Extreme rainfall and drought

This report presents indicators of extreme wet and dry weather in Aotearoa New Zealand. It comments on the current overlap in where these days occur and the geographical distribution of populations more vulnerable to extreme weather.

Key facts

- Most parts of the North and South Islands received less than their normal levels of rainfall in 2024.
- New Zealand experienced an average of 15.6 days with extreme rainfall in 2024, making it one of the drier years in recent times. Such days were most common in northern and eastern areas of the North Island, which received as many as 39 of them in 2024.
- Meanwhile, New Zealand experienced an average of 42 severely dry days and 28.3 extremely dry days in 2024, with some areas having in excess of 200 days with a deficit of rainfall that year.
- Higher concentrations of vulnerable populations live in areas that are prone to either extreme rain or dry conditions.

Climate change will increase extremes of drought and rainfall

Detecting changes in rainfall patterns in New Zealand is difficult due to the high variability in rainfall from year to year and from region to region. The variability is caused by changing weather patterns and natural climate variations such as El Niño (Ministry for the Environment and Stats NZ 2020).

Climate change is projected to cause both the annual amount of rainfall and the number of days with extreme rainfall to increase in the west and south of both islands, areas which have not historically been affected by extreme weather. An ‘extreme rainfall day’ is one where the amount of rainfall is greater than the 95th percentile during the Climate Normal Period (1991–2020).

The number of dry days (those with a deficit of moisture in the soil [NIWA 2025]) is projected to increase in the North Island and inland areas of the South Island (Ministry for the Environment 2018).

+20% **Extreme rainfall days**	**Extreme rainfall days are expected to increase by more than 20% in the south and west of the South Island by 2090** (Ministry for the Environment 2018).
+5% **Dry days**	**Dry days are expected to increase by about 5% by 2090 across New Zealand (up to 10 more days per year)** (Ministry for the Environment 2018).

Extreme rainfall and drought can have several effects on health

Variations in rainfall patterns can affect health in several ways:

- Drinking water: Prolonged drought can reduce the quality and the amount of drinking water available. Flooding caused by extreme rain can also affect the quality of drinking water. New Zealand's populations that rely on rainwater tanks for their drinking water supply can be particularly affected by periods of drought (McMichael 2013). See the 'Drinking water' domain for more information.

- Gastrointestinal infections: Heavy rainfall washes disease-causing pathogens into waterways, where they can contaminate drinking water sources. Studies show a positive association between heavy rainfall and campylobacteriosis outbreaks, such as in Havelock North in 2016 (Gilpin et al 2020).

- Leptospirosis: Floods displace rodents from their usual habitats, which may then congregate around houses where food is easily available. Rats are known to carry a variant of the leptospirosis bacteria, which may survive in flood water or soil for several days before infecting a human host (Vallee et al 2023). See the 'Climate sensitive diseases' indicator for more information.

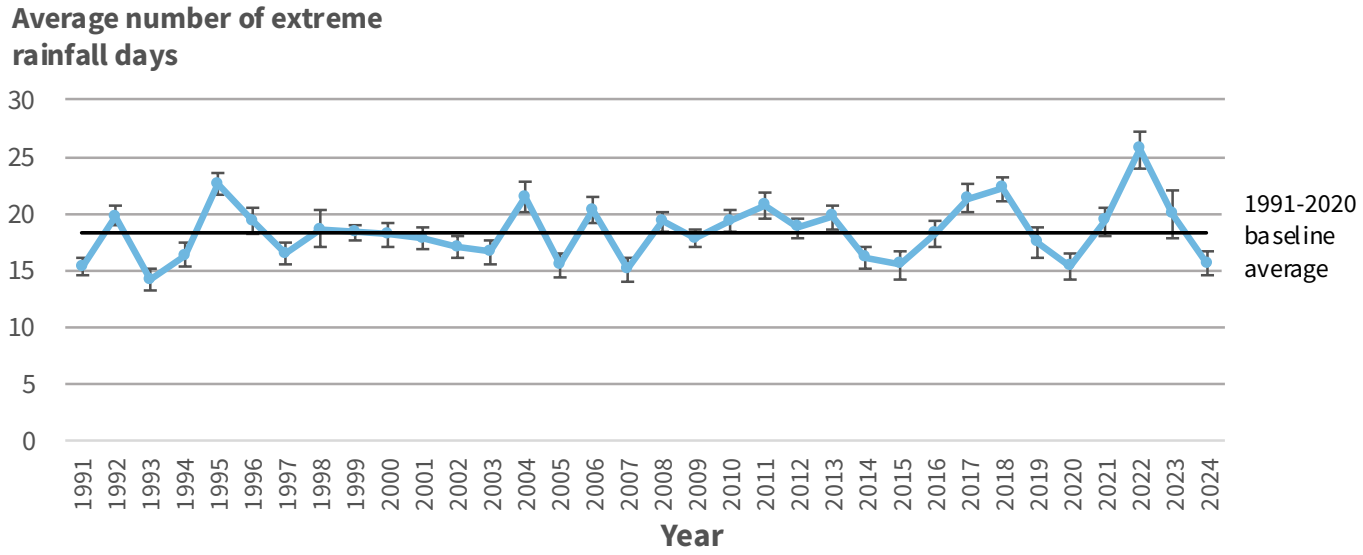
- Food: Drought can reduce crop production, meaning less food is produced and potentially raising the prices of what is available. Food from freshwater sources will also be diminished. Extreme rainfall can also damage crops or prevent harvests (McMichael 2013).

- Mental health: Drought can strongly affect mental health, particularly for those in rural areas who rely on rain for their livelihoods. Similarly, extreme rainfall can lead to flooding or landslides, damaging infrastructure and property - and placing severe mental stress on those affected (McMichael 2013).

Extreme rainfall is variable, but its effects are highly localised

During the Climate Normal Period (1991–2020), which sets a baseline for climate variables like temperature and rainfall, the annual average number of extreme rainfall days per year was 18.2 (about 5% of days in a year). In 2024, the average was 15.6 (Figure 1). In the last ten years of data, the number of annual extreme rainfall days has been more variable, with both the all-time record high (25.6 days in 2022) and some of the lowest ever tallies occurring within two years of each other.

Figure 1: Average number of days with extreme rainfall, 1991–2024



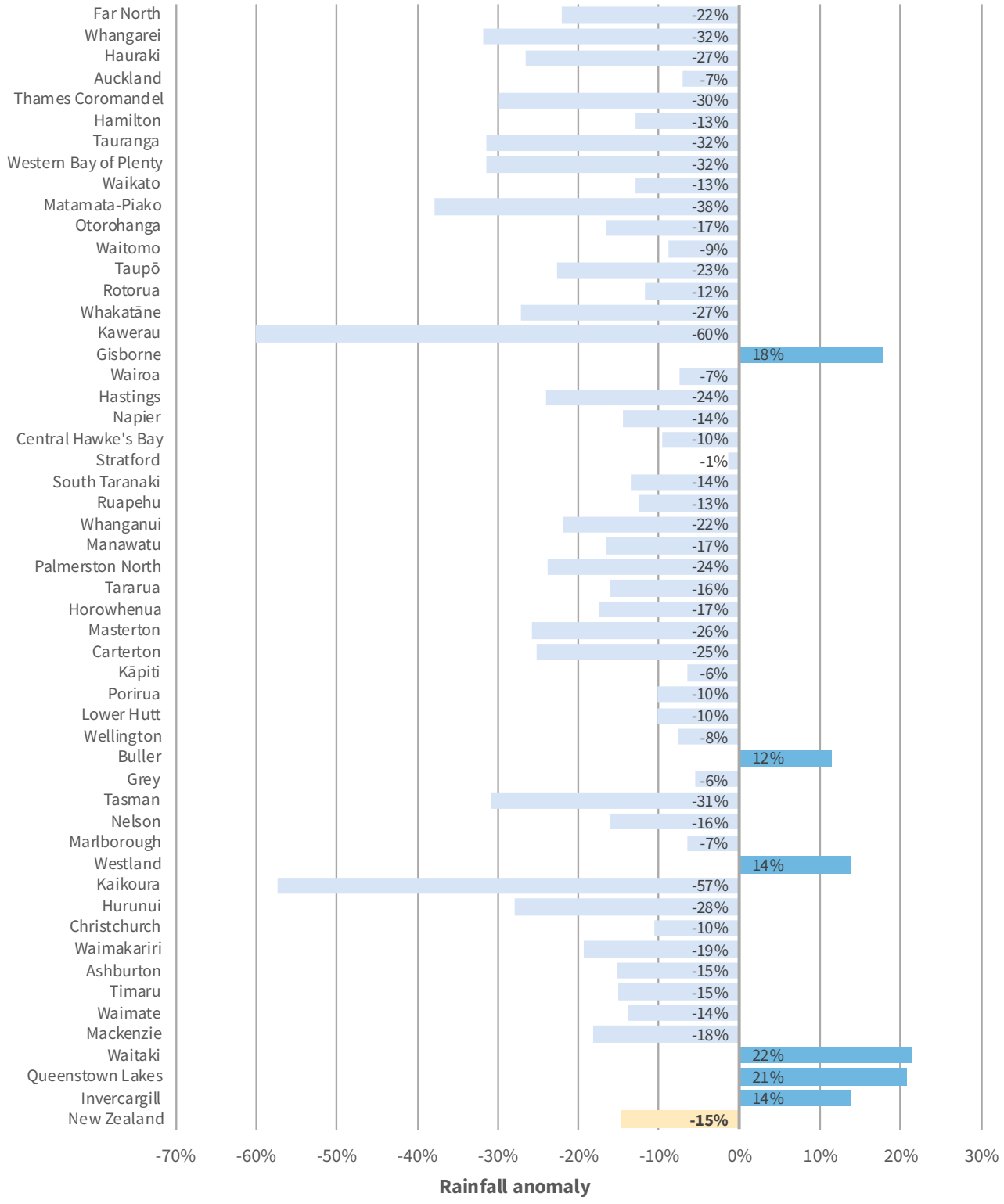
Note: 95% confidence intervals have been presented as vertical bars. The baseline refers to the most recent Climate Normal Period, 1991–2020. Thirty years of data were averaged to act as a benchmark against which current or recent observations can be compared.
Source: NIWA

Figure 2 shows the 'rainfall anomaly' for every Territorial Authority (TA) with valid data (see 'data for this indicator') for 2024. 'Rainfall anomaly' compares the quantity of rainfall each TA received in 2024 to the region's annual average during the Climate Normal Period. A positive value indicates rainfall in quantities above the norm, and a negative value indicates less.

Much of the country received substantially less rainfall than normal, with Kawerau and Kaikōura receiving as little as half their typical amount of rainfall over the course of the year.

Only six districts received more than their average quantity of rain; all but one of these were in the South Island. This demonstrates that regional-level data must be considered when analysing climate patterns, as national-level data may hide important local information.

Figure 2: Quantity of rainfall compared to the Climate Normal Period (1991–2020), by TA, 2024



Source: NIWA

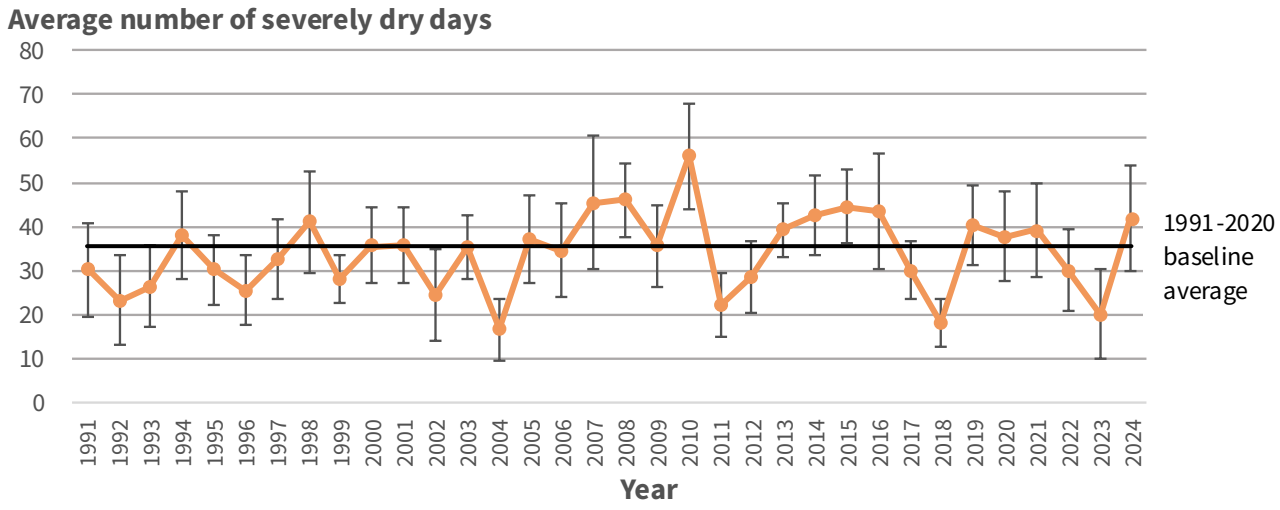
Parts of New Zealand are extremely dry for a quarter of the year or more

NIWA defines a 'severely' dry day as one where the deficit of moisture in the soil is between 110 and 130mm (ie. between 73.3–86.7% of the soil's total capacity) and an 'extremely' dry day as one where the deficit exceeds 130mm.

In 2024, the average number of days in severely dry conditions was 34.6, while the average number of days in extremely dry conditions was 19.6 (Figures 3a & 3b). Similar to rainfall, dryness has also become more variable since the mid-2000s.

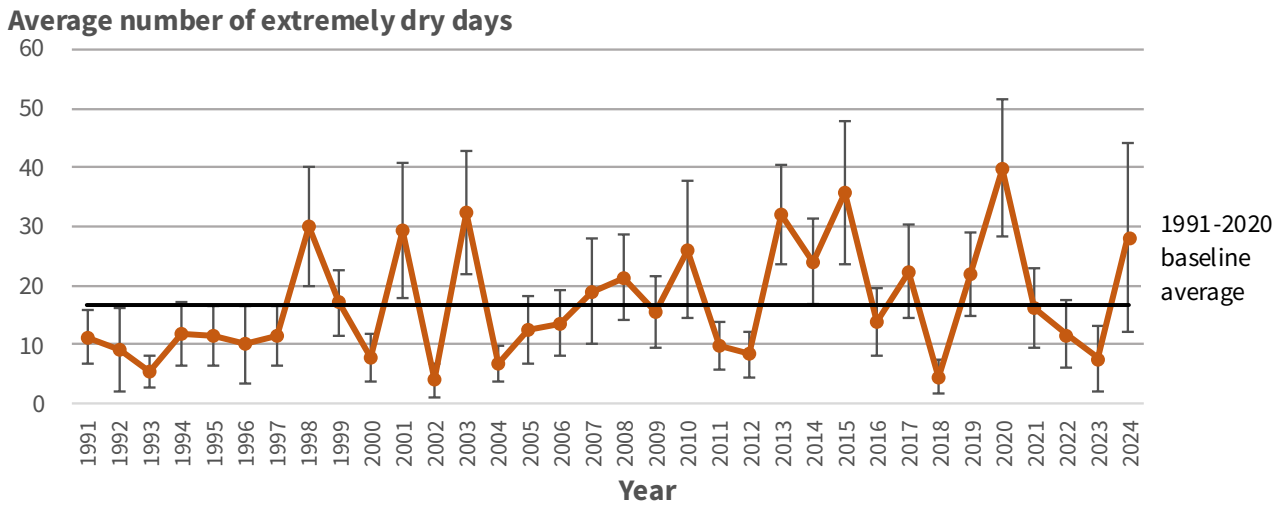
However, the prevalence of dry conditions varies greatly from place to place, with some TAs spending as many as 100 days or more in a state of severe or extreme dryness. In these terms, the driest TA was the Hurunui district, which experienced 175 extremely dry days as well as a further 56 where conditions were merely 'severely dry', totalling 231 days which were dry to varying degrees.

Figure 3a: Severely dry days in New Zealand, by TA, 2024



Source: NIWA

Figure 3b: Extremely dry days in New Zealand, by TA, 2024



Source: NIWA

The frequency of extreme rainfall and drought varies around the country

In 2024, New Zealand experienced an average of 15.5 extreme rainfall days, though several TAs, particularly in the North and East of the North Island, experienced much more than the average (Figure 4a). Note that 'extreme rainfall' refers to rain in quantities above normal levels for a given region. That is, if one region has more extreme rainfall days than another, that does not imply that the first region received more rain, only that it experienced more days of unusually high rainfall.

The greatest number of extreme rainfall days occurred in:

- Queenstown Lakes District (26 days)
- Kapiti and Westland Districts (22 days each)
- Ashburton, Gisborne and South Taranaki Districts (21 days each)

Meanwhile, New Zealand experienced an average of 42 severely dry days and 28.3 extremely dry days in 2024, with some areas having in excess of 200 days with a deficit of rainfall that year.

'Severely dry' days (where the soil moisture deficit was between 110–130mm) were most common around the central North Island and east coast of the South Island (Figure 4b).

The greatest number of severely dry days occurred in:

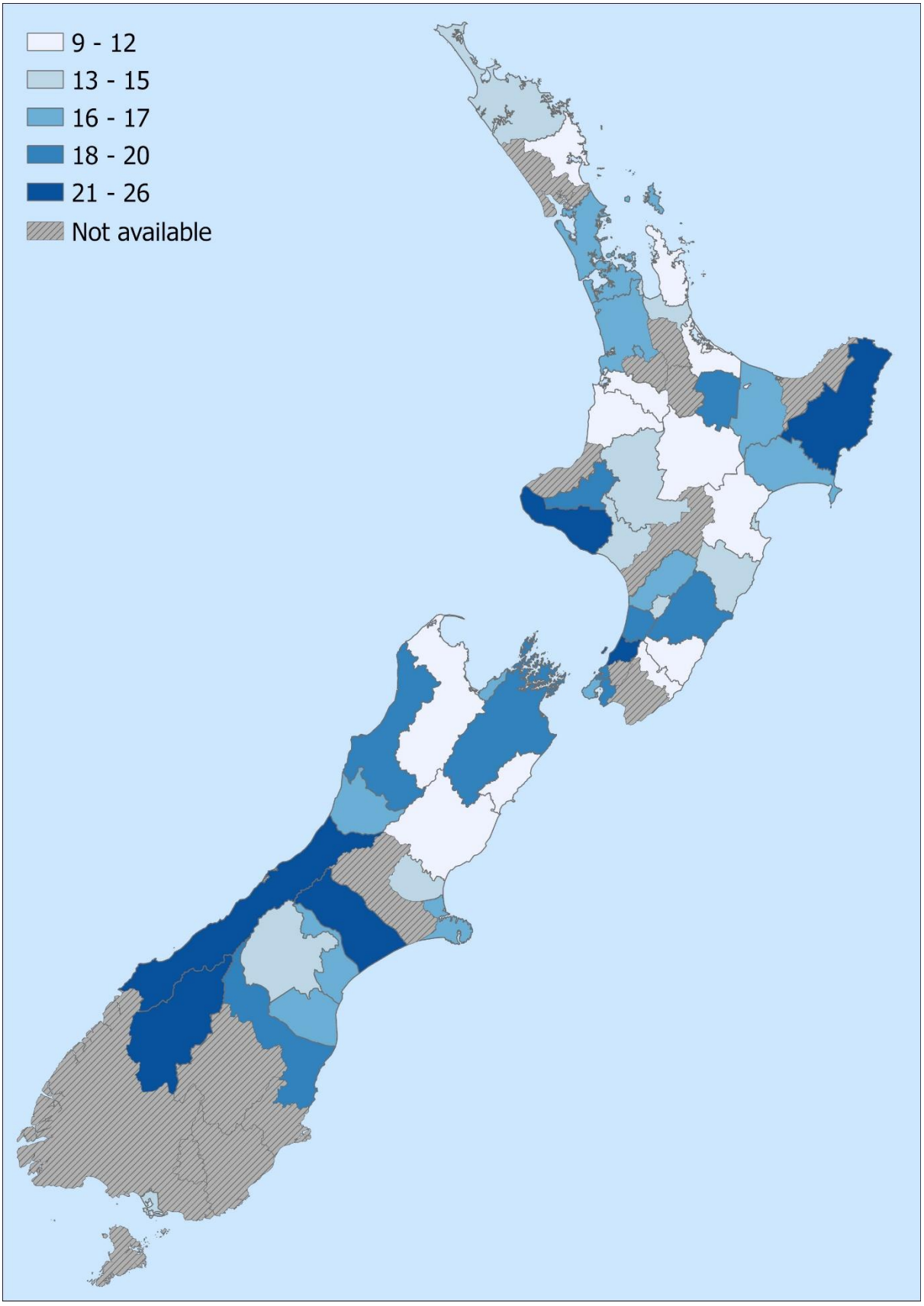
- Waimate District (138 days)
- Napier City (110 days)
- Hastings District (101 days)

'Extremely dry' days (where soil moisture deficit was 130mm or more) were most common around the upper and eastern South Island, and the Hawke's Bay area (Figure 4c).

The greatest number of extremely dry days occurred in:

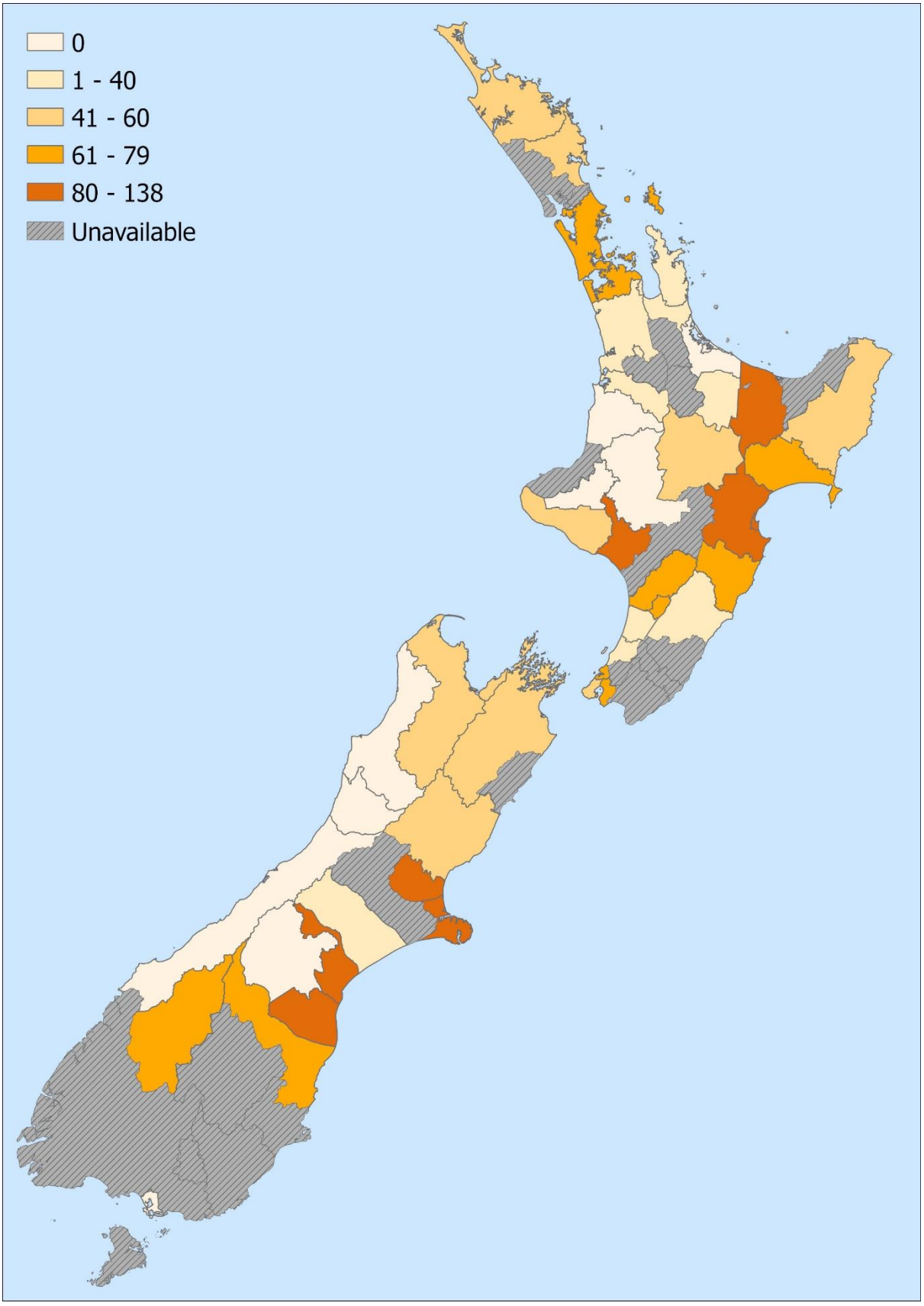
- Hurunui District (175 days)
- Tasman District (103 days)
- Christchurch City (97 days)

Figure 4a: Number of days with extreme rainfall, 2024



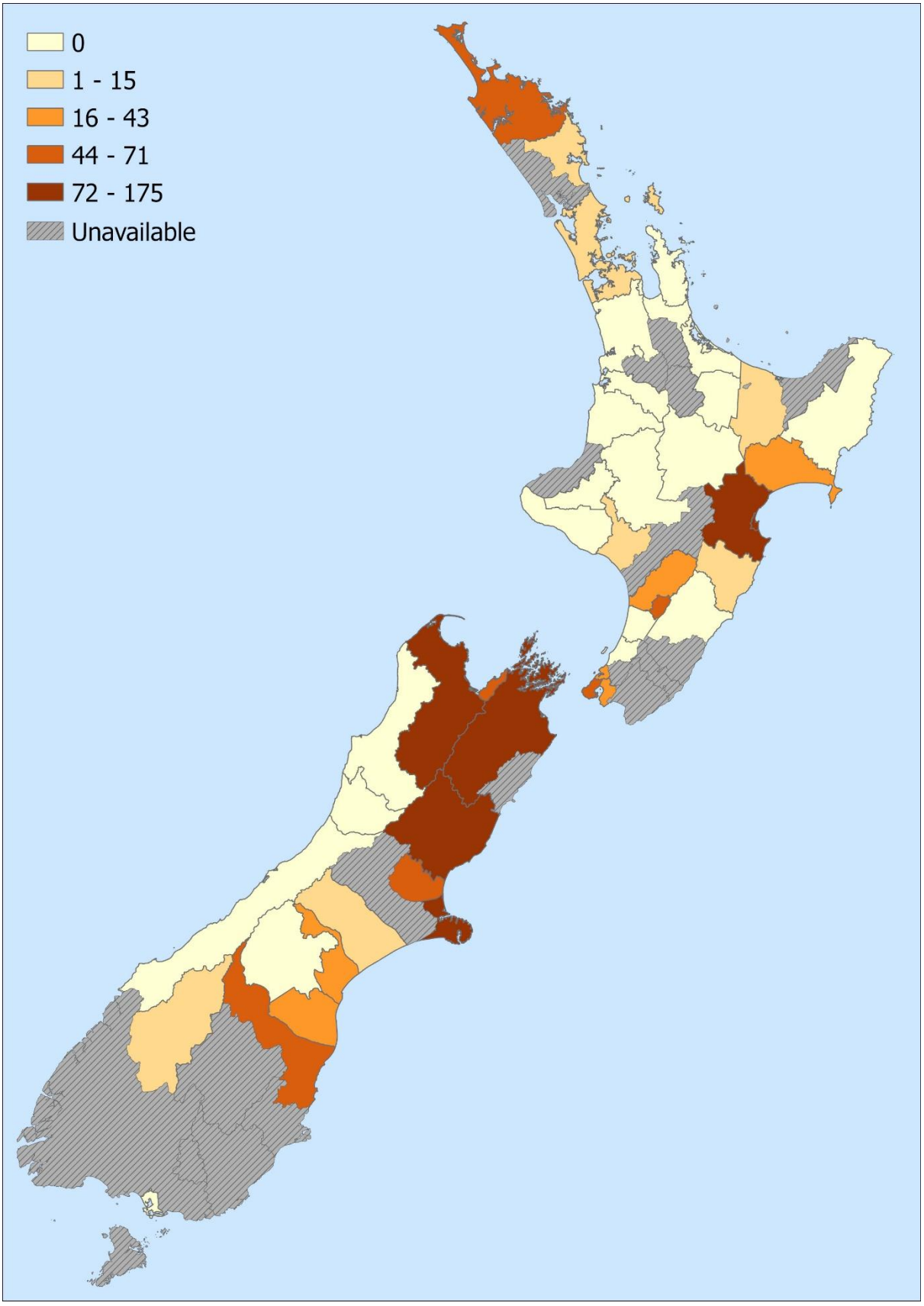
Source: NIWA

Figure 4b: Number of severely dry days, 2024



Source: NIWA

Figure 4c: Number of extremely dry days, 2024



Source: NIWA

Climate extremes and population vulnerability

Populations more vulnerable to rain or drought-related health effects are:

- young children aged 0–4 years - who are more quickly dehydrated from waterborne infection (Gamble et al 2016; Smith et al 2014)
- older people aged 85+ years - who are also more quickly dehydrated by waterborne diseases (Smith et al 2014)
- Māori communities – with high employment rates in climate-sensitive industries like farming and forestry (Te Puni Kōkiri 2007)
- people employed in primary industries - whose livelihoods may be disrupted by the effects of weather (Royal Society Te Apārangi 2017)
- rural communities - through loss of income as businesses are disrupted by wet weather, drought or flood damage (Smith et al 2014)
- those on low incomes - through inability to respond to higher food prices (Smith et al 2014).

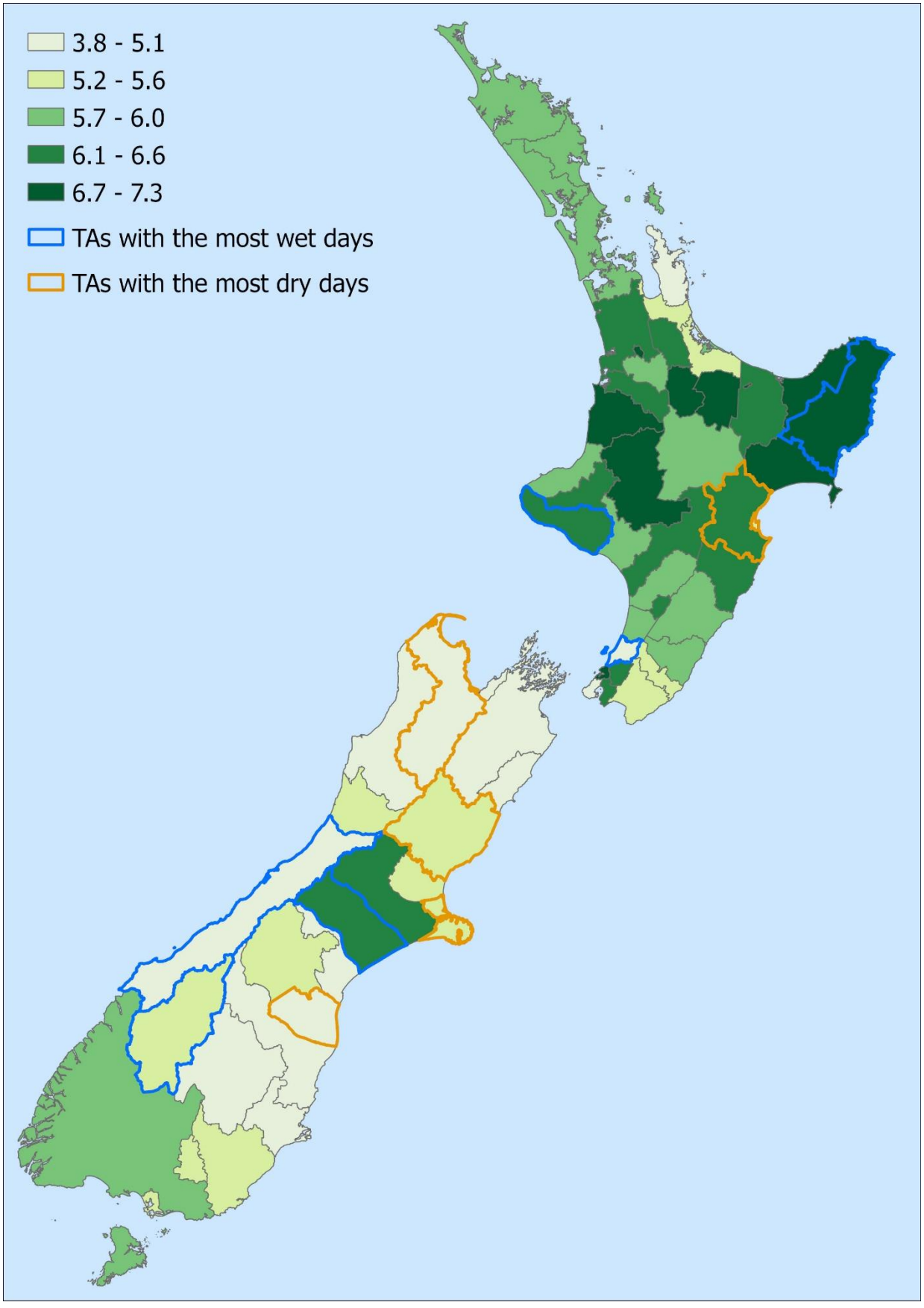
Areas with extreme rainfall, dry days and vulnerable populations

Comparing rainfall, drought and population data shows that the health effects associated with extreme rainfall are most likely to occur in the central and eastern North Island. These areas have higher concentrations of Māori, young children and people living in higher levels of deprivation.

Figures 5a – 5e below show the TAs with the most extreme rainfall days, as well as the most ‘extremely’ and ‘severely’ dry days in 2024, as listed on page six, in relation to the distribution of these vulnerable populations.

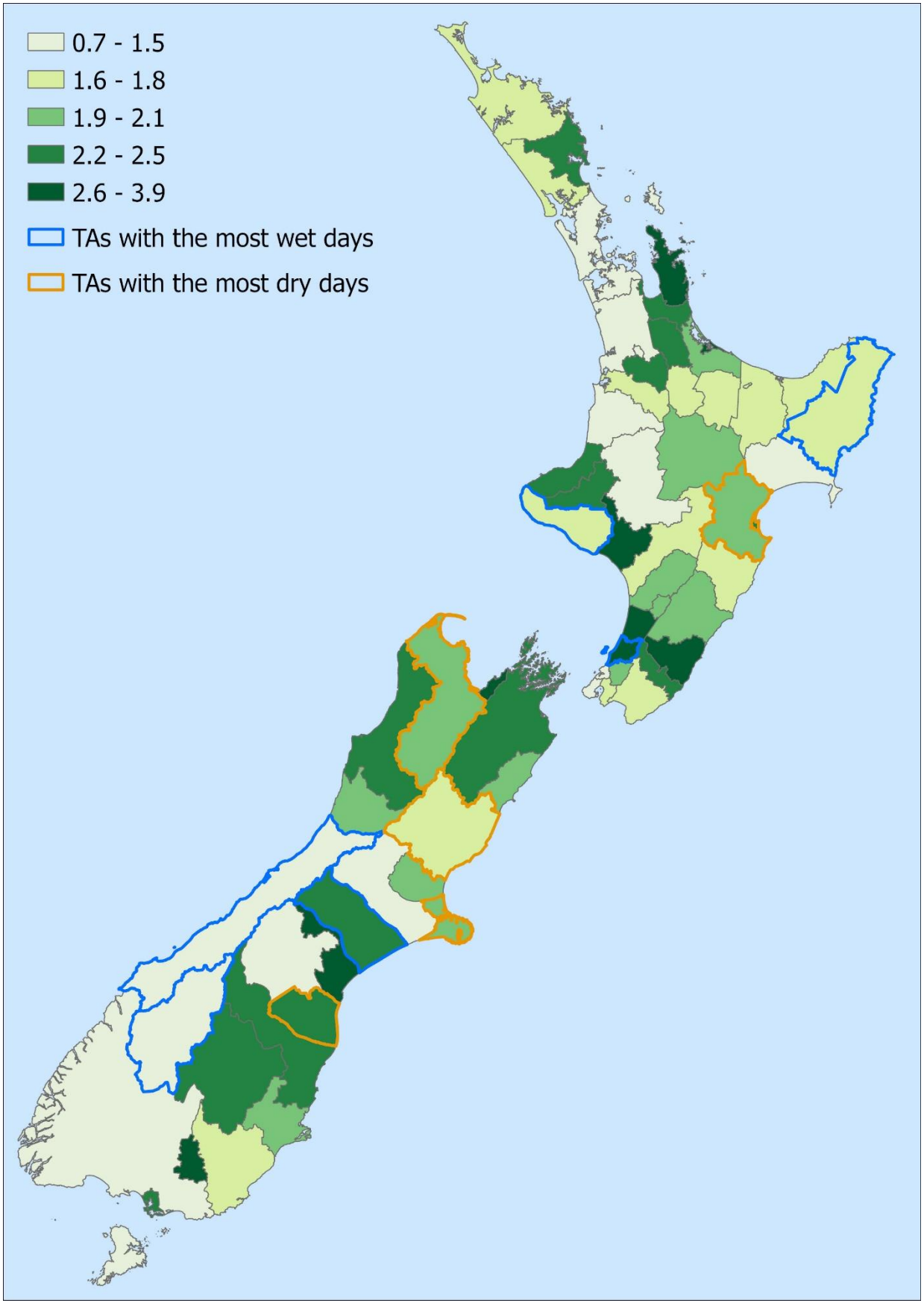
Figure 5d further suggests that increases in Soil Moisture Deficit, particularly in the South Island, would have pronounced effects on those employed in primary industries – most likely in the area of the Canterbury Plains, where the primary industries are a key employer.

Figure 5a: Children aged 0–4 years old, by TA (% of total population)



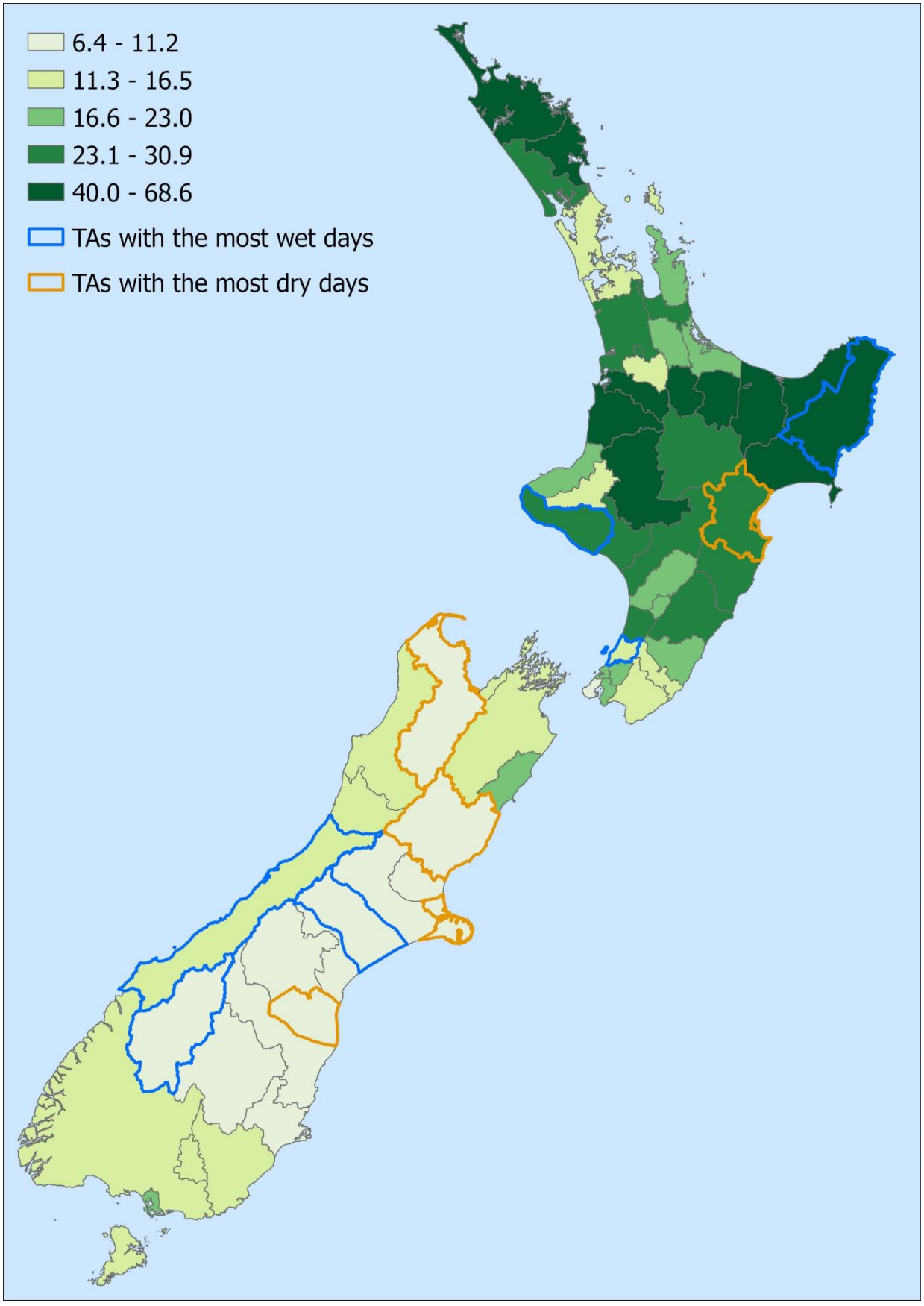
Source: NIWA

Figure 5b: Older adults aged 85+ years, by TA (% of total population)



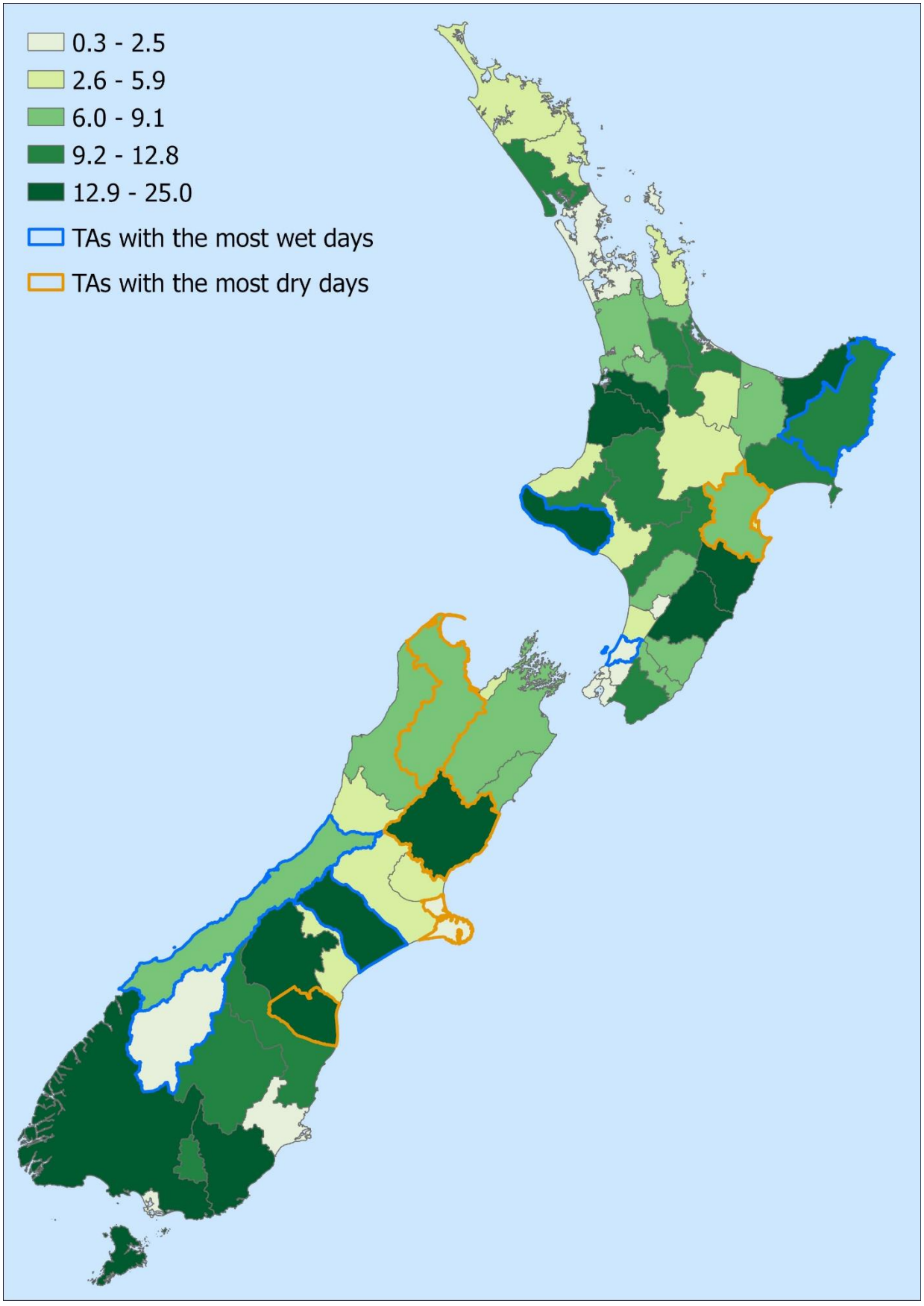
Source: NIWA

Figure 5c: Māori population, by TA (% of total population)



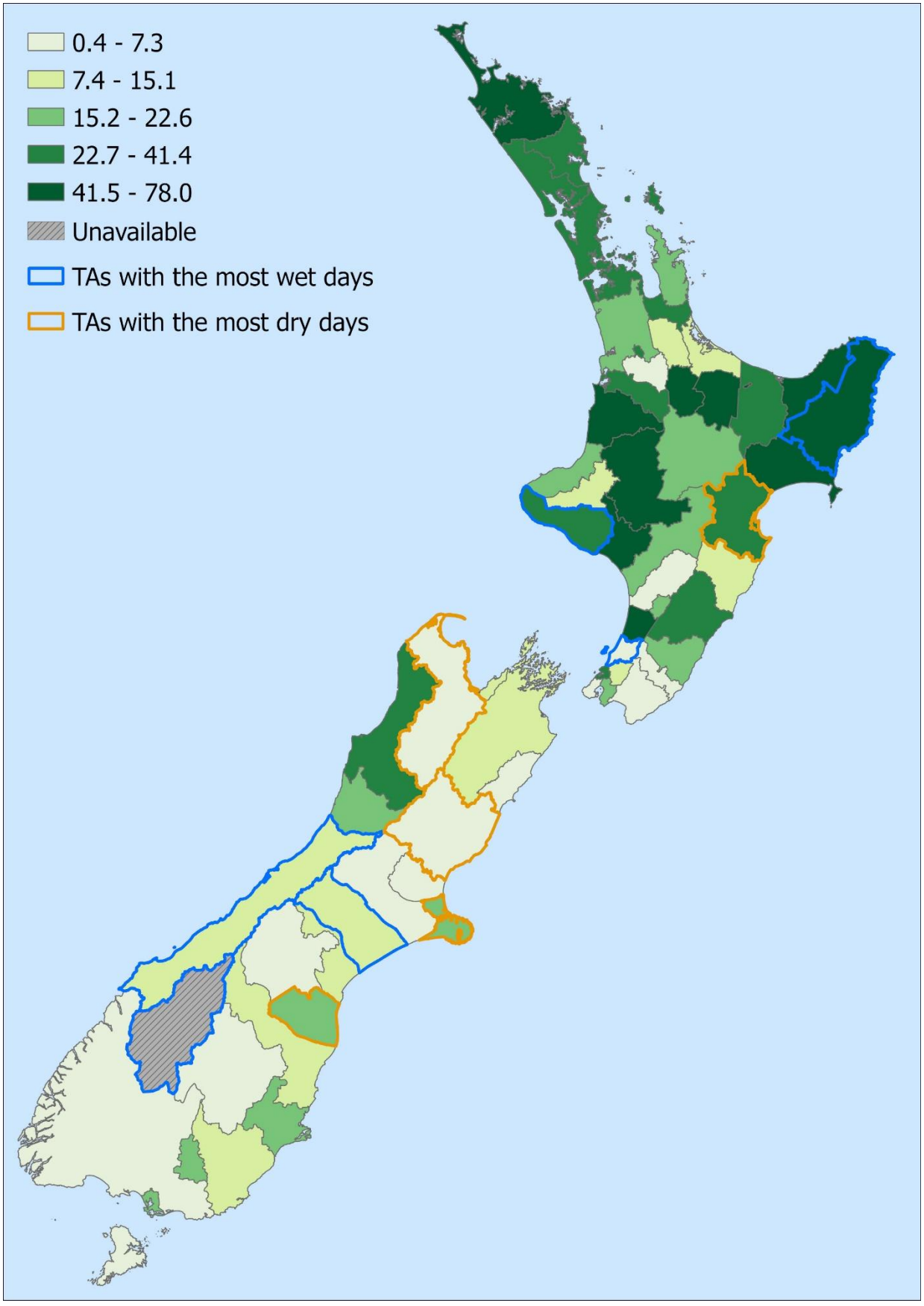
Source: NIWA

Figure 5d: People working in primary industries, by TA (% of population aged 15+ years)



Source: NIWA

Figure 5e: People living in areas of high deprivation (NZDep2023 deciles 9 & 10), by TA



Source: NIWA

Data for this indicator

This indicator analyses climate station records of daily rainfall around New Zealand, sourced from the Datahub web service provided by the National Institute of Water and Atmospheric Research (NIWA). One climate station was selected per Territorial Authority, based on their proximity to each TA's population-weighted centroid (2018 Census data). Population information was sourced from the 2018 Census figures published by Statistics New Zealand.

Number of days with extreme rainfall

The annual amount of rainfall was calculated by TA. Only stations with data for more than 90% of the year were analysed. The 95th percentile of rainfall between 1991–2020 was calculated from historical data for each TA, and the number of days above this percentile was counted as extreme rainfall days.

Number of days with soil moisture deficit ('dry days')

The number of days where Soil Moisture Deficit exceeded the thresholds used by NIWA to indicate severe and extreme dryness was counted for each year by TA. Only years with more than 90% of valid data were counted.

Data for both indicators were compared to the most recent Climate Normal Period, (1991–2020) where the 30-year average acts as a benchmark against which more recent observations can be compared.

For additional information, see the Metadata sheet.

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