Soil name: Pukerau

Overview

Pukerau soils occupy about 2,300 ha on rolling to hilly land in northern and eastern Southland, and in south Otago. The soils occur above about 300m in the Kaiwera area, lowering to above 100m in the Tokonui area. They are formed into thin loess overlying tuffaceous greywacke bedrock. These soils are well drained, have a shallow rooting depth, with moderate to high plant available water depending on the depth to the bedrock. They have heavy silt loam textures and have a P-retention of >85%. Present use is extensive grazing with sheep and beef cattle and forestry. Climate is cool with prevailing west to southwest winds because of the exposed position. Regular rainfall occurs and soils seldom dry out.

Soil classification

NZ Soil Classification (NZSC):	Acidic Orthic Allophanic; angular stoney, tuffaceous mudstone; silty.
Previous NZ Genetic Classification:	Moderately to strongly leached upland yellow-brown earth.

Classification explanation

The NZSC of Pukerau soils is consistent with the previous classification. The soils typically are strongly leached, with P-retention of >85%, low bulk density, and are acidic with pH of <5.5. Pukerau soils typically have silty textures, and bedrock occurs within 45cm depth.

Soil phases and variants

Identified units in the Pukerau soils are:

- Pukerau rolling shallow (PuR3): has gravels or bedrock within 45cm depth; occurs on slopes of 7–15°
- Pukerau undulating shallow (PuU3): has gravels or bedrock within 45cm depth; occurs on slopes of 0–7°
- Pukerau hilly shallow (PuH3): has gravels or bedrock within 45cm depth; occurs on slopes of 15–25°
- Pukerau steep shallow (PuS3): has gravels or bedrock within 45cm depth; occurs on slopes of >25°

The soil properties described in this Technical Data Sheet are based on the most common phase, Pukerau rolling shallow (PuR3). 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., Pukerau steep shallow (PuS3).

Associated soils

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

- Otaraia: deep, well drained Brown soil with P-retention of 40–85% and pH of <5.5
- Tokanui: deep, well drained Brown soil with P-retention of 40–85%
- Haldane: deep, imperfectly drained Brown soil with pH of <5.5
- Rosemarkie: strongly leached upland equivalent of the Otaraia soil; has P-retention of >85%

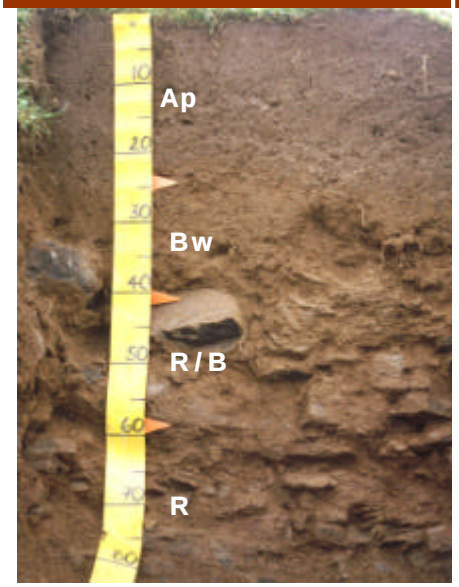
Similar soils

Some soils that have similar properties to Pukerau soils are:

- Venlaw: shallow Allophanic soil, formed in gravelly colluvium
- Kaiwera: shallow Brown soil, formed in gravelly colluvium
- Fortification: moderately deep equivalent of the Pukerau soil, with bedrock at 45–90cm depth

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.

Pukerau profile	Horizon	Depth (cm)	Description
	Ap	0–24	Greyish brown very slightly gravelly silt loam; weak soil strength; strongly developed very fine to fine polyhedral structure; gravels moderately weathered and angular; abundant roots
	Bw	24–41	Brown slightly gravelly silt laom; few worm casts; weak soil strength; moderately developed medium and very fine polyhedral structure; gravels moderately weathered and angular; many roots
	R/B	41–59	Tuffaceous sandstone bedrock with brown silt loam fine earth in fissures; few roots in fissures
	R	70+	on tuffaceous sandstone

Key profile features

Pukerau topsoils are about 20–27cm deep with a strongly developed structure. Subsoil structure is also moderately developed. It is a common for the subsoil to be absent, where there is just a thin topsoil over the bedrock.

Typical physical properties

Note: values in Italics are estimates

Horizon	Depth (cm)	Bulk density	Permeability	Texture	Gravel content
Ap	0–24	Low	*Moderate*	Silt loam	Very slightly gravelly
Bw	24–41	Low	*Moderate*	Silt loam	Slightly gravelly
R/B	41–59	—	—	Silt loam	Very gravelly
R	59+	—	—	—	Extremely gravelly

Profile drainage: Well

Plant readily available water: *High*

Potential rooting depth: Shallow

Rooting restriction: Bedrock

Key physical properties

Pukerau soils have a shallow rooting depth, restricted by the graveliness and bedrock in the subsoil, but moderate to high plant available water. These soils are well drained, with good aeration and permeability throughout the soil. Textures vary between heavy silt loam and silty clay, with topsoil clay content of 30–50%. The soils are gravelly throughout, and typically have at least 35% gravel within 45cm depth. Bedrock also typically occurs within 45cm depth.

Typical chemical properties

Horizon	Depth (cm)	pH	P retention	CEC	BS	Ca	Mg	K	Na
Ap	0–24	Moderate	Very high	Very high	Low	High	Moderate	Low	Moderate
Bw	24–41	Moderate	Very high	High	Low	High	Moderate	Very low	Moderate
R/B	41–59	—	—	—	—	—	—	—	—
R	59+	—	—	—	—	—	—	—	—

Additional chemical properties (as a profile average)

Reserve potassium (kc) values are moderate and subsoil sulphur levels high.

Key chemical properties

Topsoil organic matter levels are about 12–18%. P-retention >85% and pH moderate (low–mid 5s). Cation exchange is very high and base saturation low. Available calcium and magnesium levels are moderate and potassium levels low. Micronutrient levels are generally adequate although sheep may require supplementary cobalt and deer and cattle supplementary copper.

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 strong structure and well drained nature of the soil.
Nutrient leaching	severe	These soils have a severe vulnerability to leaching to groundwater. This rating reflects the good drainage and permeability. Those soils with high water holding capacity are likely to be moderately vulnerable.
Topsoil erodibility by water	slight	Due to the high organic matter and clay content , topsoil erodibility in 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	slight	These soils have a slight vulnerability to waterlogging during wet periods. This rating reflects the good drainage and permeability. The hilly and steep phases are likely to have nil vulnerability.

General landuse versatility ratings for Pukerau 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.

PuR3 (Pukerau rolling shallow)

Versatility evaluation for soil PuR3		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Limited	Restricted rooting depth.
Arable	Limited	Rolling slopes; restricted rooting depth.
Intensive pasture	Limited	Restricted rooting depth.
Forestry	Unsuitable	Shallow rock depth

PuU3 (Pukerau undulating shallow)

Versatility evaluation for soil PuU3		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Limited	Restricted rooting depth.
Arable	Limited	Restricted rooting depth.
Intensive pasture	Limited	Restricted rooting depth.
Forestry	Unsuitable	Shallow rock depth

PuH3 (Pukerau hilly shallow
PuS3 (Pukerau steep shallow)

Versatility evaluation for soil PuH3, PuS3		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Unsuitable	Hilly and steep slopes
Arable	Unsuitable	Hilly and steep slopes
Intensive pasture	Limited	Hilly and steep slopes; restricted rooting depth.
Forestry	Unsuitable	Shallow rock depth

Management practices that may improve soil versatility

- Careful management of fertiliser nutrient applications to minimise leaching losses.

Soil profiles available for Pukerau soils

Soil symbol	Profile ID	Topoclimate map sheet	Profile description available	Physical data available	Chemical data available	Profile photo available
PuR3	NT5	30	✓	✓	✓	✓
PuR3	KT1166	42	✓	✓	✓	
PuU3	GG/GW23	42	✓			

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