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Concerns Re Reporting on Forest and Rural Fire Danger Levels

Introduction

The Ministry for Environment/Stats NZ 'Our atmosphere and climate 2020' report published in October 2020 includes a number of failings in the methods used to support the commentary on 'The Risk of Wildfires Changing'. These include;

1) The 17 year period used, from the 30 sites is from 2020 to 2017, is insufficient to support such findings. To use such a short period to assess changes in fire danger levels do not fully reflect the history on changes if any in the fire danger levels throughout the New Zealand forest and rural landscape. The statements made in the report relating to "the Risk of Wildfires Changing' has resulted in misleading the discussions on the impacts of changes in climate to fire danger levels. This has also allowed flawed statements to be made by media on this topic.

2) In the Ministry for Environment/Stats NZ section of the report it refers to a 2017 NIWA Fire Risk Assessment Report. From the thirty sites referenced in this NIWA report eighteen sites involved a fire risk assessment using the Grasslands Fire Danger Class outputs from the NZ Fire Danger Rating System (NZFDRS). The use of the Grassland Fire Danger Classes raises a number of concerns. The Grassland Fire Danger Class involves the use of the Initial Spread Index (ISI) from the NZFDRS, and the degree of grassland curing. This degree of curing is a manual assessment at a representative grassland site near the Remote Automatic Weather Station (RAWS). It needs to involve a detailed weekly inspection of changes in the dry matter levels along a 100 meter grasslands transect.

Media Reports

An example of what was reported as alarmist and distorting statements by the media on the Ministry for Environment/Stats NZ Report was on TV3 News on 15th October 2020. TV3 suggested there would be a 70% increase in fire danger levels by 2040;

In addition Stuff also report on the 15 October 2020 that “By 2040, days with very high or extreme fire danger periods are projected to increase by an average of 70 percent, due to hotter, drier and windier conditions, the report says. The largest increases are projected for areas that are not accustomed to fire. Wellington could experience a doubling to 30 days a year and coastal Otago a tripling to 20 days a year.” Such statements cannot be supported by the facts.

Degree of Curing

The Degree of Curing component of the NZ Grassland Fire Danger Class required the assessment of levels of grassland curing at a site near each RAWS. The most satisfactory means of estimating the Degree of Curing is by direct observations for an area which represents the “typical situation” in which most wildfires are expected to occur; ideally, the location should be within a few kilometers of a fire weather station. Obviously this will require considerable judgement on the part of local fire managers. A permanent transect 100 metres in length should be established for the Degree of Curing assessment rather than relying on a roadside check or observations from a distance. Ideally, the transect should be marked with a steel post at each end as this permanent installation will allow comparisons to be made not only during the current fire season, but also from one fire season to another.

The sampling should be done by the same person. Observations are not required to be made on a daily basis but should be done at least every week or 10 days. Ten evenly spaced out samples (@ 10 m, @ 20 m, etc.) should be evaluated along the transect line Care and judgement must be exercised in making the visual estimates of Degree of Curing. The best method is to locate a 1.0 metre by 1.0 metre sized frame (made out of small diameter wooden dowelling, light-weight aluminum or similar material) immediately in front of the toe where the sampler has paced the required distance. Mentally estimate, by volume not cover, the cured (i.e., dormant) or dead material in each quadrat to the nearest 5 percent. Often the grass must be pried apart to determine the amount of dead material underneath the current season’s growth, but still undecomposed. Following this, determine an average for the entire transect.

Estimates of cured or dead material less than 50 percent should be considered very carefully. These situations occur only when no litter (excluding decomposed material) or standing dead stems remain from the previous season’s growth. Initially, when the observer is “calibrating” his/her visual assessment, and then periodically, as a check, all the material within the frame should be clipped, the dead and live material separated and the volume of each determined by ocular means or by drying in a forced-air drying oven and weighed on a electronic balance if such equipment is readily available. If a camera is available, a photo be taken at the time of each visit to the site from the starting post looking down the transect and perhaps of a “representative quadrat” or two. A permanent record of the degree of curing assessments along with this photographic record should be kept giving the name of the assessor, date of the assessment, the estimated percentages and the mean value. Before the use of the Grassland Fire Danger Class, in any formal assessment/study, confirmation is required to ensure the correct process is use to assess the degree of curing at any of the sites used in the study.

The impact of recent climate on fire danger levels in New Zealand

Further research to determine the impacts of recent climate on fire danger levels in New Zealand has recently been completed (Dudfield, Pearce, Cameron - February 2021). Using a number of outputs from the Fire Danger Rating System the research question was "Is the fuel available to burn over the past 20

years any greater than for the period prior to the year 2000". The research involved the analyses of fire weather data for up to 60 years from 15 sites throughout NZ. This study looked to analyse three key components of Drought Code (DC), Build Up Index (BUI) and Initial Spread Index (ISI) from the daily outputs from the NZ Fire Danger Rating System. These historical data sets ranged in length from 24 to 59 years. The results from this largely qualitative analysis shows a trend that fuel availability for combustion has seen an overall reduction over the past 20 years when compared with the period prior to 2000.

This study uses daily climatology records from 15 weather stations located within different regions throughout New Zealand. Data was obtained from the Fire Weather System managed for Fire and Emergency New Zealand by the National Institute of Water and Atmospheric Research (NIWA), and records for discontinued Meteorological Service of NZ stations updated to June 2020 with synoptic data provided by MetService.

The study looked at two groups of fire danger indicators. These included:

1) The monthly maximum BUI, DC and ISI values from historical data sets for the 15 weather stations ranging in length from 24 to 59 years. For stations with data available for more than 20 years prior to 2000, this was trended against the 20-year period following 2000. For those stations with historical indicators covering a 24-year period only, this data was split to compare two 12-year periods

2) The number of days with DC greater than 300, BUI greater than 60 and ISI greater than 10 were identified, and a five-year rolling average was then applied to each station.

The high level-results of this assessment are outlined in Table 1. For the 90 fire danger indicators across the 15 weather stations, 68 (77%) of the indicators showed a no change to a nominal or notable decrease, versus 22 (23%) of the indicators showing a nominal to notable increase.

	Kaitaia	Auckla	Gisbor	Napier	Rotor	Taupo	Wangar	Para-ur	Master	Nelson	Blenhei	Chch	Q-town	Dunedi	Inv-gill
Number of years/period:	59	54	24	24	24	24	24	24	24	24	24	24	41	55	58
Days of Build Up Index > 60	↑	↑	↓	↓	↑	O	▲	O	↑	O	O	↓	↑	O	O
Days of Drought Code > 300	O	O	O	↑	↑	▲	O	↓	O	↓	▼	↓	↑	O	O
Days of Initial Spread Index > 10	▼	O	▼	O	O	O	O	O	↓	↓	↓	O	O	↓	▼
Number of years/period:	59	54	56	28	54	46	41	56	28	56	27	58	41	55	58
Maximum BUI by Month for period	↑	↑	▼	O	O	▲	▲	↓	O	↓	▼	▼	↑	↓	O
Maximum DC by Month for Period	↑	↑	▼	↑	↑	↑	▲	O	O	▼	▼	▼	O	↑	O
Highest ISI per month for the period	▼	↓	▼	O	↓	O	↓	O	▼	▼	▼	▼	O	O	▼

Key		
Notable Increase	▲	5
Nominal increase	↑	17
Overall no change	O	34
Nominal decrease	↓	16
Notable decrease	▼	18
		90

Each arrow generally shows the movement between the cluster of years prior to 1999 compared with the 2000 to 2020 cluster of years.

The BUI, DC and ISI referred to above are defined as:

1) The BUI is a numeric rating of the total amount of fuel available for combustion. It combines the Duff Moisture Code and the DC.
2) The Drought Code (DC) is a numeric rating of the average moisture content of deep, compact organic layers. This code is a useful indicator of seasonal drought effects on forest fuels and the amount of smoldering in deep duff layers and large logs.
3) Initial Spread Index (ISI) is a numerical rating of the expected rate of fire spread. It combines the effects of wind and FFMC on rate of spread without the influence of variable quantities of fuel.

Table 1: Summary of changes in fire danger for 15 weather station locations across New Zealand

In fact, more stations showed decreases in fire dangers for the period since 2000 compared to the period prior to 2000, whether nominal or notable. Gisborne, Nelson, Blenheim and Christchurch mainly showed decreases, including many notable decreases, plus Invercargill and Paraparaumu also showing

no change or decreases. Only two stations (Taupo, Wanganui) showed notable increases, with significant increases for the number of days of DC >300 and maximum monthly BUI and DC values since 2000. The remaining stations showed more variable trends, with a mix of increases, decreases and/or no changes in fire danger indicators for the two comparison periods.

Conclusions

There is little evidence to show that there would be a 70% increase in fire danger level by 2040. To use such statements is misleading, emotional and indicates a lack of understanding of the management of fire in the New Zealand forest and rural landscape.

The NZFDRS provides a sound scientific basis for answering key questions in the management of fire in the forest and rural landscape, as well as supporting fire management decision-making. What has emerged in a recent research project into the number of days with fuel available for combustion at an intense level – as indicated by elevated values of the BUI and DC components of the NZFDRS – it has shown that this has remained the same or actually reduced since 2000 for almost all of the weather station locations analysed in the fifteen weather sites. Similarly, indicators of increased fire spread potential – based on the ISI component of the NZFDRS – show even more widespread decreases. Along with the BUI and DC changes, this may be explained in part by changing wind patterns and associated increases in rainfall along the Southern Alps associated with natural seasonal climate variability, as well as longer-term climate change.

Based on this study, involving up to 60 years of fire weather data for a range of locations across the country, it will take a major swing in current weather patterns to suggest that the average annual frequency of elevated fire danger levels across New Zealand will increase dramatically over the next 20 to 40 years.

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