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

Issue: 18th September 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 with elevated drought codes in the eastern South Island. There have also been short periods of dry conditions coinciding with stronger spring winds, that have led to elevated Initial Spread Index values which results in elevated fire dangers in scrub or cured grasses. See below for more detail.

ENSO neutral conditions continued during August, with neutral conditions mostly likely to persist for September and into October. However, there is a 60% chance of La Niña developing during October – December.

Current fuel and soil moisture status

As of 21 September (see Figure 4, left), soil moisture levels are near normal across most of New Zealand. Small areas of above normal soil moisture are present about Cape Campbell, as well as around central Otago and south Canterbury. Some areas of below normal soil moisture can be seen straddling areas of southern Northland, Auckland, Coromandel, as well as Gisborne, Hawke's Bay, and eastern Bay of Plenty.

Currently, fuel moisture levels are generally high due to the cooler and wetter winter weather, which reduces the availability of medium and heavy fuels, as indicated by the low Duff Moisture Code (DMC) and Drought Code (DC) values, respectively. However, periods of warmer weather are causing some drying, initially affecting only the fine fuels, as represented by the Fine Fuel Moisture Code (FFMC). The FFMC is a crucial indicator of ease of ignition and a significant factor influencing 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 result in the drying of medium and heavy fuels, causing the DMC and DC to rise.

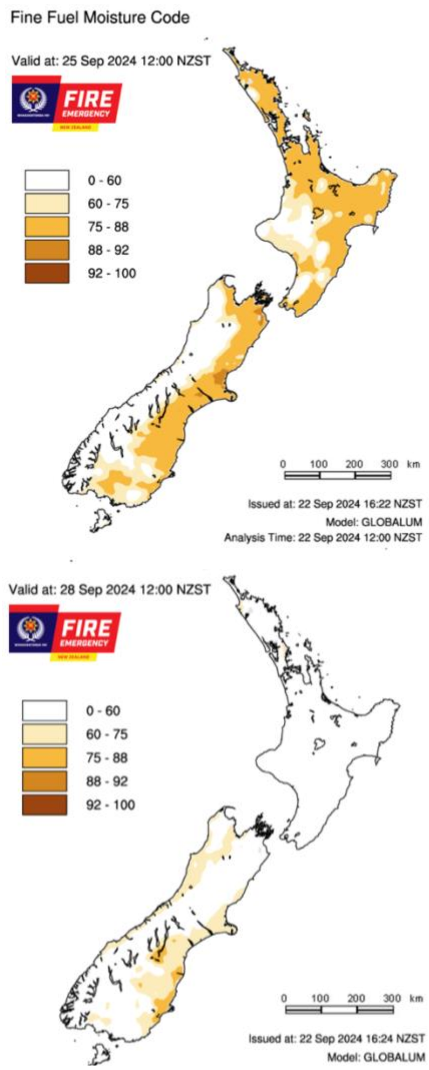


Figure 1: Maps of Fine Fuel Moisture Code (FFMC) (indicator ease ignition) showing the change that can occur over a few days.

Forecast climate and weather

The remainder of September will see variable weather patterns, typical of spring. Another burst of wet and windy weather is expected this week, followed by a period of tranquil weather.

During October, high pressure is favoured near and east of New Zealand, as the atmosphere starts to respond to the La Niña-like ocean patterns and convective forcing looks limited to the Indian Ocean during this time. During the later part of October, a period of active weather looks to develop, coinciding with a pulse of the Madden-Julian Oscillation (MJO), bringing the risk of rainmakers.

October-December will likely exhibit more northeasterly winds than usual. Wetter than normal conditions will be favoured for parts of the North Island and the top of the South Island, with drier than normal conditions most likely occurring in parts of the southern South Island. Temperatures overall look to be above average, along with a chance for lighter than normal than normal winds.

For more information, see pages 4 and 5.

The La Niña climate pattern

La Niña has around a 50% chance of continuing through the end of spring, followed by a 60% chance that ENSO-neutral conditions will develop during October-December.

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 being favoured for north and east, while drier than normal conditions tend to prevail for areas exposed to 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 during the spring 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 subsequent 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.

Frost curing

While it may seem counterintuitive to experience early-season fires in some of the colder regions of the country, spring fires in the high country of the South Island are quite common. This phenomenon is partly attributed to frost curing, where grasses accumulate significant dead material and reduced moisture content due to severe frosts. Additionally, cold winter conditions often inhibit the decomposition of dead material from the previous season. Consequently, cured grass, when subjected to dry and/or windy conditions, can lead to easy ignition and very fast-moving fires.

Photo from the Balmoral fire near Duntroon in the Waitaki Valley as an example of a spring high country grass fire.

Wind driven fires

Current seasonal forecasts indicate that spring will have fewer than average windy periods. Nevertheless, spring is still typically a season characterized by windy conditions, which can lead to wind-driven fires. Recent examples include the Balmoral fire in the Waitaki Valley, as well as past incidents at Pukaki and Ohau. Wind poses a significant risk, particularly when combined with the Föehn effect, which brings strong, warm, dry winds, such as the north-westerlies experienced in the eastern regions of the South Island.

Complacency

There is a perception that damaging wildfires require drought, but as described above there are situations where significant fire behaviour can occur in the absence of drought. This perception can lead to some complacency during spring.

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) 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.

Photo from the Glasnevin fire near Waipara as an example of a fire in open slash fuels that dry out readily.

Variation within key climate drivers

The El Niño-Southern Oscillation (ENSO) is often focussed on as a key indicator for seasonal outlooks; however, as previously mentioned, it does not account for all climatic variability as a number of other climate drivers can also influence New Zealand's weather and fire danger. The 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. Confidence around this latest potential La Niña event will increase in coming months, along with improved guidance on local rainfall and temperature patterns, but it may be different from previous events. It is therefore essential to continue monitoring the fire season conditions along with this 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.

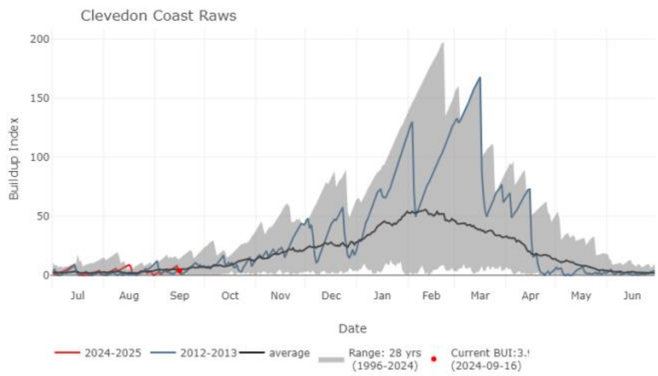


Figure 2: Significant drying occurred in the area represented by the Clevedon Coast RAWS during the 2012-2013 year which has been identified as one of the subjective analogue years for the coming season.

Figure 3a: Locations identified as areas of interest in the North Island that may develop an increased risk of above normal fire potential over the next three months. These areas are likely to change in future Outlooks as certainty around seasonal climate drivers increases.

Current climate

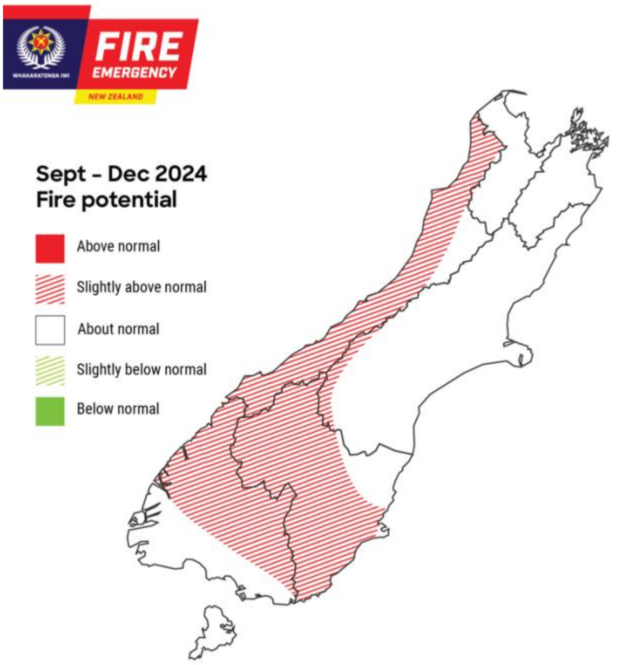


Figure 3b: Locations identified as areas of interest in the South Island that may develop an increased risk of above normal fire potential over the next three months. These areas are likely to change in future Outlooks as certainty around seasonal climate drivers increases.

In August, temperatures were near average (±0.50°C of average) or above average (0.51-1.20°C above average) for most of the country, with isolated pockets of well above average (>1.20°C above average) temperatures observed in parts of Northland, Hawke's Bay, southern Taranaki, and Fiordland. So far in September, temperatures have been near average for the majority of New Zealand (Figure 4, right), with below average temperatures for the west and southwest, and small patches of above average temperatures in Canterbury.

August rainfall was above normal (120-149% of normal) or well above normal rainfall (>149% of normal) for western, inland, and northern parts of the South Island, as well as lower parts of the North Island, and much of Taranaki. Rainfall was below normal (50-79% of normal) for eastern and southern parts of Northland, Auckland, Coromandel, Bay of Plenty, Gisborne, Hawke's Bay, the Central Plateau, coastal Canterbury about and south of Banks Peninsula, and coastal North Otago.

So far in September, rainfall has been above or well above normal across lower Westland, Southland, western parts of Otago, much of south Canterbury, as well as the lower and western North Island. In contrast to this, rainfall has been well below or below normal for much of the eastern and northern North Island, and upper South Island including north Canterbury (Figure 4, middle).

As of 21 September (see Figure 4, left), soil moisture levels are near normal across most of New Zealand. Small regions of above normal soil moisture are present about Cape Campbell, and around central Otago and south Canterbury. Some areas of below normal soil moisture can be seen straddling areas of southern Northland, Auckland, Coromandel, as well as Gisborne, Hawke's Bay, and eastern Bay of Plenty.

Climate drivers

Sea surface temperatures (SSTs) remained in the neutral range in the central equatorial Pacific (Niño 3.4 Index) during August (-0.08˚C), decreasing from +0.17˚C at the end of July. As of 27 August, the 30-day Relative Oceanic Niño 3.4 Index[1] (RONI) was -0.63˚C, reflective of the central equatorial Pacific being cooler than the average of the global tropics. A period of enhanced trade winds in September will likely result in a cooling trend across the central part of the Pacific, including the Niño 3.4 region.

The Southern Oscillation Index (SOI) was on the La Niña side of neutral during August (+0.9) and neutral from June-August (0.0). Recent SOI variability is characteristic of an ENSO neutral ocean-atmosphere system.

Of the models monitored by NIWA, there is a 50% chance for La Niña to fully develop by the end of the spring season, with a 60% chance of La Niña developing during October – December.

During August, convective forcing favoured Africa and the Indian Ocean, forced by an unusually active African monsoon. In September, a high-amplitude MJO has been active over the Maritime Continent (phases 4 and 5), and will start progressing eastward (phases 6 and 7) signalling a marked shift in weather patterns later this week. For New Zealand, phases 4 and 5 historically favour above average temperatures in September, which looks likely for early September, while phases 6 and 7 are historically associated with below-average temperatures, consistent with guidance during this

[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.

time. The same phases tend to be wetter than normal in the western and inland South Island and drier than normal in the east of both islands.

In October, the MJO is forecast to track eastward, potentially favouring the Atlantic, Africa, and the Indian Ocean. This tends to favour more westerly-quarter winds (phases 1-3), and may also favour more high pressure in the New Zealand region.

SSTs in New Zealand's coastal waters were slightly above average during August, with anomaly values increasing by 0.08˚C to 0.24˚C during the month. Model guidance suggests that increasing SST anomalies are likely in the New Zealand region over the spring season with the potential for marine heatwave conditions developing by November.

Soil moisture anomaly: 21/09/24	Rainfall anomaly: 01/09/24 – 21/09/24	Temperature anomaly: 01/09/24 – 21/09/24

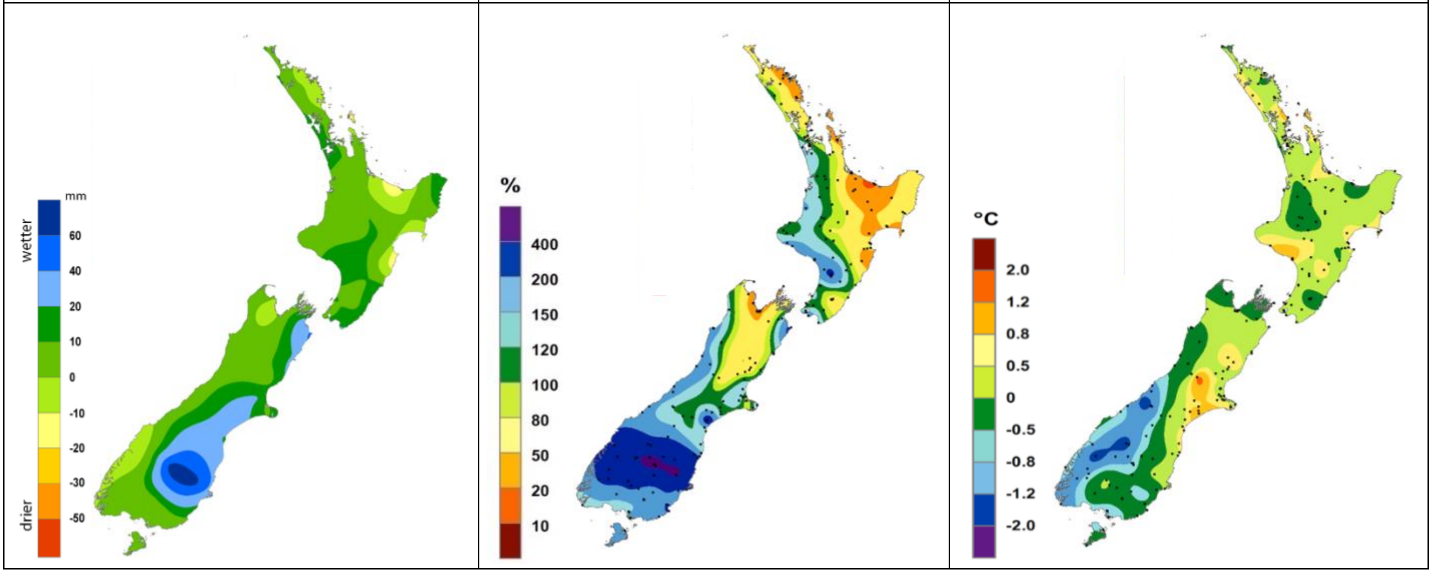


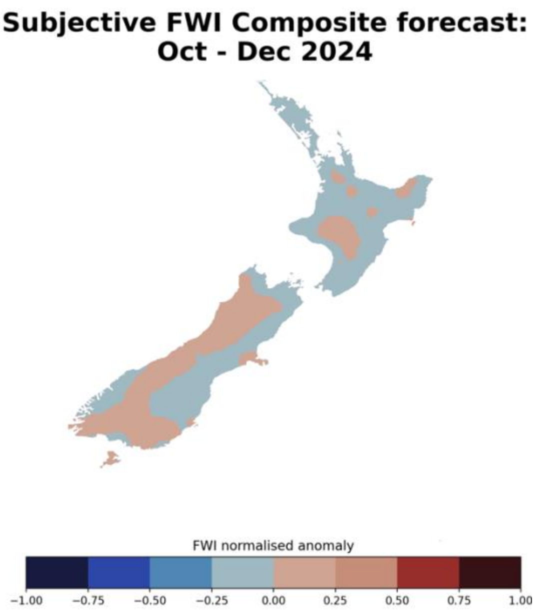
Figure 4: Maps showing the current soil moisture anomaly, as well as rainfall and temperature differences from normal since the start of the month.

Fire season analogues

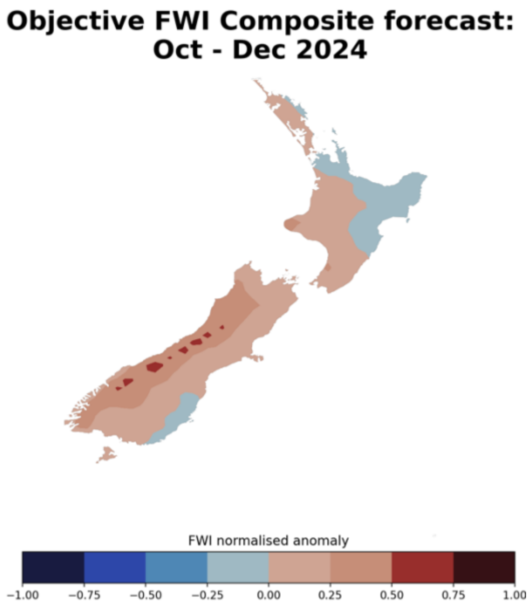
To help understand what fire weather conditions may be like this summer, we can look at analogues. Analogues are historical years with similar climatic conditions to the current year.

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.

The expectation for near normal to above normal rainfall in the west of both islands in the coming months should lessen the fire weather threat in those regions. However, drier conditions may become more likely in the east of both islands along with stronger than normal winds at times, potentially increasing the fire weather threats there.



Forecaster-selected analogue season - Oct to Dec
2022
2020
2013
2012
2011
2008
2007
1995



Data-driven analogue season - Oct to Dec
2020
2017
2007
2010
2001
2013
1996
2000

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: October 2024

October's air flows are expected to be quite different than the variability in September. More northeasterly-component winds than normal are expected as high pressure becomes favoured near and east of New Zealand. This will bring an elevated chance for drier than normal conditions, especially for western areas. 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: October – December 2024

A northeast 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 possible atmospheric transition to more La Niña-like conditions throughout the season, rainfall is generally favoured to be above normal in north New Zealand and upper South Island, with drier conditions possible in southern parts of the 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 from October 2024 through to April 2025. NIWA is currently assessing the risk of ex-tropical cyclones affecting New Zealand during this season, but historically in La Niña years, the risk to New Zealand is slightly elevated compared to normal.

Climate outlook: October

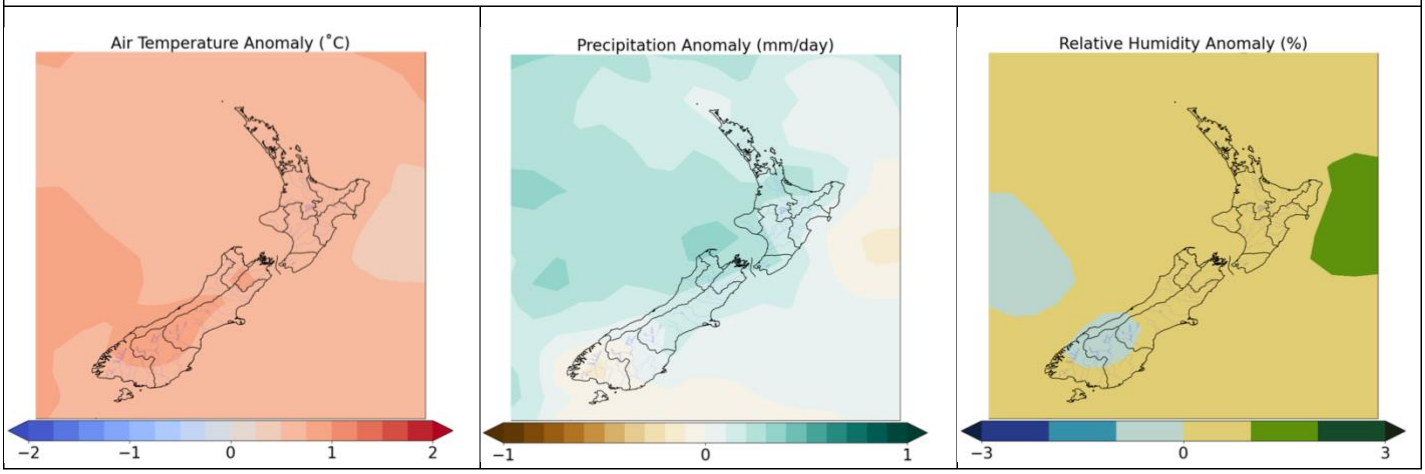


Figure 6: Climate outlook for October showing forecast temperature (left), rainfall (middle) and relative humidity (right) anomalies.

Climate outlook: October – December

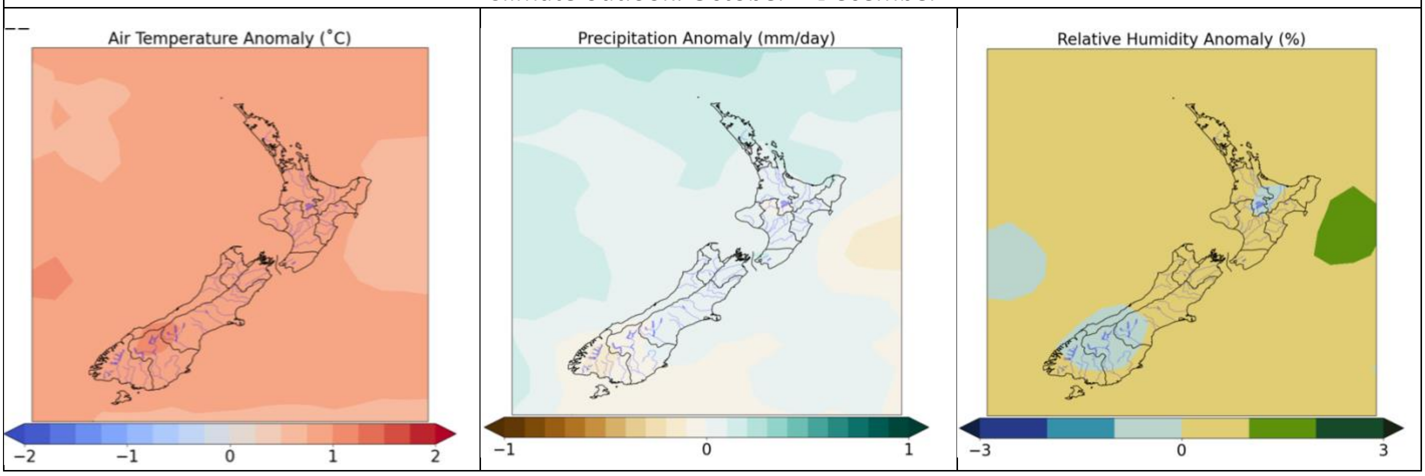


Figure 7: Climate outlook for Oct-Dec showing forecast temperature (left), rainfall (middle) and relative humidity (right) anomalies.

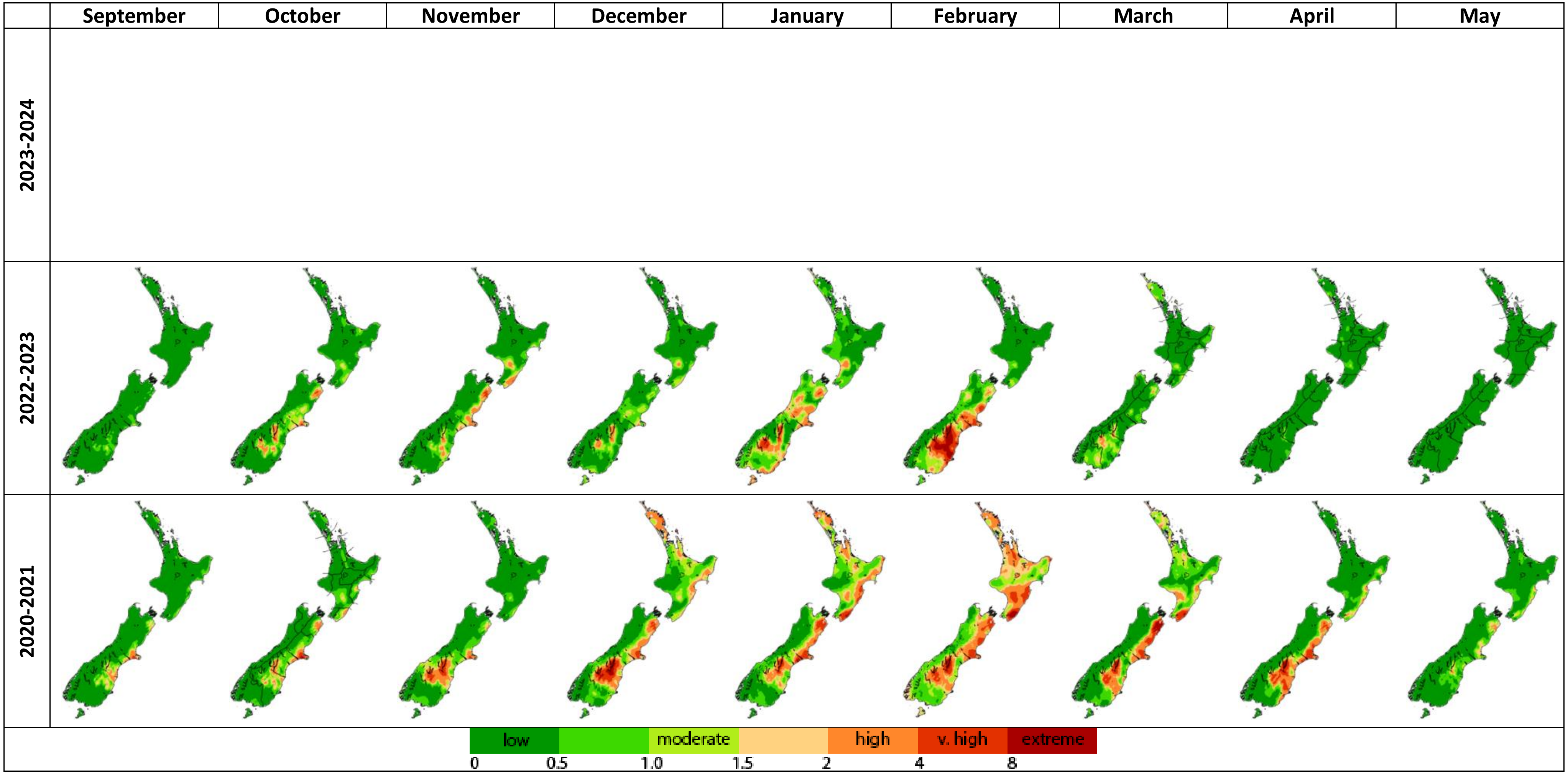


Figure 8: Monthly average severity rating for the current year 2024/2025 and the comparative years of 2022/2023 and 2020/2021. These are analogue years for the current season and give us an insight into what the upcoming season may be like.

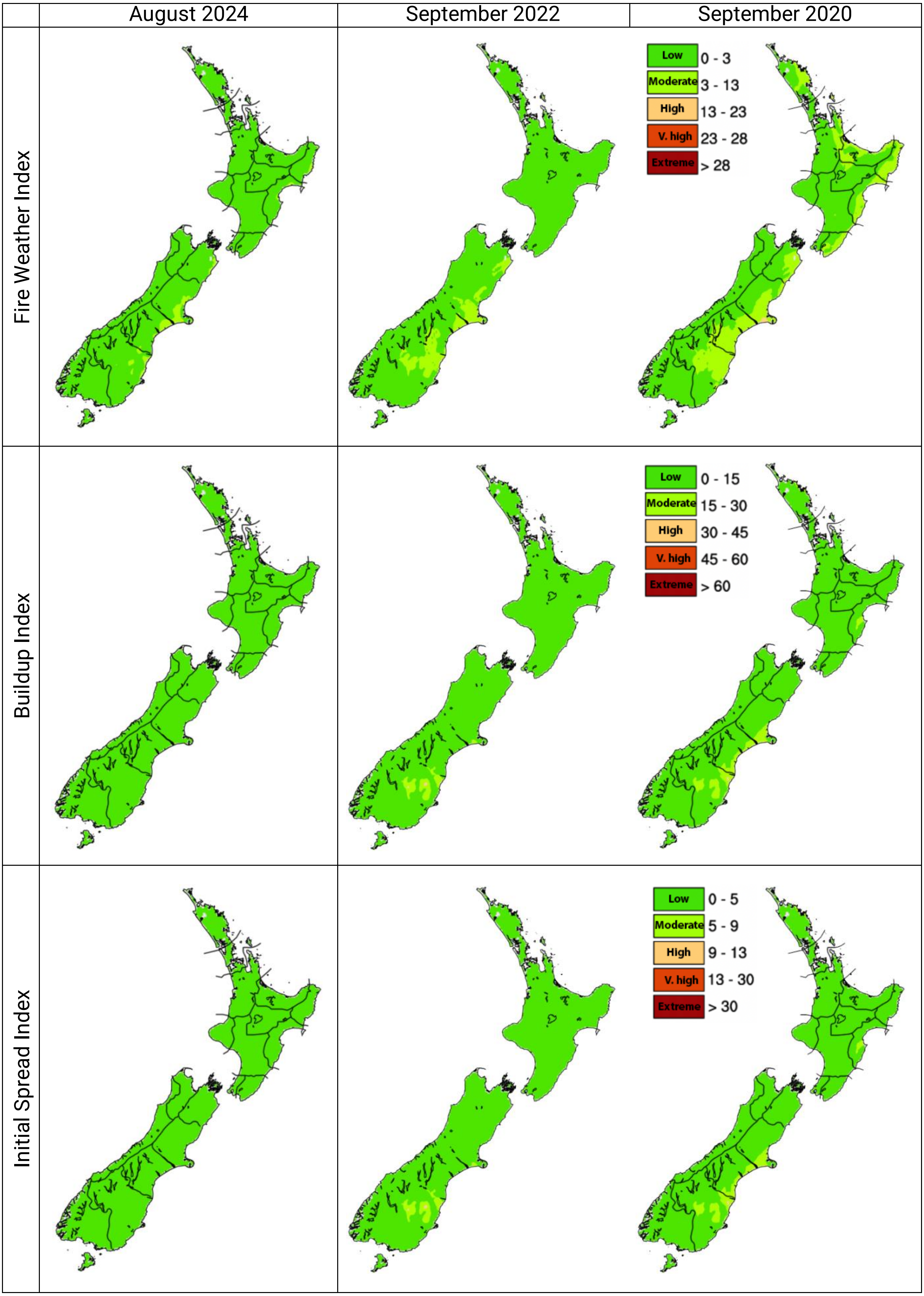


Figure 9: The most recent observed month (left column) and analogue months for October (middle and right columns); monthly average for the Fire Weather Index (top), Buildup Index (middle) and Initial Spread Index (bottom).

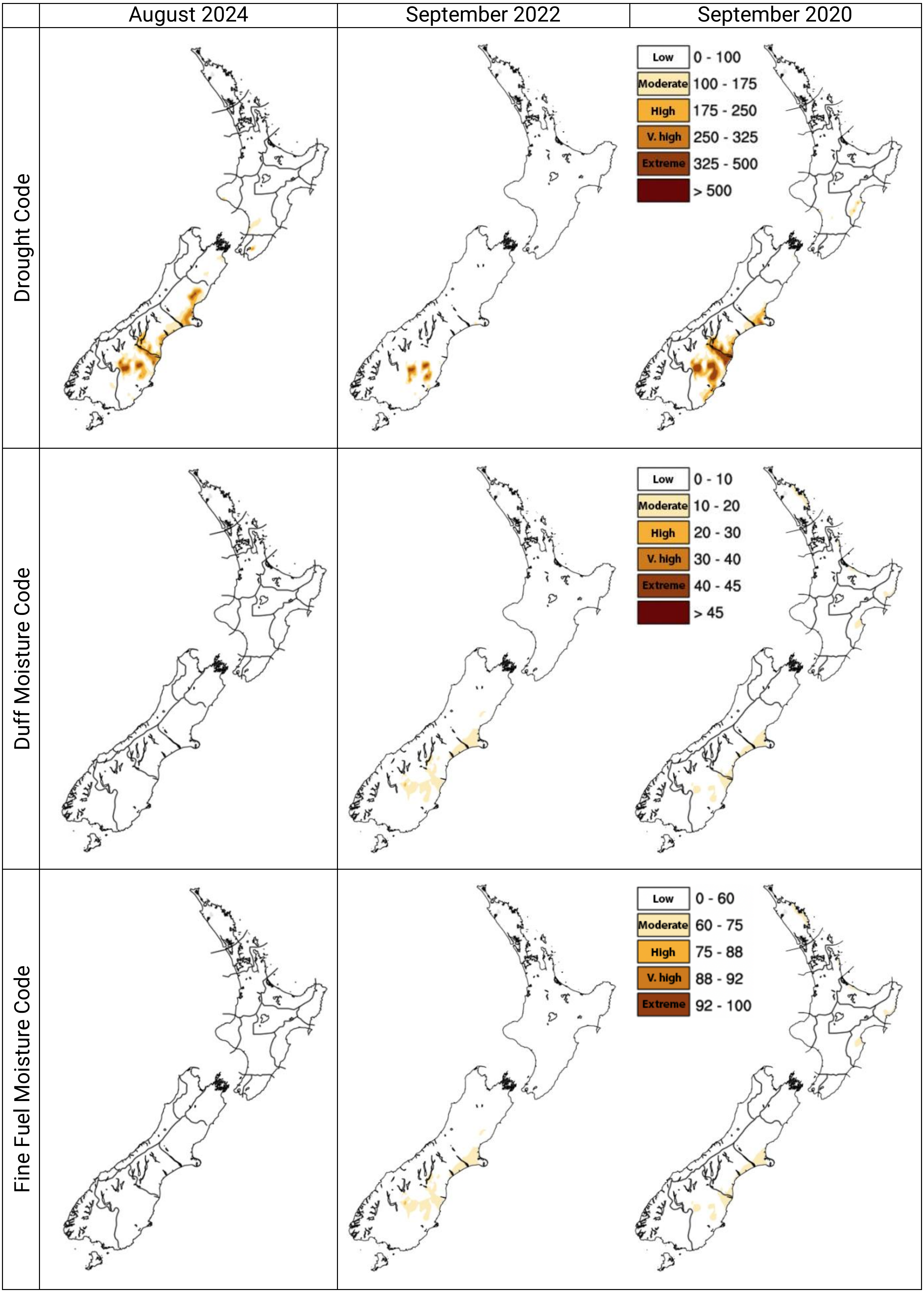


Figure 10: The most recent observed month (left column) and analogue months for October (middle and right columns); monthly average for the Drought Code (top), Duff Moisture Code (middle) and Fine Fuel Moisture Code (bottom).

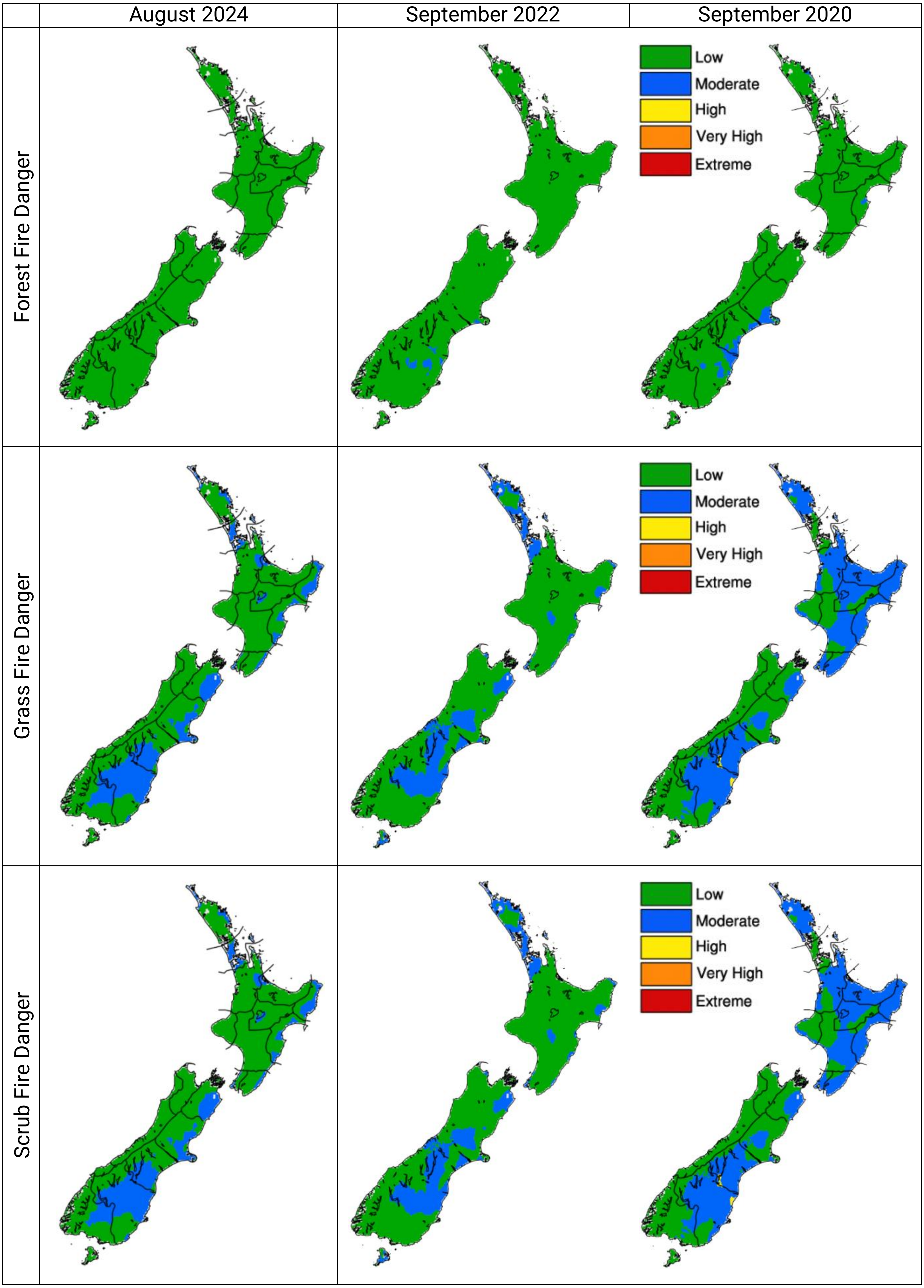


Figure 11: The most recent observed month (left column) and analogue months for October (middle and right columns); monthly average for the Forest Fire Danger (top), Grass Fire Danger (middle) and Scrub Fire Danger (bottom).

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

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

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

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

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

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

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.

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