

Brown Soil

New Zealand Soil Classification (NZSC) orders



Description

A mature soil with a distinct dark grey-brown topsoil with a brown or yellow-brown subsoil below. They mainly occur on hilly to steep landscapes and generally have good drainage and structure but low fertility.

They make up 50% of soils in Otago.

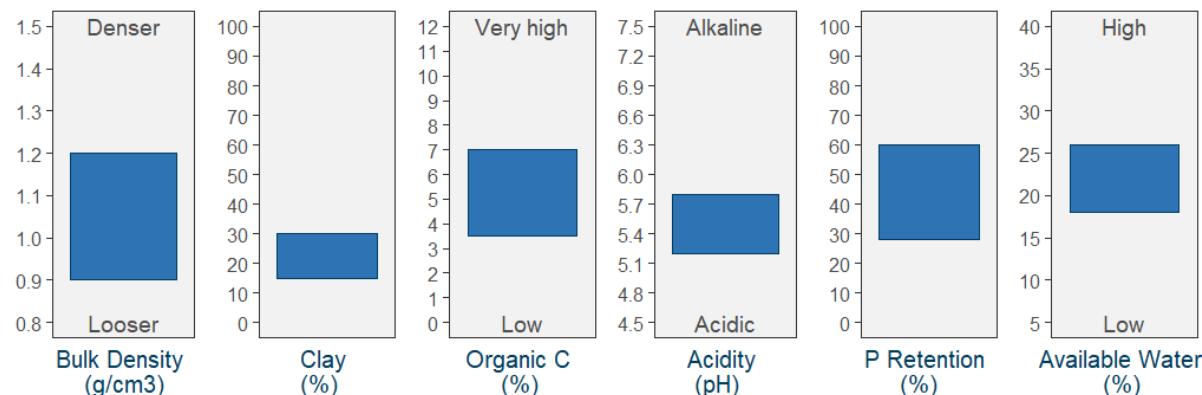


[1]

Key characteristics

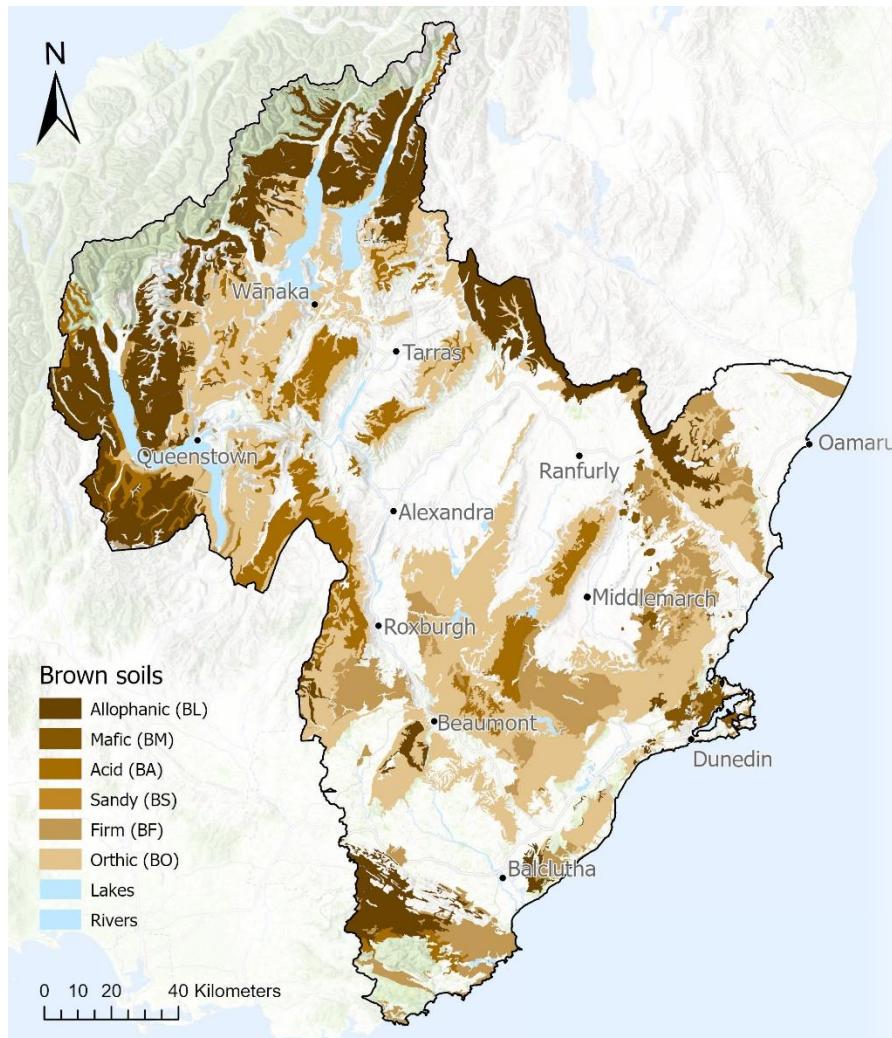
- **Parent material** Sedimentary or igneous (basaltic) rock
- **Drainage** Well to imperfect
- **Fertility** Low
- **Rooting depth** Good (unless Firm or Acid Brown)

Expected ranges of Brown topsoil (0-10 cm) key properties². C is carbon, P is phosphorus.



Vulnerabilities

► Structural damage		Low	Well drained and good structure means they are resilient to structural damage. However, when wet damage can still occur.
► Nutrient loss	N	Medium	Loss of N a risk due to free draining nature.
	P	Low	High P retention and good permeability means P runoff is not a big issue unless on steep slopes.
► Erosion		Medium	Their structure and mineralogy make them more resilient to erosion, except those formed on softer rock. As they are often found in mountains with steep slopes, erosion can always occur.
► Waterlogging		Low	Good drainage and lower density mean they are rarely waterlogged.



Occurrence

Generally, they occur in areas of annual rainfall greater than 800 mm in places where summer drought is not common, and which are not waterlogged in winter. They may occur in areas of lower annual rainfall (600-800 mm) if stony, sandy or in areas with low evapotranspiration.

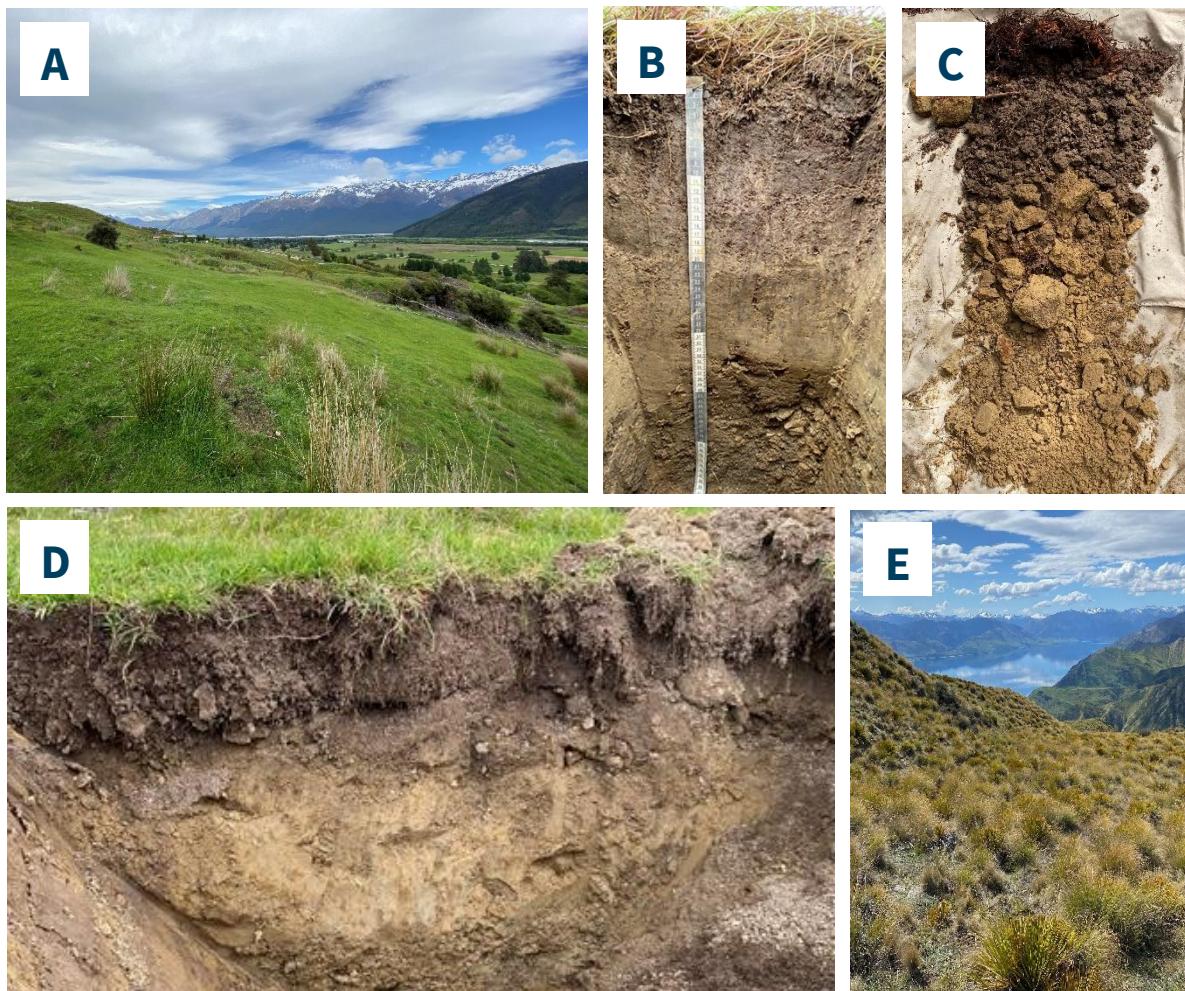
The map shows the regional extent of the different NZSC groups of Brown soil. For more detailed mapping see page 4.

NZSC group	%*	Description ²	Management considerations ²
Allopathic	29	Formed in high rainfall or from volcanic material.	Lower more frequent application of P fertiliser is required to ensure availability to plants due to the greater P retention.
Mafic	1	Formed from volcanic rocks (basalt, phonolite)	Good topsoil structure. Good fertility from volcanic material. Often on steeper slopes, but highly productive on suitable slopes.
Acid	13	Freely drained, acid, low fertility low density. Occur in high rainfall.	Rooting depth may be restricted in subsoils with low pH where aluminium toxicity may be an issue. Respond well to lime additions to increase the pH and soil fertility
Sandy	0.2	Dominated by sand. Formed on sand dunes.	Low nutrient reserves. Limited available water and rapid infiltration means dry out quickly. Wind erosion may be a risk.
Firm	14	Have a dense, firm subsoil, generally beginning at 50-60 cm depth.	Have a subsoil that is often slowly permeable and may restrict deeper rooting. Subsurface drainage can improve productivity and resilience to soil degradation.
Orthic	43	Other Brown soils.	Few limitations apart from fertility demands.

*Extent of each group as a percentage relative to all Brown soils in the Otago region.

In the region

Brown soils are extensive in Otago and are the main soil of hill and high-country farming. They are predominantly formed from schist but softer mud- and sandstone can form Brown soils also (e.g., Catlins). Orthic Brown soils are the most prevalent across Otago, followed by Allophanic Brown soils at higher altitudes. Firm Brown soils share characteristics with Pallic soils and often intergrade with them. Acid Brown soils are mostly found in the steeper tussock and schist dominated ranges in Central Otago. Mafic Brown soils are largely formed from basalt around Dunedin. Sandy Brown soils are not extensive, mostly limited to the Otago Peninsula coast.



A Shallow Orthic Brown soil on the lower slopes of the mountains near Glenorchy. **B** Orthic Brown soil profile formed from schist. **C** Acidic Brown soil profile under pine plantation. **D** Firm Brown soil under dryland pasture in hilly North Otago. **E** Allophanic Brown soils at 1,100 m in the tussocks above lake Hāwea.

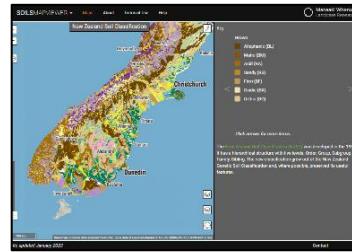
Sustainable management

► Erosion & Structure	Maintain vegetation cover, no-till crop establishment and wind breaks can reduce erosion. Avoid working and grazing (or only lightly) when the soil is wet and build organic matter.
► Nutrients	It is recommended to always work with the 4Rs for fertiliser management: <i>right place, right time, right rate and right product</i> . Find out more information on fertiliser management here .
► General	For general guidelines on sustainable soil management you can find some useful links here .

Soil maps

► Fundamental Soil Layer

Owner	Manaaki Whenua Landcare Research
Recommended use	Use at larger scales for general overview
Coverage	100%
Scale	1:50,000
Soil naming	NZSC
Development	Will be replaced by S-map
Link	soils-maps.landcareresearch.co.nz



► growOTAGO

Owner	Otago Regional Council
Recommended use	Only use where S-map not available
Coverage	100% of Otago (by lowland and upland)
Scale	1:50,000
Soil naming	Old regional soil series names
Development	Not planned
Link	maps.orc.govt.nz/OtagoMaps/



► S-map

Owner	Manaaki Whenua Landcare Research
Recommended use	Best available map. Use where present
Coverage	~30% of Otago
Scale	1:50,000
Soil naming	New S-map series names and NZSC
Development	Mapping ongoing
Link	smap.landcareresearch.co.nz/



For the te ao Māori of oneone (soil), including kaupapa Māori, history, and soil names, you can find more information [here](#).

Contact

For any questions you may have contact: science.enquiries@orc.govt.nz

Note - This Infosheet generalises typical average properties of the specified soil order and groups. It has been prepared in good faith by trained staff within time and budgetary limits. However, no responsibility or liability can be taken for the accuracy of the information and interpretations. Expert advice should be sought before making decisions on individual farms. The characteristics of the soil at a specific location may differ from those described here. The vulnerability ratings given in the table on page 1 are generalised and should not be taken as absolutes for this soil in all situations. The actual risk depends on the environmental and management conditions prevailing at a particular place and time.

References

- [1] Manaaki Whenua - Landcare Research 2023. The New Zealand SoilsMapViewer. <https://doi.org/10.26060/9vfzhw43>. Photos reproduced with permission.
- [2] Hewitt, A.E., Balks, M. R. and Lowe, D.J., 2021. The Soils of Aotearoa New Zealand. Chapter 4 Brown Soils. Springer International Publishing.
- [3] New Zealand Society of Soil Science and Manaaki Whenua - Landcare Research photo library. Photos reproduced with permission.

