New Zealand Seasonal Fire Danger Outlook 2018/19

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Current fire danger situation & outlook:

On average, Very High to Extreme fire dangers and fire climate severity currently exist in Nelson, Tasman, Marlborough, Canterbury (North and South) and Otago (Queenstown Lakes and Central Otago), with Low to Moderate in remaining areas (Figures 1 & 5). This is also reflected in the current FWI System codes and indices, where high values indicate that fuel moistures are low (Figures 5 & 7). Very High and Extreme DC and DMC values exist in parts of Nelson, Marlborough, Canterbury and Central Otago, indicating that medium and heavy fuels and deep organic layers are dry and available for combustion.

In the South, soils continue to dry out, especially in northern and eastern areas (Figure 3). Small improvements were observed in Southland and Stewart Island. However, very dry soils are located in Nelson, Tasman, Marlborough, northern Hurunui district, parts of mid Canterbury and the Mackenzie district. The driest soils for this time of the year are found in the Buller and Tasman districts (Figure 4). Soils were about normal for much of the country, and wetter than normal for Oamaru, Invercargill, and Stewart Island.

The ENSO (El Niño–Southern Oscillation) index remains at neutral levels, and neutral conditions are likely for the immediate future. The ENSO Outlook has been downgraded from El Niño ALERT to WATCH as the Tropical Pacific waters began to cool over January. Above average Sea Surface Temperatures (SSTs) are forecast around New Zealand for the next three months (February to April). These SSTs will likely be the driver behind New Zealand's weather over the next few months.

February is typically the hottest time of the year for many regions and near average temperatures are expected (above 25 degrees). Expect a continuation of warm humid days, but not to the same degree that was experienced in January. Some relief is forecast in the middle of the month, with low pressure making an appearance that may bring better odds for rainfall. Over the next three months, there is an increased chance of heavy rainfall for northern parts of the South Island.

The fire season years of 2001/02 (neutral), 2004/05 and 2006/07 (weak El Niño) are possible indicators for what to expect this fire season (Figure 9). With warmer and drier conditions expected for February, vegetation and soil moisture levels will continue to dry out, further elevating the fire risk and contributing to deeper burning, and potentially faster moving fires.

In general, fire danger and fire climate severity are expected to peak in February and March for northern and eastern locations, and potentially extend into April/May for Marlborough and Otago (Figures 1, 6 & 8). Fire dangers are expected to be Low to Moderate for western and southern areas. Based on current soil moisture status and the FWI codes and indices, specific areas to watch are: Nelson, western locations of Tasman and Buller districts, coastal and inland areas of North and Mid Canterbury, Mackenzie district, and Otago (Queenstown Lakes & Central Otago). However, any heavy rainfall (especially for northern locations) may reduce the fire dangers and severity in those regions. With very dry soils across northern and eastern locations, rainfall is less easily absorbed into the ground; this will also increase the possibility of flooding if these regions experience heavy rainfall.

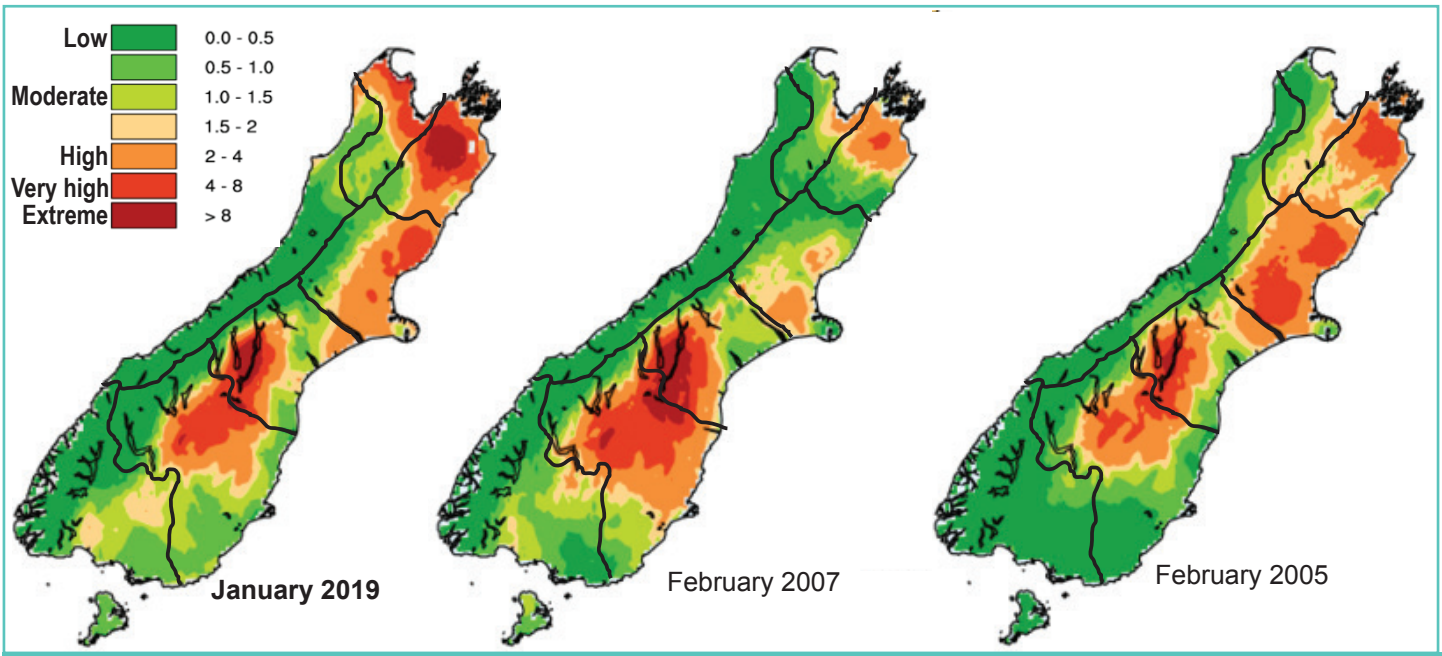

Figure 1. Monthly average Severity Rating for: current (left);
and during the 2006/07 (middle) & 2004/05 (right) Neutral years followed by a weak El Niño.

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, and ENSO-neutral conditions are likely to remain for the immediate future. Most climate models indicate the risk of El Niño has passed and it is very unlikely the ocean and atmosphere will couple in the next three months. Atmospheric indicators such as cloudiness, trade winds and the Southern Oscillation Index all continue to generally remain within the ENSO-neutral range. The Sea Surface Temperatures (SSTs) around the Tropical Pacific remain warmer than average but have begun to cool towards ENSO-neutral values during January 2019.

The ENSO outlook has been downgraded to El Niño WATCH. International climate models for the next three months (February to April) predict a 74% chance of oceanic El Niño conditions. The probability decreases further for autumn (66%) and over winter (48%). Interestingly, long range models indicate the potential for a protracted El Niño event, where above average SSTs remain above average for more than a year.

ENSO is just one of several climate drivers that can influence New Zealand's rainfall and temperature patterns. Over the next three months there is the increased chance of variability in the summer weather over New Zealand. In January, coastal waters around New Zealand remained much warmer than average. Above average SSTs are forecast for the next three months (February to April). These SSTs will likely be the driver behind New Zealand's weather over the next few months. As we approach Autumn, expect a continuation of warm humid days and low-pressure systems making an appearance.

This month: February 2019

High pressure will remain dominant for the first week, with a shift to low pressure in the second and third weeks. Westerly winds may make an appearance in the last week of the month. More rainfall is expected (compared to January), with near average rainfall and temperatures predicted for this month. Note January's temperatures will likely exceed February due to the heat wave experienced last month. However, with February typically the hottest month of the year, 'near average' temperatures can still yield days over 25 degrees.

Further ahead: February - April (Figure 2)

For the next three months (February – April 2019), slightly higher pressures than normal are forecast in the south, and lower pressure than normal in the north of the country. Weak easterly wind flows across the country are also expected. The country will likely continue to experience warm humid conditions as temperatures are forecast to be above average for all regions. Rainfall totals are predicted to be above or near normal in the north, and near normal for the remaining locations. Soil moistures are forecast to be below normal in the north and west of the island, and below or near normal in the east of the Island. Near normal or below normal river flows are expected in the north, and near normal for the remaining regions.

Note: the outlook for the next three months indicates drier than normal conditions in the north of the South Island, however there is also an increased chance of heavy rainfall for the north of the South Island (Tasman, Nelson, Marlborough, Buller) if the Tasman Sea and sub-tropics in the north become active.

Regional breakdown (Figure 2):

Temperatures are most likely to be:

- above average (50% chance) for Tasman, Nelson, Marlborough, Buller, West Coast, Alps and foothills, coastal Canterbury and east Otago, inland Otago and Southland.

Rainfall totals are most likely to be:

- near normal (45% chance) for Tasman, Nelson, Marlborough, Buller, coastal Canterbury and east Otago;
- near normal (40%) or above normal (35%) for the West Coast, Alps and foothills, inland Otago and Southland.

Soil moisture levels are most likely to be:

- below normal (40% chance) or near normal (40%) soil moistures for Tasman, Nelson, Marlborough, Buller, West Coast, Alps and foothills, inland Otago and Southland;
- near normal river flows for Tasman, Nelson, Marlborough and Buller (45%), and for the West Coast, Alps and foothills, inland Otago and Southland (40%);
- near normal (45-50% chance) soil moisture and river flows for Coastal Canterbury and east Otago.

Last month: January 2019

Looking back, January was a sunny month for many, dominated by high pressure and relatively dry south westerly winds. This combination resulted in very hot and dry January across the South Island, including Nelson, Buller, Marlborough and Christchurch. The far south received useful rainfall near the end of the month with the odd cold front passing. Warm air from Australia created strong Foehn winds and hot temperatures for eastern locations. A 5-day heatwave was recorded in Marlborough and parts of Canterbury.

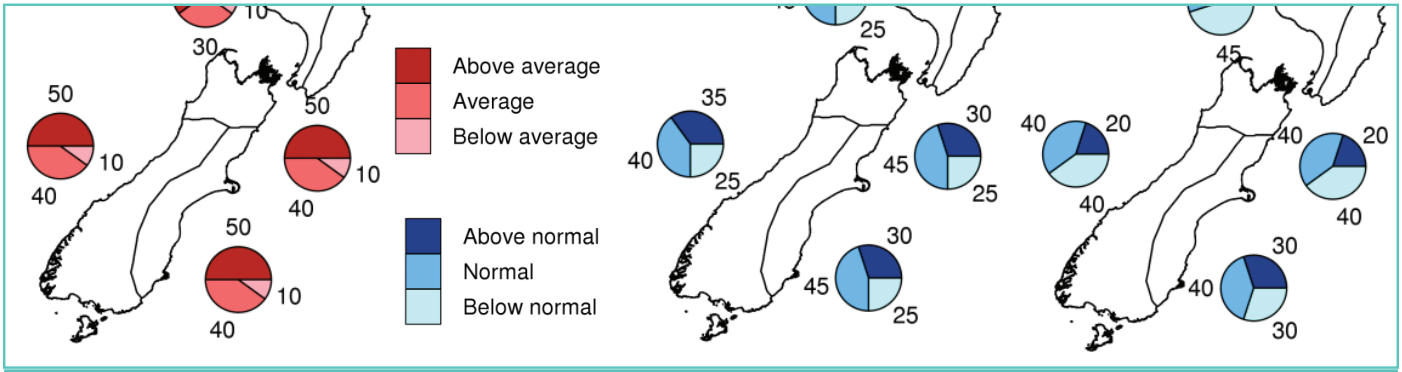

Figure 2. Outlook for Feb - April 2019: air temperature (left), rainfall (middle), available soil moisture (right). Source: NIWA.

Soil moisture (Figure 3 & 4)

In the South Island, soil moisture levels continued to decrease across northern and eastern areas (Figure 3). Very dry soils are found in Nelson, Tasman, Marlborough, coastal North and South Canterbury, and Otago (Queenstown Lakes and Central Otago) (Figure 3). Much of the West Coast is close to, or at field surplus, the exception being the Buller and Tasman districts with dry soils.

The soil moisture anomaly map (Figure 4) shows that soils are much drier than normal in the Tasman & Buller districts, and slightly drier than normal in Marlborough and Canterbury (North and South). In contrast, eastern Otago (Oamaru), Invercargill, and Stewart Island are now wetter than normal.

Fire Codes and Indices:

Although BUIs may seem below levels considered extreme, dry fine fuels under forest canopies or scrublands, and grass pastures as they brown off, can still contribute to fast fire spread and larger fire sizes, even under moderate soil moisture dryness and wind strengths. If a heat source is present in fine fuels with a FFMC of 86 or more, or grass curing over 80%, ignition will be easy, and a fire can still spread.

Grass growth:

As summer progresses, grasses continue to dry out and start appearing straw coloured. 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.

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.

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.

In some areas, the presence of dead matted material from the previous season's growth (thatch) can contribute to the ease of a fire starting and spreading. The material is often hidden underneath lush green grass that appears to have low curing (30 - 50%). However, thatch can increase a fires ability to sustain and carry a fire. These fires will typically produce small flame heights and spread in a patchy manner.

What would Neutral mean for New Zealand?

Neutral conditions encourage far more variability in weather patterns for New Zealand, whereas El Niño or La Niña tend to have more predictable patterns. Neutral weather patterns can lead to some extreme conditions – with snow following record-breaking warm temperatures, and an increase number of fires on week followed by gale force winds and floods the next.

Although ENSO events have an important influence on New Zealand's climate, it accounts for less than 25% of the year to year variance in seasonal rainfall and temperature. Under Neutral conditions, other climate factors play stronger roles in influencing New Zealand's weather. For the next three months, the warmer than normal coastal water temperatures will be a key driver of our weather.

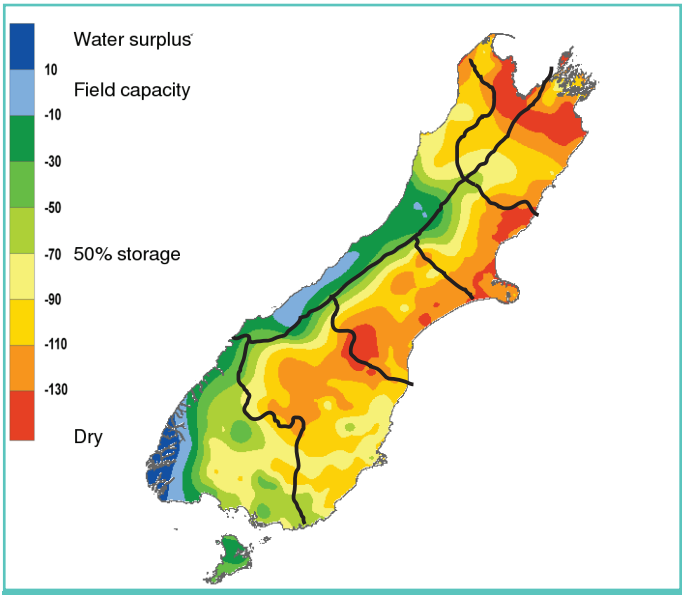

Figure 3. Soil moisture deficits as of 03/02/2019.
Source: NIWA.

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.

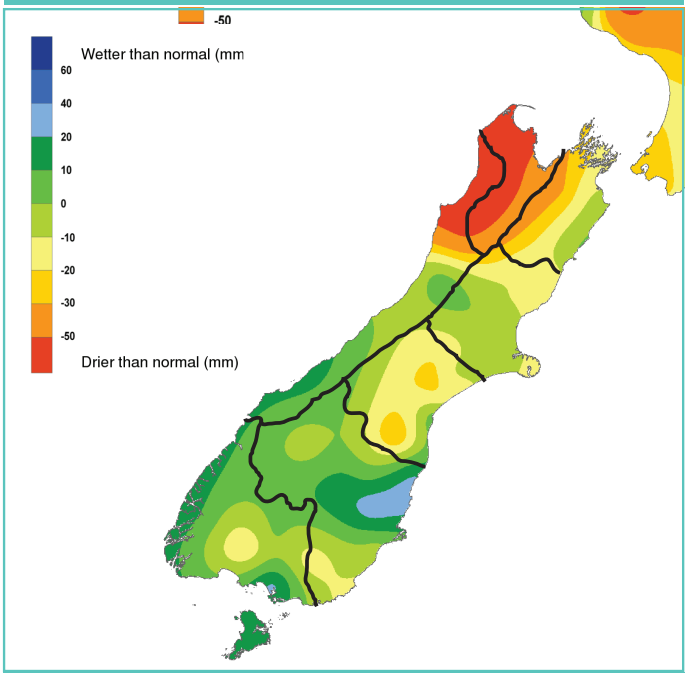

Figure 4. Soil moisture anomaly as of 03/02/2019.
Source: NIWA.

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.

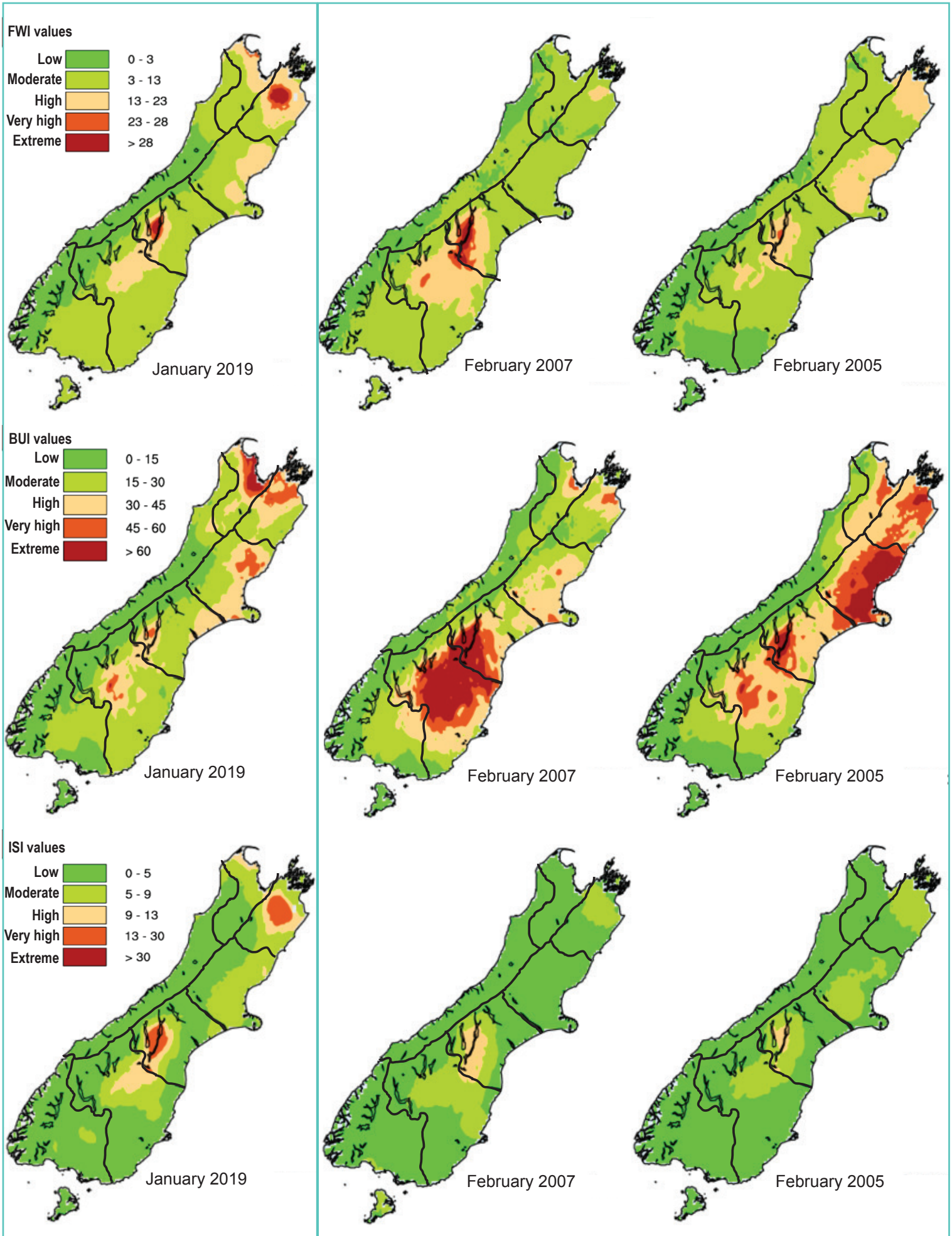

Figure 5. Current Monthly Average for the: Fire Weather Index (top), Buildup Index (middle) and Initial Spread Index (below).

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).

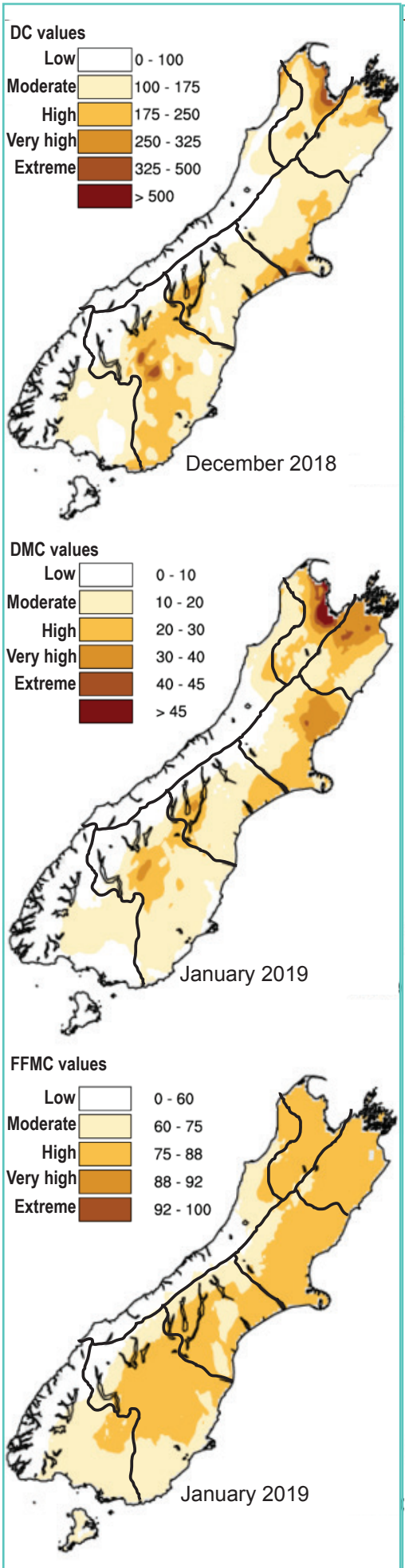

Figure 7. Current monthly average for the: Drought Code (top), Duff Moisture Code (middle) and the Fine Fuel Moisture Code (below).

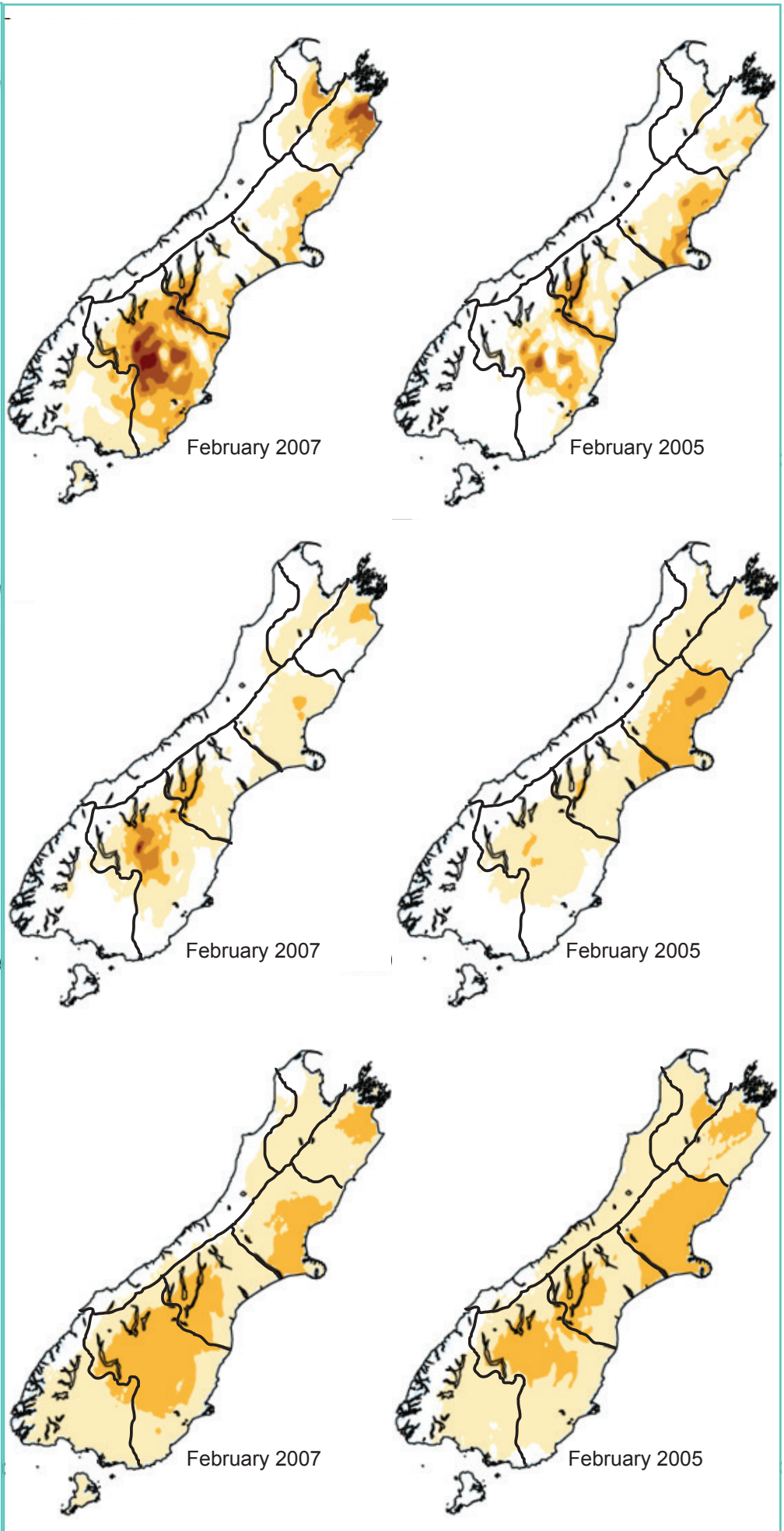

Figure 8. Average monthly values of: Drought Code (top), Duff Moisture Code (middle) and Fine Fuel Moisture Code (below); and during the 2006/07 (left) & 2004/05 Neutral year followed by a weak El Niño (right).

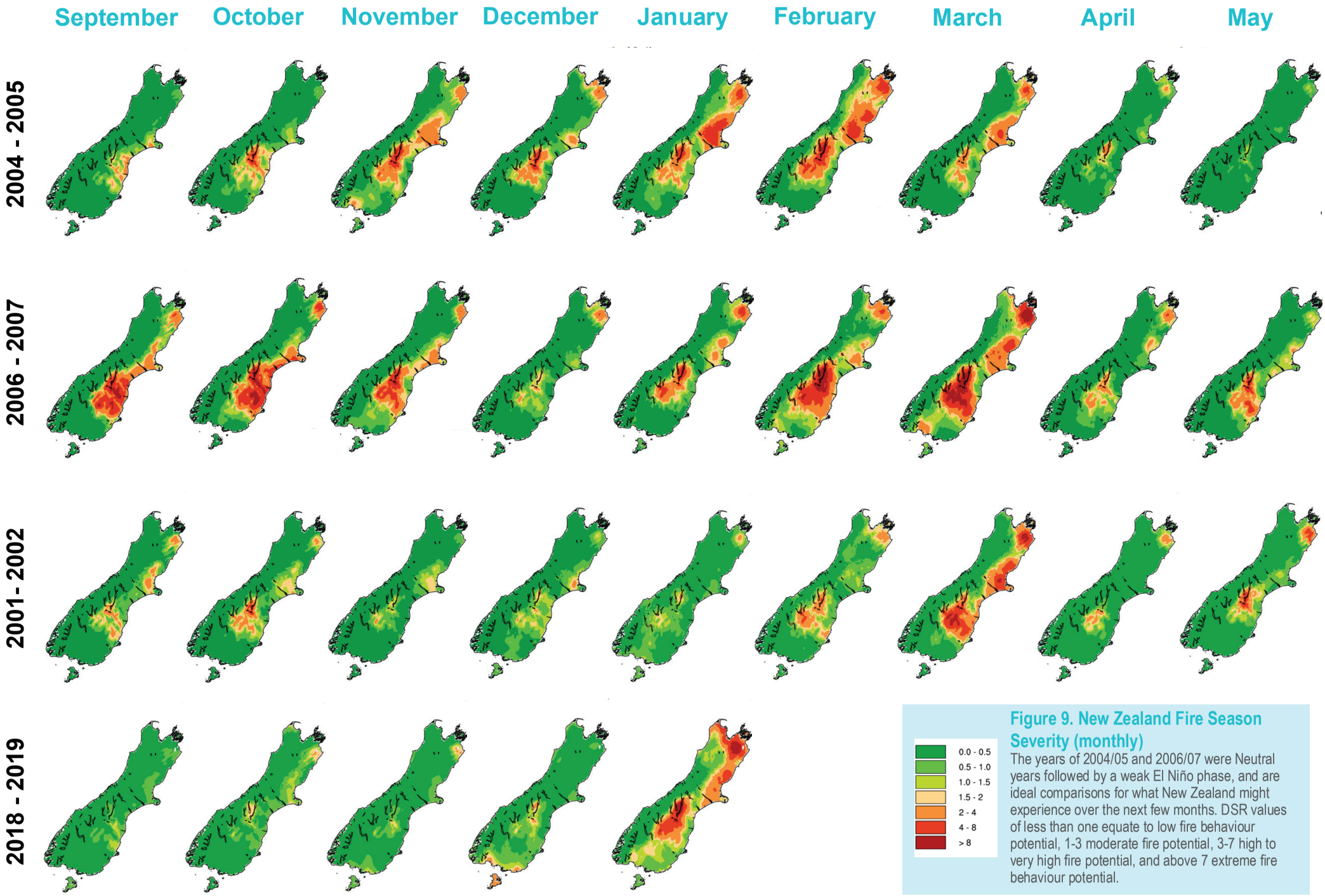

Figure 9. New Zealand Fire Season Severity (monthly)

The years of 2004/05 and 2006/07 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:
2017 Burn off, Clyde (V Clifford, Scion).

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- a high resolution image(s)
- with details on the location and the photographer's name and organisation
- to: Veronica.Clifford@scionresearch.com