Indicators of drought, climate change, and health

HIGHLIGHTS:

- **The amount of time spent in drought conditions in eastern New Zealand is projected to increase by 10% by the mid-21st century due to climate change.**
- **Eastern regions of New Zealand had more dry periods in 2015–17, as measured by soil moisture deficit.**
- **East coast areas of the North Island, such as Gisborne and Hawke's Bay, along with 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.**

This factsheet presents an indicator of drought (soil moisture deficit) and an indicator of health effects of drought (cryptosporidiosis and giardiasis: gastro-intestinal infections). It comments on the current overlap in where dry periods occur and the geographical distribution of populations more vulnerable to drought and giardiasis and cryptosporidiosis.

About drought, health, and climate change

Climate models project more droughts for parts of New Zealand

Drought frequency and intensity is projected to increase across most of New Zealand as a result of climate change. Regions that are particularly at risk are in the northern and eastern North Island and the eastern South Island (Ministry for the Environment 2016).

+10% by 2030–2050	The amount of time spent in drought conditions in eastern New Zealand and parts of the North Island is projected to increase by 10% by the middle of this century (Clark et al 2011).

Droughts have several effects on health

Drought can affect health in several ways.

- **drinking water**: Severe drought can reduce the quality and the amount of drinking water available. New Zealand's populations that rely on rainwater tanks for their drinking water supply can be particularly affected.
- **gastrointestinal infections**: Rates of the gastrointestinal infections 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 there is less (and possibly more expensive) food available for consumption. Food from fresh water sources will also be diminished.
- **effect on mental health**: Drought can have a significant effect on mental health, particularly for those in rural areas who rely on rain for their livelihoods.

Drought and population vulnerability

Populations that are more vulnerable to the health effects of drought are:

- **Māori** communities (eg, high employment in water dependent industries like farming and forestry)
- **rural** communities (eg, loss of income)
- older people **85+ years** (eg, more quickly dehydrated from water-borne infection)
- those on **low incomes** (eg, inability to respond to higher food prices)
- young children **aged 0–4 years** (eg, more quickly dehydrated from water-borne infection)
- people employed in **primary industries.**

For more information about population vulnerability and climate change, please download the Vulnerability to climate change factsheet.

Monitoring drought in New Zealand

One rainfall-related indicator of climate and health is the number of days with a soil moisture deficit:

number of days with soil moisture deficit (SMD)

SMD is one measure of drought, and measures the amount of soil moisture (in millimetres) available to pasture and plant roots. If the soil moisture content falls below a certain threshold, a day of SMD is recognized (NIWA n.d.).

Eastern New Zealand is drier

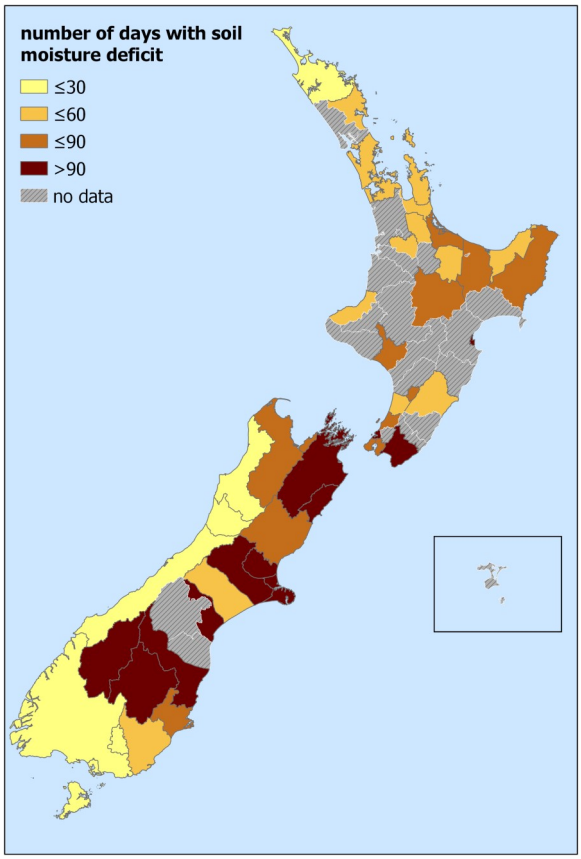
Areas with more frequent dry periods are more likely to experience droughts.

Eastern regions in both the North and the South Island had more dry periods in 2015–17 (over 90 days on average per year) (Figure 1b). The territorial authorities (TA) with the highest average number of days with a SMD are:

- **Central Otago District** (Otago): 178 days
- **Kaikoura District** (Canterbury): 177 days
- **Waimakiriri District** (Canterbury): 163 days

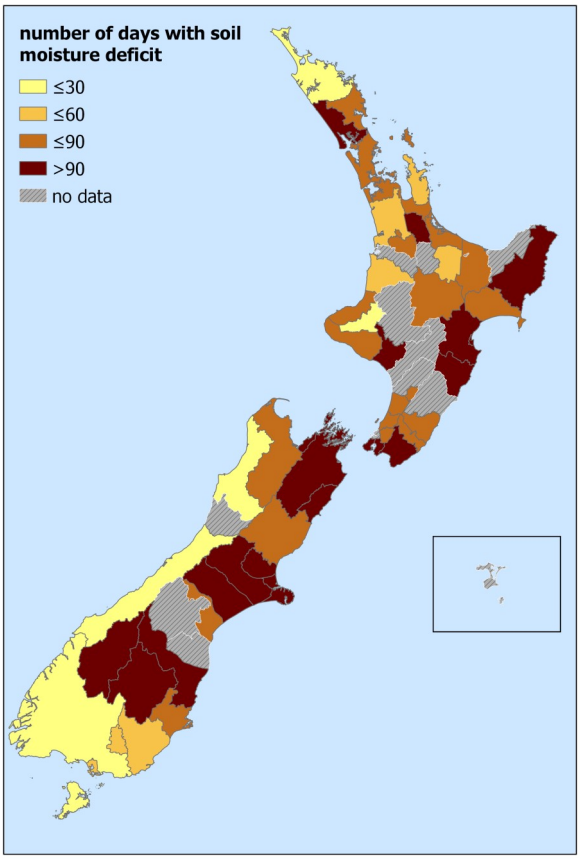
Our website shows how these dry periods changed over the past 18 years.

Figure 1a: Average number of days with a soil moisture deficit, by Territorial Authority (TA), 2000–02



Note: Averages are the annual number of hot days for the TA, averaged over the time periods 2000–02.
Source: National Climate Database (CliFlo), NIWA

Figure 1b: Average number of days with a soil moisture deficit, by Territorial Authority (TA), 2015–17



Note: Averages are the annual number of hot days for the TA, averaged over the time periods 2015–17.
Source: National Climate Database (CliFlo), NIWA

People on the east coast of the North Island are likely to be particularly affected by 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, are likely to be regions where people will be particularly affected by the health effects of drought.

Gisborne is a very rural area with a substantial Māori population and significant socio-economic 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 older people aged 85 years and over and children under 5 years old, and pockets of socio-economic deprivation.

For more information about population vulnerability and climate change please download the Vulnerability to climate change factsheet.

Monitoring health effects of changing rainfall patterns

Two climate-sensitive infectious diseases associated with rainfall patterns, including drought, are **giardiasis** and **cryptosporidiosis**:

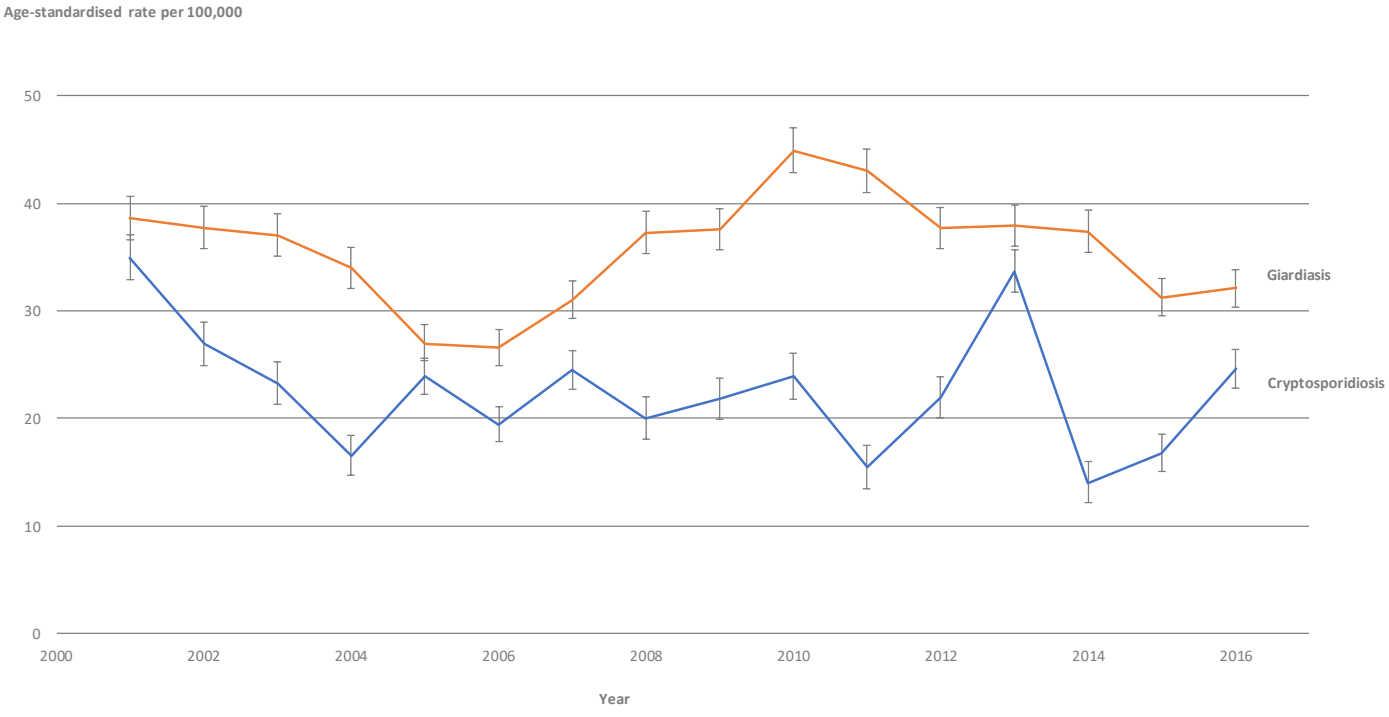
notifications of cryptosporidiosis and giardiasis
age-standardised rates of cryptosporidiosis and giardiasis notifications

No increasing trend for giardiasis or cryptosporidiosis

The age-standardised rates of both **giardiasis** and **cryptosporidiosis** have fluctuated from 2001 to 2016 (Figure 2).

Overall, giardiasis and cryptosporidiosis age-standardised notification rates currently **do not show an increasing trend** over the 16-year period 2001 to 2016.

Figure 2: Giardiasis and cryptosporidiosis notifications, 2001–2016 (age-standardised rate per 100,000)



Source: EpiSurv, ESR

Ongoing monitoring on health effects of climate change needed

In the ten-year period 2007–16, the highest age-standardised rates (per year) of giardiasis notifications were in rural parts of the South Island (Figure 3):

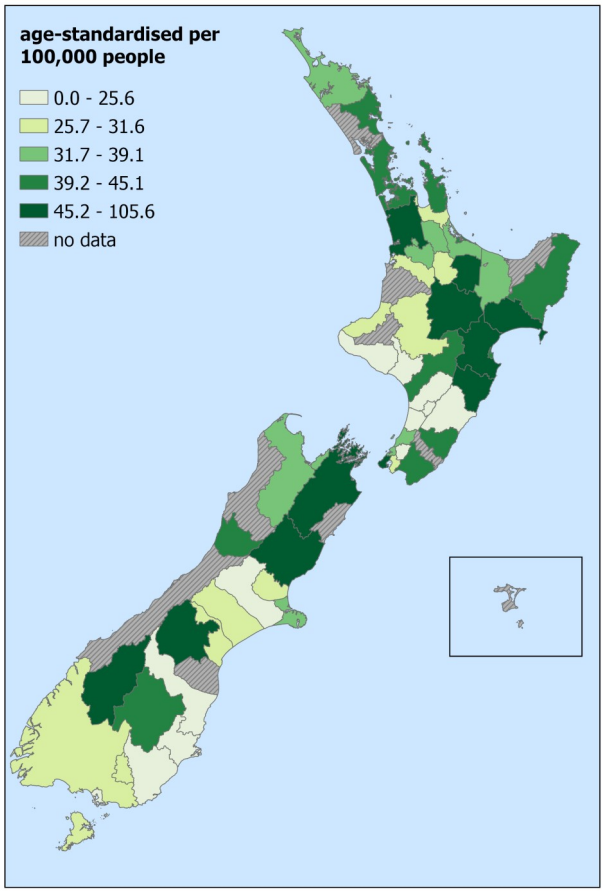
- **Queenstown-Lakes District** (Otago): 106 per 100,000
- **Mackenzie District** (Canterbury): 79 per 100,000
- **Hurunui District** (Canterbury): 68 per 100,000

In the ten-year period 2007–16, the highest age-standardised rates (per year) of cryptosporidiosis notifications were in rural areas, particularly in the bottom half of the South Island and the Waikato region of the North Island (Figure 4):

- **Waimate District** (Canterbury): 114 per 100,000
- **Mackenzie District** (Canterbury): 96 per 100,000
- **Otorohanga District** (Waikato): 93 per 100,000

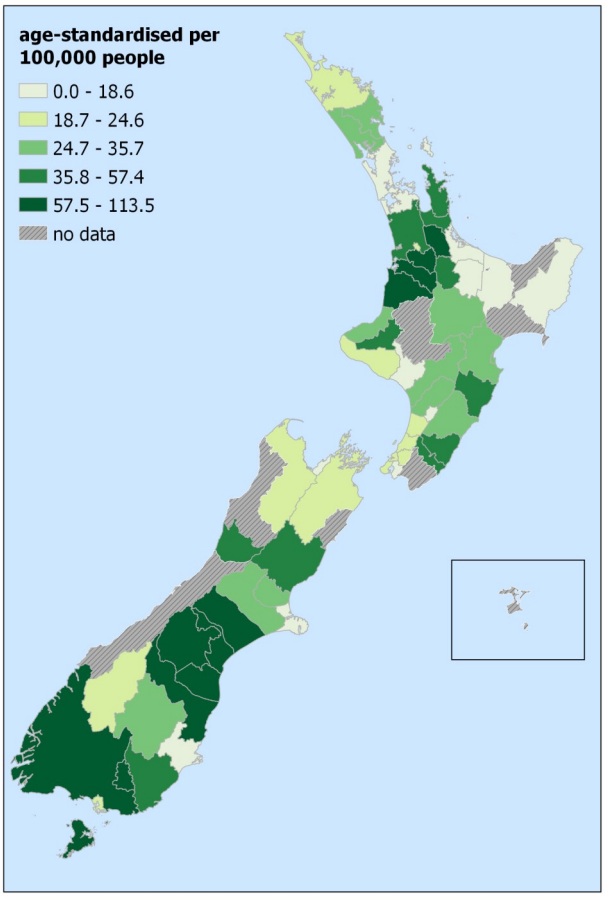
Long term health data, ideally from before 1990, are needed to robustly examine changes in disease occurrence and severity due to climate change. However, it is important to have ongoing monitoring of health effects in anticipation of possible increases as climate change makes itself felt.

Figure 3: Giardiasis notifications, by Territorial Authority (TA), 2007–16 (age-standardised rate per 100,000)



Source: EpiSurv, ESR

Figure 4: Cryptosporidiosis notifications, by Territorial Authority (TA), 2007–16 (age-standardised rate per 100,000)



Source: EpiSurv, ESR

Dry periods, vulnerable populations and climate-sensitive infectious diseases

There is some overlap between regions with high rates of giardiasis notifications and high number of days of SMD, namely Hawke's Bay (Central Hawke's Bay and Hastings TAs) and the north-east top of the South Island (Marlborough and Kaikoura TAs). Hawke's Bay has several vulnerable populations including old and young people, who tend to be more susceptible to infectious gastro-intestinal diseases.

The highest rates of cryptosporidiosis notifications are in different regions from those with high levels of dryness and populations vulnerable to infectious gastro-intestinal diseases.

FURTHER INFORMATION

Related environmental health indicators for Climate Change are available from the **EHINZ website**.

DATA FOR THESE INDICATORS

Number of days with soil moisture deficit

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 used per TA, except for Auckland City for which three weather stations were averaged. Two time points of three years of combined data are used to give a sense of change in occurrence of soil moisture deficit, as well as which parts of New Zealand tend to be driest. The number of days in SMD per year for each TA has been averaged over the three-year time period. Specific change over time corresponding with climate change cannot be shown as the common baseline period in climate change science is 1960–1990, for which comparable data is not available.

Notifications of giardiasis and cryptosporidiosis

This indicator presents giardiasis and cryptosporidiosis notifications from EpiSurv data from ESR for 2007–2016. Notifications where the person was overseas during the incubation period have been excluded. Notifications only cover those people who visited a GP or hospital for treatment, and may therefore underestimate the disease rate. Specific change over time corresponding with climate change cannot be shown as the common baseline period in climate change science is 1960–1990, for which comparable data is not available .

Rates presented are per 100,000 people (or 100,000 people per year for combined data over 10-year periods). Age-standardised rates have been presented where possible, to take into account the population age structures of different population groups. 95% confidence intervals have been presented as error bars on graphs.

Additional information for these indicators is available in the **Metadata sheets.**

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