Climate Change Engagement & Communications Practice Review

Final Report

SAFER TOGETHER COMMUNITY FIRST

CLIMATE CHANGE ENGAGEMENT
AND COMMUNICATIONS PRACTICE REVIEW
FINAL REPORT

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Date: March 2024

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1. OVERVIEW

This document serves as the final report for the project: Climate Change Engagement and Communications Practice Review (Phase 1). It provides an evidence-based synthesis and overview. The project focuses on the context of climate change and draws on bushfire as an evidence-based the lens through which change is explored.

The final report is designed as a comprehensive guide for land and fire agencies who engage with community about bushfire risk and preparedness by distilling research evidence into principles that guide better engagement practice i.e. perhaps being explicit about the engagement emphasis.

The project addresses three project Requirements:

- **Requirement 1.** *Undertake a literature review of the known impacts of climate change on bushfire risk in Victoria and undertake a scan of the known impacts of climate change on bushfire risk in Victoria, linking impacts to the values that communities care about*
- **Requirement 2.** *Document best-practice approaches to climate change engagement and communication that aim to improve community understanding and encourage actions/behaviour change for risk reduction and resilience*
- **Requirement 3.** Co-design *a tool with the project advisory team that supports reflection on practice in community engagement and communication for behaviour change in the context of change and uncertainty. Identify and document the skills, knowledge and capabilities that are useful in supporting this tool*

The project summarises key impacts from changing bushfire regimes to the environment and people.

PROJECT TEAM

The project comprises a university research team (Andrea Rawluk, Rebecca Ford, Bernice Plant, Hamish Clarke, Tom Fairman) and project partners in the Department of Energy, Environment and Climate Action (DEECA - Sam Strong) and the Country Fire Authority (CFA - Jen Kellett) and a cross-agency Project Advisory Group (PAG) that also included local government.

The PAG was critical for the framing and contextualising of the project through multiple avenues. The Advisory Group has shared framing and context during a workshop following the delivery of Requirement 1 and through a collaborative Miro board. From the workshop and Miro board, we identified key topics of crossover between the needs of the Advisory Group practitioners and the strengths and capacities of the research team regarding community engagement and behavioural communication. These were then formed into Principles.

PROJECT APPROACH

We ground this community engagement and communication document in a process called **Adaptive Doing**. Adaptive Doing is a collaborative process that enables practitioners to engage with complex and uncertain circumstances to build a shared understanding of a context, such as bushfire and climate change governance (Rawluk et al. 2020; Rawluk et al. 2021; Rawluk et al. 2023).

A desktop literature synthesis was undertaken across the environmental social sciences on agency-community relationships, knowledge integration, community values, and collaboration in social ecological systems. The decision to include content generated from this co design process / knowledge sharing process was:
- whether a strong theme emerged from the reviewed literature;
- whether the content had already been outlined as part of the proposal;
- and/or whether it was identified by the advisory group as a priority area.

The project utilised a collaborative and iterative approach. The project team met with Project Advisory Group approximately every two months across 2023 to share results of recommendations, discuss practice needs and adjust the project accordingly. A critical part of the process with the Project Advisory Group was a workshop that was held to identify the practice needs and challenges for climate change and bushfire community engagement and communication. This workshop enabled Advisory Group members to contribute in-person and afterwards on a live Miro (collaboration platform) board. This discussion supported the research team to focus the community engagement and communication principles.

REPORT STRUCTURE

We organise the report to illustrate the Climate Reflective Practice (described in next section). In the first section, we outline the Climate Reflective Practice. Following, the four sections depict the four loops of the Climate Reflective Practice. The tool helps synthesise the complex layers of knowledge and represents a holistic, interdisciplinary and multi-value approach and enabling engagement with communities around climate change and bushfire risk.

This final report is being treated as a living document. As the project proceeds to Phase 2, the Climate Reflective Practice will continue to develop. We encourage readers to contact the authors should they wish to ask questions about, comment on or discuss any of its contents.

2. CLIMATE REFLECTIVE PRACTICE

Climate Reflective Practice (Figure 1) is situationally grounded in the circumstances for staff from DEECA, CFA and Local Governments in Victoria needing to engage and communicate with communities who are trying to understand and make sense of climate change impacts, particularly in relation to bushfire risk. The Climate Reflective Practice is a synthesis of an extended literature review about bushfire projections and impacts in an era of climate change, as well as community engagement practice and communication for behaviour change, with expert interpretation and extensive discussion with the Project Advisory Group. It has been designed to address **Requirement 3.** Co-design *a tool with the project advisory team that supports reflection on practice in community engagement and communication for behaviour change in the context of change and uncertainty. Identify and document the skills, knowledge and capabilities that are useful in supporting this tool.*

This Climate Reflective Practice serves to prompt critical reflection of practice and provide a starting point for practice change. It is not prescriptive, instead it provides guideposts for reflection. It is organised into four iterative loops:

> LOOP ONE: Context
>
> LOOP TWO: Relationship Type
>
> LOOP THREE: Principles for learning centred practice community engagement for uncertainty and change
>
> LOOP FOUR: Principles for communications that aim to support behaviour change and knowledge sharing

Context asks practitioners to be aware of the social and biophysical context and dynamics of their work or challenge. It is guided by Requirement 1: to identify "*the known impacts of climate change on bushfire risk in Victoria and undertake a scan of the known impacts of climate change on bushfire risk in Victoria, linking impacts to the values that communities care about*"

Relationship Type asks practitioners to identify the kind of relationship they are seeking between government and community members

Principles for learning centred practice in community engagement for uncertainty and change provide practitioners with principles to meet community engagement practice needs

Principles for communications that aim to support behaviour change and knowledge sharing provide practitioners with principles to meet communication practice needs.

The focus for these principles was determined through a Project Advisory Group workshop (see above). They emphasise an iterative and reflective process underpinned by ongoing adaptation and change.

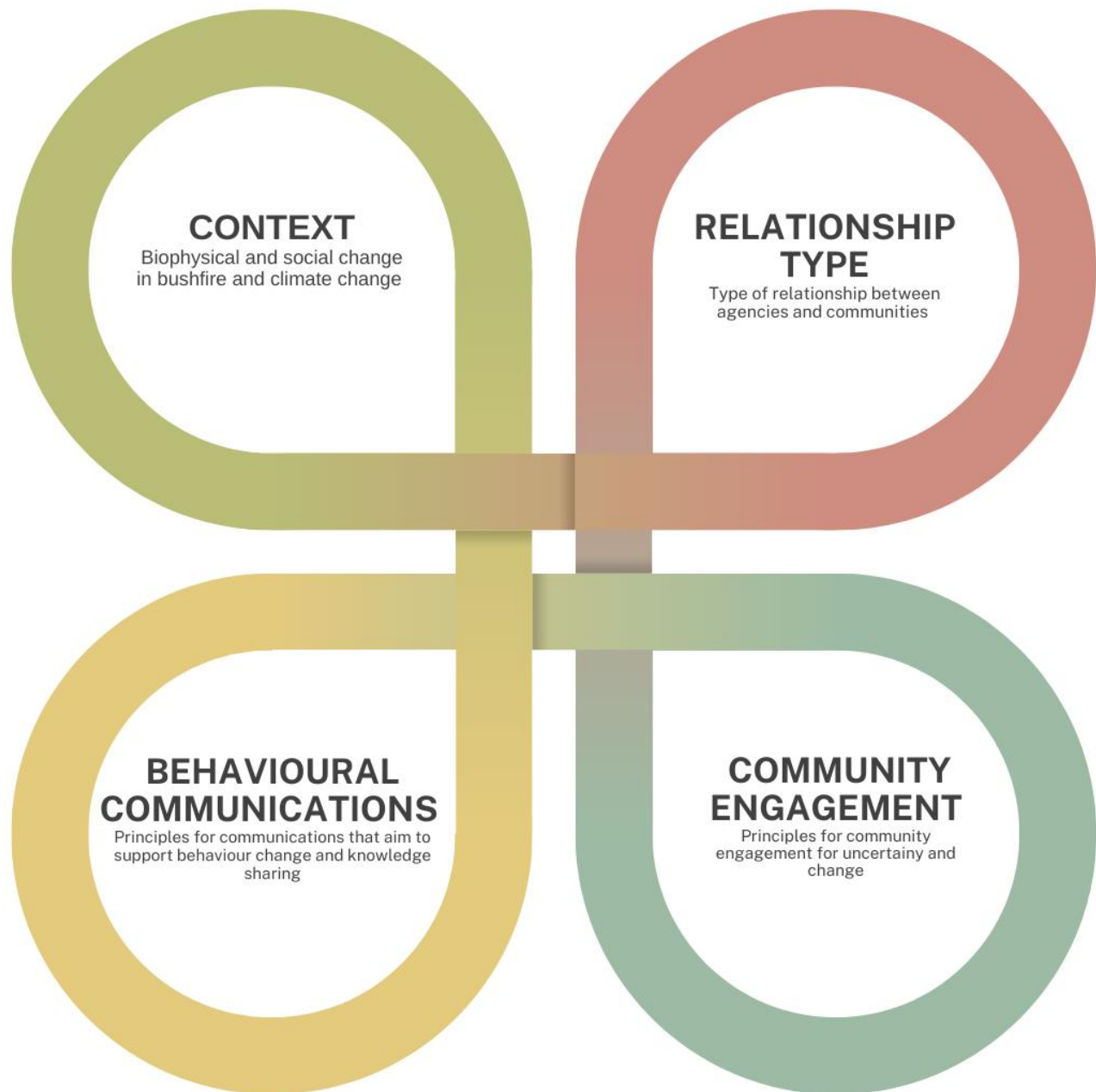The different loops of the Climate Reflective Practice are designed to speak to and inform each other.

Figure 1. Visual depiction of the Climate Reflective Practice that is formed with four loops.

2.1 LOOP ONE: CONTEXT

The first loop of the Climate Reflective Practice is to understand the social and biophysical dimensions of a particular context. Here, we present the context of bushfire and climate change in Victoria, Australia.

This section also serves Requirement 1 in the project plan as a literature review of "*the known impacts of climate change on bushfire risk in Victoria and undertake a scan of the known impacts of climate change on bushfire risk in Victoria, linking impacts to the values that communities care about*"

This CONTEXT section includes:

a. A literature review of the known impacts of climate change on bushfire risk in Victoria;
b. A scan of the known impacts of climate change on bushfire risk in Victoria; and
c. Linking impacts to the values that communities care about

We address these in the four parts that follow.

CONTEXT

Change and uncertainty: bushfire regimes and climate change in Victoria, Australia
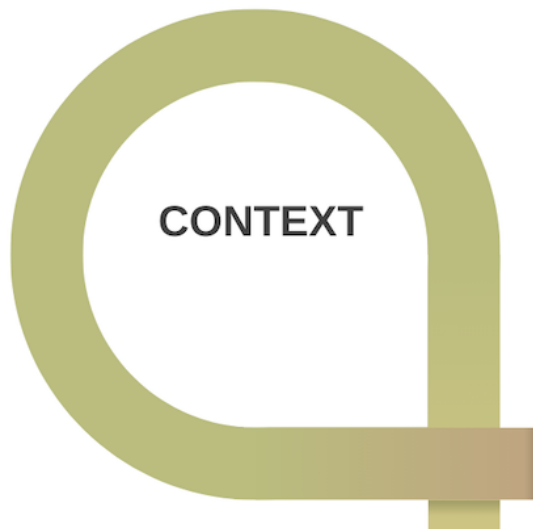
Fire is ancient. It has been part of the Earth system essentially since plants first appeared on land hundreds of millions of years ago (Marlon 2020). Species and ecosystems have evolved alongside fire, shaped by its distinct local patterns of frequency, intensity and seasonality. Relationships between fire and biodiversity are deep and complex.

First Nations communities have been using fire to care for Country in this part of the world for over tens of thousands of years. The widespread suppression of cultural burning has impacted vegetation and fire regimes in ways that we are only beginning to understand. There is renewed support for Aboriginal-led cultural land management in government, industry and community.

European colonists brought with them their own understandings and attitudes towards fire, which were subsequently shaped by their experiences of fire in the Australian context over the last two centuries. Contemporary fire management is a sophisticated and highly professional partnership of multiple organisations, which reflects many of the historical influences described above and includes the knowledge and management of Aboriginal-led initiatives.

This literature review is necessarily limited in scope and focuses on the peer-reviewed literature concerning climate change impacts on bushfire risk, principally through a biophysical lens. It then considers the interaction between these impacts and a range of community values in relation to fire and fire-prone landscapes. Readers are urged to bear in mind this context when interpreting findings.

2.1.1 OVERVIEW OF THE BIOPHYSICAL AND SOCIAL DIMENSIONS OF BUSHFIRE IN VICTORIA

In this section, the biophysical and social contexts of bushfire are presented from a review of the contemporary literature.

Overview of biophysical dimensions of bushfire

The *fire regime* describes the key properties of fire in a landscape, including frequency, seasonality, intensity and severity (Gill 1975). Victoria is home to many different fire regime 'niches' (Murphy et al. 2012), characterised by distinct combinations of dominant vegetation type, climate zone and these fire regime properties. Some Victorian fire regime niches include

- Temperate eucalypt forest, with infrequent low-intensity litter fires in spring and medium-intensity shrub fires in spring and summer
- Temperate tall eucalypt forest, with very infrequent high-intensity crown fires in summer
- Temperate mallee, with infrequent medium-intensity shrub fires in spring and summer
- Temperate pastures and croplands, with infrequent low-intensity grass fires in autumn

Fire is limited by the coincidence of *four biophysical drivers*:

- biomass growth and continuity
- fuel dryness
- an ignition source, and
- weather conditions favourable to fire spread (Bradstock 2010).

In some landscapes fuel is plentiful, but it does not dry out frequently, which limits overall risk of bushfire. In other landscapes, conditions are frequently hot and dry but these same conditions limit fuel growth, and thus the risk of major fires. A fire regime can be characterised partly by the spatiotemporal variability of these four fundamental constraints on fire incidence.

A diverse set of observations provides a series of baselines against which to assess change, either over the course of the historical record, or under potential trajectories of future climate change. These observations span the drivers of fire mentioned above (fuel, fuel moisture, fire weather and ignitions) as well as fire itself. Fire management agencies have maintained detailed records of final fire perimeters and ignition dates, in some cases dating back to the early 20th century. The quality and coverage of these records has improved over time. Records of the progression and fuel consumption (severity) of individual fires is sparse but there are good prospects for these gaps to be filled in the coming years (Collins et al. 2018; Gibson et al. 2020). Advances stem partly from high quality remotely sensed products (Chuvieco et al. 2020), which in the last two decades have radically reconfigured our understanding of the daily, seasonal and interannual ebb and flow of fire on a global scale. Insights from these global products at high temporal and spatial resolution have yet to be fully mined. Reconstructions of pre-colonisation fire are relatively sparse but growing and contribute to a much richer understanding of the long-term waxing and waning of fire, including its use by Aboriginal and Torres Strait Islander people (Mooney et al. 2016; Mariani et al. 2022).

Overview of how bushfire impacts what is important to communities

Ethical dimensions of bushfire management

Advances in biophysical science and technology have greatly improved understanding of bushfires and their management, but many bushfire-related issues also involve ethical and social questions, such as values, which should be protected and whose voices and knowledge should be represented in decision-making. Judgements on such questions are routinely made, but may be based on implicit assumptions, with unintended consequences. Drawing on parallels with the ways medical ethics supports professional decision-making, Goldstein and Kennedy (2022) call for an applied ethics of wildfire that can interrogate the subjective judgements and assumptions that guide decisions but are not always made explicit. They **propose a typology or framework that is based on an analysis of academic papers about issues and dilemmas in fire management (Figure 2). It is designed to support decision-making by offering topics for deliberation among bushfire professionals and considerations for the design of community engagement.**

In this framework, questions of values include asking which are given priority, or otherwise have most influence on decision-making. In bushfire decision-making, this includes balancing competing objectives as well as identifying values that may be concealed within decision-making processes or excluded from them (e.g. Ford et al. 2019, Williams et al. 2021). Questions of power are concerned with the ability of individuals or groups to exert influence or to act within a situation. Questions of epistemologies and representation are about whose knowledge and perspectives are sought and count in decisions. Questions of risk and uncertainty include risk perceptions and people's tolerance of adverse consequences for different values. Metaethical considerations are about the ways ethical questions are deliberated, such as the beliefs that guide decision-making and the meanings of key terms (Goldstein and Kennedy 2022).

From this framework, questions of values are particularly relevant to asking which impacts of climate and bushfire should be considered, that is for linking the technical understanding of risks and impacts with judgements about what is important that can be affected by bushfire. Separating judgements about values and objectives from technical analysis of impacts to these values is an important principle of structured decision-making (Gregory et al. 2012). Explicit consideration of the choice and level of importance of values features in some risk analysis (e.g. Thomson and Calkin 2011). However, institutional knowledge cultures and availability of what is considered suitable data tends to constrain incorporation of values in risk analysis for decision-making (Ford et al. 2019, Williams et al. 2021).

All parts of the framework in Figure 2 are relevant to community engagement and will be further discussed in later parts of the report.
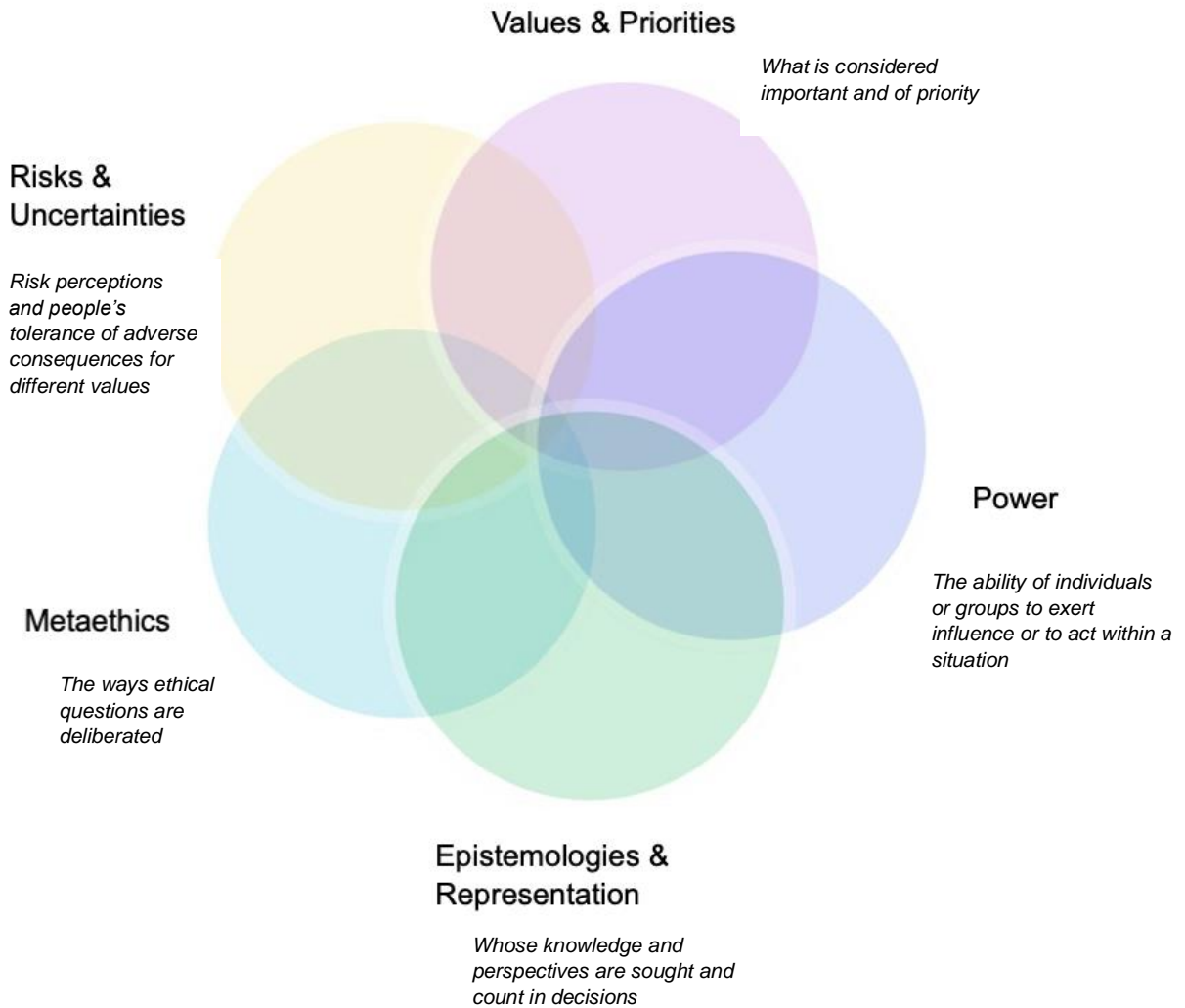
Values & Priorities

What is considered important and of priority

Risks & Uncertainties

Risk perceptions and people's tolerance of adverse consequences for different values

Power

The ability of individuals or groups to exert influence or to act within a situation

Metaethics

The ways ethical questions are deliberated

Epistemologies & Representation

Whose knowledge and perspectives are sought and count in decisions

Figure 2. The diversity of social and ethical considerations for bushfire planning and management (Goldstein and Kennedy 2022). Questions of power are concerned with the ability of individuals or groups to exert influence or to act within a situation. Questions of epistemologies and representation are about whose knowledge and perspectives are sought and count in decisions. Questions of risk and uncertainty include risk perceptions and people's tolerance of adverse consequences for different values. Metaethical considerations are about the ways ethical questions are deliberated, such as the beliefs that guide decision-making and the meanings of key terms (Goldstein and Kennedy 2022).

Understanding what is important to communities in the bushfire social ecological system: conceptualising social values

The term 'values' is used to mean different things in different disciplinary and professional contexts. We use it here as a general term to describe what is important to people and why (e.g. Rawluk et al. 2019, Kendal et al. 2015). In the bushfire social ecological system, it helps us to understand how people relate to all aspects of their physical and social environment that can be affected by fire. It has been useful to articulate relationships of valuing at different levels of abstraction (Figure 3) (Rawluk et al. 2017, Williams et al. 2018). This conceptualisation of values was co-designed with the State Government of Victoria to ensure that it has direct application to both policy and practice.

In this framework, valued entities are people's relationships to objects, places and other people that are tangible and locatable, including relationships to 'assets' in bushfire planning. Valued attributes are qualities of landscapes and communities that help explain why people value entities. Core values are people's abstract ideas about what is good or important in life in general, not only in bushfire contexts. The priority given to protection of valued entities is underpinned by valued attributes, which in turn have their basis in core values. For example, infrastructure is valued because it supports livelihoods (a valued attribute) and both infrastructure and livelihoods are important in relation to the core value of security (Williams et al. 2018). Based on this framework, values of the public of Victoria were identified through individual interviews and an online survey (Figure 4) (Rawluk et al. 2017, Williams et al. 2018). In a subsequent study, core values based on Schwarz (1992) and attitudes to aspects of bushfire management were explored in an online survey of members of the public in other states (Cormick 2018). These studies form the main evidence base to support incorporation of values of the public in Australian bushfire decision-making and community engagement.

Other Australian and international studies have focused on the values of professionals. Owen et al. (2016) used interviews and surveys to identify the values underlying senior managers' deliberations during bushfire emergencies in Australia. In Colorado, USA, participatory GIS was used to identify and value ecosystem services at risk of wildfire (Chamberlain 2020).

Another important dimension of values is the extent to which they are thought of as stable or dynamic, which varies with different conceptualisations (Rawluk et al. 2019). Core values are considered relatively stable but may change slowly with broader social changes and can drive change in other parts of the social ecological system, for example through a critical mass of people bringing particular values to the fore to influence management (Jones et al. 2016). Some approaches to studying values are concerned with how they are situated in particular contexts and practices, e.g. 'cultural values' (Stephenson 2008) or in processes related to 'place' (Beilin and Reid 2015). When in a particular situation, or taking positions on an issue, people apply a group of values that will be different for each situation (Hansis 1995). In disasters, the values invoked have been found to change throughout different phases. In the preparedness and response phases of Hurricane Michael in Florida, safety and resource efficiency were the most important values, while in the post-disaster recovery and mitigation phases, community cohesion, adaptability and growth were most important (Pathak et al. 2020).
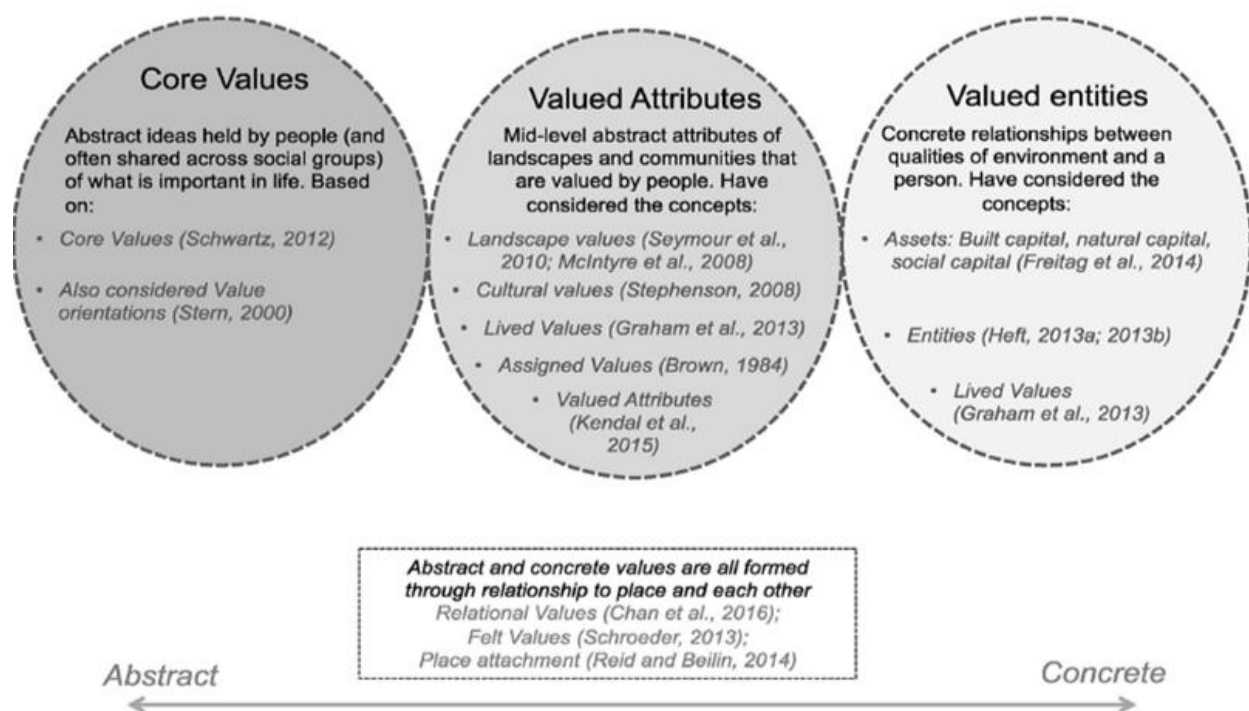
Figure 3. Conceptualisation of values of the Victorian public that can be affected by bushfire. This conceptualisation integrates a breadth of definitions of values into a form that can be applied to bushfire policy and practice.

The understanding of values of the public noted above (Rawluk et al. 2017, Williams et al. 2018) has been applied in bushfire risk planning, community engagement and research in Victoria. Categories of valued attributes were translated into a Valuation Framework to provide guidance for bushfire risk planning in Victoria from 2018 (Rawluk et al. 2020). This encouraged attention to unfamiliar values, such as Indigenous cultural heritage, and in some cases, practice change to incorporate them in decision-making (Williams et al. 2021). Similarly, in the development of a landscape DSS for forest and fire, a list of valued attributes was combined with ecosystem services (climate regulation) and policy concerns (implementation cost) to select values for modelling changes in response to climate, fire and management. This process highlighted the benefit of selecting an interdisciplinary set of values, which included all those considered important in relation to the issue, an important principle in structured decision-making (Gregory et al. 2012). These examples provide a starting point for selecting a set of values to structure consideration of the impacts of climate change on bushfire risk (Table 1). Other applications of values in community engagement are discussed later in this report.

Table 1: Values for considering the impacts of climate change on bushfire risk

Values	Basis for selecting the value
Natural environment (biodiversity, carbon, water)	The publicly valued attribute 'Natural', *the life support function of ecosystems for the diversity of living beings* (Williams et al., 2018). This value is labelled 'Environment' in the DELWP Valuation Framework for bushfire management (Rawluk et al. 2020), so this term has been added. Carbon is not prominent in values identified by members of the public but is important to include for this purpose. Like some other ecosystem services, 'climate regulation' benefits people, whether they are aware of it or not (Costanza et al. 2017). Different ecosystem services are often disaggregated but are combined for this purpose.
Community enjoyment of the natural environment	The term 'community enjoyment' is adopted from Forest Management Planning objectives to describe the benefits to human wellbeing of spending time in natural areas. It includes experiential valued attributes: *the value of natural areas for the opportunities nature provides for positive experiences and feelings provided to the individual* (Williams et al., 2018) and recreational setting attributes: *valuing the landscape as a location or setting affording some other activity* (Williams et al., 2018).
Livelihoods and economy	The publicly valued attribute, 'Livelihoods and production', *jobs and livelihoods, the local economy and business and the productive capacity of landscape* (Williams et al., 2018). This value includes industries (e.g. forest dependent, agriculture and horticulture) and the livelihoods they support. Economic benefits of visiting natural areas are included here.
Human health (life and physical health)	In bushfire policy frameworks and practice, priority is given to identifying risk to human life (DSE 2012), often represented in risk modelling as loss of houses. The publicly valued attribute, 'Human health' is broader, including *human life, physical, and mental health* (Williams et al., 2018). Here human health is divided into physical and mental health, reflecting different approaches to understanding these. Physical health includes impacts on health of poor air quality due to smoke, which is also understood through modelling.
Human health (mental health)	See above.
Human relationships (family, friends and community)	Publicly valued attribute, *the affectionate and supportive relationships people have with one another* (Williams et al., 2018). This is sometimes included in Human health (e.g. in the Valuation Framework, Rawluk et al. 2020), but for this purpose (informing community engagement) is included as a separate value
Animal welfare	Publicly valued attribute, *the welfare and well-being of farm animals and pets* (Williams et al., 2018). This is included in the DELWP Valuation Framework (Rawluk et al. 2020).
Infrastructure	Infrastructure is included in bushfire policy frameworks and practice (DSE 2012). A publicly valued attribute, 'Sense of normality', *the ability to go about normal daily life with a sense of security*, is broad in scope, but includes the services provided by infrastructure.
Cultural/personal history and heritage – non-indigenous	DEECA staff have legislative responsibility to protect cultural heritage. Indigenous and non-indigenous heritage are managed by different groups within DEECA and so are included as separate categories. Social research findings also emphasise personal history in the valued attribute, 'Personal history and identity', *the sense of identity associated with a home, and the personal memories held in possessions such as photos and other sentimental items* (Williams et al., 2018).
Cultural and personal history and heritage – Indigenous	See above.

Social values were identified through qualitative research and a survey with members of the Victorian public. They are shown here in descending order of importance (Figure 10, Williams et al. 2018).
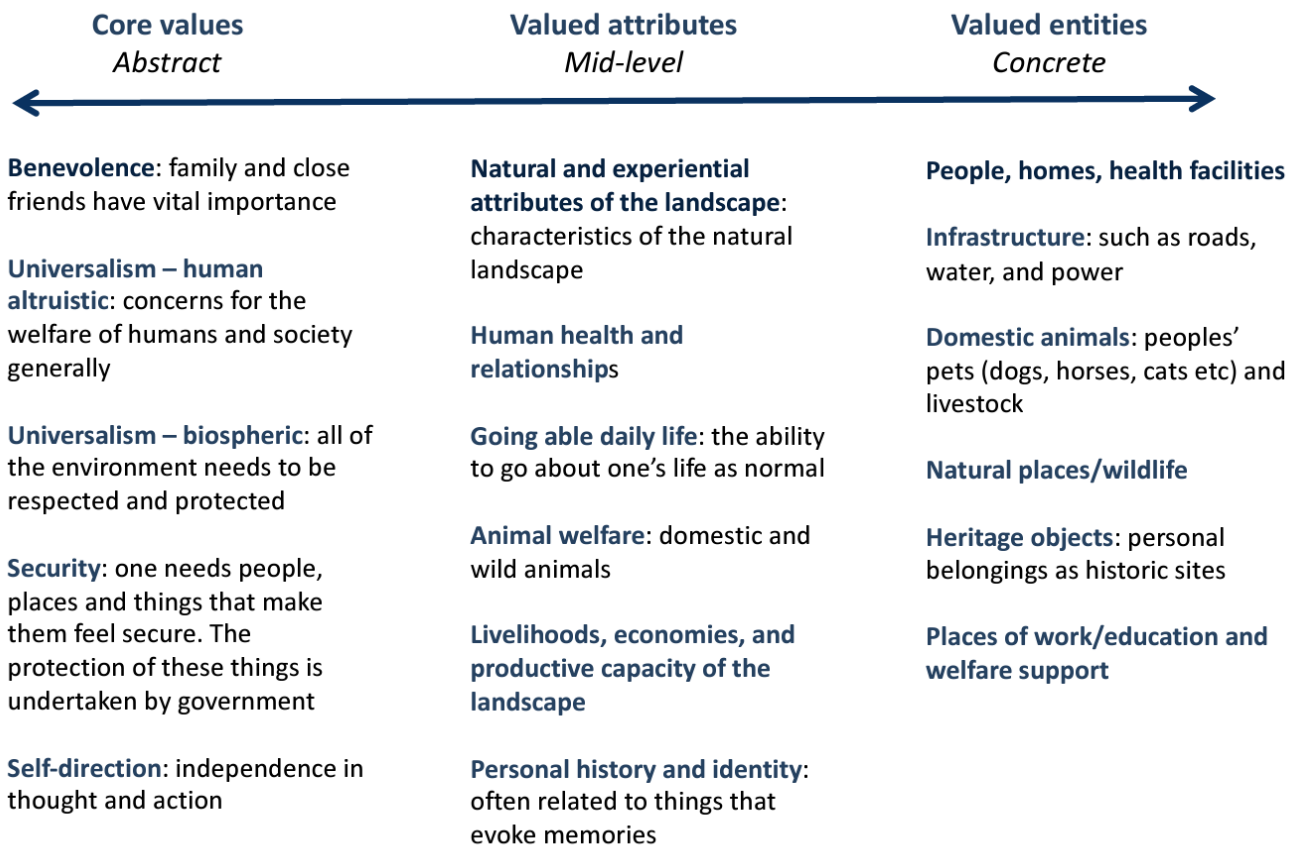
Core values
Abstract

Valued attributes
Mid-level

Valued entities
Concrete

Benevolence: family and close friends have vital importance

Universalism – human altruistic: concerns for the welfare of humans and society generally

Universalism – biospheric: all of the environment needs to be respected and protected

Security: one needs people, places and things that make them feel secure. The protection of these things is undertaken by government

Self-direction: independence in thought and action

Natural and experiential attributes of the landscape: characteristics of the natural landscape

Human health and relationships

Going able daily life: the ability to go about one's life as normal

Animal welfare: domestic and wild animals

Livelihoods, economies, and productive capacity of the landscape

Personal history and identity: often related to things that evoke memories

People, homes, health facilities

Infrastructure: such as roads, water, and power

Domestic animals: peoples' pets (dogs, horses, cats etc) and livestock

Natural places/wildlife

Heritage objects: personal belongings as historic sites

Places of work/education and welfare support

Figure 10. Values of the Victorian public that can be affected by bushfire in terms of ranked importance (Williams et al. 2018)

2.1.2 KNOWN IMPACTS OF CLIMATE CHANGE ON BUSHFIRE RISK IN VICTORIA

It is only recently that widespread claims of increased fire activity and fire severity have been backed by strong published evidence. In contrast, there is a broad and growing body of evidence for worsening fire weather conditions, which has recently been extended to fuel moisture due to its links with temperature and humidity (Nolan et al. 2021; Abram et al. 2021). In general, there is considerable spatial and seasonal variability in observed trends in fire activity, fire severity and fire weather, including some areas absent of any trend. Fire activity trends are particularly sensitive to the selection of start and end dates. Evidence for changes in fuel load and ignition is limited but this is likely to change in the coming years.

Canadell et al. (2021) showed that there has been an increase in area burnt by fire in Australia between 1990 and 2020. This trend is stronger in forests and stronger still over the autumn-winter period. In terms of agency records, three of the four '1 million hectare' seasons since 1930 have occurred after the year 2000 (Figure 4). Canadell et al. (2021) note that these trends contrast with declining trends in forest extent due to land clearing and increasing suppression resources. A consequence of these changes is a declining mean time since forest fire in recent decades. The remarkable 2019-20 season had an outsized effect on trend detection over the last twenty years in NSW, Victoria and South Australia (Filkov et al. 2020). Prior to the Black Summer fires, trends in area burnt, number of fires, life loss and house loss in these three states were often not significant for the period 2003-2020. Trend analysis that dampens the effect of outliers such as the 2019-20 season failed to detect a trend in annual area burnt in south-eastern Australian forests between 2001 and 2019 (Jones et al. 2022). Earlier studies found mixed fire activity trends in south-eastern Australia in the face of recent warming (Bradstock et al. 2014). Williamson et al. (2016) provide an overview of the baseline of variability – geographic, interannual, seasonal and diurnal – in Australia's fires over the satellite record.

Collins et al. (2021) found that the proportion of high severity fire has been increasing since 1988 in wet forests and less fire-prone rainforests and woodland communities. In contrast, the proportion of high severity fire in dry forests has remained stable. The actual amount of high severity fire – rather than the proportion of any fire that burns at high severity – reached a record during the 2019-20 seasons, due to the massive area affected.
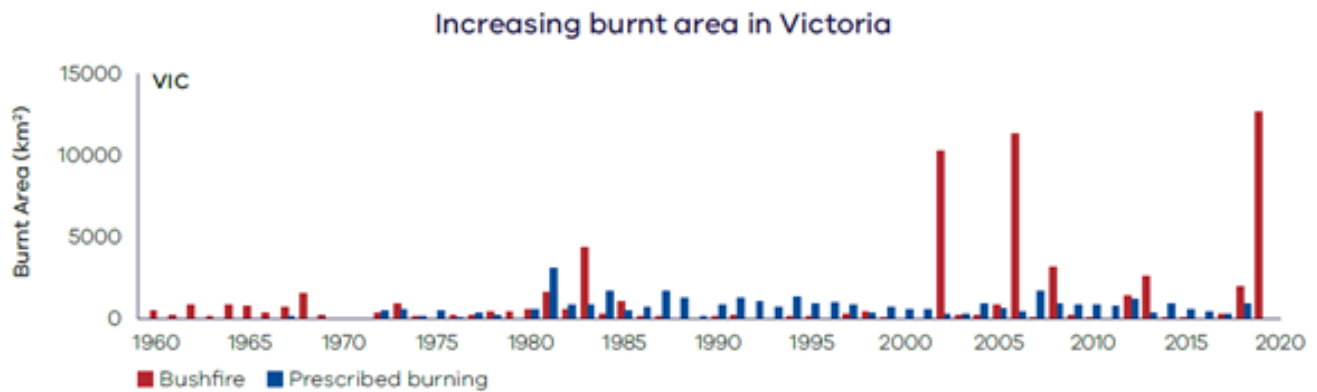
Increasing burnt area in Victoria

Figure 35. Area burnt (km2) from bushfires and prescribed burns in Victoria between 1960–61 to 2019–20. Red bars represent bushfires and blue bars represent prescribed burning. Source: Canadell et al., 2021, (Supp. Fig 4), under CC BY 4.0. Font changed

The driving forces for these changes – worsening surface fire weather conditions and seasonal drought severity – are well documented (Clarke et al. 2013; Dowdy 2018 FFDI; Harris and Lucas 2019; Abram et al. 2021; Jones et al. 2022). Collins et al. (2022) show how these conditions have increased the risk of both large fires and fires burning at high severity in south-eastern Australia since 1950. Wind changes are not included in major fire danger rating systems, but a recent study of the frequency and regional variation in wind changes in Victoria is likely to pave the way for an analysis of temporal trends in this important risk factor (Mills et al. 2020). Above the earth's surface, upper atmospheric conditions associated with fire storms (pyrocumulonimbus, or pyroCB) have been found to be increasing in south-eastern Australia (Dowdy and Pepler 2018). Another study found an increasing coincidence of days with both high atmospheric instability and high fire danger, but that this was due to more extreme fire weather conditions, not greater atmospheric instability. A global study of pyrocumulonimbus events between 2013 and 2021 noted high occurrences in 2019 and 2021 but no trend was identified (Fromm et al. 2022). Cold fronts have long been recognised as important risk factors for fire behaviour (Mills 2005a, 2005b), and it has recently been shown that the frequency and intensity of cold fronts has increased in south-eastern Australia in recent decades (Jones et al. 2021).

Climate change has caused at least some of the observed increases in fire weather in south-eastern Australia, via increased temperature (van Oldenburgh et al. 2021). Climate change-caused temperature increases were implicated in extreme fire weather in Queensland in 2018, but no clear influence was identified in an analysis of eastern Australian extreme fire weather during 2017 (Hope et al. 2019). The complex nature of fire weather conditions and, wildfire risk more broadly, make attribution difficult but progress is likely in the coming years. Recent major fire events globally were found to be much more likely due to human-caused climate change (Jones et al. 2024).

The duration, completeness and quality of ignition datasets has to date precluded detailed trend analysis, but it has been shown that parts of south-eastern Australia including Victoria have been exposed to an increased frequency of low-rainfall thunderstorm environments, such as dry lightning (Dowdy 2020). Likewise, trend analyses of fuel load are generally lacking, partly due to difficulties in reconstructing historical fuel values. No trend in fuel accumulation curve-based estimates of surface, elevated and bark fuels was identified in the 30 years prior to the 2019-20 season (Nolan et al. 2021). Notably, the 2019-20 fires did not occur against a backdrop of anomalously high fuel amount (Bradstock et al. 2020; Nolan et al. 2021) or fuel hazard (Collins et al. 2022). **Over the longer term, evidence is emerging of changes in vegetation related to colonisation and cessation of Aboriginal burning practices, including a shift towards more shrubs and fewer grasses in forest and woodland areas in south-eastern Australia** (Mariani et al. 2022).

Climate Change Impacts in Victoria and south-eastern Australia

a. *Bushfire risk*

Some studies predict future fire activity, usually by linking it with some proxy for fire that can be derived from climate model output, such as temperature or drought. Where climate change studies focus on the drivers of fire, rather than fire itself, fire weather has featured most prominently (as with observational studies). **There has been relatively little work on climate change effects on fuel amount, fuel moisture and ignition, particularly in Victoria and south-eastern Australia.** Integrated studies that attempt to account for multiple, or even all four drivers, are rarer still. However, there is a large and diverse body of research on the drivers of bushfire risk, fire behaviour and downstream effects of fire on the plants and ecosystems, which identify some aspect(s) of climate that influence these phenomena. These studies thus provide important indirect evidence of the likely effects of climate change, even where such impacts are not explicitly modelled.

Key issues in directly modelling climate change effects on fire and its drivers include:

- The range of potential changes explored.
- The scale of inputs and outputs
- The local fire regime context
- The centrality of rainfall

The range of potential changes explored can be addressed by using different climate models, different emissions scenarios and by exploring the upper and lower extremes of potential change. For a given emissions scenario, even something as seemingly straightforward as selecting the highest (or lowest) change model can be problematic. It is not generally the case that the same model will project the highest (or lowest) change for all fire-relevant weather variables, at all times of the year, in all locations. Ideally, an objectively designed climate model ensemble will be used, ensuring not just a range of potential climate futures are sampled, but also that the weakest models are excluded. Model independence can also be addressed using objectively designed ensembles. This ensures that models that perform similarly (particularly with respect to their biases / errors) are not over-represented. Any time that more than one scenario or model is used, scientists and decision makers must deal with the communication and interpretation of uncertainty.

It is critical to be specific to the scale of inputs and outputs. While decision-makers understandably prefer outputs relevant to the scale at which they operate – and generally at the highest spatial resolution possible – most studies invariably involve integration of a wide range of input datasets and hence a wide range of spatial resolution. High resolution outputs must be interpreted in the context of any lower resolution datasets that contributed to the analysis. Nor is it the case that high spatial resolution necessarily implies high confidence or accuracy in outcomes. Nevertheless, where regional climate model data is available there are often good reasons for using it in preference to global climate model data, including improved ability to represent important climate processes and finer scale land surface properties such as topography, land use and coastline shape.

Every fire regime will have a local context. Equal changes in fire weather (or any other driver) will not necessarily translate to equal changes in bushfire risk in different fire regimes, particularly where the driver in question does not currently limit overall fire incidence. The complexity and disagreement between models regarding projected future changes in rainfall is in stark contrast to the unified and relentless projections of increasing temperatures (Grose et al. 2020). Broadly speaking, the projections suggest a drying of southern Australia during winter and spring, but uncertain changes in summer and autumn (see Figures 5 and 6 below). Changes in rainfall will influence vegetation growth, moisture, ignitions and fire weather, not to mention fire activity, impacts and post-fire recovery.
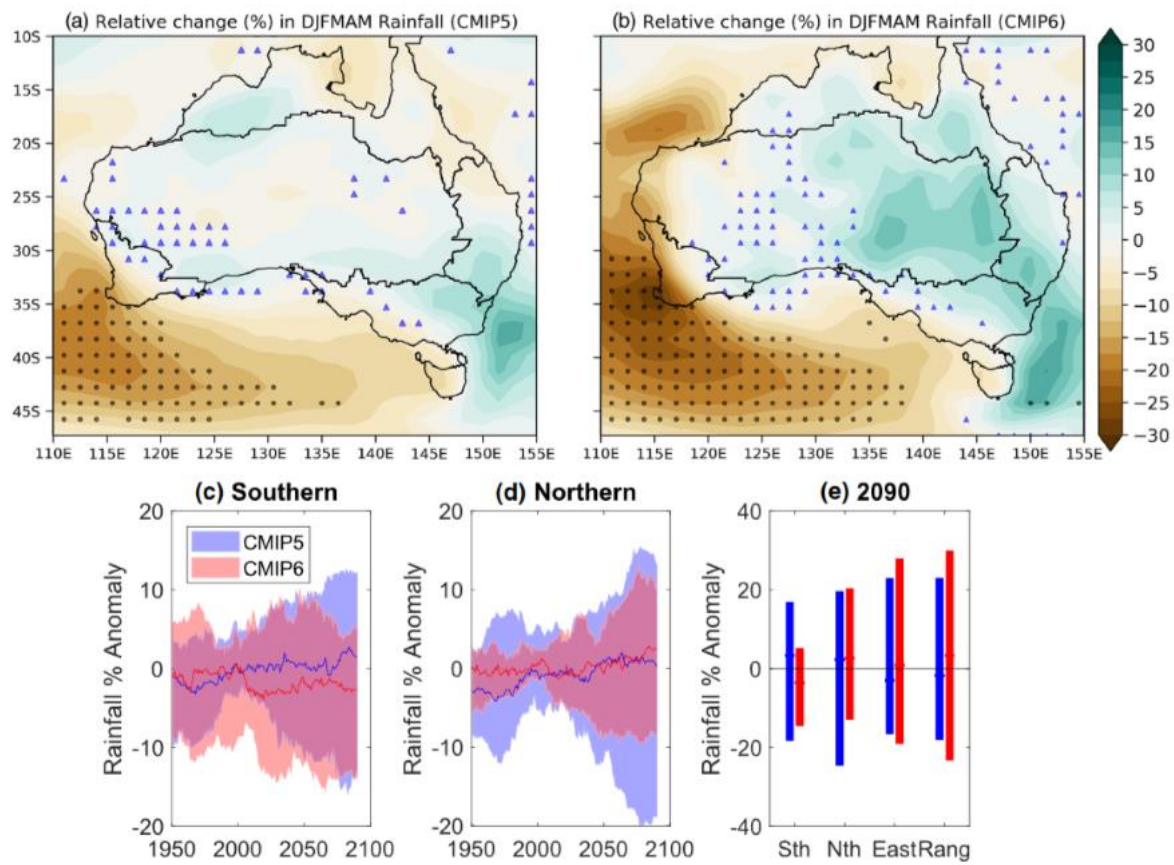
Figure 5. Rainfall projections in summer and autumn (Grose et al. 2020)
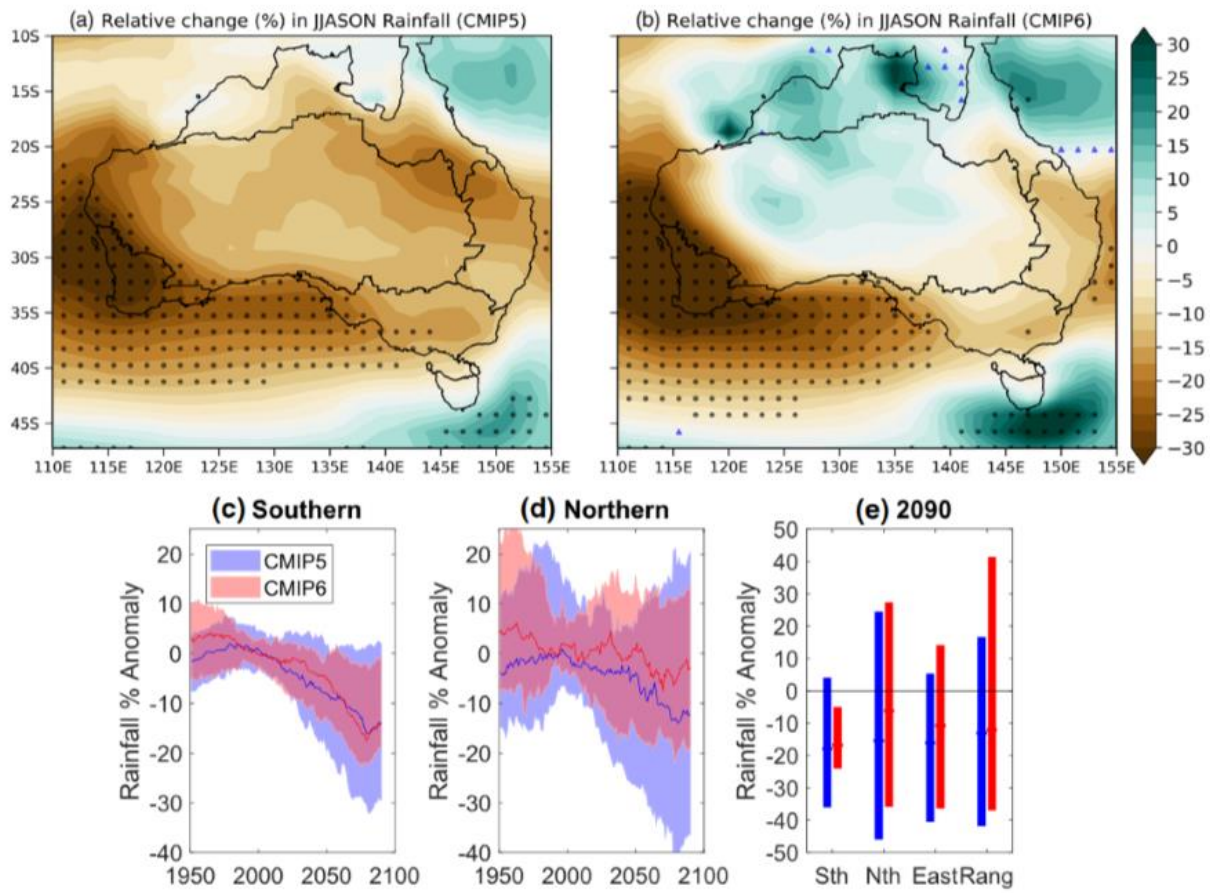
Figure 6. Rainfall projections in winter and spring (Grose et al. 2020)

a. *Weather*

The weight of evidence points overwhelmingly towards increased bushfire risk due to climate change effects on fire weather conditions. Key issues here include:

- Disentangling changes at various points in the distribution of fire weather I.e. mean changes, changes in extreme values, changes in mild and moderate conditions (for instance those favourable to prescribed burning);
- Seasonal timing of changes, including potential shifting and lengthening of the fire season (and corresponding impacts on prescribed burning 'season');
- How fire weather is represented. Common surface weather indices include the Australian McArthur Forest Fire Danger Index and the Canadian Fire Weather Index. Other simpler options are available. The Haines and C-Haines Index represent atmospheric stability; and
- The role of modes of climate variability in driving fire danger. For instance, Mariani et al. (2018) highlight the changes to the Southern Annular Mode under climate change as potentially driving increased fire activity in southern Australia. Future trends in the El Nino Southern Oscillation and the Indian Ocean Dipole are less clear, but their contributions to fire danger in southern Australia are well-established, if complex, and future intensification of these modes has been highlighted as a potential additional risk factor.

In Victoria, Clark et al. (2021) examines 99th percentile FFDI, days over various thresholds, fire season length and opportunities for prescribed burning.

b. *Fuel*

Bendall et al. (2022) explored the response of different temperate eucalypts to elevated atmospheric CO2 effects, finding drought was likely to reduce any additional growth caused by carbon dioxide fertilisation. They measured a range of properties under different CO2 and drying/wetting conditions.

See below for McColl-Gausden et al. (2022), Clarke et al. (2016) and Matthews et al. (2012), which included fuel load in bigger climate change studies.

c. *Fuel moisture*

Clarke et al. (2019) and Di Virgilio et al. (2020) included VPD-based fuel moisture models in their assessments of future prescribed burning weather conditions, but did not fully investigate fuel moisture changes directly. Di Virgilio et al. (2020) found that fuel moisture was likely to decrease over much of south-eastern Australia in May and June, but that this would have opposing effects on prescribed burning window availability – increasing such days in much of Victoria and the southeast, but decreasing them in more arid areas to the north.

See below for Matthews et al. (2011), which included fuel moisture in a bigger climate change study.

d. *Ignition*

See McColl-Gausden et al. (2021) which included ignition in a bigger climate change study.

e. *Multiple fire drivers*

UNEP (2022) provides a 'rapid response' assessment of the impact of climate change on bushfire risk globally. This extensive (126p) report provides includes sections on current fire regimes, recent changes and future projections. Projections are based partly on Kelley et al. (2019), Kelley et al. (2021) and Frieler et al. (2017). Increases in burnt area appear to be projected for south-eastern Australia in general but the global analysis suggests the magnitude is far lower than in other fire-prone parts of the world. This report explores projected changes in fuel continuity and fuel moisture as potential drivers of increased fire activity. They summarise potential climate change impacts on bushfire globally in Figure 7 reproduced below. A smaller (18p) 2022 UNEP report (led by Dowdy et al.) covers similar ground, with a focus on communication and graphic design rather than technical detail.

Clarke et al. (2019) and Di Virgiliio et al. (2020) include measures of fire weather and fuel moisture in their assessments of the future availability of prescribed burning weather conditions. The complex changes they report, including both declines, increases and seasonal shifts, suggest more work is needed to understand the current distribution of such conditions. Clarke et al. (2016) examine both fire weather and fuel load across Australia. Their fire weather findings are broadly similar to those noted above, while they find widespread increases in fuel load linked to increased productivity. Importantly, their fuel model did not account for nutrient limitations or drought, highlighting the importance of studies such as Bendall et al. (2022). Clarke (2015) provides a concise overview of projected changes in bushfire risk in NSW, in a report similar in scope to this one.

Abram et al. (2021) summarise the evidence for climate change impacts on the four drivers (switches) of bushfire risk, noting areas of uncertainty (Figure 8 reproduced below).
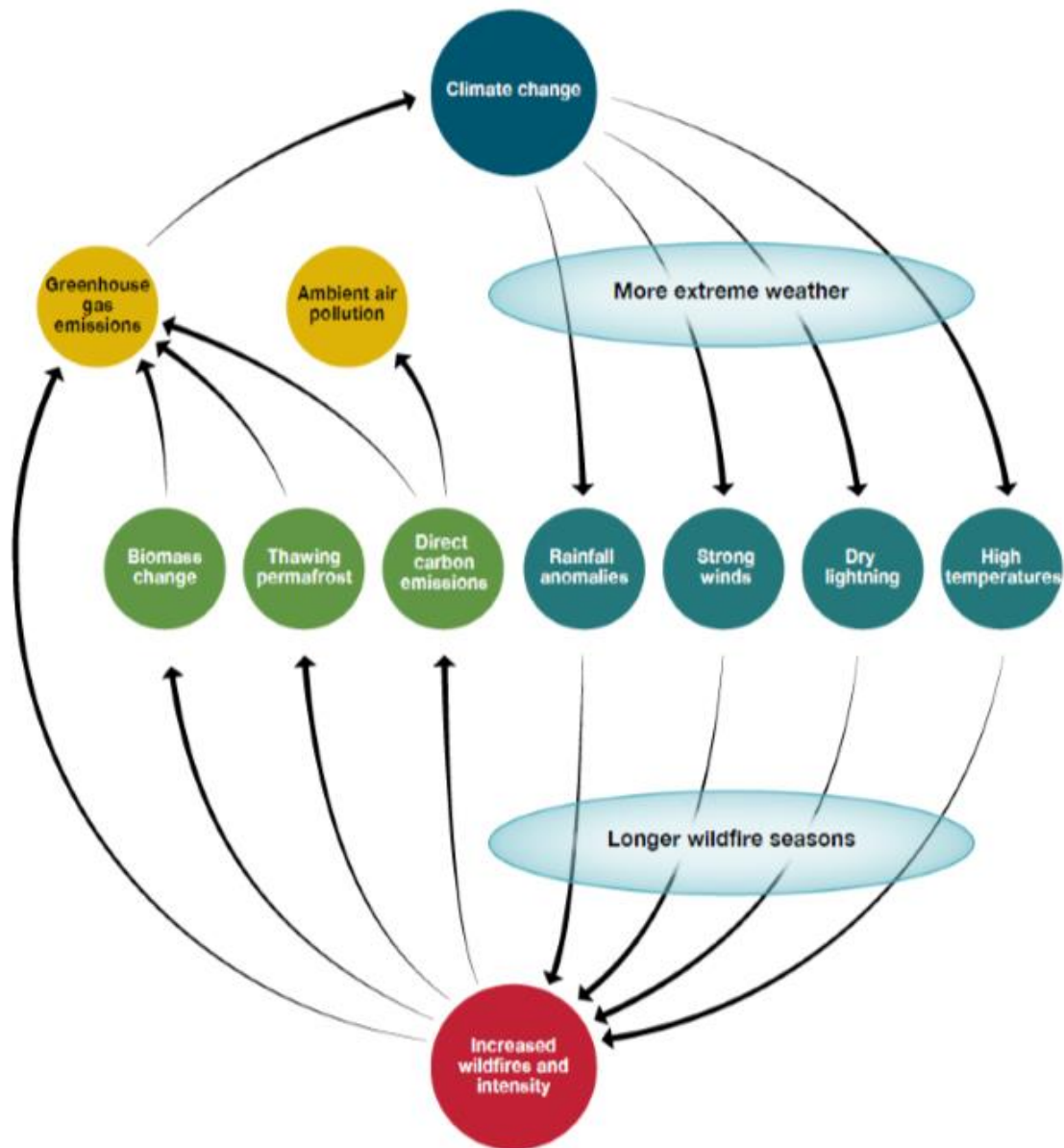
Figure 7. Potential reinforcing feedback loop of climate change on bushfires (UNEP 2022).
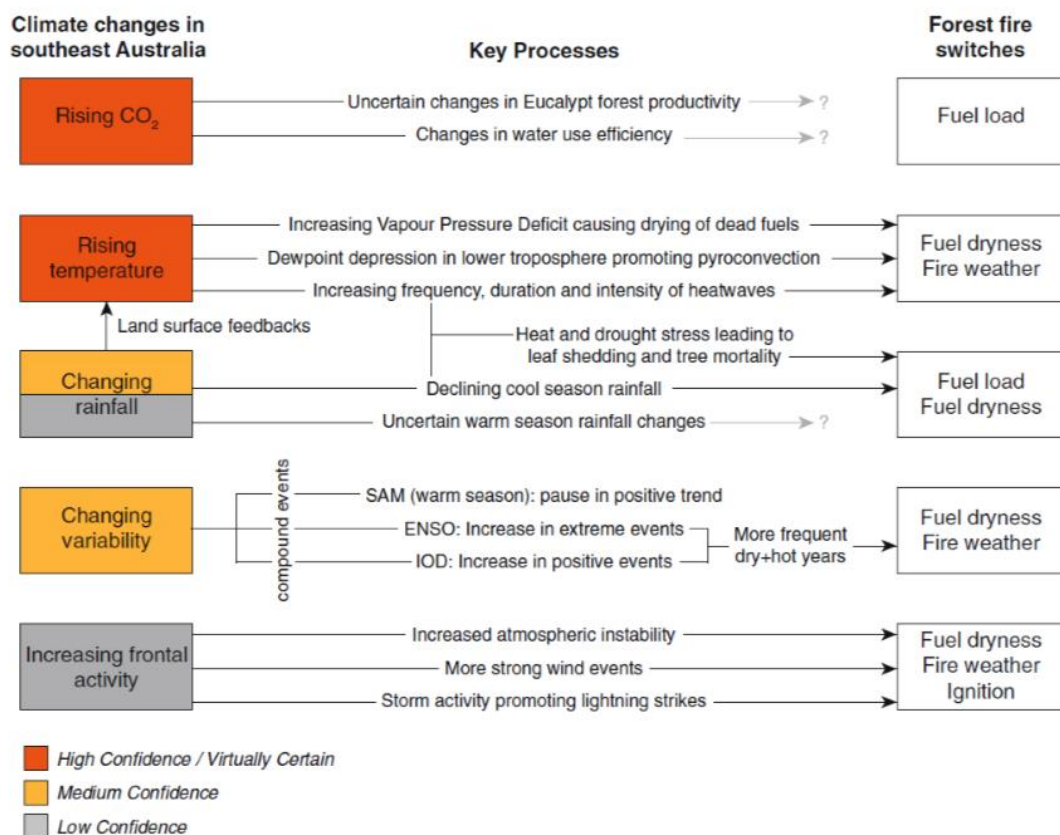
Figure 8. Summary of anthropogenic climate changes that are expected to alter forest fire risk in southeast Australia (Abram et al. 2021)

f. *Fire activity and downstream impacts*

Harris et al. (2019) documented links between fire activity and interannual climate variability in Victoria, using those links to predict increased fire activity in a warming world.

McColl-Gausden et al. (2021) investigated climate change impacts on alpine ash in Victoria. Their model included climate change impacts on fire weather and ignition probability, which flowed through to predicted fire activity and subsequent impacts on these obligate-seeder forests. They predicted fires of greater intensity and frequency, posing an immaturity risk to 2/3 of the current alpine ash distribution.

A subsequent study (McColl-Gausden et al. 2022) explored climate change effects on fire activity across an aridity gradient in south-eastern Australia. This study incorporated climate change effects on fire weather, ignition probability and fuel load, again feeding into fire behaviour simulations. As with their earlier study, they found a general tendency towards increased area burnt, increased fire intensity and decreased fire interval. However, projected fuel load changes either enhanced or dampened these effects, pointing to the crucial interplay between fuel and climate in the distinct fire regimes of south-eastern Australia.

Earlier fire behaviour simulation studies highlighted the potential effects of fire weather changes, including their implication that prescribed burning rates would need to increase, potentially to unfeasible levels, in order to maintain historical rates of risk mitigation (Bradstock et al. 2012).

Clarke et al. (2022) modelled the frequency of hot, dry conditions that drive fire activity in the world's forest biomes. They projected increased forest flammability in south-eastern Australia, but as with the UNEP (2022) report, these increases were of a relatively lower magnitude on a global scale. Clarke et al. (2022) noted the potential for increased forest fire activity to disrupt globally significant carbon stores in the Amazon and Central Africa. They also pointed to the significant impacts of increased forest fire smoke on human health, a topic elaborated on in the review of Xu et al. (2020).

Studies with climate change implications

Clarke et al. (2020) formally modelled the influence of the four key drivers of fire – fuel, fuel moisture, ignitions and fire weather – on fire activity in southern Australia. They found that increased frequency of severe fire weather conditions could drive increased risk in forests but decreased risk in grasslands. They also noted that the shifts between vegetation type could change risk more than modifications within existing vegetation type, for instance from prescribed burning. Duff et al. (2018) examined the relationship between fire activity and fuel dryness across different vegetation types in Victoria, suggesting fundamental differences between vegetation types, dryness and fire risk. Similar work was carried out earlier by Nolan et al. (2016), using vapour pressure deficit rather than Drought Factor.

Increased frequency of severe fire weather conditions, and where this leads to elevated risk of fire to forested lands, raises the prospect of changes in fire regimes which may have implications for natural environment values. In Victoria in recent years there has been substantial research in recent years exploring the environmental consequences from increased frequency of severe fire. In part, this research has been possible due to the extensive areas of the landscape which has been burned between 2000 and 2020, which has led to extensive areas of forests being two, three and four times in relatively quick succession (Geary et al. 2022; Figure 9).
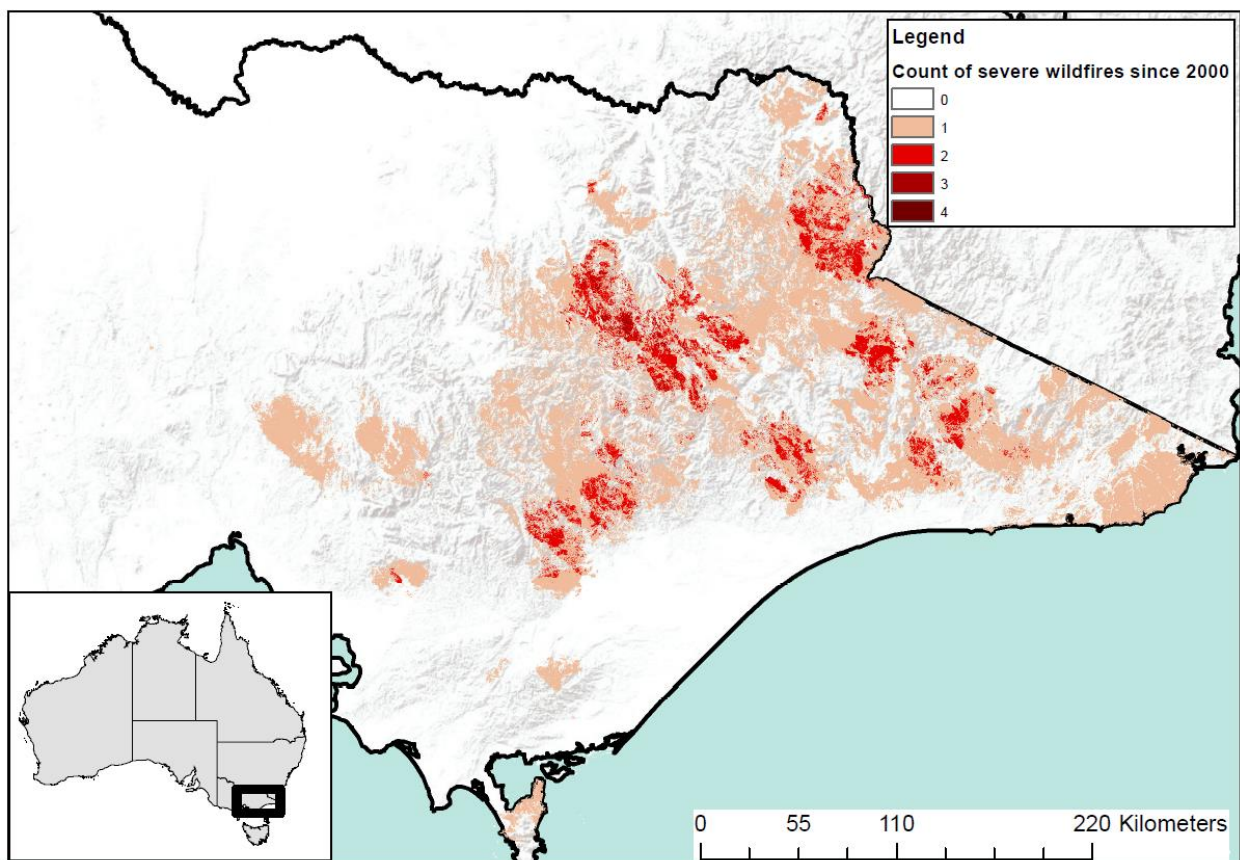
Figure 9: Extent of public land impacted by severe wildfires between 2000 and 2020. The deeper the red, the greater the frequency of severe fires (Geary et al, 2022).

In terms of forest structure and composition, an increase in the frequency of severe fires can have implications for a range of forest types. A well-known example of the risk of severe and frequent fires relates to 'ash type' forests, which occur in Victoria in higher elevation regions. These forest types have a relatively long period in which regenerating trees do not produce significant amount of seeds, and as such when severe fires re-occur within 15-20 years of one another, these forest types can undergo local population collapse and transition to different forest types (i.e., from tall open forest to low open shrubland or woodland) (Bowman et al 2014). The ramifications for other, more fire-tolerant forest types, is still being understood, however there are some notable trends. Fairman et al. (2022) investigated the influence of short interval and/or high severity fires on carbon storage and stability in temperate eucalypt forests of south-eastern Australia. The study, along with earlier ones (Fairman et al. 2019; Collins et al. 2021) point to the likelihood of significant impacts of increased fire activity, particularly high severity fire, on forest structure, resilience, and carbon storage.

Where severe fire weather conditions are conducive to allow larger and more severe fires to burn, the prospect of impact to parts of the landscape which have typically protected from fire (i.e., refugia) arises. In these locations, sensitive plant communities (such as rainforest) and threatened species may persist, and therefore may be impacted by changing conditions. For example, the foliovore Greater Glider can typically survive wildfires where fires are restricted to the understorey (Campbell-Jones, 2022). Studies have indicated that, increasing fire weather and drought conditions will likely reduce the extent of refugia (Collins et al, 2019).

Bradstock et al. (2012) explored the potential for prescribed burning to mitigate greenhouse gas emissions from forest fire in south-eastern Australia. Noting the relatively low rates of prescribed burning leverage characteristic of these forests, they found that overall fuel consumption was likely to increase with additional prescribed burning, even as mean fire intensity declined.

Clarke et al.'s (2022) study of the role of prescribed burning and fire weather in determining risk during the Black Summer fires suggested that future increases in dangerous fire weather conditions are likely to undermine prescribed burning risk mitigation efforts, consistent with Bradstock et al.'s (2012) earlier work that directly modelled weather driven changes in risk mitigation.

Dorph et al. (2022) developed a model of the drivers of bushfire ignition in Victoria with clear climate change implications. Along with supporting previous models showing the importance of fire weather and proximity to infrastructure, they identified a significant role for low fuel moisture (itself a function of climate via vapour pressure deficit) in driving ignitions. **Together these results point to the potential for substantial increases in ignition risk under warmer, drier future climates.**

Thomas et al. (2014) found complex links between climate (temperature and rainfall) and fuel properties such as load, litterfall and decomposition in south-eastern Australia. Their study suggested a pivotal role for future rainfall changes in determining the response of different vegetation types to climate change. These complex responses to rainfall contrasted with a relatively uniform prediction of declining litter load in response to temperature increases.

2.1.3 HOW SOCIAL VALUES ARE IMPACTED BY BUSHFIRE IN VICTORIA

Community enjoyment of the natural environment

When people interact with environments, including forests, they experience emotions such as pleasure or aversion and use thought-based coping to come to terms with any negative feelings (Kuller et al. 1992). While such experiences may seem insignificant, research indicates they are important for wellbeing, which is promoted through physical activity, socialising and relaxation in natural areas (Hartig et al. 2014, Marselle et al. 2021). Such experiences also shape environmental attitudes and behaviours, with connections to nature leading to environmental concern and actions such as land care (Gosling and Williams 2010). Nature experiences also inform life choices, including decisions to live in and become attached to natural landscapes that may be at risk of bushfire (Beilin and Reid 2015). **Studies of bushfire impacts on people have tended to focus on other factors, but there are a few studies of human interactions with the fire-affected environments. These provide a starting point for considering how these experiences may change over time with a changing climate.**

Four factors are helpful for understanding human interactions with burnt forests: the physical environment; the social environment; the activities a person engages in; and their personal resources, such as prior experience with an environment (Kuller et al. 1992).

The physical environment factor consists of forests affected by bushfires and under changing fire regimes, as is discussed in the previous section. Bushfire primarily affects experience by changing forest density. Immediately after a bushfire, a lack of enclosure and associated protection from the elements causes discomfort. Then in some forest types, particularly obligate seeders, dense regrowth creates too much enclosure, which can be experienced as uncomfortable and limit activities (Figure 11, for an example). The changes are less dramatic for resprouter forests. A second factor is the presence of dead trees. These elements detract from aesthetic and restorative experiences, however many people find aesthetic interest in them through cultural associations such as with sculpture and architecture (Ford et al. submitted).
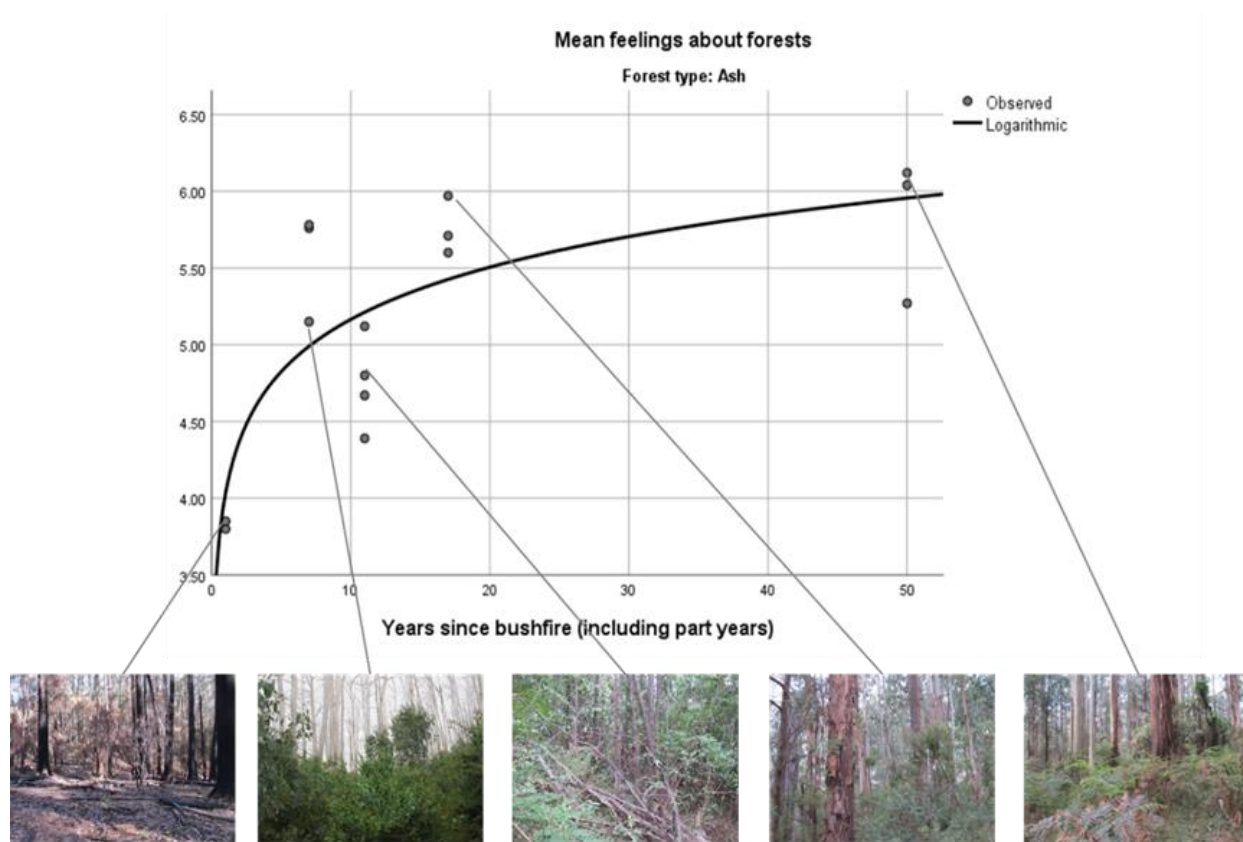
Figure 11. Obligate forests and feelings about them over time (Ford et al. submitted)

Considering only the physical environment's influence on experience would be an over-simplification. In the first few years after a severe bushfire, experiences are very varied in type and valence for reasons linked to other factors, particularly activity and personal resources (Ford et al. submitted).

The activity factor includes different relationships to forests as a recreational setting, living environment or workplace. Visitors to forests for recreation primarily report an aesthetic experience; that is, feelings of pleasure or displeasure on sensing the environment (Ford et al. submitted). Wilderness recreationists have reported being saddened by recently burned landscape, but also fascinated, such that their experience and satisfaction were not negatively affected overall (White et al. 2020, Schroeder and Schneider 2010). Experiences are more negative for campers, who change bookings more than usual after a fire and want to spend less time in burnt areas (Schroeder and Schneider 2010, White et al. 2020). For residents in forested areas, the surrounding landscapes can become part of an imagined home (Reid and Beilin 2015) and longstanding connections to familiar landscapes can be lost following fire (Kooistra et al. 2018). Residents report feelings of sadness and shock, which over time are tempered to differing extents by hope on noticing signs of recovery such as epicormic shoots (Ford et al. submitted).

Personal resources help in coping with loss. One such resource is connection to the natural environment. People with stronger connections to nature experience less psychological distress and fewer symptoms of depression and PTSD after a major bushfire, despite grieving the loss of environments (Block et al. 2019). A possible explanation for this finding is that people with a connection to the natural environment tend to be curious about it following bushfires, which leads to exploration and experiencing the recovering forest, a tangible symbol of hope that becomes intertwined with their own recovery (Ford et al. submitted). This is particularly the case when combined with another personal resource, the belief that fire plays an important ecological role in forests. This is associated with positive perceptions of landscape recovery among residents after fire (Kooistra et al. 2018) and can lead to a relatively quick return of positive feelings after bushfires (Ford et al. submitted).

To our knowledge, there are no studies that clearly demonstrate how experiences of nature will change under a changing climate, but there is some basis for speculation based on the above studies. They suggest that increased fire in the landscape will overall lead to more negative experiences in forests. However, humans may be adapting in two main ways. First, more frequent encounters with burnt forests may mean that a fire aesthetic is emerging in which people become more accustomed to finding aesthetic interest in forest elements such as dead or blackened stems through artistic, cultural or ecological associations (Ford et al submitted 2023, Pyne 2023). Second, beliefs about forests as inherently resilient and dynamic that act as a personal resource for coming to terms with loss may become more widespread as fires are more prevalent. **Exchange of information about the role of fire in forest ecology may strengthen both these adaptations over time.**

Human health (mental health)

The University of Melbourne led a large study, Beyond Bushfires, into the impacts of the Black Saturday bushfires on community member's physical and mental health and well-being over time. They found the majority of people in impacted communities were resilient, but a significant minority reported posttraumatic stress disorder, severe psychological distress and depression. There was progressive recovery as the proportion of people experiencing these symptoms reduced over time, but some people experienced delayed mental health impacts. Social networks, family, community and connection to the natural environment were important to recovery. The final report of this project provides a synthesis and summary https://mspgh.unimelb.edu.au/__data/assets/pdf_file/0008/3043187/Beyond-Bushfires-Final-Report-2016.pdf). We direct readers to it rather than reporting all of the contents here.

A recent review of international literature about climate change and mental health provides a broader perspective. Risks posed by climate change include temperature increases, drought, rainfall and flood in addition to bushfires. Climate change affects individual and community mental health through direct pathways, such as exposure to traumatic events and through indirect pathways via the social, political and economic determinants of mental health, such as unemployment and housing. Associated with climate change events are psychological distress, worsened health of people with pre-existing mental health conditions and increased hospitalisations and mortality. Resilience is linked to community-based models of health and people's connections to community and environments (Charlson et al. 2021).

Climate change risks to mental health are not evenly distributed. In Australia, rural and remote communities disproportionately experience climate change related risks, while having limited access to mental health services (Jones 2020).

Human relationships (family, friends and community)

The Beyond Bushfires project provides a summary of human relationship factors in bushfire recovery. Separation from close loved ones during and immediately after fire is a risk factor for subsequent mental health problems. Involvement in community groups is protective. Living with someone else is protective, but the risks of living alone are offset by group involvement. Bushfires lead to stresses within families through members having different needs (e.g. whether to stay or relocate), attachment insecurities linked to other mental health outcomes, and challenges in parenting children affected by trauma (Gibbs et al. 2016).

There is a small body of literature about the gendered nature of bushfire management. Formal disaster and emergency management tends to be male-dominated (Tyler and Fairbrother 2013), with some authors arguing that the gendered nature of preparedness and fire-fighting is a means by which traditional gender roles are maintained in rural Australian society (Eriksen et al 2010). Women's roles tend to be primarily in disaster recovery (Tyler and Fairbrother 2013). After the East Gippsland fires in 2003, women in farming families played a key role in applying for recovery help (Whitaker et al 2012). Gender norms are seen in the largely masculine activity of 'stay and defend' which may conflict with agency calls to 'leave early' (Tyler and Fairbrother 2013). During the Black Saturday bushfires, there was evidence of household disagreements in which, in almost all cases, men wanted to stay and defend while women wanted to leave. Overall, more men lose their lives to bushfires than women (Handmer and O'Neil 2016).

At the community level, characteristics such as sense of community and collective problem solving are important resources that support preparedness for bushfires and enhanced resilience (Prior and Erikson 2013). Community cohesion can also be affected by bushfires and particularly by how the recovery is managed by local agencies. Community cohesion can increase temporarily after a fire (Whitaker et al 2012) or decrease if poorly managed by local authorities (Prior and Paton 2008). We discuss community in more detail in later sections.

Animal welfare

The welfare of animals is important to the public of Victoria, with domestic animals valued as part of people's livelihoods and for the close relationships people have with them (Williams et al. 2018, Rawluk et al. 2020). Impacts of bushfires on animals are therefore intertwined with impacts on humans. During the Black Saturday bushfires, it was estimated that 11,000 farm animals died leading to economic losses of more than $18 million and other associated losses, such as of animal genetic history. Such losses also significantly impacted the wellbeing of individual people and rural communities. On the other hand, if people have their animals with them during and after bushfires, it can help them cope with the stresses of evacuation and disaster recovery (Pawsey 2015).

It is recognized that animal welfare needs to be better integrated with all phases of disaster management (Smith et al. 2015). In a study of practice change in bushfire risk planning, regional teams in DELWP were observed attempting to include animal welfare in planning, but finding they had few connections to the required knowledge (Williams et al. 2021). A DEDJTR staff member (Pawsey 2015) writes that until recently, animals were considered mainly during the recovery phase (e.g. treatment of injuries) with responsibilities for farm animals and wildlife spread across different agencies and groups. Animals were outside the scope of the Black Saturday Royal Commission, and instead the then Department of Primary Industry undertook its own review. This revealed the need for greater coordination and understanding of the links between people's attachment to their animals and their behaviour (Pawsey 2015). **Animal ownership is now recognized as a risk factor for the survival of humans during disasters, due to failure to evacuate (**Smith et al 2015). Recent disaster planning follows a principle that animals should remain the responsibility of their owners, with clear arrangements made for them during evacuations (Pawsey 2015).

Research about the impacts of bushfires on animal welfare is expanding. **Case studies of farms affected by bushfires have identified the importance of protective factors such as community knowledge transfer, insurance, farm bushfire planning (having a bushfire plan and fire-fighting equipment), backburning and receiving assistance from fire authorities** (Cowled et al. 2022, Smith et al. 2015).

Summary: How values of the public are affected by bushfire

The relevant literature identifying impacts mostly pertains to bushfire, rather than climate change. Most of the relevant literature is about impacts of bushfire, rather than specifically of climate change. We have chosen not to infer impacts of climate change through increased frequency and intensity of bushfires.

Table 2. How values of the public are affected by bushfire

Values	Notes on approach to writing about impacts
Community enjoyment of the natural environment	Recent work on experiences of burnt forests will provide a brief literature review and summary of impacts of bushfire on this value. Impacts of climate change have not been studied specifically, but some inferences can be made based on fire frequency etc.
Livelihoods and economy	Bushfire can greatly impact livelihoods due to loss of income and infrastructure from a disaster. Moreover, areas that are prone to bushfire (such as East Gippsland) have compounding economic vulnerabilities, such as declining farming income (Whittaker et al. 2012). More research is needed.
Human health (life and physical health)	Smoke impacts – Borchers Arriagada et al 2020, smoke impact from 2019/20. December 2020 issue of Medical Journal of Australia has a summary of links between human health, climate change and bushfires (context of 2019/20).
Human health (mental health)	Mental health impacts of bushfire can include depression, anxiety and PTSD (McFarlane et al. 1997). Gibbs et al (2016) at the Melbourne School of Population and Global Health conducted a large study into the impacts of the Black Saturday bushfires on community member's physical and mental health and well-being over time (www.beyondbushfires.org.au). They found progressive recovery, but also delayed mental health impacts. Social networks and the natural environment were important to recovery. Not sure whether there are studies that extend to climate change.
Human relationships (family, friends and community)	Rawluk et al. (2017) identified that the preservation of relationships support recovery from bushfire. Conversely, bushfire can impact human relationships through death, fragmentation, and separation. More research is needed.
Animal welfare	While animal welfare is frequently talked about by bushfire practitioners, little exists in the academic literature beyond Rawluk et al. (2017) that simply identified its importance.
Infrastructure	Quantification of houses lost under Black Saturday and Black Summer, in southeast Australia (Nolan et al and Filkov)
Cultural/personal history and heritage – non-indigenous	Rawluk et al. (2017) identified that members of the public frequently described personal artefacts, such as photographs or items of comfort (a teddy bear) as important, as well as places that support the creation of community (for example the pub). More research is needed. More research is needed.
Cultural and personal history and heritage – Indigenous	Some studies have shown that Indigenous people have disproportionate impacts from climate change. Rawluk et al. (2017) and Sapkota et al. (in press) suggest different and relational approaches to identifying what is important to Indigenous communities. More research is needed, and that which is Indigenous-led.

2.1.4 CONTEXT: SUMMARY

- Climate change is increasing the risk of bushfire to what matters to communities in south-eastern Australia.
- Climate change is increasing the complexity and uncertainty in which the multiple agencies working in bushfire and climate change are needing to respond
- The framework for social values is useful for identifying and monitoring what is important to communities.
- As bushfire risk changes, it is critical to develop ways of encouraging behaviour change that supports community preparation and response to bushfire.
- With the growing occurrence of events that can impact social values, bushfire agencies need to have a greater diversity of community engagement/partnership practices.
- The multiple agencies that work in bushfire and natural disasters from climate change need to adaptively navigate the relationships they have with communities, foster a learning centred practice in community engagement and utilise behaviour centred communications

2.2 LOOP TWO: RELATIONSHIP TYPE

The second loop of the Climate Reflective Practice is to identify the kind of relationship that government or agencies and community want to form. We draw on a relationship typology (Sapkota et al in press) to identify the kind of relationships that are sought.

Ongoing, trusting relationships provide a basis for navigating short-term events (such as bushfire and planned burning) and long-term change, such as climate change.

There are many ways that government agencies and communities are in relationship (e.g. Hill et al. 2012; Leeuwis, 2004; Ross, Buchy and Proctor, 2002). Some of these are to change longstanding social injustices between agencies and communities (Hill et al. 2012; Schultz et al 2021). Researchers in several fields have sought to expand the ways we envision relationships in environmental management (MacPherson et al., 2021), such as lack of concrete evidence in decision-making and practice (Paschen and Beilin et al. 2021; Neale and May 2020; Neale et al. 2016; Neale 2016).

Sapkota et al (in press) identify four relationship types with communities and stakeholder groups. These different relationship types have varying practical applications depending on agency or community need. The different relationship types are guided by: Practices, Problem framing, and Worldviews. The relationship types are: Authoritative, Managerial, Interactive, and Relational (Sapkota et al. in press).

The typology provides a way to understand the relationships between community and agencies, but **no relationship is better than or more important than the other**. Each of the relationships have their place and value in practice between agencies and communities.
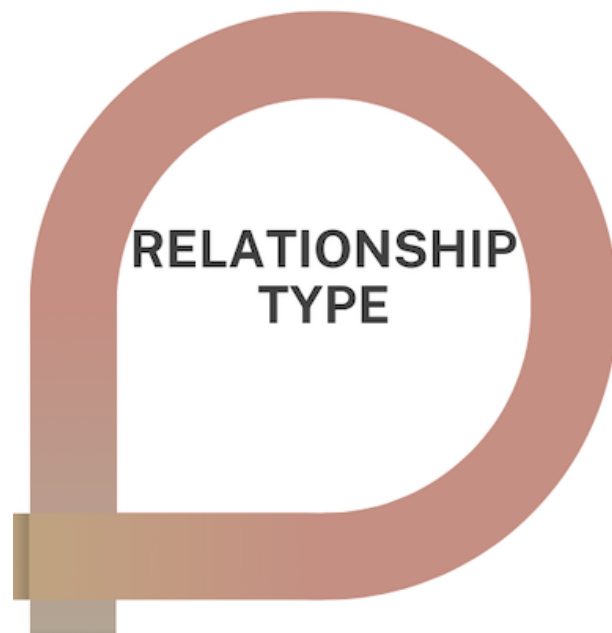
RELATIONSHIP TYPE

Authoritative relationships are government-led and involve planned decision making where community has extremely limited roles. These are grounded in instrumental problem framings and mechanistic world views. Examples include evacuation and dissemination of information pertaining to fuel management.

Managerial relationships observe environmental problems as including contested values, knowledge, and multiple stakeholders. However, practices are grounded in mechanistic world views that maintain relatively constrained forms of community participation and echo a top-down, command and control approach to governing and decision-making. Forms of community engagement that recognise diversity in communities but maintain government control of decision-making are managerial relationships. Examples include the Regional Forest Agreement and Strategic Bushfire Management Planning processes, which recognise contested values of the public.

Interactive approaches are more participatory and give community a greater role in defining institutions while supporting negotiation in the context of uncertainty and change. Examples of interactive relationships include Community Based Bushfire Management (CBBM) in which communities co-design decisions with government. It is important to note however that these processes are often implemented within the worldview and knowledge culture of DEECA, which primarily values biophysical science as the evidence base for decisions. The focus on trust and longer-term relationships between agencies and communities/stakeholders among the interactive approaches make these suitable for integrating communication for climate change.

Relational approaches are expressed through devolved decision making with a focus on establishing trust necessary for inclusive and ongoing deliberations among extended communities of actors. A relational type may involve the redistribution of power away from the worldview and assumptions of knowledge about government to the diversity that exists within communities. Where relational approaches may be most salient is in co-governance that is led by First Nations. This type is distinguished from interactive relationships by an extended understanding of community, agency and knowledge that incorporates the more than human world. The ongoing relationships underpinned by trust among relational approaches make these suitable for communicating risk and uncertainty for climate change (Sapkota et al. in press; Rawluk et al. in preparation).
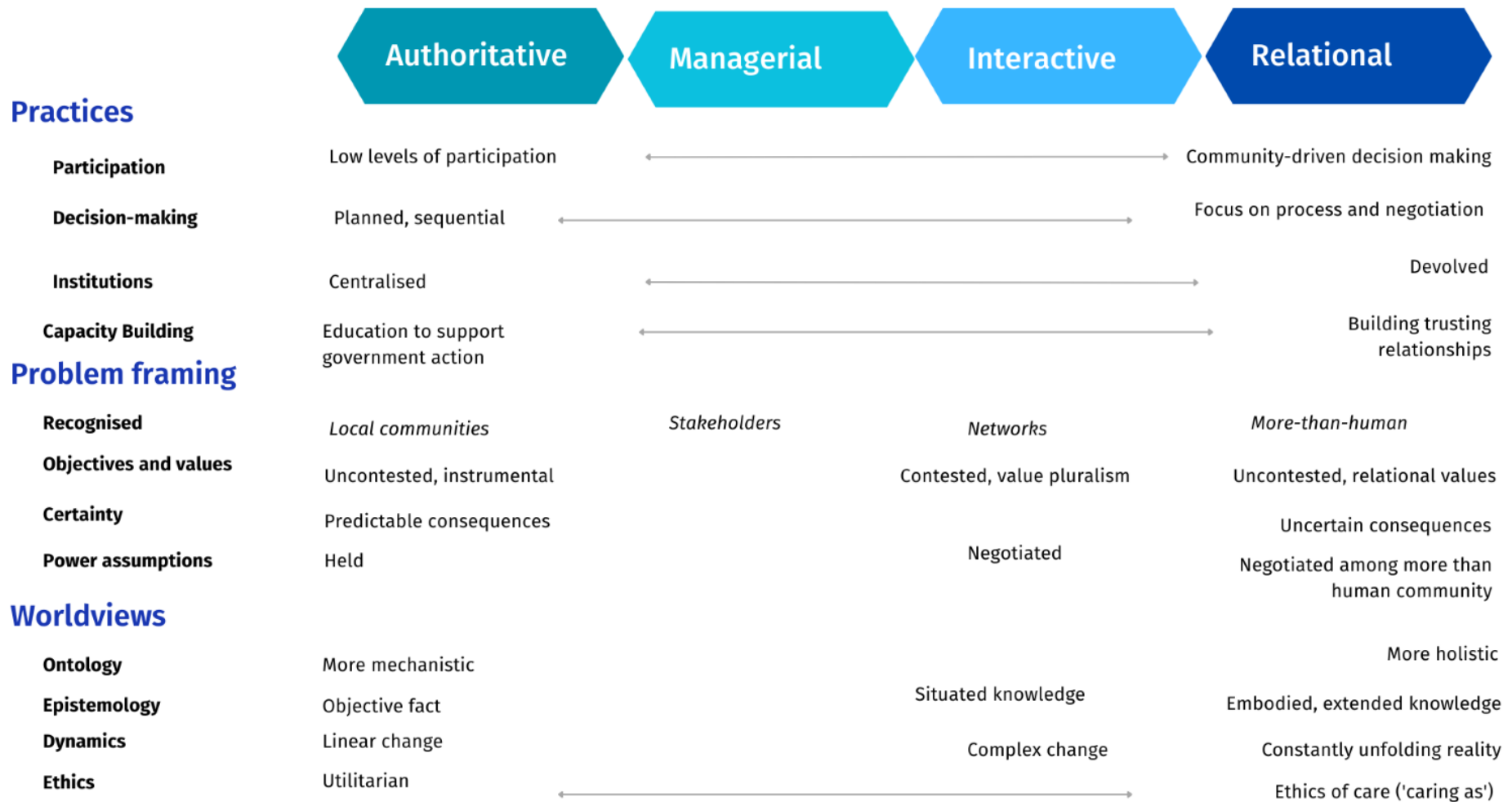
Practices

	Authoritative	Managerial	Interactive	Relational
Participation	Low levels of participation ←		→	Community-driven decision making
Decision-making	Planned, sequential ←		→	Focus on process and negotiation
Institutions	Centralised ←		→	Devolved
Capacity Building	Education to support government action ←		→	Building trusting relationships

Problem framing

	Authoritative	Managerial	Interactive	Relational
Recognised	*Local communities*	*Stakeholders*	*Networks*	*More-than-human*
Objectives and values	Uncontested, instrumental		Contested, value pluralism	Uncontested, relational values
Certainty	Predictable consequences			Uncertain consequences
Power assumptions	Held		Negotiated	Negotiated among more than human community

Worldviews

	Authoritative	Managerial	Interactive	Relational
Ontology	More mechanistic			More holistic
Epistemology	Objective fact		Situated knowledge	Embodied, extended knowledge
Dynamics	Linear change		Complex change	Constantly unfolding reality
Ethics	Utilitarian ←		→	Ethics of care ('caring as')

Figure 12. Relationship types that exist between government and communities (Sapkota et al in press

Why is this important?

- **We can tailor community engagement practices to suit different relationship types**
- Interactive and relational types can be suited to building long-term relationships to work for contexts of uncertainty and complexity
- Authoritative and managerial types can be suited for short-term, operational decision-making (Rawluk et al. Forthcoming)
- A mis-match in relationship type sought by community/stakeholders and government agencies can be a source of tension/challenge

How to apply Relationship Types

- We need to identify the type of relationship we are trying to form (indicated through policy, practice, guidelines, etc)
- We need to consider the type of relationship type that communities or stakeholders are expecting/seeking with us
- We can identify the relationship type that we are seeking by critically engaging with the **practices, problem-framing and worldview** that is guiding our work
- Dare et al. suggest a breadth of tools that can support relationship building
- Building trust by working with people who are trusted within their communities, and with key people who are trusted by different parts of the community

Linking to practice: Examples and reflections from Project Advisory Group

Managerial

Practitioners reflected that looking at their engagement with Traditional Owners, often conversations are centred around informing (managerial) instead of two-way discussion (relational)

Planned burning is a context in which managerial relationships are used, where practitioners inform communities of planned burning activities.

It takes a toll on staff to implement processes that trickle down from managerial level.

When engaging around complex and contested values, the Project Advisory group emphasised the importance of leadership and support within teams and how this assists with coping during high pressure periods.

The Project Advisory group emphasised the importance of acknowledging the managerial nature of working for within a hierarchical organisation / department.

Interactive

The project advisory group acknowledged the relationship typologies for engagement and the benefit of selecting multiple approaches. Approaches are all intertwined and there is not always a need to pick one.

A sandpit metaphor was used to describe the interactive relationship type. An example is where practitioners support a casual space where people do an activity such mapping on a table, while also thinking and talking. This creates a safer space toward shared understanding than when one person from an agency is talking. Practitioners noted that

communities are miles ahead of agencies in these relationships and that agency staff have a great opportunity to listen and learn from communities in their practices.

The theme for interactive processes needs to be carefully selected to resonate with community interests and it makes sense to engage on multiple issues rather than a single-issue focus. For example, while the main issue for agency staff may be fire risk, to encourage participation from a range of people, it is helpful to frame interactions to also include ecology and management.

The interactive approach does not suit all contexts. Not everyone wants to engage in interactive spaces, some prefer to just receive information. There are also situations, such as during a fire, when more instrumental forms of communication are appropriate. Different relationship types can be combined, for example used in parallel for people with different communication styles, or with authoritative information provided initially, followed by a group being curious together.

The project advisory group acknowledged the interchanging of different relationships and that they can exist together.

Relational

Practitioners discussed that the relational type encourages a shift in power relationships and the voice of the environment. With a lot of reflection, practitioners said that they weren't able to identify any distinct examples of the relational type in practice. The relational type was described as aspirational, yet it was not present in the current governance structures and government-community relationships. This could have reflected that more time was needed to identify examples of relational types that are not being shared or celebrated to the extent that they could be.

The skills required to foster relational ways of working need to be nurtured by agencies. Often the skills of a person/people supporting a relational type are different than the more common bushfire-specialist expertise. These skills are typically not the standard in bushfire agencies.

Practitioners discussed that the relational type indicated a redistribution of power that is not currently present in governance structures, which are reflected more in the authoritative and managerial types, and in some instances working in the Interactive type. Shifting to work with a relational type requires radical change in the paradigm of how agencies work. A relational relationship type was acknowledged as difficult to achieve and maintain, to achieve this it may require a transformation and reimaging of how government exists.

A feature of relational work is focused on the rights of people and nature, and how do we engage and reflect the needs of nature in this work.

2.3 LOOP THREE: Principles for community engagement for uncertainty and change

In the third loop, we encourage practitioners to reflect on principles for community engagement in the context of uncertainty and change. We have brought together these principles based on practice needs identified by the Project Advisory Group. These three principles are:

- Incorporate local knowledge
- Consider people's values and beliefs about forests, bushfires and climate
- Riding the waves of uncertainty

ENGAGEMENT PRINCIPLE 1: INCORPORATE LOCAL KNOWLEDGE

What this means

Incorporating local knowledge is challenging because governments and community members tend to work differently. Governments start with broad-scale policies and biophysical science, while communities start with people and the immediate environment they know from experience. Sometimes these differences can be brought together, but there is a tendency for people in government to assume their way is better (Colliver 2010).

When making difficult decisions, governments tend to trust knowledge from measurements or modelling over knowledge expressed as stories, descriptions, or actions. This preference for measurement is a barrier to the integration of local knowledge with science for good decision-making (Ford et al. 2019, Paschen and Beilin 2015).

Why is this important?

- Policies such as Safer Together state that *local knowledge and experience* will inform agency actions (Safer Together 2015), and community members expect this (Ford et al. forthcoming).
- Not incorporating local knowledge in decisions can undermine trust in government, as actions may be viewed as irrelevant (at best) and only meeting government needs (Marton and Phillips 2005).
- There are many regional and local variations in landscapes and communities, which may be missed if only generalised knowledge is relied upon (Marton and Phillips 2005).
- Local people have knowledge and experience about what will work in their landscapes. Agencies can miss this unless they attend to local knowledge (Colliver 2022)
- Local knowledge can be quicker to adapt to change than scientific knowledge (Berkes 1993)
- **Incorporating local knowledge leads to good decisions and builds trust and social licence**

How to apply this principle

Engaging with local knowledge:

- Value knowledge that comes in different forms. Listen and observe for knowledge in the form of stories, descriptions and actions, not only numbers and facts.
- Reflect on the 'taken for granted' assumptions in agencies and your own practice. Are certain forms of knowledge considered better than others, why? What barriers are there to valuing local knowledge?
- When judging the quality of any form of knowledge (science or local) consider how it was produced (Latour 1987). Local knowledge that is based in observations and experience in a place over a long period of time can support effective local action (Reid et al. 2011)

Integrating local knowledge with that of agencies:

- Acknowledge local experience as valid evidence to incorporate in decision-making and action (Colliver 2022, Rawluk et al. 2020)
- Identify opportunities for social learning and knowledge production with local people:

- o Post-bushfire forest recovery is an opportunity for local volunteering to learn about ecosystem resilience, re-connect with home landscapes and prepare for the next fire season (Ryan and Hamin 2008).
  - o Field trials of new forest or fuel management practices are an opportunity to collaborate with stakeholders to learn about the consequences of implementing these methods (Hagerman et al. 2021)
- In collaborative processes, recognise knowledge sharing and integration as a task in itself that involves time and effort. Uncover different assumptions among participants through small group discussion in safe settings. Good questions to ask are (Macmynowski 2007, Ford et al. 2021):
  - o What do you mean by this term (e.g. 'prepare')?
  - o What is good evidence to support this decision? How will you know if it is good?
  - o What differences do you notice about the ways different participants approach decision-making?

Tips for better practice

Foster social learning using lessons from Landcare (Colliver 2022, in Dale et al. p.243)

- o Create space for inquiry – propose a place for inquiry and inventive action
- o Cultivate companionship – other people's views help to shake up pre-conceptions
- o Facilitate with activist intent – probe for the experience behind opinion
- o Learn to do it while you do it – analyse and co-design to make social learning explicit
- o Recruit allies – search for others who want to create safe spaces for learning
- o Get used to being out of your depth – we learn by not knowing and finding a way forward

Linking to practice: Examples and reflections from Project Advisory Group

Practitioners discussed the different ways knowledges can be grappled with in practice, ranging from acknowledgment to integration. Local and professional forms of knowledge are complementary, for example local community members (including local agency staff) can have a deep understanding of local issues such as localised fire risks and weed locations.

Valuing and listening to different forms of knowledge changes how agencies currently practice.

A community engagement practitioner described working within a community of people with very diverse interests, taking on a role of representing agencies to community and community to agencies. Space and trust was built over a period of time. In initial conversations, the practitioner asked very open questions to understand what community members wanted. In this interactive process, it was important to keep the space respectful and positive. This meant enabling community members to discuss their own fuel management practices (local knowledge). Community members also wanted to see the Phoenix outputs agencies use to make decisions. The engagement practitioner coached agency staff to ensure they understood the locally defined goals and were prepared for a conversation about them, From this beginning, goals and solutions were developed together over time. Evaluation showed that community members changed their fire plans and came to know that they could have more conversations as needed

Related principles Ways of thinking about
forest fire and climate

Resources 8.1 What is local knowledge?

ENGAGEMENT PRINCIPLE 2: CONSIDER PEOPLE'S VALUES AND BELIEFS ABOUT FORESTS, BUSHFIRES AND CLIMATE

What this means

Climate change, and its effects on our World, raise philosophical questions about the relationship between humans and nature. How people judge different climate actions by governments depends on their values and their beliefs about human-nature relationships, among other aspects.

Why is this important?

- Governments are challenged with developing strategies and planning ways to adapt to climate change that will be supported by the public and will contribute to social licence.
- Values and beliefs can help to explain different levels of support for climate adaptation (Peterson St. Laurent et al. 2018) and the acceptability of actions such as fuel management (Burtz and Bright 2014).
- People in government often seek to characterise members of the public by demographic characteristics, but in many situations (especially where the natural environment is involved), it is more helpful to understand values and beliefs, as these are more directly associated with support (Ford et al. 2019)
- Knowing people's values and ways of thinking helps in designing engagement and communications that will be relevant and resonant.

How to apply this principle

Have in mind the different beliefs, values and ways of thinking that may be important to people:
- A belief that humans are separate from nature has underpinned most Western science. However, much Indigenous and Religious wisdom and some conservation thinking is based in beliefs that humans are part of nature (Walsh et al. 2021).
- As an example of a valued environment, Four ways of thinking about forests vary on these beliefs and on values. They are: Shaping forests; Partnering forests; Defending forests; and Relating forests and society (see resources).
- A very wide range of values are at risk of bushfire and its management (Williams et al. 2018) (see resources). While people's core values are relatively stable, their priorities for protecting valued entities in the landscape may vary with context and experience.
- If people's values and beliefs are not known for a particular situation, conversations and engagement processes can be designed to explore them:
  - Communicate climate scenarios for forests or bushfire carefully, then ask open questions about what people think
  - Include laddering interview questions ('why is this important') in conversations to uncover values
  - Use participatory mapping to translate people's abstract values to locations on a map
  - Deliberative discussions are a participatory way to relate values to management options
  - Value and priority workshops can help to determine strategic priorities
  - Surveys can be used to measure values of in a population
  - Value-based scenario development can be used to define a decision space for policy

What this looks like in practice

- Paradoxically, the people who most need to engage with agencies are the least motivated to do so. People with stronger core values for self-direction tend to actively engage, but those with stronger values for security expect governments to protect them. There are particular challenges in engaging this group (Ford et al. 2017, Rawluk et al. 2021).
- People who share the "Shaping forests" way of thinking are likely to support goal-directed professionally designed actions such as planned-burning and thinning for forest resilience. But these kinds of actions are not as well supported by people with other ways of thinking.

What practitioners have told us for linking to practice: Examples and reflections from Project Advisory Group

The Project Advisory Group described that understanding the values and beliefs of people shapes why people live where they do, and how this affects preparedness e.g., land clearing, willingness to leave. They described that it is important to understand what is important to people and start from a place of trust, equality, and seeing each other with humanity. It is important to see people instead of a uniform.

A community engagement practitioner described working within a community whose members cover a spectrum, some people bring forestry interests, some environmental ones, others interests lie somewhere in between, and other people have no interest. In an interactive approach, the practitioner described taking time and care to create a safe and respectful space. This included asking open questions about community members' interests and goals, as a way to understand values and get to know one another. It included discussion of topics of shared interest to all participants, such as what a bushfire could look like in the local area. In the beginning, the practitioner was prepared to manage any conflicts that arose, but this was not necessary.

Another community engagement practitioner indicated that she will be using the Values research from the IFER social research program (Rebecca Ford, Kathryn Williams, Andrea Rawluk) and it would be to check in with her learning in the future.

A community engagement practitioner described that after the 2019-2020 bushfires in East Gippsland a tension occurred between the government and regulatory approach to managing the risk not align with the community values and attachments to place. For example, many community members did not want to remove native vegetation close to their homes to meet BAL standards.

Resources: 8.1 What is local knowledge?

ENGAGEMENT PRINCIPLE 3: RIDING THE WAVES OF UNCERTAINTY IN AGENCIES

What this means

Drawing on the learning from LOOP ONE: CONTEXT, Climate change forces agencies to consider the uncertainties embedded in their work. For example, from Requirement 1 we know that climate change brings shifting fire regimes and seasonal patterns. Yet, we don't know exactly how this will look and when fires or other events will happen.

Continuous and ongoing change can be challenging for agencies such as DEECA CFA and Local Governments , whose organisational practices are based on evidence and operations. However, contemporary systems science argues that the systems we are managing are dynamic and continuously changing. Further, there are significant aspects of these systems that are not knowledge. In such, phenomena will emerge that we were not able to plan for – such as pandemics. Being congnisant of the unexpected and the inherent uncertainties shift practices from controlling a system with hard evidence to focusing on learning and adapting to change.

We ground this community engagement and communication document in a process called **Adaptive Doing**. Adaptive Doing is a collaborative process that enables practitioners to engage with complex and uncertain circumstances to build a shared understanding of a context, such as bushfire and climate change governance (Rawluk et al. 2020; Rawluk et al. 2021; Rawluk et al. 2023).

Adaptive Doing is a process that is framed by social ecological systems thinking, which observes the world as highly complex and continuously changing. Adaptive Doing (Figure 1) is organised into four iterative phases that enable learning and practice change:

- PHASE A: **Disrupt**ing the status quo
- PHASE B: Critical **reflect**ion and discussion
- PHASE C: Developing a shared **understand**ing
- PHASE D: Returning to **practice**

We connect Adaptive Doing with Adaptive Hope (Bender and Rawluk 2023), which suggests that we need ways to build and maintain hope in the face of growing change and uncertainty in issues such as climate change and bushfire.
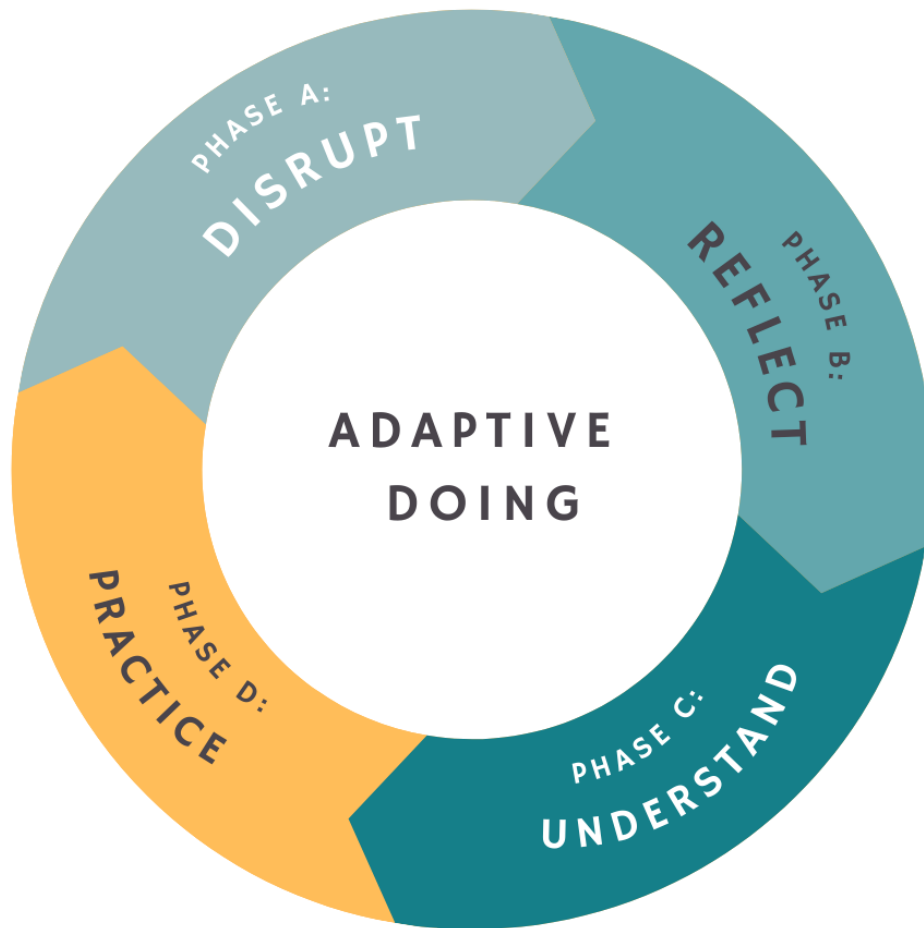
Figure 13. Adaptive Doing is a collaborative process for learning and practice change. It is organised into four phases: Disrupt, Reflect, Understand, and Practice (Rawluk et al. 2020)

Why is this important?

- Community engagement policy and practices are inherently underpinned by uncertainty, yet these can be challenging to identify and articulate (Rawluk et al. 2020)
- Working with communities can involve developing a shared understanding of context and expectations, yet there are few practices to do this (Rawluk et al. 2021)
- A shared understanding and adaptive practice can be critical for addressing social ecological injustice and working with First Nations communities (Rawluk et al. 2023)
- Drawing on Adaptive Doing enables practitioners to recognise moments of disruption and change as opportunities for conversations (Rawluk et al. 2020)
- Uncertainty and climate change can be a source of grief and Adaptive Hope can support communities to find strategies for working with uncertainty (Bender and Rawluk 2023)
- Community engagement practitioners are often working in institutional contexts where knowledge norms are pulling in different directions, cultural change (Rawluk et al. 2023)

How to apply this principle

- Recognise that agencies and practitioners are working with uncertainty in their community engagement
- Identify moments of disruption as opportunities to change practice and have discussions with communities and colleagues
- Identify needs for policy and practice change in agencies to acknowledge and centre uncertainty

Examples of and reflections on the principle from the Project Advisory Group

Practitioners did not identify clear pre-existing examples in agencies where teams or the organisation was able to navigate uncertainty and complexity well and deliberately.

They reflected that certain features of ongoing, trusting relationships with communities (eg. the work of Bridget Clarke in the Wombat State Forest Region) would help to navigate uncertainty and complexity in climate change and bushfire, and included others to support the conversations from within DEECA and local Government.

Practitioners also discussed that in a space of uncertainty means taking multiple, iterative steps that accommodate the needs of relationships and the opportunity of growth.

They discussed that this Community Engagement Principle acknowledged that they are now often working in a space of not knowing what the future is. Doing so is a fundamental difference to how they currently working and identified the need to have clearer processes for working with uncertainty and complexity.

2.4 LOOP FOUR: Principles for behavioural communications that aim to support behaviour change and knowledge sharing

In the third loop, we encourage practitioners to reflect on principles for behavioural communications about climate change impacts and preparedness to bushfire. We have brought together these principles based on practice needs identified by the Project Advisory Group. These four principles are:

- Keep things action focused and achievable
- Address barriers to action
- Keep motivation high
- Make sure it's relevant to the audience

BEHAVIOURAL COMMUNICATIONS
Principles for communications that aim to support behaviour change and knowledge sharing

This section applies a behavioural science lens to present principles for communications that aim to support behaviour change and knowledge sharing within the context of bushfire preparedness in climate change. These principles primarily focus on elements within communications that can enhance their effectiveness, rather than the communication medium or method of engagement.

These principles can be approached flexibly based on the nature of the relationship between communicators and the community. Since different relationship types may require different communication strategies, and different approaches to establishing an evidence base, we have included guiding questions at the end of each principle to support reflection and facilitate discussion for the different approaches that may be needed to apply these principles across diverse contexts.

Many organisations have existing guidelines for engaging with the community, including ethical frameworks. Similarly, where change is being encouraged or supported via behavioural communications, the emphasis is on fostering positive change (see 'How to support change for good').

The examples provided in this section are informed by evidence into what works, but they are illustrative only. For effective behavioural communications, it is important to incorporate suitable processes for design and testing (see 'Processes for designing and testing communications').

In addition to the behavioural communication principles outlined here, several general principles are important for effective communication, including for visual communications. While these broader principles were not the focus of the current review, various complementary resources are available, including a recent guide to behavioural communications (see 'A practical guide to behavioural communications').

COMMUNICATION PRINCIPLE 1: KEEP THINGS ACTION FOCUSSED AND ACHIEVABLE

What this means

When engaging with community about serious and life-threatening topics, like bushfire, it can be tempting to emphasise the risks, negative consequences of inaction, or what people should NOT do. However, it is generally more effective to focus on, or support this information with, practical steps that people can take to reduce their risk.

Why is this important?
- Focussing solely on risks, without offering guidance on how to reduce those risks, can disempower people (Coppola and Maloney 2009; Paton and Wright 2008; Petty et al. 2009).
- Emphasising what people should NOT do fails to provide clear alternatives for action (Ministry for the Environment 2023).
- Providing information (Toomey 2023) or attempting to shift attitudes does not necessarily support behaviour change (Jungbluth et al 2021).
- Focussing on effective, practical steps to reduce risk emphasises what people CAN do, which can increase their sense of agency and motivate them to act (Petty et al. 2009).

How to apply this principle
- Identify actionable steps that people can take to reduce their risk (Plant and Boulet 2022). Actions reflect things people could **do** and that could be **observed** (rather than attitudes or outcomes) (Kneebone et al. 2021; Presseau et al. 2019).
- Focus on ONE action and key message at a time (Coppola and Maloney 2009; Petty et al. 2009; Toomey 2023). Prioritise an appropriate action based on the situation and audience (i.e., explore 'What is right for you?').
- Prioritisation of preparedness actions can be done by considering what is impactful and what is achievable for the audience (i.e., ease or likelihood of adoption) (Presseau et al. 2019). Also consider what actions are already being performed and which could have multiple benefits (Coppola and Maloney 2009; Kneebone et al. 2017).
- When communicating actions, try to be specific (Petty et al. 2009; Kneebone et al. 2021; Presseau et al. 2019). Rather than using terms like 'act', 'prepare', or 'shared responsibility', clearly define the preparatory action and provide observable examples (Plant and Boulet 2022). Specific actions include **who** needs to **do what** and ideally includes contextual information, like **when** and **where** (see 'What is behaviour?' in the accompanying resources section).
- If the action involves a series of steps (e.g., developing a bushfire safety plan), it can help to break the process into simple steps (Coppola and Maloney 2009; Petty et al. 2009). Emphasise

and encourage the first step that is relevant to the audience and their situation (i.e., explore 'Where could you start?').

Reflective questions to guide application of this principle

Consider the following:

- *How could we identify and prioritise suitable risk-reduction action(s)?*
- *How could we identify what steps or actions are already being taken?*
- *How could we identify what actions are impactful, meaningful, and achievable?*
- *How could we identify which action is prioritised next?*
- *How could these objectives be met in a way that aligns with our approach, including the kind of relationship that government or agencies and community want to form?*
- *How could these objectives be met while factoring in our partnerships and other agencies working in this space?*

Tips for better practice

- At the core of this principle sits the objectives of identifying actions that reduce risk and prioritising one appropriate action (at a time). Note that these objectives can be achieved via different approaches according to factors like relationship type with community, methods of communication, and partnerships with other sectors. As an illustrative example:
  - For one-way communications with the community (e.g., website content, social media posts), actions could be identified and prioritised using existing research evidence (e.g., existing list of risk-reduction actions, an existing impact-likelihood matrix) and/or via community consultation or audience research.
  - For multidirectional communications and engagement activities that happen in real time, actions could be identified collaboratively with community members by exploring what actions are right for them.
- Avoid communicating practical steps that may be perceived as too obvious, as this can come across as condescending and unhelpful.
- Be cautious of providing practical steps that could be seen as ineffective or unachievable, as this can disempower people and reduce trust.
- Be mindful of the tone used when delivering suggestions, practical steps or instructions, as an authoritarian tone can induce resistance and reduce trust.

Related principles

Keep motivation high

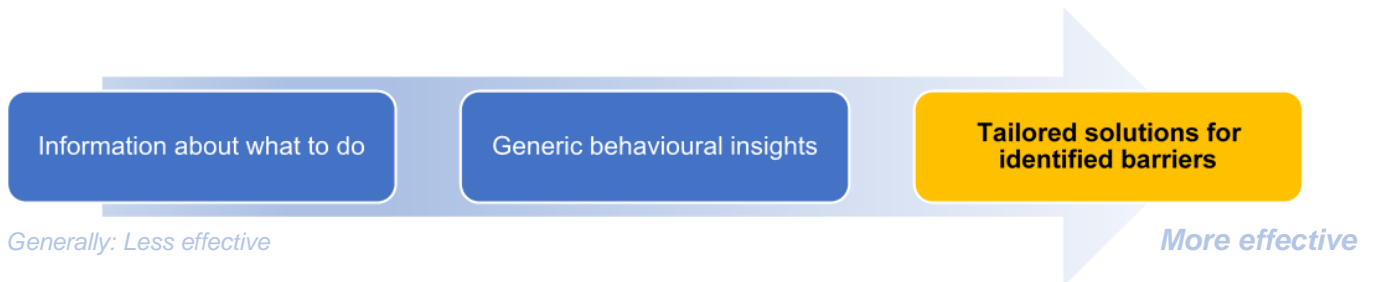Make sure it's relevant to the audience

Resources

8.5 What is behaviour?

COMMUNICATION PRINCIPLE 2: ADDRESS BARRIERS TO ACTION

What this means

When trying to encourage or support behaviour change, it can be easy to make assumptions about why people do or do not currently perform specific actions. Such assumptions can hinder effective communication and engagement with community. Gaining a deep, evidence-based understanding of what gets in the way of people taking steps to reduce their risk can inform communications (and other approaches) that help to address important barriers and enable change.

Information about what to do	Generic behavioural insights	**Tailored solutions for identified barriers**

Generally: Less effective   *More effective*

Why is this important?

- Often factors beyond knowledge (Toomey 2023) and attitudes get in the way of people performing positive actions (Meis-Harris et al. 2019; Michie et al. 2011). When broader barriers exist, providing information or encouraging risk-reduction actions alone will generally not be enough to support these actions.
- Understanding what barriers exist for specific preparedness actions and supporting people to overcome these barriers can inform tailored communications and solutions beyond communications to increase success (Cane et al. 2012; Jungbluth et al 2021; Michie et al. 2011).
- Similarly, if specific facilitators to positive actions are known (e.g., values), these can be harnessed via tailored communications to increase success.

How to apply this principle

- Gain a deep understanding of what 'gets in the way' of community taking steps (Curtis et al. 2021) to reduce their risk. There may be multiple barriers at play, and not all will be suitable to address via communications. This means suitable barrier(s) will need to be prioritised.
- To prioritise suitable barrier(s) for communications, identify those that reflect misunderstandings or gaps in **knowledge** and any that reflect unhelpful **beliefs or intentions** (reflective motivation). Generally, knowledge and reflective motivation barriers are suitable to target via behavioural communications (Cane et al. 2012; Jungbluth et al 2021; Michie et al. 2011). Barriers outside of these categories will need to be supported via alternative approaches.
- To keep messages clear and simple, focus on addressing ONE key barrier for ONE key action at a time. Prioritise the most appropriate barrier based on the situation and audience (Cane et al. 2012; Jungbluth et al 2021).

Reflective questions to guide application of this principle

Consider the following:
- *How could we identify and prioritise key barrier(s) to risk-reduction action(s)? How could we capture our evidence base?*
- *How could we identify what barriers our audience faces?*
- *How could we identify effective and feasible ways that barriers could be supported or addressed?*
- *How could these objectives be met in a way that aligns with our approach, including the kind of relationship that government or agencies and community want to form?*
- *How could these objectives be met while factoring in our partnerships and other agencies working in this space?*

Tips for better practice
- As for identifying and prioritising actions, there are different approaches to identifying and prioritising barriers. Consider different approaches according to factors like relationship type with community, methods of communication, and partnerships with other sectors.
- If faced with significant barriers that are insurmountable, it may be worth adapting or choosing an alternative action that is achievable (i.e., revisit *Communications Principle 1: Keep things action focussed and achievable*).

Related principles
Keep things action-focussed and achievable

Make sure it's relevant to the audience

Resources
8.6 What influences behaviour?

COMMUNICATION PRINCIPLE 3: KEEP MOTIVATION HIGH

What this means

When communicating about topics we're knowledgeable and passionate about, it can be easy to fall into communication traps like an overreliance on information provision and the overuse of technical terms. It is important to keep messages clear, simple and jargon-free, and to keep people engaged with the communication and the action of interest — this can be supported by using behaviour change principles that tend to apply across a variety of contexts (Smith et al. 2021).

Why is this important?

- Providing information alone is often insufficient to motivate people to change their behaviour (Toomey 2023).
- When there aren't sufficient resources available to invest in identifying specific barriers or facilitators, and especially when trying to reach a broad audience, drawing on generic behavioural insights can be beneficial to maintain the audience's motivation (although their less targeted nature means they tend to only provide modest effects) (Ministry for the Environment 2023; Smith et al. 2021). Even in communications addressing specific barriers, using generic behavioural insights can have complementary effects.
- The effects of behavioural insights can vary depending on the context, so it's also important to avoid applying them in ways that can be counterproductive (Ministry for the Environment 2023) and to establish a good process for communications development and testing (Coppola and Maloney 2009; Jungbluth et al 2021; Ministry for the Environment 2023)

How to apply this principle

- Some tips for applying behavioural insights (Ministry for the Environment 2023; Smith et al. 2021) common across EAST (The Behavioural Insights Team 2014) and INSPIRE (Faulkner et al. 2019) are:

Strategy	Better practice tips	Avoid or watch out for
Make it **easy to understand** the message **and to do** the action	Keep messages clear, simple, and jargon free. Make any actions or first steps feel relatively easy (and increase steps incrementally). Simplify complex information and only provide what's needed (also see 'Navigating uncertainty'). Using relatable analogies can improve engagement and understanding.	Avoid information overload and using jargon. Instead, break information into smaller 'chunks'. Also, getting people to 'try' or to 'do' something first can enable them to be open to subsequent information.
Use social **norms** & encourage **commitments**	Emphasise what other people in the community already do to prepare. About climate change, emphasise the 97% consensus among scientists. Encourage commitments to prepare, including public commitments. Where action planning is needed, draw on if-then plans ('implementation intentions') to support commitments.	Avoid highlighting negative norms, like stating or implying most people aren't prepared. Where positive norms are low, focus on what *champions* are doing or focus on a *growing number* of people doing the positive action. Do not present artificial norms, as this can reduce trust.
Use **authorities** & **liked people** to deliver messages	Have respected, knowledgeable, and trusted people deliver or endorse fair messages ('authorities'). Have 'liked' people (e.g., with shared values, common interests) or champions in the community deliver or endorse fair messages.	Be mindful of the tone used when delivering messages — an authoritarian tone can induce resistance and reduce trust. Similarly, while drawing on 'authorities' can be effective, be mindful of an overreliance on traditional hierarchical approaches, as this can hinder collaborative relationships.

Reflective questions to guide application of this principle

Consider the following:

- *How could we make information, messaging, and resources easy to access and easy to understand?*
- *How could we make information, messaging, and resources attractive?*
- *How will we make appropriate action(s) easy and attractive?*
- *How could we identify what is accessible for our audience and what is meaningful and easy for them?*
- *How could these objectives be met in a way that aligns with our approach, including the kind of relationship that government or agencies and community want to form?*
- *How could these objectives be met while factoring in our partnerships and other agencies working in this space?*

Related principles

Keep things action-focussed and achievable

Make sure it's relevant to the audience

Resources

8.7 What are some tools to foster motivation?

COMMUNICATION PRINCIPLE 4: MAKE SURE IT'S RELEVANT TO THE AUDIENCE

What this means

It sounds obvious, but there's no one-size-fits-all approach to effective communication about climate change or bushfire risk and preparedness. This principle involves customising the content and guidance provided in communications, as well as the framing of messages, so that they resonate with your audience. Incorporating this principle increases the chance that communications will be engaged with, motivate, and be acted upon.

Why is this important?

- A communication approach that works for one person may not be appropriate or effective for the next.
- If people cannot connect with what is being communicated, they're unlikely to pay attention or engage with the message.
- If people cannot relate to the situation being communicated or see the relevance of the information to their own lives, they're unlikely to be motivated and/or to act.
- To grab and hold attention, and to motivate and encourage action, the communication needs to feel personally relevant and relate to the audience's current situation and motivations.

How to apply this principle

- Try to grab attention by using personalised language and content (e.g., second person language, local information, place names and images) (Ministry for the Environment 2023).
- Tailor climate change impacts and risk information to local risks and impacts, rather than state, national or global information.
- Present risks, risk-reduction actions, and any suggestions for ways to overcome barriers that are relevant to the audience.
- In addition, try to connect to the audience's experiences and values, so that communications can be aligned with their context, including their community, terminology, and values.

- Incorporating gamification, like fun quizzes, can be engaging and enhance relevance if personalised feedback is offered—this can connect information to personal experiences.
- In the context of developing messages for one-way communications (e.g., website content, social media posts), applying this principle may require audience research, message co-design and testing prior to implementation. This could allow messages to be fine-tuned using evidence, audience input, and feedback.
- In the context of community engagement activities and other interpersonal communications, applying this principle may require asking questions and listening to your audience. Try to understand what the audience is already doing to prepare, their intentions to prepare, as well as their challenges and what matters to them. This information can allow guidance and messaging to be adapted to 'fit' them.

Reflective questions to guide application of this principle

Consider the following:
- *How could we make information, messaging, and resources easy to access and easy to understand?*
- *How could we make information, messaging, and resources attractive?*
- *How will we make appropriate action(s) easy and attractive?*
- *How could we identify what is accessible for our audience and what is meaningful and easy for them?*
- *How could we understand our audience and what is relevant to them?*
- *How could we personalise content and language?*
- *How could we localise risk information and impacts?*
- *How could we identify different communication needs and preferences? How could we approach communications and community engagement activities in a flexible way to meet different needs and preferences?*
- *How could these objectives be met in a way that aligns with our approach, including the kind of relationship that government or agencies and community want to form?*
- *How could these objectives be met while factoring in our partnerships and other agencies working in this space?*

Related principles
Address known barriers to action

3.CONCLUSIONS AND RECOMMENDATIONS

The co-designed Climate Reflective Practice has been created by combining recent research with insights from practitioners about their needs and experiences. While this project was originally conceived as a review of literature, the engagement with practitioners steered it toward selected research that best reflects the uncertainties of working with changing communities in a changing climate. The co-design approach means the Practice should address practitioner needs as they assist others in developing skills in community engagement.

The scientific literature and discussion with the Project Advisory Group indicates that practitioners are working in a highly dynamic space that requires practice change and skills development. A Practice based in academic concepts, such as that produced here, can support practice by prompting reflection during the design and planning for engagement and behaviour change. Interactions such as occurred during Project Advisory Group meetings also contribute to this reflection. There will be benefits in further engaging with the Climate Reflective Practice across different practitioner teams in the Department of Energy, Environment and Climate Action and the Country Fire Authority.

RECOMMENDATIONS

To support practice adaptation in a deeper way, co-research is needed which includes participatory data collection and analysis, using methods such as practice observation, interviews and workshops. Such research could identify how change occurs in community engagement practice within dynamic institutional, social and biophysical contexts.

The Project Advisory Group emphasised the importance of continuing to unpack knowledges and power in the agency and community-agency relationships. Further, they emphasised the importance of being aware of the organisational paradigm and seeing how this needs to change to really grapple with uncertainty and change.

4. RESOURCES TO SUPPORT THE PRINCIPLES FOR COMMUNITY ENGAGEMENT AND BEHAVIOURAL COMMUNICATIONS

4.1 WHAT IS LOCAL KNOWLEDGE?

Scientific knowledge characteristics	Local (or traditional) knowledge characteristics
Mainly Quantitative	Mainly Qualitative
Purely rational	Has an intuitive component
Reductionist, mechanistic and (supposedly) value free	Is holistic, spiritual and moral bound
Works on experimentation and systematic, deliberate accumulation of fact. Slow to change established norms	Based on empirical observations and accumulation of facts by trial-and-error. Can be quick to adapt to change
Synchronic data, i.e., short time-series over a large area	Based on diachronic data, i.e., long time-series on information on one locality

Figure 14. Scientific knowledge compared to local and traditional knowledges (Based on Berkes 1993)

Examples of effectively applied local knowledge are:

- A volunteer friends group has been revegetating Organ Pipes National Park since it was declared in 1972, and well before ecological restoration became a science. Their local ecological knowledge is expressed as stories linked to places in the park, among other forms (Reid et al. 2011).

4.2 RESOURCES: WHAT ARE WAYS OF THINKING ABOUT FORESTS?

One way of thinking about forests is through a systems of values, beliefs and practices that have developed through social interactions over time (social representations). People draw on these ways of thinking in new situations, such as climate change (Figure 15).

Shaping forests	
• **Belief:** people shape forests • **Values:** personal pleasure and security • **Ideal forest:** mown or grazed • **Practices:** production and fuel management; • **Trust knowledge of:** locals and forest workers	*controlled burning … very beneficial*

Defending forests	
I would just really like to see a hell of a lot of money and effort and everything put into stopping climate change	• **Belief:** people threaten forests • **Values:** biospherism • **Ideal forest:** old growth • **Practices:** 'leave it alone', raising awareness • **Trust knowledge of:** activists and volunteers

Partnering forests	
• **Belief:** people partner forests • **Values:** biospherism • **Ideal forest:** tall, intact, beautiful • **Practices:** restoring ecosystems • **Trust knowledge of:** scientists	*I go into forest, because it's peaceful and makes me connect with the wider world around me*

Relating forests and society	
For my country, and from my religion, some of the trees have religious value, like we worship the tree … And it is good to have in our village and nearby the home, it will give good vibes and we worship the tree as well.	• **Belief:** people partner forests • **Values:** benevolence and social altruism • **Ideal forest:** varied • **Practices:** caring • **Trust knowledge of:** Indigenous people and professionals

Figure 15. Ways of thinking about forests (Ford et al. forthcoming

4.3 RESOURCES: WHAT ARE VALUES AT RISK OF FIRE?

Williams et al. (2018) identified and ranked the values of the Victorian public that are impacted by bushfire and its management (Figure 16).

Values of the Victorian public at risk of bushfire and its management
(in descending order of importance)

Abstract ideas about what is important in life **(Core Values)**	Qualities of entities that help explain why they are important to people **(Valued Attributes)**	Concrete (tangible) places and object that people seek to protect from harm **(Valued Entities)**
• **Benevolence:** Family and close friends have vital importance	• **Natural and experiential attributes of the landscape:** characteristics of the natural landscape	• **People/homes/health facilities**
• **Universalism – human altruistic:** Concerns for the welfare of humans and society generally	• **Human health and relationships**	• **Infrastructure:** such as roads, water, power
• **Universalism – biospheric:** The environment needs to be respected and protected	• **Going about daily life:** the ability to go about one's life as normal	• **Domestic animals:** peoples' pets (dogs, horses, cats, etc), livestock
• **Security:** One needs people, places, and things that make them feel secure in order to live	• **Animal welfare:** domestic and wild animals	• **Natural places/wildlife**
• **Self-direction:** Independence in thought and action	• **Livelihoods, economies, and productive capacity of the landscape**	• **Heritage objects:** personal belongings and historic sites
	• **Personal history and identity:** often related to things that evoke memories	• **Places of work/education and welfare support**

Figure 16. Values of the Victorian public that are impacted by bushfire and its management (Williams et al. 2018)

4.4 RESOURCES: BROADER PRINCIPLES TO SUPPORT BEHAVIOURAL COMMUNICATIONS

How to support change for good

Some useful resources on the ethics of supporting behaviour change:
- A framework to identify **nudges and sludges**, developed by Dilip Soman (2020).
- A toolkit for **sludge audits**, developed by the NSW Behavioural Insights Unit.
- A guide and framework to consider **unintended consequences**, developed by the UK Cabinet Office.

Processes for designing and testing communications

Some useful frameworks and resources can support suitable processes for designing and testing communications. An example includes Coppola and Maloney (2009) in the context of campaign development for communicating emergency preparedness, which covers:
- Stage 1: Planning and strategy development. This includes understanding the problem and the role that communication can have in working towards a solution, including audience research.
- Stage 2: Developing and pre-testing concepts, messages and materials informed by insights from Stage 1.
- Stage 3: Implementation of the program, including tracking exposure and reactions.
- Stage 4: Assess effectiveness upon completion and refine for future use.

Step 2 includes guidance on selecting communication channels and methods (also see channels used in disasters, including bushfire smoke events) (Heaney et al. 2021).

A practical guide to behavioural communications

This practical guide for behavioural communications, developed by the Ministry for Environment and BehaviourWorks Australia (2023) is a valuable resource. Topics and resources include:
- General **behaviour change principles**, such as behaviour, barriers, solutions, and testing;
- A **library of behavioural insights** with principles and considerations for effective application; and
- **Checklists and supporting guidance** for building and reviewing behavioural communications (writing communication messages; visually designing communications; and selecting communication delivery channels).

Note: While the practical guide was developed for waste minimisation in New Zealand, the general behaviour change principles and much of the guidance in the resources section can be applied to other contexts.

4.5 WHAT IS BEHAVIOUR?

To reduce many of the impacts of bushfire, as well as human influences on natural drivers of bushfire risk, human behaviour is critical. When we refer to 'behaviour' we mean an **observable action – they are actions that we can see people do**.

As part of the BehaviourWorks Australia Method (also see Presseau et al. 2019), behaviours are often clearly defined using a framework – Audience, Target, Action, Context, and Time – which helps to specify who does what, when and where. This is illustrated in the figure below, including an example of a clearly defined behaviour (adapted from Plant and Boulet 2022).

Audience: WHO performs the behaviour.

Target: WHAT is the subject of the behaviour.

Action: WHAT is done to the target item.

Context: WHERE the behaviour takes place.

Time: WHEN the behaviour takes place.

Example: All Victorians (**audience**) develop (**action**) a bushfire survival plan for their household (**target**) following Country Fire Authority guidelines (**context**) before the bushfire season (**when**).

Figure 17. The Behaviour Works Australia method of defining behaviours

These different elements of behaviour matter because changing one or more of these can change the occurrence and what will have influence on the behaviour (Kneebone et al 2021; Presseau et al. 2019).

What defined behaviours could look like in the context of community bushfire risk reduction

Examples of specific community bushfire risk reduction behaviours are provided below, adapted from the list of behaviours presented in Plant and Boulet (2022):

Prevent	Prepare	Respond
1. When designing gardens around your home, ensure the garden is designed to reduce the effects of direct flame and radiant heat on a house (as per the guidelines on the Country Fire Authority [CFA] website).	3. Attend any bushfire planning workshops in your area that are scheduled by Regional Community Engagement Coordinators.	6. If a day is rated as 'Extreme' or 'Catastrophic' on the Australian fire danger ratings, and you live in a high-risk area, leave for a safer place the day before and stay there until the rating returns to 'High' or lower.
2. From September to March, clean gutters of leaves, sticks and other debris once a month.	4. Develop a bushfire survival plan for your household following Country Fire Authority (CFA) guidelines.	7. On days of high fire danger ('Severe' or above), regularly check in with neighbours to share information.
	5. Install the VicEmergency app on all household members' phones and set up fire alerts for your area.	

Note that this list reflects behaviours that could be performed by all Victorians, and that additional or different behaviours may be more relevant for other audiences, such as farmers or visitors to high-risk areas. For a longer list of behaviours and audiences, please see Plant and Boulet (2022).

Why prioritise which behaviours to encourage or support?

The list above shows that there are many potential behaviours that could support bushfire preparedness. As outlined in the 'Keep things action focussed and achievable' section, it is often more effective to focus on just one key action in a particular communication, so that messages are clear and simple (i.e., providing a long list of things to do can overwhelm and demotivate an audience) (Paton and Wright 2008; Plant and Boulet 2022; Kneebone et al. 2021; McCaffrey 2015).

For this reason, it can be helpful to first prioritise which action(s) to communicate to the audience(s).

One way to prioritise and select key actions

A useful tool to support behaviour prioritisation is an impact-likelihood matrix (Plant and Boulet 2022; Kneebone et al. 2021; Kneebone et al. 2017), which visually presents behaviours based on specific criteria.

Typically, to create an impact-likelihood matrix, behaviours are rated according to their perceived impact on the problem (e.g., rated by practitioners or specialists in the area) and their likelihood of being performed by the audience (this typically reflects how 'easy' the behaviour is to do, as rated by the audience).

An example of such a matrix, for the behaviours listed above is provided below (adapted from Plant and Boulet 2022):
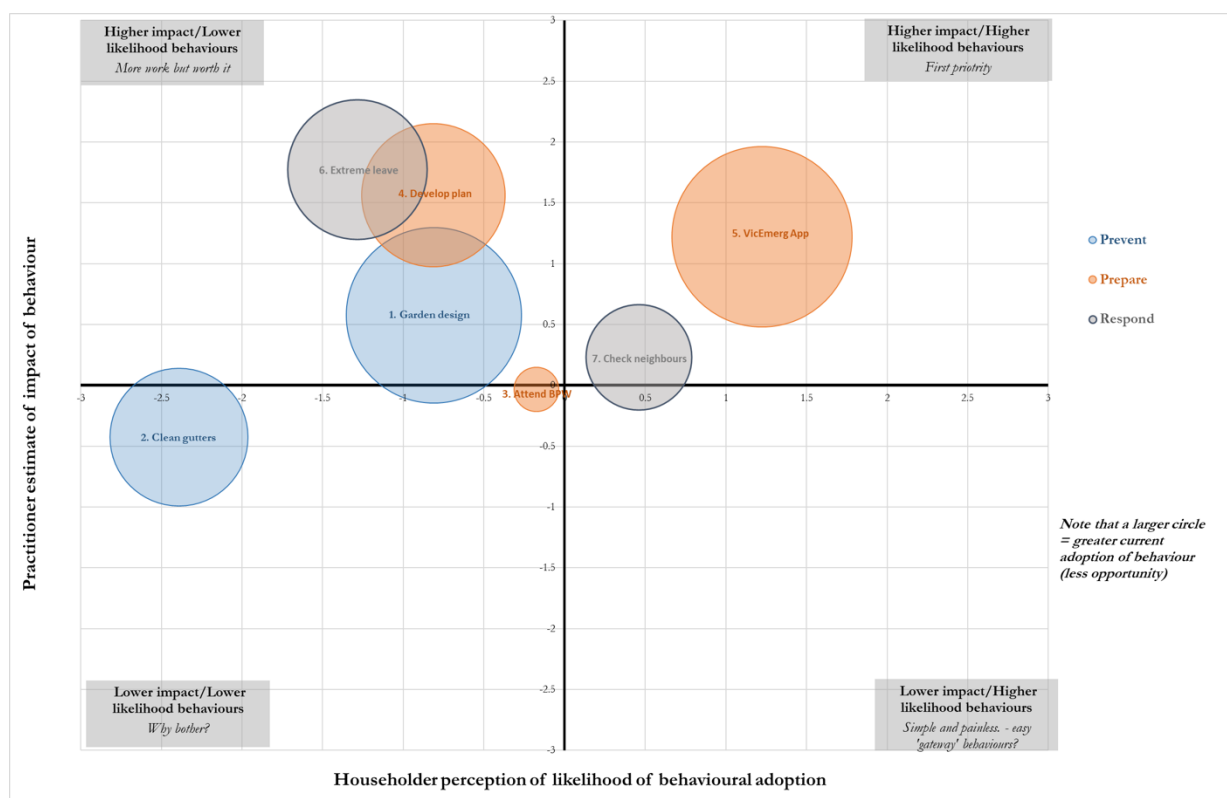
Such tools are not designed to make definitive categorisation or objective assessments of the impact and likelihood of uptake of the behaviours, but to facilitate discussion and as a tool to guide decision making.

Other examples of criteria that can be applied to support prioritisation include (Kneebone et al. 2021; Kneebone et al. 2017) current adoption by the audience (i.e., where there is lower adoption across the community there may be greater opportunity for change) and considering which behaviours may have multiple benefits (Paton and Wright 2008) or whether behaviours serve as a 'gateway' for other high-impact behaviours.

For more detailed information about defining, identifying and prioritising behaviours, see:

Kneebone, S., Boulet, M., Jungbluth, L., Downes, J., & Klemm, C. (2021). Chapter 5: Getting ready to deep dive – defining, identifying and prioritising behaviours. In Curtis, J. (Ed.), *The Method Book.* BehaviourWorks Australia, Monash University. http://doi.org/10.26180/14515794.v1

4.6 WHAT INFLUENCES BEHAVIOUR?

To encourage or support community preparedness to bushfire, it is valuable to identify what 'helps' or 'hinders' preparedness (Curtis et al. 2015).

'Facilitators' ('help') are influences that make the behaviour of interest **more** likely to occur – they're things that tend to encourage or support the behaviour.

On the other hand, **'Barriers'** ('hinder') are things that make the behaviour **less** likely to occur – they're things that tend to 'get in the way' of the behaviour.

Two key considerations worth noting in the context of the principles for effective behavioural communications are:

- A diverse range of drivers can influence an individual's behaviour (Curtis et al. 2015); and
- Factors beyond the individual can influence behaviour (Kaufman et al. 2021).

These considerations and their implications for behavioural communications and supporting bushfire preparedness are briefly outlined below.

Influences on individual behaviour are diverse

Given the diverse range of potential influences, several useful frameworks have been developed based on reviews of psychological theories and models of behaviour (Kneebone et al. 2021; Cane et al. 2012). To illustrate where values may sit within a broader range of potential influences, one useful model to consider is the Capability, Opportunity, Motivation, Behaviour (COM-B) model of behaviour (Michie et al. 2021).

The COM-B model proposes that an individual's behaviour is the interaction between their capability (psychological and physical), opportunity (physical and social), and motivation (reflective and automatic). From this perspective, 'values' are largely captured by reflective motivation. A diagram summarising the COM-B model of behaviour, with examples of the influences captured and which category they fall under within this model, is provided in the figure below.
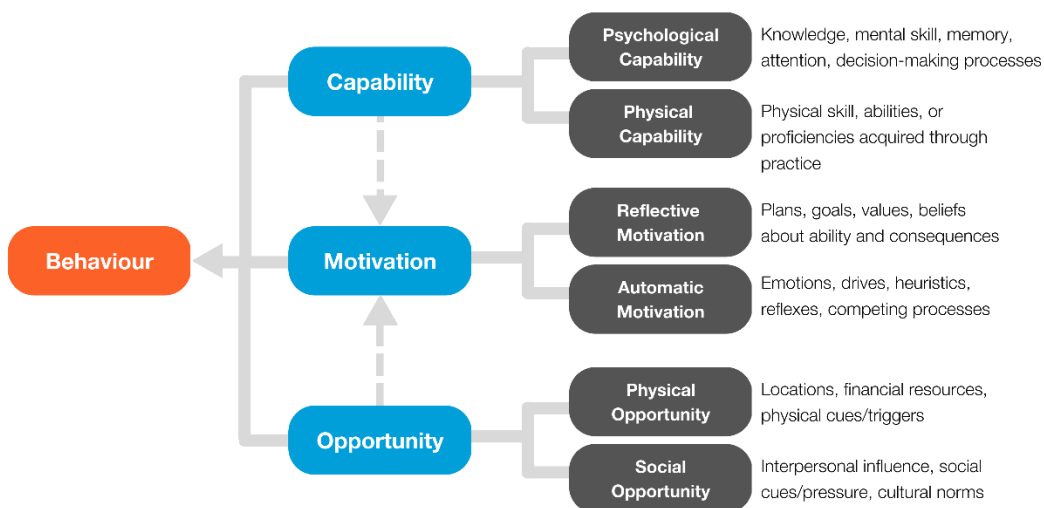
Examples of reported barriers to bushfire preparedness

If we apply the COM-B framework to some examples of reported barriers to bushfire preparedness (Paton and Wright 2008; Meis-Harris 2019; McCaffrey 2015; Paton et al. 2008), this could look like:

Behaviour	Capability	Psychological capability	Inadequate knowledge about the causes and management of bushfires: *lower psychological capability to prepare*
		Physical capability	Less able to perform preparation actions: *lower physical capability to prepare*
	Motivation	Reflective motivation	Negative attitudes towards bushfire risk, such as a willingness to take a risk: *lower reflective motivation to prepare*
		Automatic motivation	Anxiety about bushfires: *lower automatic motivation to prepare*
	Opportunity	Physical opportunity	Inadequate resources to prepare, such as financial or time constraints: *lower physical opportunity to prepare*
		Social opportunity	Pressure from family that preparation is unnecessary: *lower social opportunity to prepare*

Which types of barriers can be supported via communications?

For a given individual, communications can **directly** address barriers of *psychological capability* and *reflective motivation*—these are generally where communications are targeted (i.e., to educate or persuade) (Jungbluth et al 2021; Michie et al. 2011).

However, communications are **not** designed to, and cannot **directly** address barriers of *physical capability*, *physical opportunity*, *social opportunity* or *automatic motivation* (Jungbluth et al 2021; Michie et al. 2011).

If we apply this to the aforementioned examples of reported barriers, ones that could be targeted directly by communications are indicated (in **green**) in the table below:

Behaviour	Capability	Psychological capability	Inadequate knowledge about the causes and management of bushfires: *lower psychological capability to prepare*
		Physical capability	Less able to perform preparation actions: *lower physical capability to prepare*
	Motivation	Reflective motivation	Negative attitudes towards bushfire risk, such as a willingness to take a risk: *lower reflective motivation to prepare*
		Automatic motivation	Anxiety about bushfires: *lower automatic motivation to prepare*
	Opportunity	Physical opportunity	Inadequate resources to prepare, such as financial or time constraints: *lower physical opportunity to prepare*
		Social opportunity	Pressure from family that preparation is unnecessary: *lower social opportunity to prepare*

Individual behaviour occurs in context

While individual factors, such as attitudes, values, knowledge, and skills are important influences on behaviour, it is important to consider the broader contextual and system level factors that influence bushfire preparedness (Figure 18). Multi-level perspectives provide a useful framework to think about behaviour, with the various factors that influence behaviour grouped at different levels (Meis-Harris et al. 2019; Kaufman et al. 2021; Boulet et al. 2021).

An example of factors that have been reported in the literature as influencing bushfire preparedness across different levels of the system is presented in the below diagram, from Meis-Harris et al. (2019).
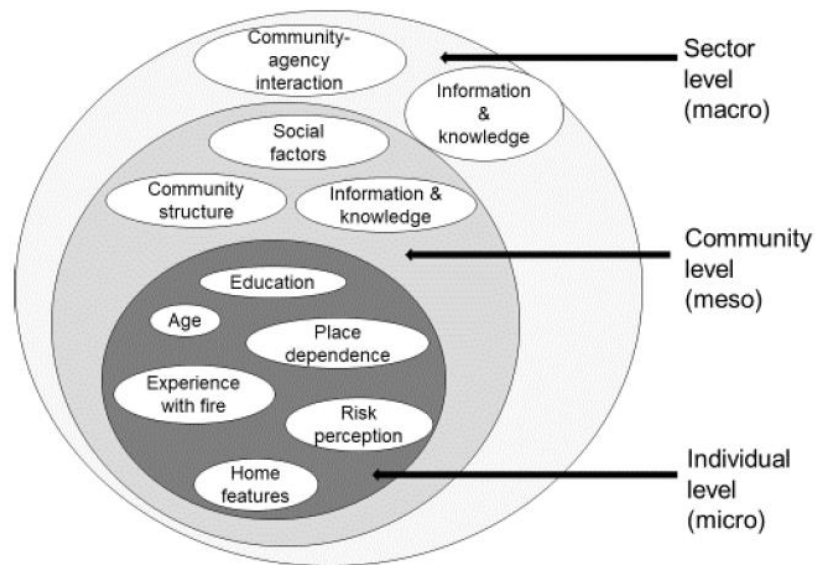
Figure 18. Systems thinking of behaviour

Figure 18 illustrates some factors relevant to the micro (individual), meso (household), and macro (beyond household) levels that could influence bushfire preparedness. It also illustrates that preparedness behaviours emerge from several factors – rather than a single factor – and their interactions across levels.

What this means for communications and supporting bushfire preparedness more broadly

Behavioural communications can play an important role in enhancing the community's understanding of the impacts of climate change on bushfire risk and in encouraging bushfire preparedness, particularly in situations where:

- A targeted approach is being taken to *address* specific gaps or misunderstandings in **knowledge** or specific **motivations** that have been identified as important *barriers* to behaviours of interest; and/or when
- A targeted approach is being taken to *harness* specific **knowledge** or **motivational** factors that have been identified as important *facilitators* to behaviours of interest; and/or when
- A generalist approach is being taken and/or communications are being used as part of a broader suite of tools to support bushfire preparedness. In such cases, drawing on generic strategies or insights could be applied.

It is important to keep the following in mind: If the goal is to encourage or support community preparedness for bushfire, a targeted and multifaceted approach may be necessary — relying on behavioural communications alone may not be sufficient (Coppola and Maloney 2009; Jungbluth et al 2021).

To find out more about the role of systems and behaviour, see:

Kaufman, S., Goodwin, D., Slattery, P., Macklin, J. (2021). Chapter 2: Systems Thinking and Behaviour. BehaviourWorks Australia, Monash University. https://doi.org/10.26180/13661561.v2

For more detailed information about understanding influences on behaviour, see:

Curtis, J., Tear, M., Garivaldis, F., & Tull, F. (2021). Chapter 6: "You're not normal!". Understanding the influences on behaviour. BehaviourWorks Australia, Monash University. http://doi.org/10.26180/14703789.v1

To find out more about the different types of solutions, including those beyond education and persuasion, and aligning solutions to behavioural influences, see:

Jungbluth, L., Zhao, K., Wright, B., Plant, B., Goodwin, D. (2021). Chapter 8: From insights to interventions. BehaviourWorks Australia, Monash University. https://doi.org/10.26180/15071037.v1

4.7 WHAT ARE SOME TOOLS TO FOSTER MOTIVATION?

There are several useful generic behaviour change tools that can be drawn upon in communications. We use the term 'generic behaviour change tools' to refer to approaches that are based on behaviour change principles that tend to apply across a variety of contexts (Smith et al 2021), for example **social norms** and **ease** (outlined in '[Keep motivation high](#)')[1].

Two such tools introduced here are the EAST (The Behavioural Insights Team 2014) and the INSPIRE (Faulkner et al. 2019) frameworks.

The EAST framework

Developed by the UK Behavioural Insights Team, the [EAST framework](#) (The Behavioural Insights Team 2014) is a useful generic behaviour change tool, which proposes that behaviour change is more likely to occur if you make it **Easy**, **Attractive**, **Social** and **Timely**.

To apply EAST in communications, consider how you can:

- Make the information or action **easier** for the audience?

- Make the information or action more **attractive or personally relevant** to them?

- Link the information or action to others, make it more **reputable or social** or require a **social commitment**?

- Time the information or behaviour when they may be **more able or receptive** to act?

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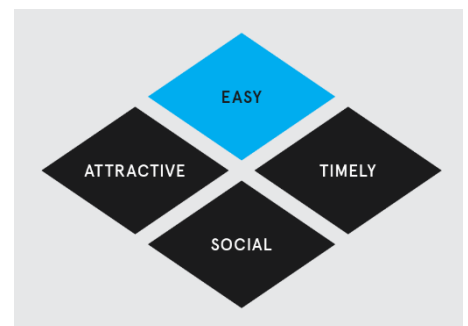
[1] This is in contrast to a targeted approach, where solutions are designed which align with unique barriers and facilitators identified for a behaviour of interest – this is outlined in '[Address barriers for action](#)' and '[What influences behaviour?](#)'.

The INSPIRE Framework

BehaviourWorks Australia's INSPIRE framework (Faulkner et al. 2019), draws on the approaches of **implementation intentions**, **norms**, **salience**, **procedural fairness**, **incentives**, **reputation and credibility**, and **ease**.

Implementation intentions
Norms
Salience
Procedural fairness
Incentives
Reputation and credibility you
Ease

To apply INSPIRE in communications, consider how can:

- Encourage the audience to make an **if-then** **plan** to achieve a goal?

- Emphasise positive actions that **most people do** or what others **approve of**?

- Make key aspects of the information or action **stand out** and **attract the attention** of your audience?

- Treat the audience **fairly, transparently, and with respect**, and emphasise procedural fairness?

- Provide or remind the audience of **benefits** of doing positive actions (financial or non-financial incentives)?

- Draw on communicators with **high-authority** and/or **liked** sources?

- Make the information, request, or action **easy** to understand and do?

For more detailed information about generic tools, including their advantages and disadvantages, see:

Smith, L., Slattery, P., Macklin, J., & Kunstler, B. (2021). Chapter 9: Using generic behaviour change tools when time and resources are scarce. BehaviourWorks Australia, Monash University. https://doi.org/10.26180/16544376.v1

Additional resources

The EAST and INSPIRE frameworks capture useful behaviour change principles that tend to apply across a variety of contexts; however, note that there are many more that could be drawn upon in communications. For instance, 15 useful approaches to support communication, engagement, and behaviour change can be explored via The Make It Toolkit.
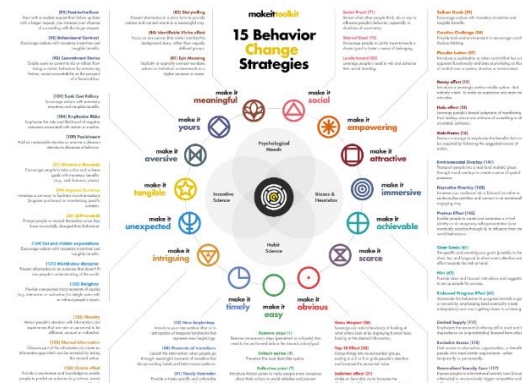

In addition, this best practice communications guide, developed by the Ministry for Environment and BehaviourWorks Australia (2023) includes a **library of behavioural insights** with principles and considerations for effective application and examples. While the evidence-base and guidance provided in the guide was developed for waste minimisation in New Zealand, the behavioural insight and general principles for their application can be applied to other contexts.


Furthermore, 'Hidden Persuasion' illustrates the use of 33 strategies used in advertising and visual persuasion. While these are demonstrated in the context of the marketing of *products*, the content is highly accessible and guides the reader through examples of application of useful approaches that haven't been covered in this report. For example, it includes **acknowledging resistance**, **loss and gain framing**, **self-persuasion**, and takes a more detailed look at implementation intentions.

Andrews, M., van Leeuwen, M. L., & van Baaren, R. B. (2013). *Hidden Persuasion. 33 psychological influence techniques in advertising*. Amsterdam: BIS Publishers.
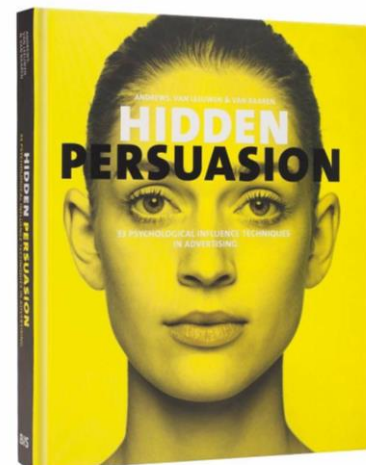
On navigating uncertainty
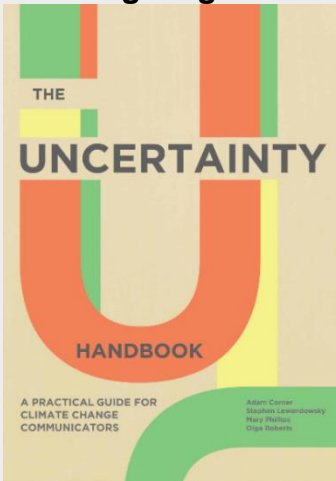
Related to the communication principle of keeping motivation high, there is a valuable line of work by Corner and Lewandowsky about effective ways to navigate and communicate about uncertainty. This handbook is an accessible and practical resource, with examples of what to do and what to avoid when communicating around climate change. While the principles are based on research on climate change communication, and positioned as such, many of these principles could be applied to other contexts.

Corner, A., Lewandowsky, S., Phillips, M. and Roberts, O. (2015) The Uncertainty Handbook. Bristol: University of Bristol. Accessible via: https://climateoutreach.org/reports/uncertainty-handbook/

Some key principles that appear especially relevant to communications about the role of climate change on bushfire risk include:

- First focus on **what is known** (rather than what is unknown).

- Where the audience expresses uncertainty about climate change, emphasise the **scientific consensus** (see 'Keep motivation high'), and/or **draw on analogies** that people can relate to. For example:

    o "When it comes to the link between human behaviour and climate change, the science is settled"; "97% of scientists agree".

    o "Scientists are as confident about the link between climate change and bushfire as they are about the link between smoking and lung cancer".

- Instead of framing messages around the uncertainties, messages can be framed around **managing risks**. This approach may be more empowering for people, particularly if **framed positively** and effective **actions or steps** they can take to reduce their risk are clear (see 'Keep things action focussed and achievable').

- The most important question for climate impacts including bushfire is 'when', not 'if':

    o This means it may be more effective to **place certainty on the outcomes**, with **uncertainty placed on when** they will occur.

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