

# BLACKWOOD & BARRY'S REEF LANDCARE GROUP

## SOIL HEALTH WORKSHOP

Compost

Worms

Air

Texture

Fertility

pH

Aspect

Bacteria

Humus

H<sub>2</sub>O

Profile

Na<sup>+</sup>

Erosion

Ca<sup>2+</sup>

Fungi

Cl<sup>-</sup>

Dispersion

Structure

Waterlogging



We wish to acknowledge the traditional custodians of this land, the Wurundjeri people and their Elders past, present and emerging.

We take inspiration from and respect their continuing culture and the contribution they make to the life in this region.



# SOIL HEALTH

## SOIL

- Soil is our fundamental terrestrial asset. Along with sunlight, air and water, soil provides the basis for all terrestrial life - biodiversity, crops, animal products
- Soil supplies nutrients, water and *oxygen* to plants, and is populated by soil biota essential for decomposing and recycling.

## SOIL HEALTH

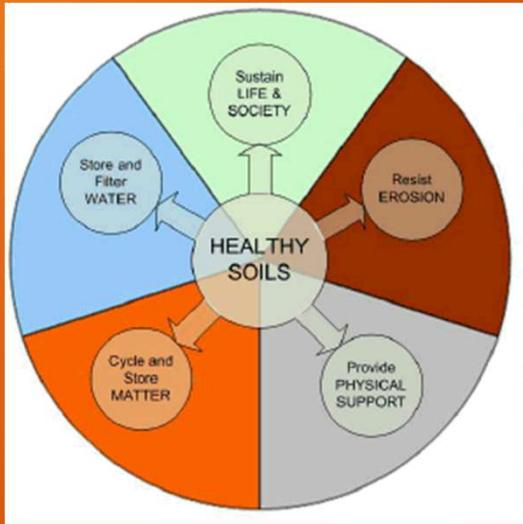
- Soil health is the condition of the soil in relation to its inherent (or potential) capability, to sustain biological productivity, maintain environmental quality, and promote plant and animal health. A healthy soil is productive, sustainable and profitable.
- Soil health equates to environmental health, human health, plant health, and animal health.
- Understanding, protecting and improving soil health is critical for managing natural assets. Soil health fundamentally links to land productivity and environmental sustainability.

Source: Agriculture Victoria



# SOIL HEALTH

## HEALTHY SOIL:



- Supplies nutrients, water and oxygen for healthy plant growth.
- Allows water to infiltrate freely, resists erosion, stores water.
- Is well structured and readily exchanges gases with the atmosphere while retaining nutrients.
- Acts as an environmental buffer in the landscape
- Resists disease.
- Contains a large and diverse population of soil biota.
- Is not acid or saline.
- There is not one set of chemical, physical and biological characteristics for healthy soil. This varies depending on the qualities of the vast array of soils that exist.

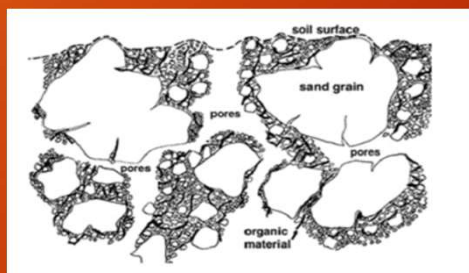
Source: Agriculture Victoria



## SOIL STRUCTURE

**SOIL STRUCTURE** is strongly influenced by soil chemistry and organic matter. 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.

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. **Source:** Agriculture Victoria



**Source:** Agriculture Victoria



## SOIL TEXTURE

- Soil texture is the “feel” of moist soil between thumb and fingers.
- Soil is composed of Clay, Silt and Sand fractions in different proportions.
- Relative % of soil fractions influences soil properties e.g. Clay is sticky when moist, Loam can moulded but doesn't stick, sands or non-cohesive.
- Clay < 0.002 mm “sticky”
- Silt 0.002 - 0.02 mm “silky, smooth”
- Sand 0.02 - 2.0 mm “coarse”
- (Gravel > 2.0 mm) visible
- 12 main soil classes, represented in a triangular graph called the Soil Texture Triangle.
- Soil texture can alter down the soil profile, sometimes gradually and sometimes quite dramatically e.g. sand or loam over clay “duplex” soils.
- Surface area of particles influences their adhesion, cohesion and ability to hold water and nutrients.

Source: Agriculture Victoria



# SOIL TEXTURE

## How do sands, loams and clays behave?

**SANDS** because of their large grain size allow faster permeability of water than clays. The disadvantages of sands are that they hold very little water that would be available to plants and have no ability to hold onto plant nutrients in the way that clays do.

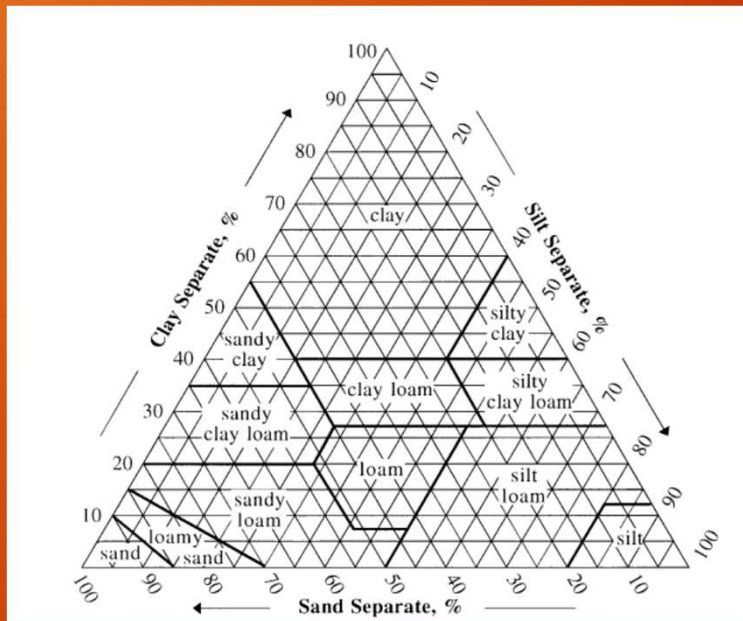
**LOAM** soils contain sand, silt and clay in such proportions that stickiness and non-adhesiveness are in balance - so the soils are mouldable but not sticky. Loams are the "friendliest" soils to cultivate.

**CLAYS** can absorb and hold onto large amounts of water because of their sheet structure and large surface area. This property causes the swelling and shrinking of clay soils as they wet and dry.

Source: Agriculture Victoria



# SOIL TEXTURE TRIANGLE



Soil Texture Triangle. Source: Agriculture Victoria

Interactive exercise.

Source: USDA





## SOIL PROFILES

Soils can have a gradational profile that changes gradually with depth, or may have distinct layers that are different textures e.g. duplex sandy loam over clay.

A soil profile usually has these basic layers or horizons:

- A1 Surface
  - A2 Subsurface
  - B Subsoil
  - C Substrate or Bedrock
- 
- These can be further subdivided or suffixed to better describe the soil, such as the presence of hard pans or disturbance, colour, bleaching or presence of concretions of various materials.

**Source:** Agriculture Victoria



# SOIL PROFILE

## What is a soil profile?

A soil profile consists of several **soil horizons**.

### O horizon

- humus on the ground surface.

### A horizon

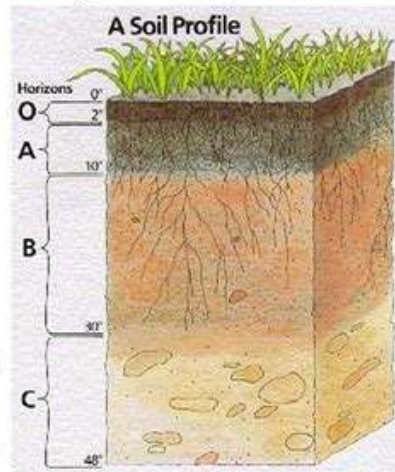
- Top soil.
- Rich in organic matter. Typically dark color.
- Also called zone of **leaching**.

### B horizon

- Subsoil.
- Also called zone of accumulation.
- May contain soluble minerals such as calcite in arid climates (caliche).

### C horizon

- Weathered bedrock (rotten rock).
- Bedrock lies below the soil profile.



Source: Warren County SWCD



## SOIL PROFILES

Right:

- Gradational soil profile.
- Locally, Quarternary volcanic soils.
- Acid throughout profile.
- Well structured and resistant to compaction.

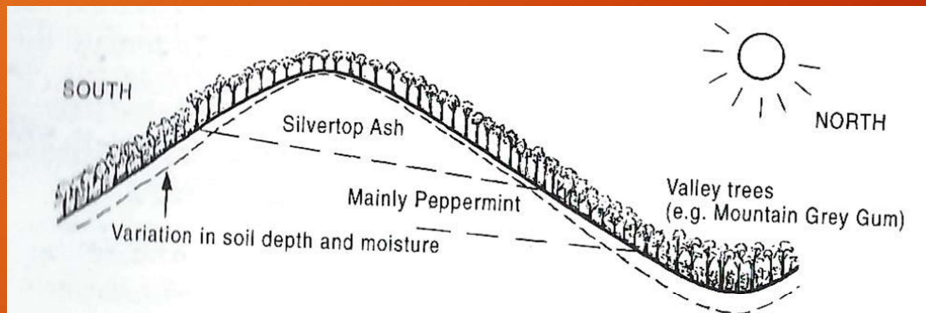


Left:

- Duplex soil profile.
- Locally, Palaeozoic sedimentary / metamorphic soils.
- Acid throughout profile.
- Strongly different textures between horizons.
- Sodic subsoils Pentlands.



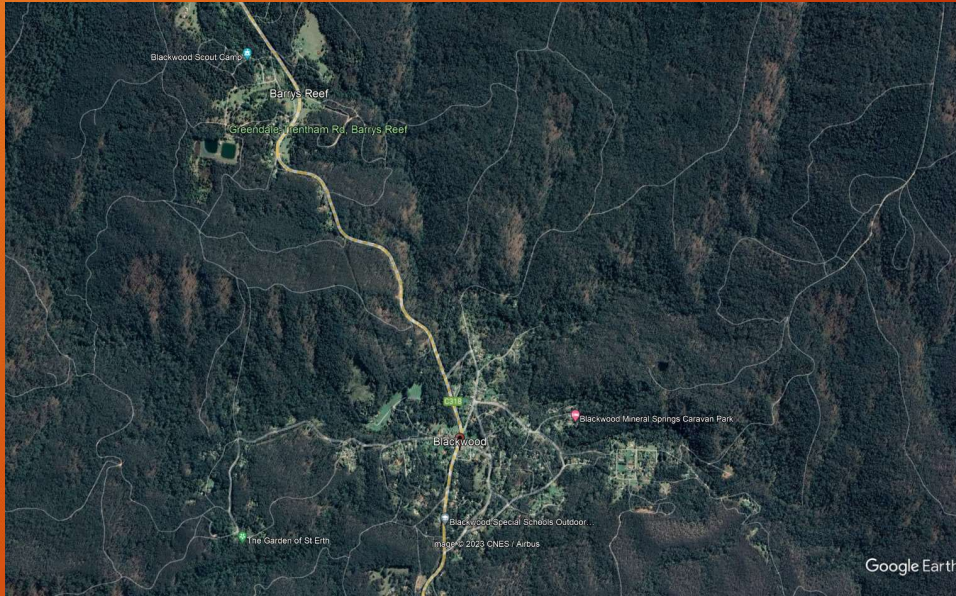
## THE EFFECT OF ASPECT



Source: Costermans

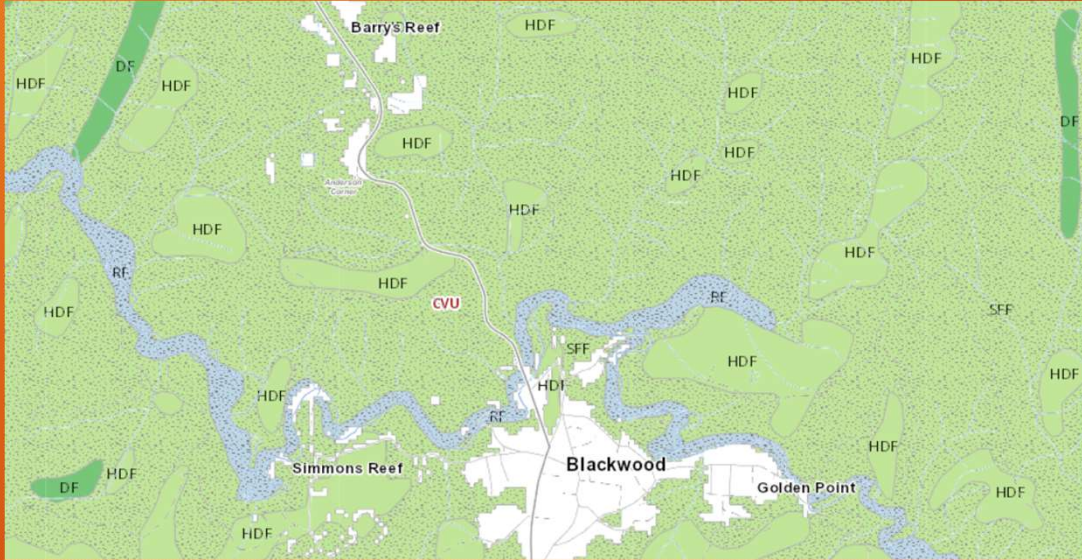


# THE EFFECT OF ASPECT





## EVC's - BLACKWOOD / BARRY'S REEF



Source: Naturekit



## SOIL HEALTH PROBLEMS

*Structural.* Can be influenced by management.

*Environmental.* Events, climate, topography.

*Disturbance.* Fire, flood, cultivation / mechanical, mining.

*Drainage.* Too wet, too dry, poor soil structure.

*Chemical.* pH, nutrients, trace elements, CEC.

*Biological.* Pathogens, beneficial organisms, humus, worms, soil biota.

*Effluent disposal.* Nutrients, waterlogging.

*Erosion.* Wind, water, gravity, disturbance / intervention.



## IMPROVING SOIL HEALTH

**Structural.** Management, humus - colloids, Gypsum (Calcium sulphate), aeration. Mulch - preserves moisture, combats weeds, encourages worms etc, breaks down.

**Environmental.** Possibly out of our control. Significant intervention.

**Disturbance.** May require significant intervention.

**Drainage.** Improve soil structure, address external causes, drainage or earth works.

**Chemical.** Lime to neutralise pH, apply nutrients & trace elements, CEC - Lime (Calcium carbonate), compost / humus - colloids.

**Biological.** Drainage, biosecurity, tolerant plants, compost, mulch, aeration. Biodynamics - concept of soil as a living organism.

**Effluent disposal.** Pond /wetland systems, trenches with Gahnia, Lepidosperma, Juncus, Carex etc.& wetland plants.

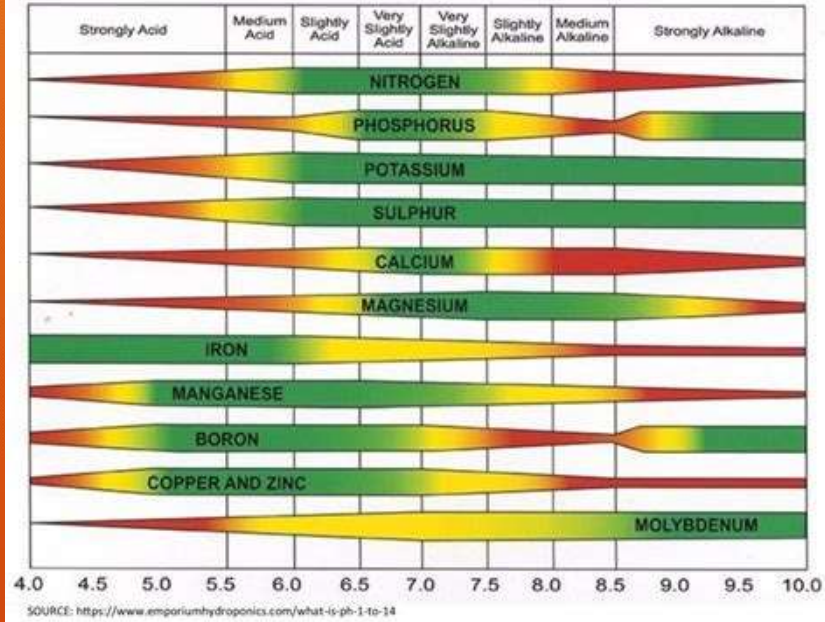
**Erosion.** Works, calcium (sodic soils).





# THE EFFECT OF pH

How soil pH affects availability of plant nutrients.



## SOIL EROSION CONTROL MEASURES

- Integrated pest animal control program.
- Increase vegetative cover.
- Apply soil ameliorating agents - lime, gypsum (Ca)
- Increase soil organic matter content.
- Earthworks, diversion banks, structural engineering works.
- Stabilisation and water diversion product installations such as matting, mesh, coir logs.
- Willow removal - cut & paint. Mulch tops.
- Snag relocation.
- Controlled grazing / stock access.

### OVERALL AIMS:

- To reduce the volume and velocity of run-off water.
- To reduce the impact of wind.
- To reduce the impact of pest animals.



## EXTRA INFORMATION

[https://vro.agriculture.vic.gov.au/dpi/vro/vrosite.nsf/pages/soilhealth\\_toolbox](https://vro.agriculture.vic.gov.au/dpi/vro/vrosite.nsf/pages/soilhealth_toolbox)

<https://www.csiro.au/en/research/natural-environment/land/soil>

### GARDENS



- Nest boxes - birds, bats, marsupials.
- Native plants - pollinators, pest predators, threatened species, habitat creation.
- Reuse & recycle - mulch, compost, worm farm, biodynamic cultures.
- Water - bird bath, frog pond.
- Soil tests.
- Consider natural assets - soil type, aspect / topography, light & shade.

