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

Issue: February 2025

Current fire danger situation

Many fire indices are currently in the low to moderate range across the country, although Drought Code, Duff Moisture Code, and Fine Fuel Moisture Code are generally moderate to high. However, several indices are higher across Waikato and interior Otago.

A weak La Niña is now present, but it is likely be short-lived and "traditional" La Niña-like patterns may not be consistently observed in the coming months.

Current fuel and soil moisture status

As of 13 February (see Figure 6, left), soil moisture levels were below normal or well below normal across much of the country. Near normal soil moisture was observed in the Coromandel Peninsula, Gisborne, and much of Canterbury, with a pocket of above normal soil moisture located in the Far North.

The Build Up Index (BUI), representing dryness and availability of medium and heavy fuels in a forest, has for many areas moderated over recent days with some light to moderate rain. However, it remains elevated for parts of Waikato, Manawatu, Wairarapa, Marlborough, Northern Canterbury and through to Otago (Figure 1).

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

However, if we look at the Drought Code (DC) (Figure 2), much of the country remains elevated. This is because the DC represents the dryness of buried organic matter and heavy fuels such as logs that are slower to absorb moisture and require more rain over a longer period to result in a significant decline. These elevated DC values mean fires will have potential to burn deep into the ground and be very difficult to fully extinguish. Additionally, with the DC values remaining elevated, there is potential for the BUI to climb again relatively quickly once the shallower, medium fuels represented by the Duff Moisture Code (DMC) dry out.

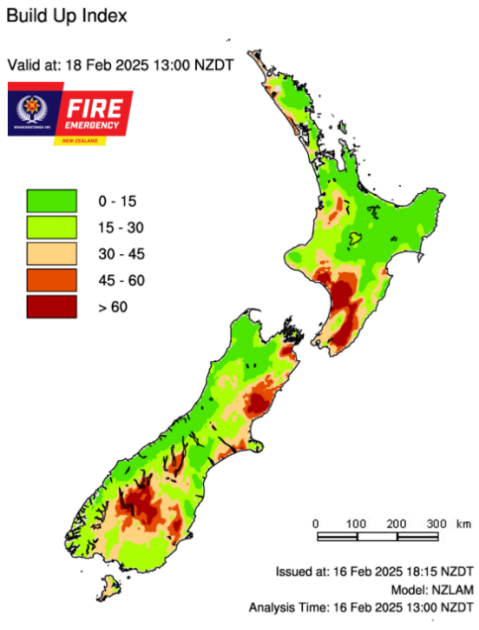


Figure 1: Maps of the Build Up Index (BUI), indicating total fuel availability.

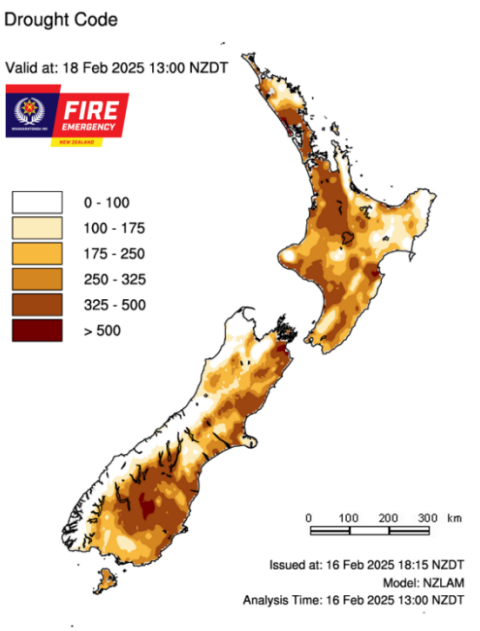
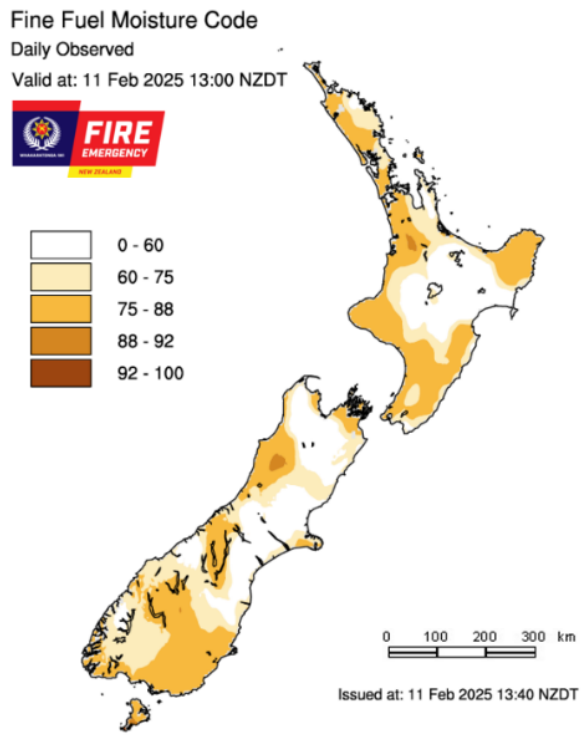
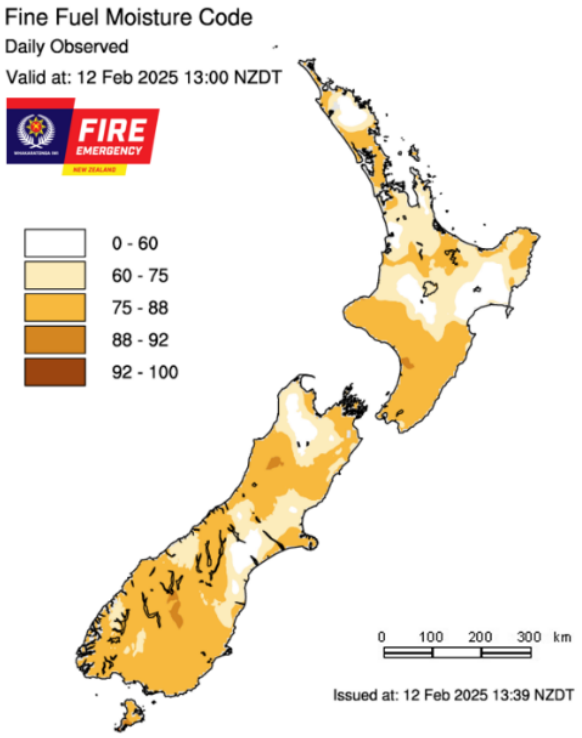
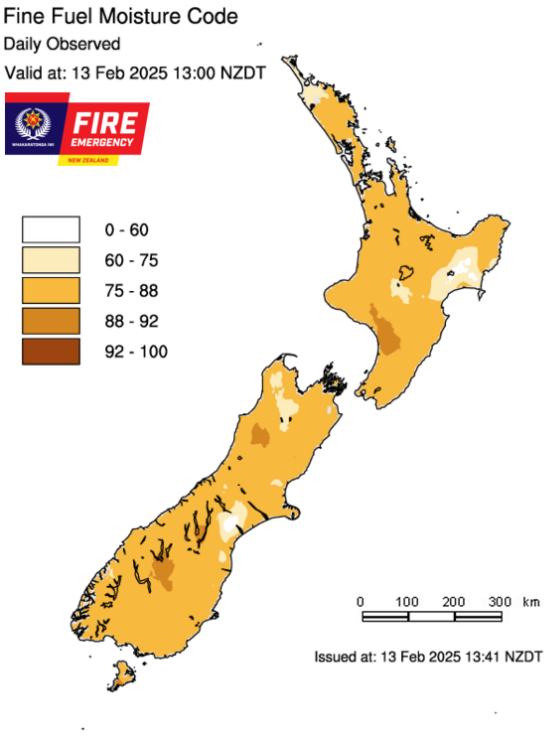


Figure 2: Maps of elevated Drought Code (DC), indicating dryness and fuel availability of logs and buried organic matter across many parts of the country despite recent rain.

Fine fuels continue to fluctuate and, at times, quite rapidly with the intense summer sun, and especially with strong winds assisting the drying. The four-day sequence below (Figure 3) represents the changeable dryness of dead fine fuel represented by the Fine Fuel Moisture Code (FFMC), which is not unusual for this time of year.







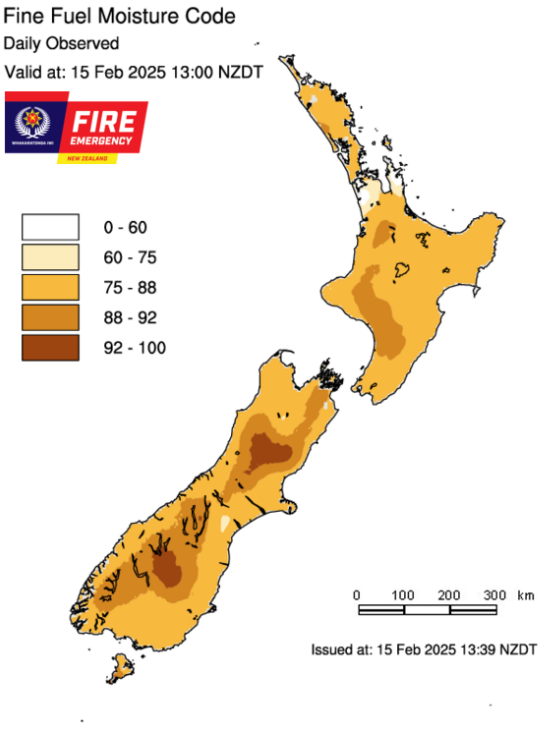


Figure 3: Maps of the Fine Fuel Moisture Code (FFMC), indicating dryness and ease of ignition of fine dead material. These images show the great variation in the moisture content of fine fuels over a short period.

Forecast climate and weather

After moderate to heavy rainfall totals for many regions this week, the final week of February may be very dry as high pressure is forecast to settle over the country.

Early March may continue to be drier than normal with high pressure favored to be located near or east of the country. However, the second half of March may begin to trend wetter as the high pressure is forecast to break down while a pulse of the Madden-Julian Oscillation (MJO) moving into the western Pacific may channel tropical moisture toward New Zealand. An east-northeast wind anomaly is most likely, reflecting the influence of a weak La Niña. Temperatures during March are likely to be warmer than average, while below normal wind speeds are favoured.

The March-May period is expected to see a continued prevalence of northeasterly and easterly winds with the influence of a weak La Niña, although La Niña may officially end sometime during March-May. Wetter than normal conditions are favored for the upper North Island and eastern areas of both islands, while the lower South Island could experience drier than normal conditions. Temperatures are forecast to be above average, accompanied by lighter than average winds.

For more information, see page 9.

The La Niña climate pattern

A weak La Niña is now present, but it is likely be short-lived and "traditional" La Niña-like patterns may not be consistently observed in the coming months.

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.

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. 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

Deep burning material

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. Fire crew at the Tiwai Point fire working to extinguish fire burning underground.

Rebounding fire danger

As mentioned above, the FFMC, DMC and BUI could rebound relatively quickly after recent rain. 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.

Grass Curing

Grass curing is the seasonal 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 dying 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 intensity. Many of our fires at least initially start in grass, so great care is needed when burning and or carrying out heat or spark generating activities in or near grass fuels. Please refer to the FENZ website Checkitsalright.nz for further guidance.

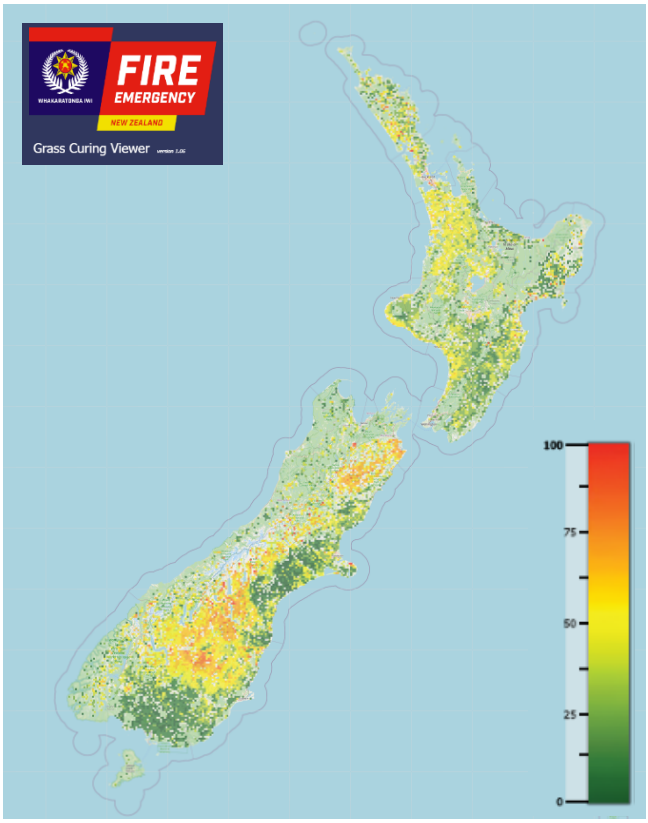


Figure 4. Map of current grass curing across NZ.

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.

Areas to watch:

With easterlies being more frequent than normal, the west coast of both Islands has been subject to a rain shadow resulting in drier than normal conditions and higher fire risk conditions. The effect of the past weather and a continuation of this easterly/ northeasterly flow is expected to remain in place through to May.

However, the lower parts of the South Island are at a latitude that misses some of the easterly flows that affect the upper parts of the country. And with less moist westerlies coming around the bottom of the island, this area is likely to have slightly drier weather and more elevated fire risk than normal.

In contrast, eastern areas of both islands exposed to these more frequent E/NE airflows will have slightly lower than normal fire potential due to higher humidity, cooler temperatures, and increased rainfall. Note however that eastern parts, although showing as below normal or normal, still have relatively elevated fire risk; for example, parts of Wairarapa and Marlborough, as showing in the BUI map (see Figure 1).

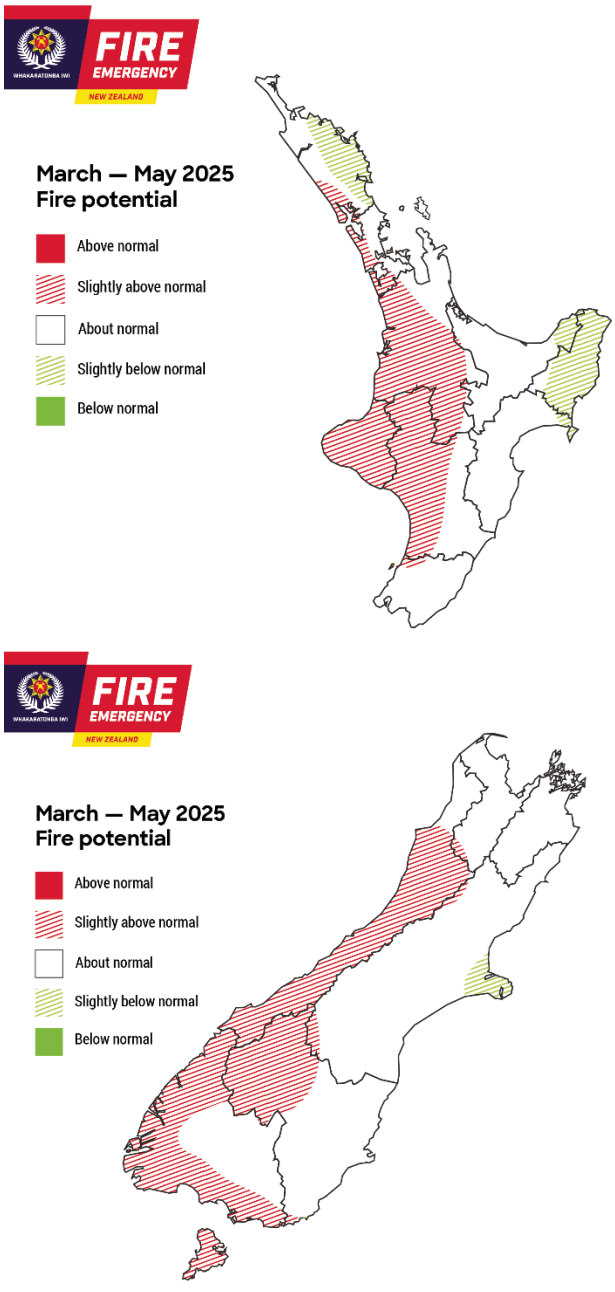


Figure 5. Fire potential over the next three months for the North and South Islands based on assessment of the effects of climate predictions for the March - May period.

Current climate

In January, temperatures were below average (0.51-1.20°C below average) or well below average (>1.20°C below average) for much of the North Island to the south of central Waikato and the western Bay of Plenty, as well as northern, eastern, and southern parts of the South Island. Temperatures were above average (0.51-1.20°C above average) or well above average (>1.20°C above average) for western parts of the South Island. So far in February temperatures have been near average or below average in the east of both islands, but above average or well above average in the west of both islands (Figure 6, right).

January rainfall was below normal (50-79% of normal) or well below normal (<50% of normal) across western, inland, and southern parts of the South Island, Marlborough, Taranaki, Hawke's Bay, Waikato, Bay of Plenty, Auckland, and southern Northland. Above normal (120-149% of normal) or well above normal (>149% of normal) rainfall was observed across eastern parts of Canterbury, Nelson, and northern Northland. So far in February, rainfall has been below normal or well below normal for nearly the entire country (Figure 6, middle).

As of 13 February (see Figure 6, left), soil moisture levels were below normal or well below normal across much of the country. Near normal soil moisture was observed in the Coromandel Peninsula, Gisborne, and much of Canterbury, with a pocket of above normal soil moisture located in the Far North.

Climate drivers

Sea surface temperatures (SSTs) in the central equatorial Pacific (Niño 3.4 Index) during January were just over NIWA's conventional threshold to define La Niña (-0.72˚C). As of late January, the 30-day relative Niño 3.4 Index[1] (RONI) was -1.28˚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 technically in the neutral range (+0.07) as of late January. However, over the past two months, the SOI crossed the La Niña threshold occasionally but failed to remain consistently in La Niña territory.

In summary, weak and atypical La Niña conditions are present in the Pacific Oceanic and atmospheric conditions in the Pacific meet most of NIWA's criteria for La Niña. Consequently, a La Nina Advisory is in place. While the coupling between the ocean and atmosphere is locally strong in the central Pacific, as a whole the event is weak and expected to be short-lived. 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.

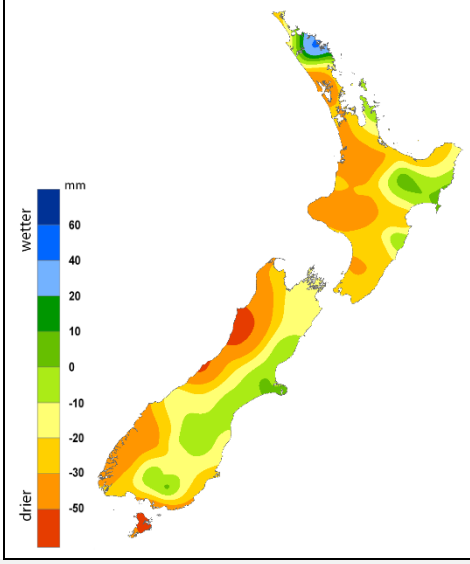
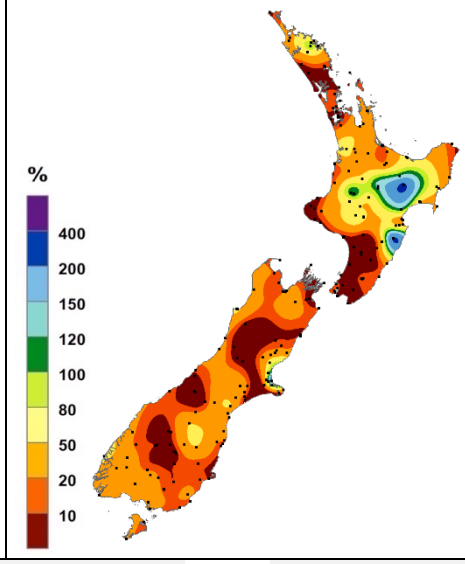
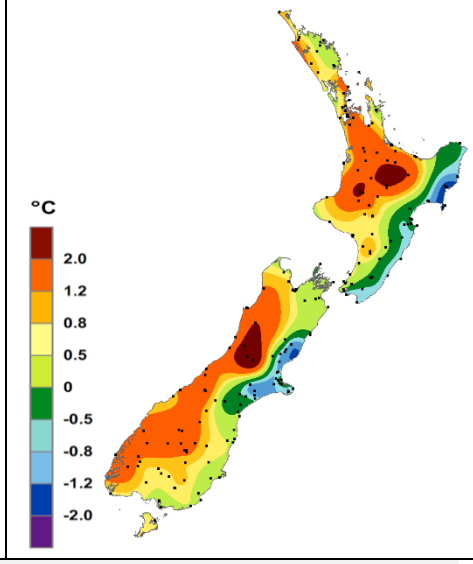
The Indian Ocean Dipole (IOD) index was neutral in January 2025, with the average anomaly for the month being -0.50°C. The guidance from the Australian Bureau of Meteorology is for the IOD to remain neutral throughout the forecast period.

During January, convective forcing associated with the MJO reached the eastern Indian Ocean (phase 3) and enhanced convective activity affected most of the Maritime Continent, while decreased convection was present further east to the International Date Line, associated with the enhanced trade winds that are currently present in the central Pacific.

New Zealand's coastal water temperatures cooled significantly since December 2024 around the North Island. Conversely, much warmer than average SSTs persist along and off the west coast of the South Island. Model guidance generally suggests that near normal to above normal ocean temperatures are likely over 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: 13/2/25	Rainfall anomaly: 1/2/25 – 13/2/25	Temperature anomaly: 1/2/25 – 13/2/25
		

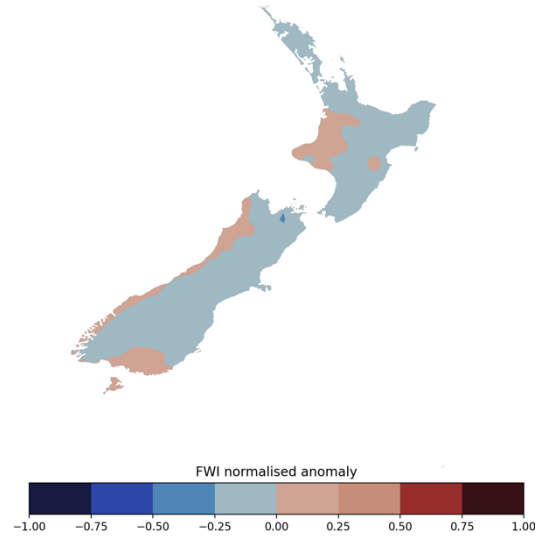
Photos 2 and 3. Aerial views showing rapid spread of the Tiwai Point Fire, in the Awarua Wetlands near Bluff.

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 that had La Niña decaying late in the season (Figure 7). The subjective analogue seasons are selected with expert interpretation from NIWA.

Northeasterly quarter winds will become more likely in March, and this is likely to cause a drying trend in the west of both islands, potentially increasing the fire weather threats there. However, this pattern may not be consistently observed in the coming months. Conversely, the east of both islands may be exposed to more rainfall, onshore winds, higher humidity, and a decrease in the fire weather potential. The upper North Island may also be more exposed to northerly rainmakers as the three-month period progresses.



Forecaster-selected analogue season - Mar to May
2023
2009
2008
2006
2000
1999
1996
1989

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: March 2025

March's air flows are expected to tend more northeasterly to easterly as high pressure becomes favoured near and east of New Zealand, especially in the first half of the month. This will bring an increased chance for drier than normal conditions to the west of the South Island, although the West Coast may still see moisture-bearing fronts at times. Meanwhile, the North Island may see irregular heavy rainfall events, especially later in the month. Wind speeds are expected to be below normal, while above average temperatures are favoured (Figure 8).

Climate outlook: March – May 2025

A northeast to east 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 and likely short-lived La Niña currently in place and expected to continue over the coming weeks, rainfall is generally favoured to be above normal in the upper North Island and east of both islands, with drier than normal conditions possible in the lower South Island. Slightly above normal relative humidity is expected in most northern and eastern regions. Wind speeds are expected to be lower than normal.

The tropical cyclone season for the Southwest Pacific runs through April 2025. 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.

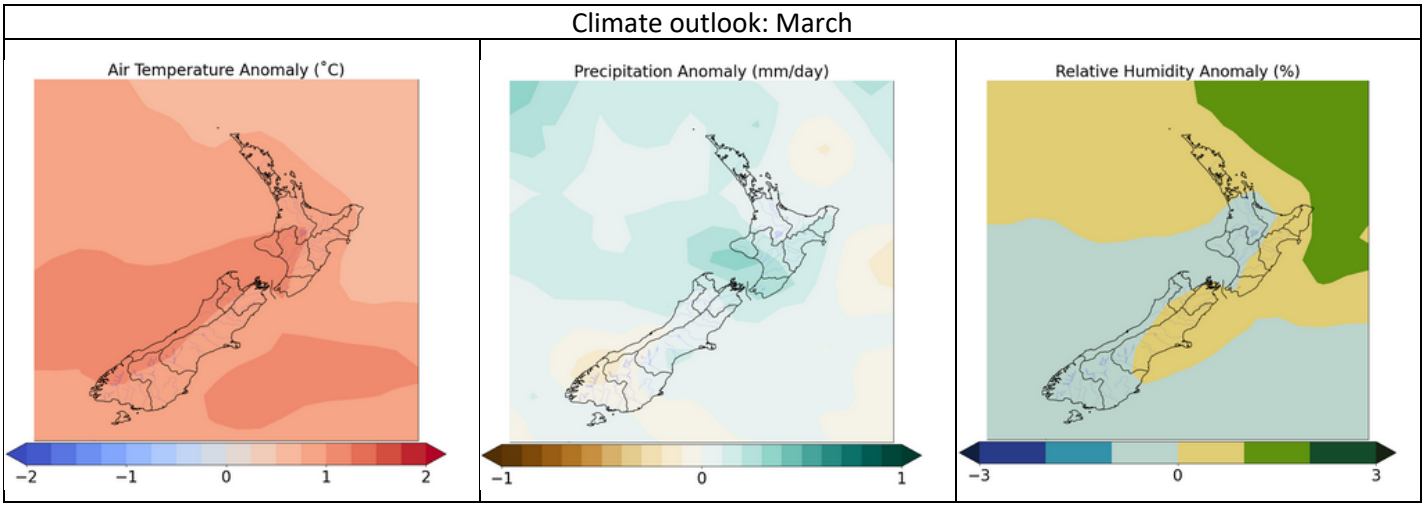


Figure 8: Climate outlook for March showing forecast temperature (left), rainfall (middle) and relative humidity (right) anomalies.

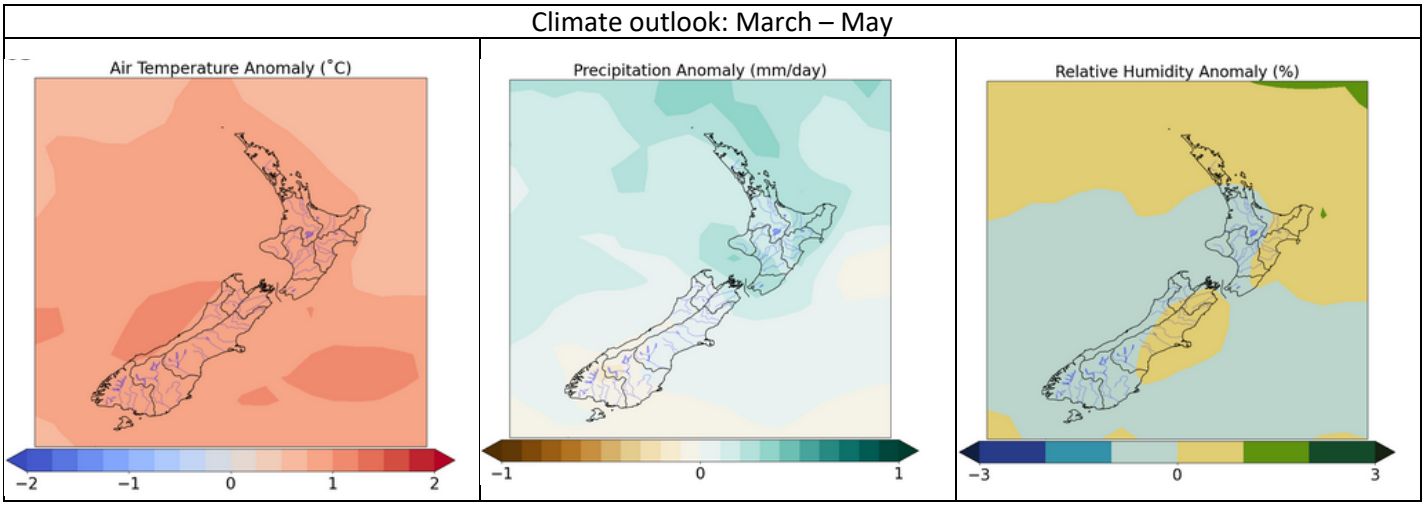


Figure 9: Climate outlook for March-May showing forecast temperature (left), rainfall (middle) and relative humidity (right) anomalies.

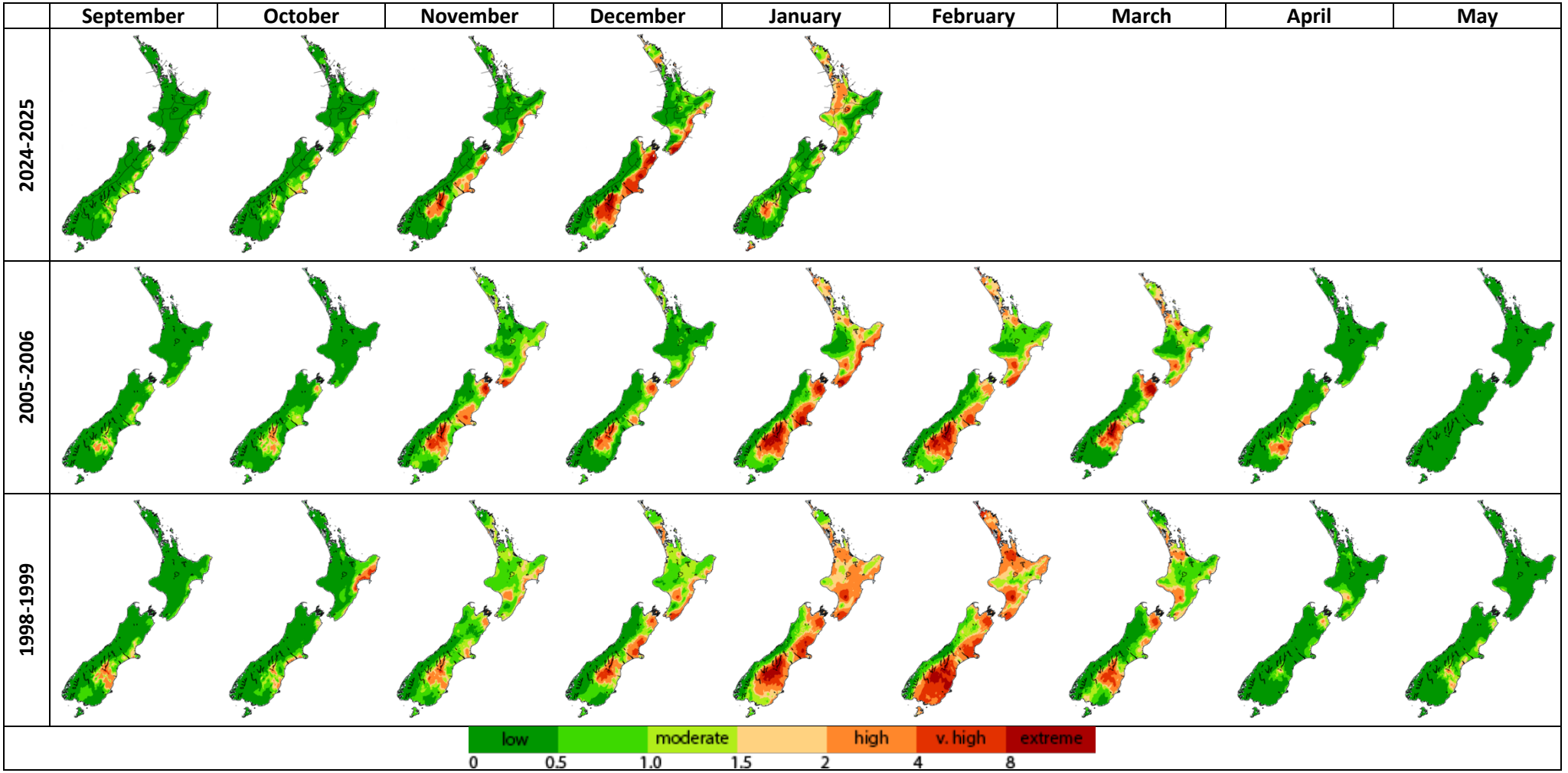


Figure 10: Monthly average severity rating for the current year 2024/2025 and the comparative years of 2005/2006 and 1998/1999. These are analogue years for the current season and give us an insight into what the upcoming season may be like.

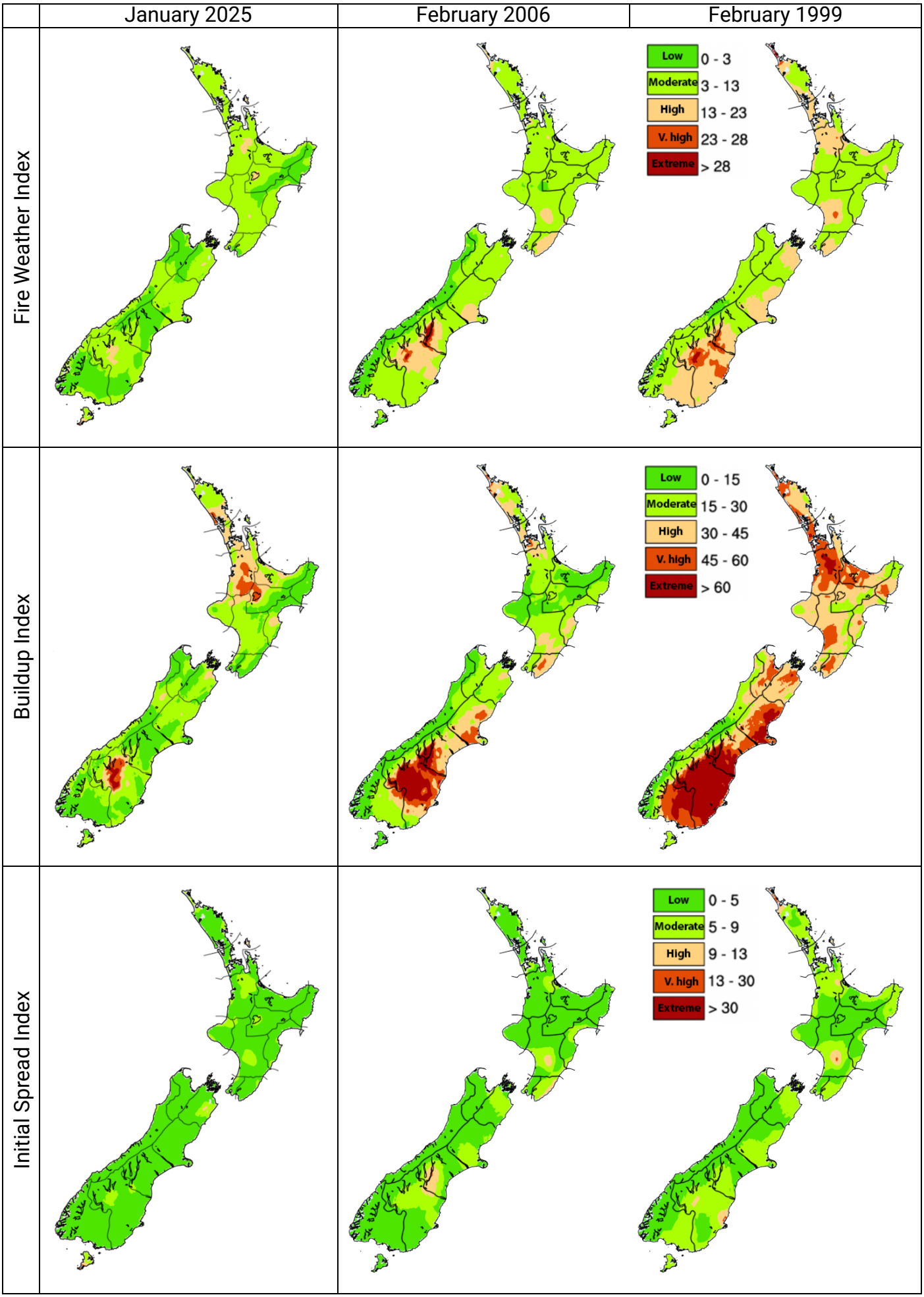


Figure 11: The most recent observed month (left column) and analogue months for February (middle and right columns); monthly average for the Fire Weather Index (top), Buildup Index (middle) and Initial Spread Index (bottom).

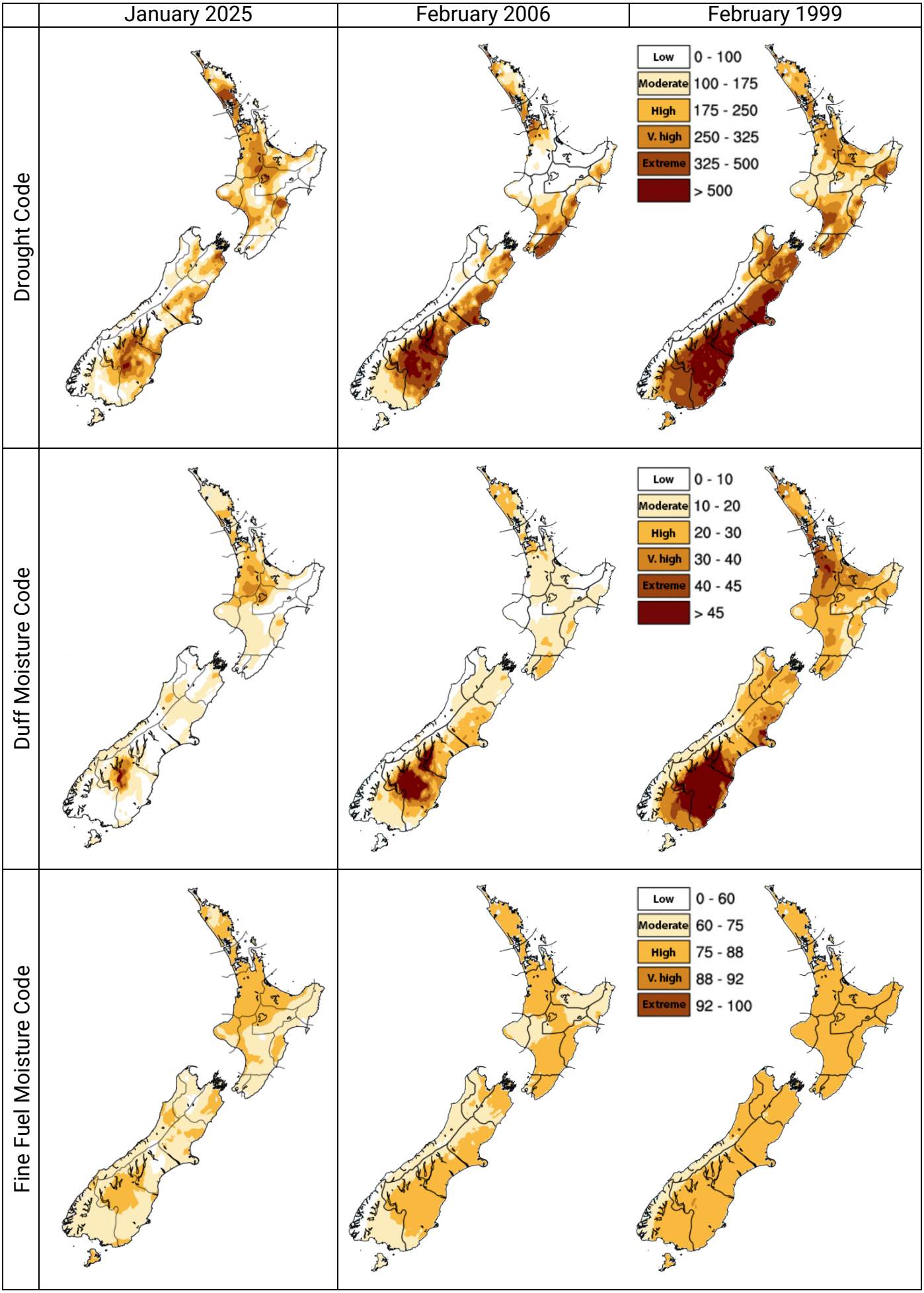


Figure 12: The most recent observed month (left column) and analogue months for February (middle and right columns); monthly average for the Drought Code (top), Duff Moisture Code (middle) and Fine Fuel Moisture Code (bottom).

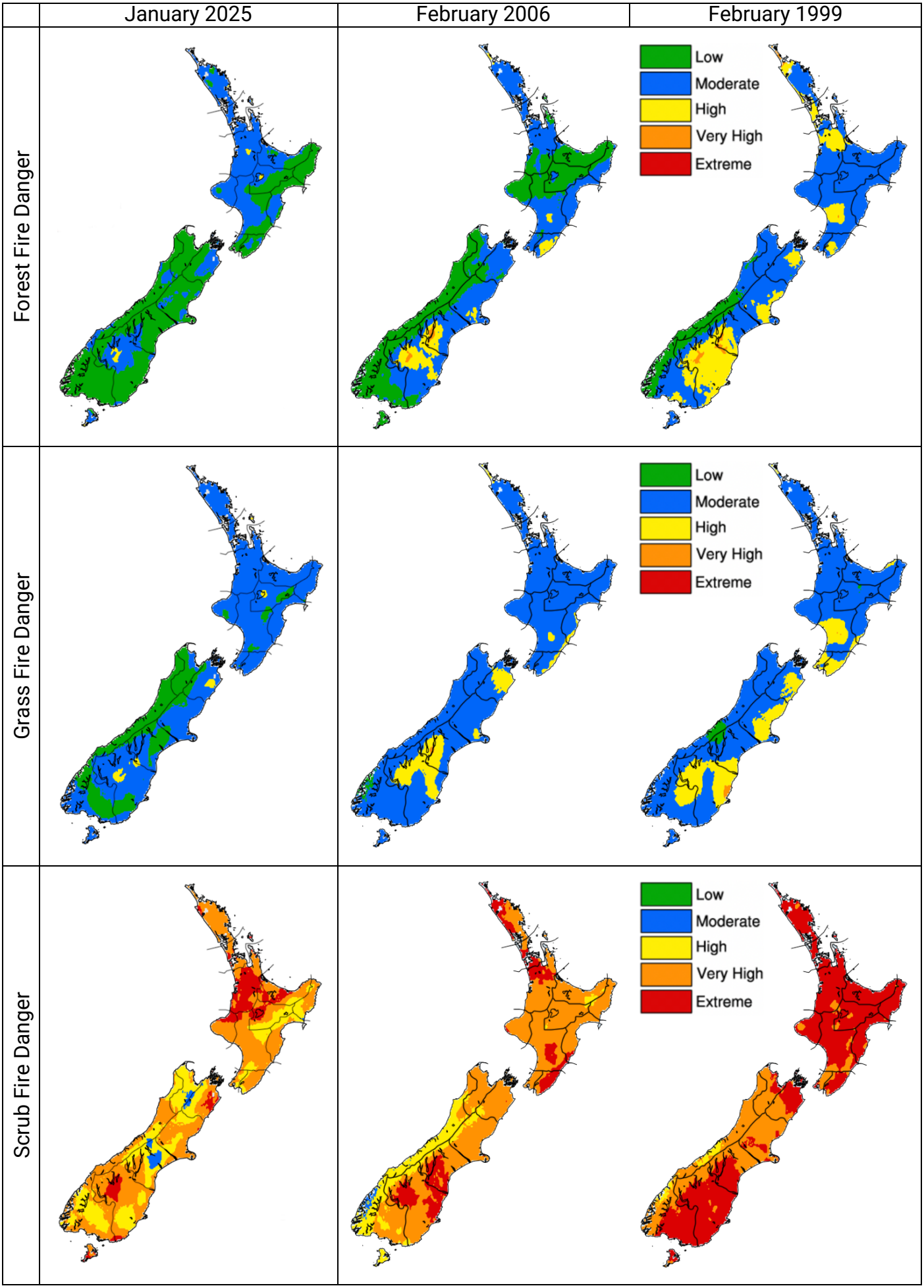


Figure 13: The most recent observed month (left column) and analogue months for February (middle and right columns); monthly average for the Forest Fire Danger (top), Grass Fire Danger (middle) and Scrub Fire Danger (bottom).

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