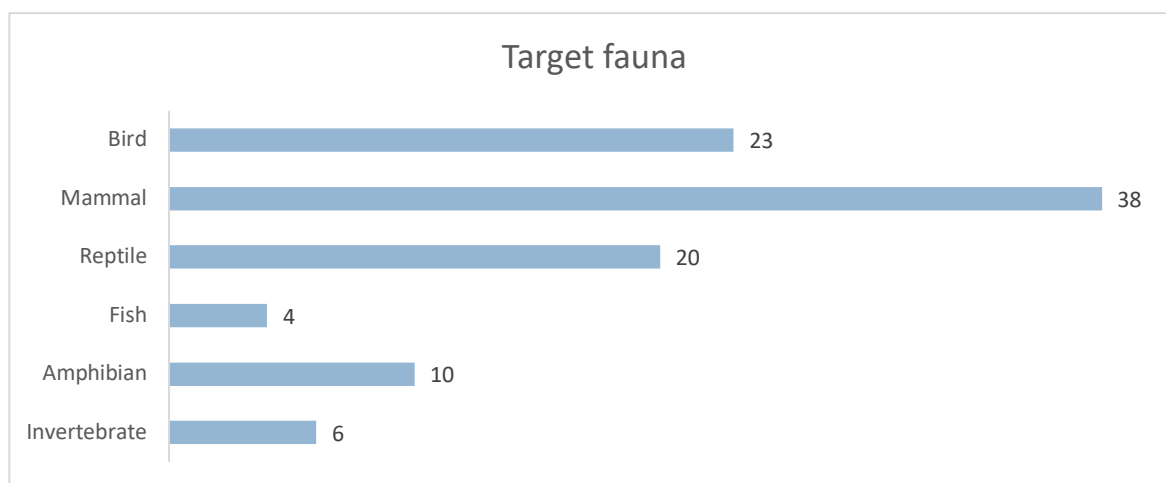
Figure 8. The target fauna for each management action. Multiple responses were allowed for each action, with the number next to each bar indicating the number of responses.

Vegetation community

Community	Value
Alpine	5
Aquatic	3
Forest	30
Grassland	5
Heath	12
Plantation	2
Savannah	3
Semi-arid	5
Shrubland	12
Wetland	9
Woodland	24

Figure 9. The vegetation community in which the action was conducted. Multiple responses were allowed for each action, with the number next to each bar indicating the number of responses.

Of the 41 actions described, most were primarily conducted at the local level (n=33), followed by at the regional level (n=11). Only one was implemented at the state or territory level; this action was described as an assessment of fire history.

The idea or knowledge for the action mainly originated from local knowledge, experience and or interest (n=29), or were part of local practices or procedures (n=15), local management plans (n=12) or standard policy or procedures (n=10). Other influential sources included external influence (e.g. researchers, community groups, n=18), scientific literature (n=14) and Indigenous knowledge (n=7) (Fig. 10). Other factors cited included an expert elicitation workshop and project funding. These latter factors were not given as options in the survey but were provided by individual respondents. The absence (or presence) of options could have influenced participants responses.

Origin of action

Category	Value
Standard policy/procedure	10
Local management plans	12
Local practice or procedure	15
Local knowledge, experience and or interest	29
External influence	18
Scientific literature	14
Indigenous knowledge	7
Other	6
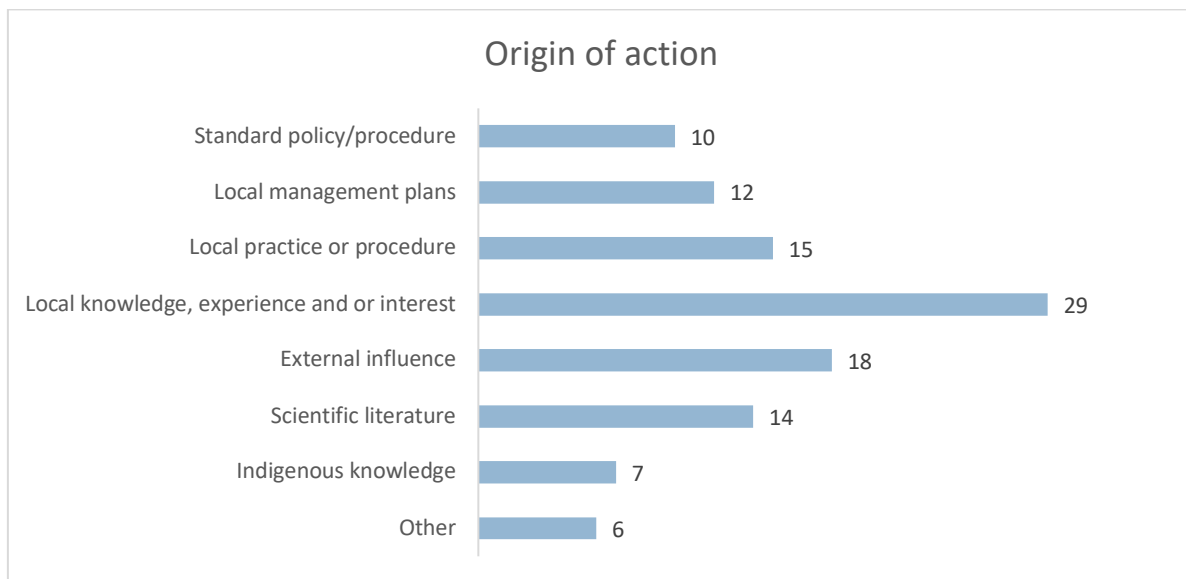
Figure 10. Source of knowledge or idea that was the basis for the action. Multiple responses were allowed for each action, with the number next to each bar indicating the number of responses.

While the majority of actions were documented within a standard procedure (n=26), or were described in policy (n=5), 13 of the 41 actions were not documented in either a standard procedure or policy. One respondent said that there was no "procedure that directs the implementation of predator control after bushfire or planned burn operations".
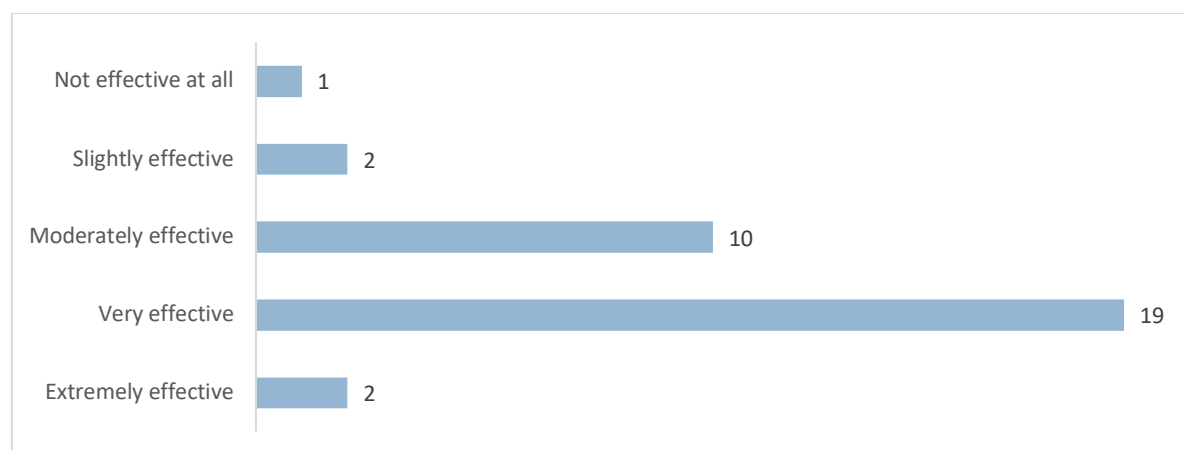
Monitoring

Three quarters (n=31) of the 41 actions described were monitored. In two thirds of these cases, monitoring design was mostly characterised either as a Before After Control Impact (BACI) design (n=10) or as repeated random sampling (n=11). Four monitoring programs were best described as inventories, while other programs were designed ad hoc. Some respondents indicated that their 'BACI designs lacked controls' (sic), suggesting a misrepresentation of their monitoring design in calling it BACI.

Of the 31 programs that were monitored, most were able to describe the response variables (n=27) but less often the predictor variables (n=22); respondents either left predictor blank (n=3) or stated that were no predictors (n=2). Response variables included measures of target fauna (e.g. occupancy, abundance, breeding), introduced species (predators, competitors), vegetation or habitat condition, use of supplementary resources (e.g. habitat, food) or other values in the landscape (e.g. bush tucker). Predictor variables included measures of fire (severity, scale, time-since-fire, history, patchiness) and management interventions (e.g. introduced species control, habitat modification).

Frequency of monitoring varied from continuous (e.g. camera traps, n=3) and/or regular data collection (weekly to several times per year, n=13), to longer time frames (> 1-2 years, n=4), to infrequent and ad hoc (n=6). These data were stored primarily on internal drives or databases (n=22) with some stored in national databases (n=2), research institution (n=1) or as hard copies in office (n=1). Data for half of the actions described (n=20) were available upon request, but eight respondents said the data were not available.

Most respondents considered that the action was effective in meeting the primary objective (Fig. 11). Thirty-one respondents said that the action was beneficial for fauna conservation and or recovery from fire, and a further five were unsure if the action was beneficial to fauna.

Figure 11. The effectiveness of the action in meeting the primary intent (n=34). Number next to each bar indicates the number of responses.

Final comments on individual actions

Many actions described were part of ongoing monitoring work that was long-term, and not necessarily implemented for recovery post-fire per se, but had been altered or augmented because of fire increasing the threat to endangered fauna and or their habitats. Other respondents indicated that it was too early to tell the effectiveness of the actions, that some actions were still being implemented and other actions had been delayed or hampered by COVID-19, remoteness of locations and difficult weather. Respondents indicated that information gathered via monitoring would be important to inform future planning, decision making and management.

Overarching comments on post-wildfire management actions to assist fauna recovery

The final survey questions were not specific to a particular action, but were intended to gauge overall views on post-wildfire actions implemented within their organisation, and the effectiveness of monitoring in assisting with decision making.

Of 15 respondents, six people said that monitoring activities post-wildfire had not resulted in any changes to management actions. A further five people said that it was too early for monitoring data to be useful or that they were unsure. Four people outlined how monitoring had informed management decisions. These involved: decisions to end wildlife feeding, adaptations to pest control (e.g. identifying target areas, triggers for control), and adjustments to weed management (e.g. provision of post-wildfire habitat to threatened fauna).

Most of the actions described in the survey were intended to promote fauna recovery. Respondents had mixed responses to whether post-wildfire management actions targeted to support fauna could also be detrimental, including from indirect impacts on non-target species (no = 8, maybe = 5, yes = 4). Possible detrimental impacts included lethal baiting of non-target fauna, and supplementary food either attracting non-target fauna, spreading weed seeds or being unhealthy for target fauna.

Possible detrimental impacts from post-wildfire actions identified by survey respondents

Side-effects from actions designed to promote fauna recovery could include:

- lethal baiting of non-target fauna
- supplementary food attracting non-target fauna
- supplementary food spreading weed seeds
- supplementary food being unhealthy for target fauna

Potentially detrimental actions not designed to promote fauna recovery:

- the removal of habitat trees for safety reasons
- habitat damage and wildlife disturbance from the re-opening of natural areas to visitors
- hazard reduction in adjacent unburnt areas to meet burning targets

Other detrimental impacts to fauna described were related to actions not designed to promote fauna recovery; these actions included the removal of habitat trees for safety reasons, habitat damage and wildlife disturbance from the re-opening of natural areas to visitors, and hazard reduction in adjacent unburnt areas to meet burning targets.

Respondents provided many suggestions for potential post-wildfire management actions to assist with fauna conservation and recovery; many of these included actions already being undertaken but perhaps not in their jurisdiction or with some modification or enhancement. Actions listed included the provision of post-wildfire refuges (n=6), supplementary feeding (n=2), targeted pest control (e.g. feral horses), protection of unburnt refuges (e.g. from future fire, or salvage logging) and management of vegetation post-wildfire (managing dense regrowth, weeds, revegetation). The need for better knowledge of post-fire faunal responses and mapping of habitat was recognised, along with targeted, strategic and question-driven monitoring and conservation planning to ensure management is more effective. Respondents also highlighted the need for clear coordinated responses following wildfire, good communication with on-ground practitioners, and dedicated fire recovery teams. Specific suggestions included investigating biodegradable habitat structures, and the effectiveness of supplementary feeding.

The final comments by respondents mainly addressed uncertainty about the needs of fauna and the appropriate (primarily post-wildfire) management actions to enhance recovery, along with a lack of funding. One respondent outlined that there is post-fire guidance for weed management, and guidance for wildlife management during wildfires and their subsequent treatment, but "no manual or guidance for managing the impact of wildfire or planned burn operations on Threatened Fauna". In a similar vein, another respondent outlined how their organisation conducts "research into impacts of wildfire and planned burning on wildlife" but, to their knowledge, there were no specific actions undertaken to assist wildlife following fire. Another called for more "radical responses to augment fire-affected species", though no specific examples were given.

Suggested actions for post-wildfire fauna management from survey participants:

Emergency wildlife support:

- provision of post-fire refuges
- supplementary feeding

Habitat management

- targeted pest control
- management of vegetation post-fire (managing dense regrowth, weeds, revegetation)
- protection of unburnt refuges (e.g. from future fire, or salvage logging)
- Improving knowledge:
- better knowledge of post-fire faunal responses
- mapping of habitat
- investigating biodegradable habitat structures
- investigating the effectiveness of supplementary feeding

Monitoring and governance

- targeted, strategic and question-driven monitoring and conservation planning to ensure management is more effective
- the need for clear coordinated responses post-fire
- good communication with on-ground practitioners
- dedicated fire recovery teams in management agencies

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