New Zealand Seasonal Fire Danger Outlook 2017/18

ISSUE: South Island, March 2018

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Current fire danger situation & outlook:

Looking back at February, it was a very unsettled month. The tropics directed New Zealand's weather, with frequent lows and two Cyclones affecting the country. Persistent northerly winds resulted in an extremely wet month for many regions, with sub-tropical rainfall and humidity affecting most of the country at times.

Around the South Island, fire potential and danger is currently, on average, Low to Moderate (Figures 1 & 5). The exceptions being Marlborough, northern Canterbury (Hurunui, Waimakariri and Selwyn) and Otago, which is currently experiencing, on average, High to Extreme fire severities. This is a result of elevated Drought Code and Duff Moisture Code values (Figures 5-6 & 7-8). Central Otago is currently experiencing High to Extreme DC's and High DMC's. Southland and parts of Canterbury are still experiencing High DC's and DMC's.

This is somewhat reflected in the soil moisture deficit map (Figure 3), where soils remain dry for parts of Selwyn and Ashburton, Queenstown Lakes, Central Otago, Clutha, eastern parts of Southland and Stewart Island. Interestingly, Stewart Island soils are showing signs of climatological dryness (based on the NZ Drought Index map reported by NIWA). The regular rainfall, heavy at times, has resulted in soils being wetter than normal for this time of the year for much of the east coast (Figure 4). Soils are wetter than normal for Nelson, Marlborough, Canterbury, inland West Coast, and coastal Otago. Soils are drier than normal for Clutha, lower Fiordland and Stewart Island.

The ENSO Outlook this month is for a decaying weak La Niña. International climate models suggest a continued decay of La Niña conditions over the next three months (March to May), and a return to neutral conditions in winter (June – August 2018). The models also indicate a chance transition to El Niño conditions over the September – November 2018 period (45% chance).

New Zealand's climate over the next three-month period is expected to have warmer than average temperatures, and above normal rainfall. Expect unsettled conditions, and weak north-easterly quarter wind flows over the next three months.

March is forecast for Low pressure systems to continue to feature. A wetter than normal March is expected for Nelson and Marlborough. A drier than usual March is signalled in the south and west of the South Island. Elsewhere, normal to above normal rainfall is indicated. Expect above average temperatures to continue in March, although the extreme heat of early 2018 has passed. There is the likelihood for temperature swings to begin in March also, so intermittent cooler days are to be expected.

Because of expected warm temperatures and continued underlying dryness in the south, expect fire potential and dangers to remain elevated for North Canterbury, Mackenzie and Central Otago (Figures 1, 6 & 8). However, any major rain events will provide relief and reduce the fire dangers and severities. The fire season years of 2016/17, 2013/14, 2012/13 & 2008/09 are useful indicators of what a weak La Nina could bring for the South (Figure 9), although these years were not a good indicator of the elevated codes and indices experienced in Southland during December and January.

Note: This is the last monthly outlook for the 2017/18 fire season. It is written as a high level national summary due to conditions around the country easing as we head towards the autumn months.

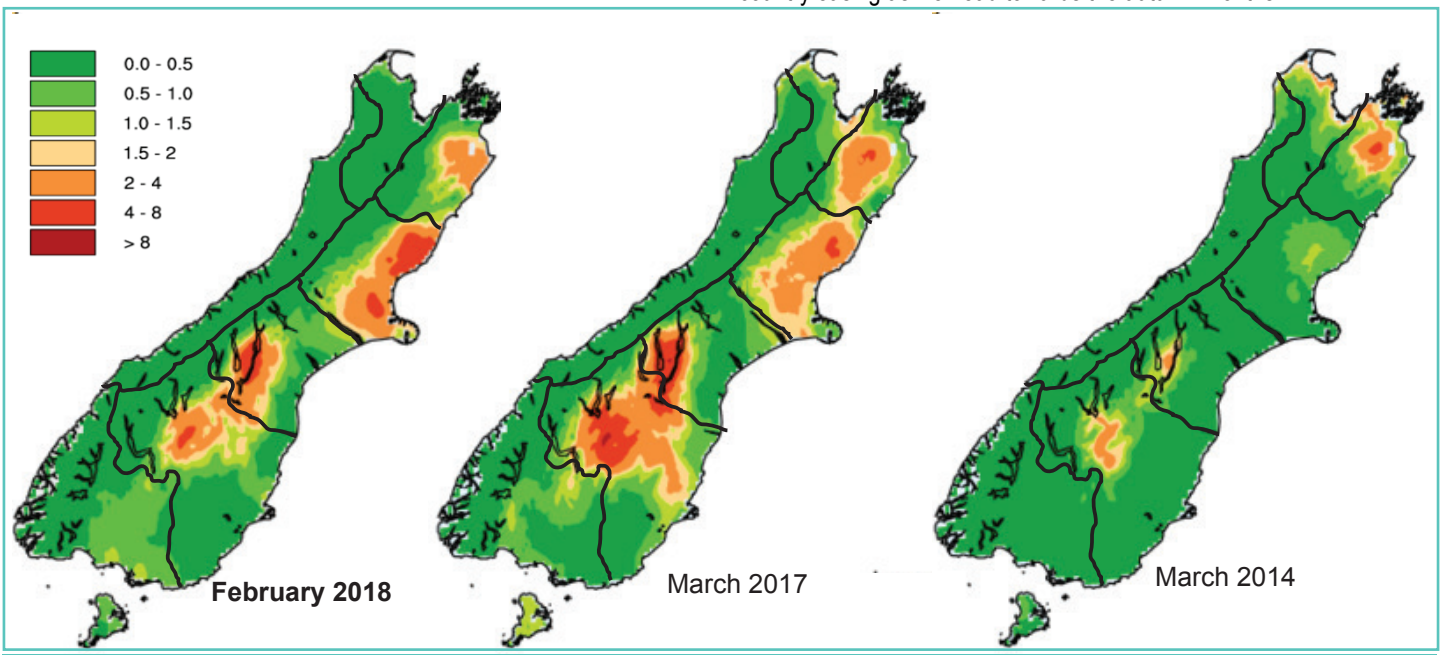

Figure 1. Monthly average Severity Rating for: current (left), last year (middle), 2013/14 Neutral year followed by a weak La Niña (right).

EXPECTED CLIMATE OUTLOOK:

Weak La Niña conditions continued in the Pacific Ocean during February 2018. The current state of the Ocean – Atmosphere system in the Equatorial Pacific signal that La Niña has reached its decay phase. The consensus from international models is for the tropical Pacific to rapidly transition to an ENSO-neutral state over the next 3-month period (March – May 2018). ENSO-neutral remains the most likely outcome over the winter season (June – August 2018), and a transition towards El Niño becomes increasingly likely thereafter (45% chance for El Niño conditions to emerge over the September – November 2018 period).

With La Niña's influence waning over the next three months, New Zealand's regional climate over March – May 2018 is expected to be driven by the warmer than average ocean waters that are present around the country (the Tasman Sea and the Southwest Pacific Ocean), which will influence surface air temperatures and the likelihood of significant rainfall events.

Soil moisture (Figure 3 & 4)

In the South Island, the driest soils are in parts of Selwyn and Ashburton, Queenstown Lakes, Central Otago, Clutha, eastern Southland districts, and Stewart Island (Figure 3). The wettest soils (soil moisture at field capacity or surplus) are located in the Sounds, Tasman, West Coast, inland Kaikoura, parts of North and South Canterbury, and the Waitaki. As a result of the recent heavy and prolonged rainfall in February, soils are wetter than normal for this time of the year along much of the east coast, Tasman and inland west coast (Figure 4). Soils are drier than normal for Clutha, lower Fiordland and Stewart Island.

This month: March 2018

This month, an intermittent ridge of high pressure is signalled across the lower South Island. While this occasional ridge should bring relatively drier conditions over the far south of the country, expect the odd cold front too, as is typical for this time of the year. A continuation of frequent northerly to easterly winds over the country is clearly indicated in the forecast. Above normal March rainfall totals are predicted for Nelson and Marlborough. Normal to above normal March rainfall is forecast for Canterbury. Otago should receive about normal March totals, while a drier than normal March is predicted for the west and south of the South Island.

Above average March temperatures are forecast across the country overall. However, it is important to understand that March is the time of year when temperature swings start to show up, and some cooler spells are likely against the warmer backdrop. Also, the extreme heat of early 2018 is likely gone - with the forecast temperature deviations being much smaller than seen so far in 2018.

Further ahead: March - May 2018

New Zealand's climate over the next three-month period is expected to be characterised by lower than normal atmospheric pressure northwest of the country, extending over parts of New Zealand. This pressure pattern, combined with the warm ocean waters around the country, is expected to be associated with warmer than average temperatures, and above normal rainfall. Expect unsettled conditions, and weak northeasterly quarter wind flows over the next three months.

For the next three months (January – March 2018):

Temperatures are forecast with high confidence to be above average for all regions of New Zealand. As autumn progresses, however, frosts may occur from time to time in cooler locations.

Rainfall totals are predicted to be above normal in north of the South Island, and about equally likely to be near normal or above normal in the west and east of the South Island. Soil moisture levels and river flows are forecast to be above normal in the north and east of the South Island. In the west of the South Island, soil moisture levels and river flows are about equally likely to be near normal or above normal.

Regional breakdown (Figure 2):

Temperatures are most likely to be:

- above average (70% chance) for Tasman, Nelson, Marlborough, Buller, coastal Canterbury & east Otago;
- above average (60% chance) for West Coast, Alps and foothills, inland Otago & Southland.

Rainfall totals are most likely to be:

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

Soil moisture levels are most likely to be:

- above normal (45% chance) for Tasman, Nelson, Marlborough, Buller;
- near normal (40% chance) or above normal (35% chance) for West Coast, Alps and foothills, inland Otago, Southland;
- near normal (55% chance) for coastal Canterbury & east Otago.

Last month: January 2018

Looking back, the tropics were in charge of New Zealand's weather. With two cyclones targeting the northern South Island, it was the wettest February on record for Nelson and Blenheim (in records at both

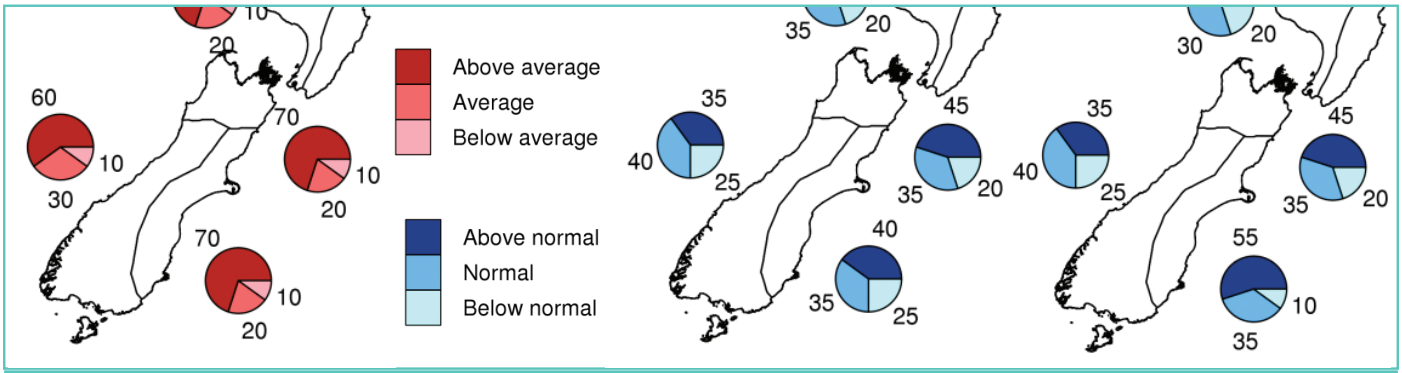

Figure 2. Outlook for Mar - May 2018: air temperature (left), rainfall (middle), available soil moisture (right). Source: NIWA.

locations starting 1941). The rainfall was 370% and 400% (four times) the usual February amount, respectively. Temperature-wise, the upper South Island was on the warm side of the ledger. In contrast, southern and inland parts of the South Island ran average to cooler than normal. 2018 temperatures have been unusual, in that February lacked the heat extremes experienced during January.

Grass growth:

As we approach the autumn months, grasslands will start to become greener (low curing values). However, dead grass remaining from this or previous seasons can contribute substantially to the amount of dead fuel in a grassland and is therefore important to include in your curing estimation. This is referred to as 'thatch'. This thatch is still capable of carrying a fire through green grass that would otherwise not burn. This influence is particularly important when the current season has curing values around 30%-50%. In the absence of thatch, this grass would not necessarily be able to sustain fire spread. Typical fire behaviour in these grasslands will produce very small flame heights, be smoky, patchy in its progression and will be low intensity.

Depending on where you are in the country, grass curing could be patchy over a series of paddocks/area, especially during the 40-80% curing period. Or if you experienced summer droughts, curing will become more continuous in the dry phase of 70 – 100% curing. Above 80% curing, grass fuel moisture content begins to be significantly influenced by the environmental factors (humidity, temperature and wind).

For areas experiencing high curing values, wildfires burning under these high grass curing conditions can spread very quickly, produce large to very tall flame heights (2 m+), be very intense and much more difficult to suppress. Some areas would also have experienced abundant grass growth over the last month, increasing the fuel loading.

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 along the tops in places experiencing a dense/continuous top cover of dry grass. Heavy and prolonged rains can delay the maturing process until the onset of hot dry weather conditions, when curing will proceed rapidly. Rainfall before 60% curing will prolong grass life and slow the curing process, while rainfall after 60% will not delay the curing of mature grass.

The finer details:

In partially cured grasslands, enough dead fuel needs to be present to ignite and sustain fire spread. Surrounding green grass with higher fuel moisture contents will require a substantial heat input to burn off excess moisture and ignite. If there is not enough heat to ignite the greener sections of the grass, fire spread will either be very patchy or not spread at all. Burning under these conditions will produce very small flame heights, will be low intensity and be easily suppressible.

It is often necessary to part the current season's grass to examine how much thatch is underneath. Even if a paddock has been harvested or grazed, there is often a couple centimetres of dead grass remaining.

What would La Niña mean for New Zealand?

La Niña tends to warm the ocean surrounding New Zealand, which encourages frequent lows and sub-tropical storms for the north, occasionally stretching down as far as Canterbury. During a La Niña, north-easterly and easterly winds are more frequent, resulting in the risk of heavy rain and flooding. New Zealand is typically warmer than average during a La Niña, although there are regional and seasonal exceptions.

La Niña typically brings more storms, clouds, humidity and rain to the north and east of New Zealand. During a La Niña summer, anticyclones are more frequent, bringing dry weather. With a weak La Niña expected, it means our 'local' climate players (the Southern Ocean southerlies and Tasman Sea lows) will continue to take turns ruling our weather. This is a good reminder that local climate patterns (blocking Highs over or near New Zealand, Lows over the Tasman Sea or to the north of the country, and the southern ocean storms) generally 'trump' climate patterns such as El Niño and La Niña.

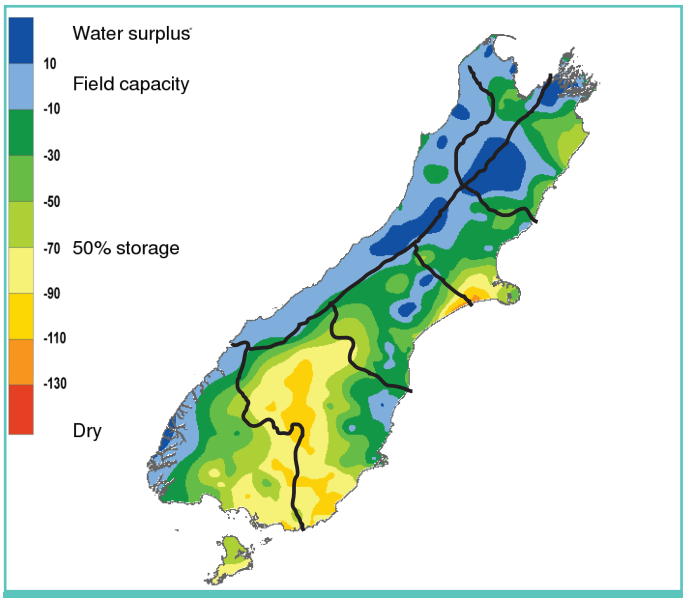

Figure 3. Soil moisture deficits as of 07/03/2018.
Source: NIWA.

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.

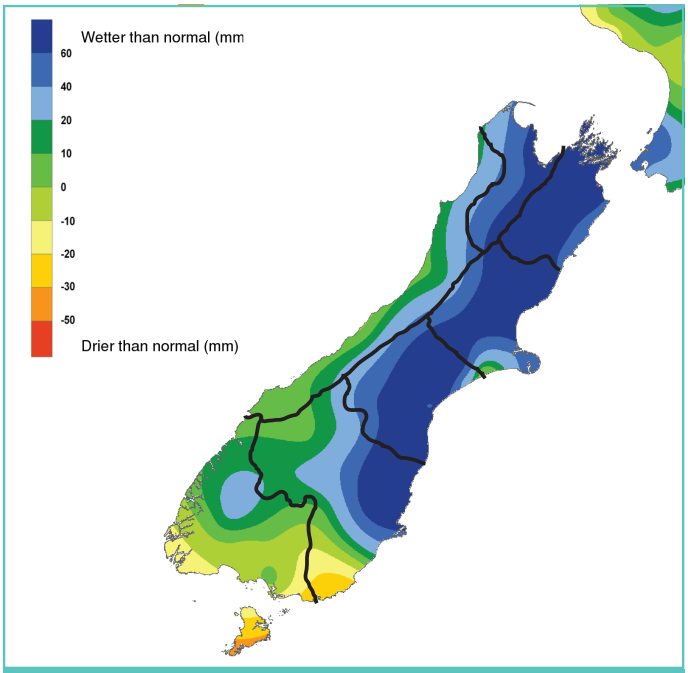

Figure 4. Soil moisture anomaly as of 07/03/2018.
Source: NIWA.

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.

Background info

The intention of these monthly outlooks is to provide a heads up on current and potential fire danger for the North and South Islands. This is not a detailed fire seasonal outlook for specific localities, nor does it summarise 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 weather and climate).

It should be used as a prompt for local and regional discussions/debates on fire potential, and where things are at, where it is heading, and to drive awareness about what this might mean in your patch and for your neighbours. Now is the chance to carry out your pre-planning if you haven't done so already.

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 National Rural Fire Authority 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 Research burn, Darfield. (Veronica 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

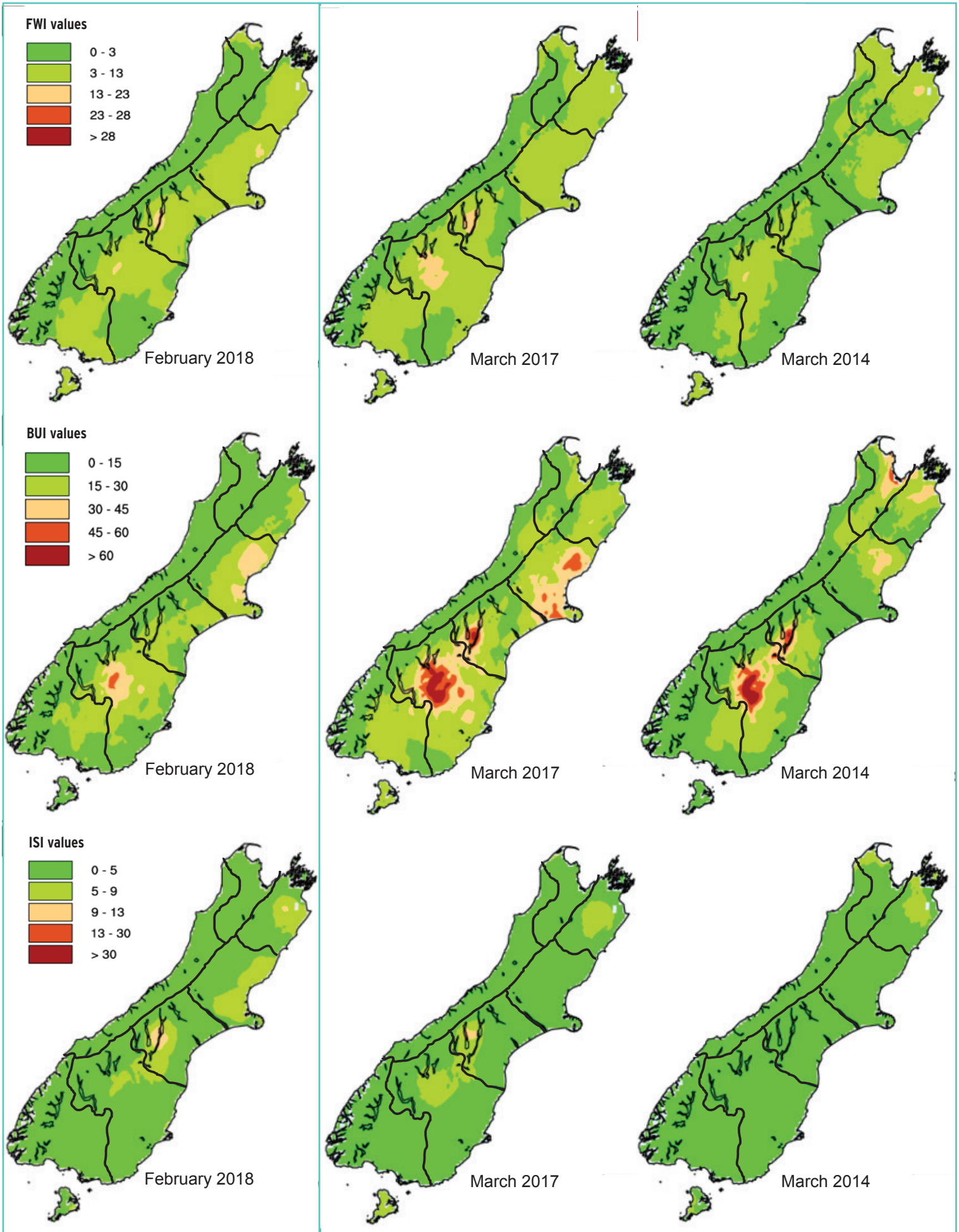

Figure 5. Current Monthly Average for the: Fire Weather Index (top), Buildup Index (middle) and Initial Spread Index (below).

Figure 6. Average Monthly values of: Fire Weather Index (top), Buildup Index (middle) and Initial Spread Index (below); for the previous year and during the 2013/14 Neutral year followed by a weak La Niña year.

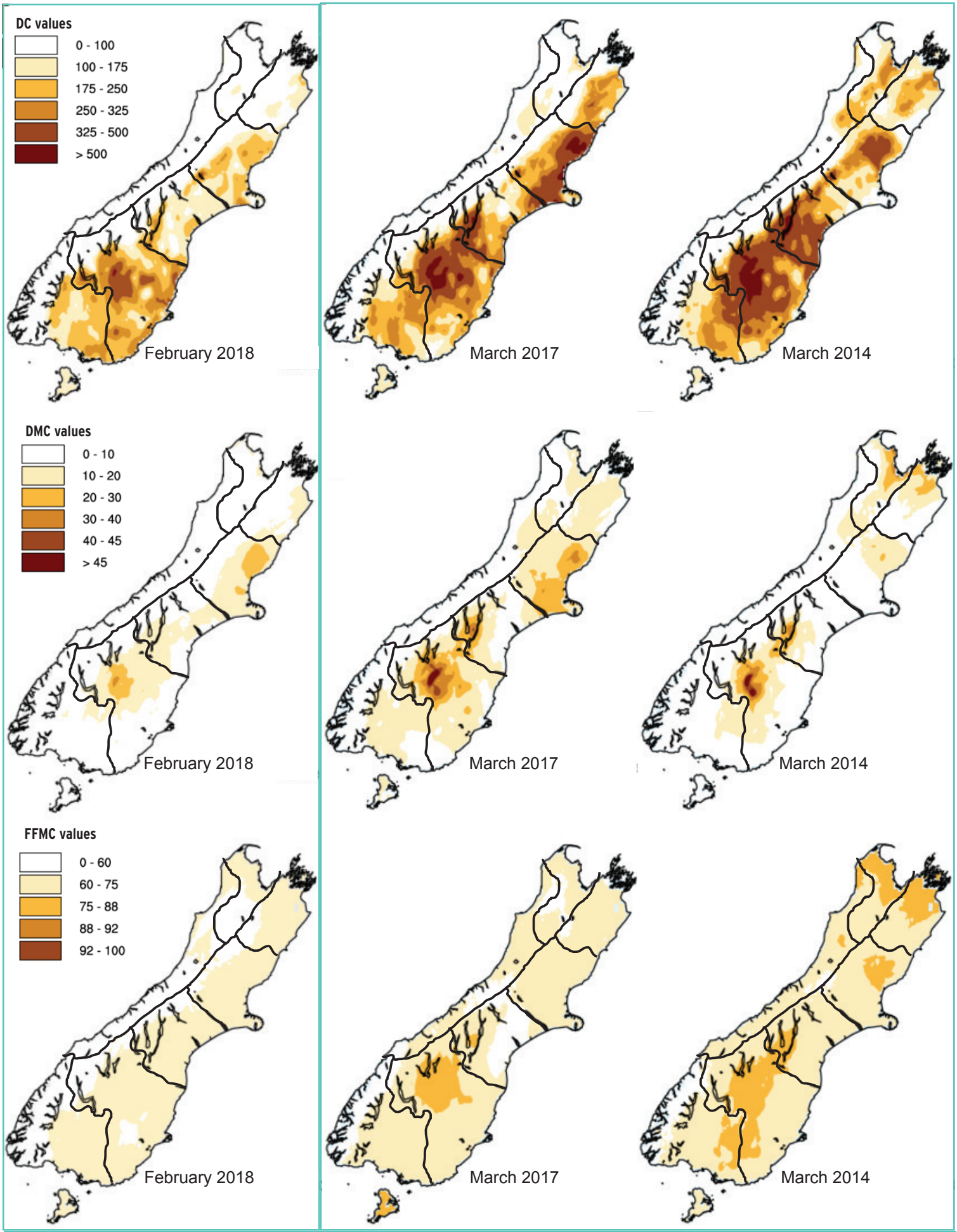

Figure 7. Current monthly average for the: Drought Code (top), Duff Moisture Code (middle) and the Fine Fuel Moisture Code (below).

Figure 8. Average monthly values of: Drought Code (top), Duff Moisture Code (middle) and Fine Fuel Moisture Code (below); for the previous year, and the 2013/14 Neutral year followed by a weak La Niña year.

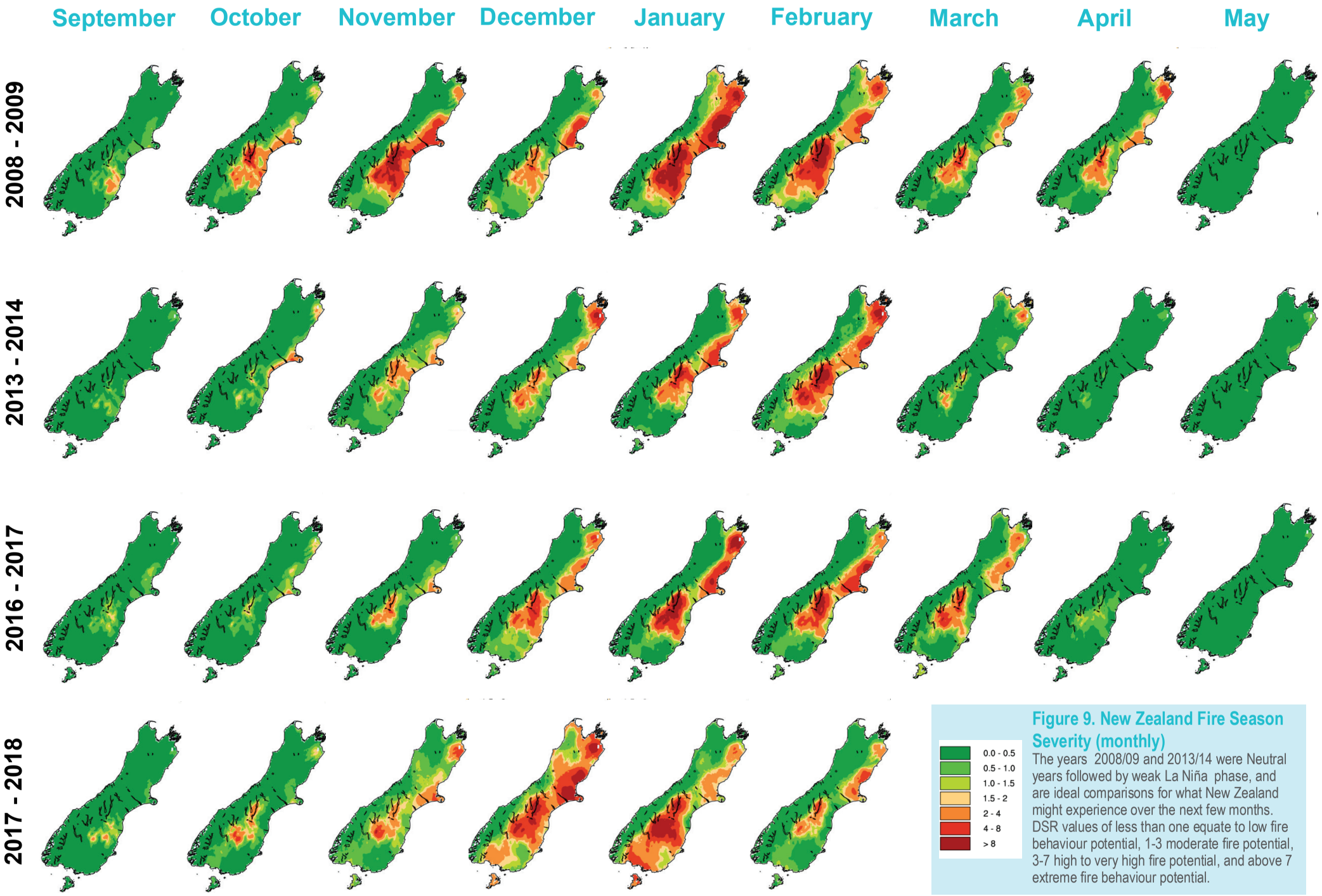

Figure 9. New Zealand Fire Season Severity (monthly)

The years 2008/09 and 2013/14 were Neutral years followed by weak La Niña 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.