Extreme rainfall and drought

This factsheet presents indicators of dry days and extreme rainfall days. It comments on the current overlap in where dry or very wet periods occur and the geographical distribution of populations more vulnerable to drought and extreme rainfall.

Key facts

Northern and eastern parts of New Zealand are currently more affected by dry days, whereas western regions of the South Island are more affected by extreme rainfall days.

In 2019, New Zealand had, on average, 65.9 (54.7–77.2) dry days and 17.7 (16.3–19.0) days with extreme rainfall. The climate station representing Tauranga District had the most dry days (136), whereas the stations representing Dunedin, Mackenzie, Southland and Westland District had the most extreme rainfall days (26 each).

East coast areas of the North Island, such as Gisborne and Hawke's Bay, and also Canterbury, are likely to be regions where people will be particularly affected by the health effects of drought, as they have populations more vulnerable to drought.

Climate models project more dry days for parts of New Zealand

The amount of rainfall in New Zealand varies around the country and with the season. Climate change is projected to cause the annual amount of rainfall and the number of days with extreme rainfalls to increase in the west and south and decrease in the north and east of both islands. The number of dry days is projected to increase in the North Island and inland areas of the South Island (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).
+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).

Drought and extreme rainfall have several effects on health

- **Drinking water:** Severe drought can reduce the quality and the amount of drinking water available. Flooding caused by extreme rainfall 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:** Rates of gastrointestinal infections such as cryptosporidiosis and giardiasis are affected by rainfall patterns. Rainfall washes giardia and cryptosporidium cysts into waterways, where they can contaminate drinking water sources. Drought conditions can lead to a greater cyst concentration in groundwater and surface water sources (Britton et al. 2010; Lal et al. 2013).
- **Crop production:** Drought can reduce crop production, meaning that less (and possibly more expensive) food is available for consumption. Food from freshwater sources will also be diminished. Extreme rainfall can also damage crops (McMichael, 2013).
- **Effect on mental health:** Drought can significantly 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, causing damage to infrastructure (McMichael, 2013).

See our '**Health effects of climate change**' and '**Vulnerability to climate change**' indicators for more information.

Dry days are more common in the east

Areas with more frequent dry periods are more likely to experience droughts, whereas areas with extreme rainfalls are more likely to experience flooding. 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).

Data from 2019 show dry days (days with a soil moisture deficit) are more common in eastern regions in both the North and the South Island (Figure 1). Extreme rainfall was more common in the South Island's western areas in 2019 (Figure 2).

In 2019, the annual average amount of rainfall in New Zealand was 1,627.0mm. Western regions of the South have the highest amounts of rainfall in New Zealand. The territorial authorities (TAs) with the highest amount of annual precipitation in 2019 were:

Regions	Rainfall (mm)
Westland (West Coast)	3877.6
Grey (West Coast)	3726.2
Buller (West Coast)	2124.2
New Plymouth (Taranaki)	1978.4

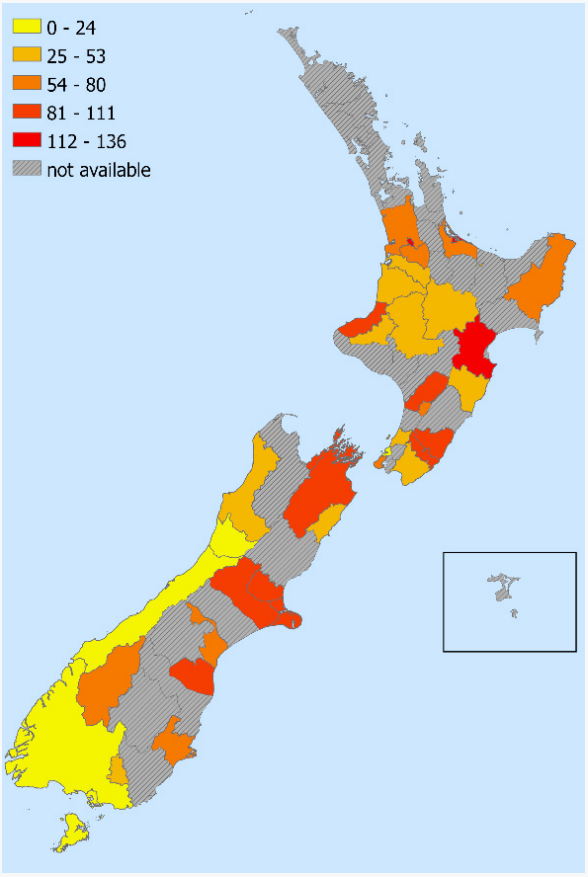
In 2019, New Zealand experienced, on average, 65.9 (95% confidence interval: 54.7–77.2) dry days and 17.7 (16.3–19.0) days with extreme rainfall. In 2019, the TAs with the highest number of dry and extreme rainfall days were:

Regions	Number of dry days
Tauranga (Bay of Plenty)	136
Hamilton (Waikato)	132
Hastings (Hawke's Bay)	121
Christchurch (Canterbury)	111

Regions	Number of extreme rainfall days
Dunedin (Otago)	26
Mackenzie (Otago)	26
Southland (Southland)	26
Westland (West Coast)	26

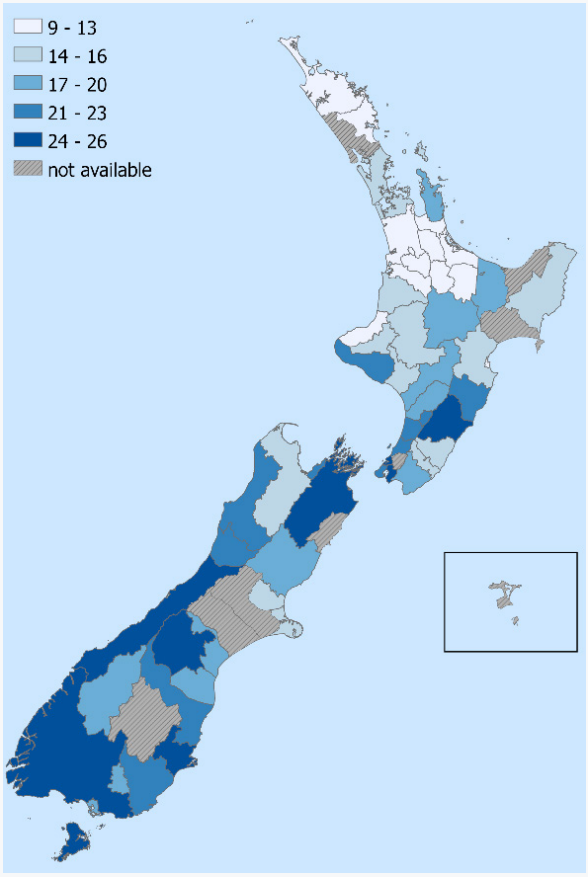
Our **website** shows how these rainfall extremes have changed year-by-year over the past 40 years (1981–2019) across territorial authorities (TAs) in New Zealand.

Figure 1: Number of days with soil moisture deficit, by territorial authority, 2019



Note: One climate station per TA is selected. Data may, therefore, not be representative of the whole district.
Source: National Climate Database (CliFlo), NIWA

Figure 2: Number of days with extreme rainfall, by territorial authority, 2019

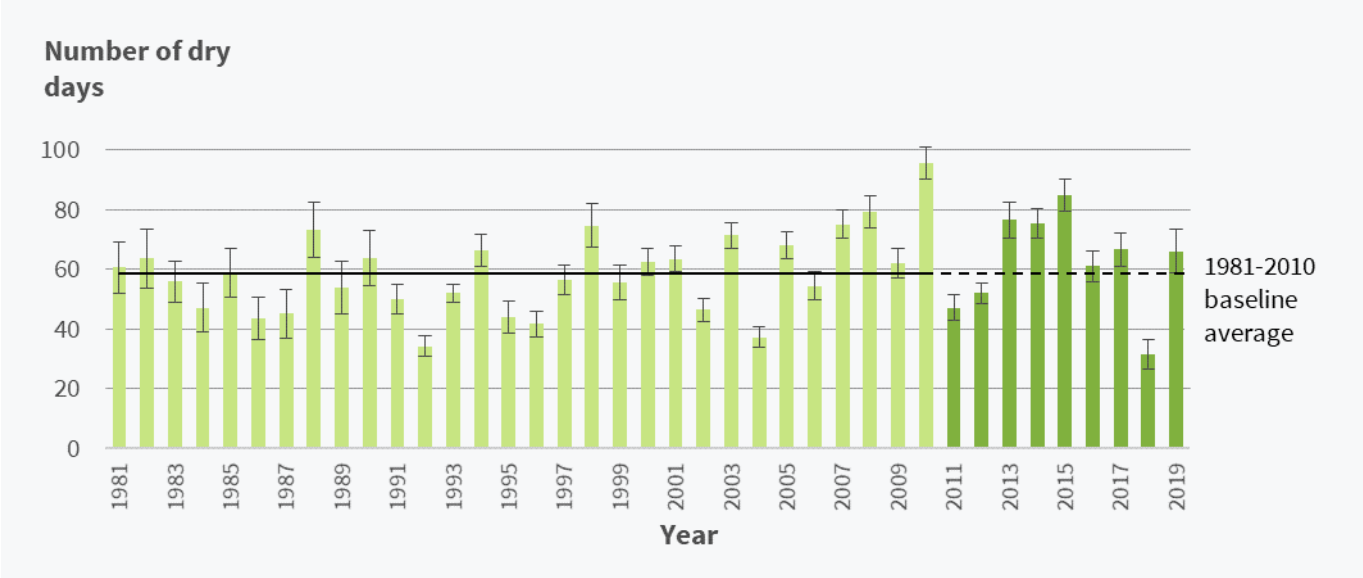


Note: One climate station per TA is selected. Data may, therefore, not be representative of the whole district.
Source: National Climate Database (CliFlo), NIWA

The number of dry days and extreme rainfall days varies from year to year

The average number of dry days in New Zealand varies from year to year (Figure 3). In the 30-year climate normal period, which presents a baseline temperature for 1981–2010 (WMO 2017), New Zealand experienced 58.7 (56.7–60.7) dry days per year. One of the years with the fewest dry days was 2018 (31.4, 24.3–38.4), whereas 2010 was one of the years with the most dry days (95.6, 85.1–106.2).

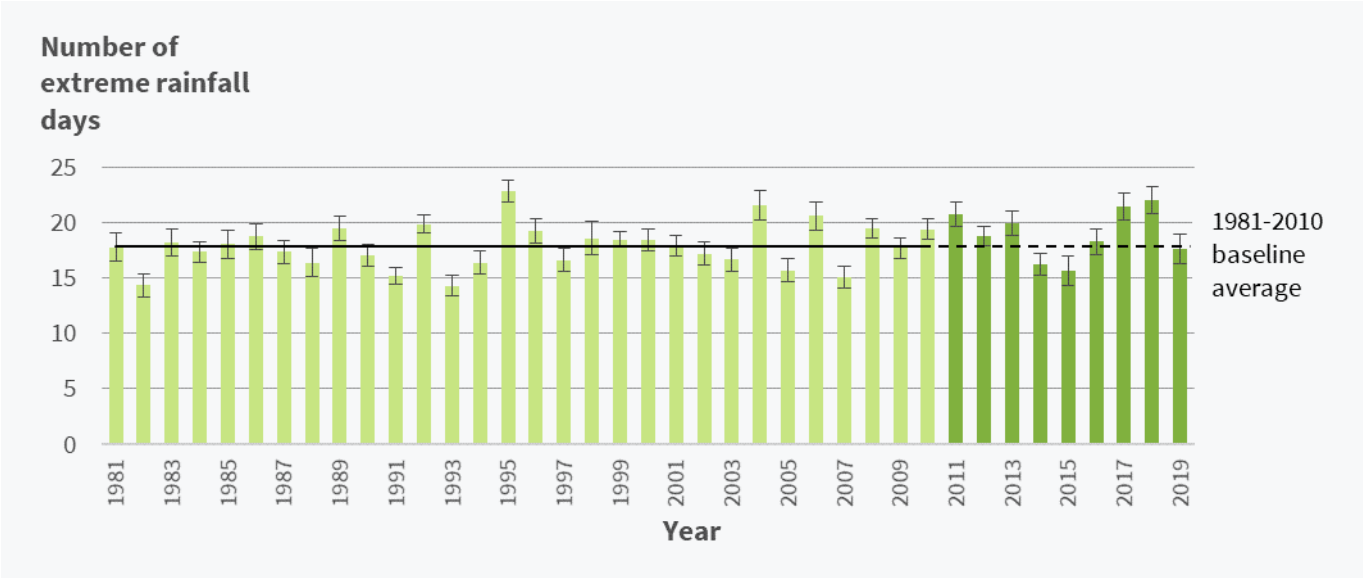
Figure 3: Average number of dry days in New Zealand, 1981–2019



Note: The baseline average period refers to the most recent Climate Normal Period, 1981–2010 (WMO 2017). Thirty years of data were averaged to act as a benchmark against which current or recent observations can be compared.
Source: National Climate Database (CliFlo), NIWA

The average number of extreme rainfall days in New Zealand varies from year to year (Figure 4). In the 30-year climate normal period from 1981–2010, New Zealand experienced 17.9 (17.7–18.1) extreme rainfall days per year. 1982 was one of the years with the fewest extreme rainfall days (14.3, 13.2–15.4), whereas 1995 was one of the years with the most extreme rainfall days (22.8, 21.9–23.8).

Figure 4: Average number of extreme rainfall days in New Zealand, 1981–2019



Note: The baseline average period refers to the most recent Climate Normal Period, 1981–2010 (WMO 2017). Thirty years of data were averaged to act as a benchmark against which current or recent observations can be compared.
Source: National Climate Database (CliFlo), NIWA

Rainfall variations and population vulnerability

Populations that are more vulnerable to the health effects of drought or extreme rainfall are (Figures 5a-e):

- young children aged **0–4 years** (who are also more quickly dehydrated from waterborne infection) (Gamble et al. 2016, Smith et al. 2014)
- older people aged **85+ years** (who are more quickly dehydrated by waterborne diseases) (Smith et al. 2014)
- **Māori** communities (high employment rates in water-dependent industries like farming and forestry) (Te Puni Kōkiri, 2007)
- people employed in **primary industries** (Royal Society Te Apārangi, 2017).
- **rural** communities (e.g. through loss of income) (Smith et al. 2014)
- those on **low incomes** (e.g. through inability to respond to higher food prices) (Smith et al. 2014).

For more information, see the '**Vulnerability to climate change**' and '**Population vulnerability**' topics.

People on the east coast of the North Island are likely to be particularly affected by the health effects of drought

Combining soil moisture deficit and population data suggests that the **east coast of the North Island**, such as **Gisborne** and **Hawke's Bay**, will likely be regions where people will be particularly affected by drought's health effects.

Gisborne is a very rural area with a substantial Māori population and significant socioeconomic deprivation, plus a high percentage of the population is under 5-years-old. Similarly, Hawke's Bay is a rural area with a sizeable Māori population, high numbers of both older people aged 85 years and over and children under five years old, and pockets of socioeconomic deprivation.

Figure 5a: Children aged 0–4 years, by TA, 2018 (percentage of total population)

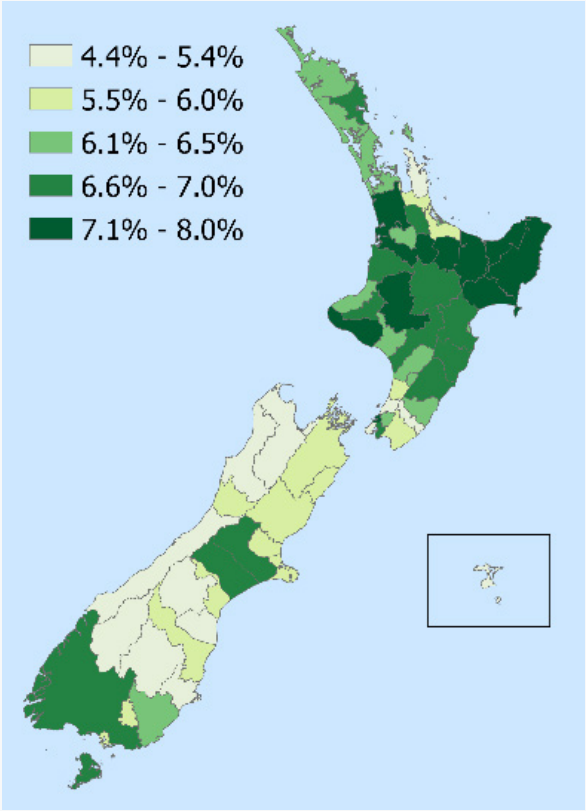


Figure 5b: Older adults aged 85+ years, by TA, 2018 (percentage of total population)

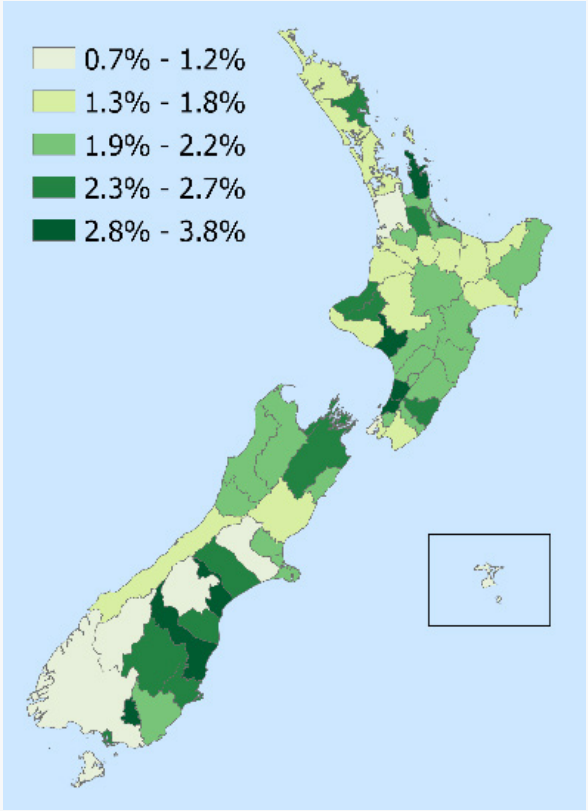


Figure 5c: Māori population, by TA, 2018 (percentage of total population)

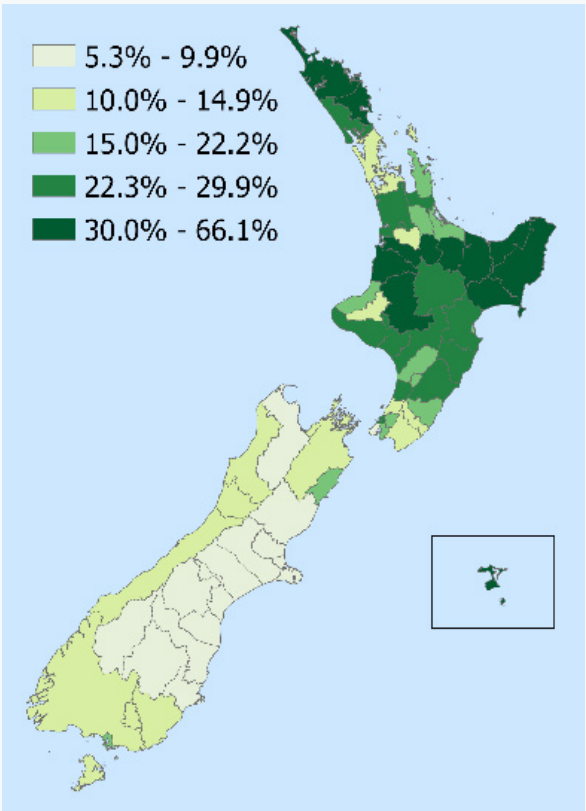


Figure 5d: People working in primary industries, by TA, 2018 (percentage of population aged 15+ years)

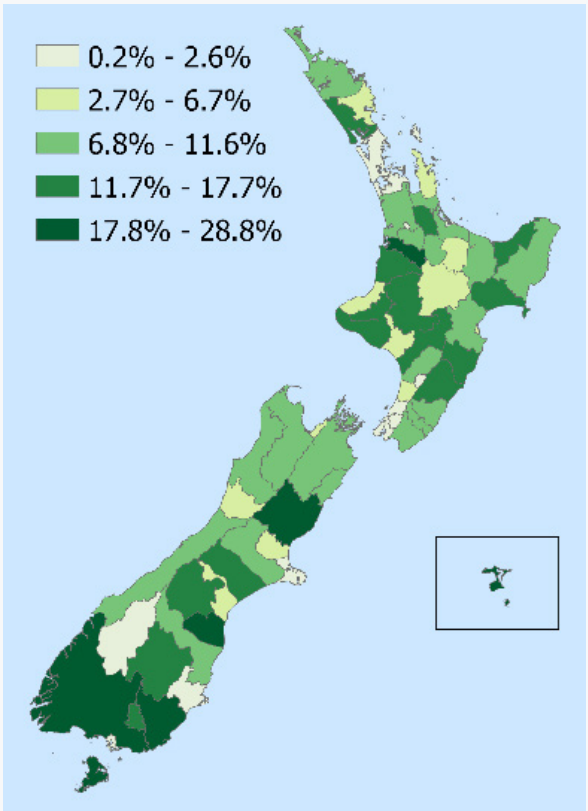
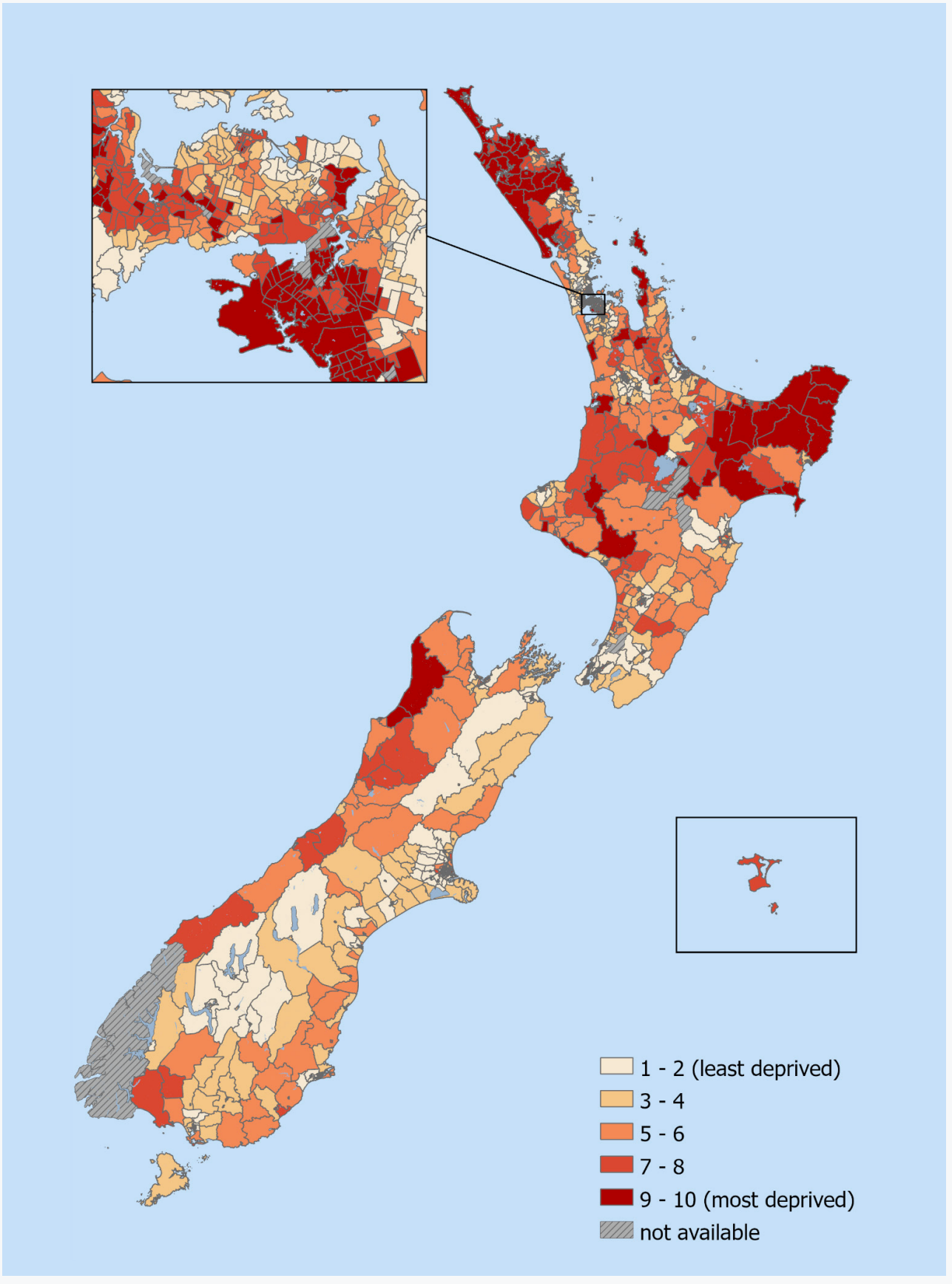


Figure 5e: Socioeconomic deprivation index (NZDep2018 decile), by statistical area 2 (SA2)



Source: Stats NZ, New Zealand 2018 Census of Populations and Dwellings.

Data for this indicator

Number of days with soil moisture deficit (SMD)

Climate station data of the number of days per year in SMD from around New Zealand was sourced from the National Institute of Water and Atmospheric Research (NIWA). One climate station was selected per territorial authority, based on proximity to each TA's population-weighted centroid (2018 Census data). The number of dry days was counted for each year by TA. Only years with more than 90% of valid data were counted. Data was compared to the most recent Climate Normal Period, 1981–2010, where the 30-year average acts as a benchmark against which more recent observations can be compared.

Annual amount of rainfall and number of days with extreme rainfall

Climate station data of the amount of daily rainfall (in mm) from around New Zealand was sourced from the National Institute of Water and Atmospheric Research (NIWA). One climate station was selected per territorial authority, based on proximity to each TA's population-weighted centroid (2018 Census data). The amount of rainfall was calculated for each year by TA. Only years with more than 90% of valid data were counted. The 95th percentile for the period 1981–2010 was calculated for each TA, and the number of days above this percentile was counted as extreme rainfall days. Data was compared to the most recent Climate Normal Period, 1981–2010, where the 30-year average acts as a benchmark against which more recent observations can be compared.

All 95% confidence intervals have been presented as error bars on graphs. Unless otherwise stated, all differences mentioned in the text between two values are statistically significant at the 5% level or less.

For additional information, see the metadata link below.

References

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Other related topics include:

Extreme temperature

Health effects of climate change

Vulnerability to climate change

Access to safe drinking water

Waterborne diseases related to drinking water

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Further information

For descriptive information about the data Soil Moisture Deficit Extreme Rainfall

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