Soil name: Te Anau

Overview

Te Anau soils occupy about 10,100 ha on rolling terrain in the Te Anau basin. They are formed on glacial moraines, derived from Fiordland rocks. These soils are formed in shallow to moderately deep mixed loess and gravel, overlying the compacted unweathered gravelly glacial till. They are well drained, with silt loam topsoil texture, strongly leached and have a high P-retention. They are suited to pastoral farming with sheep and deer and require a high fertiliser input to maintain pasture production. Winters are cold with summers occasionally seasonally dry in some years.

Soil classification

NZ Soil Classification (NZSC): Firm Allophanic Brown; rounded-stony; dioritic; silty
Previous NZ Genetic Classification: Very strongly leached yellow-brown loam

Classification explanation

The NZSC of Te Anau soils is consistent with the previous classification. Te Anau soils are formed in gravelly till that is compacted enough to form a barrier to root penetration. The soils are strongly leached, reflected in P-retention of >85% in the upper subsoil.

Soil phases and variants

Identified units in the Te Anau soils are:

- TeAnau undulating shallow (AuU3): has gravel within 45cm depth; occurs on slopes of 0–7º
- Te Anau undulating moderately deep (AuU2): gravel occurs between 45 and 90cm depth; occurs on slopes of 0–7º
- Te Anau rolling moderately deep (AuR2): gravel occurs between 45 and 90cm depth; occurs on slopes of 7–15º
- Te Anau rolling shallow (AuR3): has gravel within 45cm depth; occurs on slopes of 7–15º
- Te Anau hilly moderately deep (AuH2): gravels occur between 45 and 90cm depth; occurs on slopes of 15–25º
- Te Anau hilly shallow (AuH3): has gravel within 45cm depth; occurs on slopes of 15–25º
- Te Anau steep moderately deep (AuS2): gravels occur between 45 and 90cm depth; occurs on slopes of >25º
- Te Anau steep shallow (AuS3): has gravel within 45cm depth; occurs on slopes of >25º

The soil properties described in this Technical Data Sheet are based on the most common phase, Te Anau undulating shallow (AuU3). Values for other phases and variants can be taken as being similar. Where they differ significantly they are recorded with a separate versatility rating, e.g., Te Anau hilly moderately deep (AuH2).

Associated soils

Some soils that commonly occur in association with Te Anau soils are:

- Kakapo: shallow, poorly drained soils occurring in depressions on old moraine surfaces.
- Excelsior: moderately deep to deep well drained soils with a fragipan
- Otanomomo: A peat soil occurring on low-lying poorly drained depressions

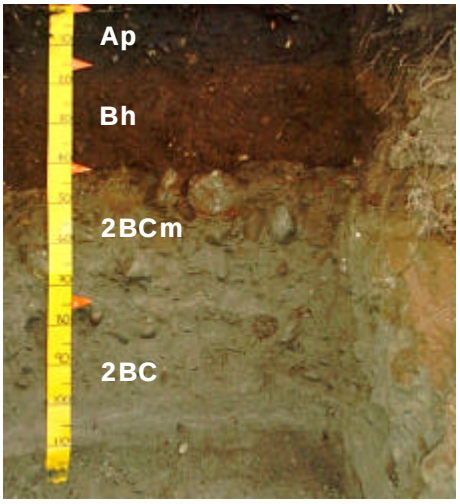
Similar soils

Some soils that have similar properties to Te Anau soils are:

- Monowai: formed on glacial outwash terraces

Typical profile features

The following is a 'generic' or composite profile description representing the most common combination of characteristics for this soil type. The actual profiles for which descriptions and data are available are listed at the end of this Technical Data Sheet.

Te Anau profile	Horizon	Depth (cm)	Description
	Ap	0–15	Dark brown slightly gravelly silt loam; weak soil strength; weakly developed very fine polyhedral structure; gravel slightly weathered and rounded; many roots
	Bh	15–41	Strong brown moderately gravelly silt loam; weak soil strength; moderately developed fine polyhedral structure; gravel slightly weathered and rounded; many roots
	2BCm	41–75	Olive very gravelly sandy loam; common dull brown organic/iron complex staining; very dense particle packing; massive structure; gravel slightly weathered and rounded; no roots
	2BC	75–110	Pale olive very gravelly loamy sand; firm soil strength; compact particle packing; massive structure; gravel slightly to moderately weathered; no roots

Key profile features

Te Anau soils have a dark coloured topsoil, rich in organic matter, that is 10–20 cm deep, with weakly developed structure. Subsoil structure is weakly to moderately developed, with strong brown colours reflecting the strong leaching and accumulation of organic-iron compounds. The underlying till occurs at 40–60cm and has olive colours reflecting the weak weathering.

Typical physical properties

Note: values in Italics are estimates

Horizon	Depth (cm)	Bulk density	Permeability	Texture	Gravel content
Ap	0–15	Moderate	*Moderate*	Silt loam	Slightly gravelly
Bh	15–41	Moderate	*Moderate*	Silt loam	Moderately gravelly
2BCm	41–75	–	*Slow*	Sandy loam	Very gravelly
2BC	75–110	–	*Slow*	Loamy sand	Very gravelly

Profile drainage: Moderately well
Plant readily available water: *Moderately high*
Potential rooting depth: Shallow
Rooting restriction: densely packed glacial till

Key physical properties

Te Anau soils have shallow rooting depth, due the glacial till, but have moderately high plant available water. The moderately deep phases are likely to have slightly deep rooting depth. Soils are moderately well drained, with good aeration in upper horizons, but drainage may be restricted during wet periods due to the slow water permeability through the glacial till. Textures are silt loams in the topsoil, with a clay content of less than 20%. The soil horizons above the glacial till are slightly to moderately gravelly, and boulders are common.

Typical chemical properties

Horizon	Depth (cm)	pH	P retention	CEC	BS	Ca	Mg	K	Na
Ap	0–15	Moderate	High	Moderate	Low	Moderat	Low	Very low	Very low
Bh	15–41	Moderate	Very high	Moderate	Low	Low	Very low	Very low	Very low
2BCm	41–75	Moderate	Moderate	Very low	Very low	Very low	Very low	Very low	Very low
2BC	75–110	Moderate	Moderate	Low	Very low	Very low	Very low	Very low	Very low

Additional chemical properties (as a profile average)
Reserve potassium levels low; sulphate sulphur levels moderate; phosphorus levels low

Key chemical properties

Topsoil organic matter levels are 12–16%; P-retention values above 80% in horizons above the till; pH values are moderate throughout the profile. Cation exchange values are moderate and decrease down the profile, with low base saturation figures. Available calcium, magnesium and potassium levels are low. Reserve potassium and phosphorus values are low. Subsoil sulphate levels are moderate. Micro-nutrient levels are generally adequate.

Vulnerability to environmental degradation

Note: the vulnerability ratings given in the table below are generalised and should not be taken as absolutes for this soil type in all situations. The actual risk depends on the environmental and management conditions prevailing at a particular place and time. Specialist advice should be sought before making management decisions that may have environmental impacts. Where vulnerability ratings of Moderate to Very severe are indicated, advice may be sought from Environment Southland or a farm management consultant.

Vulnerability factor	Rating	Vulnerability compared to other Southland soils
Structural compaction	minimal	These soils have a minimal vulnerability to structural degradation by long-term cultivation, or compaction by heavy stocking and vehicles. This rating reflects the good drainage, as well as high organic matter and P-retention in the topsoil.
Nutrient leaching	severe	These soils have a moderate vulnerability to leaching to groundwater. This rating reflects the good drainage and moderate water-holding capacity.
Topsoil erodibility by water	slight	Due to the high organic matter content, the topsoil erodibility of these soils is slight. Erodibility is highly dependent on management, particularly when there is no vegetation cover.
Organic matter loss	slight	Vulnerability to long-term decline in soil organic matter levels is partly dependent on soil properties, and highly dependent on management practices (e.g., crop residue management and cultivation practices).
Waterlogging	slight	These soils have a slight vulnerability to waterlogging during wet periods. This rating reflects the good drainage, but slow permeability of the underlying till. The hilly phase is likely to have no vulnerability to waterlogging.

General landuse versatility ratings for Te Anau soils

Note: The versatility ratings in the table below are indicative of the major limitations for semi-intensive to intensive land use. These ratings differ from those used in the past in that sustainability factors are incorporated in the classification.

Refer to the Topoclimate district soil map or property soil map to determine which of the soil symbols listed below are applicable, then check the versatility ratings for that symbol in the appropriate table.

AuU3 (Te Anau undulating shallow)
AuU2 (Te Anau undulating moderately deep)

Versatility evaluation for soil AuU3, AuU2		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Limited	Shallow potential rooting depth
Arable	Limited	Shallow potential rooting depth
Intensive pasture	Limited	Shallow potential rooting depth
Forestry	Limited	Shallow potential rooting depth

AuR3 (Te Anau rolling moderately deep)
AuR2 (Te Anau rolling shallow)

Versatility evaluation for soil AuR3, AuR2		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Limited	Shallow potential rooting depth
Arable	Limited	Shallow potential rooting depth and rolling slopes
Intensive pasture	Limited	Shallow potential rooting depth
Forestry	Limited	Shallow potential rooting depth

AuH2 (Te Anau hilly moderately deep)
AuH3 (Te Anau hilly shallow)
AuS2 (Te Anau steep moderately deep)
AuS3 (Te Anau steep shallow)

Versatility evaluation for soil AuH2, AuH3, AuS2, AuS3		
Landuse	**Versatility rating**	**Main limitation**
Non arable horticulture	Unsuitable	Hilly to steep slopes
Arable	Unsuitable	Hilly to steep slopes
Intensive pasture	Limited	Shallow potential rooting depth and hilly to steep slopes
Forestry	Limited	Shallow potential rooting depth

Management practices that may improve soil versatility

- Organic matter levels should be carefully maintained and enhanced
- Over-cultivation of dry soils in summer may allow wind erosion
- Irrigation for intensive pasture and crop production to overcome summer moisture deficiencies.
- Management of nutrient applications so as to minimise leaching losses

Soil profiles available for Te Anau soils

Soil symbol	Profile ID	Topoclimate map sheet	Profile description available	Physical data available	Chemical data available	Profile photo available
AuU3	SB9574	39	✓	✓	✓	
AuU3	AT2	39	✓	✓	✓	✓
AuU2	AT3	39	✓	✓	✓	✓
AuU2	SB7735	39	✓	✓	✓	✓
AuU2	SB9573	39	✓	✓	✓	✓
AuR2	AT5	39	✓	✓	✓	✓
AuR3	149/74/9	39	✓	✓		
AuH2	AT1	39	✓	✓	✓	✓
AuS3	AT8	39	✓	✓	✓	✓
AuS2	AT8a	39	✓	✓		

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