North Island Monthly Fire Danger Outlook (2022/2023 season)
Issue: October 2022

Current fire danger situation

September's monthly fire danger and fire climate remained similar to August. Overall, the various fire indices are all low or moderate (aside from scrub fire danger), typical for this time of year. See Figures 7-10 for more detail.

Current fuel and soil moisture status

As of 16 October (Figure 3, left), soil moisture levels are above normal or well above normal across the eastern North Island and in parts of the Manawatū, below normal for parts of Auckland and Northland, and near normal elsewhere. The New Zealand Drought Index is currently showing no signs of dryness or drought in the North Island of New Zealand.

Fire dangers across the North Island are currently low due to the low to moderate Fire Weather System codes and indices (BUI, DC, DMC and FFMC – refer appendix for definitions) that have resulted from winter and early spring precipitation, and normal to below normal temperatures (slower drying rates).

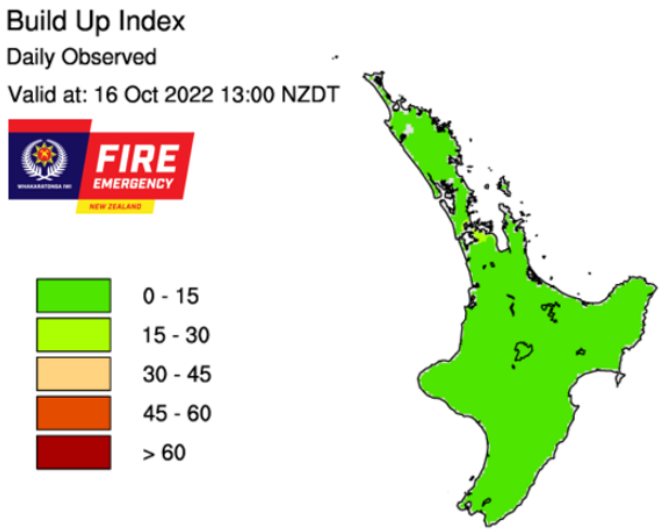


Figure 1: Map of Buildup Index (an indicator of the amount of fuel available to burn in a forest based on their expected moisture content) for the North Island as at 16 October.

The lower BUI values (Figure 1) and contributing DCs and DMCs mean minimal burning of moderate, heavy or subsurface fuels is likely. However, the dryness of fine fuels (represented by FFMC values) is more responsive to day-to-day weather and can become elevated under periods of warm, dry or windy conditions, which can result in fire ignitions and spread in these fine fuels.

Forecast climate and weather

Late October and into November looks to bring long dry spells, but a period of unsettled weather may occur near early November due to a return of the Madden-Julian Oscillation (MJO) to the western Pacific. For November as a whole, more easterly winds than normal are expected as La Niña strengthens. This could result in near to above normal rainfall for much of the northeastern and east North Island, although precipitation in central and western regions may be below normal.

Late spring and into summer should continue the trend of more easterly winds than normal as La Niña continues. Higher-than-normal rainfall is favoured for northeastern areas. However, occasional heavy rain events from tropical systems could bring flooding to parts of the North Island, as the risk of an early-season tropical cyclone is enhanced this season. For more information, see pages 3 and 4.

What to watch for

Another La Niña summer (see below) means we may see conditions very similar to the past two seasons, which brought above normal fire dangers to the north and west of the North Island, and below normal fire danger to eastern areas.

Although still very early in the fire season, the areas of the North Island most likely to experience above normal or slightly above normal fire potential over the next few months are in the west and north (Auckland, Waikato and Northland). Eastern areas (Gisborne and Hawkes Bay) are most likely to see below normal fire potential (see Figure 2).

- Watch for areas where grass fuel loads are higher than normal due to good growing conditions, and grass curing more advanced than normal due to dead "thatch" layers or frost curing. Together with elevated FFMCs and warm, dry windy conditions, these can contribute to easy ignition and spread of grassfires.
- Property owners undertaking burning may be complacent due to the low prevailing fire danger conditions, so escapes may be more likely, especially under windy conditions.
- Flare-ups or re-ignitions of old burns may also occur, especially during periods with strong winds.

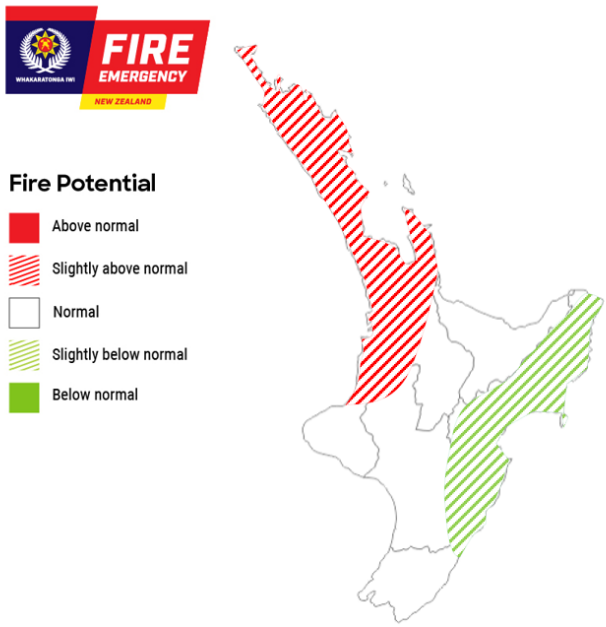


Figure 2: Locations identified as areas of interest that may develop an increased risk of above normal fire potential over the next three months.

The Mt Crichton fire of 7 Oct. 2022 spread rapidly in fine flashy tussock and scrub fuels.

Current climate

September temperatures were near average (within ±0.50°C of average) for most of the North Island. Areas of above average temperatures (0.51°C to 1.20°C above average) were observed in Manawatū, Hawke's Bay, inland Gisborne, eastern Bay of Plenty, central Waikato, and northern Northland. So far in October, temperatures have below average (0.51°C to 1.20°C below average) to well below average (>1.20°C below average) in the south, with areas of above normal temperatures in the Bay of Plenty and Northland. The remainder of the North Island has been near average. (Figure 3, right).

September rainfall was above normal (120-149% of normal) or well above normal rainfall (>149% of normal) in parts of northern Northland and Auckland, Waikato, Bay of Plenty, Gisborne, Hawke's Bay, Wairarapa and southeastern Marlborough. Rainfall was below normal (50-79% of normal) or well below normal (<50% of normal) for parts of Kāpiti Coast, and central parts of Northland. Near normal rainfall (80-119% of normal) was typically observed elsewhere (Figure 3, middle)

Soil moisture levels are below normal or well above normal across the eastern North Island and in parts of the Manawatū, below normal for parts of Auckland and Northland, and near normal elsewhere (Figure 3, left).

Climate drivers

The NINO3.4 Index anomaly (in the central equatorial Pacific) during September was -0.94˚C (climatology: 1991-2020), consistent with what was observed in August.

The September monthly Southern Oscillation Index (SOI) was +1.8 and +1.4 from July-September (climatology: 1991-2020), both well within the La Niña range.

Trade winds were much stronger than normal across the central equatorial Pacific and off-equatorial South Pacific during September, maintaining a moderate La Niña strength.

In the subsurface central equatorial Pacific, cold anomalies intensified during September, particularly east of 160˚W longitude. Unusually cool sub-surface anomalies are expected to continue to push toward the surface, likely resulting in further cooling of the NINO indices through November and additional strengthening of La Niña.

A SST seesaw in the Indian Ocean, called the Indian Ocean Dipole (IOD), continued in its negative phase during September and into October. The IOD has been associated with greater moisture availability for low pressure systems in the wider Australasia region

However, as the negative IOD eases from November-December, La Niña will become the main driver of seasonal climate variability in the tropics, with typical impacts for New Zealand including more easterly to northeasterly winds, warmer temperatures, lower rainfall about inland and western parts of both islands, and less frequent hot days in the east of both islands. This may also be conducive to early season tropical cyclone activity in the Southwest Pacific. This will be the first "triple dip" La Niña (three consecutive La Niña events from 2020-2022) since 1998-2000.

New Zealand's coastal water temperatures remained above average during September, with anomaly values increasing in 4 out of 6 climate regions (all but the west of the North Island and north of the South Island). The marine heatwave (MHW) signal was amplified in climate model guidance issued in September, showing a sharp increase in SSTs from October-December. Overall, it implies that MHW strength could rival that which was experienced in 2017-18 and 2021-22.

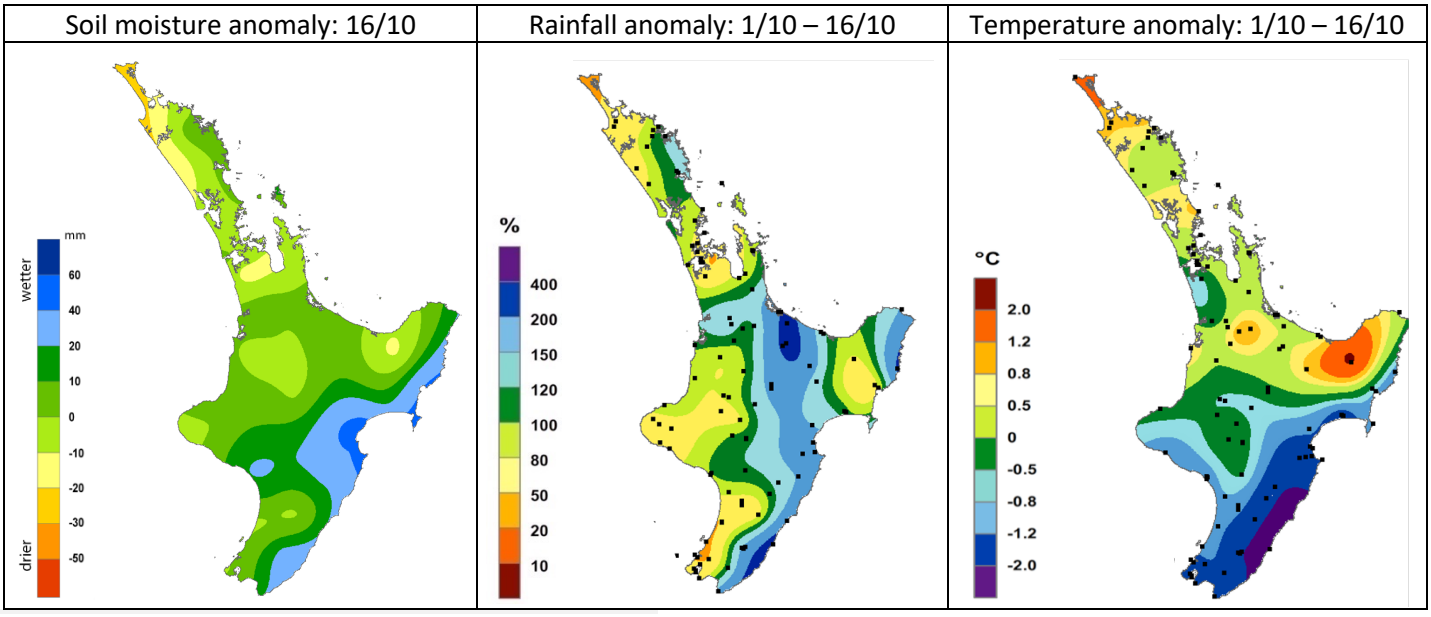


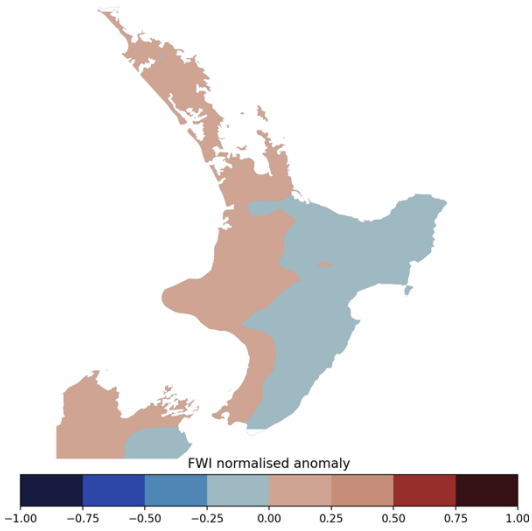
Figure 3: Maps showing the current soil moisture anomaly, as well as temperature and rainfall differences from normal since the start of the month.

Fire season analogues

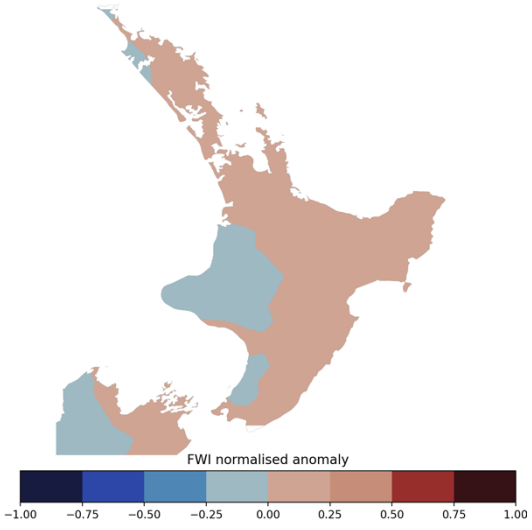
To help understand what fire weather conditions may be like this summer, we can look at analogues. Analogues are historical years with similar climatic conditions to the current year.

This season's analogue years featured historical years that had La Niña-like patterns in the ocean and/or atmosphere (Figure 4). The last two seasons (2020-21 and 2021-22) were both La Niñas. 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 signal is mixed between the expert-selected years and the objective years for spring and into early summer. However, northern areas are expected to have slightly higher fire danger than normal. Overall, this indicates that some regions will need to be prepared for elevated fire weather conditions. The subjective expert-selected guidance agrees more with La Niña-like patterns and is therefore favoured.



Forecaster-selected analogue season - Nov to Jan
2021-22
2016-17
2020-21
2017-18
2005-06
2000-01
1999-00
1998-99



Machine-selected analogue season - Nov to Jan
2007-08
2011-12
2001-02
1996-97
2014-15
2012-13
2010-11
2013-14

Figure 4: 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 2022

November's air flows are generally expected to be more easterly than normal, continuing the trend of recent months. The signal is for a wetter than normal month in northeastern areas. Wind speeds are expected to be below normal for the North Island. Above average temperatures again appear very likely, especially in the west. Relative humidity is forecast to be higher than normal in eastern areas and near normal in western areas (Figure 5).

Climate outlook: November 2022 – January 2023

Guidance suggests that early spring and into summer will exhibit more easterly winds than usual. Temperatures overall look to be warmer than average (Figure 6). Rainfall looks to be near normal or above normal for the northeast and eastern North Island, although it may be drier in some western areas. Somewhat humid conditions look to develop in the east, although relative humidity is forecast to be slightly below normal in western areas. Wind speeds continue to look lighter than normal. These climate anomalies continue to be well-aligned with La Niña conditions.

The tropical cyclone season for the Southern Hemisphere runs begins in November. On average, at least one ex-tropical cyclone passes within 550 km of New Zealand each year. This season the risk is considered elevated compared to normal, particularly early in the season.

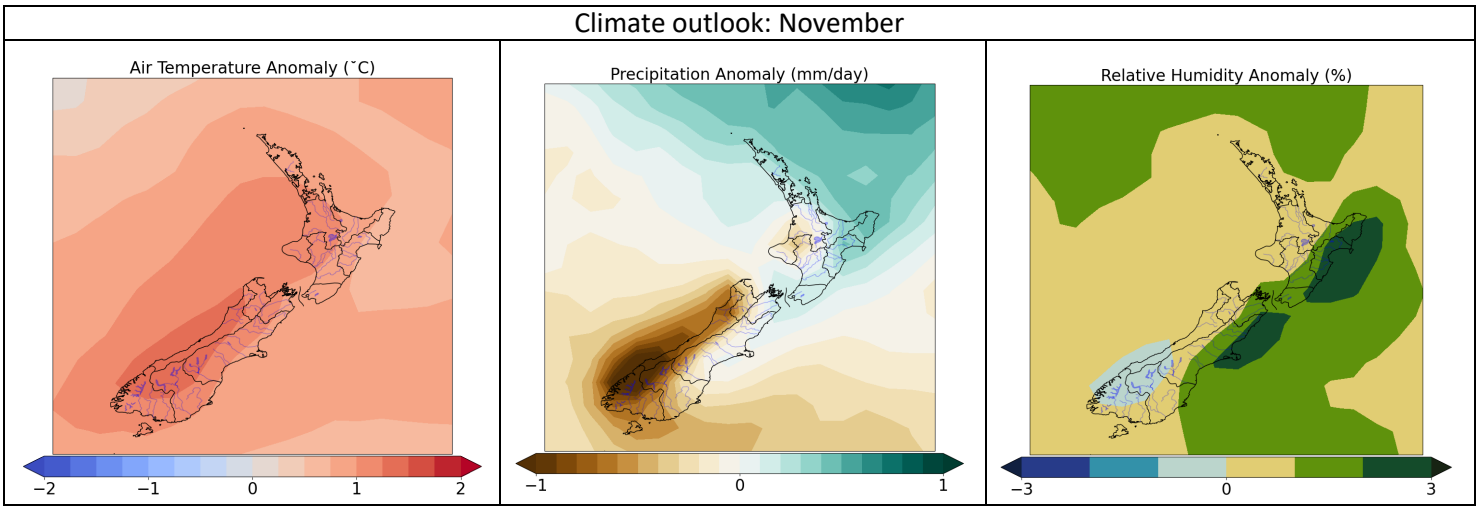


Figure 5: Climate outlook for November showing forecast temperature (left), rainfall (middle) and relative humidity (right) anomalies.

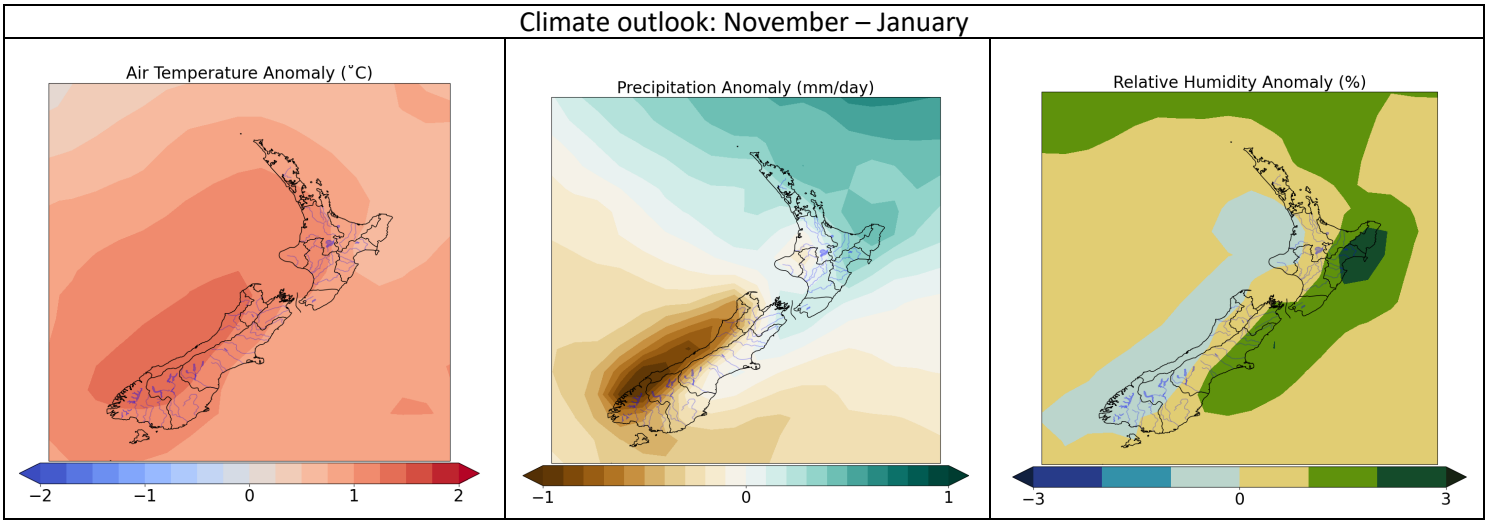


Figure 6: Climate outlook for November-January showing forecast temperature (left), rainfall (middle) and relative humidity (right) anomalies.

Expected impact on fuels and fire danger

Fine fuel moisture is critically important to fire behaviour, with lower moistures resulting in easier ignitions and faster spread rates. Fine fuel moistures are affected by temperature, wind, humidity and precipitation. Based on the outlook above, it is anticipated that drying rates will be increased by warmer temperatures in most parts of the North Island, but this will be offset in the east by normal or above normal humidity and precipitation.

Anticipated lower wind speeds are likely to see less frequent wind-driven fires and generally reduced spread rates, although the reduction may be offset by drier than normal fine fuels in the west and north as described above.

Looking to November and beyond, the changing of the season will see increasing availability of medium, heavy and subsurface fuels as they dry out. The moisture of these fuels has less of an impact on fire spread rates, but as they dry the fuel availability increases resulting in greater fire intensity making suppression more difficult. The drying of these fuels is dependent on temperature, precipitation and to some degree humidity. The outlook above indicates that the medium and heavy fuel availability will likely be below normal in eastern areas but potentially about or greater than normal in the north and west.

The net effect of the climatic outlook is that western and northern parts of the North Island (Auckland, Waikato and Northland) are likely to have normal or slightly higher than normal fire dangers while the eastern parts experiencing increased easterly wind flows (Gisborne and Hawkes Bay) are expected to receive more humidity and precipitation and have below normal fire danger.

There will however still be periods when the westerly flows return and, especially if they are strong and not accompanied by precipitation, they are likely to result in spikes in the fire danger. It should also be noted that although eastern parts are not expected to have higher than normal fire danger, their usual summer fire dangers are still relatively high.

Grass growth & curing

Most fires start in fine fuels such as grass, which ignite easily and promote fire spread to other fuels. Grass fuel loads and curing rates should therefore be closely monitored as a critical factor in assessing fire danger.

Most of the North Island has experienced good growing conditions over the past few months, with a relatively warm winter and abundant spring rainfall. As a result, we can expect increased grass fuel loads in many areas, especially where grazing has not kept up with grass growth. As the summer progresses, these grass fuels will die off and dry out. This seasonal “curing” of grasses has already begun in some areas, although for the most part grass curing is still low, especially in managed pastures.

Curing for most pasture species occurs as a natural process with summer drying and seed set, the timing of which will vary between regions and seasons. As we move through spring, some areas will also have been subject to frost curing which causes a build-up of dead material over winter; this is then replaced by a green spring flush. This frost curing can result in higher than expected curing levels. Similarly, depending on grazing and pasture management, some grass species may also retain a “thatch” layer of dead material from the previous season. Some green species, especially tussocks, also have lower moisture levels in their live foliage in order to survive severe winter frosts. This is why we often see tussock fires in the early spring. The temperatures will now be increasing, but the winter frost-cured or thatch material may still be present, elevating curing levels.

If they are less than 50% cured (i.e. less than 50% brown or dead material), grass fuels will generally only burn in exceptional conditions (low humidity and high winds). But subject to weather and topography influences, grass fire ease of ignition, spread rates and fire intensity will increase steadily as the curing percentage increases. At 50% cured, grasslands produce slow-moving fires with small flames; but at 80-100% cured, grassfires are able to ignite easily, spread rapidly and produce extreme flame lengths and intensities.

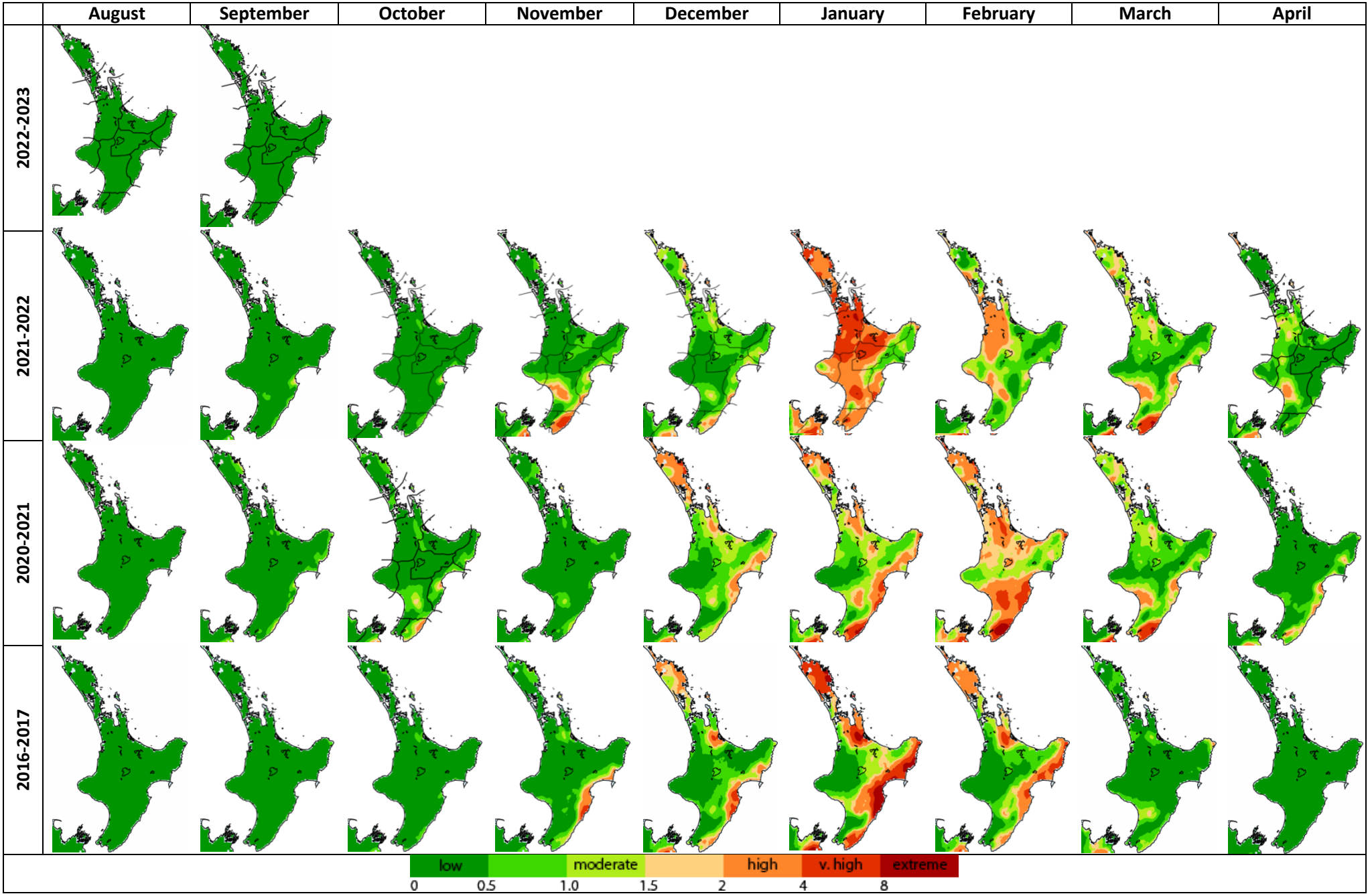


Figure 7: Monthly average severity rating for 2022-2023 up to and including February and the comparative years of 2021/2022, 2020/2021, and 2016/2017. These are analogue years for the current season and give us an insight into what the upcoming season may be like.

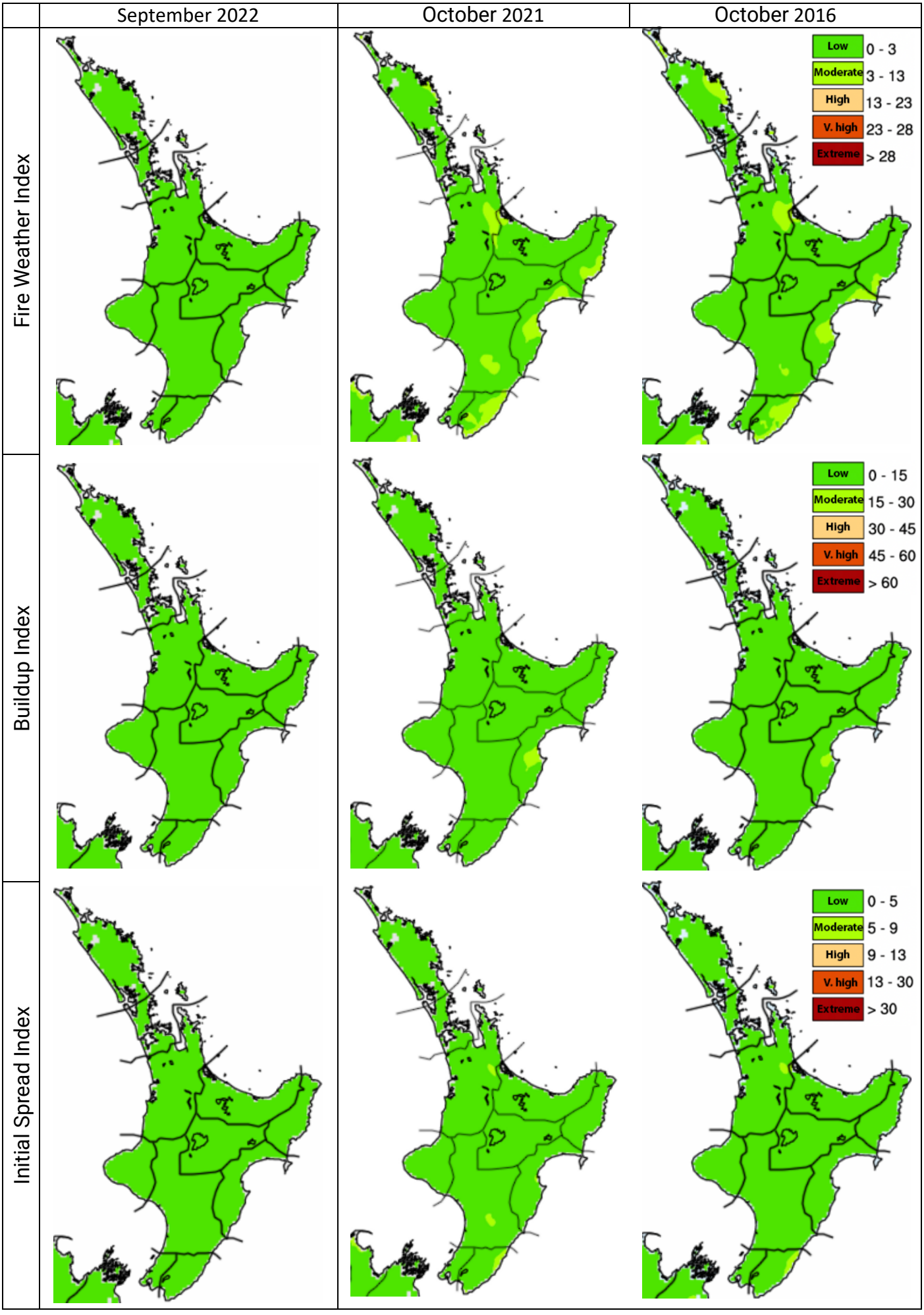


Figure 8: The most recent observed month (left column) and analogue months for October (middle and right columns); monthly average for the Fire Weather Index (top), Buildup Index (middle) and Initial Spread Index (bottom).

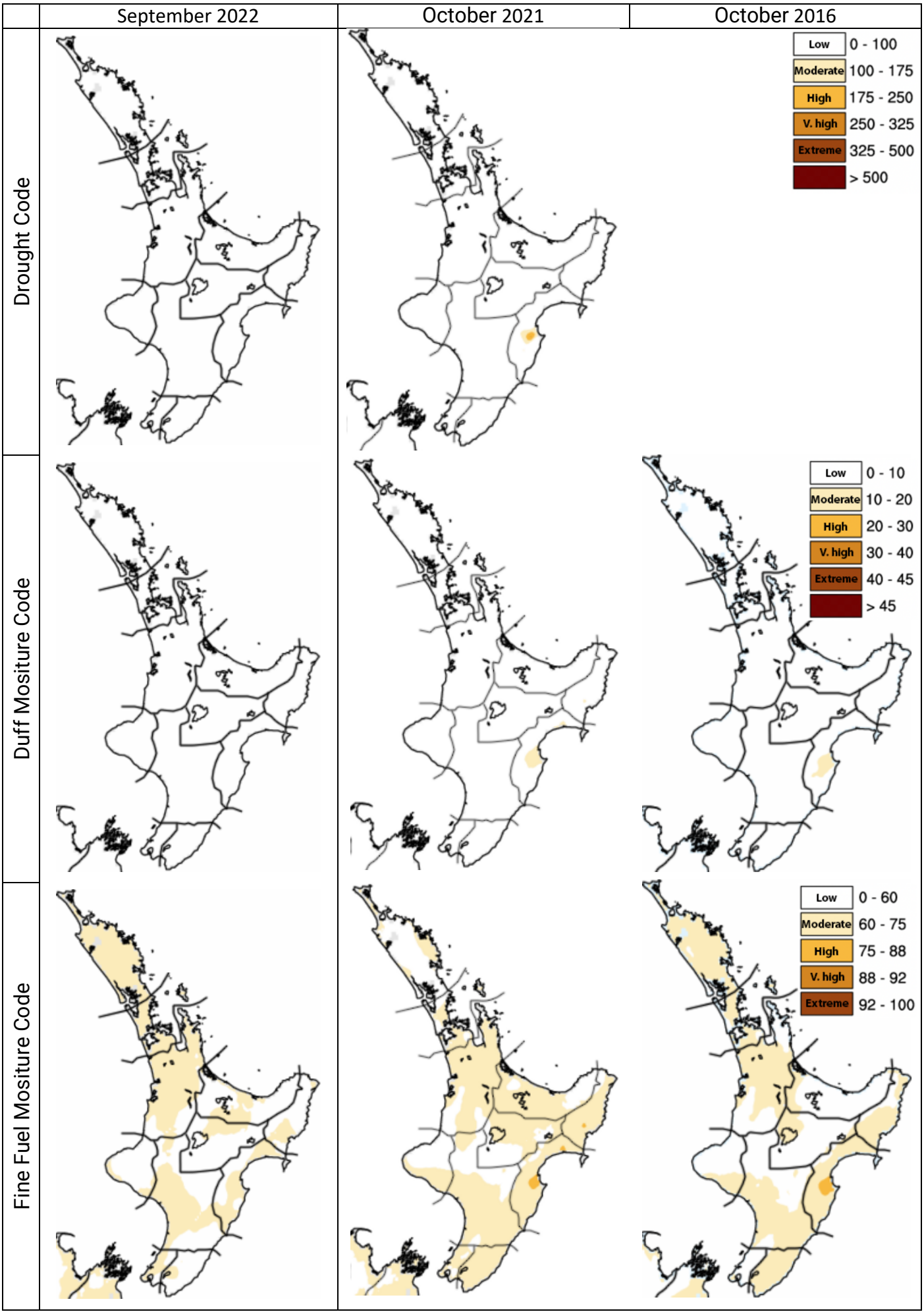


Figure 9: The most recent observed month (left column) and analogue months for October (middle and right columns); monthly average for the Drought Code (top), Duff Moisture Code (middle) and Fine Fuel Moisture Code (bottom).

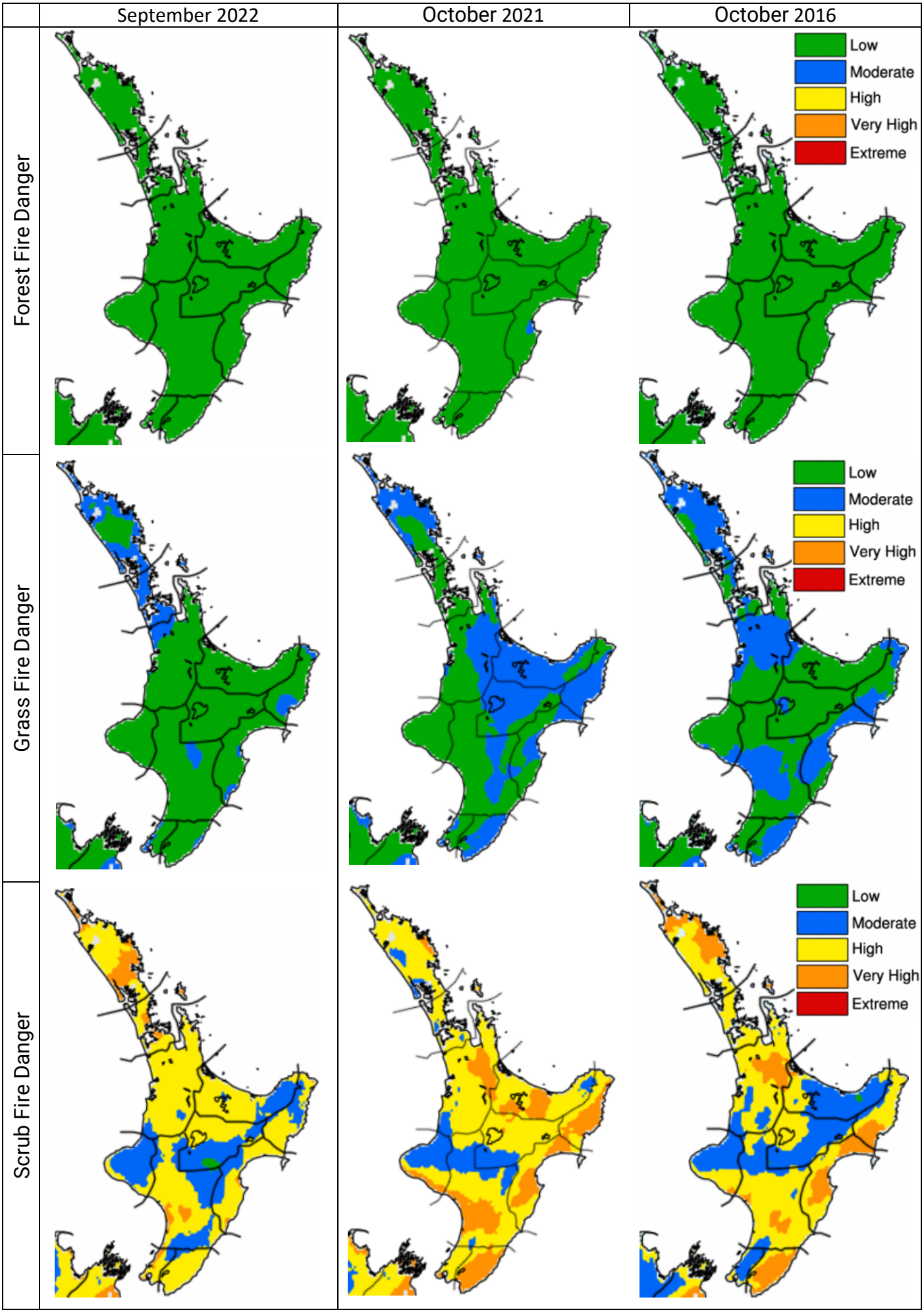


Figure 10: The most recent observed month (left column) and analogue months for October (middle and right columns); monthly average for the Forest Fire Danger (top), Grass Fire Danger (middle) and Scrub Fire Danger (bottom).

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