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RURAL FIRE RESEARCH UPDATE
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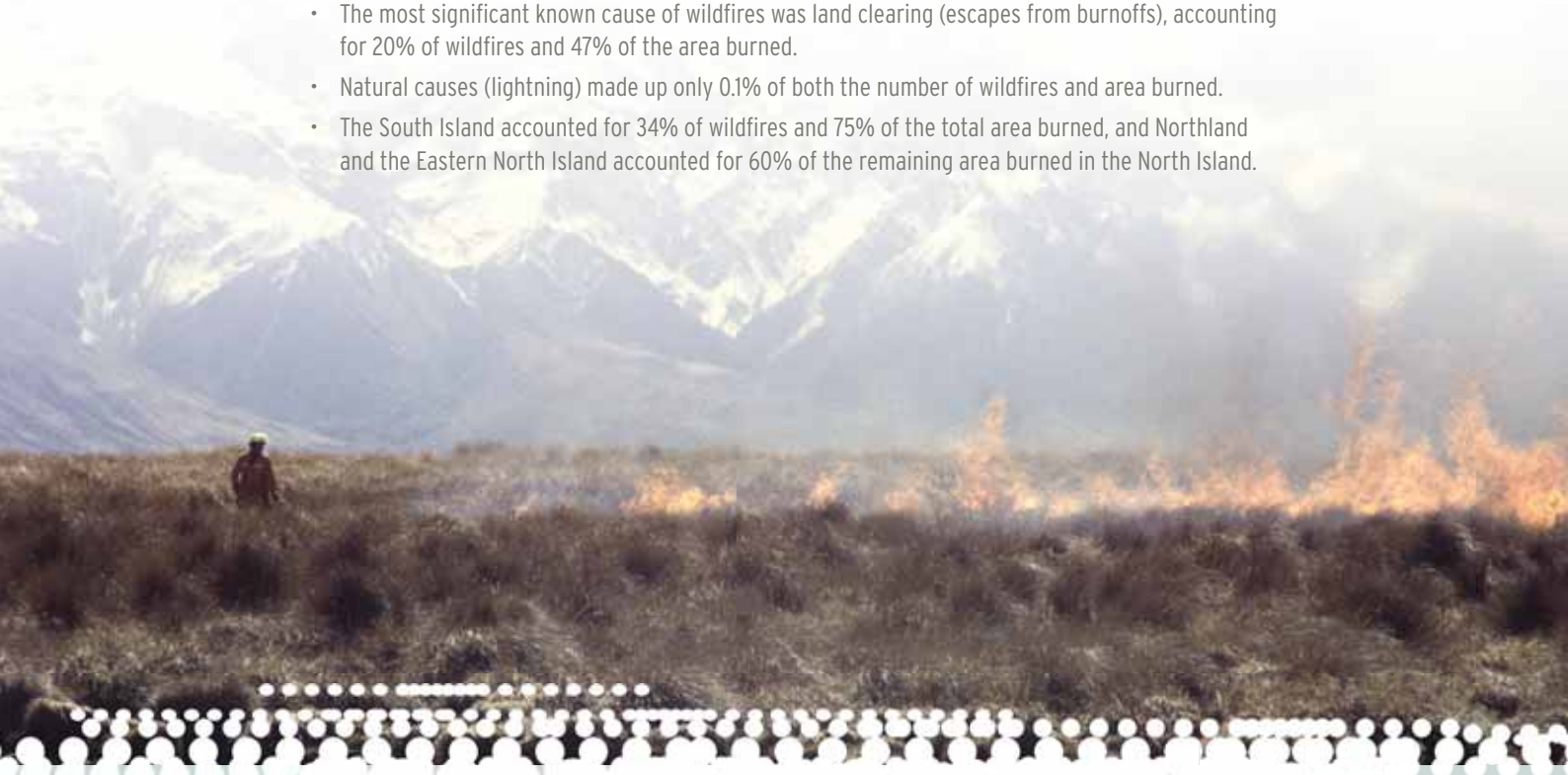
# Analysis of New Zealand's wildfire records

An understanding of wildfire occurrence and causes in relation to fuels, weather and topography can enable fire managers to better quantify fire risk and target mitigation measures. This understanding requires long-term fire records of good quality data. Scion recently undertook a study to provide a comprehensive analysis of wildfire occurrence in New Zealand. The study analysed wildfire records in New Zealand from 1991/92 – 2007/08 to determine trends in fire occurrence, area burned and fire causes. These findings have particular relevance for development of wildfire reduction and readiness strategies.

## Key findings:

- Each year an average of 3,033 wildfires burned 5,865 ha.
- There was a significant increase in the number of wildfires reported annually, from around 1,200 in 1991/92 to more than 4000 in 2007/08.
- The total area burned was made up of 54% grasslands, 40% scrublands and 6% forests.
- Unknown and miscellaneous causes accounted for almost half (46%) of the total number of fires and 31% of the area burned.
- The most significant known cause of wildfires was land clearing (escapes from burnoffs), accounting for 20% of wildfires and 47% of the area burned.
- Natural causes (lightning) made up only 0.1% of both the number of wildfires and area burned.
- The South Island accounted for 34% of wildfires and 75% of the total area burned, and Northland and the Eastern North Island accounted for 60% of the remaining area burned in the North Island.



# Methods

The National Rural Fire Authority (NRFA) database of annual fire returns ("Annual Returns") was used for this study. This database contains records of wildfires by fire year (1 May – 30 April) and Rural Fire Authority (RFA). It excludes the large number of prescribed burns carried out across the country annually. It was found that many records for 1989/90 and 1990/91 were missing and could not be located. Therefore, only records from 1991/92 to 2006/07 were used. Regardless of these issues of data quality, the findings from this analysis still provide a useful overview of the occurrence and severity of wildfires in New Zealand.

Inconsistencies with both the quality and accuracy of data collected occurred due to different wildfire reporting systems being used, along with variability in the numbers of annual records returned. Not all returns were submitted by RFAs each year: in some years the percentage of returns submitted by RFAs was between 85% and 95%. The area burned did not always appear to be recorded accurately, with the number of fires sometimes listed without any corresponding area burned.

Data were grouped by fire cause for each RFA and classified into three fuel types (forest, scrub or grass). In the case of forests, this included exotic plantations, native forests, woodlots, and other tree vegetation. The fire causes listed were inconsistent from year to year, and to reduce the range of causes and provide consistency, data were collated into a set of 14 standard causes. Given changes in the composition of RFAs over time, they were grouped according to 13 geographic regions as of the 2006/07 fire year.

# Results

## Number of fires - trends

- From 1991/92 to 2006/07 there was an increase in the number of wildfires from around 1,200 to more than 4,000 annually (Figure 1). The national average number of wildfires reported annually was 3,033.
- The national trend of increasing numbers of fires was also observed in 10 of the 13 regions of the country. Exceptions were the Auckland region and the West Coast (no clear trend), and Waikato (with a lesser increase in fire numbers).
- The North Island accounted for two thirds (66%) of the total number of wildfires. Four regions (Waikato - 10%, Central North Island - 9%, Eastern North Island - 14%, Canterbury - 18%) accounted for just over half of the number of wildfires (Figure 2b).

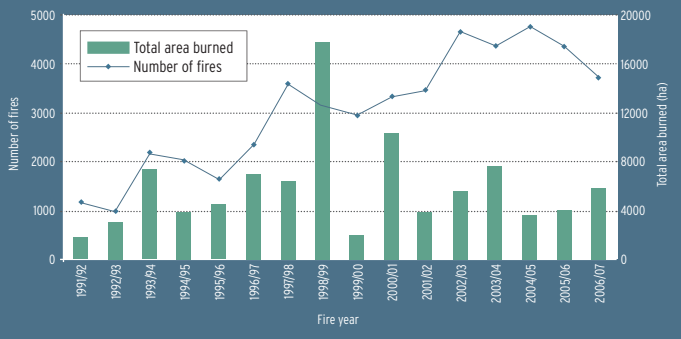
## Number of fires by cause

- A high number of fires were attributed to miscellaneous (33%) and unknown (13%) causes – 46% in total to "unspecified" causes (Figure 3b). This made it difficult to clearly identify trends.
- Although the number of fires increased for most causes, the proportion of fires for each cause category remained mostly constant. Significant fire causes were land clearing (20%) and vehicles (17%).
- The number of land clearing fires varied between years; arson and incendiary fires increased over time, and fires from cigarettes remained relatively low at less than 50 fires per year for most years.
- Lightning accounted for just 0.1% of fires. However, lightning was only listed as a separate fire cause from 2000/01 and was classed as a miscellaneous cause prior to this.

## Area burned

- A total of 93,860 ha were reported burned during the 16-year study period, ranging from 1,813 ha in 1991/92 to 17,698 ha in 1998/99.
- The total area burned nationally displayed no distinct directional trend (Figure 1). The average annual total area burned was 5,865 ha.
- The annual total area burned was influenced by large individual fire events and/or large areas burned in a single region, such as the 1998/99 Alexandra fires (7,800 ha) and Blenheim fires (over 6,500 ha) in 2000/01.

Figure 1 Number of wildfires (line) and total area burned (bars) from 1991/92 to 2006/07.




## Area burned by fuel type

- Grass fires accounted for the majority of the total area burned - 50,403 ha (54%) over the study period, with an average of 3,150 ha/year.
- Scrub fires burned 37,287 ha (40%), with an average of 2,330 ha/year.
- The total forest area burned was 6,170 ha (6%), with an average of 386 ha/year. The smallest forest area burned was in 1991/92 (119 ha or 3%), with the largest in 1997/98 (1,399 ha or 22%).
- On a proportional basis, forest fires accounted for less than 10% of the total area burned in most years.

## Area burned by cause

- Wildfires from land clearing burning accounted for the largest proportion of the area burned - 44,070 ha or 47% of the total (Figure 3a).
- Annually, an average of 2,754 ha was burned by land clearing wildfires.
- Fires of unknown cause represented nearly a quarter (24%) of the total area burned.
- Miscellaneous causes represented 7%. Unknown and miscellaneous causes combined therefore represented 31% of the total area burned.
- Other causes accounted for relatively low proportions, such as incendiary (6%) and vehicles (5%). Lightning accounted for only 0.1% of the area burned.

## Area burned by region and fuel type

- The South Island accounted for 75% of the total area burned, with Otago making up 42% of the national total.
- Northland and the Eastern North Island accounted for 15% of the total national area burned (Figure 2a).
- Otago had the highest average grass (1781 ha/year) and scrub (631 ha/year) areas burned annually.
- Nelson/Marlborough had the highest annual average forest area burned (83 ha/year).
- Nelson/Marlborough and the Eastern North Island accounted for around 40% of the total forest area burned.
- Other regions that recorded significant levels in terms of the total forest area burned were Northland (12%), Otago (12%), Canterbury (10%) and the Central North Island (8%).

Figure 2 (a) Total area burned, and (b) number of wildfires by region from 1991/92 to 2006/07.

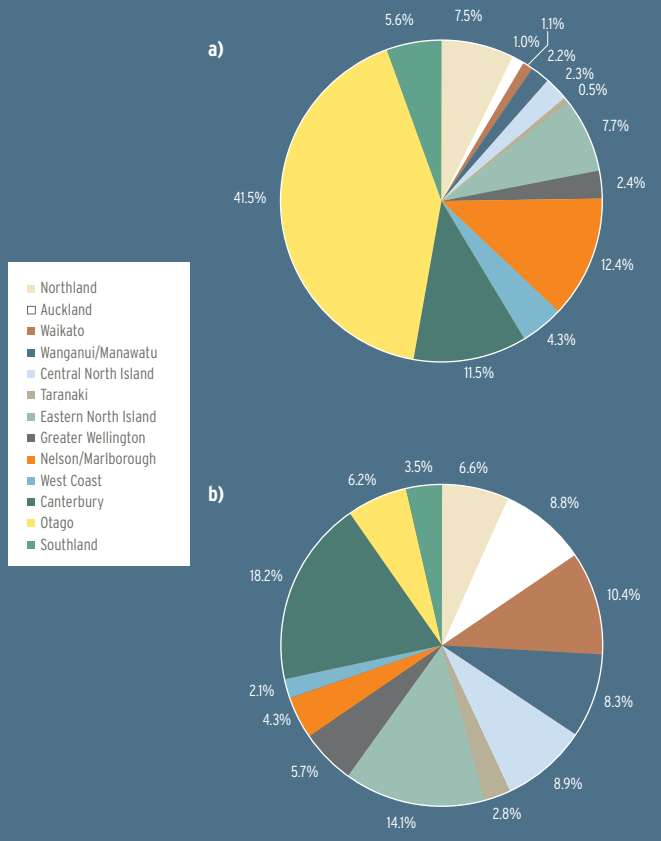
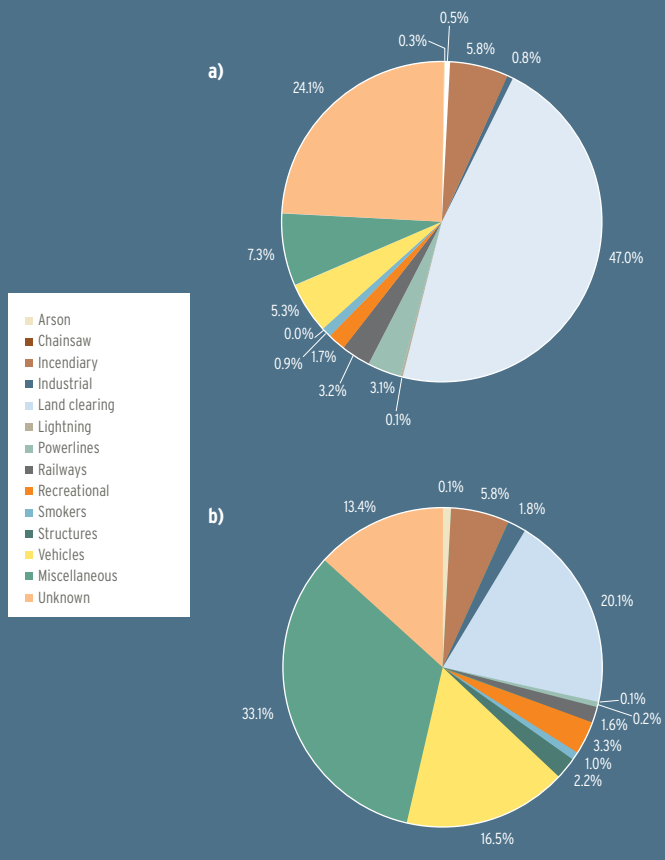



Figure 3 (a) Total area burned, and (b) number of wildfires by cause from 1991/92 to 2006/07.



## Conclusions

The main reason for the four-fold increase in the annual number of fires is most likely from improved reporting of wildfires by the public through the use of the 111 system, and better reporting by RFAs.

Large fire events had a major influence on results for area burned, and it is therefore important to consider both area burned and number of fires. For example, Otago accounted for around 40% of the total area burned but only 6% of the total number of fires; Canterbury 12% of the area burned and 18% of the total number of fires; and Auckland just 1% of the area burned and 9% of the number of fires. A large number of small "nuisance fires" over time can potentially cost as much in time and resources as larger fires.

Land clearing was the most dominant cause for the total number of fires (20%) and total area burned (47%). However, large proportions were also attributed to unknown and miscellaneous causes. The combined 'unspecified' (unknown and miscellaneous) causes represented 46% of the total number of fires and 31% of the total area burned. Lightning accounted for only 0.1% of both the total number of fires (34 fires) and total area burned (91 ha) from 1991 to 2007. The overwhelming majority of fires in New Zealand are therefore caused by human activities, which can largely be mitigated against.

The need for a consistent approach to data collection at all levels is required. Standardised cause classes, consistency in reporting and quality control would greatly increase our understanding of the causes, occurrence and impact of wildfires in New Zealand

## Further information

The full report can be downloaded from the Scion Rural Fire Research website (located under: >publications >Rural Fire Research Reports): http://www.scionresearch.com/fire

The full report contains a series of appendices with detailed information on fire numbers, area burned and causes by region (these appendices can be also downloaded separately in addition to the full report).

**Doherty, J.J., Anderson, S.A.J.; Pearce, G. 2008: An analysis of wildfire records in New Zealand: 1991-2007. Scion Report Number 12789. Scion, Christchurch.**

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