Aotearoa New Zealand National Monthly Fire Danger Outlook (2024/2025 season)

Issue: March 2025

Current fire danger situation

Many fire indices are currently in the moderate to high range across the country, although Buildup Index and Drought Code values are generally at least very high. Geographically, indices are generally highest across the western North Island and eastern South Island.

A weak La Niña is now occurring, but it is likely to dissipate to ENSO-neutral in the coming weeks. Thus, “traditional” La Niña-like patterns may not be consistently observed.

Current fuel and soil moisture status

As of 14 March (see Figure 6, left), soil moisture levels were below normal or well below normal across the upper and western North Island, Tasman, and the upper West Coast. Near normal soil moisture was observed across most of the rest of the country. The New Zealand Drought Index (NZDI) indicated extremely dry conditions in the western North Island.

The Build Up Index (BUI), representing dryness and availability of medium and heavy fuels in a forest, has again become elevated for Auckland, Northland and Waikato, and remains elevated in Manawatu and Central Otago (Figure 1 showing last month for comparative purposes, and Figure 2 current BUI).

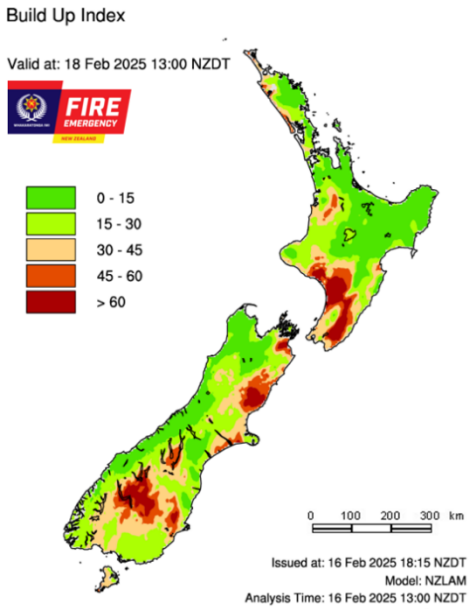


Figure 1: Map of the Build Up Index (BUI), indicating total fuel availability from last month for comparative purposes.

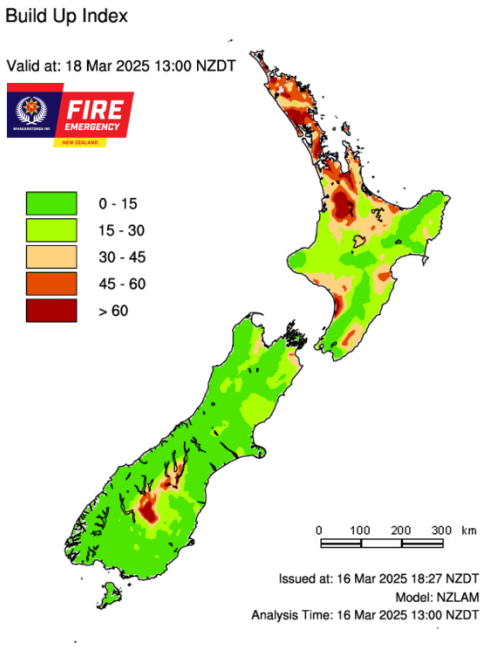


Figure 2: Map of the current Build Up Index (BUI), indicating present total fuel availability.

When BUI is elevated, more fuel becomes available in forest situations as more of the medium and heavy fuels are dry enough to burn.

Fine fuels continue to fluctuate and, at times, quite rapidly with the intense summer sun, low humidity, and especially with strong winds assisting the drying. During days when wind and or Fine Fuel Moisture (FFMC) codes are up, we see Very High and Extreme fire dangers. Over the coming weeks, the days will become shorter, sun angle lower, and more dew in the mornings will make the FFMC slower to recover.

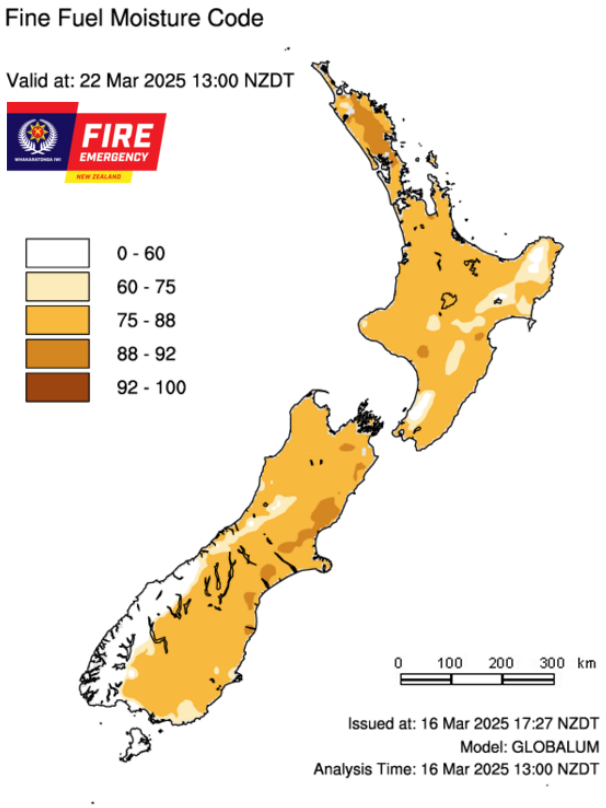


Figure 3: Map of the Fine Fuel Moisture Code (FFMC), indicating dryness and ease of ignition of fine dead material. This image looking ahead 4 days showing that the periods of elevated FFMC will continue.

Forecast climate and weather

Conditions may be somewhat drier than normal in late March as high pressure is forecast to settle over the country.

During April, low pressure in the Southern Ocean may cause westerlies at times for the South Island, increasing rainfall chances there. Moisture plumes may also move out of the subtropics periodically, with a chance for short and sharp rainfall events in the North Island. A mixed wind anomaly is most likely, reflecting the influence of a weakening La Niña. Temperatures during April are likely to be near average or above average, although occasional cool periods are possible.

The April-June period is expected to see mixed airflows, and La Niña may officially end sometime during the season. Wetter than normal conditions are favored for the upper North Island and eastern areas of both islands, while the lower South Island could experience near normal or drier than normal conditions. Temperatures are forecast to be above average, accompanied by slightly lighter than average winds.

For more information, see page 9.

The La Niña climate pattern

A weak La Niña is now occurring, but it is likely to dissipate to ENSO-neutral in the coming weeks. As a result, traditional" La Niña-like patterns may not be consistently observed.

No two La Niña events are the same, and each event can produce different effects on weather conditions and therefore fire dangers across New Zealand depending on its timing, strength, and duration. In general, however, La Niña events are historically associated with higher-than-normal pressures east of New Zealand, resulting in more northeasterly winds than normal. This leads to wetter than normal conditions being favoured for northern and eastern areas, while drier than normal conditions tend to prevail in the south and west. To some extent, this pattern has been observed over recent months, with drier than normal conditions across the central and southwestern North Island and on the South Island's West Coast.

The El Niño-Southern Oscillation (ENSO), which includes El Niño and La Niña phases, is often highlighted in seasonal forecasts, as it the most important source of intraseasonal variability. But while ENSO provides predictability over longer timescales, it doesn't fully explain all climate variability. Increasing global Sea Surface Temperatures (SSTs) due to climate change in recent years have also altered traditional impacts of ENSO phases and its associated weather patterns. It is therefore essential to continue monitoring the fire season through the Fire Weather System, with an understanding that even under normal or near-normal conditions, there will be periods of elevated fire danger.

What to watch for

<u>People impatient to burn</u>

For areas where a dry fire season may extend later into the year than normal, and fire restrictions remain in place, there is a risk that people will be impatient to burn. In some cases, it can be because they are sick of waiting to get rid of material, and in other cases there is a mistaken belief that things won't burn during autumn and winter. People also often underestimate how much rain it takes to reduce the fire danger, or they don't realise how quickly moisture dissipates after small amounts of rain. These factors can result in increased numbers of fires when elevated fire dangers extend into autumn.

Windy periods

A likely increase in westerlies for the South Island and lower North Island during April can be expected to cause a foehn effect for eastern parts. This will have some medium to long-term drying effect but, more significantly, will cause spikes in the FFMC indicating that ignition will be easy and when coupled with winds, will elevate the Initial Spread Index (ISI) meaning potential for rapid spread rates.

Rebounding fire danger

As mentioned above, the FFMC, DMC and BUI could rebound relatively quickly again after any rain events. This can catch people out who are complacent thinking the rain from a few days ago has alleviated the risk. Or they light a fire on a day when the risk is low, but the fire remains burning for a few days during which time the area dries out and fire risk returns causing the fire to escape.

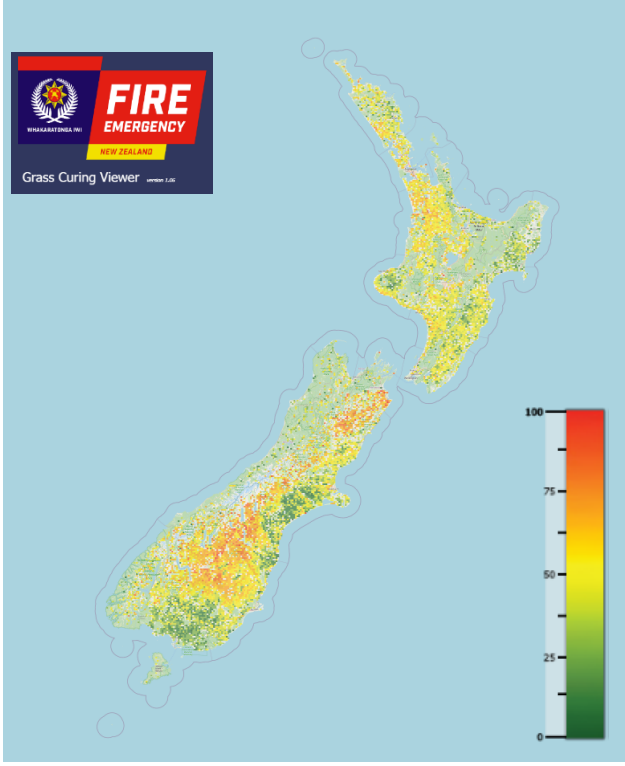


Figure 4. Map of current grass curing across NZ.

Grass curing

Grass curing is the seasonal or stress related die-off or 'browning' of grasses. Grasses around the country are currently at various levels of curing (Figure 4), with some areas having greened up again following recent rains, while drier areas are continuing to die off.

Cured grass has considerable dead material which has much lower moisture than green grass, and is therefore much easier to ignite and burns with much greater speed and intensity. Many of our fires initially start in grass, so great care is needed when burning or carrying out heat or spark generating activities in or near grass fuels. Please refer to the FENZ website Checkitsalright.nz for further guidance.

The potential rate of spread of grass fires is easily underestimated. Figure 5 below from Pukaki shows spread rates of 1000 m per hour on flat ground is common.

Even once an area has received enough rain for a flush of green growth, the dead material can remain for an extended period, sometimes even into and beyond winter.

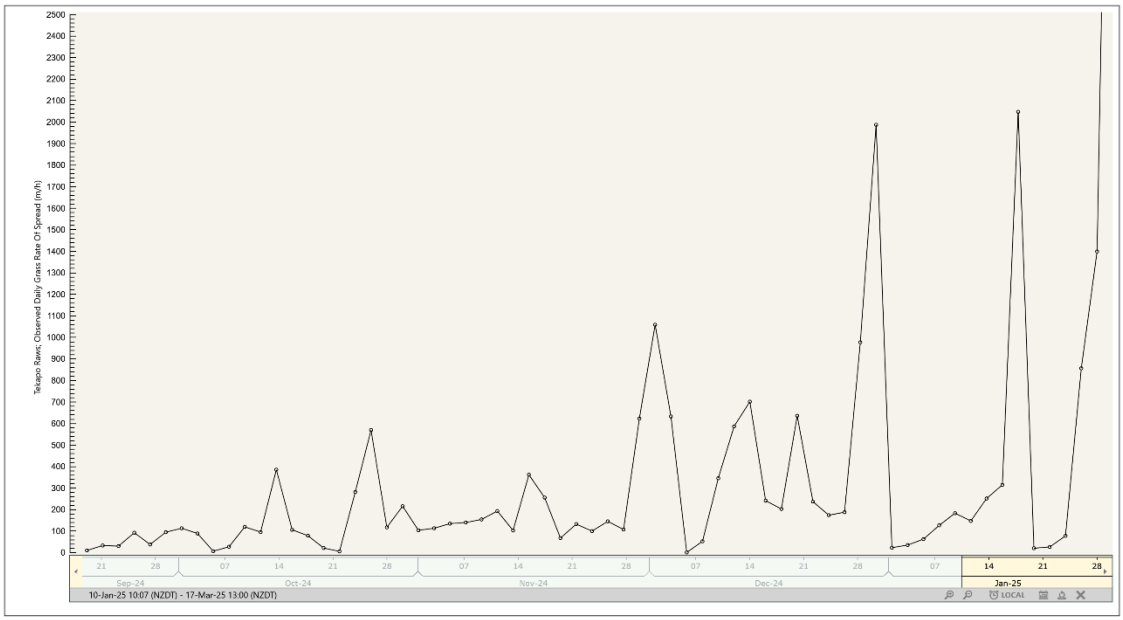


Figure 5: Graph of Pukaki estimated Grass Fire Rate of Spread (on flat ground).

Deep burning where Drought Code is elevated

When Drought Code (DC) values are elevated and deep soil organic layers are dry, there is a risk of controlled burns burning underground without people realising. Similarly, firefighters responding to fires may miss deep burning material when attempting to extinguish fires. These underground fires have the risk of resurfacing days later, especially during hot windy days when the fire danger is elevated.

Photo 1. Smouldering sub surface fire near Kaikohe (March 2024).

Areas to watch:

There is a chance that moisture from the tropics will impact the northern parts of the North Island in coming weeks, but there is also a good chance that these systems will pass offshore and northern areas will receive little rain over the next few weeks meaning they will continue to experience elevated fire dangers.

The lower part of the North Island is likely to receive some impact from the stronger westerly flows including the upper tail of fronts moving up the country. These passing fronts may not bring large amounts of rain, but they are likely to gradually ease the current elevated fire danger.

Similarly, the South Island will be impacted by the more frequent westerly flows which will bring rain and reduced fire potential for the West Coast. This will be quite impactful for southwestern areas which are likely to return quickly to about normal, while fire potential for the upper parts of the West Coast may be a little slower to return to normal.

For eastern parts of the South Island, the foehn effect from the more frequent westerlies will have some drying effects that are likely to bring moisture codes such as DMC and DC back to about normal as this is a common weather pattern. This normal does however bring some spikes in fire danger with these warm, dry, windy foehn events.

Photo 2. Grass and Scrub fire impacting rural community in Northland March 2025.

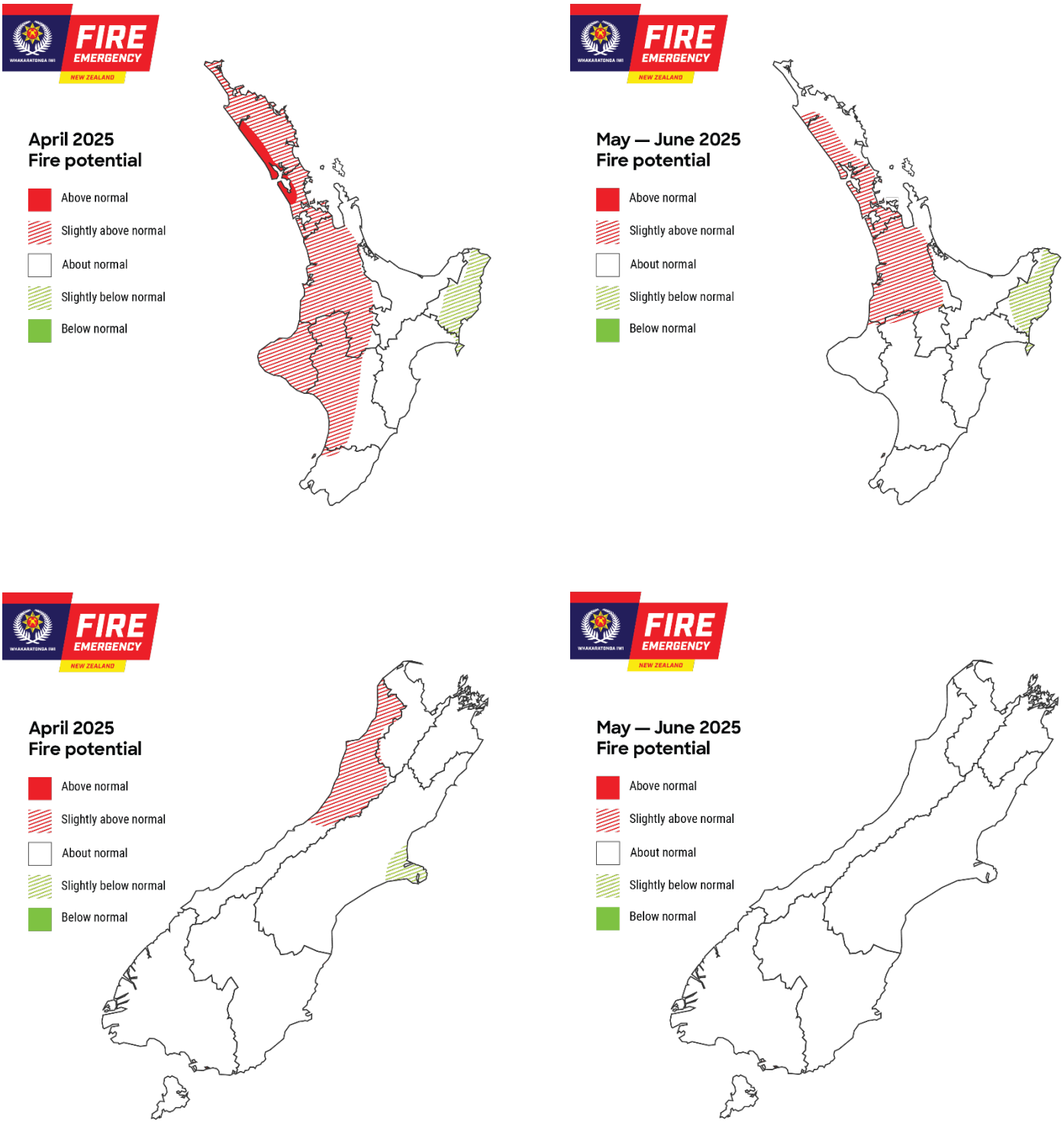


Figure 5. Fire potential over the next three months for the North and South Islands based on assessment of the current conditions as well as the effects of climate predictions for the April (left) and May - June (right) periods.

Current climate

In February, temperatures were above average (0.51-1.20°C above average) or well above average (>1.20°C above average) for most regions of the country. Temperatures were near average (±0.50°C of average) in eastern parts of Canterbury, northeastern Wairarapa to East Cape, and northeastern Northland. Below average temperatures (0.51-1.20°C below average) were observed in Gisborne. So far in March temperatures have been near average or below average for most of the country, with above average temperatures in Tasman and the West Coast (Figure 6, right).

February rainfall was below normal (50-79% of normal) or well below normal (<50% of normal) in almost all regions of the country. Rainfall was near normal (80-119% of normal) in eastern Central Otago, Westport, and Tauranga. Isolated areas of above normal (120-149% of normal) or well above normal (>149% of normal) rainfall occurred in Nelson, and southern Hawke's Bay. So far in March, rainfall has been below normal or well below normal for most of the country, but above normal rainfall has been observed in the east of both islands (Figure 6, middle).

As of 14 March (see Figure 6, left), soil moisture levels were below normal or well below normal across the upper and western North Island, Tasman, and the upper West Coast. Near normal soil moisture was observed across most of the rest of the country. The New Zealand Drought Index (NZDI) indicated extremely dry conditions in the western North Island.

Climate drivers

Sea surface temperatures (SSTs) in the central equatorial Pacific (Niño 3.4 Index) during February were below NIWA's conventional threshold (-0.7˚C) to define La Niña at -0.37˚C. As of 1 March, the 30-day relative Niño 3.4 Index[1] (RONI) was -1.02˚C, reflective of the central equatorial Pacific being significantly cooler than the average of the global tropics and being in La Niña territory.

The Southern Oscillation Index (SOI) was indicative of neutral conditions in February, with a value of +0.29, it also showed significant intra-seasonal variability over the course of the month, indicating that the tropical Pacific ocean – atmosphere system is not strongly nor consistently coupled.

In summary, weak and atypical La Niña-like conditions are currently still present in the Pacific, but some indicators have recently shown a significant weakening. As was the case last month, the coupling between the ocean and the atmosphere is not strongly and consistently sustained. It also presents atypical characteristics, with the location of the maximum SST anomalies in the Pacific shifted west of what is usually observed during La Niña events. Over New Zealand, atmospheric circulation patterns are expected to depart at times from those typically associated with La Niña.

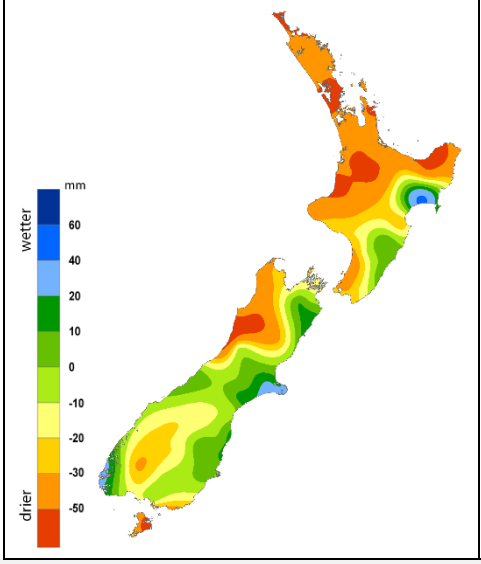
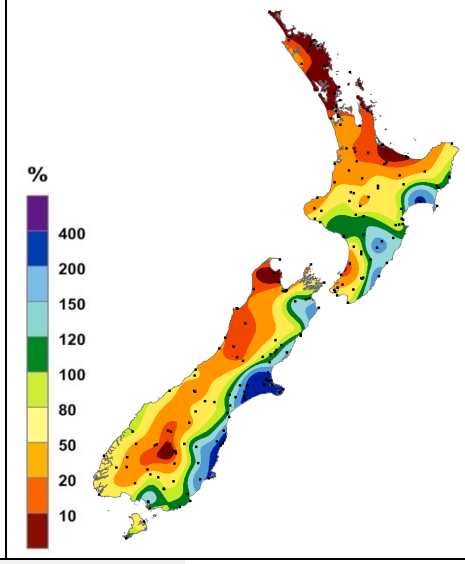
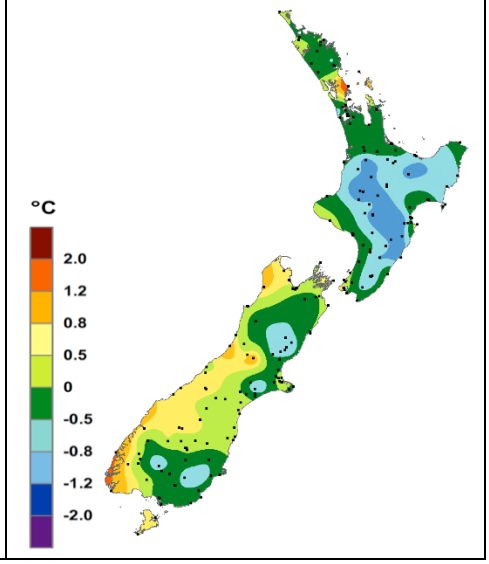
The Indian Ocean Dipole (IOD) index was in the neutral range in February 2025, with the average anomaly for the month of February 2025 being -0.07°C. The guidance from the BoM is for the IOD to remain neutral throughout the forecast period.

During February, convective forcing associated with the MJO propagated into the western Pacific (phases 6 -7) and then weakened considerably. This MJO signal temporarily counteracted the general La Niña pattern (i.e. enhanced convection over the Maritime Continent, decreased convection around the International Date Line, and enhanced trade winds).

New Zealand's coastal water temperatures remained much warmer than normal in February around the South Island, and Marine Heat Wave conditions (five or more consecutive days above the climatological 90th percentile) were present over extended areas off the west and east coasts of the South Island, as well as in Cook Strait. Model guidance generally suggests that near normal to above normal ocean temperatures are likely, especially around the South Island, during the coming months.

[1] The Relative Oceanic Niño 3.4 Index (RONI) is a modern way of measuring oceanic El Niño and La Niña that is complementary to oceanic traditional indices. While traditional oceanic indices like the Niño 3.4 Index monitor SSTs in one region, the RONI compares the average SST in the central equatorial Pacific with the average SST across the global tropics. Since tropical rainfall patterns respond to relative changes in ocean temperatures, this new relative index can help forecasters better determine if the equatorial Pacific is warmer or cooler than the rest of the global tropics, which has become more challenging to discern as seas warm because of climate change.

Figure 6: Maps showing the current soil moisture anomaly, as well as rainfall and temperature differences from normal since the start of the month.

Soil moisture anomaly: 14/3/25	Rainfall anomaly: 1/3/25 – 14/3/25	Temperature anomaly: 1/3/25 – 14/3/25
		

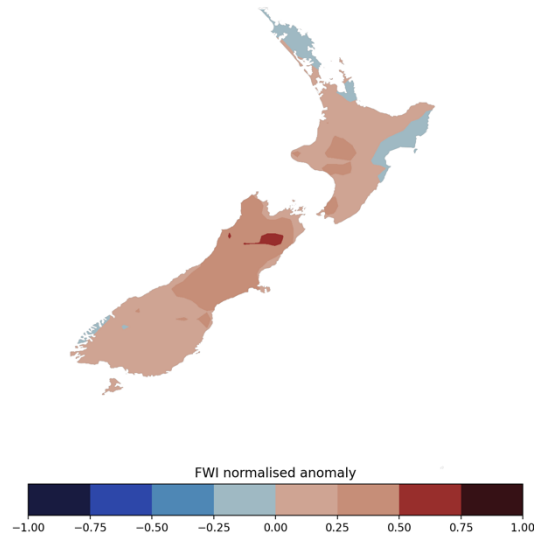
Photos 3 and 4. Aerial views showing active fire in the Waipoua Forest, Northland in March 2025.

Fire season analogues

To help understand what fire weather conditions may be like this summer, we can look at analogues. Analogues are historical years with similar climatic conditions to the current year.

This season's analogues feature historical years with summers influenced by La Niña conditions. These years also exhibited strong Walker Circulation anomalies resembling decaying La Niña patterns, characterised by rising air over the Maritime Continent, sinking air in the eastern Pacific, along with a pronounced descent around the western Pacific warm pool (Figure 7). The subjective analogue seasons are selected with expert interpretation from NIWA.

This month's analogues show a significantly different outcome than what the dynamical models are indicating for the April-June period. The analogues indicate a possibility for high pressure near or over the country, leading to drier than normal conditions for most of New Zealand. The analogues also indicate seasonal temperatures generally near average.



Forecaster-selected analogue season - Apr to Jun
2012
2008
2001
2000
1999
1989
1988
1984

Figure 7: Analogue fire seasons as selected with expert interpretation from NIWA. The Fire Weather Index (FWI) is a combination of the Initial Spread Index and Buildup Index, and is a numerical rating of the potential frontal fire intensity. In effect, it indicates fire intensity by combining the rate of fire spread with the amount of fuel being consumed. Here, the Fire Weather Index anomaly is calculated by averaging historical analogue years together and comparing to the average FWI between 1991-2020 for the relevant season.

Climate outlook: April 2025

April's air flows are expected to be mixed, with periods of northeasterlies interspersed with occasional westerlies. Westerlies will bring an increased chance for wetter than normal conditions to the west of the South Island. Meanwhile, the North Island may see irregular heavy rainfall events due to low pressure arriving from the north. Wind speeds may be below normal in the North Island, but gustier at times in the South Island. Above average temperatures are generally favoured (Figure 8).

Climate outlook: April – June 2025

A northeast air flow anomaly will be favoured during the season. Temperatures for the next three months are expected to be above average overall (Figure 9). With a weak La Niña likely to transition to ENSO-neutral during the season, rainfall patterns may be La Niña-like at times, but occasionally atypical of "traditional" La Niña patterns. The North Island may experience occasional short and sharp rainfall events due to low pressure or moisture plumes moving out of the subtropics. Slightly above normal relative humidity is expected in most northern and eastern regions. Wind speeds may be near or slightly below normal.

The tropical cyclone season for the Southwest Pacific runs through April. NIWA has assessed that the risk for an ex-tropical cyclone to come within 550 km of New Zealand is normal to elevated for the season.

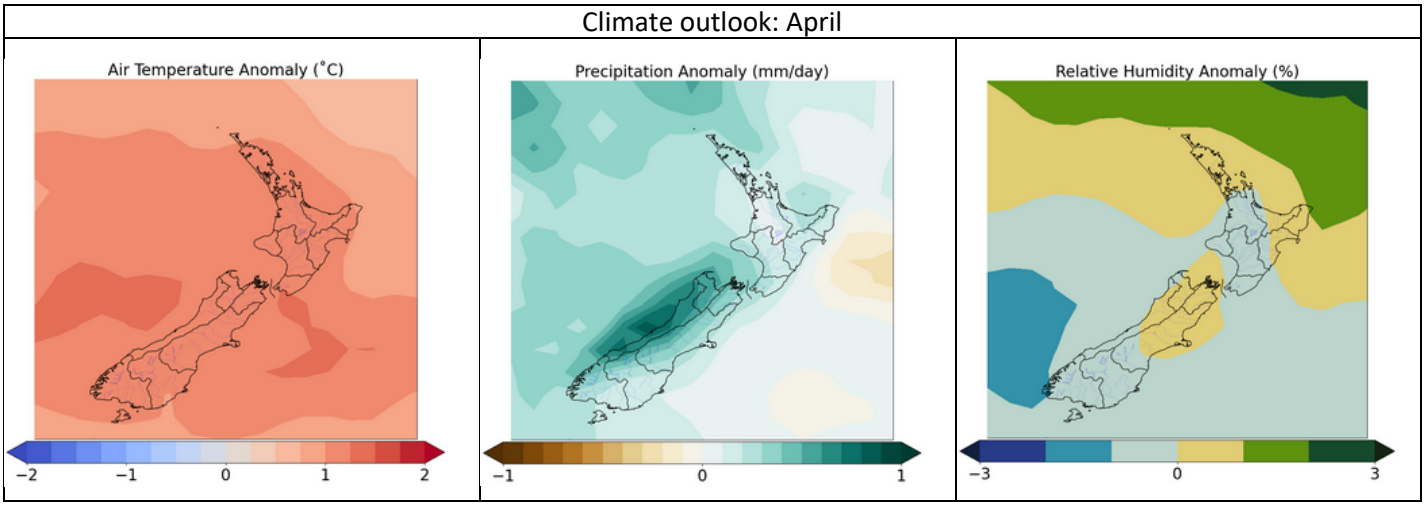


Figure 8: Climate outlook for April showing forecast temperature (left), rainfall (middle) and relative humidity (right) anomalies.

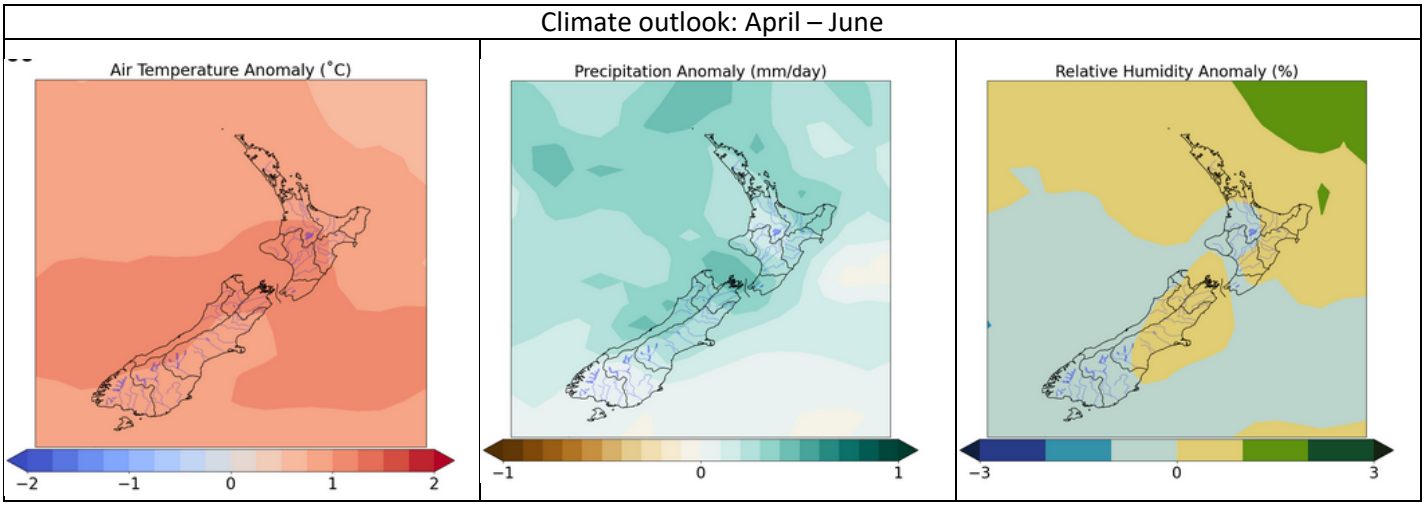


Figure 9: Climate outlook for April-June showing forecast temperature (left), rainfall (middle) and relative humidity (right) anomalies.

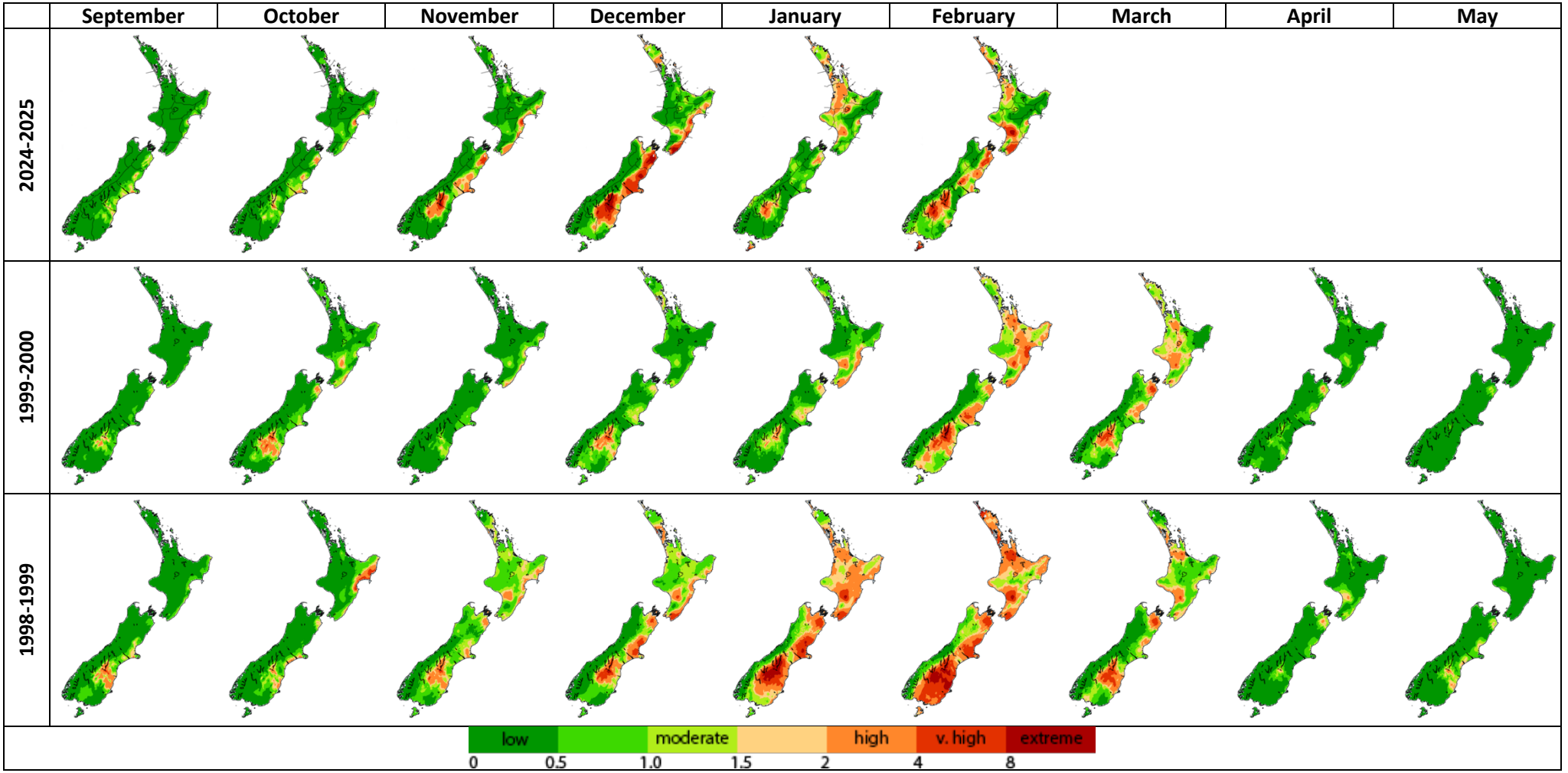


Figure 10: Monthly average severity rating for the current year 2024/2025 and the comparative years of 1999/2000 and 1998/1999. These are analogue years for the current season and give us an insight into what the upcoming season may be like.

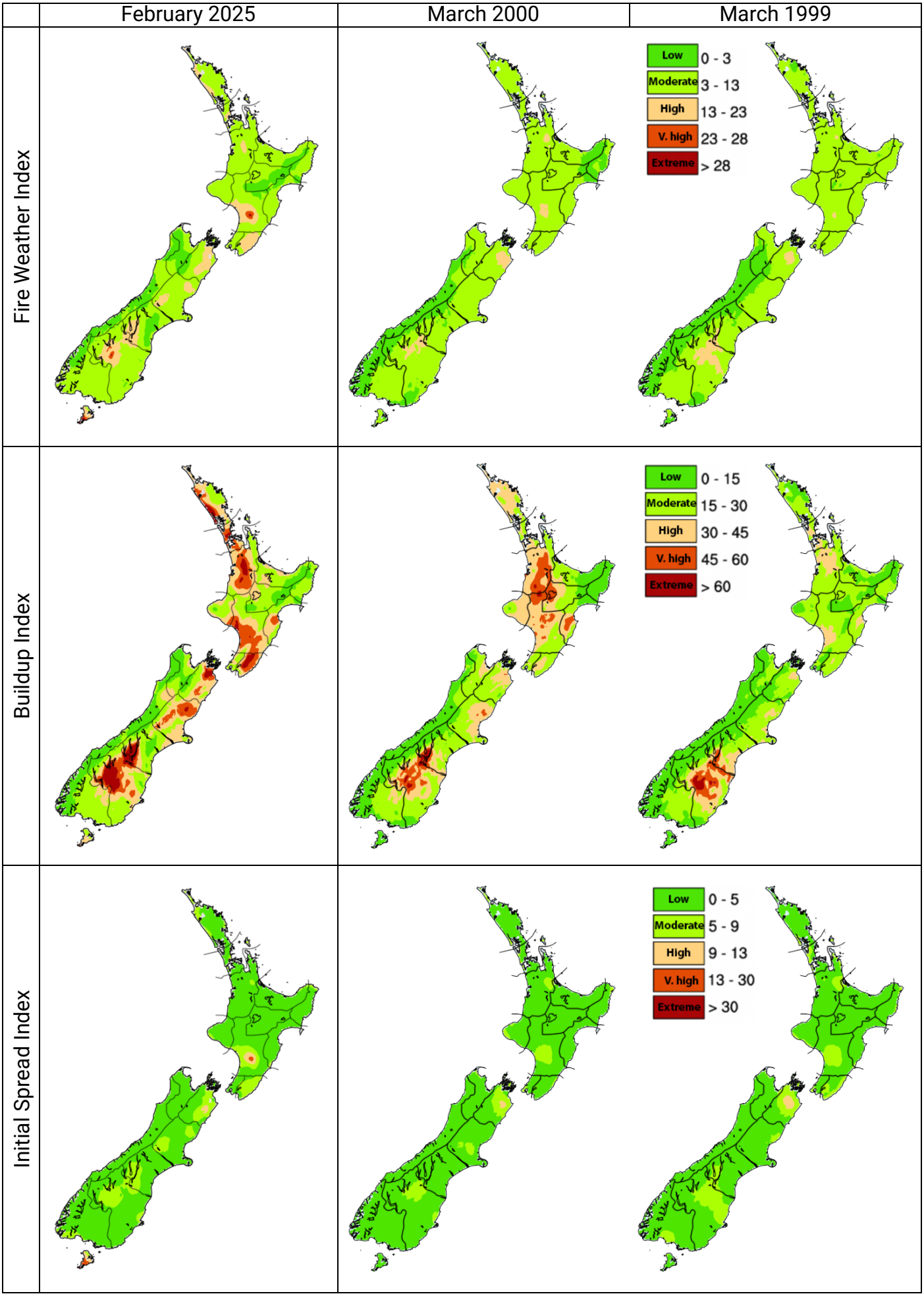


Figure 11: The most recent observed month (left column) and analogue months for March (middle and right columns); monthly average for the Fire Weather Index (top), Buildup Index (middle) and Initial Spread Index (bottom).

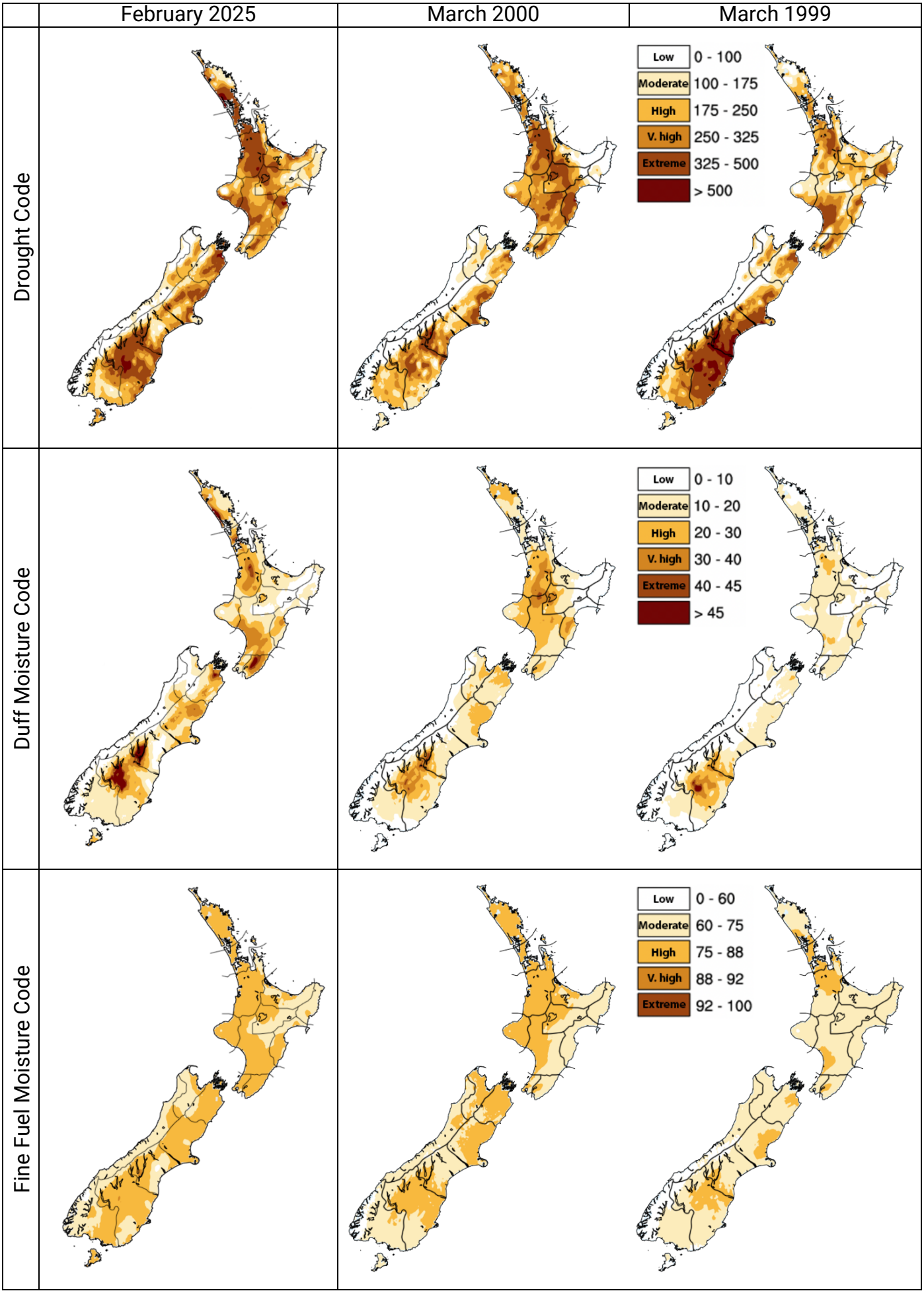


Figure 12: The most recent observed month (left column) and analogue months for March (middle and right columns); monthly average for the Drought Code (top), Duff Moisture Code (middle) and Fine Fuel Moisture Code (bottom).

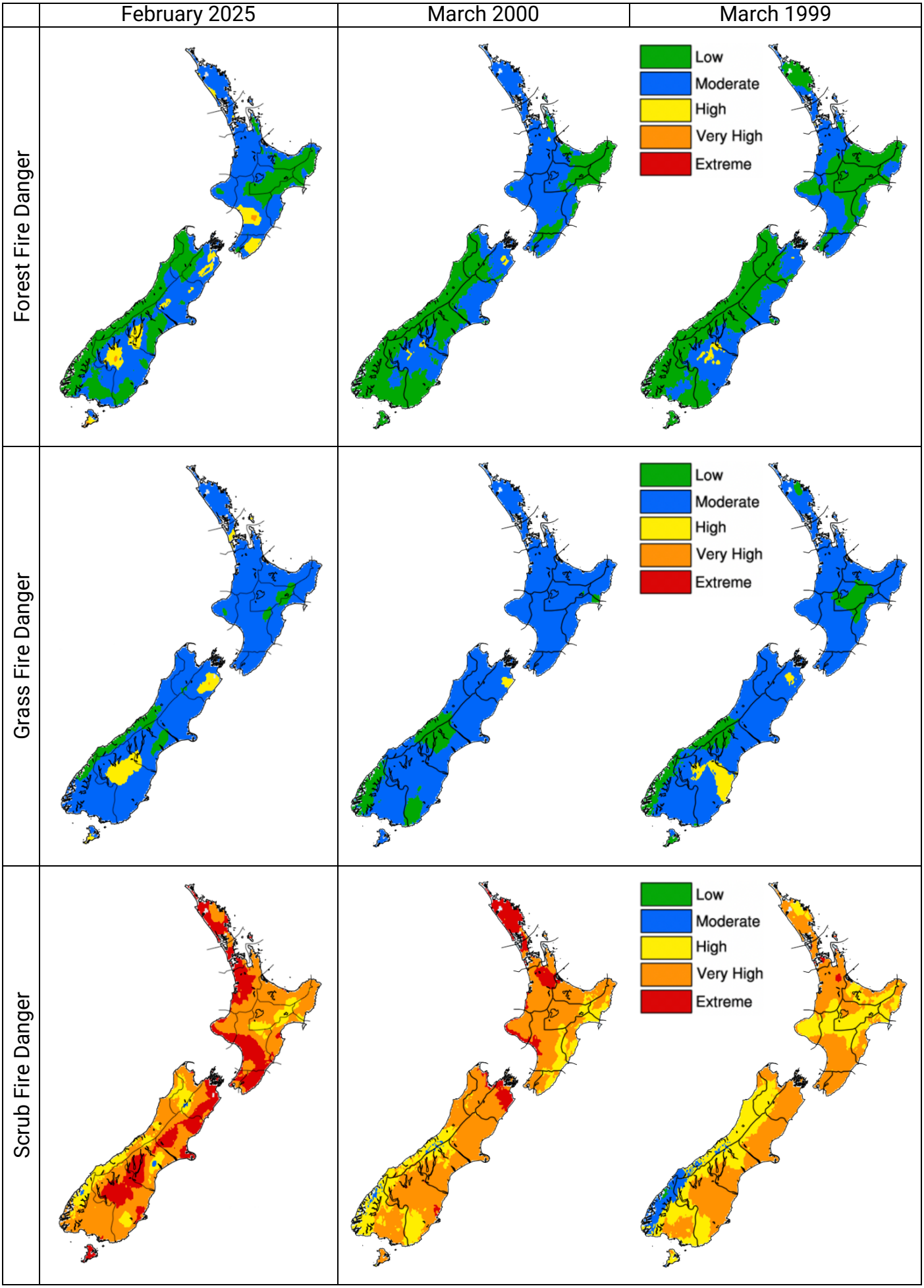


Figure 13: The most recent observed month (left column) and analogue months for March (middle and right columns); monthly average for the Forest Fire Danger (top), Grass Fire Danger (middle) and Scrub Fire Danger (bottom).

Background information on fire weather indices and codes

Fine Fuel Moisture Code: An indicator of the relevant ease of ignition and flammability of fine fuels.

0-74	Difficult
75-84	Moderately easy
85-88	Easy
89-91	Very Easy
92+	Extreme Easy

Initial Spread Index: Combines the effect of wind speed and the FFMC, providing a numerical rating of potential fire spread rate.

0-3	Slow rate of spread
4-7	Moderate fast
8-12	Fast
13-15	Very fast
16+	Extremely fast

Duff Moisture Code: A rating of the average moisture content of loosely compacted organic soil layers (duff/ humus) of moderate depth, and medium-sized woody material.

0-10	Little mop-up needs
11-20	Moderate
21-30	Difficult
31-40	Difficult & extended
41+	Extreme & extensive

Fire Weather Index: Combines the ISI and BUI to indicate the potential head fire intensity of a spreading fire (on level terrain).

0-5	Low fire intensity
6-12	Moderate
13-20	High
21-29	Very high
30+	Extreme

Drought Code: A rating of the average moisture content of deep, compact, organic soil layers, and a useful indicator of seasonal drought effects on forest fuels and amount of smouldering in deep duff layers and large logs.

0-100	Little mop-up needs
101-175	Moderate
176-250	Difficult
251-300	Difficult & extended
301+	Extreme & extensive

Daily Severity Rating: A numerical rating of the daily fire weather severity at a particular station, based on the FWI. It indicates the increasing amount of work and difficulty of controlling a fire as fire intensity increases. The DSR can be averaged over any period to provide monthly or seasonal severity ratings.

Buildup Index: Combines the DMC and DC, and represents the total amount of fuel available for combustion.

0-15	Easy control
16-30	Not difficult
31-45	Difficult
46-59	Very difficult
60+	Extremely difficult

Monthly Severity Rating: is the average of the DSR values over the month. DSR and MSR captures the effects of both wind and fuel dryness on potential fire intensity, and therefore control difficulty and the amount of work required to suppress a fire. It allows for comparison of the severity of fire weather from one year to another.

0-1	Low fire behaviour potential
1-3	Moderate fire potential
3-7	High to very high fire potential
7+	Extreme fire behaviour potential

This document was prepared by NIWA in collaboration with Fire and Emergency NZ