New Zealand Seasonal Fire Danger Outlook 2018/19

ISSUE: North Island, January 2019

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Current fire danger situation & outlook:

Fire dangers and fire climate severity remain low to moderate across the North Island (Figures 1 & 5). This is also reflected in the current FWI System codes and indices (BUI, DC & DMC) (Figures 5 & 7). Small pockets around the country have high DC values (Kaipara & Palmerston North) which indicate that heavy fuels are drying.

Across the North Island, soils are drying out and are currently near 50% storage capacity (Figure 3). Soils that are showing signs of dryness (below 50%) are in the far north, Taranaki, Whanganui-Manawatu and along the East Coast. Drier than normal soils for this time of the year are occurring in the Far North, Taranaki, and Horowhenua (Figure 4). In contrast, wetter than normal soils are occurring along the east coast of Auckland, Thames/Coromandel, Bay of Plenty, Gisborne, Hawkes Bay and Wairarapa.

The ENSO (El Niño–Southern Oscillation) Outlook remains at El Niño ALERT. Even though the tropical Pacific Ocean temperatures exceed El Niño thresholds, the atmosphere remains reluctant to couple with the ocean. There is still a chance of a weak El Nino forming this summer, however there is a much lower probability for it to form this late into summer. Should a weak El Nino form, the influence on New Zealand's climate will be weak and limited. Sea surface temperatures are currently warmer than average around New Zealand. The influences of the Tasman Sea will most likely be the dominant driver for New Zealand's summer weather.

January is expected to be drier and warmer than average, especially in the first half of the month before the blocking highs break down and are replaced with south westerlies. Outbreaks of rain are likely with the odd shower here and there, especially in the second half of the month. A number of locations are set to experience very high temperatures (high twenties and low thirties).

With warmer and drier conditions expected for January, vegetation and soil moisture levels will begin to dry out, elevating the fire risk and contributing to deeper burning, and potentially faster moving, fires. However, any substantial rainfall events will improve soil and fuel moistures, especially in the lower half of the North Island.

The fire season years of 2004/05 and 2006/07 are possibly good indicators for what to expect during a weak El Niño this coming fire season (Figure 9). Fire dangers and severity are expected to increase in late summer and continue to extend into April and May for eastern locations. We may also be in for a similar season to the 2001/02 neutral fire season, where the fire danger and fire climate severity remained low to moderate up to mid-summer then peaked during February and March.

In general, fire dangers and fire climate severity for January are expected to be low to moderate for most, but elevated in Northland, Auckland, Hawkes Bay and Whanganui-Manawatu (Figures 1, 6 & 8). Due to current soil moisture status and the FWI codes and indices, specific areas to watch are Northland, Great Barrier Island, Hawkes Bay, Taranakiand Manawatu, including Palmerston North . However, further heavy rainfall may reduce the fire dangers in these regions, as well as other parts of the North Island.

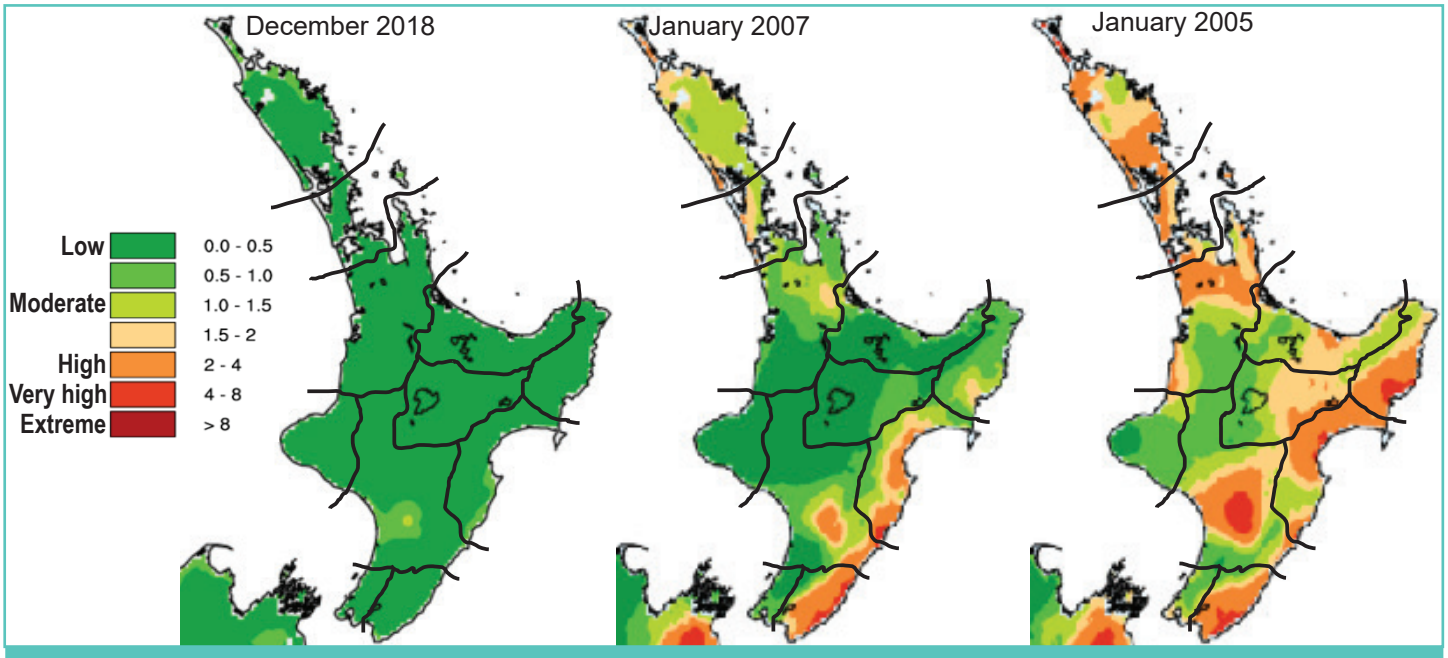

Figure 1. Monthly average Severity Rating for: current (left);
and during the 2006/07 (middle) & 2004/05 (right) Neutral years followed by a weak El Niño.

EXPECTED CLIMATE OUTLOOK:

One of the major climate drivers for New Zealand is the El Niño–Southern Oscillation (ENSO). The ENSO index remains at neutral levels, despite ocean temperatures having reached El Niño levels. Most models indicate sea surface temperatures remaining warm until the middle of 2019. If the tropical Pacific Ocean continues to stay warm over summer, this increases the chance of an El Niño developing for next fire season.

The ENSO outlook for this summer remains at El Niño ALERT (which means there is about a 70% chance of El Niño developing). However, the current atmospheric indicators (cloudiness, pressure patterns, the Southern Oscillation Index (SOI) and trade winds) have generally remained neutral. This is because the ocean and atmosphere are not reinforcing each other, or "coupling". It is this coupling that defines and sustains an ENSO event. Also, the likelihood of an ENSO event developing during mid-summer is much lower than at other times of the year. It would be unusual (though not impossible) for an event to develop this late into summer. A late developing El Niño has occurred in 2006-07 and 2009-10, although there is no record of one starting in January.

International climate models indicate weak to moderate oceanic El Niño conditions over the next three months (96% chance over January to March 2019). It is still unclear whether the atmosphere will eventually show indicators and couple to signal an El Niño event. Currently, the uncoupled ocean and atmosphere increases the chance of variability in the weather over summer for New Zealand. Should a weak El Niño event form, the impact on New Zealand's weather patterns is likely to differ from what is typically experienced during a conventional El Niño event. It is not expected to be of a similar intensity to what was experienced during 1997-98 or 1982-83. This means we will likely see deviations from the south westerly air flow patterns typically experienced during traditional El Niño events. But ENSO is just one of several climate drivers that can influence New Zealand's rainfall and temperature patterns.

Currently, New Zealand's coastal waters are much warmer than average for this time of the year. The models are also predicting warmer temperatures during January to March. Much warmer than normal ocean temperatures are also affecting the Tasman Sea. In the absence of an El Niño event, sea temperatures will be the dominant weather driver for New Zealand over the next three months.

NIWA's tropical cyclone outlook (November 2018 to April 2019) indicates the risk for New Zealand will be near normal. This means at least one ex-tropical cyclone passes within 550 km of New Zealand each year. Last year New Zealand experienced three. Significant rainfall, damaging winds, and coastal damage can occur during these events, and reduce fire risk in affected areas. A protracted El Niño event could have an impact on delaying the tropical cyclone season.

This month: January 2019

High pressure will dominate much of January resulting in warm settled weather. The first two weeks of the month are expected to be drier than average. In the second half of the month, south-westerly winds and rain will replace the high pressure as it withdraws into the Tasman sea. Expect some cloudier and windier periods as well as some wetter weather for those in southern and western areas. Temperatures are expected to be above average as a result of settled weather from the high-pressure system. Some locations are expected to hit or exceed 30 degrees, especially eastern areas experiencing north westerly winds.

Further ahead: January - March (Figure 2)

For the next three months (January – March 2019), higher pressures than normal are forecast across New Zealand. It is expected the country will also experience weak south westerly wind flows. Temperatures are forecast to be above average for the north and near or above average for the remaining regions. Rainfall totals are predicted to be near normal for many, the exception being the north of the North Island (near normal or below normal rainfall). Near normal soil moistures and river flows are expected for the west and east coasts, and near normal or below normal for the north.

Regional breakdown (Figure 2):

Temperatures are most likely to be:

- above average (50% chance) for Northland, Auckland, Waikato and Bay of Plenty;
- above average (45%) or near average (40%) for Central North Island, Taranaki, Whanganui, Manawatu, Wellington, Gisborne, Hawkes Bay and Wairarapa.

Rainfall is most likely to be:

- near normal (40% chance) or below normal (35%) for Northland, Auckland, Waikato and Bay of Plenty;
- near normal range (45-50%) for Central North Island, Taranaki, Whanganui, Manawatu, Wellington, Gisborne, Hawkes Bay, and the Wairarapa.

Soil moistures are most likely to be:

- near normal (45% chance) for soil moistures and river flows will be either near normal (45%) or below normal (40%) for Northland, Auckland, Waikato, and Bay of Plenty;
- both soil moisture levels and river flows will be near normal range (40-45%) for Central North Island, Taranaki, Whanganui, Manawatu, Wellington, Gisborne, Hawkes Bay, and the Wairarapa.

Last month: December2018

Looking back, December's weather was just as variable as November. Settled periods as a result of high pressure were over thrown by heavy rain and

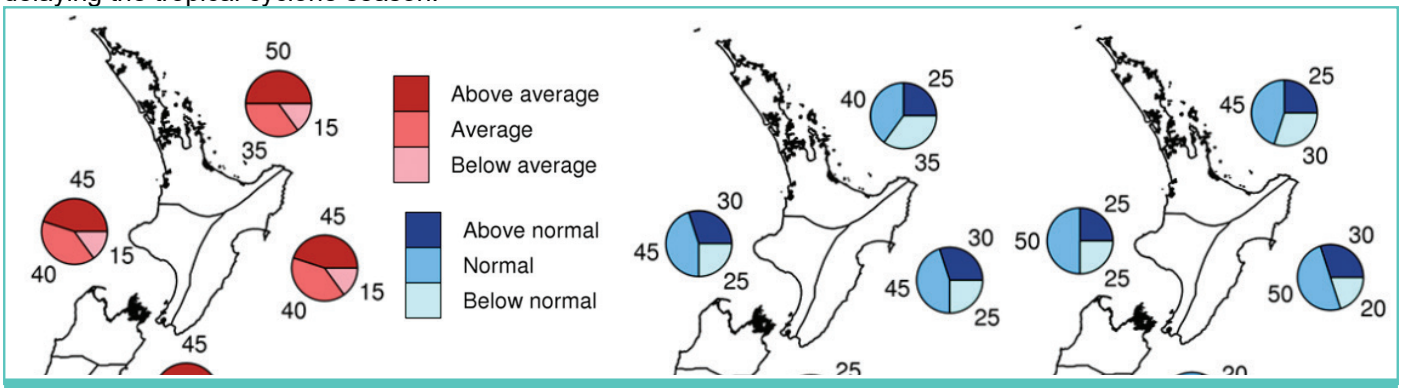

Figure 2. Outlook for Jan - March 2019: air temperature (left), rainfall (middle), available soil moisture (right). Source: NIWA.

frequent thunderstorms. December was a wetter than average month for many locations (except Gisborne and Taranaki). Parts of Bay of Plenty experienced heavy rainfall, near three times the December average.

Temperature was around average for this time of the year, especially for the East Coast, with Gisborne being a touch cooler than average. Elsewhere was much warmer than usual. This was in part due to warm, moist air from the tropics, and partly due to extended sunny days.

Soil moisture (Figure 3 & 4)

Soil moisture levels are currently at 50% storage capacity in many areas (Figure 3). Dry soils are located along the east coast of Northland, coastal Kaipara & Auckland (including Great Barrier Island), east coast of Gisborne & Hawkes Bay, coastal Taranaki and coastal Palmerston North. Very dry soils are currently located along the coast between Whanganui and Paraparaumu.

This is somewhat reflected in the soil moisture anomaly map (Figure 4). The driest soils across the North Island compared to normal for this time of the year are found along the west coast of the Taranaki region. Slightly drier than normal soils are also occurring around Wairoa, the Kapiti Coast and east coast of the Far North. The wettest soils for this time of the year are found in Thames-Coromandel, Bay of Plenty, northern Gisborne, inland Hawkes Bay, and the Wairarapa.

Grass growth:

Naturally, grasses undergo curing in late spring/early summer, where the plant dies or becomes dormant following flowering and seed drop. However, this process has been delayed due to heavy and prolonged rainfall. Over the last few months climatic conditions (mild temperatures and high soil moistures) have also continued to support growth, which has led to abundant grass growth and unusually green landscapes in many areas for this time of the year.

Current and forecast warm, dry and windy conditions will set the curing process in motion and grasslands will begin drying out, increasing the potential of fire ignition and rate of spread. The curing process can proceed rapidly under the right environmental conditions. However, rainfall before 60% curing will slow the curing process, but generally rainfall after 60% will not delay the curing of mature grass.

As grasses cure, the amount of dead material increases, heightening the potential for fire to ignite and spread. When grasses cure and fuel moisture content decreases, there is less heat required to ignite the grass. As a result, more heat is released as it combusts. Burning under these conditions can produce larger flame heights (2 m+), and fires can spread quickly, be very intense and much more difficult to suppress. Any burning in low grass curing areas will produce small flame heights and low intensities for easy suppression. Now is the time to be prepared as there can be an increased risk of grass fires for some areas, especially those areas experiencing abundant grass growth.

Depending on where you are in the country, some landscapes may already have started to form a mixture of green and yellow/brown as grasses begin the curing phase. Grass curing over a landscape is most likely to be patchy over a series of paddocks/areas, especially during the 40-80% curing period. Curing can also be patchier with variations due to topography and species type.
In some areas, curing can become more continuous. Above 80% curing, grass fuel moisture content begins to be significantly influenced by the environmental factors (humidity and temperature and wind speed).
For some parts of the country still undergoing bouts of rainfall, it's not uncommon to see green grass growth under the dry vegetation. This can help reduce or halt a fire's spread (depending on the amount). However, fires will still race through this "thatch", or along the tops in places experiencing a dense/continuous top cover of dry grass.

What would a weak El Niño mean for NZ?

The indications for the current weak El Niño event that could still develop suggest that it will not follow a typical El Niño climate pattern. New Zealand will likely experience deviations from the typical south westerly air flow patterns (to more southeast to northeast air flows), with the Tasman Sea and Southern Ocean continuing to influence weather across the country.

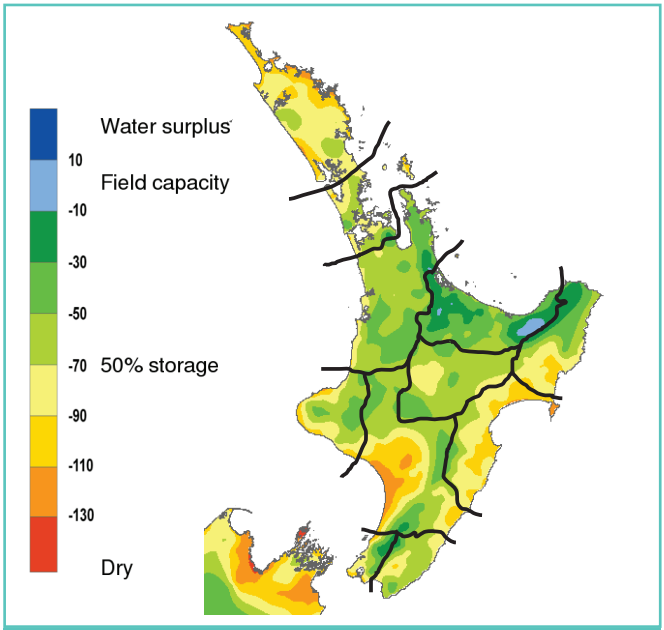

Figure 3. Soil moisture deficits as of 08/01/2019.
Source: NIWA.

Note: Soil moisture deficit means the amount of water needed to bring the soil moisture content back to field capacity, which is the maximum amount of water the soil can hold.

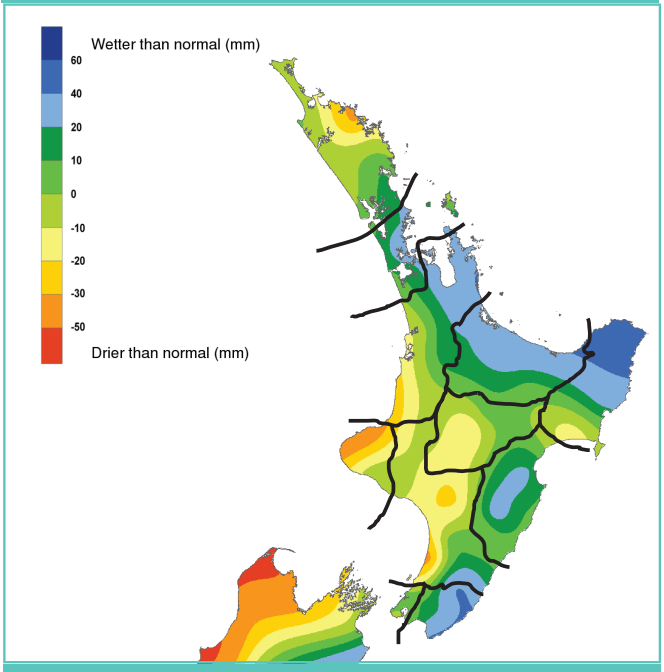

Figure 4. Soil moisture anomaly as of 08/01/2019.
Source: NIWA.

Note: Soil moisture anomaly means the difference between the historical normal soil moisture deficit (or surplus) for a given time of year and actual soil moisture deficits.

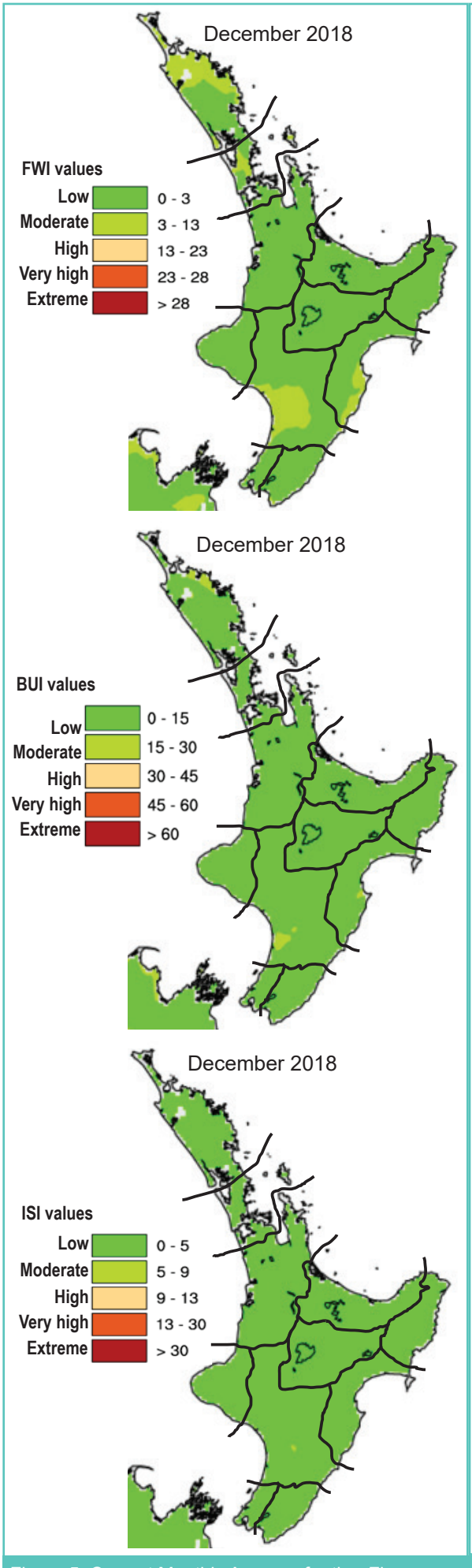

Figure 5. Current Monthly Average for the: Fire Weather Index (top), Buildup Index (middle) and Initial Spread Index (below).

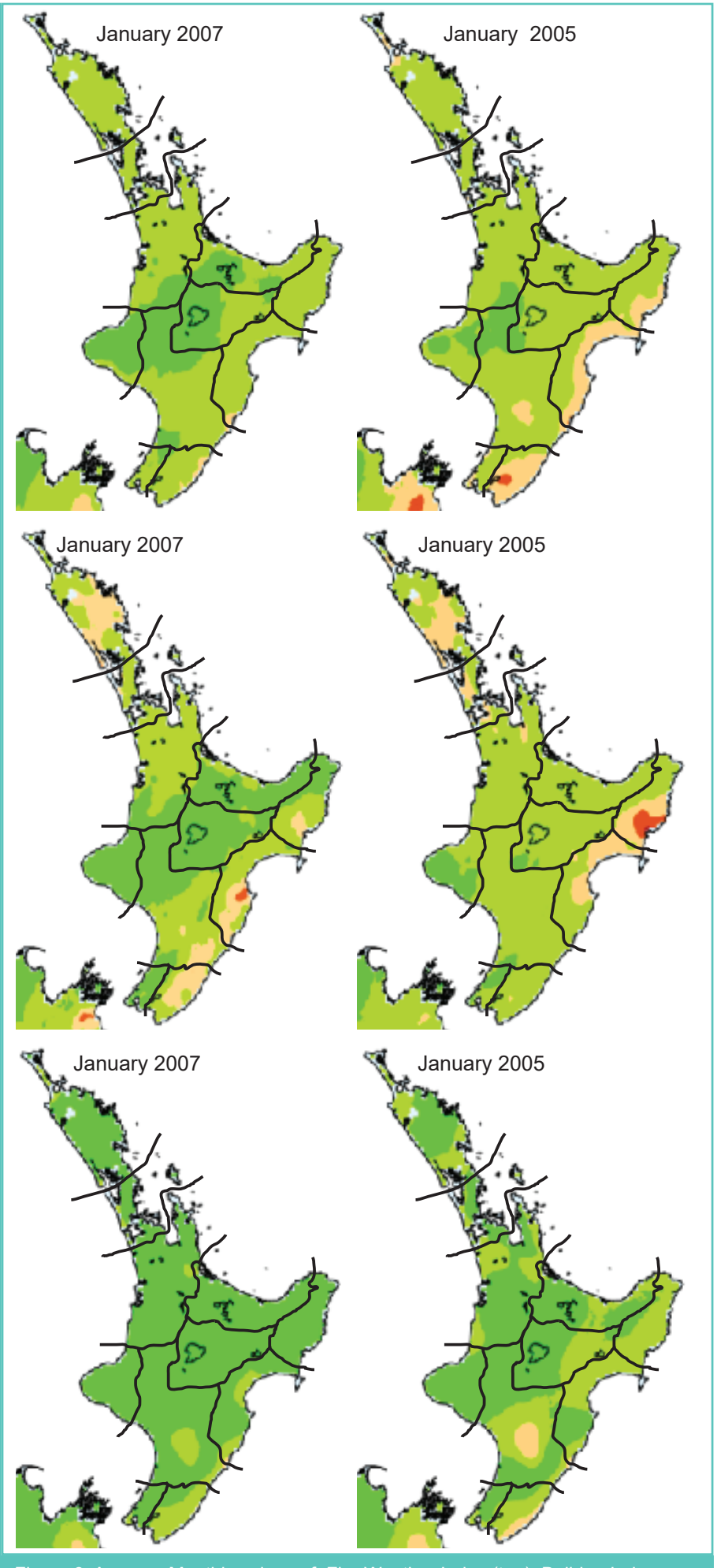

Figure 6. Average Monthly values of: Fire Weather Index (top), Buildup Index (middle) and Initial Spread Index (below); and during the 2006/07 (left) & 2004/05 Neutral year followed by a weak El Niño (right).

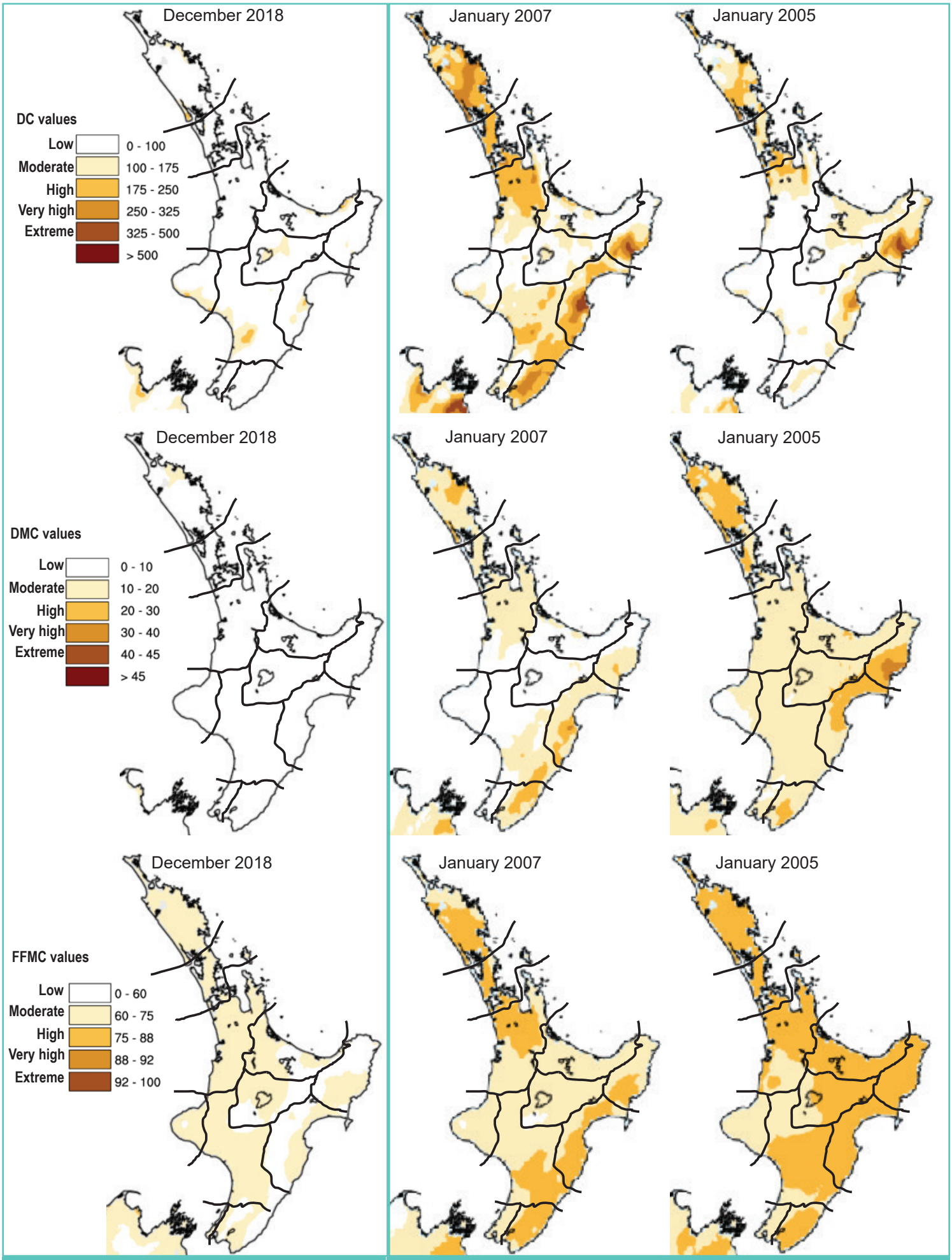

Figure 7. Current monthly average for the: Drought Code (top), Duff Moisture Code (middle) and the Fine Fuel Moisture Code (below).

Figure 8. Average monthly values of: Drought Code (top), Duff Moisture Code (middle) and Fine Fuel Moisture Code (below); and during the 2006/07 (left) & 2004/05 Neutral year followed by a weak El Niño (right).

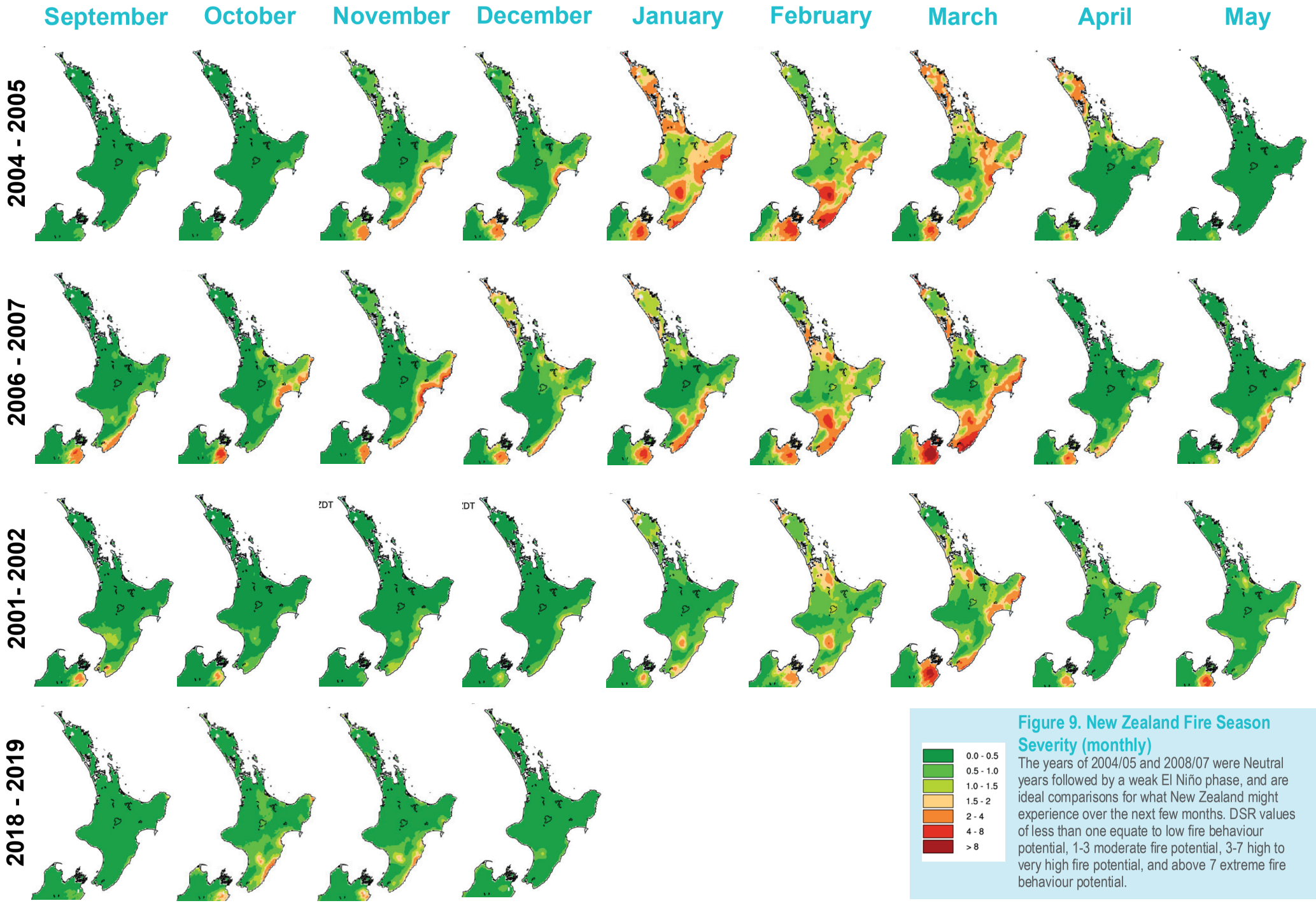

Figure 9. New Zealand Fire Season Severity (monthly)

The years of 2004/05 and 2008/07 were Neutral years followed by a weak El Niño phase, and are ideal comparisons for what New Zealand might experience over the next few months. DSR values of less than one equate to low fire behaviour potential, 1-3 moderate fire potential, 3-7 high to very high fire potential, and above 7 extreme fire behaviour potential.

Note:

The purpose of these monthly outlooks is to provide a heads up on the progression of fire danger as we transition from spring to summer and, later, into autumn. It aims to forewarn fire agencies of current and potential fire danger conditions that can be used as a prompt for local and regional discussions on fire potential (which depends on fuel conditions (i.e. grass curing), risks of ignitions, recent fire history and fire management resources available in an area, as well as climate and fire weather).

Continue your pre-planning (if you haven't done so already), by discussing where conditions are at where they are heading, and how this can drive awareness about what this might mean in your patch and for your neighbours.

Tracking trends
Comparisons of fire dangers for individual indicator stations for different regions are not shown in this outlook due to the low fire danger and severity across the country. As fire dangers increase, more detailed regional outlooks will recommence highlighting where Buildup Index (BUI), Drought Code (DC) and Cumulative Daily Severity Rating (CDSR) values sit in comparison with previous fire seasons.

For those who are interested in tracking fire season trends for all your weather stations, the graphs are still available monthly on the Scion Rural Fire Research website. If tracking on a more frequent basis (as opposed to the monthly analysis done here), you can contact Scion for the data.

Background info on FWI codes and indicies:

Fine Fuel Moisture Code (FFMC)
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 (DMC) 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 mopup needs
11 - 20	Moderate
21 - 30	Difficult
31 - 40	Difficult & extended
41 +	Difficult & extensive

Drought Code (DC) 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 mopup needs
101 - 175	Moderate
176 - 250	Difficult
251 - 300	Difficult & extended
301 +	Difficult & extensive

Buildup Index (BUI)
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 (ISI) 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 (FWI)
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 (DSR) 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.

0 - 1	Low fire behaviour potential
1 - 3	Moderate fire potential
3 - 7	High to very high fire potential
7 +	Extreme fire behaviour potential

Monthly Severity Rating (MSR) 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.

Acknowledgements:
Fire Danger interpretation was from information gathered from the Average Monthly Maps for: Severity Rating, FWI, BUI, ISI, DC, DMC, FFMC. These maps were obtained from the Fire and Emergency New Zealand's Fire Weather System powered by Eco Connect.

Information on the Expected Climate Outlook was gathered from:
- MetService, Rural Monthly outlooks: www.metservice.com/rural/monthly-outlook
- NIWA, Seasonal Climate outlook: www.niwa.co.nz/climate/sco
- Australian Bureau of Meteorology Climate outlooks http://www.bom.gov.au/climate/ahead/?ref=ftr

Front Cover Image:
2018 Burn piles (V Clifford, Scion).

If you are keen to submit a weather and fire related photo that will appear on the front page, please email:
- a high resolution image(s)
- with details on the location and the photographer's name and organisation
- to: Veronica.Clifford@scionresearch.com