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

Issue: October 2024

Current fire danger situation

As is typical for this time of year, fire indices are predominantly low across both islands. However, there are pockets of medium values, generally in the east of both islands. The scrub fire danger values are also high to very high in many regions. See below for more detail.

While ENSO neutral conditions currently continue, there is a 60-70% chance of La Niña developing during November-January.

Current fuel and soil moisture status

As of 15 October (see Figure 4, left), soil moisture levels are near normal across most of New Zealand. Areas of above normal soil moisture are located in Auckland, Bay of Plenty, Marlborough, South Canterbury, and Otago. Areas of below normal soil moisture are observed along the east coast of the North Island and Banks Peninsula.

As with soil moisture, fuel moisture levels reflect the effects of recent rainfall across most areas of the country. Values of the Duff Moisture Code (DMC), Drought Code (DC) and Buildup Index (BUI) are generally low, indicating that the availability of medium and heavy fuels to burn is also low. Values of these fuel moisture codes have decreased in most areas from last month, although pockets of dryness remain around Hawkes Bay and North Canterbury, as indicated by values of the BUI (Fig. 1, top).

The moisture contents of fine fuels are more changeable, with periods of warmer weather between rain events causing some drying, as represented by increasingly more elevated values of the Fine Fuel Moisture Code (FFMC) (Fig. 1, bottom). The FFMC is a key indicator of ease of ignition and a significant factor influencing fire spread rates, along with wind. Although these periods of dry fine fuels and elevated FFMC are currently brief, as we progress through spring, the dry periods will become longer and more frequent, leading to more days with elevated FFMC values. Prolonged drying periods will eventually also result in the drying of medium and heavy fuels, causing DMC and DC values to rise.

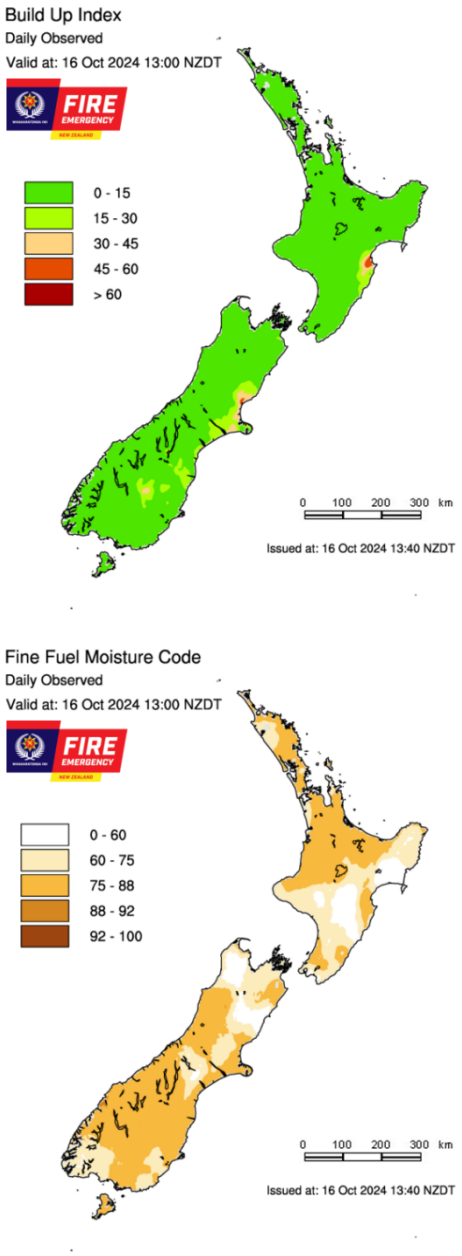


Figure 1: Maps of Buildup Index (BUI) (top, indicating total fuels available for combustion) and Fine Fuel Moisture Code (FFMC) (bottom, indicating ease of ignition) as at 16 October 2024.

Forecast climate and weather

The remainder of October may see conditions trending wetter as low pressure forms in the Tasman Sea in response to a pulse of the Madden-Julian Oscillation (MJO) transiting the western Pacific.

During November, the early part of the month may continue with the same active pattern that began in late September. However, as the month progresses, high pressure will become favoured near and east of New Zealand. This will bring an elevated chance for drier than normal conditions, especially for the west of both islands.

November-January will likely exhibit more northeasterly-easterly winds than usual as the influence from a developing La Niña increases. Wetter than normal conditions will be favoured for the upper North Island and the east of both islands, with drier than normal conditions most likely occurring in the west of both islands and the lower South Island. Temperatures overall look to be above average, along with a chance for lighter than normal winds.

For more information, see pages 6 and 8.

The La Niña climate pattern

ENSO-neutral conditions will likely continue into November, but there is a 60-70% chance that La Niña will develop during November-January.

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. For example, during La Niña, moisture-laden weather systems from the tropics and subtropics have sometimes bypassed the upper North Island, leaving Northland, Auckland, and Waikato drier than what is traditionally expected in La Niña years. 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

Holdover fires

The use of fire at this time of year is common. For larger burn-offs, this can result in fires that burn slowly or smoulder for extended periods when DMC and DC values are low, and the medium and heavy fuels are not available to burn. In coming days or weeks, as the fuels dry and become available to burn, these fires can become more active and potentially escape, particularly during dry and windy periods.

Complacency

There is a perception that damaging wildfires can only occur in summer months, once conditions are very dry. This perception can lead to some complacency amongst the public, landowners and firefighters during spring. However, many of our more significant fires in recent years have occurred in spring, in the absence of drought when conditions are more changeable. The combination of short drying periods, strong winds and availability of fine flashy fuels still provide conditions suitable for fires to start, spread rapidly and burn with moderate to high intensities, which can result in burning of large areas.

Photo from the Gumfields fire near Ahipara in Northland on 5th Oct., an example of a significant spring scrub fire in elevated fine flashy fuels.

Light flashy fuels

Forest fuel types with a closed canopy and significant heavy and medium fuels take time to dry out at the end of winter and are therefore a lower risk than during summer. However, fine fuels and fuels open to sunlight such as scrub, logging slash and young plantations (often mixed with scrub or grass fuels) are elevated and so more responsive to atmospheric conditions, so that they dry out very quickly as is demonstrated with the very changeable FFMC. We therefore need to watch out for fires in these fuel types, and especially during sunny, windy periods common in spring and early summer.

Wind driven fires

The current seasonal forecast indicates that winds over the next few months will be lighter on average than normal. However, spring is still typically a season characterized by windy conditions. As such, there will continue to be short periods of stronger winds, usually associated with passing weather systems, which can lead to wind-driven fires. Recent examples include the Balmoral fire near Tokarahi in the Waitaki Valley, as well as incidents from past years such as Ohau and Pukaki in the Mackenzie Basin. Wind poses a significant risk, particularly when combined with the Föehn effect, which brings strong, warm, dry winds over elevated terrain, such as with the north-westerlies experienced in the eastern regions of both islands.

Grass curing

While grasses around the country are currently green due to recent rainfall and cooler conditions, these will start to undergo seasonal die-off as summer approaches. While onset of this grass curing may be delayed in many areas this year because of recent conditions, it will eventually take place and may have even begun in drier areas. The increase in the amount of dead fuel present because of seasonal curing leads to easier ignition and fire spread in grass fuels, and in conjunction with wind, faster fire spread, higher fire intensities and potentially larger fires. Now is the time to be managing grass fuels before they cure in the summer months.

Uncertainty around La Niña

While the chances of a La Niña event occurring this summer are relatively high, there still remains significant uncertainty around the timing and strength of the event if it does occur. As it is only predicted to begin from around December, its full effects may not be seen until later in the fire season, and so fire weather conditions over much of the period of this outlook (Nov-Jan) may continue to be driven by the current more changeable weather patterns. If and when a La Niña event does eventually occur, its effects will also vary depending on its strength and duration. A weaker or shorter La Niña may not produce cooler, wetter conditions expected in eastern and northern parts of both islands under a stronger, more "average" La Niña.

El Niño-Southern Oscillation (ENSO) events are also only one of the drivers of New Zealand's weather, explaining just 25% of the variation in a seasonal weather. Recent patterns of global and local warmth have also differed from historical patterns of sea surface temperatures (SSTs) associated with ENSO and these other climate drivers. This means future predictions of ENSO based on SSTs during past La Niña (and El Niño) events may not be reliable indicators of future events. It is therefore essential to continue monitoring the fire season conditions along with climate guidance. But it is important to recognise that no matter what the climate pattern, there will be periods of elevated fire danger in most areas. Please refer to the resources at Outdoor and rural fire safety | Fire and Emergency New Zealand, as now is the time to prepare for the fire season.

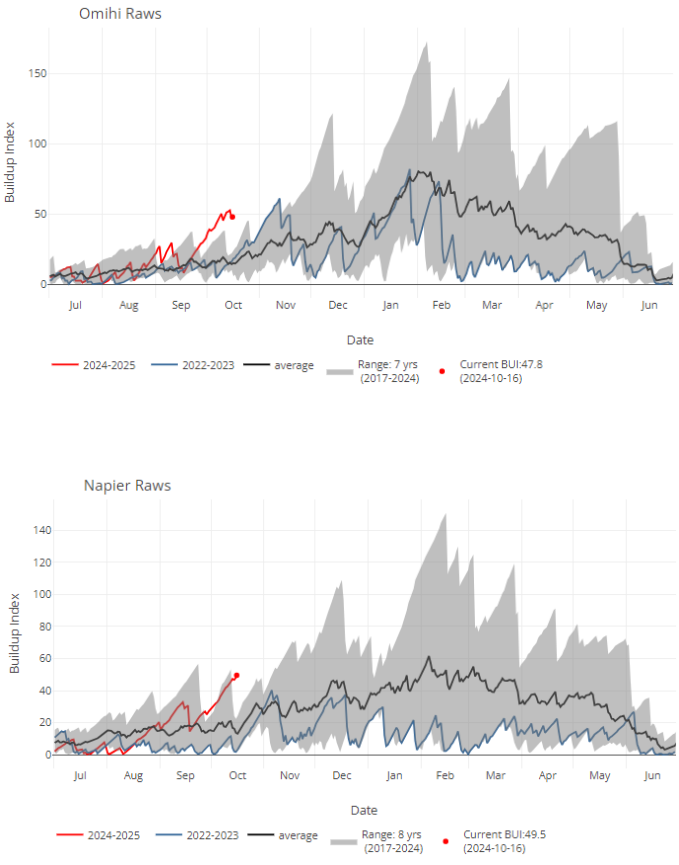


Figure 2. Examples of trends in fire dangers using the Buildup Index for Omihi (top) and Napier (bottom), illustrating the dry conditions currently remaining in the North Canterbury and Hawkes Bay areas.

Areas to watch

In the short term, areas to watch for fire potential include the currently dry areas in Hawke's Bay and North Canterbury. Dry conditions in these areas could see fire dangers become even more elevated. However, continuation of recent changeable weather patterns or the onset of more easterly flow with La Niña bringing increased rainfall could see fire dangers decline to more normal or even below normal levels.

In the longer term, the onset of La Niña is expected to bring cooler moister flow to eastern and northern parts of both islands. This would result in below normal fire potential, particularly for the east and north of the North Island around East Cape, the Coromandel and Northland where conditions are predicted to be slightly below normal by January (Fig. 3). Fire potential in other eastern areas is not expected to be influenced quite so much, as the influence of damper La Niña conditions is likely to be offset by the more elevated fire dangers currently existing in these areas, so that by January fire potential is expected to be normal.

For the South Island, the onset of La Niña with its increased E/NE flows is predicted to produce slightly above normal fire potential for the West Coast and inland Otago and Southland. In the east, fire potential is expected to be around normal, with the currently elevated fire dangers around Christchurch and North Canterbury again offsetting the expected effects of cooler, moister onshore flows; however, depending on the timing and strength of the La Niña event, fire potential might end up below normal, especially along the eastern coastal strip. Warmer, drier conditions are expected for the far south with La Niña, but are only predicted to produce normal fire dangers due to the wetter than normal conditions experienced in these areas in recent weeks.

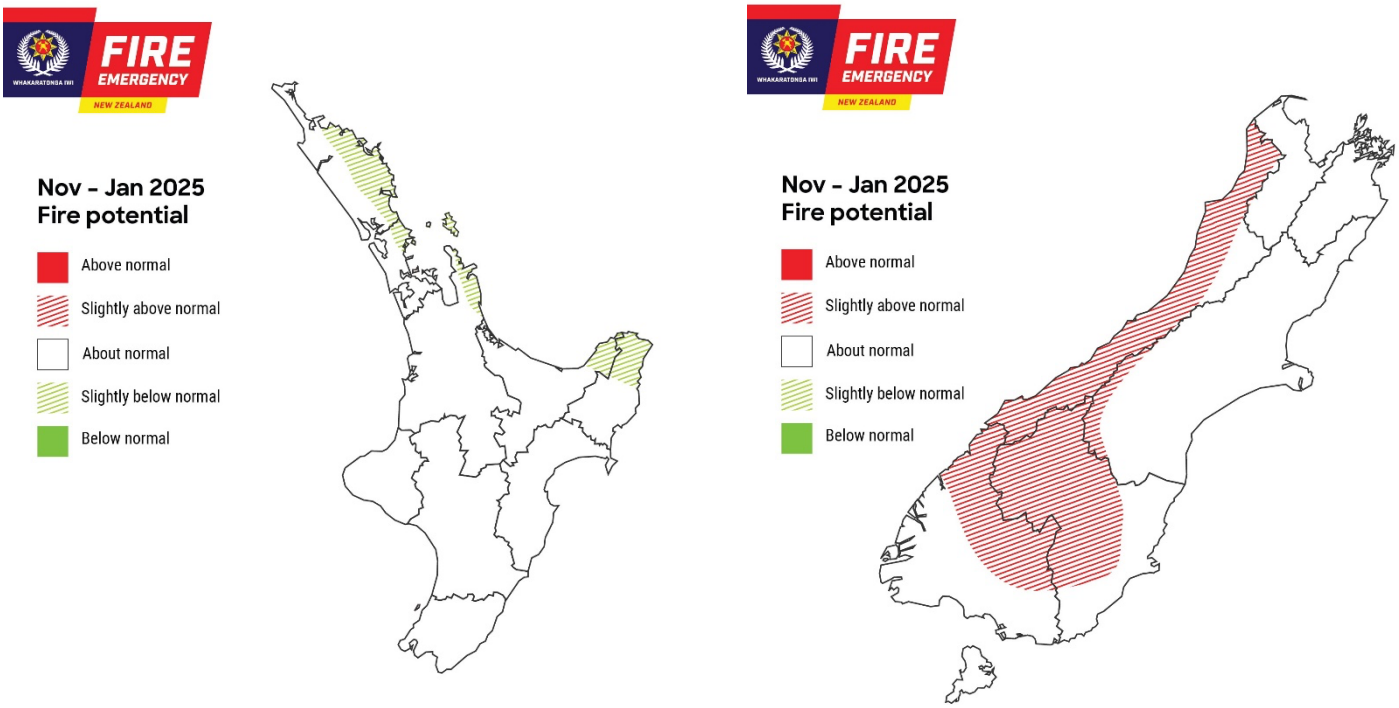


Figure 3. Fire potential over the next three months for the North and South Islands based on an assessment of the effects of current conditions and climate predictions for the Nov-Jan period. Areas identified as above or below normal may change in future outlooks as certainty around seasonal climate drivers increases as the fire season progresses.

Current climate

In September, temperatures were above average (0.51°C to 1.20°C above average) or well above average (>1.20°C above average) for much of the North Island, Marlborough, much of Canterbury, and eastern Otago. Temperatures were below average (0.51°C to 1.20°C below average) for parts of Fiordland and western Southland. So far in October, temperatures have been above average in much of the North Island and eastern South Island, with near average temperatures in the rest of the South Island (Figure 4, right).

September rainfall was below normal (50-79% of normal) or well below normal (<50% of normal) in northern, eastern and central parts of the North Island, Tasman, Nelson, western Marlborough, and northern and central parts of Canterbury. Rainfall was above normal (120-149% of normal) or well above normal (>149% of normal) for the lower half of the South Island, the West Coast, parts of Wellington, and Manawatū-Whanganui.

So far in October, rainfall has been above normal or well above normal across the upper half of the North Island, Wellington, the upper South Island, and the lower South Island. Conversely, rainfall has been below or well below normal in the eastern North Island, northern Canterbury, and Fiordland (Figure 4, middle).

As of 15 October (see Figure 4, left), soil moisture levels are near normal across most of New Zealand. Areas of above normal soil moisture are located in Auckland, Bay of Plenty, Marlborough, South Canterbury, and Otago. Areas of below normal soil moisture are observed along the east coast of the North Island and Banks Peninsula.

Climate drivers

Sea surface temperatures (SSTs) remained in the neutral range in the central equatorial Pacific (Niño 3.4 Index) during September (-0.27˚C), decreasing from -0.06˚C at the end of August. As of 27 September, the 30-day Relative Oceanic Niño 3.4 Index[1] (RONI) was -0.81˚C, reflective of the central equatorial Pacific being cooler than the average of the global tropics. Trade wind strength was above normal or well above normal in the equatorial Pacific during September, contributing to a continued oceanic cooling trend.

The Southern Oscillation Index (SOI) was in the neutral range during September (-0.2) and July-September (+0.1). Continued SOI variability is characteristic of an ENSO neutral ocean-atmosphere system.

Of the models monitored by NIWA, there is a 60-70% chance for La Niña to develop by December, an increase in the percentage chance compared to last month.

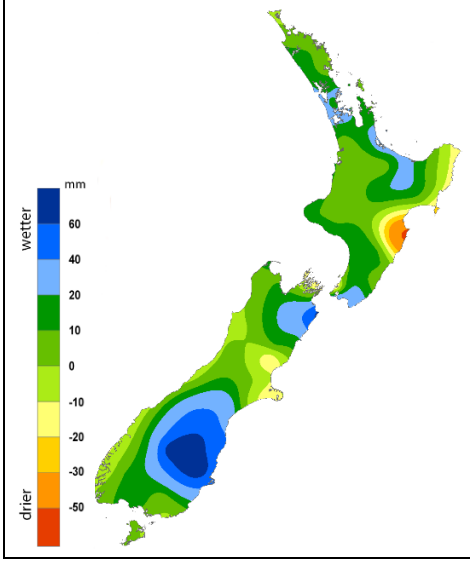
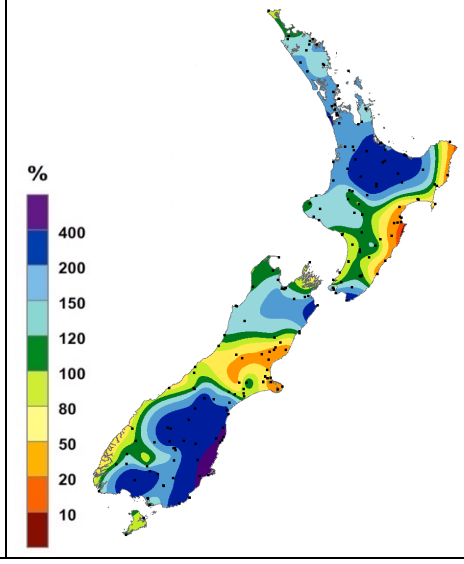
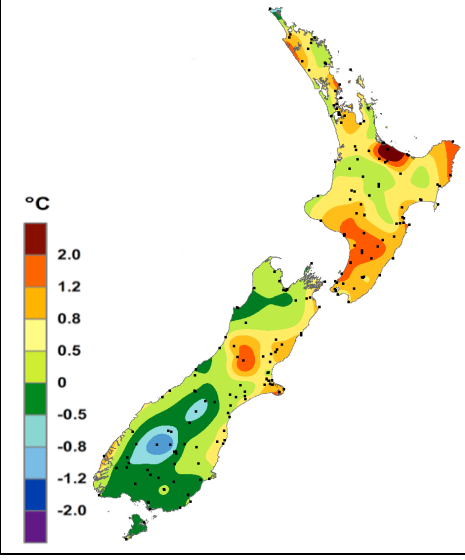
During September, convective forcing favoured the eastern Indian Ocean, Maritime Continent, and western Pacific. In late October, the convectively active phase of the Madden-Julian Oscillation (MJO) is forecast to move into the Maritime Continent and West Pacific, which could favour wetter than normal conditions for much of the country.

In November, the MJO progression is favoured to track through the Atlantic, Africa, and the Indian Ocean initially before quickly moving into the West Pacific. This may begin to favour more easterly quarter winds.

SSTs in New Zealand's coastal waters became more unusually warm during September, with marine heatwave conditions developing near the northern and western North Island and northern South Island. Model guidance suggests that increasing SST anomalies are likely in the New Zealand region over the next three months with the potential for marine heatwave conditions to intensify, which are often associated with La Niña summers.

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

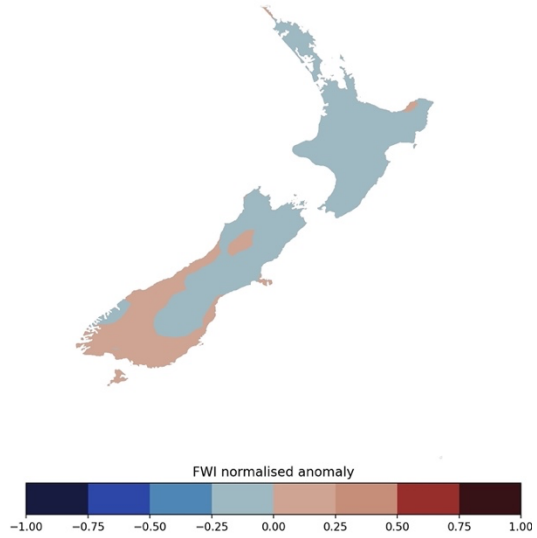
Soil moisture anomaly: 15/10/24	Rainfall anomaly: 01/10/24 – 15/10/24	Temperature anomaly: 01/10/24 – 15/10/24
		

Fire season analogues

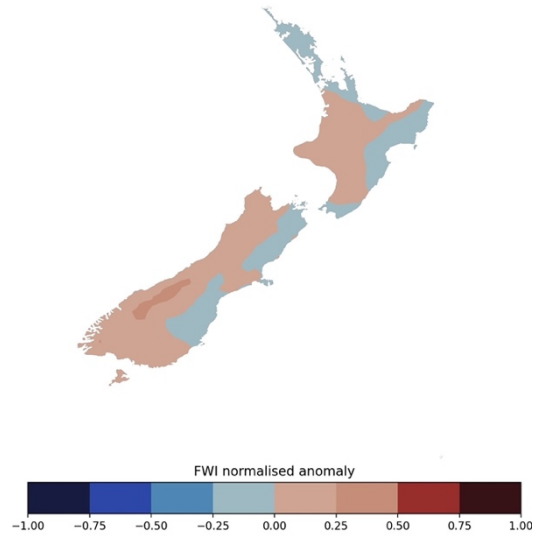
To help understand what fire weather conditions may be like this summer, we can look at analogues. Analogues are historical years with similar climatic conditions to the current year.

This season's analogue years feature historical years that had burgeoning La Niña patterns in the ocean (Figure 5). The subjective analogue seasons are selected with expert interpretation from NIWA. The objective analogue seasons are automatically selected via a computer analysis. Where the two methods agree, confidence tends to be higher. The current situation favours a mix of the two analogue sets.

Easterly quarter winds may become more likely in the coming months, and this is likely to cause a drying trend in the west of both islands, potentially increasing the fire weather threats there. Conversely, the east of both islands may be exposed to more rainfall and a decrease in the fire weather potential. The upper North Island may also be more exposed to rainmakers as the three-month period progresses.



Forecaster-selected analogue season - Nov to Jan
2022-2023
2020-2021
2013-2014
2012-2013
2011-2012
2008-2009
2000-2001
1983-1984



Data-driven analogue season - Nov to Jan
2007-2008
2011-2012
2001-2002
2014-2015
2012-2013
1996-1997
2013-2014
2010-2011

Figure 5: Analogue fire seasons as selected with expert interpretation from NIWA (top) and automated computer analysis (bottom). 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: November 2024

November's air flows are expected to tend more northeasterly or even easterly at times as high pressure becomes favoured near and east of New Zealand. This will bring an elevated chance for drier than normal conditions, especially for the west of both islands. Wind speeds are expected to be below average across most of the country. Above average temperatures are favoured for much of the country (Figure 6).

Climate outlook: November 2024 – January 2025

A northeast-east air flow anomaly will be favoured across the country during the season. Temperatures for the next three months are expected to be above average overall (Figure 7). Owing to the likelihood for more La Niña-like conditions throughout the season, rainfall is generally favoured to be above normal in the upper North Island and east of both islands, with drier conditions possible in the west of both islands and lower South Island. Slightly above normal relative humidity is expected. 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-elevated for this season.

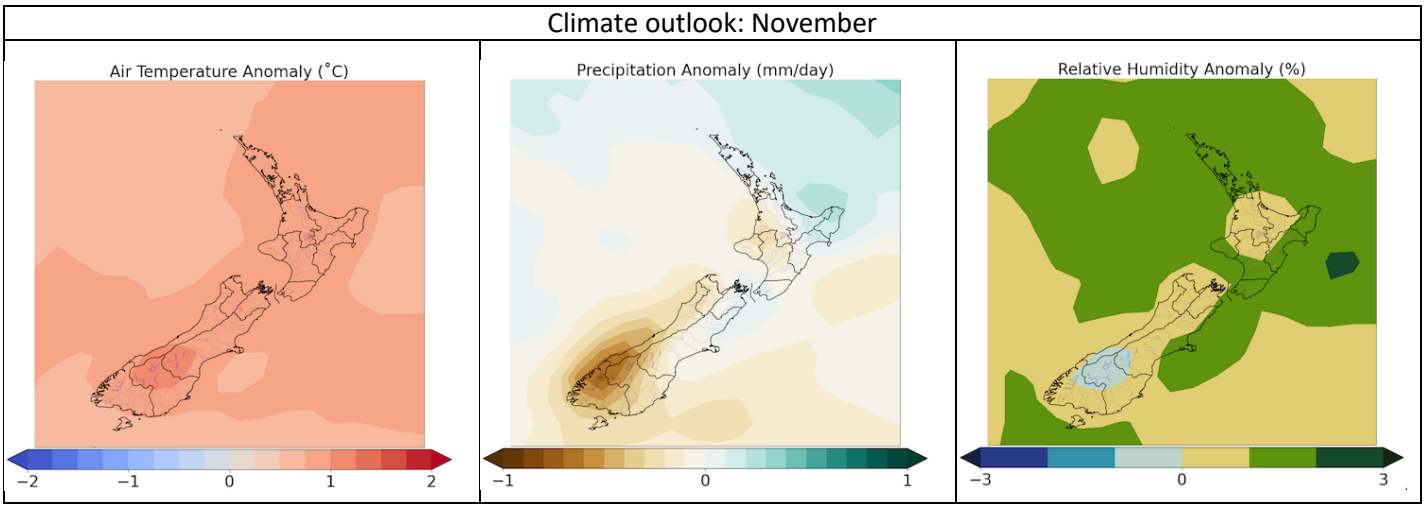


Figure 6: Climate outlook for November showing forecast temperature (left), rainfall (middle) and relative humidity (right) anomalies.

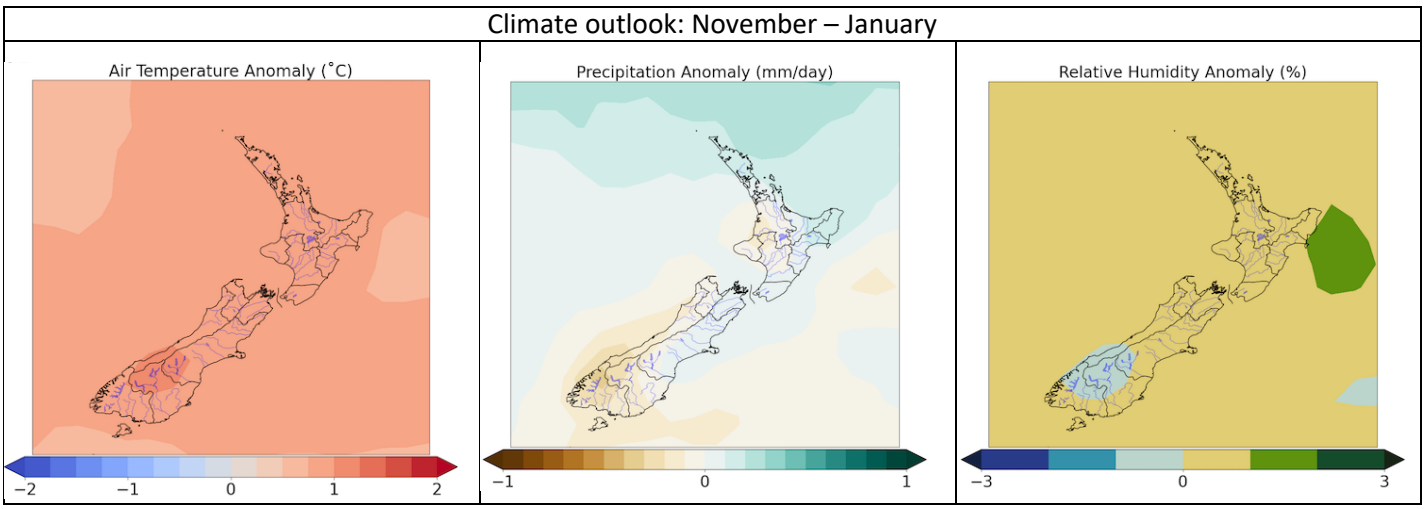


Figure 7: Climate outlook for November-January showing forecast temperature (left), rainfall (middle) and relative humidity (right) anomalies.

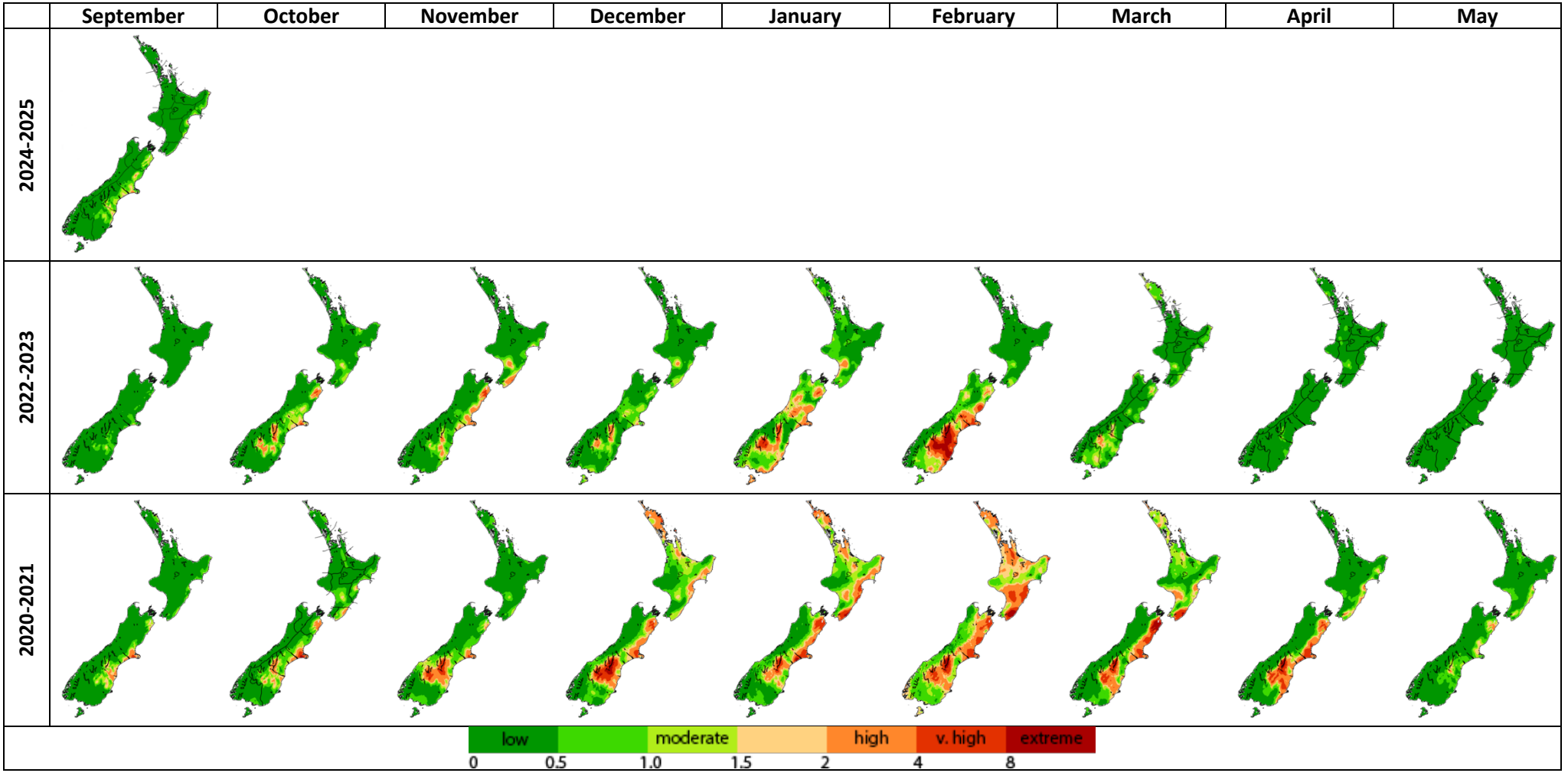


Figure 8: Monthly average severity rating for the current year 2024/2025 and the comparative years of 2022/2023 and 2020/2021. These are analogue years for the current season and give us an insight into what the upcoming season may be like.

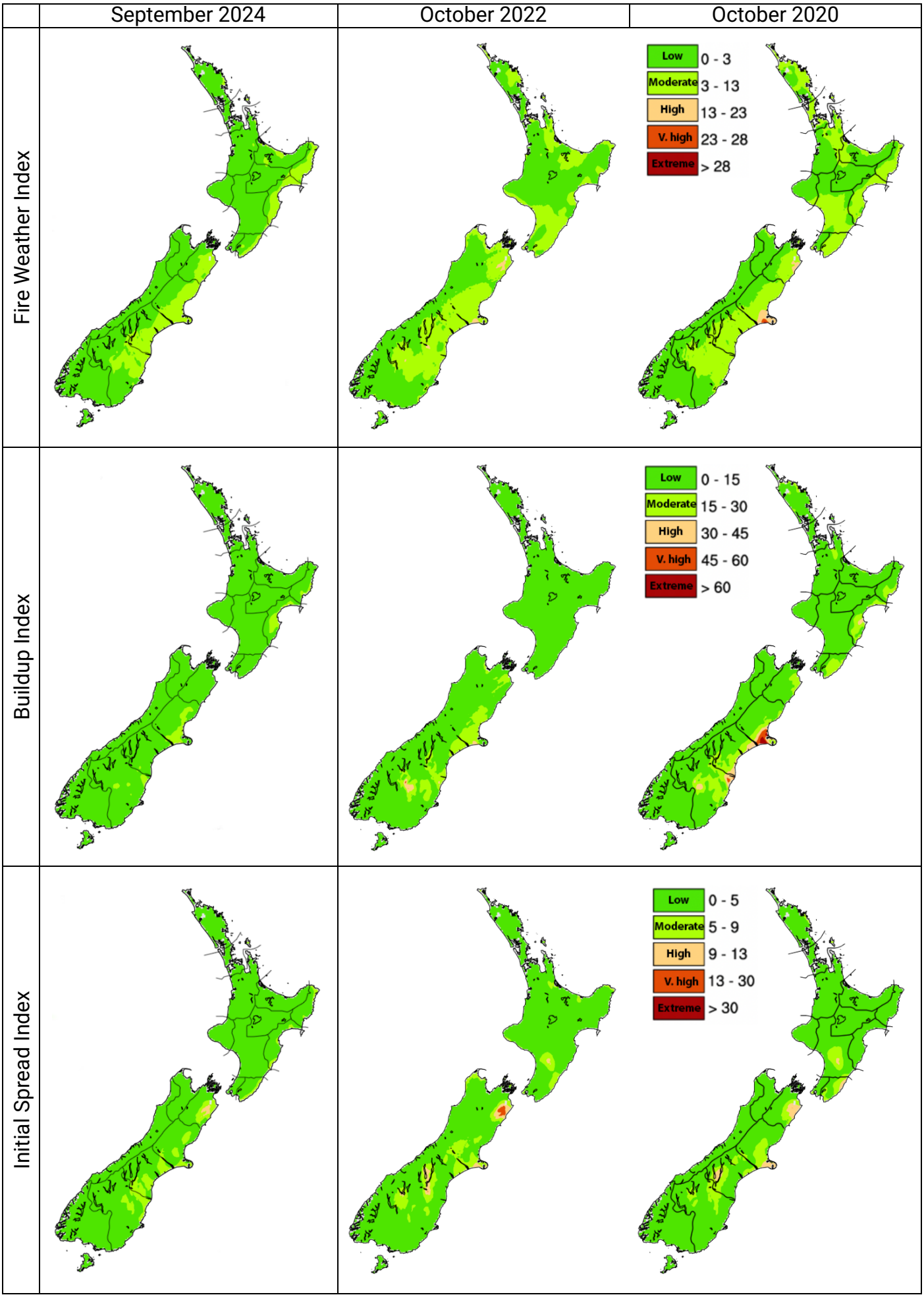


Figure 9: The most recent observed month (left column) and analogue months for October (middle and right columns); monthly average for the Fire Weather Index (top), Buildup Index (middle) and Initial Spread Index (bottom).

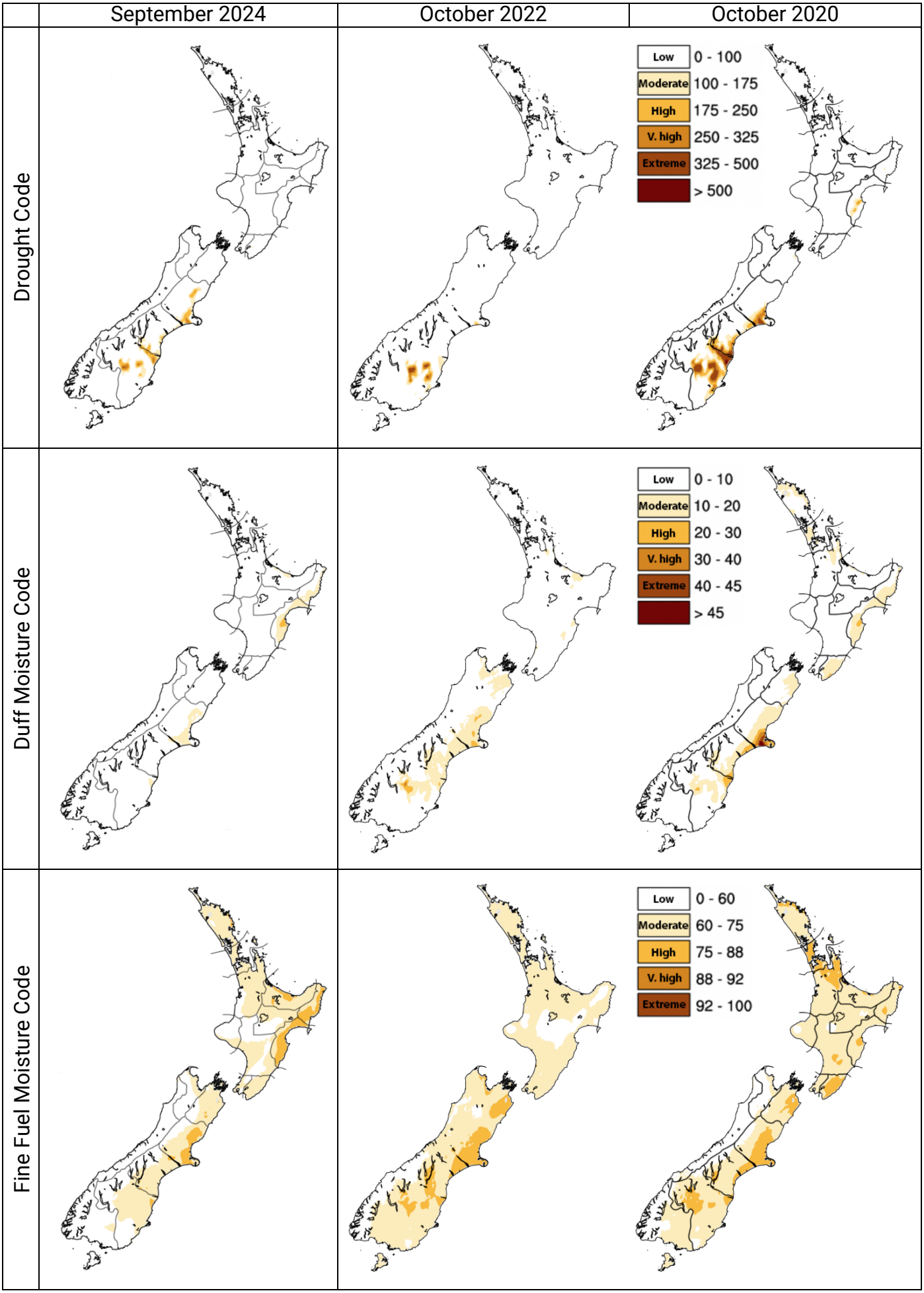


Figure 10: The most recent observed month (left column) and analogue months for October (middle and right columns); monthly average for the Drought Code (top), Duff Moisture Code (middle) and Fine Fuel Moisture Code (bottom).

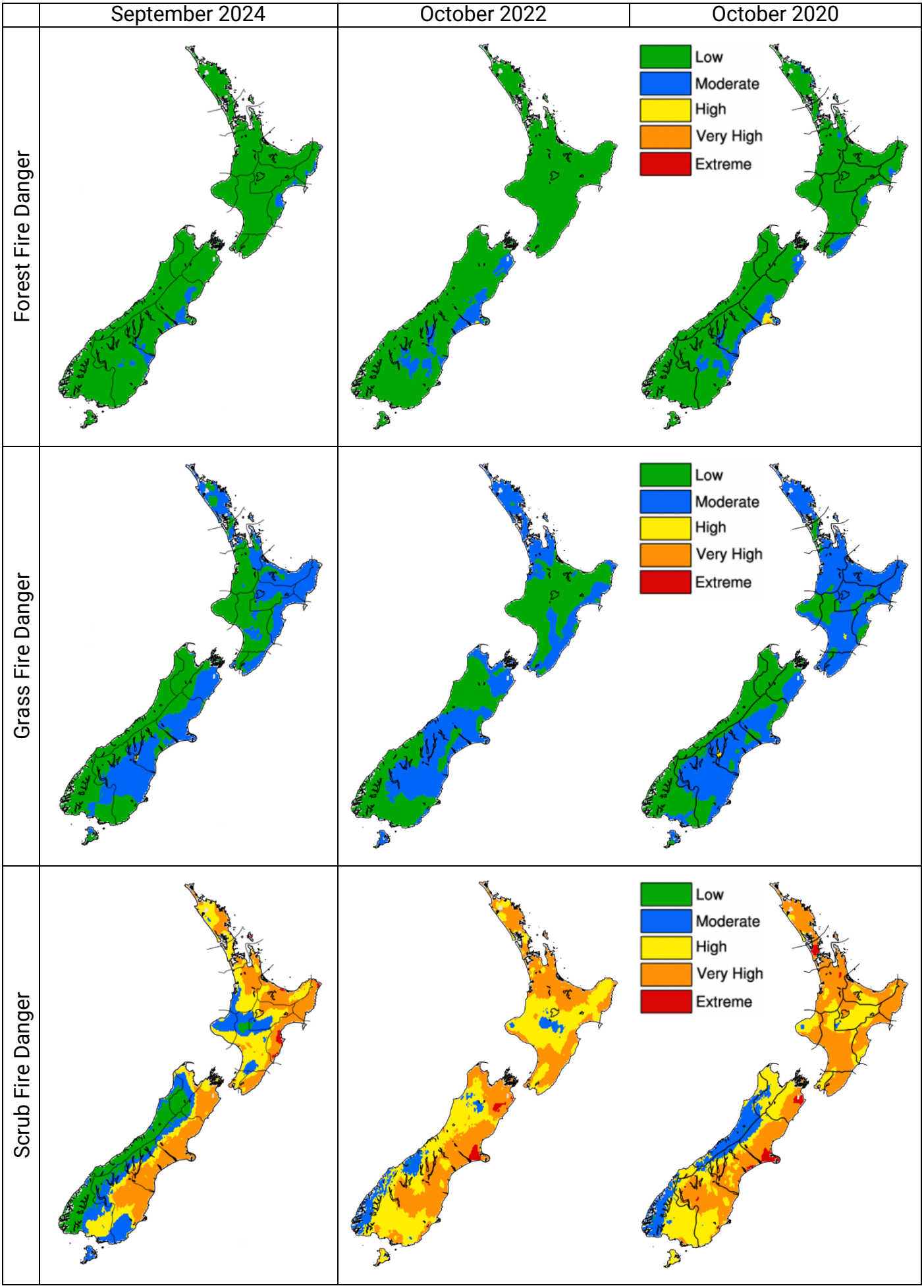


Figure 11: The most recent observed month (left column) and analogue months for October (middle and right columns); monthly average for the Forest Fire Danger (top), Grass Fire Danger (middle) and Scrub Fire Danger (bottom).

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