Soils of the Australian Alps

Our people treat soil with respect. If a hole is dug to gather bush tucker then it is always filled in again.

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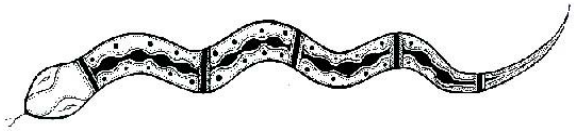
Illustration: Jim Williams



Mountains with soil

The Australian Alps are 'mountains with soil' as distinct from many ranges overseas which are 'rock mountains'. Mountains on other continents are generally younger and steeper, and have been more heavily glaciated, all factors that contribute to the absence of soil. **Glaciation**, which has led to the removal of soil by snow, ice, water and wind, has been restricted to a small area at the highest elevations in New South Wales.

Soil is an essential part of any land-based ecosystem. Soil provides an anchor for plants to grow, it provides nutrients and water for plants and it also provides a habitat for **micro-organisms** and **invertebrates**. These plants and animals then become the food source for many other animals, providing the biological support base of all other organisms in the ecosystem. Plants also protect the soil from erosion by providing ground cover. The stability of Australian mountain ecosystems therefore, depends primarily on good vegetation cover maintaining the health of the soils.

Feathertop summit, an example of the Australian Alps as 'mountains with soil'

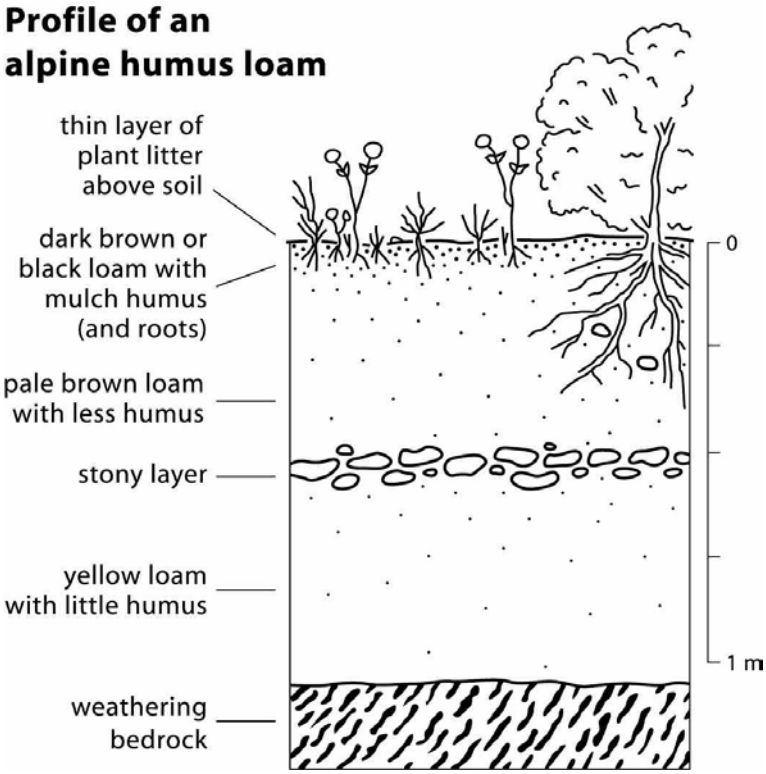
Features of the soils of the Australian Alps

The development of soils in any ecosystem is shaped by geology, climate and topography. In the Australian Alps, low temperatures slow down **chemical weathering** of the various types of bedrock, thus slowing the formation of soil. At the higher elevations ice crystals form inside rock cracks, speeding up the mechanical shattering of rocks as the ice expands and opens up the cracks even more. The high rainfall causes most of the **soluble** products of weathering, including minerals and plant nutrients, to be **leached** or washed out of the soil and rocks, finishing up in streams and ultimately the sea. The more strongly the soils are leached the more **acidic** they become.

Humus, or dead plant and animal matter, **decomposes** slowly in the cold conditions of the Australian Alps. Consequently nutrients are low in the soils at higher elevations. Bacteria and fungi, which are the agents that break down humus, prefer lower elevations where temperatures are higher and there are more nutrients necessary for growth. The humus therefore builds up, making the soil highly porous, very crumbly and interspersed with varying sized rock '**floaters**'.

The high level of humus means the soil can hold and release a large amount of water. High potential for water storage and release are important, considering the large volumes of rain and snow falling on the Australian Alps. Nearly all the water falling as snow, hail and rain passes through the soil. Some available water supports spring and summer plant growth; the rest drains from the Alps through an extensive system of bogs, streams and rivers. The slow release of water into the river system after winter contributes to a more uniform **stream flow**, making water available in the dry summer months. The bog and fen communities are also of particular significance in regulating water flow in the Alps. Sphagnum Moss, the key species in the bog communities, can absorb up to twenty times its own weight in water. Moss beds act as natural reservoirs for the storage and **discharge** of water.

The alpine soils are highly vulnerable to damage. Low temperatures, frosts and strong winds mean that regrowth of plants, is slow. Once exposed, soils are vulnerable to the weather and more likely to erode. Frost on exposed soil surfaces in the Australian Alps can cause significant erosion. As the soil freezes, fine needles of ice form in the surface soil, drying it out and pushing soil particles upwards. When the ice melts, the loose soil falls down the slope, or may be removed by wind or water. This **needle-ice erosion** is soon followed by faster wind and water erosion. This action is particularly severe on alpine humus soils when they are not protected by snow cover in late autumn and after the spring thaw. Needle-ice erosion is a periglacial phenomenon.



Soil types found in the Australian Alps

Soils of the Australian Alps are very diverse; a relatively large range of soil types is found over a comparatively small area. Soil type varies across the Alps and this is determined by the type of rock underneath, the steepness of the slope and the level of exposure to the weather. The main types of soils found in the Alps include:

Sandy lithosols [Lith (rock) sol (soil)] are shallow soils developed largely from weathering of rock. Sandy lithosols have very low organic content and are shallow, dry and sandy. They are found on the high exposed ridges and stony slopes at subalpine and alpine altitudes and are associated with shrubby heathland, herbfields and feldmark plant communities.

Humus soils are developed largely from the breakdown of organic material so are rich in decomposing plant matter. They are found on the gently undulating, sheltered and well-drained slopes at subalpine and alpine altitudes. This is the most common soil type and is associated with tussock grasslands, herbfields and Snow Gum woodlands.

Peat soils are developed under saturated conditions and are made up of decomposed and partially decomposed plant matter. Peats are acid, waterlogged soils with large chunks of undecomposed plant material and are found in the basins and depressions of valleys. They are formed in wet conditions where the breaking down of dense layers of moisture-loving plants occurs slowly and are associated with bogs, candle heath and sedges.

Loam has equal quantities of clay, sand and silt, and frequently has a good content of organic matter.

Duplex Soils have two distinct horizons in their profile.

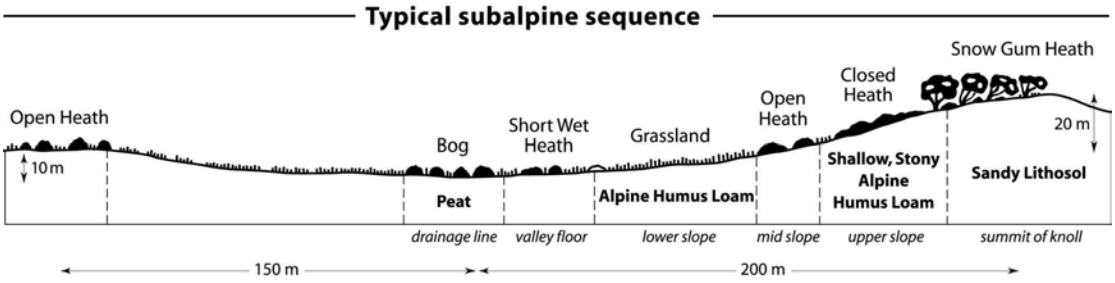
Gradational Soils have increasing clay content with depth.

Soils and landuse of the Australian Alps

From the point of view of human use, the most important feature of the soils of the Australian Alps is the capacity of the alpine and subalpine soils to hold and release water. The high rates of precipitation and their water holding capacity makes the Australian Alps one of the most important **water catchment** areas for Australia. Water is stored in, and slowly released from, snow, ice, pools, the soil and some vegetation such as Sphagnum Moss, so the high country generates enormous amounts of **runoff** water. Through storage and regulation of stream flows this is available to people for domestic use, irrigation and generation of hydro-electricity.

The high country is highly vulnerable to severe soil erosion. Soils exposed by overgrazing or burning, road or track construction, camping, walking off designated tracks or vegetation slashing, are quickly eroded by frost, wind or water.

In an environment where plant growth is restricted to a short season, rehabilitation of damaged sites is extremely difficult. Damage is not just restricted to the local area. Soil material eroded from the higher elevations is deposited in different habitat zones further down the mountain, disrupting the fine balance of these ecosystems and causing further problems. It is very important therefore that the environment is managed to protect it from these kinds of effects.



Characteristics of soils of the Australian Alps

Zone	Lower elevations (Tableland/lower slopes)	Montane	Subalpine and alpine		
Soil Type	Duplex	Friable Gradational Loams Brownish Gradational Loams	Alpine Humus Loams	Peats	Lithosols
Description	These soils have two distinct horizons: a sandy loam or hard-setting loam overlaying a heavy clay horizon. They are found on the lower slopes and tableland areas adjacent to the Australian Alps.	Lower Montane: loams gradually merging into clay with depth. Upper Montane: deep friable loams. Highly porous and friable, these soils are found on the steep slopes of the montane zone.	Shallow, very friable loams. The most extensive soil type found in the subalpine and alpine zones, occurring on relatively sheltered, gentle, well-drained slopes. The surface soil is highly organic with strong plant root development. Highly porous and friable.	Found in basins and depressions where water collects all year round. They are highly organic and contain undecomposed and partially decomposed plant remains.	Very shallow loams found in pockets on high exposed ridges and elevated stony slopes. They have a lower organic content than alpine humus loams and are highly porous.
Surface Colour	yellow to grey-brown	brown to grey-brown	dark brown	black	light brown
Organic content ('A' Horizon)	medium	medium high	high	extremely high	medium high
Clay Content	low in surface high in subsurface	low in surface medium in subsurface	low	low	low
Depth	medium	deep	medium	medium	shallow
Floaters	not many	few	many	many	many
Acidity (pH)	6-7	5-6	4-5	4	4-5
Origin	*In situ* weathering of parent materials with some deposition of soils above.	Weathering of bedrock, some deposition of soils from above and the breakdown of plant remains. Wetter and cooler conditions produce deeper soils and a greater accumulation of organic material.	Weathering of bedrock and intense biological cycling in the upper layers.	An accumulation of undecomposed and decomposed plant remains. Waterlogged environment and low temperatures restrict decomposition of organic matter.	Weathering of bedrock under extremes of heat, cold, wind and precipitation.
Associated Vegetation Communities	open woodlands mixed eucalypt forest	tall open forests (wet) open forests (dry)	tussock grasslands alpine herbfields Snow Gum woodlands	Sphagnum bogs	shrubby heathland, herbfield feldmark

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Glossary

Acidic

Soils that are acidic have a low pH (less than 7). The more organic content that is broken down in the soil, the more acidic it will be. Acidic soils that are leached increase the acidity of the streams and rivers that they run into. This in turn impacts on the biology of those streams.

Chemical weathering

Some chemicals react with rock to break it down. This erodes the rock and releases elements into the soil, which are important for all plant and animal life.

Decomposition

The breakdown of dead plant or animal material through chemical reactions or micro-organisms and other invertebrates.

Floaters

Medium and small sized rocks that hang loosely in soil, unconnected to the bedrock.

Glaciation

A landscape impacted by glaciers that occurred 2,000,000 to 10,000 years ago. Glaciation is characterised by glacial features including cirque lakes, moraines and by an absence of soil.

Humus

Organic material from dead plants and animal, or plant and animal waste, that collects in the soil.

Invertebrates

Animals without a backbone, many of which live in the soil and contribute to the health of the soil by breaking down organic material and in turn contributing to the organic content as they themselves die. Invertebrates, including worms, centipedes, millipedes, bugs, insects and spiders, also help to aerate the soil.

Leaching

As water passes through the soil, soluble compounds are leached or washed out of the soil.

Micro-organisms

Tiny organisms that cannot be seen with the naked eye. Many micro-organisms (both plant and animal) live in soils and are important in breaking down dead plant and animal material.

Runoff

Water that is not retained in the soil but is released into a drainage system.

Soluble

A compound that dissolves in water. As rainwater or snow passes through soil any soluble compounds attached to the soil particles or rocks are dissolved into the water and washed out of it.

Stream flow

The velocity and volume of water in a particular stream, creek or river at a particular time.

Water catchment

The area of land from which the water runs into a drainage system. All rivers, streams and lakes have a water catchment.

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