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Fire Technology Transfer Note

Influencing public behaviour through improved communication of fire danger

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Summary: While there is a good understanding of levels of awareness raised by fire danger communication methods, knowledge of the extent to which they actually influence behaviour (and thus reduce the impacts of human-caused wildfires) is limited. In this study, previous Scion findings on communicating fire danger have been updated and expanded to highlight the effectiveness of different methods of communication on changing behaviour. Findings indicate the following actions and approaches for consideration by fire authorities.

Action	Rationale	Approach
Identifying desired behaviours and correlating these with fire ratings.	A clear and consistent set of guides are needed to drive desired behaviours.	Symbols provide a universal language that could be used to communicate fire permit and danger status.
Building on two-way communications, particularly face-to-face interactions.	Face-to-face interactions are known by fire managers to be successful at changing behaviours.	Interaction could be built on, including incorporation of social media, which uses the influence of social norms, a standard behavioural change mechanism.
Selected timing of communication can be used to enhance positive effects.	Risk windows are good times to communicate as they represent opportunities to overcome people's inherent inertia biases and tap into their emotions as drivers of change.	Shortly after or on anniversaries of major events or another opportune time is when people enter an area for the first time, e.g., when they move home or are new visitors.
Supporting people's belief that they are capable of making a difference.	Interventions that provide tools for people to make a difference to their environment (e.g., home-based risk assessments), are a useful mechanism to effect change.	People are also more likely to change when they believe they could suffer a significant loss (e.g., loss of their home or possessions).
Law enforcement remains a possible mechanism of change, but it can be expensive to implement.	The perceived penalties resulting from an action need to outweigh the benefits of non-adherence in the minds of people for there to be significant effect.	Legislation that requires interaction does offer a good avenue for two-way communication through the fire permitting process.

Research approach

Scion Rural Fire Research Group social scientists undertook a study for Fire and Emergency New Zealand to explore existing knowledge of fire danger communication methods and the extent to which they influence behaviour and thus reduce impacts of human-caused wildfires. The goal of this project was to inform New Zealand fire and land management agencies on how best to influence people's behaviour to reduce the number and effects of human-caused wildfires.

The main methods of communication about fire danger are based on information distribution, with rural fire danger warnings typically provided on signs and in print media. However, there is evidence that this approach does not lead to a measurable change in behaviour (Langer & Hart, 2014). In a study conducted in Northland and Canterbury, most rural and urban residents, and domestic and international visitors were aware of fire danger warning signs but had limited understanding of what behaviour was expected of them to reduce or mitigate fire risk (Hide, Tappin & Langer, 2011). Many landowners are aware of fire seasons and actively seek out information. However escaped land clearing burns and fires resulting from machinery use remain major causes of wildfire. Bonfires, rubbish fires and camp fires are also increasing as a cause of escaped fires.

Our research approach using qualitative methods included:

Direct questioning of participants (N=20) in relation to the effectiveness of initiatives in influencing behaviour change related to fires both in New Zealand and other locations (Figure 1):

- Interviews with researcher and practitioner – five New Zealand rural fire authority personnel (in Auckland, Wellington, Palmerston North and Invercargill), three Australian practitioners (two of whom were previously researchers), and one Canadian and one US researcher;
- Emails with crowdsourced/networked participants – one Australian researcher and one practitioner, two Canadian practitioners, four US researchers and two practitioners.

Reviews of New Zealand and international research and grey literature regarding communication methods and behaviour change initiatives for a variety of purposes (not just wildfire).

Research findings

This summary of research findings is based on a comprehensive report (Grant, Hooper, & Langer, 2017) to Fire and Emergency New Zealand.

<https://fireandemergency.nz/assets/Documents/Files/changing-public-behaviour-report-156-Dec-2017.pdf>

Understanding the effectiveness of methods

Behaviour change is complex and requires a shift in communication approach; our research aimed to identify what types of shift may have the most effect. From the literature review, interviews and email exchanges, it was confirmed that common means of communication are:

- Broadcast one-way
 - signage – roadside fire danger and information about fire season status
 - broadcasting of information, e.g., radio, print media, brochures, online, networks
- Directed one-way
 - location-based mobile technology for site specific information
 - legislation and policy – requiring compliance of specific individuals based on activity/location/fire risk
- Two-way interaction
 - face-to-face interactions – community education events, permitting, training of rural land managers or recreational fire users
 - social media engagement as opposed to information delivery.

However, this does not take into account the different types of audience (Langer & Hart, 2014) and what kinds of information needs or behavioural responses may be affected.

Responses from interviews and emailed questions suggested the most effective communication methods in eliciting behaviour change are two-way interactions, with the best results experienced around face-to-face interactions. Specific methods referred to were directly engaged communities, e.g. as part of



Figure 1: Location of research participants interviewed and emailed surveys (blue pins signify interviewees and red pins signify emailed crowdsourced/networked participants).

BE AS READY AS YOU CAN BE THIS FIRE SEASON

Community Fireguard is CFA's most comprehensive fire safety program.

Take control of your own bushfire safety and be better prepared to:

- Plan for a range of scenarios
- Make informed decisions when it counts
- Maintain a fire smart house and garden

Is it for me?

If you are passionate about keeping your home and your family safe, and can get together with your neighbours or other locals from around your area, then Community Fireguard is for you. This program is available for residents in high risk bush or grass fire areas.

How much does it cost?

Community Fireguard is free of charge.

How many people do I need to get together to form a group?

As a general rule you will need to include people from at least four or five households in your group. But this might vary depending on your local area – your first step should always be to speak to CFA.

Where are the meetings held?

Once you have your group together, CFA will come to you. Community Fireguard meetings are held in people's homes or local community centres, at a time that's convenient for the group - usually on weekends or in the evening.

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FireReady Victoria

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Figure 2: Facilitating two-way interaction, Victoria's Prepare Act Survive policy encourages communities to seek Country Fire Authority (CFA) support via Community Fireguard that can establish key links with community leaders to support appropriate fire risk mitigation practices. (Image: CFA, Victoria, n.d.)



A Be Ready Warrandyte scenario planning workshop, where a facilitator stepped through a hypothetical fire scenario, allowing community members to test household plans and actions and gain feedback from emergency management organisations.

Figure 3: As an alternative to legislation, Be Ready Warrandyte was a community-led initiative that facilitated community engagement with emergency managers who were invited to: i) inform and engage but not to advise the development of appropriate social norms, and ii) overcome constraints in helping communities set priorities and innovate in bushfire preparedness approaches. (Image: McLennan, 2016)

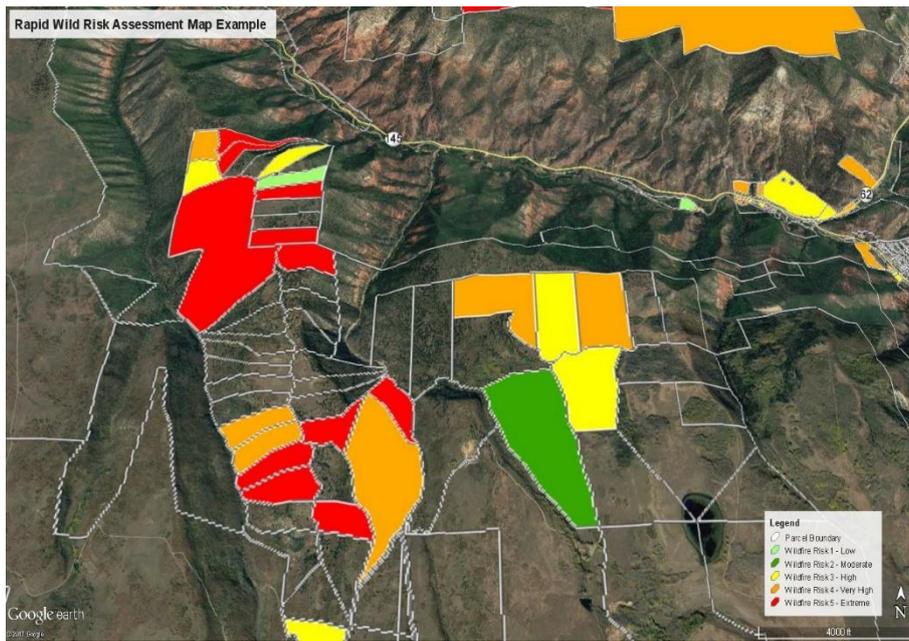


Figure 4: In Colorado, a summary of rapid fire risk assessment results are displayed on Google Earth imagery varying from red as extreme to green for low wildfire risk. An online self-assessment by a homeowner can then lead to individual property assessment site visits by wildfire risk experts identifying things that people can do to reduce risks around their home for a relatively small cost (under \$50). (Image: Barth, 2017)



Figure 5: Provocative transformation of the traditional fire danger rating sign used in Auckland to trigger permit seeking during high fire danger periods, however this approach is not widely supported for a variety of reasons including a deviation of the traditional fire danger warning signs intended purpose to inform fire managers. (Images: Auckland Council, 2016)

a comprehensive program in Tasmania of community involvement in fuel reduction burning (Tasmanian Fire Service, 2017; see also Paton, 2017) or individual Community Fireguard programs (Figure 2) such as Be Ready Warrandyte (Figure 3) led by communities in Victoria (McLennan, 2016). This approach has also been trialled in New Zealand, through presentations to community groups in which questions and engagement are encouraged, e.g., in Marlborough. Limitations identified are expense and reaching people who are unaware of, or unresponsive to, risk mitigation messages. Rapid wildfire risk assessments at property level such as those conducted in Colorado (Figure 4) were also seen as a cost-effective means of supporting behaviours that could reduce fire risk exposure.

New Zealand has had limited experience with extreme fire events, although that is changing with some more recent fires exhibiting extreme fire behaviour. However there is a lack of clarity around the human behaviours that fire managers would like to see members of the public adopt, partly because that depends on circumstances such as the nature of the fire environment or individual levels of awareness. Generally, however, there is agreement that face-to-face interactions are most successful when people are sensitised to fire risk after a major event such as the 2017 Port Hills fires.

Combining behavioural theory and communication practice

Creating real, lasting behavioural change is a challenge, and successful interventions need to be flexible to cater for different audience needs and contexts (COI, 2009). It is also not enough to simply be aware of the potential consequences and risks of our behaviours (Wegwarth, Kurzenhäuser-Carstens, & Gigerenzer, 2014). Most smokers are likely to be aware that smoking is unhealthy, yet they still engage in this behaviour. Understanding why they do so is a fundamental step in progressing from a merely educational initiative to a meaningful behavioural shift. There is a depth of information regarding neuropsychology and behavioural psychology that is relevant to understand the 'why' and changing human behaviour in relation to starting fires and managing fire risk.

Systems thinking is a behavioural approach that enables practitioners to analyse the interrelationships between factors influencing complex behaviour and anticipate the effects of potential initiatives. Behavioural models, based on systems thinking, can be used to demonstrate that change is a dynamic process, as opposed to a single, discretionary event (Darnton, 2008). The incorporation of such thinking has been successfully used in interventions to change behaviour, including drunk driving (Angle,

Pinkney, Johns, & Cass, 2012), use of seat belts (Linkenbach & Perkins, 2003) and prevention of AIDS transmission (Kegeles, Hays, & Coates, 1996). Given that change is a dynamic process and there are multiple, linked interactions taking place over time and with different people, we suggest that behavioural change interventions need to be well-planned, collaborative and sustained to have effect.

Clarity of messaging is critical to influencing behaviour. Fire danger signs in New Zealand are the most common method of providing information on fire danger, yet the majority don't impart a message to the sign reader as to what action to undertake, but simply tell the sign reader the 'level' of danger (Hide, Tappin & Langer, 2011; Langer & Hart, 2014) or that there is a restricted season. It is important that there is a concerted New Zealand view on desired behaviours in response to fire messages; this view is yet to be established.

Consistency of messaging is also critical, but this must be tempered by *local relevance*. Fire signs in New Zealand provide different messages in the Auckland region compared to most of New Zealand (Figure 5). In Auckland, they tell the sign reader only whether they can have fires, need a permit, or must light no fires. In much of the rest of New Zealand they simply have a level of danger (designed primarily to inform fire managers within a region), although in some areas they include information on both fire danger and fire season status/permit requirements. People moving between one place and another can be confused by the difference of the messages on signage. Therefore it must be made clear that different locations have different conditions, and fire risk is related to these conditions. This message can be best delivered by encouraging people to think through the fire dangers in their local environment (see *Self-efficacy* below). Simplifying signage can help create consistency in what to consider.

Habitual behaviour also plays an important role in determining people's actions. Over time, a repeated behaviour will become more and more habitual and this automaticity develops into a key driver for our day-to-day behaviours (Wood & Neal, 2007). This means an observed behavioural response may not be the result of a carefully reasoned choice based on information alone, it may be a conditioned habit based on repetition and frequency rather than conscious application of logic. Several behaviour change theories argue that habitual behaviours must be raised into the conscious mind to enable them to be changed (see Lewin, 1951). An example relating to fire is that it is easier to change behaviours when people move into an area than when they have lived there for some time. In some rural settings, an effective technique is encouraging property buyers

and sellers to discuss fire risk practices and resources such as permit requirements and location of water tanks (see *Other people's behaviour* below).

Emotions are another powerful influence on behaviour, as is well known in the advertising world. Emotions such as fear or anxiety can have a significant influence on decision making, sometimes overriding logical reasoning (Curtis, Garbrah-Aidoo, & Scott, 2007). Accessing the 'risk window' to communicate messages regarding fire, i.e. the time immediately after a major fire event (or the anniversary of such an event), taps into the emotions that people felt during that event.

Other people's behaviour, including social and cultural norms, is critical in influencing behaviour, however, it is often underestimated (Goldstein, Martin & Cialdini, 2007). Social and cultural norms are the customary 'rules' that define and govern acceptable behaviour within a society or group. When we are unsure of behavioural expectations in certain situations, we look to others to guide our actions. Using social norms is one method of looking for the socially acceptable behaviour with associated benefits of conformance or penalties for non-conformance. Behavioural change interventions can identify and highlight targeted social norms through peer-to-peer approaches, testimonials and declarations from respected opinion leaders, prompting people to act in accordance with the purported behaviour of others (Goldstein, Martin & Cialdini, 2007).

Two-way interactions, both face-to-face interactions and via social media, are strong methods of imparting social and cultural norms (Latonero & Shklovski, 2011). Social media offers an opportunity to change behaviour based around social norms, e.g., through the use of Scion's "Fire Danger Today" and the "Fires Near Me" apps in Australia, or other networks such as the Facebook pages of local Fire Brigades. However, the fire management community is not necessarily well-versed in use of social media; training, support and additional personnel may be required for it to be used effectively. It is worth noting that social norms can be rapidly modified as the result of legislation, although reinforcement over an extended period is generally required for social norm effects to become self-sustaining (Paveglio, Boyd & Carrol, 2012). In relation to fire, having champions who are visibly undertaking actions, e.g., around their homes as a result of a risk assessment (as above), may influence others to undertake the same actions.

Self-efficacy influences behaviour, and is a person's belief that he or she has the capability to successfully perform a particular action to bring about an expected outcome (Bandura, 1997). Many early behavioural psychology models postulated that

attitudes lead to action (Fishbein & Ajzen, 1975). However evidence now suggests that the influential link between attitudes and behaviour is not as robust as once thought, and that other factors, such as self-efficacy may have a larger influence (DeVries, Dijkstra, & Kuhlman, 1988). In particular, lack of self-efficacy can be a barrier to action, e.g., people feel the problem of climate change is too great to make a difference and therefore do not alter their actions in any way (Darnton, 2008). Behavioural change initiatives can amplify individuals' self-efficacy by making certain behaviours seem achievable, for example, by using testimonials of others who have changed their behaviour successfully, and clear instructions regarding the uptake of relevant skills (Darnton, 2008).

In relation to rural fire, there is evidence that self-efficacy is best realised when people are aware of relatively high risks and able to take some simple steps to minimise their exposure; e.g., the Fire Adapted Communities Interagency Programme in the US (Figure 6) supported risk assessors and tools to enable people to consider hazards within their home environment and this was most effective in very exposed or remote locations (Wilson, 2016).



Figure 6: Community Wildfire Protection Planning (CWPP) with Wildland Urban Interface (WUI) communities in the US are encouraged to support self-efficacy of communities and individuals to develop their own plans. (Image: Wells, 2009)

Legislation, or similar hard instruments of change, can be effective, depending on the scale of penalty relative to the perceived benefits of the activity; e.g., a parking fine will likely be most effective when it is significantly greater than the cost of parking. Penalties for escaped fires need to be sufficient that they outweigh perceived benefits of having fires. Until recently, the penalties associated with causing an escaped fire (while relatively low) included the costs

Table 1: Well-known cognitive biases and their potential impact on behavioural change initiatives, with examples applicable to guiding both one- and two-way efforts in communicating wildfire danger.

Bias	Description	Using the Bias to Achieving Behavioural Change
Framing Biases	Choices are influenced by the way they are presented or framed. In particular, we are loss-averse. For example, a message framed as a loss – ‘you will lose \$X each year if you don’t service your car’ – will have more impact if it were framed as a gain – ‘you will save \$X each year if you have your car serviced’.	The context of delivery shapes a person’s perceptions about the information and influences the likelihood of engaging in an action. As an example, a hypothetical campaign communicating seasonal fire danger framed as a loss, e.g., ‘you will lose your home, possessions and possibly your life if you do not reduce unnecessary vegetation around your house in summer’, will be more likely to affect fire risk management behaviour than if the same information was framed as a gain, e.g., ‘you will protect your home, possessions and your life if you reduce unnecessary vegetation in summer’ (see Kahneman & Tversky, 1984).
Saliency Biases	Information that is conspicuous, novel or seems appropriate is more likely to shape our actions.	Saliency can be manipulated in provision of information by changing the way it is delivered or when it is delivered. A very pertinent example for fires is using the ‘risk window’, i.e. getting attention of the public exposed to fire danger when a significant wildfire event heightens awareness (see <i>Emotions</i> above).
Status Quo / Inertia Biases	Humans have a natural preference for the default option or status quo (inertia).	Inertia can be overcome by making a behaviour seem easier to undertake than people expect, or by setting the default as something to opt out of rather than opt in to (Thaler & Sunstein, 2008). A specific example related to fire is the experience of vegetation control ordinances in the US being supplemented by garden refuse collection by local councils to help people dispose of the garden waste after pruning at key risk sites.
Temporal Biases	We have a tendency to prefer short-term reward over long-term gain (COI, 2009). We are more likely to disregard future gain if it appears more remote.	Temporal bias is associated with an immediate benefit. A fire example taking advantage of this bias might involve giving people a discount on green waste disposal for several months before summer to encourage vegetation control, as opposed to drafting communications that show long term property value stability if vegetation is well controlled resulting in no fires.



Figure 7: Fire Danger Rating signs that can be adjusted remotely to keep signs up to date are more reliable. They can also include electronic text emphasising the fire danger level or other fire prevention messages. (Image: Grant, 2017)



Figure 8: New Zealand law when driving – symbols used to convey simple messages specifically targeted at visitors or new residents to New Zealand. (Image: New Zealand Transport Authority, 2014)

of extinguishing the fire (which could run into millions of dollars). However recent changes to the legislation has meant the cost recovery penalties have been abolished but penalties for human-caused escaped fires remain. Nevertheless, an important aspect of legislation in New Zealand, enacted through permitting, is the two-way interaction in the permitting process which is an opportunity to educate the public. Legislation, however, is generally seen as a very costly way of trying to influence change.

Behavioural economics is the intersection of psychology and economics, and considers that decisions are both context dependent and may be misguided due to cognitive biases and mental shortcuts (heuristics). Some relevant cognitive biases are provided in Table 1. The understanding that decisions depend on the context or setting supersedes previous behavioural models that people act rationally (the socio-economic theory of “rational choice”). The premise that providing people with accurate information and incentives means they will weigh up the risk/benefit ratio and respond accordingly has been shown to be flawed (Peters, Klein, Kaufman, Meilleur, & Dixon, 2013). Behavioural economics provides principles for sense checking behavioural change tools on the basis that cognitive biases and heuristics exist across differences of age, gender, intelligence, social class and personal preferences (Ariely, 2008).

Choice architecture is about designing behaviour prompts to increase the chances of desired actions being readily adopted, e.g., if you put a handle on a door it is likely that people will try to pull the door – the intuitive action is to pull a handle (Thaler & Sunstein, 2008). Several practical principles based on human behaviour can be incorporated into choice architecture to influence behavioural change. However, consistent approaches are also needed to ensure a message is not confusing or unclear, especially for people unfamiliar with local custom or

norms. Having more reliable fire danger rating signs can be achieved through use of remotely adjustable electronic signs that makes the effort of changing them a lot more efficient and less demanding on fire managers’ time (Figure 7). Another successful initiative has been the partnership between the New Zealand Transport Authority and the New Zealand Rental Vehicle Association to create some recognisable symbols capturing rules for visiting drivers placed on removable tags where they are clearly visible on the steering wheel of rental vehicles (Figure 8). Similar relationships could be built with real estate associations.

Conclusions

It is crucial to identify what desired behaviours are sought to elicit behavioural change – if you don’t know what you want to achieve, you can’t start trying to change behaviour of people within wildfire prone communities. Once the desired behaviours are identified, it is then essential to achieve clarification and consistency of fire messaging, whilst also appreciating that different contexts including different audiences may need different types of information or guidance (e.g., Langer & Hart, 2014).

Behaviour change takes time and requires prolonged and multi-pronged efforts to support the transition towards a more responsible and responsive public in fire risk management and safe behaviour. Two-way interactions, particularly face-to-face, are considered important for improving behaviours and embody the principle of influencing via social norms. Social media offers further opportunities for influence of fire behaviour via two-way interactions, based on appropriate support and upskilling of fire managers.

There are a number of principles from understanding of human behaviour that can be used to influence behaviour change. A strategic approach would draw on methods suitable to different contexts; some examples follow.

Risk windows offer a time to have major effects on behaviours, including shortly after and at anniversaries of major fire events or at the beginning of fire seasons. These are times when *emotions*, another major influence, can be brought to play to change behaviour. They also are an opportunity to maximise salience of messages.

Times of change, e.g., when people enter an area, are another time when people are most likely to change behaviours because their habitual behaviours will have less of an influence. This overcomes people's inertia biases and possibly temporal biases. These times include when people move houses and when visitors enter a new area, e.g., when taking a holiday away from home.

Other people's behaviour are a significant influencer of behaviours and can be used in campaigns aimed at changing behaviours. Two-way interactions embed the use of other people's behaviour as an influencer, but need to be considered carefully to avoid framing bias as they can have reverse effects.

Self-efficacy - giving people tools and understanding so that they believe *they are capable of making a difference* - is critical in influencing change, e.g., carrying out risk assessments of people's properties, which include identifying simple actions that can be undertaken such as removing leaves from guttering or clearing vegetation growth around buildings. The more people can be involved in their own planning efforts, the more likely they are to take action.

Legislation is a possible but expensive mechanism for change, and penalties need to outweigh perceived benefits. An important aspect of permitting legislation is it provides an opportunity for two-way interactions between permit issuers and fire users to discuss fire risk and appropriate reduction measures.

Messages regarding the impacts of fire should *focus on avoiding loss*, rather than achieving gain, as humans are generally strongly risk-averse, so an understanding of how message framing influences behaviour is an important tool for effective behaviour change.

Specific recommendations

- **Determine what behaviours are expected** under different fire danger ratings and create a clear and consistent set of guides to drive these behaviours, e.g., direct messaging stating that a permit is required conveys the behaviour expected rather than stating that there is a restricted fire season on fire signs.
- **Capture opportunities for face-to-face interactions** with fire users in wildfire prone areas, such as when they move into an area or apply for a permit.

- **Explore the use of symbols** as a universal language to convey a clear and simple message about fire permit requirements and fire danger similar to the total fire ban symbol (a fire within a red circle with a diagonal line through it), e.g., for national use in TV fire weather reports.
- **Develop opportunities for using social media** with those who have knowledge of appropriate behaviours to spread the word through people in the community (e.g., fire force volunteers) on actions that can be taken, as well as other pertinent information during fire danger periods and the losses that might ensue if action is not taken.
- **Introduce property risk assessments** as a relatively low cost measure to inspect properties and identify hazards that could be readily modified by property owners, increasing their self-efficacy and increasing face-to-face interaction opportunities.
- **Plan effective measures to capture risk windows** of opportunity (e.g., after a fire event), to engage with exposed communities, access their emotions and the salience of the event to support individuals taking actions to change behaviour.
- **Target visitors via appropriate websites**, e.g., freedom-camper and rental car companies, to outline rules and regulations of fire permitting and compliance requirements, as well as where to get further information.
- **Work with community groups** through partnerships (including local fire force volunteers, community fire wardens or other community groups) to support the development of appropriate social norms around safe fire behaviour led by community champions. A partnership and assisted approach is necessary to provide support during each high fire danger season.
- **Recognise the value of peril** such as cost recovery liability (under the previous Forest and Rural Fires Act (1977)) and permit requirements as hard instruments to enforce legislation and gain compliance, through enacting sufficient penalties to deter potential offenders.

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Further information

More information on behaviour change can be found through the online resources from references cited including the report underpinning this Fire Tech Transfer Note available from the Scion Rural Fire Research website www.scionresearch.com/fire.

Photograph credits

Figure 2: Country Fire Authority (n.d.). Community Fireguard – Be as ready as you can this fire season. <http://www.cfa.vic.gov.au/plan-prepare/community-fireguard/CommunityFireguard-factsheet.pdf>

Figure 3: Blythe McLennan (2016). Extending into community-led preparedness and planning just enough (but not too much?). *Australian Journal of Emergency Management*, 31(1): 5-6, <https://ajem.infoservices.com.au/items/AJEM-31-01-02>

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Figure 5: Auckland Council (2016). Fire season change for Auckland. <http://ourauckland.aucklandcouncil.govt.nz/articles/news/2016/04/fire-season-changes-for-auckland/>

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Figure 7: Andrea Grant (2017). Author photo taken in Woombah, New South Wales showing a solar powered remotely adjustable electronic Fire Danger Rating sign.

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