Soil name: Mokotua

Overview

Mokotua soils occupy about 17,700 ha on high terraces and old marine terraces of the southern Southland plains between Invercargill and the Mataura River, and on similar surfaces in the lower Makarewa and Oreti rivers. They are formed in deep wind-deposited loess derived from greywacke and schist rocks. Mokotua soils are strongly mottled, have imperfect drainage tending towards being poorly drained, and are associated with soils showing podzolised features on the southern Southland plains. The soils have a deep rooting depth, high water holding capacity, and have silt loam textures. They are used for intensive pastoral farming with sheep, dairy and some cropping. They have a cool temperate climate and receive regular rain over the year and seldom dry out.

Soil classification

NZ Soil Classification (NZSC):	Mottled-acidic Orthic Brown; stoneless; silty
Previous NZ Genetic Classification:	Southern yellow-brown earth

Classification explanation

The NZSC of the Mokotua soils is consistent with the previous classification. Mokotua soils are imperfectly drained soils with yellow-brown subsoils, and rarely suffer from drought. Subsoils are structured to 90cm depth, but have slow permeability that causes waterlogging during wet periods, which is reflected in the imperfect drainage. The soils have a P-retention of 30–85%, typically have subsoil pH of less than 5.5, are stone free and have silt loam textures to 90cm depth.

Soil phases and variants

Identified units in the Mokotua soils are:

- Mokotua undulating deep (MtU1): has no gravel within 90cm depth; occurs on slopes 0–7°
- Mokotua rolling deep (MtR1): has no gravel within 90cm depth; occurs on slopes 7–15°
- Mokotua hilly deep (MtH1): has no gravel within 90cm depth; occurs on slopes 15–25°

The soil properties described in this Technical Data Sheet are based on the most common phase, Mokotua undulating deep (MtU1). 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., Mokotua hilly deep (MtH1).

Associated soils

Some soils that commonly occur in association with Mokotua soils are:

- Dacre: poorly drained soil on floodplains of streams and minor drainage channels
- Waikiwi: occurs on the same landforms, but is well drained
- Kapuka: podzolised moderately deep soil on marine terraces
- Tisbury: occurs on same landforms but are poorly drained

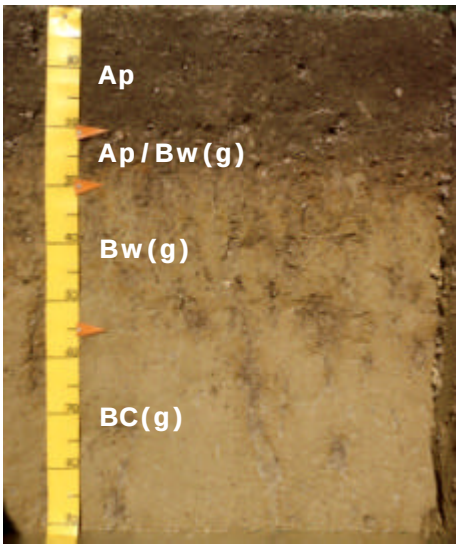
Similar soils

Some soils that have similar properties to Mokotua soils are:

- Woodlands: has a firm strutureless subsoil; not as strongly mottled, imperfectly tending to moderately well drained
- Ashers: deep podzolised soil on marine terraces
- Haldane: imperfectly drained soil also associated with soils with podzolised features on hilly land west of the Mataura River, from Waimahaka to the south coast.

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.

Mokotua profile	Horizon	Depth (cm)	Description
	Ap	0–22	Greyish brown silt loam; weak soil strength; moderately developed fine to medium polyhedral structure; abundant roots
	Ap/Bw(g)	22–30	Dull yellow-orange silt loam; common greyish yellow and bright brown mottles; abundant worm casts; weak soil strength; moderately developed fine to medium polyhedral structure; abundant roots
	Bw(g)	30–55	Dull yellow-orange silt loam; many greyish yellow and bright brown mottles; few worm casts; slightly firm soil strength; moderately developed medium to coarse prismatic structure; many roots.
	BC(g)	55–90	Bright yellowish brown silt loam; many greyish yellow and bright brown mottles; slightly firm soil strength; weakly developed coarse to very coarse prismatic structure; common roots

Key profile features

Mokotua soils have topsoils 20–30cm deep with a moderately developed structure. Subsoils have moderate structure, that becomes more weakly developed with depth. The soil has imperfect drainage that is reflected in the typically strong mottling of the subsoil.

Typical physical properties

Note: values in Italics are estimates

Horizon	Depth (cm)	Bulk density	Permeability	Texture	Gravel content
Ap	0–22	Low – Moderate	*Moderate*	Silt loam	Gravel free
Ap/Bw(g)	22–30	Moderate	*Moderate*	Silt loam	Gravel free
Bw(g)	30–55	Moderate – High	*Slow*	Silt loam	Gravel free
BC(g)	55–90	Moderate – High	*Slow*	Silt loam	Gravel free

Profile drainage: Imperfect

Plant readily available water: *High*

Potential rooting depth: Deep

Rooting restriction: No major barrier

Key physical properties

Mokotua soils have a deep rooting depth and high plant available water, meaning there is no major physical barrier to root growth. The compact subsoil is slowly permeable, and causes short-term waterlogging and limits aeration during wet periods. Texture is silt loam in all horizons, with topsoil clay content of 20-35%, and the soils are typically stonefree.

Typical chemical properties

Horizon	Depth (cm)	pH	P retention	CEC	BS	Ca	Mg	K	Na
Ap	0–22	Moderate	Moderate	Moderate	Low	Moderate	Low	Very low	Low
Ap/Bw(g)	21–30	Moderate	High	Moderate	Very low	Low	Very low	Very low	Low
Bw(g)	30–55	Moderate	High	Moderate	Very low	Very low	Very low	Very low	Low
BC(g)	55–90	Low	Moderate	Low	Very low	Very low	Low	Very low	Low

Additional chemical properties (as a profile average)
Subsoils have high sulphate sulphur values.

Key chemical properties

Topsoil organic matter levels range from 7 to 16%; P-retention values 45-70% in the topsoil, tending to increase in the subsoil (60–80%); pH values are moderate; Cation exchange values are moderate but base saturation low, indicating low availability of cations that are present. Natural reserves of phosphorus are low and there are high levels of sulphate sulphur in the subsoil. Soils respond well to lime and phosphorus. Micro-nutrient levels are generally adequate, although molybdenum responses in legumes and boron responses in brassicas can occur.

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	slight	These soils have a slight vulnerability to structural degradation by long-term cultivation, or compaction by heavy stocking and vehicles. This rating reflects the topsoil P-retention and organic matter levels, but is offset by the imperfect drainage.
Nutrient leaching	slight	These soils have a slight vulnerability to leaching to groundwater. This rating reflects the imperfect drainage, high water-holding capacity and slow subsoil permeability .
Topsoil erodibility by water	slight	Due to the topsoil clay percentage and organic matter levels, the topsoil erodibility of these soils is slight. Erodibility is highly dependent on management, particularly when there is no vegetation cover.
Organic matter loss	minimal	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	moderate	These soils have a moderate vulnerability to waterlogging during wet periods. This rating reflects the imperfect drainage and slowly peremable subsoil.

General landuse versatility ratings for Mokotua 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.

MtU1 (Mokotua undulating deep)
MtR1 (Mokotua rolling deep)

Versatility evaluation for soil MtU1, MtR1		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Limited	Inadequate aeration during wet periods.
Arable	Limited	Inadequate aeration during wet periods; rolling slopes on rolling phase.
Intensive pasture	Moderate	Inadequate aeration during wet periods; risk of short-term waterlogging after heavy rain.
Forestry	Moderate	Inadequate aeration during wet periods; risk of short-term waterlogging after heavy rain.

MtH1 (Mokotua hilly deep)

Landuse	Versatility rating	Main limitation
Non-arable horticulture	Unsuitable	Hilly slope
Arable	Unsuitable	Hilly slope
Intensive pasture	Limited	Hilly slope
Forestry	Moderate	Inadequate aeration during wet periods; hilly slope

Management practices that may improve soil versatility

- Careful management after heavy rain and wet periods will reduce the impact of short-term waterlogging. Intensive stocking, cultivation and vehicular traffic should be minimised during these periods.
- Installation and maintenance of sub-surface mole and tile drains will reduce the risk of short-term waterlogging.
- If compaction occurs, aeration at the correct depth and moisture content can be of benefit.

Soil profiles available for Mokotua soils

Soil symbol	Profile ID	Topoclimate map sheet	Profile description available	Physical data available	Chemical data available	Profile photo available
MtU1	LT14	41	✓	✓	✓	✓
MtU1	ET6	28a	✓	✓	✓	✓
MtU1	UT15	14	✓	✓	✓	✓
MtU1	JT9	21	✓	✓	✓	✓
MtU1	CT3	6	✓	✓	✓	✓
MtU1	JT5	21	✓	✓	✓	✓
MtU1	176/76/30	8	✓			

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