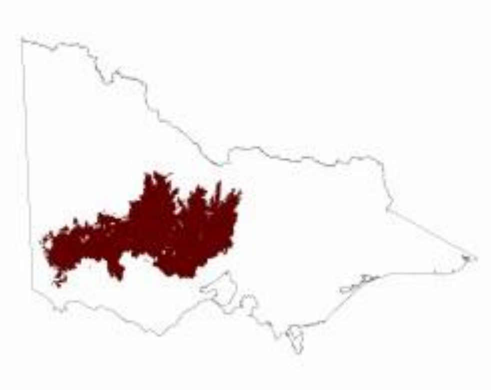
Glenaroua Soil & Fertility Field Day

14th November 2014

Geomorphology of the Glenaroua district (Western Uplands)

Victorian Resources Online
Statewide



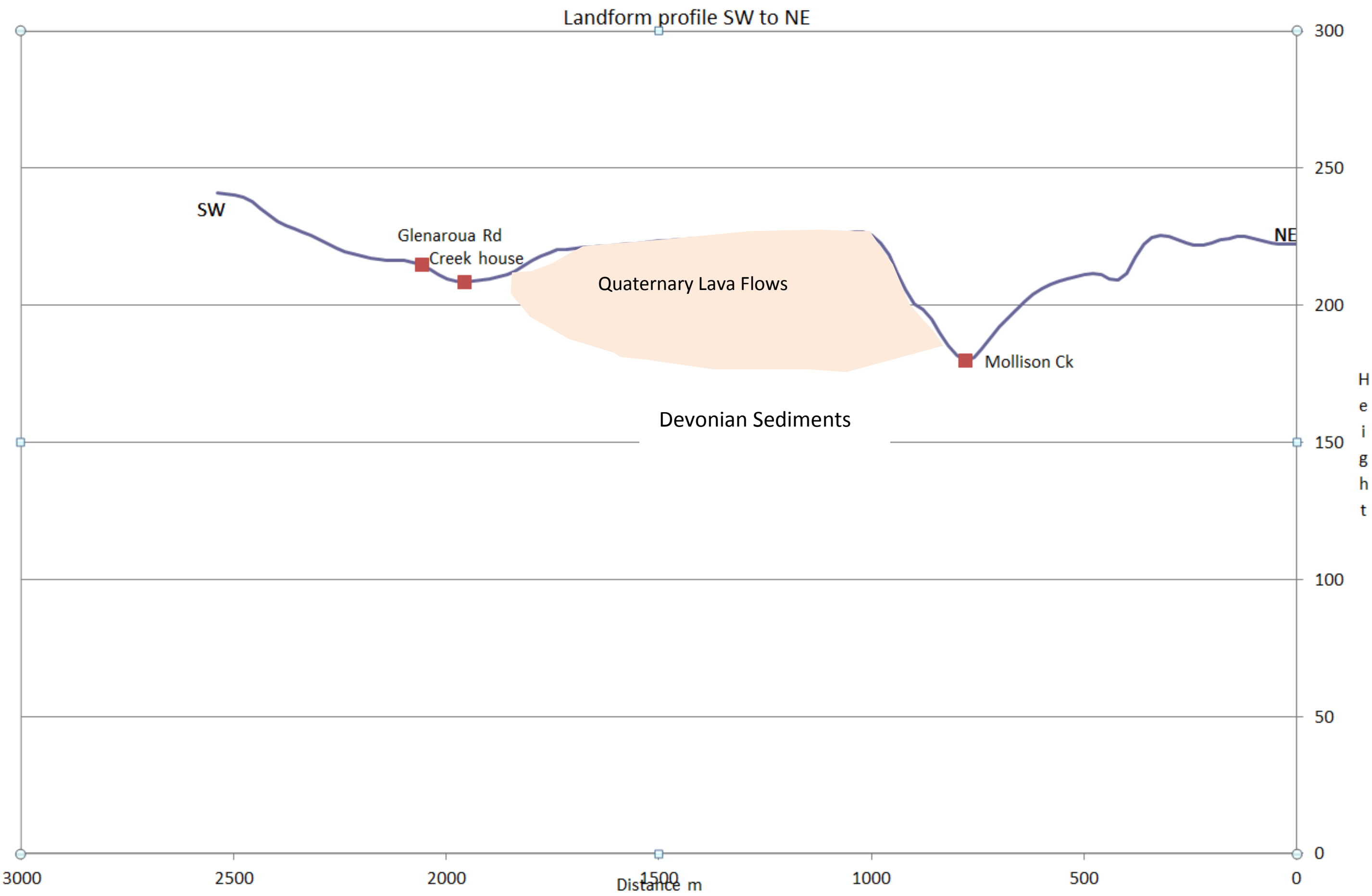
The Western Uplands of Victoria are the western part of the Victorian Highlands (Hills 1940) or Central Victorian Uplands as distinct from the Eastern Victorian Uplands (Jenkin 1988). The Western Uplands extend westwards from the Kilmore Gap (a geocol) to the western edge (Glenelg River) of the Dundas Tableland

The terrain is characterised by a suite of Palaeozoic bedrock formations that are now residuals due to differential erosion. Landforms are typically asymmetrical with gentle northern slopes and dissected southern slopes (Hills 1975). Resistant rock residuals include the granitic Harcourt batholith (Mt Alexander and Harcourt), the Cobaw Ranges, Mount Buangor and Mount Langi Ghiran; the rhyodacite massif of Mount Macedon; metamorphic ridges of Mt Tarrangower and Big Hill; Palaeozoic marine sediments of the Pyrenees Ranges and Trentham Dome; and the stratigraphic succession of quartzo-feldspathic sandstones of the Grampians Ranges.

The Western Uplands is a composite of lowlying landscapes compared to those of the Eastern Uplands, and can be described as a broad, elongated and dome-like eastwest drainage divide of low relief, with an average elevation of only 300 m (Joyce *et al*. 2003). The highest summits and mountains include Mount Macedon (1 001 m) and Camels Hump (1 011 m), Mount William (1 167 m), Mount Buangor (966 m) and Mount Langi Ghiran (922 m). Remnants of a broad Mesozoic palaeosurface have been retained, and are at lower elevations than the more striking High Plains of the Eastern Uplands. Remnants of this surface include the plateaus of Mount Cole and Mount Buangor, Mount Macedon, Mount Alexander and the Major Mitchell Plateau. At a lower level than the Mesozoic palaeosurface, an extensive Cainozoic palaeoplain lies north, west and south of the Western Uplands. Localised dissection combined with tectonic activity has formed N-S and E-W fault scarps and monoclines, and broad domal uplifts (Joyce 1992) leaving dissected landscapes of the Brisbane and Blackwood Ranges with extensive gorges (e.g. Lerderderg Gorge) and valleys (e.g. Parwan Valley). Elsewhere low angle valley sides are thinly mantled with gravel, sand and clay. Volcanic plains also occur within the Midlands part of the Westen Uplands, with numerous and closely-spaced scoria cones with their lava flows forming a surrounding subdued landscapes. The youthful north-south Muckleford Fault marks the boundary between the numerous scoria cones of the Creswick-Ballarat lava fields, and the lava shields and valley flows of the Daylesford area further east.

Recent stream dissection has stripped regolith and produced alluvial deposits and colluvial aprons fringing the margins of the Western Uplands. The main Divide separates north-flowing streams draining to the Northern Riverine Plains from south-flowing streams that have much steeper gradients owing to their closer proximity to the Victorian coastline. The Divide is ill defined (Hills 1975) due to extensive weathering of landscapes leaving ranges and ridges with extensive valley systems that do not resemble the well-defined ridge and valley relief of the Eastern Uplands.

Nineteenth century gold mining has left a major imprint on the modern landscape. reducing forest cover, disturbing rock outcrops, drainage and flood plains, and producing post-contact deposits (Kotsonis and Joyce 2002) as thin sheets of alluvium downstream on valley floors or as alluvial fans onto the plains.


Landform profile SW to NE
SW
NE
Glenaroua Rd
Creek house
Quaternary Lava Flows
Mollison Ck
Devonian Sediments
Height
Distance m
300
250
200
150
100
50
0
3000
2500
2000
1500
1000
500
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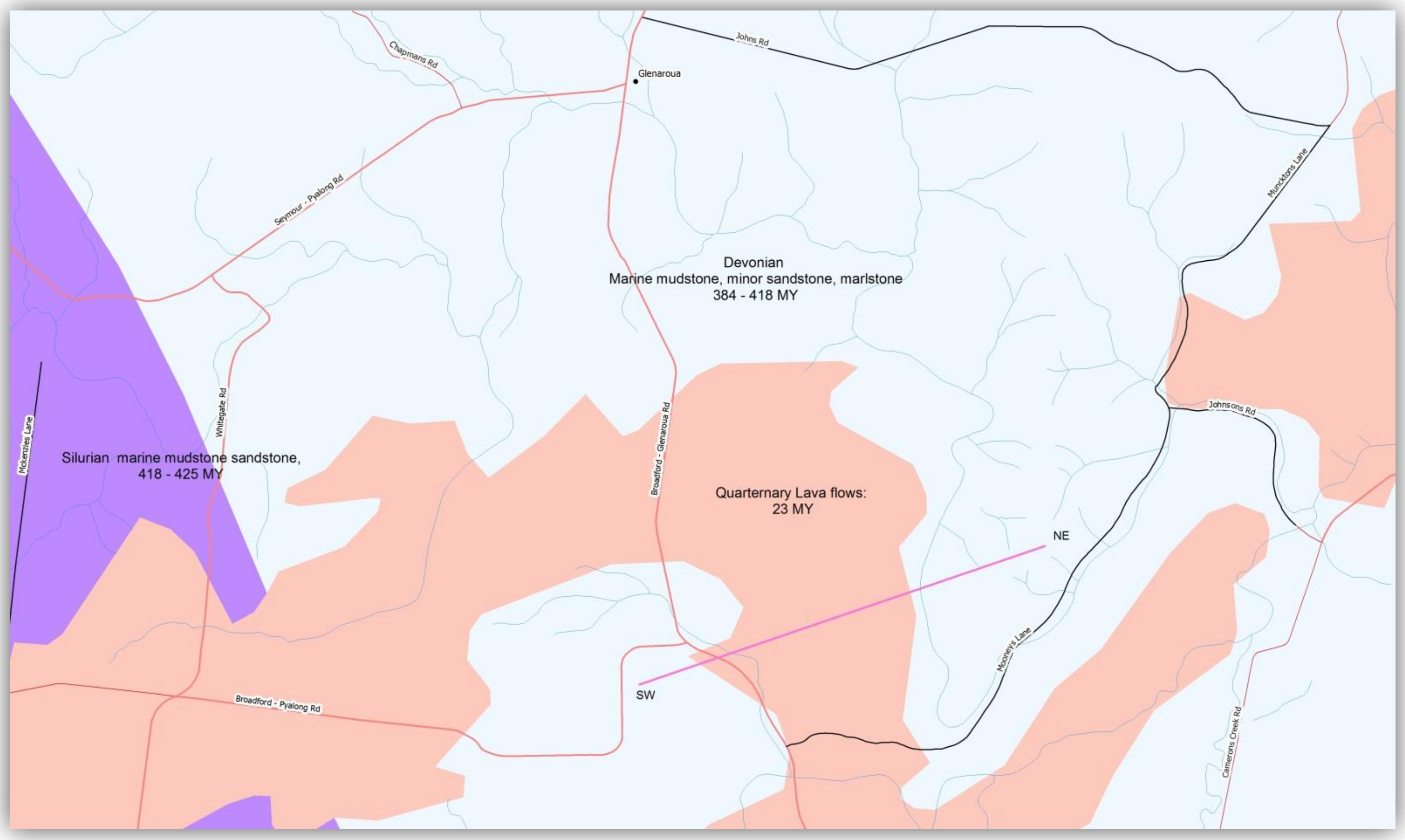

Glenaroua
Johns Rd
Chapmans Rd
Seymour - Pyalong Rd
Munckton Lane
Devonian
Marine mudstone, minor sandstone, marlstone
384 - 418 MY
Whitegate Rd
Broadford - Glenaroua Rd
Johnsons Rd
Mckenzies Lane
Silurian marine mudstone sandstone,
418 - 425 MY
Quarternary Lava flows:
23 MY
NE
SW
Mooneys Lane
Broadford - Pyalong Rd
Camerons Creek Rd

Soil Profile

Soil profile is a side view or vertical cross-section of the soil as seen in a ditch, road cutting, bank or soil pit. The soil profile is divided into layers or "horizons." These layers differ in colour, physical properties, chemical composition, and biological characteristics. A soil profile has three major parts or horizons: (1) the topsoil or "A" horizon, (2) the subsoil or "B" horizon, (3) the parent material or "C" horizon. A hypothetical soil profile is shown in Figure 1.

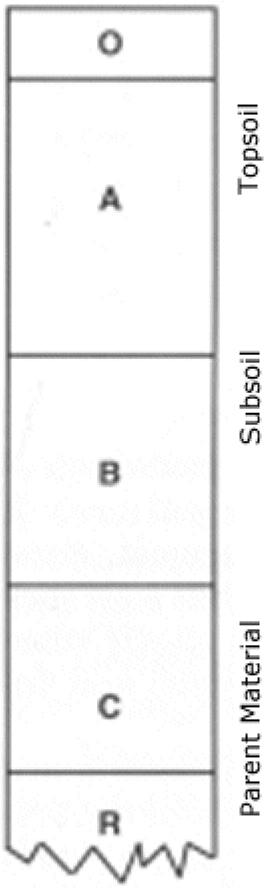


Figure 1 Hypothetical soil profile showing the letter designation used in describing the major kinds of horizons usually present

Organic horizon(O) of undecomposed and decomposed organic matter. Absent in cultivated and many other soils.

Mineral surface soil which has accumulated decomposed organic matter and is usually darker colored than lower layers. It is also the horizon that has lost organic matter, clay, iron, and aluminum due to downward movement.

Mineral horizon that usually has a finer texture, or a darker, stronger, redder color and a distinctly different developed structure. Structure is often more distinct than in the "A" horizon.

Mineral horizon of weathered parent material like the material from which the soil developed or other substratum of unconsolidated material not related to the above soil.

Underlying consolidated bedrock. Absent under many soils.

Soil Depth

Depth refers to the total thickness of the surface and subsoil plus any underlying material that is favorable for root development. Soils are categorized into several different soil depths. Depth is an important factor of soils. It determines the total amount of water held in the soil, the volume of soil available for plant root growth, and the supply of nutrients available to plants. Generally this material is underlain by bedrock, clay, or shale beds, or alluvial material.

Deep soils have over 100 cm of soil that can be penetrated by plant roots.

Moderately deep soils have between 30 cm and 100 cm of soil that can be penetrated by plant roots.

Shallow soils have between 15 cm and 30 cm of soil that can be penetrated by plant roots.

Very shallow soils have less than 15 cm of soil that can be penetrated by plant roots.

Elements of the soil

Soil texture is the proportion of sand, silt and clay in the soil. Soil Texture normally refers to the solid particles less than 2mm in diameter known as the Earth Fraction

On an average soil, as shown in the pie chart, the mineral particles only comprise about 45% of a soil's volume. Air and water provide about 25% each and the active, live parts of the soil (plant roots, organic matter etc) usually comprise less than 5% of the volume.

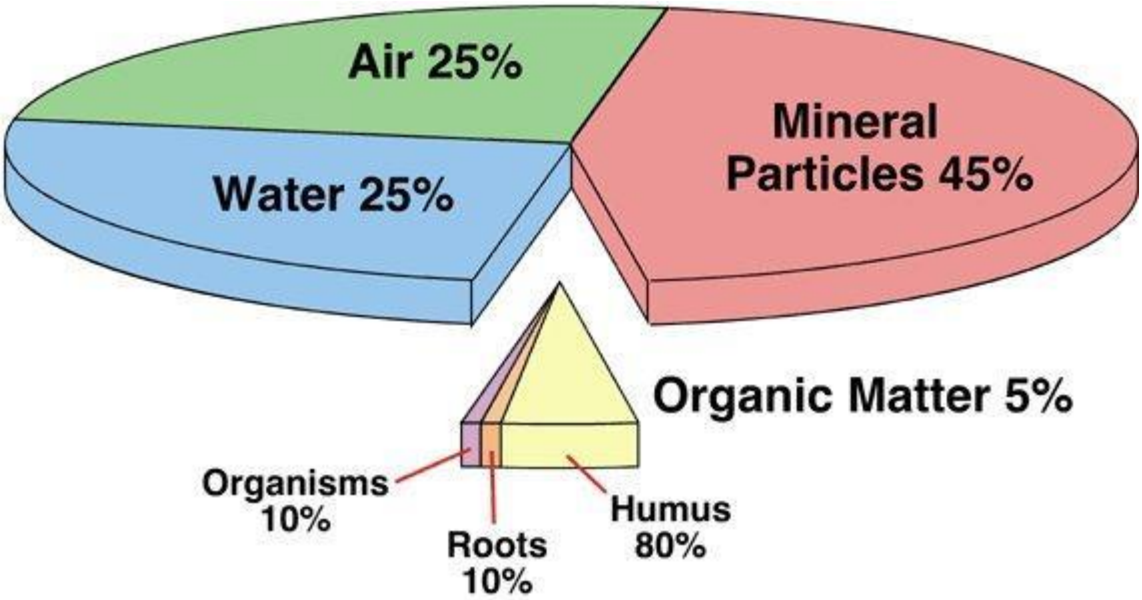


Figure 2 Components of the soil

The soil particles of sand, silt and clay have different characteristics influenced by their particle size and chemistry.

The four standard soil particle sizes are:

- Coarse sand 0.2 – 2mm
- Fine sand 0.02 -0,2mm
- Silt 0.002 – 0.02mm
- Clay < 0.002mm

Sand

Sands are generally sharp angular fragments of weathered rock and mainly consist of the mineral quartz with smaller amounts of other minerals. The particle size of sands is 0.02mm to 2 mm

Properties of Sand -

- Has large pore spaces between particles.
- Has low water holding capacity.
- Has a low ability to absorb and hold plant nutrients.
- Provides good soil aeration.

Silt

Silt is a smooth soil particle formed from weathered rock and mainly consists of the mineral quartz, with smaller amounts of other minerals. Particle size – 0.02mm to 0.002mm

Properties of Silt -

- Has higher moisture retention, slower drainage and less aeration than sand.
- Feels smooth and soapy.
- Silt particles provide little in the form of nutrient supply or storage, unless it is coated with clay material.

Clay

Clays are formed by the chemical weathering of rock minerals. Particle Size – Less than 0.002mm.

Properties of Clay

- Absorbs and holds plant nutrients.
- Contains very small pore spaces (but has large total pore space).
- Has high water holding capacity.
- Has a very large surface area.

Soil Organic Matter

The term "organic matter" refers to all the plant or animal material in a soil.

The benefits from organic matter come from the release of plant nutrients from decaying material and the formation of "humus". Humus increases the soils ability to store water and retain plant available nutrients.

Various organic and inorganic acids are formed in soils when organic matter decays. These acids help to dissolve soil minerals.

Organic matter is a source of food and energy for many of the soil organisms – including earthworms and useful soil bacteria.

Humus

Humus is the very stable form of organic matter (between 1 and 10% of total soil organic matter). Humus increases the cation-exchange capacity – higher than in mineral colloids (eg clay). These colloidal particles have a strong ability to hold on to plant nutrients and so reduce the rate of loss by leaching.

Properties of Humus -

- Has a negative surface charge that helps retain nutrients and water
- Does not exchange ions as easily as clay.
- Important for building and maintaining soil structure, aiding infiltration and lessening runoff.

Soil Texture

Soil texture refers to the relative proportion of sand, silt, and clay particles in a specific soil mass. It is easiest to determine when the soil is moist. Sand feels gritty when rubbed by the finger. Silt feels slick or velvety. Clay is usually sticky and plastic when wet and when pinched between the thumb and finger forms a flexible ribbon.

How to define soil texture.

Soil texture is worked out in the field by manipulating a moistened soil sample between the thumb and fingers.

Take a sample of the soil, moisten it slightly from a water bottle, and work it into a ball between your thumb and fingers. Clay soils can take several minutes. Silty soils can be worked up very quickly, sands don't work up..

The first picture is of a silty clay soil. The soil took a long time to work up so it could be easily moulded. It contained approximately 40-45% clay.



- Clay soils cannot be easily "flicked" from your thumb. Silty soils can be "flicked" off easily.
- Clay soils form large peaks between your finger and thumb. Silty soils do not form peaks of any significance.
- Clay soils leave their yellow colour on your finger. Silty soils can be cleaned right off.
- Silty soils feel "soapy". Clay soils feel "buttery".
- Silty and sandy soils spread out across your hand when shaken. Clay soils stay intact. This is due to both particle shape and particle chemistry.

Soil Texture can also be more accurately determined in the laboratory using a variety of mechanical sifting and other technical processes.

There are a number of standard diagrams, usually triangles or pyramids, that explain the standardised naming of soil texture according to the proportions or percentages of sand, silt and clay in the mix.

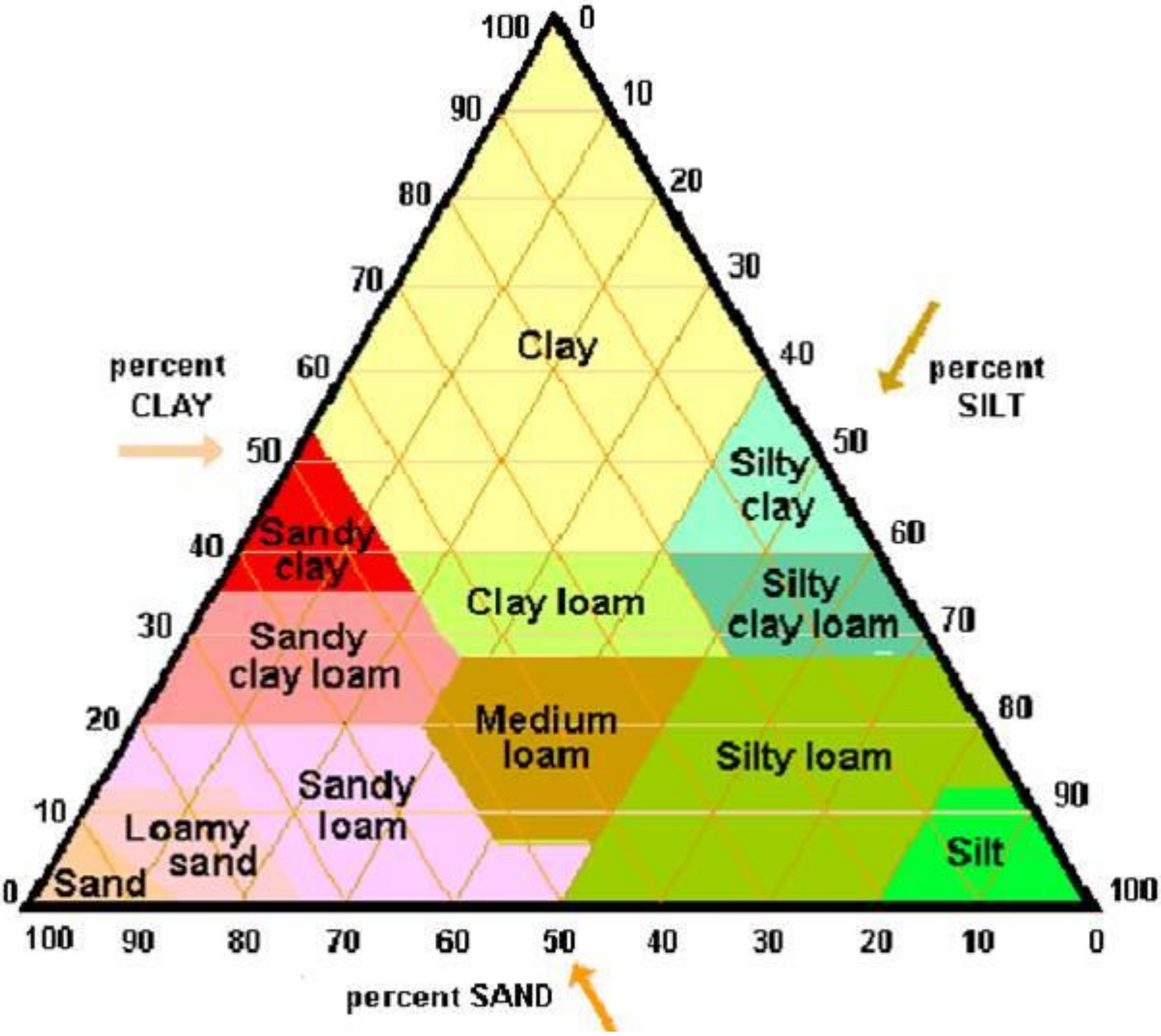


Figure 3 Soil texture triangle

Soil Structure

What is soil structure?

Soil structure is the arrangement of pores and fissures (porosity) within a matrix of solid materials (soil particles and organic matter). The solid materials bond and aggregate to give the pores and fissures. The quantity, distribution and arrangement of pores determines water holding capacity, infiltration, permeability, root penetration, and, respiration.

Soil structure close-up

Only about 50% of soil is solid material. The remainder is pore space. It is in these spaces that the action happens. Water is stored there. Organisms live there. Organic matter and nutrients accumulate there.

The diagram (magnified about 20 times) demonstrates how solids and pores might arrange in soil to give a porosity of 50 %.

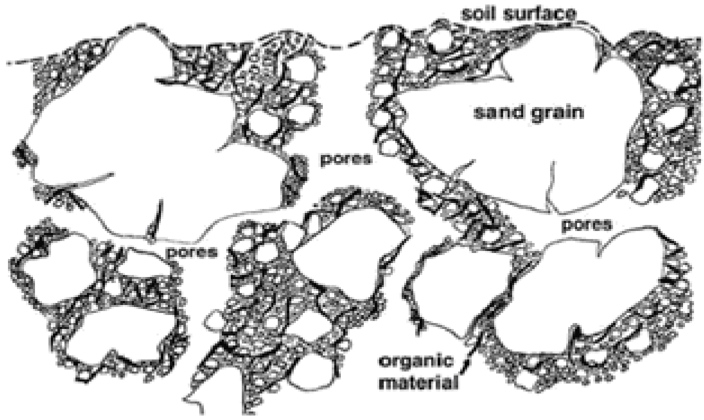


Figure 4 General diagram of soil structure

Small pores within the aggregates provide storage and refuge. The larger pores (and fissures) between the aggregates are the pathways for liquids, gases, roots and organisms.

Why is soil structure so important?

The structure and layout of soils determine how things happen, the rate at which they happen, and the capability to keep them happening.

The following characteristics are used to help evaluate the ability of any soil to perform well (or otherwise):

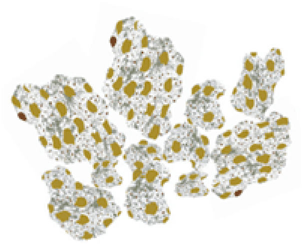
- Porosity (to represent aeration, water storage capacity, plant wilting point and drainage)
- Permeability (to represent infiltration, drainage and respiration)
- Bonding and aggregation (to represent how the solids group together and the construction materials used)
- Soil strength (to represent toughness and resilience of structures)
- Friability, tillage and trafficability (to represent how soils behave with mechanical disturbance)

What types of soil structure are there?

Soil material fits and binds together in many different ways. With some, the bonding is very weak, in others very strong. With some, the size of aggregates is very fine, in others coarse and large. With some the aggregates are dense containing few pores, in others quite open with plenty of pores.

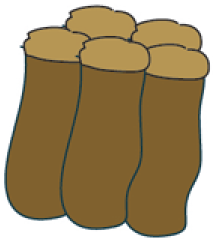
There are six broad categories of soil structure:

Granular (high permeability)

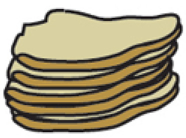


Aggregated (high permeability)

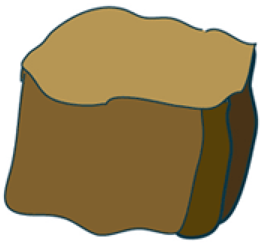
Blocky (moderate permeability)



Columnar/prismatic (moderate permeability)



Platey (low permeability)



Massive (low permeability)

Figure 5 Main types of soil structure

Indicators of damaged soil structure

- Root restriction
- Compacted layers
- Plough pans
- Surface crusting
- Soil erosion

Soil Colour

Colour is one of the most obvious characteristics of soil. Colour can also provide a valuable insight into the soil environment.

The most influential colours in a well drained soil are white, red, brown and black. White indicates the predominance of silica (quartz), or the presence of salts; red indicates the accumulation of iron oxide; and brown and black indicate the level and type of organic matter. A colour triangle can be used to show the names and relationships between the four influential colours (Figure 6).

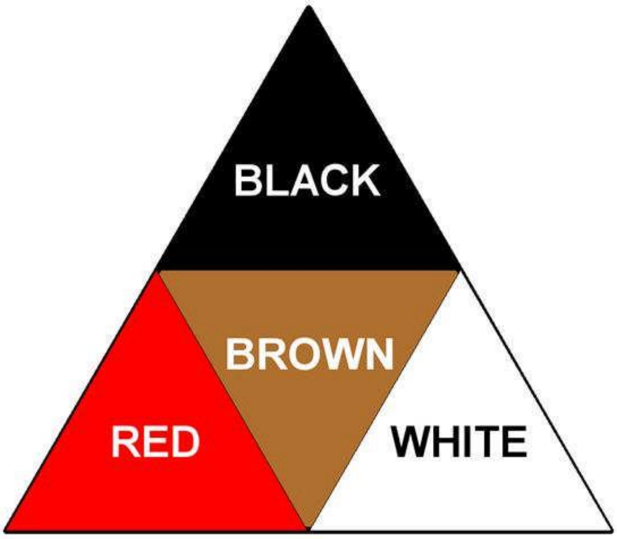


Figure 6 The four influential colours of soil colour

What determines soil colour

Four main factors influence the colour of a soil:

Mineral matter – rocks are broken down to form soils, and sometimes these rocks give their colour to the soil. More usually the colour of the soil results from compounds such as iron.

Organic matter – humus, the final stage of organic matter breakdown is black. Throughout the stages of organic matter breakdown the colour imparted to the soil varies from browns to black.

Sodium content influences the depth of colour of organic matter and therefore the soil. Sodium causes the organic matter (humus) to disperse more readily and spread over the soil particles, making the soil look darker (blacker).

Iron – Red, yellow, grey and bluish-grey colours result from iron in various forms. Under average conditions of air and moisture, iron forms a yellow oxide imparting a yellow colour to the soil.

Figure 7 Photographs of mottled soil, indicative of waterlogged conditions

Where soils are well draining or under dry conditions, iron forms red oxides imparting a red colour to the soil. Yet in waterlogged soil, with a lack of air, iron forms in a reduced state giving the soil grey/green/bluish-grey colours.

Water – Soil colour darkens as the soil changes from dry to moist. But longer term colour changes are linked to water relations as well. Careful observation of colour can help to identify problems of waterlogging or leaching.

Poorly drained soils are often dominated by blue grey colours often with yellow mottling. Well drained soils will usually have bright and uniform colours.

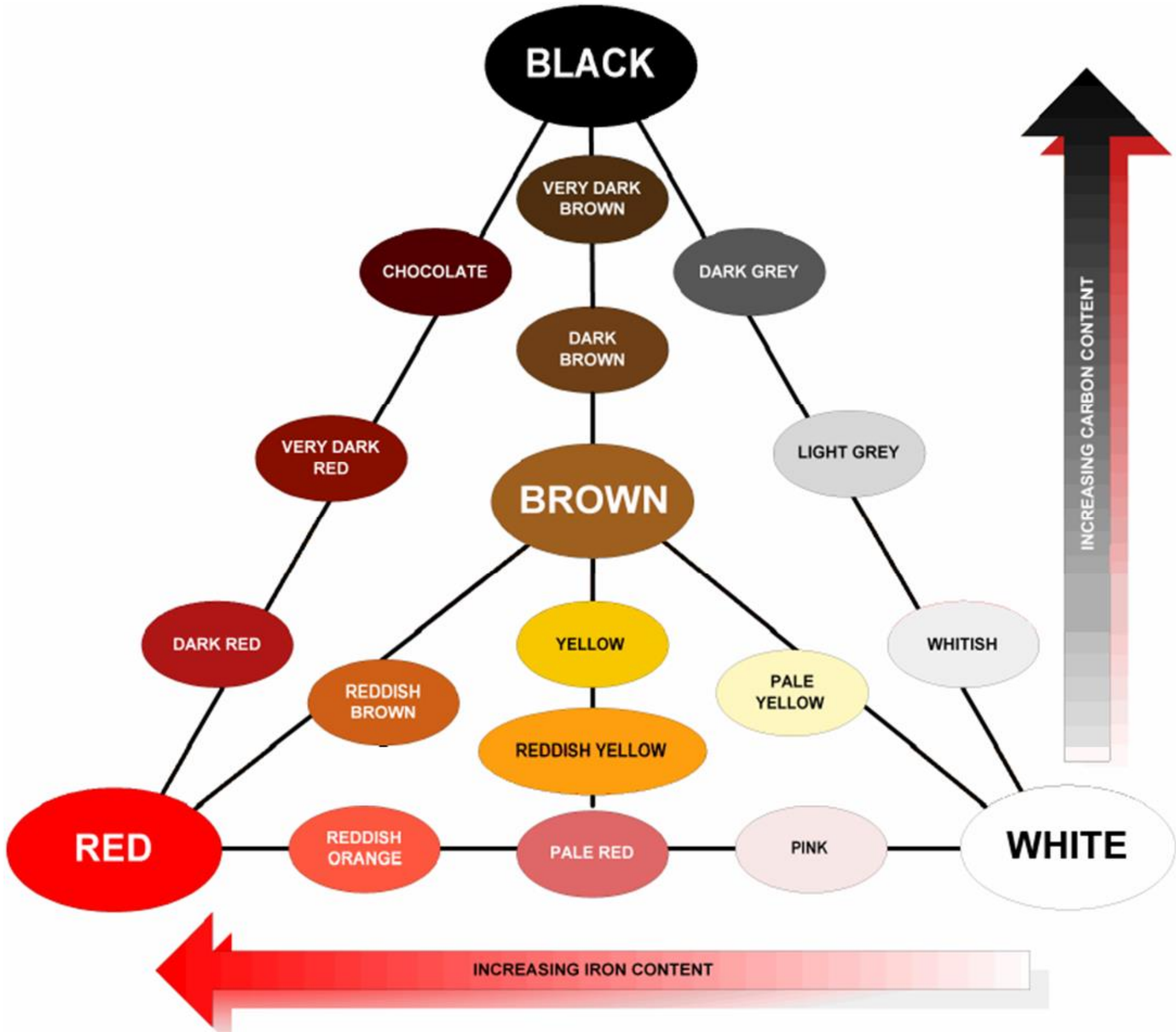


Figure 8 Colour triangle showing relationships between soil colours and influencing factors/conditions

Sources:

PRACTICAL NOTE: Soil Colour An output of the 'Soil Health for Sustainable and Productive Landscapes' Project http://soilhealthknowledge.com.au/images/PDFfiles/pracnote_colour.pdf

The Why and How of Defining your soil's texture http://informedfarmers.com/defining-your-soils-texture/

What is soil pH?

Soil acidification is a natural process and is generally accelerated by agriculture. The rate of acidification varies enormously depending on the soil type, land use, productivity and management of the farming system.

Acidity is a problem throughout the soil profile.   It is common to separate acidification of the topsoil (0 to 10 cm), from that of the underlying soil. In some cases the subsurface soil is acidifying while the topsoil pH has increased since clearing

The pH of soil indicates the strength of acidity or alkalinity in the soil. Soil is neutral when pH is 7, it is acid when pH is less than 7 and alkaline when it is greater than 7. A difference of a unit is a tenfold difference in acidity or alkalinity (eg. pH 5 is ten times more acid than pH 6).

Carbon cycle

The role of the carbon cycle in soil acidification is connected with product removal and increasing concentrations of organic anions in the soil.

Product removal. When plants absorb nutrients they tend to actively absorb more positively charged nutrients (e.g. NH_4^+, K^+, Ca^{2+}, Mg^{2+}, Na^+) than negatively charged nutrients (e.g. PO_4^{3-}, NO_3^-, Cl^-, SO_4^{2-}) from the soil solution. This excess of cations over anions is usually balanced by the plant excreting hydrogen ions from the roots. The plant tissue becomes alkaline, while the soil is acidified in the region of the roots. If plant tissue is not removed from the area the net effect is zero, although there can be a redistribution of H^+ within the soil profile. However, removal of grain, hay, silage, meat or wool leaves a net excess of hydrogen ions in the soil, causing acidification.

Stock tend to redistribute alkalinity within paddocks when large quantities of dung and urine are deposited in camps. These factors contribute to the spatial variability of soil acidity, both within and between paddocks.

Increases in soil acidity have been attributed to organic matter but this depends on the initial pH of the soil and the dissociation constants of the weak organic acids.

Nitrogen cycle

The nitrogen (N) cycle is frequently implicated in acidification, but overall it is chemically neutral. The N cycle results in no net change in acidity, *providing the cycle is completed*. If nitrogen enters the soil in one form and leaves in another, there can be a net addition or removal of H^+ (Figure 5.1.3). In broadscale agriculture, most N enters the nutrient pool through the fixation of atmospheric N by legumes. If the highly soluble nitrate ion is leached below the root neutrality it usually does so in combination with Na^+, K^+, or even Ca^{2+}, leaving H^+ in the leached zone.

Table 1 The lime equivalent to neutralise the acidity associated with organic anions at different soil organic matter and pH levels*. The effect of a change in pH, on the acidity associated with organic anions is estimated from the initial soil pH and the change in organic matter

Soil organic	CaCO3 equivalent (t/ha.10 cm)		
matter	pHCa		
(%)	4	6	8
1	0.54	0.93	1.32
2	1.08	1.86	2.63
5	2.71	4.66	6.58

Fertilisers

The main fertilisers that contribute to acidification are the nitrogenous fertilisers plus elemental sulphur (S). Elemental S has to be converted to sulphate ions by microbes before plants can absorb it, and this conversion releases H^+. The sulphate ions are soluble and thus readily leached. When sulphate ions leach, they usually do so in association with cations other than hydrogen, thereby acidifying the soil in the leached zone. The contribution of the S cycle to acidification is likely to be small in comparison with the N and C cycles.

Similarly, urea fertilisers cause net additions of H^+ if nitrate is leached. Adding fertilisers that contain N in the form of ammonium (e.g. DAP, MAP) is acidifying even when nitrate is not leached. The role of ammonium-forming fertilisers in lowering pH has been well established.

Adding single, double or triple superphosphate fertilisers does not contribute directly to soil acidity. These fertilisers only contribute by increasing the productivity of the farming system, so they increase the amount of N that can leach or the amount of produce that can be removed.

Effects of soil acidity

Soil acidity has a number of effects on plant growth including direct toxicities and nutrient availability. Deficiencies of molybdenum, nitrogen, sulphur, phosphorus, calcium and magnesium can also occur. . One major toxicity in acid soils is due to aluminium.

Nutrient availability. The supply of most nutrients is altered by soil pH (Figure 9). Decreases in the availability of molybdenum and to a lesser extent N, S, P, Ca and Mg can occur in acid soils., although this varies between soils. Increases in availability of Mn, Fe, Al and Zn can also occur. Molybdenum (Mo) supply is reduced when pH_{Ca} is lower than 4.2, because the Mo is strongly adsorbed by the soil, and fertiliser Mo has a low residual value. The rates of both nitrification ($NH_4^+ \rightarrow NO_3^-$) and nitrogen mineralisation (organic-N$\rightarrow NH_4^+$) are lower in acid soils because soil flora (fungi, bacteria, viruses) generally do not grow rapidly under these conditions. The reduced mineralisation can reduce availability of N, S and P to plants. Conversely, liming raises the pH, causing a large increase in microbial activity, increasing mineralisation of organic matter which releases N, P and other nutrient elements.

Aluminium toxicity. Aluminium (Al) toxicity can be a major problem of acid soils. It can reduce root growth in both the topsoil and subsurface soil. The effect of Al toxicity in the subsurface soil will often be seen as symptoms of drought stress, resulting from the reduced root elongation and branching. Aluminium toxicity is often described as a chemical hardpan, because the effects on root elongation are similar to those caused by subsurface compaction. The critical soil pH at which sufficient Al becomes soluble to be toxic is difficult to predict because it depends on many factors including clay mineralogy, organic matter, other cations and anions and total salts. In general, Al starts to dissolve when the pH CaCl is lower than 5.5, while below 4.5 there is a marked increase in extractable Al.

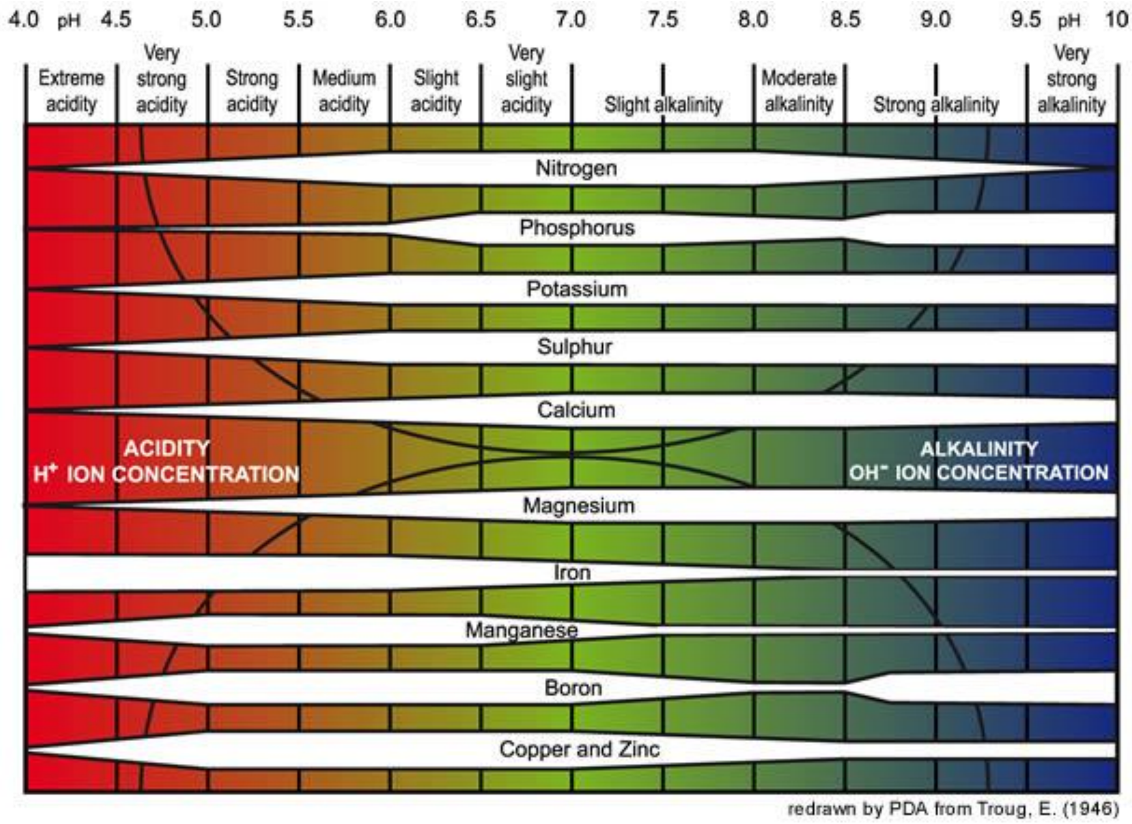


Figure 9 Effect of soil pH on availability of macro and micro nutrients

pH buffer capacity (pHBC)

This is the ability of the soil to resist changes in pH after the addition of an acid or a base, such as lime and helps explains why some soils acidify more readily than others or respond to lime more quickly. It can be defined as the rate of acid or alkali (e.g. lime) addition per unit change in soil pH.

The pHBC varies with pH. Under alkaline conditions (pH_{Ca} >7.5), the pHBC is high because of reactions involving carbonate minerals. Similarly, at low pH (pH_{Ca} <4.5), soils may be strongly buffered by reactions involving aluminium hydrous oxides. Between pH_{Ca} 4.5 to 7.5 the soil is less strongly buffered. The pHBC may be considered approximately constant between pH 4.5 and 6.0 (Magdoff and Bartlett 1985). Factors that increase the pHBC include increasing the organic matter, clay and carbonate minerals.

Measuring soil pH

A portable kit (Raupach's Indicator) has been widely used to provide an indication of soil pH in the field. A small sample is collected and an indicator solution is added to form a paste. The paste is then coated with barium sulphate powder. The colour of the powder is then compared with a colour chart. This method is not as precise as the laboratory methods. The kits deteriorate with age and therefore should be discarded after 12-18 months. Ameliorating soil acidity Lime is usually used to increase soil pH in strongly acid soils. The quantity of lime needed will vary between soils. Generally, coarse textured soils (eg. sands) need less lime than finer textured soils. Also, low organic matter soils need less lime than peaty soils. A lime requirement test will incorporate these affects when used to determine the amount of lime needed to raise soil pH. Other factors needed to determine an appropriate lime rate include target pH of the specific plant, lime quality, application method and economics.

http://vro.depi.vic.gov.au/dpi/vro/gbbregn.nsf/pages/gb_lcs_mitchell_docs/$FILE/mitchell.pdf

Volcanic Land Units

Quaternary Volcanic soils cover approximately 21 360 hectares of the Shire of Mitchell . Geological age is estimated to be between 100 00 and 1.8 million years. Olivine basalt, with some alkaline derivatives, is the common parent material of the Quaternary volcanic terrain of the Shire.

Two distinct soil types occur on the basalt map units.
They are **shallow gradational soils**, and **uniform cracking clays**.

The **gradational soils are usually red in colour**, with some brown occurrences. These soils are most commonly associated with volcanic cones, steeper hills and rises. The topsoils are well-structured heavy clay loams, with a strongly structured medium clay subsoil. Nutrient status is moderate to high throughout the profile and permeability is moderate. **Uniform black or dark grey cracking clays** are common on the very gentle basalt slopes and extensive volcanic plains. Dark grey moderate to strongly structured heavy clay topsoils overlie dark greyish brown moderate to strongly structured clay subsoils. The properties of these clays cause them to shrink and crack upon drying, hence their name 'cracking clays'. When moist, these cracks close resulting in surface ponding of water.
These soils have a very high nutrient status throughout the profile and have been cleared substantially for grazing. A high proportion of surface stone and boulders are common throughout the gently undulating volcanic plain, although some areas may be devoid of this surface stone.

Plate 7 (B2) Map unit: Qvp
PPF: Ug5.2
Grey Vertosol

Land Management Considerations
The major concerns in these units are **steep rocky slopes, shallow depth to hard rock, poor site drainage, impermeable subsoils** and the physical restraints associated with building on these soils. High levels of linear shrinkage create problems with construction of earthen dams, secondary roads and building foundations. Soils which shrink and swell sufficiently to cause problems for buildings and roads are termed expansive or reactive soils. The degree of shrink and swell is dependant on the clay content, the clay mineral types present in the soil, depth of fluctuation in moisture content and the rainfall variations, both short and long term. Many of these areas show a phenomenon known as gilgai formation. This results in various types of surface humps and hollows formed by massive shrinking and swelling of the soils. Gilgai formations are a good indicator of soils with high linear shrinkage as are fence posts that lean all directions.
Rock outcrops are common on the steeper basalt terrain. This will cause significant problems with siting of access tracks, building foundations and effluent disposal for housing development. In addition, the high proportion of surface stone on the gentle basalt terrain will have a similar impact on site development. Due to poor site drainage and impermeable subsoils, the gently undulating basalt plain is unlikely to be suited to septic tanks, other more appropriate forms of effluent disposal may need to be investigated. Land degradation is limited on the basalt terrain. Minor sheet erosion occurs on the steep to moderate slopes with some gully erosion associated with salting occurring on the drainage lines.

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http://vro.depi.vic.gov.au/dpi/vro/gbbregn.nsf/pages/gb_lcs_mitchell_docs/$FILE/mitchell.pdf

Sedimentary Land Units

Silurian/Devonian sedimentary soils cover approximately 148 850 hectares of the Shire of Mitchell. Silurian and Devonian sedimentary map units have been combined due to the similarity between major and minor soil types. Geological age is estimated at between 367 and 446 million years. Silurian/Devonian sediments contain deeply weathered marine sandstone, mudstone and shale with minor intervals of greywacke-conglomerate. Soils vary considerably with marked changes in land use, topography and climate.

Soils common to the crests, steep and moderate slopes, are hard setting gravelly yellow duplex soils, with moderately structured sandy loams overlying whole coloured light to medium clay subsoils. Soils common to the gentle and very gentle slopes are typically bleached, yellow duplex soils, with hard setting sandy loam topsoils over mottled medium to heavy clay subsoils. Drainage depressions have deep, bleached yellow duplex soils with moderately structured fine sandy clay loam or silty clay loam over mottled light clays. These map units vary considerably depending on the condition of the particular catchment area. Much of the steep sedimentary terrain has been formed through the upwelling of granitic rock through the Silurian/Devonian sediments. This has resulted in uplift, folding and metamorphism of the sedimentary rock. These areas are called metamorphic aureoles and are found adjacent to the Mt Disappointment granitic plateau. The heat associated with the upwelling granite also bakes and hardens the sedimentary rock making it less susceptible to erosion. The areas are characterised by high relief, with narrow, often rocky crests, steep side slopes, and very shallow soils. The rocky metamorphic aureole and the widespread clearing of native vegetation have contributed to high groundwater recharge in the steeper sedimentary terrain. In many cases local groundwater discharge occurs downslope causing salting. The gentle slopes and drainage depressions of the Silurian/Devonian sediments have the highest incidence of salt affected land within the Mitchell Shire. Acidic soils are common in the sedimentary terrain.

Plate 12 (M5) Map unit: Ssh
PPF: dy3.41
Brown Dermosol

Land management considerations The steep terrain, including the metamorphic aureoles, have obvious hazards for all proposed land uses. The major limitations are steep slopes, depth to hard rock and shallow soil depth. The steep terrain is highly susceptible to sheet and gully erosion, especially where vegetation cover is poor. The major concerns in the gentle terrain include flooding risk, site drainage and salinity.

Salinity is considered a major problem and may require long term remedial action at a catchment wide level if control is to be achieved. The incidence of salting in this map unit is moderately high. It is advisable to become familiar with identifying its presence and associated indicator plants. Bare soils and the presence of spiny rush are good indicators of salinity. The impact of salinity on the environment can range from severe direct effects to long term indirect losses. Severe salinisation can result in total loss of soil productivity, which can be irreversible and costly, and have a direct effect on the environment through increased saline runoff, soil erosion and land and stream degradation...

The siting of access tracks, building foundations, septic tanks and dams is made extremely difficult by steep slopes, depth to hard rock and shallow soils. Soil conservation measures will be required to minimise erosion during site development. Permeability and drainage is restricted on gentle slopes and drainage lines. This will inhibit standard effluent disposal fields. Modification to standard effluent disposal fields or the use of alternative effluent disposal options may need investigation. Improved management of steep slopes and drought prone crests is required to ensure minimal land degradation in grazing areas. Acidic soils can cause a chemical effect resulting in plant establishment failure, increase in plant disease and poor plant growth. Fertiliser response is restricted and overall productivity is reduced. Stock grazing such pastures may also be affected by acidic soil.