RURAL FIRE RESEARCH Update

SCION

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# Improving safety at controlled burns

The tragic deaths of three farmers in rural fires in recent years has highlighted the risks of burning practices. With no database of fatalities, injuries or near miss events to help understand the problem, little was known about how farmers use fire and what specific actions lead to injury or death.

This research set out to compile fire incidents for the past 140 years and to find out what we can learn from these events. New Zealand does not have a definitive database of fire-related fatalities, injuries, and near miss events. Most of the known incidents are from anecdotal accounts or newspaper reporting. Our research has looked through official and unofficial records to compile a list of rural fire incidents since 1878.

We also wanted to know if the information provided with a fire permit was being considered by land managers to assist with keeping themselves safe during a burn.

This research aims to give Fire and Emergency New Zealand (FENZ) more insight into how land managers approach controlled burns and what can be done to improve safety.

To help farmers use fire in a safe way, we first have to understand their practices. From here, we can identify where things go wrong and what can be done better. When farmers use fire as a land management tool, they are encouraging fire to spread through vegetation. Firefighters, on the other hand, focus on stopping fire spread. In both cases, the need to focus on fire safety needs to be similar.

With this understanding, we can help farmers reduce the risk of injury to themselves and staff.

*Forestry land preparation, Waihopai, 2014.*

## Methods

This project compiled and analysed all known incidents of fire-related rural injuries and fatalities since 1878. It has looked into four detailed case studies and through analysis, worked out what actions contributed to fatalities or injuries.

The project also surveyed land managers to find out if the information provided when a fire permit is issued is used by land managers during a controlled burn, and if it is useful in keeping them safe. The interviews probed the reason they requested a permit; how the permit was sought and delivered; the information provided by the Rural Fire Authority (this study took place prior to the merge of urban and rural fire authorities); the level of attention paid to written versus verbal information; knowledge around safe practices (including awareness of LACES – Lookouts; Awareness/Anchor points; Communication; Escape Routes; and Safety zones); and the steps taken to ensure the burn was conducted in a safe manner.

Publically available information was assessed in terms of: fire behaviour; actions farmers can take to keep safe; legal requirements and conditions for burning; and levels of ambiguity within the information.

Researchers interviewed farmers with experience in high country burning to understand and document the common practices used in controlled burning.

## Key findings

We found 68 incidents that resulted in serious harm injuries, 38 that resulted in fatalities and 72 reported incidents that did not result in injury (Figure 2).

We have been unable to find any known fatality or injury incidents involving crop stubble burning, beyond slight burns to the hand due to ignition (Figure 1). Similarly, very few injuries have been reported involving pile burning, with no known fatalities.

We found that very little of the safety information available to farmers is widely used.

In most cases, burn plans (how to proceed with the fire) and permit conditions (the conditions under which the burn is allowed) are the only formal written information most farmers consult before lighting.

There is evidence that farmers do listen and respond to advice about safe burning practices from Rural Fire Officers (RFOs). This makes onsite engagement by the RFOs critical in the exchange of knowledge around safe burning practices.

Farmers were confident in their abilities to burn safely, especially in their own terrain. Younger farmers, and those who do not burn regularly, appear less confident in conducting controlled burns. Farmers conducting fire on one type of land may therefore have very limited knowledge of how fire would behave in a different landscape, or with varying fuel types. Safe work methods exist, but these methods are not always passed on to famers or built into working practices.

While experienced high country burners use most elements of LACES, only around 10% of farmers we spoke with were aware of the term LACES. When prompted on LACES, many were conducting some of these elements, but very few enacted all five. Hardly any used a lookout or anchor points as a matter of course. To aid farmers in practically identifying safe zones and anchor points and why they are safe, as well as practical and operational aspects to look for and undertake when preparing a burn, international guidelines around safety at on-farm prescribed burns could be adapted to New Zealand conditions, along with standardised burn plan templates for various types of fires. In addition, making practical burn training opportunities available to farmers describing how to achieve land management goals, while maintaining safe burning practices under a variety of conditions, would help to mitigate injuries and fatalities.

*Figure 1: Farmers use fire to burn crop stubble ahead of replanting. No serious injuries have been reported for this farm practice.*

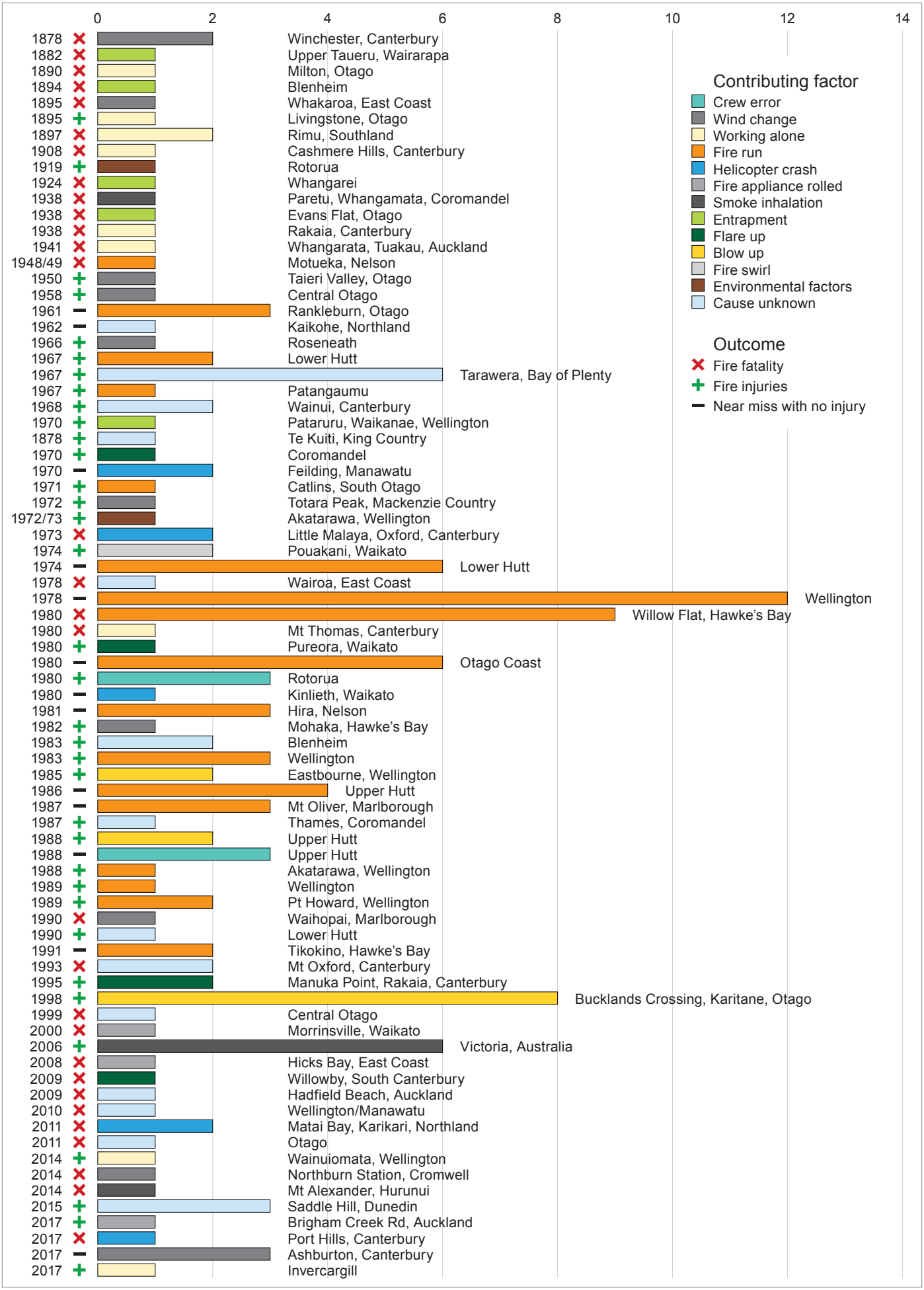


*Figure 2: Known rural fire incidents involving New Zealand farmers and firefighters since 1878, by contributing factor, location, number of persons involved and outcome.*

## Biggest contributing factors

From the available reports of known incidents, we have identified the most common contributing factors were due to entrapment and working alone. Entrapment often occurred from farmers not having safe escape routes in place, entering dense gullies and burning on foot, or due to wind changes (Table 1). Burns were most common on arms, hands, face and head (Table 2).

| Contributing factors | Number of incidents |
|---|---|
| Burned over by fire/trapped | 7 |
| Working alone | 7 |
| Wind change | 6 |
| Unsuitable clothing for task | 6 |
| No identified safe zone | 5 |
| Working in steep gully | 5 |
| Trying to extinguish fire | 5 |
| Overcome by smoke | 5 |
| Unexpected fire behaviour | 4 |
| Working uphill of fire | 4 |
| Lost communication | 3 |
| Delayed medical assistance | 2 |
| Fire crossed firebreak | 2 |
| Use of flammable chemical | 2 |
| Tripped over | 2 |

Table 1: *Contributing factors to injury.*

The factors that most often led to injury or fatality were:

**Lack of preparation**
- no safety zones identified or escape routes
- opportunistic burning of small areas

**Communication failure**
- working alone
- not following the plan
- no cellphone or radio coverage

**Being in the wrong place**
- Positioning uphill of fire
- Positioning in unburnt fuel
- Entering gullies and lighting

**Trying to extinguish a fire or rescue animals**

**Equipment failure or accident**
- Use of liquid fuels (drip or leak)
- Inadequate or unsuitable clothing
- Helicopter or appliance accidents
- Not carrying a wet sack or hand tool
- Leaving radio or equipment on the farm bike/ute

| Burn injuries | Number of incidents |
|---|---|
| Arms | 8 |
| Hands | 6 |
| Face | 6 |
| Torso | 4 |
| Legs | 3 |
| Mouth | 1 |
| Eyes | 1 |
| Neck | 1 |

Table 2: *Body parts burned as a result of incident.*

## Recommendations

From these findings, we recommend:
**Setting up a database of rural farm-based incidents.** As the Station Management System is updated, we can make sure that farmer's actions and decisions are included alongside other contributing factors such as terrain, fuels, weather and fire behaviour. Regular review of the database will reveal common errors and point the way towards improvement.

**Standardise the wording in permit conditions.** Pre FENZ, fire permit conditions differed across the country; however, some conditions were common to all regions. The wording of these needs to be standardised to reduce confusion.

**Provide practical information to farmers on how to conduct a burn safely and effectively.** "A Landowners Guide to Land Clearing by Prescribed Burning" is not pitched to the farming community. Farmers need simple and practical tools or demonstrations to improve safety.

**Working with Federated Farmers, empower RFOs to learn more about safe and effective practice in their farming communities.**

Fire and Emergency **place greater emphasis on communicating with farmers so they understand the main contributing factors of injury,** in particular:
- Situational awareness, including how to identify of safe zones and escape routes.
- Preparedness and safe equipment, including adequate clothing and non-drip/non-spray fuels.
- Not working with fire independently of others, or on your own.
- Awareness of risks from smoke inhalation, delayed medical intervention, and shock.
- Identifying alternatives to burning on foot in more dangerous terrain or heavy fuel (e.g. gullies or thick vegetation).

FENZ are currently working to address the recommendations.

## Further Information

Bayne, K., Wallace, H., Parker, R., and Baillie, B. (2018). Improving safety at controlled burns through land manager knowledge and practices. Research report number 164. Fire and Emergency New Zealand: Wellington. ISSN 1178-3648

(Available at: https://fireandemergency.nz/assets/Documents/Files/Controlled-Burns-Final-Report-20092019.pdf)

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