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

Issue: November 2024

Current fire danger situation

Similar to last month fire indices remain predominantly low across the country this time last month. However, there are pockets of medium values, in the east of both islands. Meanwhile, the scrub fire danger values are high to extreme during wind periods more than a day or so since rain. See below for more detail.

While ENSO neutral conditions currently continue, there is about a 55% chance of La Niña developing during December-February.

Current fuel and soil moisture status

As of 16 November (see Figure 4, left), soil moisture levels are above normal in parts of the western and lower North Island, Tasman, Nelson, Marlborough, southern Canterbury, and much of the lower South Island. Areas of below normal soil moisture are observed in eastern Northland, the Coromandel, and the east coast of the North Island. Elsewhere soil moisture is near normal.

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 remains low. This is about normal for this time of year with the exception being a small area around Napier which is slightly dryer than normal 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 have been brief, they have been increasing as we progress through spring, 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.

When elevated FFMC occurs with a period of wind we can see elevated Initial spread index (ISI) indicating potential for high spread rates. A modest example of this is shown in the lower map of figure 1.

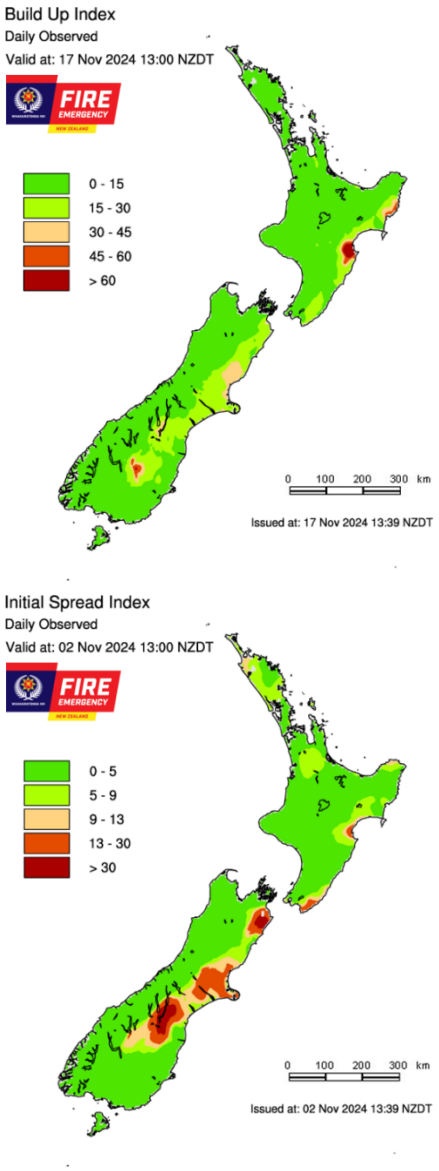


Figure 1: Maps of Buildup Index (BUI) (top, indicating total fuels available for combustion) and Initial Spread Index (ISI) (bottom, indicating spread rates) looking ahead to 20th November 2024.

Forecast climate and weather

The remainder of November will see conditions trending drier as high pressure becomes favoured in the New Zealand region. After a brief period of cooler than average temperatures, a warmup is likely late in the month.

During December, high pressure will be favoured near or east of New Zealand. This will bring an elevated chance for drier than normal conditions, especially for the west of both islands, although the West Coast may still see moisture-bearing fronts at times.

December-February will likely exhibit more northeasterly or 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 lower South Island. Temperatures overall look to be above average along with lighter than normal winds.

For more information, see pages 7 and 8.

The La Niña climate pattern

ENSO-neutral conditions will likely continue into December, but there is about a 55% chance that La Niña will develop during December-February.

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 Island Block Road fire Waikato on 22nd Oct., another 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.

Like scrub fuel some hedges can be readily available to burn as they are also elevated with fine needles, and can hold dead fuel throughout their structure, managing burn piles near hedges requires extra vigilance.

Wind driven fires

The current seasonal forecast indicates that winds over summer 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.

Alternatively, we do also see some early grass fires due to last year's dead and collapsed grass (thatch) drying out enough to carry a fire. These fires can catch people out as they burn through dead material that is hidden beneath the green top layer.

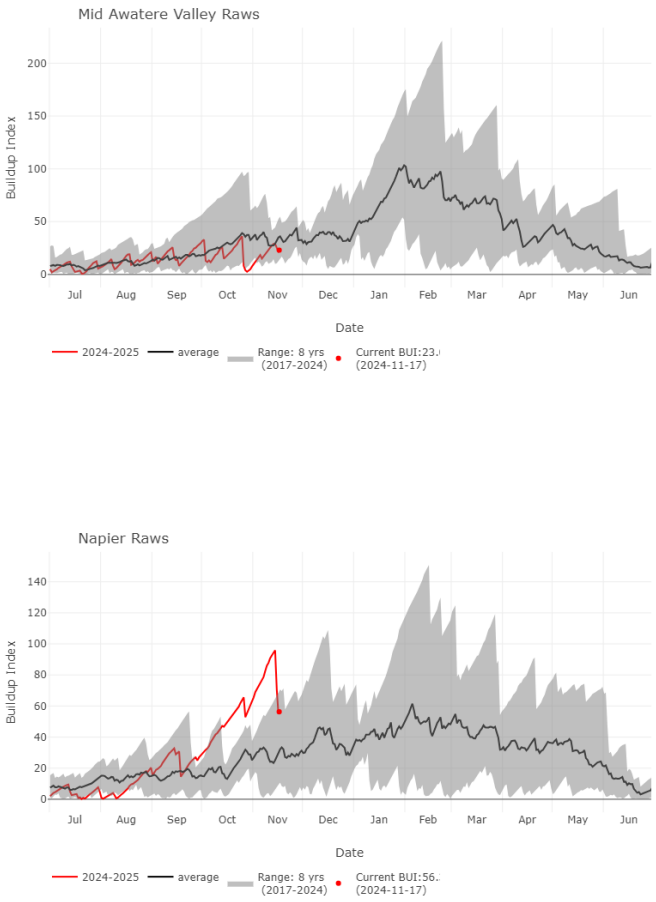


Figure 2. Examples of trends in fire dangers using the Buildup Index for Mid Awatere in Marlborough (top) which shows trends similar to normal, like many parts of the country and Napier (bottom) which is one of the few places that are showing trends of above normal BUI representing fuel availability.

Aspect

It is also worth pointing out the enduring impact of aspect. North facing slopes better capture solar radiation because the radiation hits squarer. This contrasts with South facing slopes where the radiation hits the landscape at an angle meaning it is more spread out. With more solar radiation the North-facing slopes are warmer and dry out quicker, making them more conducive to fire. Greater caution is needed when managing fire risk on Northern aspects due to greater fire potential.

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 moister flows to eastern and northern parts of both islands. This is likely to 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 such as Hawkes Bay is not expected to be as reduced, due to the La Niña moisture being offset by the more elevated fire dangers currently existing in these areas, such 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 inland Otago and Southland but this may partly be offset by the current moisture anomaly which is in contrast to the outlook.

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.

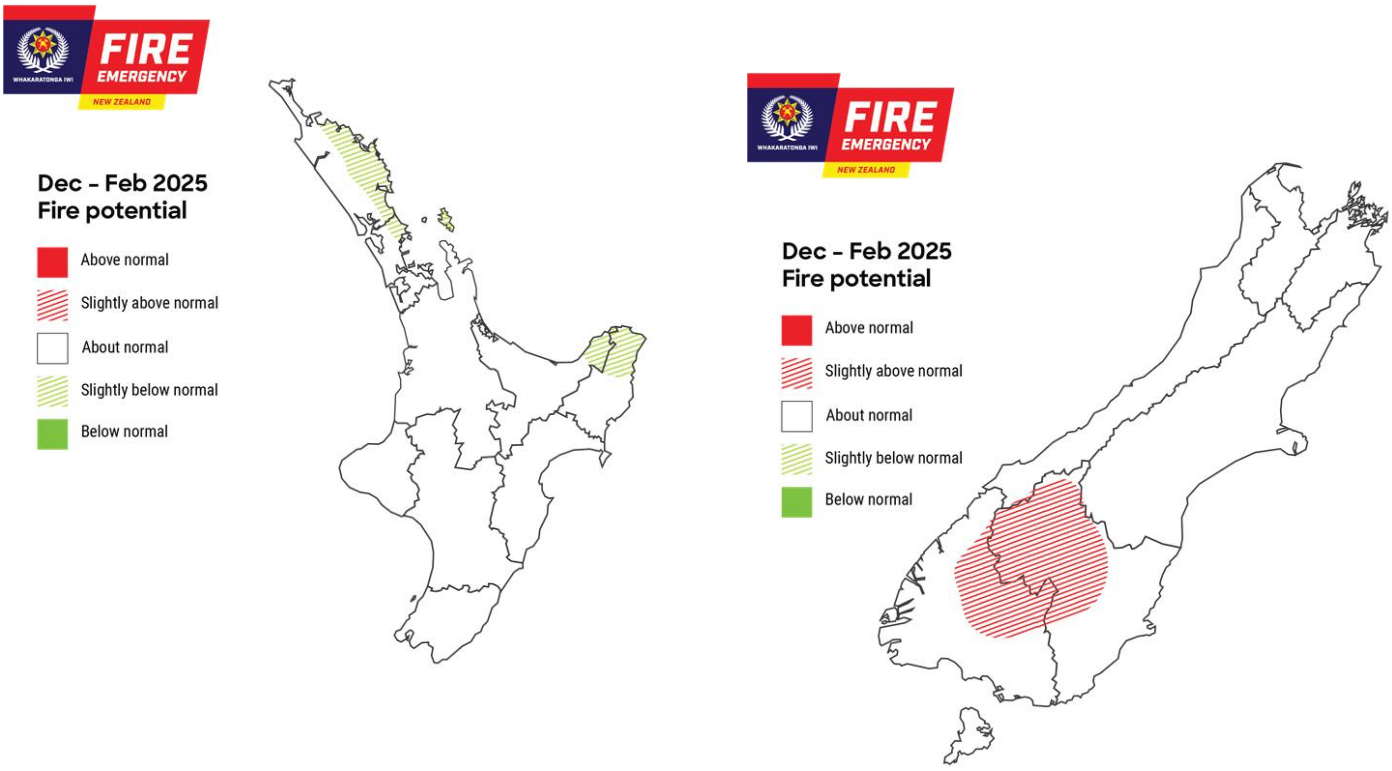


Figure 3. Fire potential over the next three months for the North and South Islands based on an assessment of the effects of climate predictions for the Dec-Jan period. However, this outlook is at odds with the current situation which may offset the impact of the seasonal prediction. Areas identified as above or below normal may change in future outlooks as certainty around seasonal

Current climate

In October, temperatures were above average (0.51°C to 1.20°C above average) or well above average (>1.20°C above average) for most of the North Island, Marlborough, northern and eastern Canterbury, West Coast, Fiordland, and eastern parts of Otago. Near average temperatures (±0.50°C of average) occurred in northeastern Northland, Tasman, Nelson, inland parts of southern and central Canterbury, inland Otago, and central and southern Southland. So far in November, temperatures have been above average or well above average across nearly the entire country (Figure 4, right).

October rainfall was above normal (120-149% of normal) or well above normal (>149% of normal) in much of the South Island, southern Wellington, Bay of Plenty, southern and central parts of Waikato, and northwestern parts of Northland. Below normal (50-79% of normal) or well below normal (<50% of normal) rainfall was observed in Gisborne, Hawke's Bay, southern parts of the Central Plateau, northeastern parts of Wairarapa, and Banks Peninsula.

So far in November, rainfall has been above normal in parts of Waikato, Taranaki, Wellington, Tasman, and the West coast. Conversely, rainfall has been below normal or well below normal in eastern Northland, the Coromandel, eastern Bay of Plenty, the east coast of the North Island, Marlborough, Canterbury, and parts of Otago and Southland (Figure 4, middle).

As of 16 November (see Figure 4, left), soil moisture levels are above normal in parts of the western and lower North Island, Tasman, Nelson, Marlborough, southern Canterbury, and much of the lower South Island. Areas of below normal soil moisture are observed in eastern Northland, the Coromandel, and the east coast of the North Island. Elsewhere soil moisture is near normal.

Climate drivers

Sea surface temperatures (SSTs) remained in the neutral range in the central equatorial Pacific (Niño 3.4 Index) during October (-0.34˚C), decreasing from -0.25˚C at the end of September. As of 29 October, the 30-day Relative Oceanic Niño 3.4 Index[1] (RONI) was -1.05˚C, reflective of the central equatorial Pacific being significantly cooler than the average of the global tropics. Trade wind strength is expected to remain above normal in the equatorial Pacific in late November and December, contributing to a continued oceanic cooling trend.

The Southern Oscillation Index (SOI) was on the La Niña side of neutral during October (+0.6) and August-October (+0.5) but trending towards La Niña-like conditions compared to September.

Of the models monitored by NIWA, there is about a 55% chance for La Niña to develop by January, a decrease in the percentage chance compared to last month (60%), reflecting an increase in forecast uncertainty for what would now become an unseasonably late La Niña development.

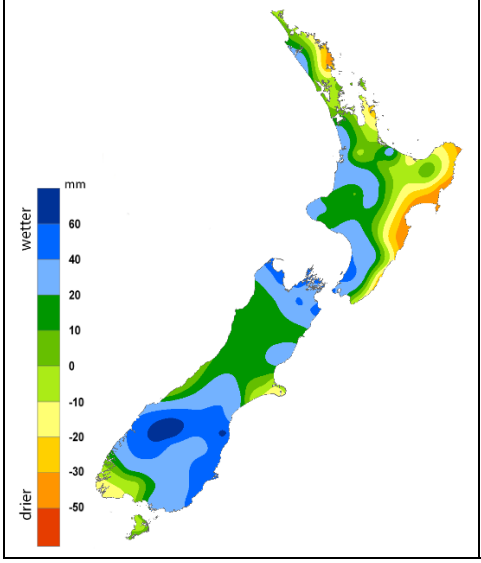
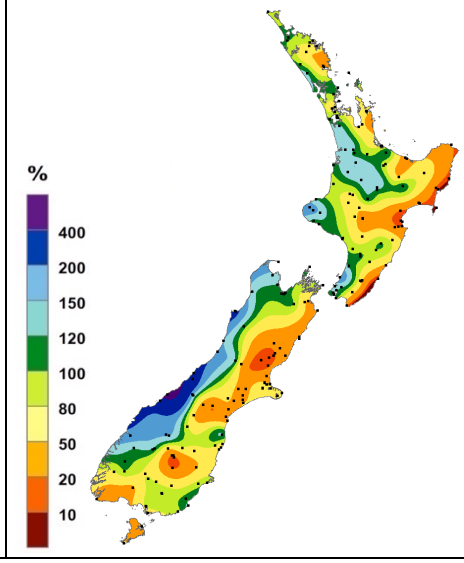
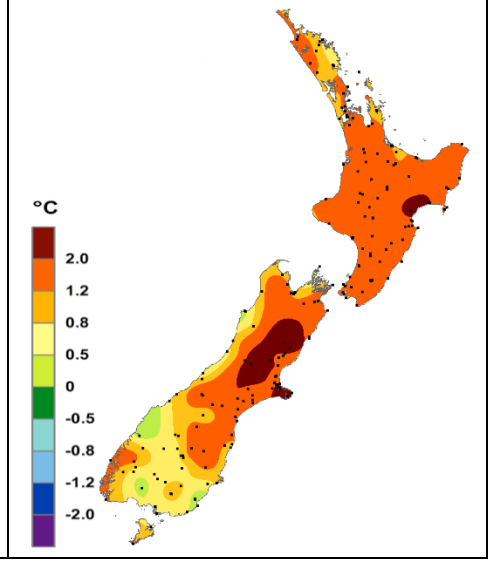
During October, convective forcing associated with the Madden-Julian Oscillation (MJO) transitioned from the western Indian Ocean (phase 1) to the Maritime Continent (phase 5). During the first week of November, the convectively active phase of the MJO is forecast to further propagate eastward (phases 6 and 7) albeit with weaker amplitude.

In December, the MJO progression is favoured to track through the West Pacific early in the month with a potential return in late December. These time periods may favour better chances for rainmakers arriving from north of New Zealand.

New Zealand's coastal water temperatures remained higher than average in October. Marine heatwave conditions are occurring near the southeast of the North Island and east of the South Island, and to a lesser extent along the west coast of the North Island. Model guidance suggests that increasing SSTs are likely in the New Zealand region through the next three months, with the potential for intensifying marine heatwave conditions.

[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.

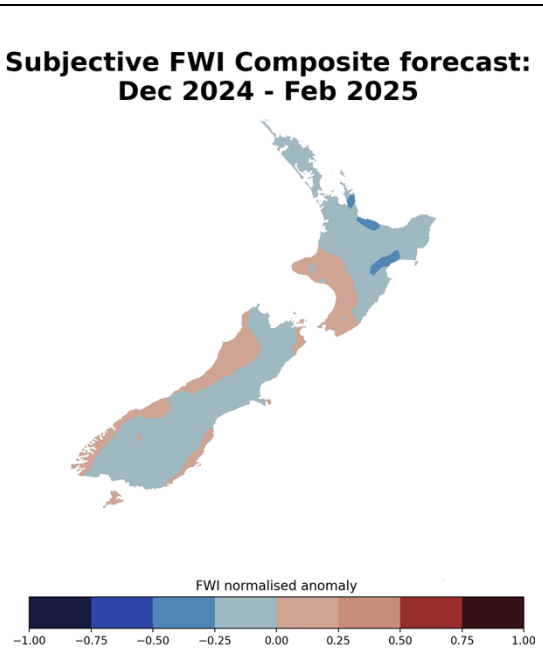
Soil moisture anomaly: 16/11/24	Rainfall anomaly: 01/11/24 – 16/11/24	Temperature anomaly: 01/11/24 – 16/11/24
		

Fire season analogues

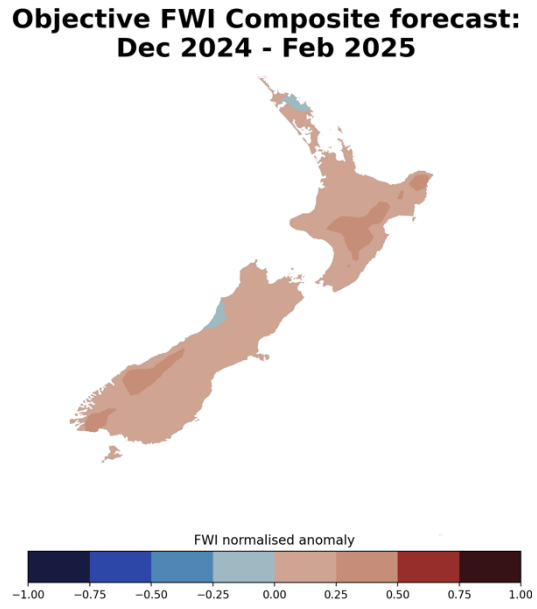
To help understand what fire weather conditions may be like this summer, we can look at analogues. Analogues are historical years with similar climatic conditions to the current year.

This season's analogue years feature historical years that had 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 likely favours the forecaster-selected analogue set.

Northeasterly quarter winds will 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, 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 - Dec to Feb
2022-2023
2020-2021
2010-2011
2007-2008
2000-2001
1999-2000
1993-1994
1983-1984



Data-driven analogue season - Dec to Feb
2021-2022
2015-2016
2014-2015
2012-2013
2011-2012
2008-2009
1997-1998
1981-1982

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: December 2024

December'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 increased chance for drier than normal conditions to the west of both islands, although the West Coast may still see moisture-bearing fronts at times. Wind speeds are expected to be below average across most of the country, while above average temperatures are favoured (Figure 6).

Climate outlook: December 2024 – February 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 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 than normal conditions possible in the lower South Island. Slightly above normal relative humidity is expected in most 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 this season.

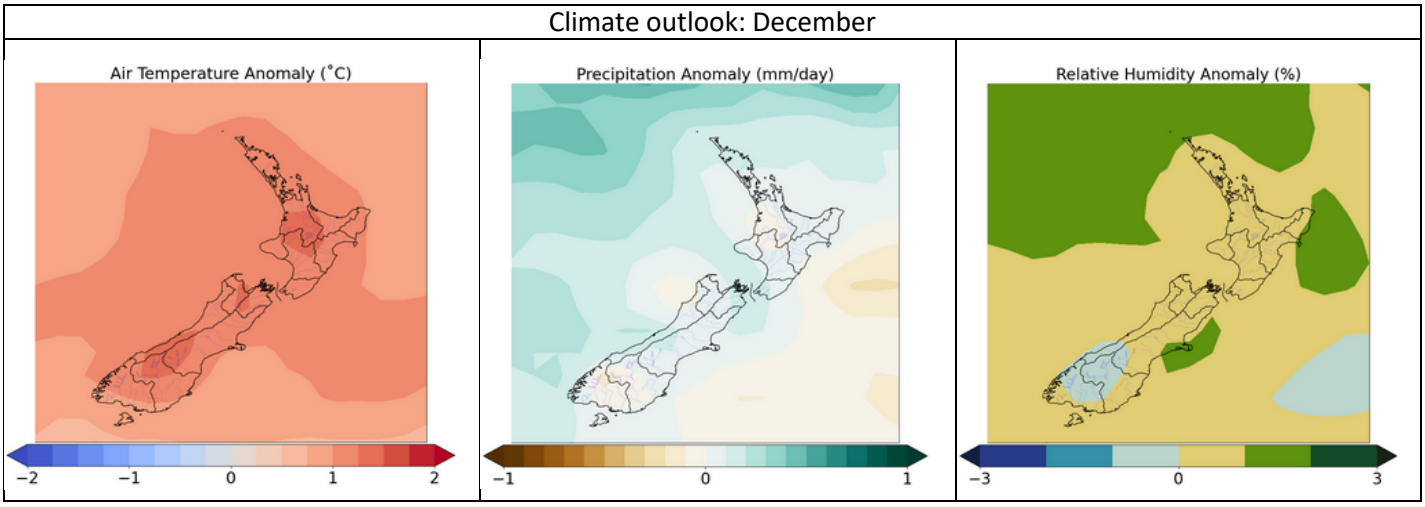


Figure 6: Climate outlook for December showing forecast temperature (left), rainfall (middle) and relative humidity (right) anomalies.

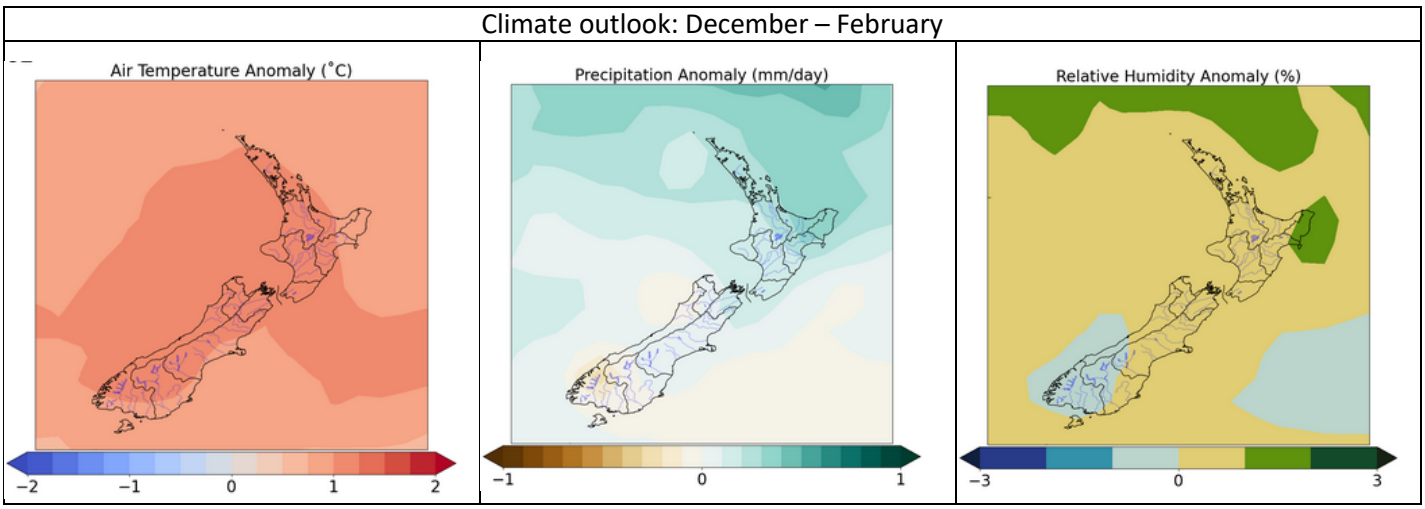


Figure 7: Climate outlook for December-February showing forecast temperature (left), rainfall (middle) and relative humidity (right) anomalies.

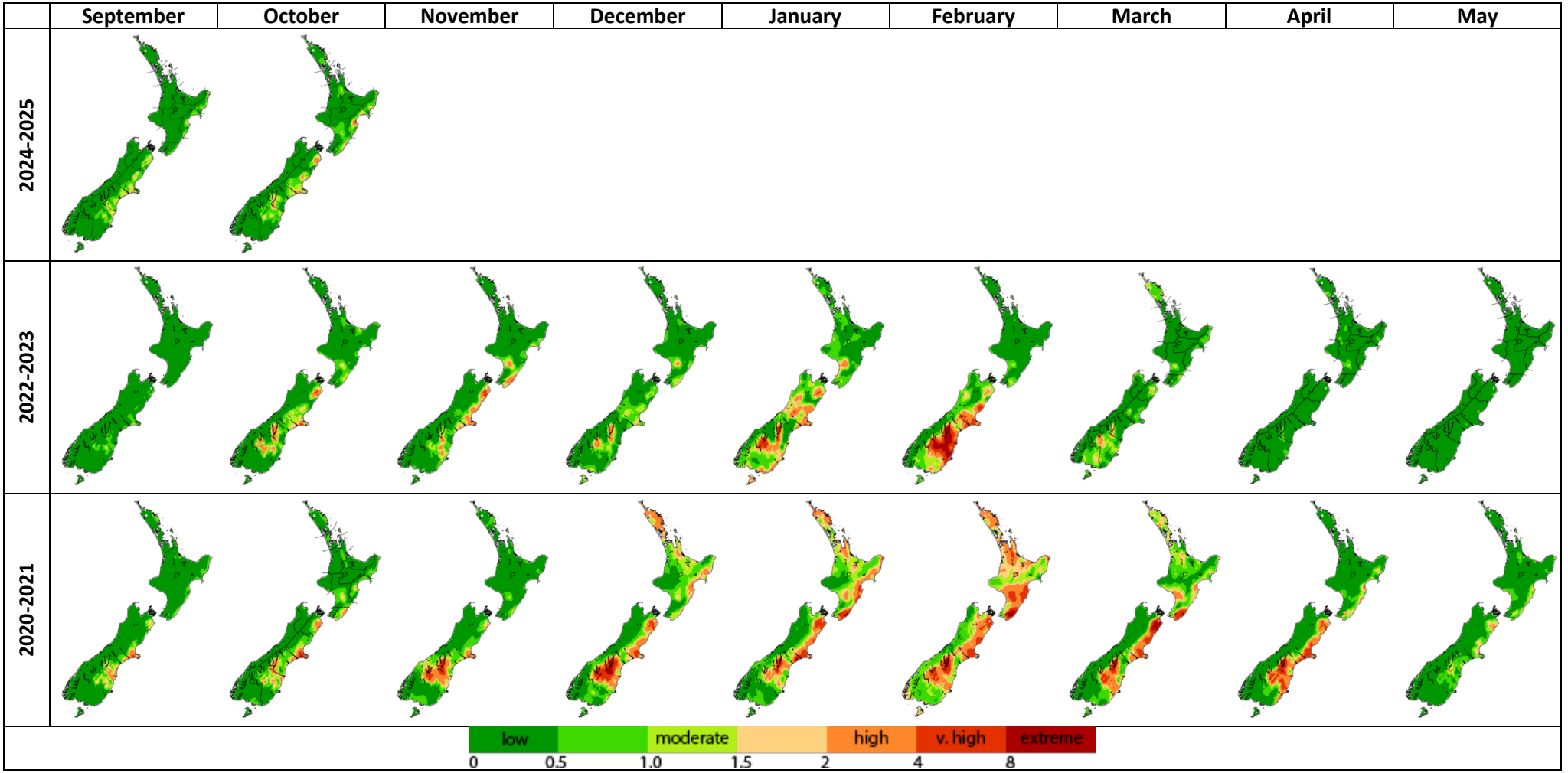


Figure 8: Monthly average severity rating for the current year 2024/2025 and the comparative years of 2022/2023 and 2020/2021. These are analogue years for the current season and give us an insight into what the upcoming season may be like.

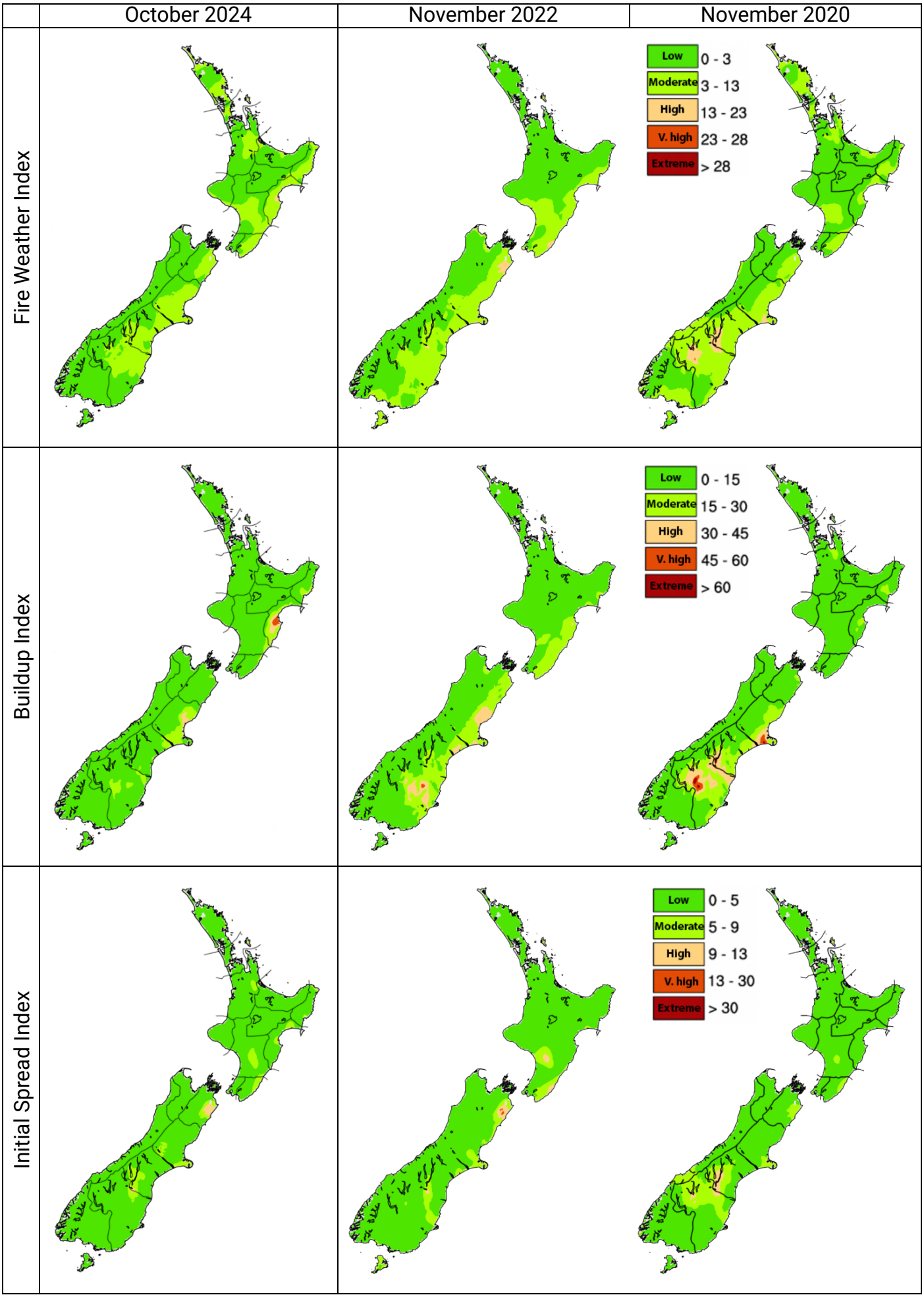


Figure 9: The most recent observed month (left column) and analogue months for November (middle and right columns); monthly average for the Fire Weather Index (top), Buildup Index (middle) and Initial Spread Index (bottom).

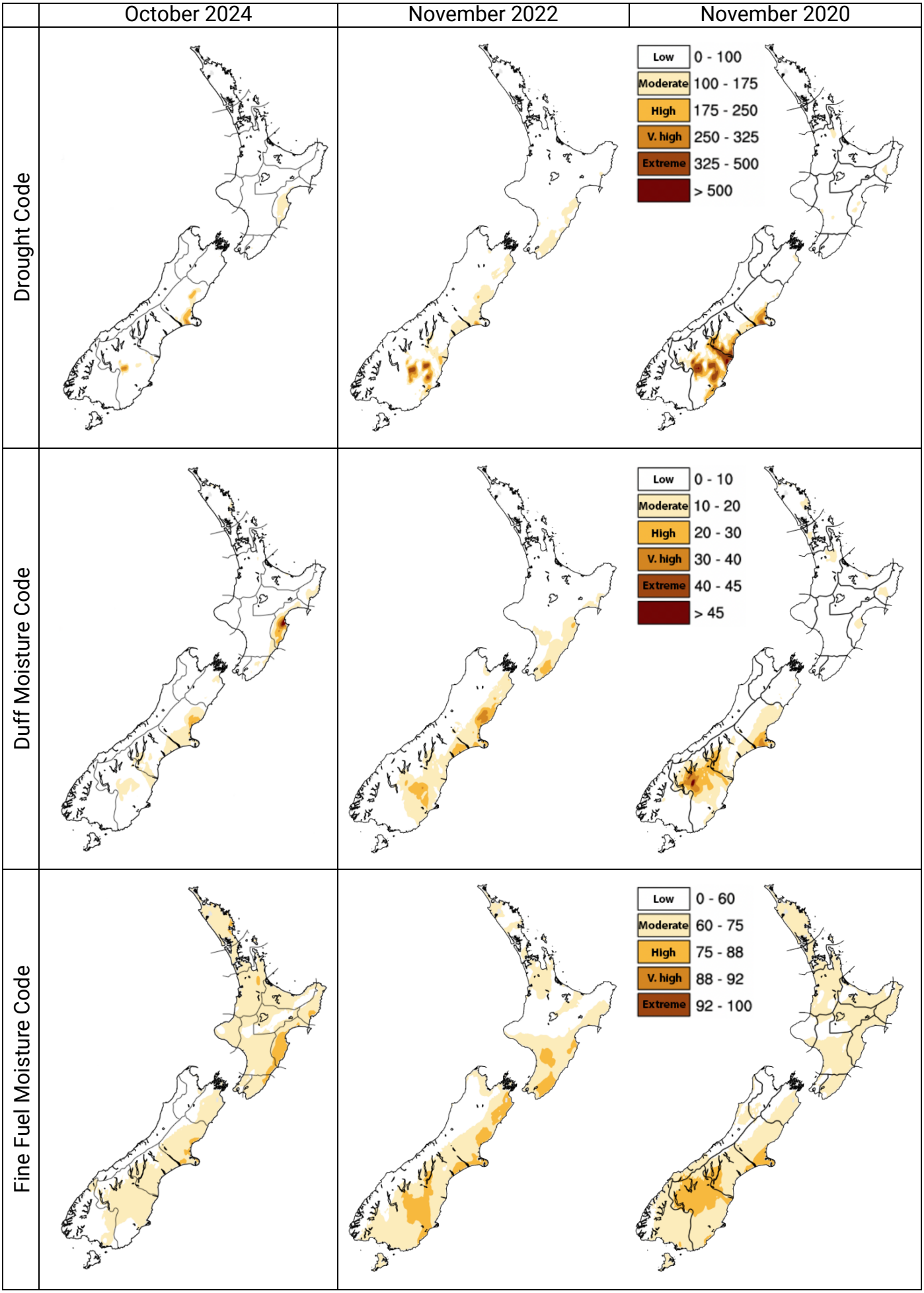


Figure 10: The most recent observed month (left column) and analogue months for November (middle and right columns); monthly average for the Drought Code (top), Duff Moisture Code (middle) and Fine Fuel Moisture Code (bottom).

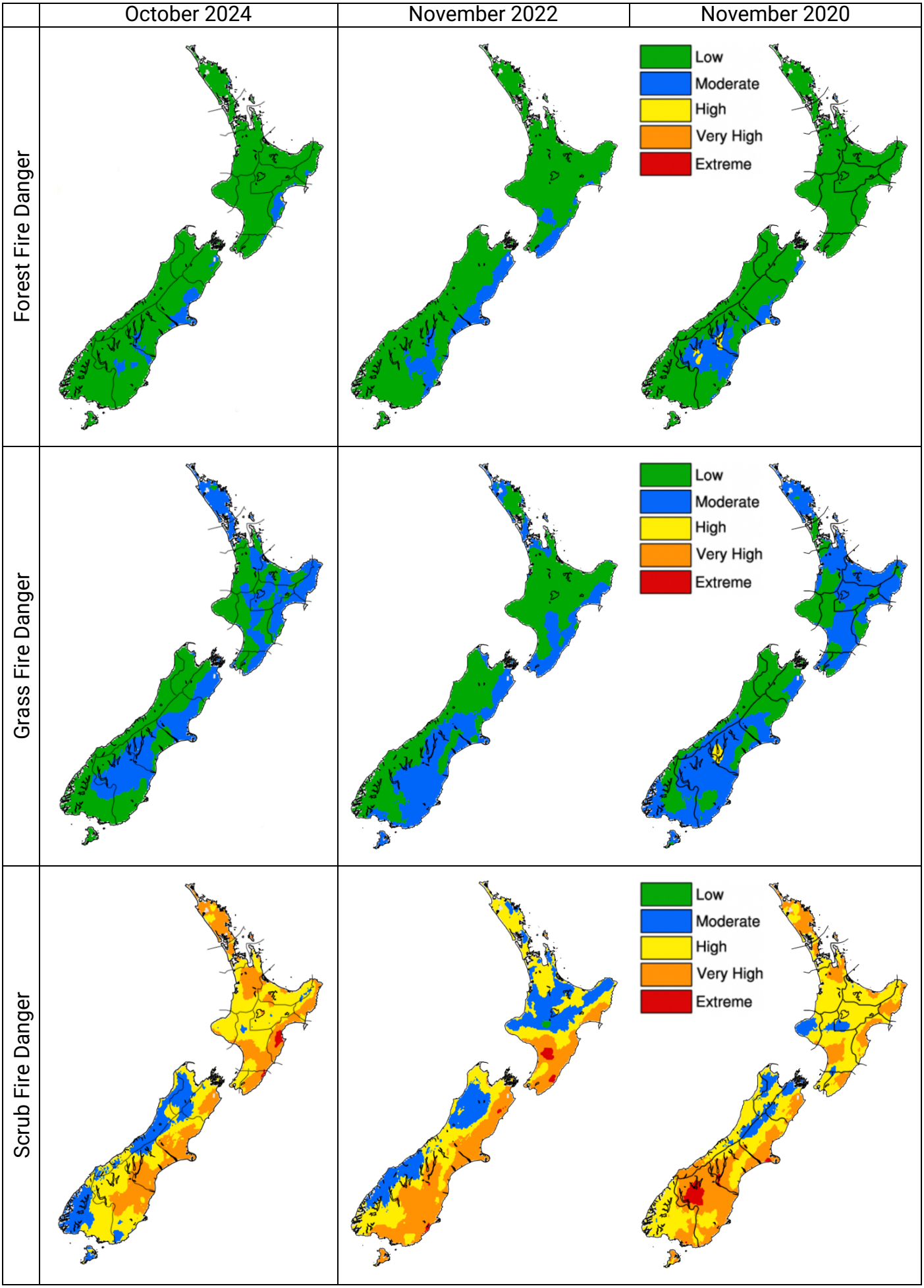


Figure 11: The most recent observed month (left column) and analogue months for November (middle and right columns); monthly average for the Forest Fire Danger (top), Grass Fire Danger (middle) and Scrub Fire Danger (bottom).

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