Fire and Emergency New Zealand
Research report 202

An Updated Fire Danger Climatology for New Zealand

A final report summarizing research completed under the project: "Fire Danger Climatology Analyses and Tools"

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Read the full report on Scion's website:
https://www.ruralfireresearch.co.nz/__data/assets/pdf_file/0010/93745/Updated_Climatology_report.pdf

Executive summary:
New Zealand experiences around 4,400 vegetation fires each year that burn on average 6000 ha of rural lands. Strong winds, high temperatures, low humidity and seasonal drought can regularly combine to produce dangerous fire weather situations. To effectively manage this risk, New Zealand fire managers require a knowledge of these extremes and their likelihood of occurrence relative to long-term statistics of fire weather and fire danger conditions. This information is essential to support wildfire risk assessment and operational implementation of fire season status and activity control triggers.

Previous analyses, conducted in 1996, 2003 and 2011, developed and extended a database of fire weather and fire danger indices for weather stations across New Zealand, and produced summary tables summarising the fire climate for each location. The fire weather monitoring network has continued to grow over the past decade to now comprise over 300 stations. This study sought to update the fire weather station climatology datasets (to June 2021), and to extend the summaries of long-term averages and extremes of fire weather and fire danger for a greater number of stations.

The study comprised five main steps: 1) compilation or extension of datasets of daily noon fire weather records for each weather station; 2) quality control of each dataset, by checking and replacing missing or erroneous values; 3) recalculation of Fire Weather Index (FWI) System components with an updated version of the FWI equations calibrated for New Zealand's location; 4) calculation of associated fire danger class values based on the New Zealand criteria for Forest, Grassland and Scrubland fuel types, including use of seasonal grass curing trends for grasslands; and 5) statistical analysis of long-term average and extreme (min/max) values for weather and fire danger indices, and fire danger class frequencies, for each weather station.

In total, 158 stations were identified from the wider list of 373 stations with available data that met the requirement of having at least 10 years of daily data (to 30/06/2021). Gap filling and other corrections were performed on these datasets, which included a total of 5,879 years of data. This also included correcting errors identified in the historical data prior to 2011 when the last updates were undertaken. This part of the analysis highlighted a number of data quality problems associated with accuracy and completeness of data contained within FENZ's present fire weather archive that

have resulted from station changes and maintenance issues. As a result, completed datasets could only be obtained for 100 stations which were then analysed to produce summary values. [Since the completion of the project, work has continued on completing the datasets for several of the other stations, with the aim of increasing the total number for which fire climatology summaries are available].

The principal output from the analyses is a summary table for each of the 100 stations containing the long-term average and extreme values of each of the noon fire weather and FWI System components summarised by month, fire season and year. In addition, the summary tables include fire danger class frequencies for Forest, Grassland and Scrubland vegetation types, as well as wind roses (a new addition), also by month, fire season and year. These summary statistics for each station were then used to identify the individual weather stations and geographic regions with the most severe fire climates. Stations in Marlborough and the East Coast demonstrated the highest values of the fire climate severity measures contrasted.

The continued updating of the comprehensive database of daily fire weather and fire danger information for the growing network of fire weather stations is the other major output from the project. This database is essential for research on predicting fire season severity and monitoring the onset of climate change. In its own right, it also provides an extremely useful tool for FENZ fire managers and stakeholders in making more informed fire management decisions on wildfire risk reduction, readiness, and prescribed burning activities.

The analytical methodology used during the analysis was automated within an R statistical software routine so that, in future, regular updates of the database and associated statistical analyses can be conducted more easily. It is suggested that this updating be conducted annually or, at the very least every few years, to maintain the accuracy and utility of the database and to minimise the workload required to repeat the analyses.

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