Soil name: Kapuka

Overview

Kapuka soils occupy about 3,600 ha on alluvial and old marine terraces in the coastal area of the Southland plain south east of Invercargill. They are formed in shallow to moderately deep loess derived from greywacke that overlies gravel. Kapuka soils are imperfectly drained soils, with moderately deep rooting depth, high available water capacity and silty textures. The soils show strong leaching, with high P-retention and are strongly acidic. The podzol features are likely to be less evident in areas that have significant development inputs. Present use is pastoral grazing with sheep, beef cattle and some dairy. Climate is cool temperate with regular rain throughout the year.

Soil classification

NZ Soil Classification (NZSC):	Firm Pan Podzol; with stones; silty over skeletal
Previous NZ Genetic Classification:	Lowland podsolised yellow-brown earth

Classification explanation

The NZSC of the Kapuka soil is consistent with the previous classification. Kapuka soils are strongly leached with low base saturation, and are stongly acidic. The profile form is characterised by humus and iron eluviation staining the matrix and coating peds, with the development of a Bs horizon. There is a subsoil horizon that is structureless, with slightly firm or greater soil strength, that may limit root penetration, and has slow permeability that may cause waterlogging during wet periods. The soils typically have silt loam textures, and gravels between 45–90cm depth.

Soil phases and variants

Identified units in the Kapuka soils are:

- Kapuka undulating moderately deep (KpU2): has gravel between 45 and 90cm depth; occurs on slopes of 0–7°
- Kapuka undulating shallow (KpU3): has gravel within 45cm depth; occurs on slopes of 0–7°

The soil properties described in this Technical Data Sheet are based on the most common phase, Kapuka undulating moderately deep (KpU2). 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., Kapuka undulating shallow (KpU3).

Associated soils

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

- Otanonomo: poorly drained peat soil; formed on raised peat bogs
- Invercargill: poorly drained peat soil; formed on basin peat bogs
- Mokotua: imperfectly drained Brown soil
- Tisbury: occurs on same landforms but are poorly drained

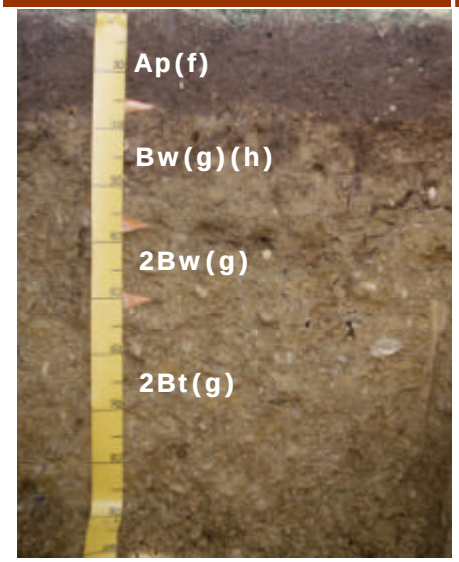
Similar soils

Some soils that have similar properties to Kapuka soils are:

- Ashers: podzolised soil formed into deep loess
- Tiwai: podzolised shallow to moderately deep soil on marine terraces with thin iron pans, and cemented underlying gravels; tend to have dominantly organic enriched Bh horizons, whereas Kapuka tends to have dominantly iron enriched Bs horizons

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.

Kapuka profile	Horizon	Depth (cm)	Description
	Ap(f)	0–16	Greyish brown very slightly gravelly silt loam; few dark brown concentrations; weak soil strength; moderately developed very fine to fine polyhedral structure; gravels subrounded and slightly weathered; abundant roots
	Bw(g)(h)	16–37	Bright yellowish brown very slightly gravelly silt loam; many dull yellow and few bright brown mottles; abundant dull brown and common brownish black organic coats on faces of peds; few worm casts; weak soil strength; moderately developed fine to coarse polyhedral structure; gravels subrounded and slightly weathered; many roots
	2Bw(g)	37–50	Bright yellowish brown moderately gravelly loamy silt; many dull yellow and few bright brown mottles; few brownish black organic coats on faces of peds and gravels; few worm casts; weak soil strength; moderately developed very fine to fine polyhedral structure; gravels subrounded and slightly weathered; few roots
	2Bt(g)	50–90+	Bright yellowish brown very gravelly loamy silt; many dull yellow and few bright brown mottles; many bright yellowish brown clay coats on faces of gravels; massive structure; gravels subrounded and slightly weathered; few roots

Key profile features

Kapuka topsoils are 16–25 cm deep and have a moderately developed structure. Subsoil structure is also moderately developed, which changes to a massive structure in the underlying gravels. The slow permeability of the clay-bound underlying gravels is reflected in the subsoil mottling. The upper subsoil is characterised by the accumulation of complexes of iron and organic matter, reflecting the podzolised nature of this soil.

Typical physical properties

Note: values in Italics are estimates

Horizon	Depth (cm)	Bulk density	Permeability	Texture	Gravel content
Ap(f)	0–16	Moderate	*Moderate*	Silt loam	Very slightly gravelly
Bw(g)(h)	16–37	Moderate	*Moderate*	Silt loam	Very slightly gravelly
2Bw(g)	37–50	Moderate – High	*Moderate*	Loamy silt	Moderately gravelly
2Bt(g)	50–90+	—	*Slow*	Loamy silt	Very gravelly

Profile drainage: Imperfect

Plant readily available water: *High*

Potential rooting depth: Moderately deep

Rooting restriction: Subsoil gravelliness. The subsoil acidity and aluminium toxicity may also be limiting

Key physical properties

Kapuka soils have a moderately deep rooting depth and high plant available water, although the subsoil gravelliness, acidity and aluminium toxicity may be limiting (particularly on less developed sites). Soils are imperfectly drained, with slowly permeable subsoils that may cause short-term waterlogging after heavy rain. Textures are silt loams throughout the profile, with topsoil clay content of 10–22%. Kapuka soils typically have gravels between 45 and 90cm depth. The shallow phase has gravels within 45cm, and will have a slightly deep rooting depth and moderately high plant available water.

Typical chemical properties

Horizon	Depth (cm)	pH	P retention	CEC	BS	Ca	Mg	K	Na
Ap(f)	0–16	Moderate	High	High	Moderate	High	Moderate	Low	Low
Bw(g)(h)	16–37	Moderate	High	Moderate	Low	Low	Very low	Very low	Very high
2Bw(g)	37–50	Moderate	Moderate	Moderate	Very low	Very low	Very low	Very low	Low
2Bt(g)	50–90+	Low	Moderate	Low	Very low	Very low	Very low	Very low	Low

Key chemical properties

Topsoil organic matter levels are 12–16%; P-retention 45–90% and pH low to moderate (low–mid 5s). Soil acidity tends to decrease in the subsoil, and be <5.0 in less developed sites. Cation exchange is high and base saturation moderate to low. Available calcium and magnesium levels are moderate in the topsoil but low in lower horizons. Potassium levels are low throughout the profile. Reserves of phosphorus are also low. Micronutrient 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	moderate	These soils have a moderate vulnerability to structural degradation by long-term cultivation, or compaction by heavy stocking and vehicles. This rating reflects the imperfect drainage and low clay content, offset by the high organic matter and P-retention.
Nutrient leaching	slight	These soils have a slight to moderate vulnerability to leaching to groundwater depending on soil depth. This rating reflects the imperfect drainage, high water-holding capacity and slow subsoil permeability.
Topsoil erodibility by water	slight	Due to the high organic matter content, topsoil erodibility in 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	moderate	These soils have a moderate vulnerability to waterlogging during wet periods. This rating reflects the imperfect drainage and slow subsoil permeability.

General landuse versatility ratings for Kapuka soils

Note: The versatility ratings in the table below are indicative of the major limitations for semi-intensive to intensive landuse. 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.

KpU2 (Kapuka undulating moderately deep)

Versatility evaluation for soil KpU2		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Moderate	Inadequate aeration during wet periods; restricted rooting depth
Arable	Moderate	Inadequate aeration during wet periods; vulnerability to short-term waterlogging after heavy rain
Intensive pasture	Moderate	Inadequate aeration during wet periods; subsoil acidity
Forestry	Moderate	Restricted rooting depth; vulnerability to sustained waterlogging

KpU3 (Kapuka undulating shallow)

Versatility evaluation for soil KpU3		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Limited	Restricted rooting depth
Arable	Moderate	Inadequate aeration during wet periods; restricted rooting depth
Intensive pasture	Moderate	Inadequate aeration during wet periods; subsoil acidity
Forestry	Limited	Restricted rooting depth.

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 heavy vehicular traffic should be minimised during these periods.
- Installation of subsurface tiles and open ditches will reduce the risk of short-term waterlogging.

Soil profiles available for Kapuka soils

Soil symbol	Profile ID	Topoclimate map sheet	Profile description available	Physical data available	Chemical data available	Profile photo available
KpU2	LT21	41	✓	✓	✓	✓
KpU3	LT18	41	✓	✓	✓	✓
KpU2	LT10	41	✓	✓	✓	✓

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