Information topic	Details
Indicator name	**Number of days with soil moisture deficit**
Domain and topic	Climate change: Extreme rainfall and drought
Indicator definition and units	Number of days in soil moisture deficit. A day is in soil moisture deficit if the total soil moisture (calculated in millimetres from daily rainfall and evaporation) in the pasture plant root zone is less than 75mm. This equates to less than half of the soil moisture holding capacity, which is set to 150 mm for all soils (NIWA n.d.).
Data source	- CliFlo. NIWA's National Climate Database. URL: https://cliflo.niwa.co.nz/ - Data type: 74 Days of deficit (Wbal Awc=150mm)
Numerator	Annual number of days with a soil moisture deficit by Territorial Authority (TA)
Methodology	Climate stations were selected based on their proximity to the population-weighted centroid for a TA as well as completeness of data for the period 1981-2019. One weather station per TA was selected. Using the population-weighted centroid coordinates for each TA, we looked at weather stations within a 25km radius. The weather station closest to the centroid was selected, provided it was currently operating and had a long record of data (ie, minimum of 10 years of data). Where there was insufficiently complete data or the station was closed, we then examined the next closest weather station, and so on until the 'best fit' was found. In four cases, a climate station is used for two TAs (Hamilton/Waikato, Lower Hutt/Porirua, New Plymouth/Stratford, Tauranga/Western Bay of Plenty). In two cases, the only suitable climate station was currently closed and an exception was made (Kaipara, Opotiki). If a climate station's data had over 10% missing data for a calendar year, results for that year were excluded from analysis. The population-weighted centroid of a TA was calculated from 2018 Census data, using the geographic centroid of statistical area 1 (SA1, small Census area description) weighted by their usual resident population. The most recent Climate Normal for New Zealand was calculated as an average over the 30-year period 1981-2010 (all available data from all TAs was included). This average number acted as a benchmark against which current or recent observations were compared to (ie, anomalies).

Time period and time scale	Annual; from 1981 onwards
Spatial Coverage	National; by TA
Measures of frequency	- Average number of days per year in soil moisture deficit - Number of days per year in soil moisture deficit, by TA - 1981-2010 baseline average number of days with soil moisture deficit
Limitations of indicator	- There will be geographic variation in soil moisture deficit across a TA that is not represented in this indicator because we have used one weather station per TA. - There are several methods to identify drought conditions and several ways to define drought. This indicator might therefore under- or over-estimate health effects related to dry conditions. - Counting the number of days exceeding a pre-determined deficit level has the effect of reducing a continuous variable (soil moisture) to a binary one (moisture less than 75mm). This gives a clear picture for an indicator purpose, but it also reduces the underlying data to use as an indicator only.
Limitations of data source	Some of the selected weather stations have missing data, usually due to starting collection after the year 1981.
Created by	Environmental Health Indicators Programme, Massey University
Related indicators	- Number of days below 0°C - Number of days over 25°C - Annual amount of rainfall - Number of days with extreme rainfall - Notifications of salmonellosis - Notifications of cryptosporidiosis and giardiasis
For more information	- https://www.niwa.co.nz/climate/nz-drought-monitor/droughtindicatormaps - Ministry for the Environment & Stats NZ. 2020. New Zealand's Environmental Reporting Series: Our atmosphere and climate 2020. Wellington: Ministry for the Environment & Stats NZ.
References	NIWA (National Institute of Water and Atmospheric Research). Nd. Soil Moisture Deficit (SMD). URL: https://www.niwa.co.nz/climate/nz-drought-monitor/droughtindicatormaps/soil-moisture-deficit-smd (accessed February 2021).