NSW GOVERNMENT | Local Land Services

SNAPSHOT

A practical tool for assessing the current condition of your soil health, pasture condition, native vegetation and farm water

Disclaimer

Contents

Introduction

The purpose of this workbook is to assist graziers to make observations which can link land type and condition to pasture production to soil health to pasture quality and ultimately to profitability.

The SNAPSHOT assessments in this workbook can be used in three ways:

1. a baseline assessment to provide a snapshot of various aspects of the functioning of natural systems
2. a way to monitor the changes over time to various aspects of the property as a result of changes in management
3. a way to identify particular aspects which may benefit from a closer look and a more complicated or rigorous assessment.

The results of the assessments can be recorded in Recording Sheets at the back of the workbook.

There are many methods available to assess various aspects of a grazing enterprise. The assessments selected:

- are easy to do
- require only inexpensive equipment
- provide useful information.

Most of the SNAPSHOT assessments are indicators rather than scientific measurements.

The assessments give an indication of condition, and while many of the assessments have numbers in them, the results can all be ranked more generally as Excellent, Good, Moderate or Poor (See table in recording sheets).

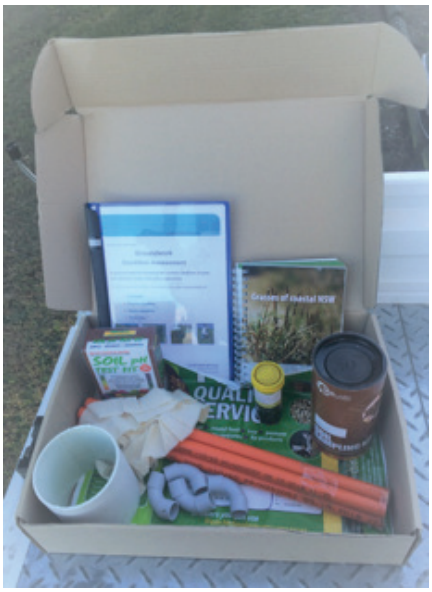
When the SNAPSHOT assessments indicate that there are issues which may need some further attention, then more rigorous assessments can be conducted.

A list of additional assessments which provide more detailed information on each aspect (soil, pastures, water and native vegetation) is provided on page 42.

What you will need

- A star picket
- A long screwdriver (ideally Philips screwdriver with 40-45cm shaft) or a 60cm length of 8mm steel rod, with one end bent over as a handle
- A square mouth garden spade or Nº 2 long handle spade
- A heavy hammer
- A piece of timber 100mm x 50mm by about 0.5m long
- 20 litres of water
- 125mm piece of stormwater pipe*
- watch or timer (or mobile phone)
- calculator (or mobile phone)
- camera (or mobile phone)
- 6 Cotton strips* (calico)
- pH test kit*
- 0.5m x 0.5m quadrat* (wire or pipe)
- 1m x 1m sheet of ply (or something hard e.g. steel)
- tarp bigger than 1m x 1m
- 9 litre watering can with rose
- Potassium permanganate solution* (2 mol)
- Grass Identification book*
- … and your SNAPSHOT booklet* and about half a day of your time.

** included in kit*



SNAPSHOT Kit

Tips on getting started

Read the booklet:

It is a good idea to read through the SNAPSHOT booklet so that you are familiar with what has to be done, know what things you will need and get some idea of how long it will take to do.

How many sites:

Decide how many areas of your property you would like to test/assess.

Allow time:

The assessments should take a couple of hours for each monitoring site.

Tips:

You might want to look at different paddocks. You will need a monitoring site for each area if you want to assess the condition of each area or track changes over time.

You might want to look at different land types on your property e.g. the alluvial flats could be one area of interest, and the slopes and low hills might be another.

If you do the assessments with your family and farm workers, you can learn from each other.

If you do the assessments with a neighbour it will be easier, and you can compare more sites and get ideas from each other.

The SNAPSHOT assessment has been constructed so that you simply follow the steps as you progress through the workbook.

1. Gather all the bits and pieces that you will need for the assessments.
2. Have a look through the workbook to get a feel for what you need to do.
3. Select your monitoring sites and take 3 photos of the site, being careful not to get your shadow in the picture. See Page 8 for photo instructions.
4. Complete the assessments in the order they appear in the workbook.
5. Record the results in the Recording Sheets.
6. Paste the photos into the Recording Sheets.

Establishing a monitoring site

Step 1 Select an area which has fairly consistent slope and vegetation.

If your property or paddock contains more than one land type, you can establish a monitoring site on each land type.

The monitoring site should be not a holding paddock or hospital paddock, and should be at least 50 metres from fence lines, major tracks, stock camps, troughs, dams and waterways.

Step 2 Drive in a star picket (the photo post) in the middle of the monitoring site .

Step 3 Make sure you will be able to locate the star picket later on. You can remove it if it will interfere with stock or vehicle movement, as long as you are sure you can locate that point next year (e.g. by GPS or a stake driven flush with the ground).

Taking three photos

Ground photo:

- Stand next to the picket and take a photo looking straight down to the pasture.

Mid-distance photo:

- Stand beside the picket so you are facing south.
- Position the base of the post in the middle of the picture, and focus on the pasture.

Landscape photo:

- Stand close to the picket and position the top of the photo post in the middle of the picture, and take the photo.

Write the date, time of day and name of the site for the photos on the Recording Sheet.

Tip: Take pictures at the same time of day.

How to do the Assessments

Starting at the photo post, you will throw the quadrat a total of ten times in a random zig-zag pattern within a circular area with a radius of around 20 metres from the centre post. You should aim to cover the whole monitoring site.

Wherever the quadrat lands the ***first nine times,*** you complete the assessments for:

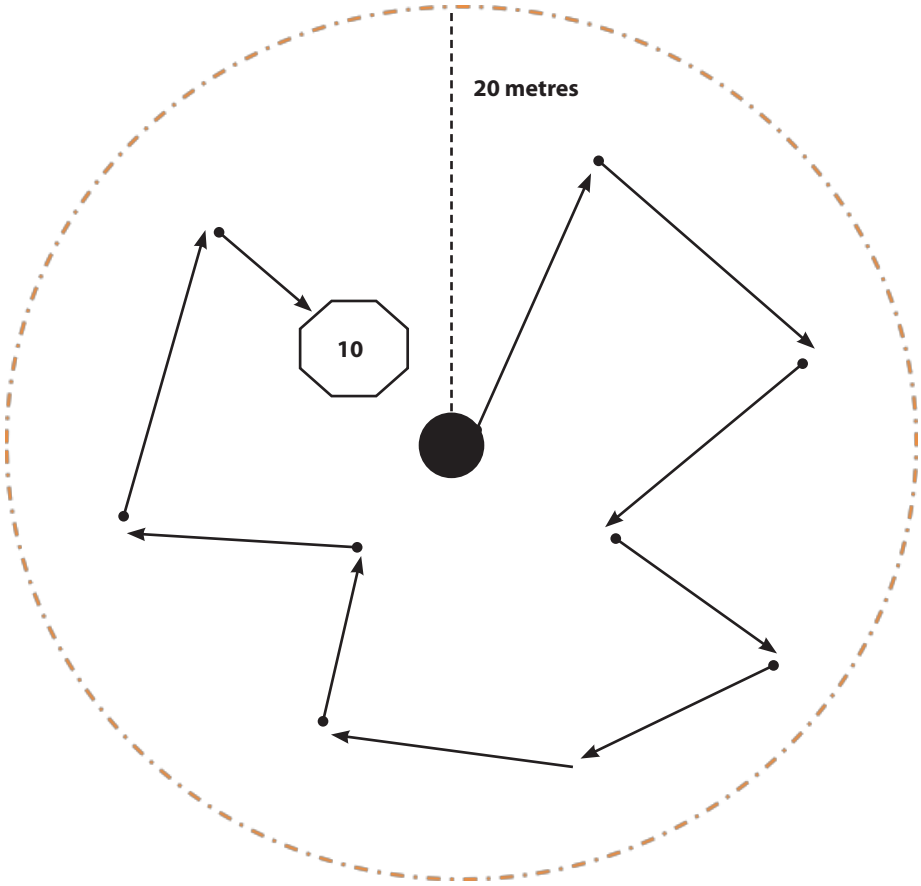
- Groundcover and Surface Condition
- Pasture Condition
- Penetration

Record your results as you do the assessments.

For the ***tenth quadrat***, do these three assessments (above) plus also do:

- The Quick Scan
- Soil Structure
- Infiltration rate
- Active Organic Matter
- Biological Activity
- pH

Record all your results.



How grasses grow

Most of the mass of a grass plant comes from the inputs of photosynthesis, not from the soil itself.

About 96% of the mass of a plant comes from oxygen (45%), carbon (45%) and hydrogen (6%) which are readily available in air and water. The remaining 4% of the mass of a plant comes from the soil.

Each grass leaf is a solar panel that powers energy production within the plant, by converting energy from the sun into chemical energy within the sugars produced by photosynthesis.

Almost all the building blocks of life (DNA, amino acids, proteins, starches, fats, oils, vitamins etc) are derived from the simple sugars produced from photosynthesis.

The sugars produced in the leaves from photosynthesis power the root system, the root system is then able to grow into the bulk soil and explore for nutrients. The roots exude these sugars to feed the microbes in the 2mm zone around the roots called the rhizosphere.

Graphic: L Wilson

Sunlight is captured by chlorophyl molecules in the leaves

Water and carbon dioxide are taken from the environment

Sugars are formed and oxygen is released

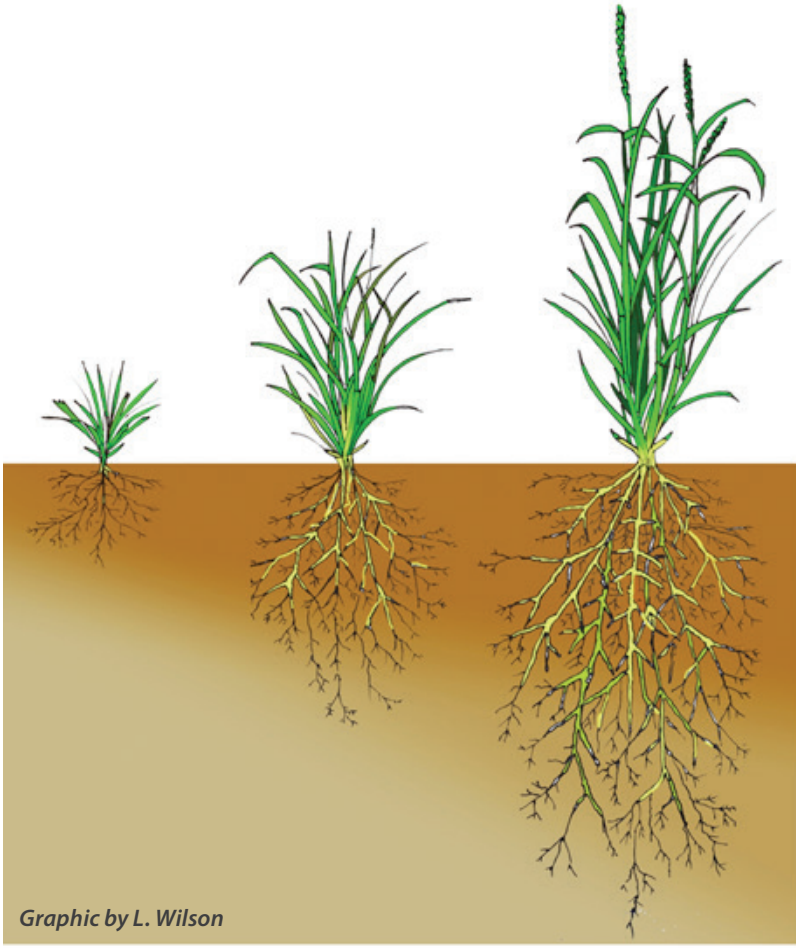
Carbon Dioxide + Water + Sunlight → Glucose + Oxygen + Water

$$6CO^2 + 12H^2O + \text{Sunlight} \rightarrow C^6H^{12}O^6 + 6O^2 + 6H^2O$$

Around 60% of the sugars are transported below ground to power the root system.

Pasture in good condition will:

- capture a lot of solar energy
- use rainwater efficiently
- protect soil condition
- cycle nutrients effectively.



Graphic by L. Wilson

Solar Panels

Leaf blades are the panels which harvest the sun's energy to grow and drive the earth breaking roots beneath the soil. *More leaves means more energy is available.*

Micro Gardeners

Roots create a good tilth in the soil by breaking it up and feeding the soil biota which glue the soil particles into aggregates to create irrigation channels for water and nutrients to flow.

Roots fertilise the soil with carbon compounds and then harvest other nutrients made available by the biota. *More roots means more water and nutrients are available.*

More leaf means more energy captured and bigger root systems. If too many of the leaf solar panels become shaded by others because pastures are getting too long, the production potential of that pasture over time will be limited.

Similarly, if a pasture has been grazed so short that very little leaf is left for photosynthesis, the plant needs to use its root reserves and growth will be delayed while the leaf emerges.

The grass on the right has been clipped about three times during the growing season; the one on the left every 2-3 weeks to simulate continuous heavy grazing. Repeated grazing in the early phase of growth depletes stored root reserves and generates a smaller root system.

Reproduced with permission from Ash, A, Corfield, J & Ksiksi, T 2002, The ecograze project: developing guidelines to better manage grazing country, CSIRO Sustainable Ecosystems, Brisbane, Queensland.

Pasture assessments

Penetration

What is it?

Soil penetration is an assessment of soil strength and its resistance to roots growing within it.

Soil penetration is affected by soil texture (fine grained soils with a high clay content resist penetration more than sands), moisture levels (easier penetration when soil is wet) and soil structure (small granular soil aggregates are easier to penetrate than larger clods).

What it tells you

Soil penetration is important because it relates to the ease with which plant roots can grow and move through the soil. As soil strength increases roots are impeded and their rates of growth are slowed.

Grass roots begin to be impeded from moving through soil when resistance to penetration is around 2.0 MPa (300 psi). Grass roots will be completely impeded from moving through the soil itself when the penetrometer reading is above 4 MPa (600 psi), and their growth and movement will be restricted to existing cracks and channels within the soil.

Over 4 MPa (600 psi) you could expect creeping stoloniferous grasses (with shallow root systems) to be become dominant in the pasture, as deeper-rooting species find it difficult to penetrate the soil.

300 psi on a penetrometer

How to do the Assessment

A simple penetrometer can be made from a length of 6mm steel rod. Sharpen one end with a grinder, and bend the other end over to make a handle. A Philips head screwdriver with a long shank (40cm) also makes a good penetrometer.

At each of the soil sampling locations:

1. Push the screwdriver vertically into the soil with the palm of your hand, being careful to maintain a steady pressure.
2. Stop pushing when it becomes difficult to push the penetrometer into the soil.
3. Hold the screwdriver at the point where it meets the ground, remove the screwdriver and measure the depth of the screwdriver that went into the soil.
4. Write down the depth for each of the 10 assessments, add them all up and then divide by 10. Record this in the Recording Sheet.

As a rough guide, when the pressure on the palm of your hand becomes uncomfortable, you would be exerting about 2.0 MPa (300 psi) pressure on the rod, and roots will begin to find it hard to penetrate that soil.

Using a screwdriver as a penetrometer

Groundcover and Surface condition

In general, a minimum of 70% ground cover is recommended to reduce the risk of soil erosion and minimise run-off. On sloping ground in the coastal hinterland groundcover of over 90% may be required to reduce erosion risk. Ground cover includes both plants and litter.

Ideally litter on the soil surface should be actively decaying, not old and inert, but there should be some litter remaining on the surface to protect the ground.

A soil surface where micro-organisms are breaking down the litter will allow rain to infiltrate easily and will cycle nutrients into the soil and plant roots.

How to do the Assessment

Use a 50cm x 50cm square (quadrat) to assess groundcover and surface condition at 10 locations. Record the scores at each location then add them, and divide by 10. After each assessment, throw the quadrat about 4 or 5 metres to the next location, and take a new assessment of the percentage groundcover and surface condition in the quadrats.

For groundcover:

- use the pictures on Page 15 (below) to estimate groundcover in each quadrat

For surface condition:

- consider both amount of litter in one quarter of the quadrat, and the degree of breakdown of the litter
- scrape up as much litter as you can from an area within one quarter of the quadrat
- look at where the litter meets the soil surface. Is it distinct from the soil surface, a little bit mixed, or is it not distinct and you are unable to tell where the soil starts?
- add your two scores together to get the total score for each quadrat, and write it in the Recording Sheet.

Groundcover and Surface Condition Scoring recording sheet

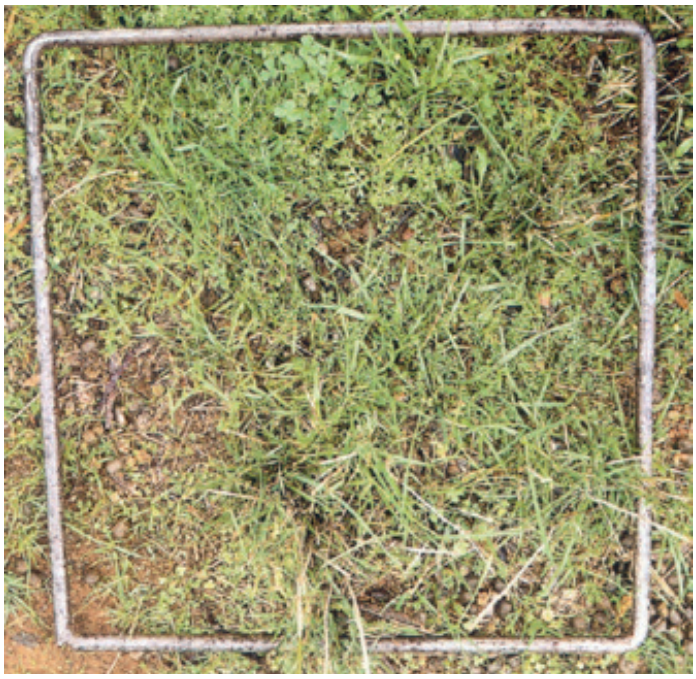
	Surface Condition					
	Distinct. Score 0	A bit mixed. Score 2	Not distinct. Score 4	Number of handfuls in 1/4 quadrat	Total for each quadrat	Groundcover %
Quadrat 1						
Quadrat 2						
Quadrat 3						
Quadrat 4						
Quadrat 5						
Quadrat 6						
Quadrat 7						
Quadrat 8						
Quadrat 9						
Quadrat 10						
					Total/10	Total/10

20 % ground cover

- run-off water loss = 160 mm per year
- soil loss = 8.5 mm per year
- poor plant production and sustainability
- low green leaf and plant vigour
- low water infiltration
- plants exposed to temerature extremes
- low litter
- low microbial activity
- poor organic matter content
- poor soil structure and surface seeling of soil

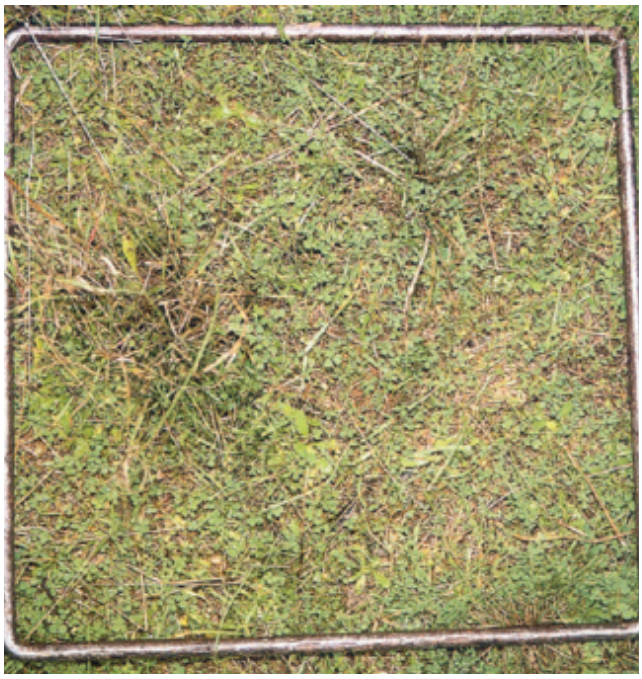
40 % ground cover

- = average pasture
- still too low
- run-off water loss = 90 mm per year
- soil loss = 4.0 mm per year
- poor pasture and soil health



70 % ground cover

- run-off water loss + 10 mm per year
- soil loss + 0.3 mm per year
- good plant production and sustainability
- high green leaf and plant vigour
- high water infiltration
- plants bases protected from temperature extremes
- hign litter
- good microbial activity
- hign organic matter content
- good soil structure and soil surface



90 % ground cover

- reduced water run-off and soil loss
- on slopes ground cover should target 100% to retain top soil, nutrients and to promote stable pasture conditions
- weed colonisation will be reduced where bare ground is removed

Images : McCormick LH, Lodge GM (2001) A field kit for producers to assess pasture health in the paddock. In 'Proceedings of the tenth Australian Agronomy Conference', Hobart

Pasture Condition

What is it?

Pasture Condition is an indicator of the ability of your pastures to provide stock feed requirements which combines:

- Proportion of desirable species which are **Perennial, Palatable and Productive (3P)**
- Estimation of the percentage Dry Matter yield of the desirable 3P species
- Estimation of the density and health of desirable 3P species within the whole pasture.

The most important element of Pasture Condition is the presence and health of 3P grasses: those grass species which are *Perennial, Palatable and Productive.*

Pasture Condition is related to soil condition, and provides an indication of the likely performance of stock in that particular paddock.

Why it is important

The basis of our pasture systems are perennial grasses, both native species and exotic 'sown' species.

The presence of *perennial, palatable and productive* (3P) grasses is a good indicator of land condition and productivity.

Pasture management decisions should be aimed at promoting the growth and population of these grasses.

The 3P grasses are the key to maintaining energy flow, nutrient cycling and effective water use in a sustainable grazing system.

Perennial species have an extensive root system and are able to access water and nutrients from deep in the soil profile. For this reason, they are less sensitive to seasonal weather fluctuations and more resilient under grazing.

The palatability of a plant is typically proportional to the amount of leaf it has. Plant species that mature quickly and have a high proportion of stem compared to leaf are not as palatable as those that have a long vegetative phase and a high proportion of leaf.

Productivity refers to the amount of leaf a plant is able to produce over time. Perennial species, with their extensive root systems, are generally able to mobilise more nutrients and water and therefore produce much more leaf than small, annual plants

From: http://www.stocktakeplus.com.au/wp-content/uploads/2013/01/Stocktake-users-manual.pdf

How to do the Assessment

To complete this assessment, consider the pastures within a whole paddock if it contains only one land type. If there is more than one land type (a combination of soil type and vegetation) within the paddock, you might complete the assessment for pastures in each land type. A list of perennial grass species is provided on page 18.

1. Check to see what proportion of 3P grasses contribute to the total pasture yield in the paddock and gauge their health by assessing crown cover.
2. Check off your estimates against the table below and decide which Pasture Condition rating suits best.
3. Record the result in the Recording Sheet.

Good Pasture Condition	score
• >3 desirable species (3P grasses only) • Most of the pasture biomass is 3P species • Dense and healthy plants	10
Moderate Pasture Condition	
• 3 desirable species (3P grasses only) • About half the pasture biomass is 3P species • Healthy plants but some gaps between plants	7-9
Average Pasture Condition	
• 2 desirable species (3P grasses only) • About a quarter of the pasture biomass is 3P species • Healthy plants but many gaps between plants	4-6
Poor Pasture Condition	
• 1 or less desirable species (3P grasses only) • Sparsely spaced plants in unhealthy condition	1-3

NB This assessment may not apply to sown, intensive pastures.

3P	2P	1P
Cocksfoot (*Dactylis glomerata*) p105	Bahia grass (*Paspalum notatum*) p55	Bent - browntop (*Agrostis capillaris*) p78
Fescues p122, 123	Bamboo grass - slender (*Austrostipa verticillata*) p94	Blady grass (*Imperata cylindrical*) p125
Kangaroo Grass (*Themeda australis*) p174	Barbed Wire Grass (*Cymbopogon refractus*) p168	Couch – common (*Cynodon dactylon*) p38
Kikuyu (*Cenchrus clandestinus*) p176	Blown Grass (*Lachnagrostis filiformis*) 127	Crabgrass (*Digitaria violascens*) p48
Panic – green (*Panicum maximum*) p130	Bluegrass - forest (*Bothriochloa bladhii*) p57	Elastic grass (*Eragrostis tenuifolia*) p121
Para grass (*Urochloa mutica*) p75	Carpet grass (*Axonopus compressus* or A. fissifolius) p31, 32	Molasses Grass (*Melinis minutflora*) p131
Paspalum – broadleaf (*Paspalum mandiocanum*) p69	Couch - blue (*Digitaria didactyla*) p44	Panic - wiry (*Entolasia stricta*) p63
Paspalum – common (*Paspalum dilataum*) p68	Millet - ditch (*Paspalum orbiculare*) p70	Plumegrass – longhair and shorthair (*Dichelachne crinite*) p107
Phalaris (*Phalaris aquatic*) p143	Millet - native (*Panicum decompositum*) p138	Poa tussock (Poa labillardiera) p146
Prairie grass (*Bromus catharticus*) p99	Lovegrass - Browns (*Eragrostis brownie*) p114	Red Natal Grass (*Melinis repens*) p132
Ryegrass – perennial (*Lolium perenne*) p19	Lovegrass - paddock (*Eragrostis leptostachya*) p119	Rat's Tail Grass – western (*Sporobolus creber*) p161
Scented Top (*Capillipedium spicigerum*) p102	Oatgrass - false (*Arrhenatherum elatius*) p 87	Sorghum - wild (*Sorghum leicladum*) p159
Setaria (*Setaria sphacelata*) p27	Panic - hairy (Panicum effusum) p139	Speargrass - oat (*Anisopogon avenaceous*) p81
Signal grass (*Urochloa decumbens*) p74	Paspalum – giant (*Paspalum urvillei*) p71	Speargrass (*Austrostipa pubescens*) p91 Also Foxtail, Rough and Soft Speargrasses
Wallaby grass (*Rytidosperma racemosum*) (*Austrodanthonia*) p155	Red grass (*Bothriochloa decipiens)* p33	Speargrass – three awn (*Aristida vagans*) p85
Weeping grass (*Microlena stipoides*) p133	Rhodes grass (*Chloris gayana*) p34	Vernal grass - sweet (*Anthoxanthum odoratum*) p82
Other	Tambookie Grass (*Hyparrhenia filipendula*) p170	Vetiver - Australian (C*hrysopogon filipes*) p58
Other	Torpedo Grass (*Panicum repens*) p140	Whisky grass (Andropogon virginicus) p167
Other	Windmill grass - tall (*Chloris ventricosa*) p35	Windmill grass (*Chloris truncata*) p35, 36
Other	Other	Wiregrass – purple (*Aristida ramose*) p84
Other	Other	Yorkshire Fog (*Holcus lanatus*) p124
Other	Other	

Page references are from the book: ***Grasses of coastal NSW*** *by Harry Rose and Carol Rose*

Other things to look for

Proportion of legumes

A common recommendation is to aim for at least 5% legume in native pastures, 10% in fertilised native pastures and 30% in improved pastures.

Every ton of clover dry matter will provide around 20 – 25 kg of Nitrogen per hectare.

Suitability for animal production

Is pasture quality and quantity adequate to meet livestock requirements? High quality pastures are necessary for weight gain or lactation. Are your stock gaining, maintaining or losing weight or condition?

Year round feed

Does the mix of pasture species provide feed throughout the year? Is there a winter feed gap?

Weeds

There are many weeds commonly found in pastures that are not listed as priority weeds from a regional perspective, for example:

- Fleabane (*Conzya species*)
- Purple top (*Verbena bonariensis*)
- Paddy's Lucerne (*Sida rhombifolia*)
- Scotch thistle (*Onopordum acanthium*)

Since weeds often germinate in bare ground, maintaining adequate groundcover can minimise the potential for invasive weeds to take hold.

A good strategy can be to out-compete weeds with a vigorous pasture.

A useful question to ask is: What percentage of pasture biomass is made up of weeds?

Soil

Some background

Soil scientists describe soil fertility as having three components:

Soil biological fertility is:

- The capacity of organisms living in the soil (micro-organisms, fauna and roots) to contribute to the nutritional requirements of plants and foraging animals for productivity, reproduction and quality.

Soil chemical fertility is:

- The capacity of the soil to provide a suitable chemical and nutritional environment for plants and foraging animals for productivity, reproduction and quality.

Soil physical fertility is:

- The capacity of soil to provide the physical conditions that support plant productivity, reproduction and quality.

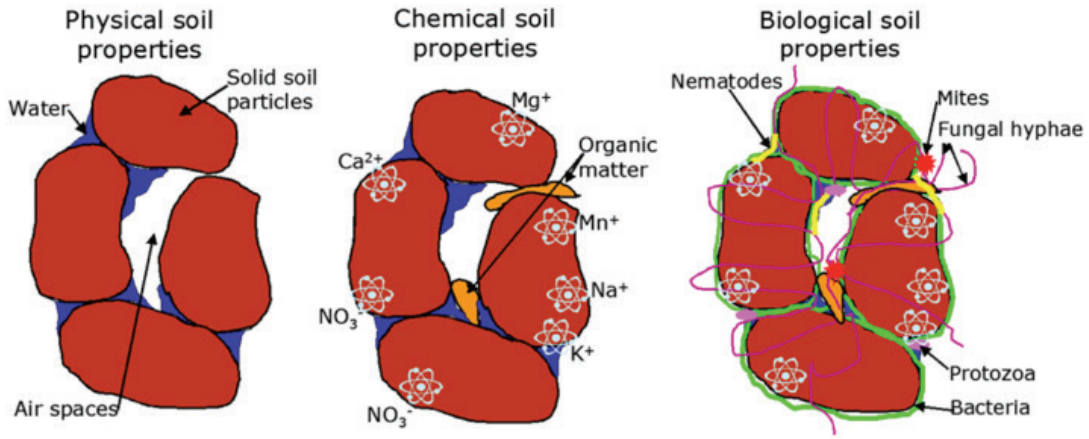
Soil Biological Fertility: A Key to Sustainable Land Use in Agriculture 2004 by Lynette K. Abbott (Editor), Daniel V. Murphy (Editor)

Soil in good condition will:

- absorb and store rainwater
- store and cycle nutrients
- provide habitat for seed germination and plant growth
- resist erosion.

Soil is more than just pieces of weathered rock. It is a combination of solids, liquids and gases.

The component parts of the soil ecosystem (by volume) are shown below:



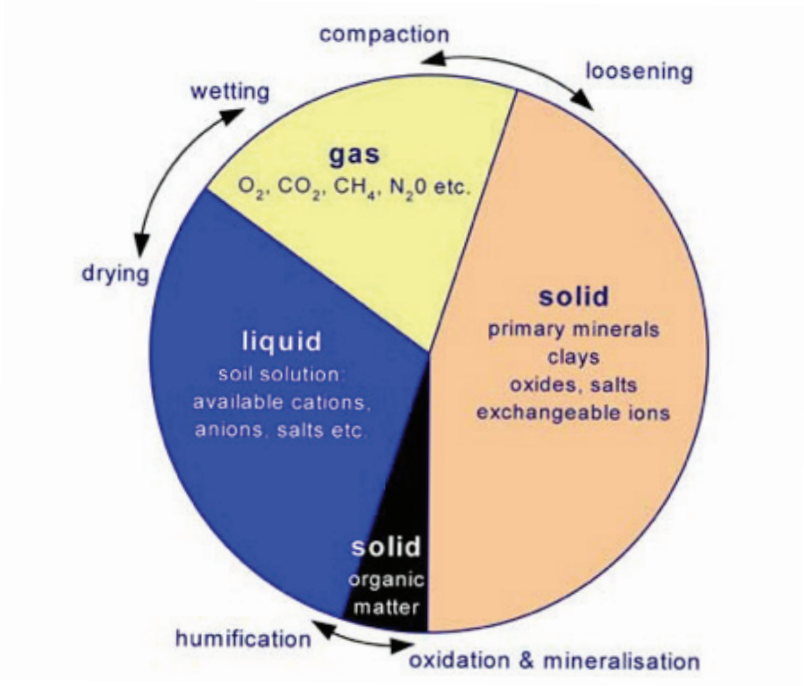
The surfaces on the soil particles are where the water, nutrient ions, organic matter and micro-organisms are found. Reproduced with permission of Tony Pattison, Department of Agriculture and Fisheries, Queensland.

The development of soil starts with the breakdown of rocks and continues via physical, chemical and biological activity. The sands, silts and clays of soil are fragments of the original parent material but the rest of the soil is highly modified by living things: plants and micro-organisms.

Less than half of the volume of soil is solid, with around 50% being pores and channels. These pores and channels enable a lot of important activity to occur:

- Water, air, nutrients and organic materials can all accumulate and be stored here, so that bacteria, fungi and the tiny animals can grow and multiply,
- Roots can grow readily into and through the soil,
- Rainwater can be stored and excess water can be drained to the groundwater systems.

The better the range of sizes, and the condition and the stability of the soil pores, the more productive the soil can be.



Solids	A mineral fraction from parent material (i.e. rock)	45%
	Organic matter	4%
	Micro-organisms	1%
Air		25%
Water		25%

From: http://vro.agriculture.vic.gov.au/dpi/vro/vrosite.nsf/pages/soil_health_mis7898_4

A quick scan

A quick scan of your property can provide a lot of knowledge about the physical characteristics of your soil and a feel for the health of your soil and pasture.

At the tenth quadrat:

1. Have a walk around
   - Does the ground feel soft to walk on, or hard?
   - Can you push your index finger into the soil surface up to the first joint?
2. Have a look around
   - How does the pasture look? Tall or short? Even or uneven (clumps of uneaten pasture or tussocks)? Green or yellow? Are there many green urine patches?
3. Dig a hole 20cms x 20cms x 20cms (and set aside the 20 x 20 x 20 block of soil for the soil structure test)
   - Was it hard or easy to dig? Plant roots will find it hard to grow in a soil which you find hard to dig.
   - What colour is the soil? Dark or light? Soils become darker as organic matter levels increase.
   - How deep is the topsoil?
   - Are there living organisms visible in the soil? Can you see small tunnels in the soil? Are there castings (faeces) in the soil? Any insects?
   - Are there lots of roots visible on the sides of the hole? How deep do they grow? Are they mostly in the top 75-100mm, or do they go to the depth of the hole?
4. Take a handful of soil from the hole.
   - What does it smell like? Is it sour; dusty; or sweet and earthy like compost?
   - What does it feel like? Sandy? Gritty? Silky? Sticky?
5. Ask yourself, if it rained now, how well would the rain soak into the soil?
   - Fill the watering can with water and with the sprinkler rose in place steadily pour the water evenly over an area of about one square metre of the ground.
   - Finish pouring after 60 seconds, and have a look to see if all the water has soaked in, or if there is water ponding or running off outside the square metre of ground.

The best fertiliser is the footsteps of the farmer

Chinese proverb

Soil assessments

Soil structure

Soil is composed of sand, silt, clay and organic matter. When the tiny particles are bound together they form aggregates. These are the crumbs or lumps which soil breaks into when you dig it.

The key ingredients in the binding together of the particles are sugars produced by soil bacteria and fungi, which form a net that traps particles of sand, silt, clay and organic matter and holds them together to form the aggregates.

While parent material and clay surface chemistry regulate micro-aggregate formation, plants and soil organisms are the major drivers of macro-aggregate formation. Because of this, the feedbacks between plants, soil organisms and soil structure are key regulators of productivity and biogeochemical functioning of agroecosystems.

In soils with a high proportion of fine silt and clay particles, aggregation is a prerequisite for life because most plants require some level of aggregate structure to create pores for aeration and water flow in order to grow in these soils.

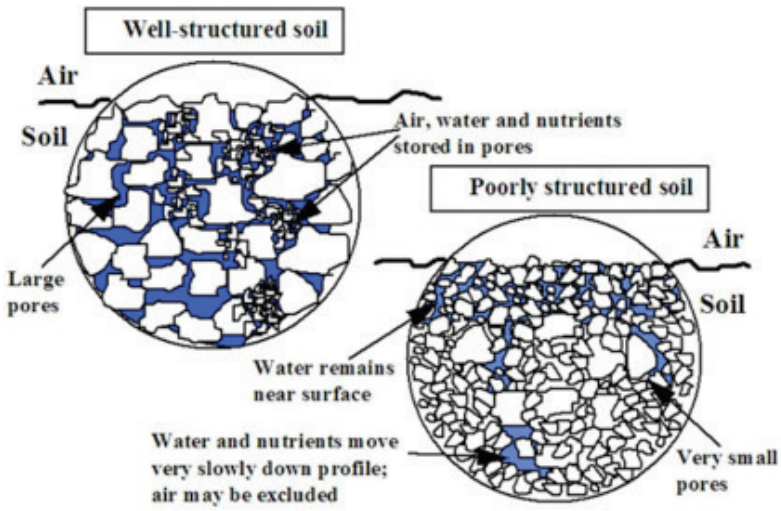
For example, glomalin is a sugar that was identified and named in 1996. Glomalin is produced by mycorrhizal fungi that live inside plant roots and extend hair-like filaments (called hyphae) into the surrounding soil to obtain more nutrients.

From: Understanding and Managing the Rhizosphere in Agroecosystems. Drinkwater & Snapp, 2007

Why it is important

Soil structure is determined by the arrangement of aggregates. Good soil structure has adequate spaces (pores) between aggregates to allow water and air to enter the soil and drain easily, while holding enough moisture to maintain plant growth. Poor soil structure has few aggregates and few pores between soil particles.

A crumbly soil is softer and more encouraging to root and shoot development than a massive (solid) soil where soil particles are all the same size (such as fine silt), or a cloddy soil which breaks apart into large clods and is difficult to break down further.
https://www.dpi.nsw.gov.au/agriculture/soils/structure/check



A well structured soil allows more air, water and nutrients to enter the soil and stick to surfaces of the soil particles.

How to do the Assessment

Follow the steps below with the soil you dug out in the Quick Scan.

1. Lay out the tarp and place the wooden board on top.

2. Dig an intact section of top soil 15cm x15cm (approx. shovel width) x10cm deep.

3. Drop the soil mass onto a board 3 times from 1m (waist height).

4. If large clods break away after the 1st or 2nd drop, drop them individually.

5. Transfer any spilt soil from the tarp onto the board.

6. Grade the clods by placing the coarsest at one end and the finest at the other.

7. Assign the soil fragments to three categories: coarse (A), medium (B), fine (C).

8. Use the following pictures and the key on the right to assess the soil condition.

Good Condition: No significant clodding, most aggregates are fine with some medium aggregates

Moderate Condition: Most aggregates are fine and medium with up to a quarter of the total in coarse firm clods

Poor Condition: Dominated by coarse firm clods, with some medium aggregates but very few fine aggregates

NOTES
Step 3: Once a clod has shattered into small structural units it does not need dropping again. Do not drop any piece of soil more than 3 times.
Other: Soil may also be unstructured, with individual soil particles or coarse fragments. This soil is also in poor condition.

Reproduced with permission from: Murray Local Land Services, Soil Monitoring Kit Manual.
NB, A soil with all large clods, or all fine particles with no aggregates, would be described as having very poor structure.

Infiltration rate

Infiltration rate is the rate at which soil can accept water from rainfall. It is important because it determines:

- How much of the rain which falls on your land can be captured for use by plants
- How easily sediments and nutrients will be picked up and removed during heavy rain.

Why it is important

Plants need water and the nutrients which are dissolved in water to grow, so it is important to capture as much rainfall as possible in the soil.

Plant roots also need oxygen and microbes use nitrogen from the air. The cracks, channels and pores through which water infiltrates when it rains are also the avenues through which air diffuses within soil and where the roots grow. Air is comprised of about 78% nitrogen and nearly 21% oxygen.

The degree to which soil pores are filled with water is very important:

- Soil bacteria and protozoa tend to live in water at all times
- Plants take up nutrients in solution
- Plant roots must suck water from soil pores, and will die if the pressure required is greater than 1.5 Kpa
- Soil water becomes more saline as the soil dries out and the concentration of salts increases.

What it shows

The rate at which water enters the soil is a function of the soil texture, structure and pore spaces.

Water enters the soil when it rains through cracks, channels created by living organisms and pore spaces between soil aggregates. So infiltration is also an indirect measure of soil compaction.

How to do the Assessment

The best time to do this assessment is around 2-3 days after good rain. A dry soil can cause water to "bead" on the surface and will affect the results.

1. Select a spot within the monitoring site and clear the ground of long grass which could interfere with the pipe. Try not to disturb the surface of the soil.
2. Hammer the stormwater pipe into the ground until it reaches the 25 mm texta mark.
3. Gently fill the tube to the top with water from the watering can. This will be 100 mm of water depth. Have a look to ensure water is not running out under the bottom of the pipe.
4. Wait 6 minutes and then measure the depth of the water level from the top of the pipe. Multiply this figure by 10 to get the rate of infiltration in millimetres (mm) per hour.
5. If nothing much has happened after 6 minutes, then look again after 15 minutes and multiply by four, or again after 30 minutes and multiply by two.
6. Record the result in the Recording Sheet.

Example: After 6 minutes the water level has dropped about 20m.
20 x 10 = 200 mm per hour

Biological activity

Biological activity refers to the role of macro-organisms (ie organisms that you can see such as worms, insects and ants) and micro-organisms (i.e. organisms that you cannot see such as bacteria, fungi and protozoa) in the soil.

Plants require many elements from the soil and largely depend on microbes to extract these nutrients and incorporate them into organic molecules. As organic matter breaks down, the nutrients dissolve into the soil water where they can be accessed by plant roots.

This means that at any one time the nutrients in the soil can be in one of three places:

- bound to soil particles
- incorporated in organic matter
- dissolved in the soil water.

Over three quarters of the air we breathe is nitrogen. Unfortunately plants cannot use this form of nitrogen and instead require it as nitrate or ammonia. Though a small amount of nitrogen is converted by lightning, plants generally depend on microbes to fix nitrogen into useable forms.

From: Soil biology basics, Written by Greg Reid ©2005 State of New South Wales Department of Primary Industries

What it tells you

It is important because the level of biological activity in the soil reflects the extent to which all the conditions (air, moisture and organic matter) for healthy plant growth are present. The primary source of mineral nutrients for plants is the decomposition of organic matter by soil micro-organisms.

Biological activity is stimulated by the growth of plants with their continual supply of carbon compounds into the soil system through photosynthesis. The carbon compounds not only provide the energy flow into soil, but it is a major contributor to soil productivity and soil structure.

The assessment for biological activity is an indication of the number of micro-organisms present in the soil. Since micro-organisms feed on organic matter, and then die to become organic matter themselves, this assessment provides an indication of the level of organic matter in your soil.

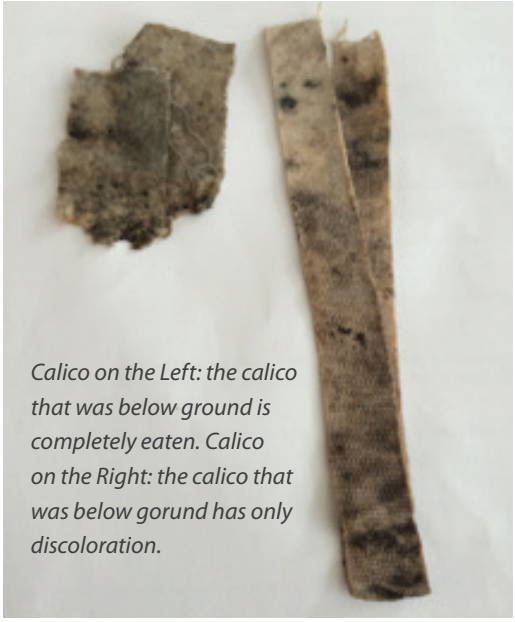
Soils with high levels of micro-organism activity have:

- More nutrients available for plant growth
- Better rainfall infiltration and moisture holding capacity
- Better structure and resistance to erosion, and
- easier root penetration.

How to do the Assessment

1. Gather 6 strips of calico: 40mm wide x 40cm long.
2. Push a square-nosed spade into the soil near a star picket to a depth of about 15 to 18 cm. Wiggle it gently to loosen the soil, then pull it out gently to leave a vertical slot in the soil.
3. Fold one cotton strip in half over the end of the spade and push it gently into the slot in the soil to the depth of the slot. There should be about 50mm of cloth left above the ground.
4. Withdraw the spade, leaving the cotton strip in place, and firm around the cotton strip by stamping your feet on the soil surface near the strips.
5. Place the remaining 5 cotton strips in a similar manner within one meter of the pickets.
6. Return after 1 week and take one cotton strip out of the soil. Note the degree of discoloration. Remove one cotton strip each week until the strip you remove is rotted completely.

Record the number of days until the cotton strips are rotted in your own notebook. Also note the time of year and the soil moisture level (for example, dry, moist, wet). Biological activity will increase and decrease with changes in temperature and moisture.



Calico on the Left: the calico that was below ground is completely eaten. Calico on the Right: the calico that was below gorund has only discoloration.

Active Organic Matter

Soil organic carbon can be seen as the basis of soil fertility. Carbon makes up approximately 58% of organic matter, some of which turns over rapidly and is available to plants, whilst other forms of carbon turn over more slowly (taking perhaps 2,000 years).

Organic matter in soils can be living, dead (active), or very dead (humus).

The active organic matter provides nutrients and the aggregating gums when it decomposes and supplies food for a diverse population of micro-organisms.

The active organic matter portion responds relatively quickly when management practices change.

Why it is important?

Nutrient availability

Decomposition of soil organic matter releases nitrogen, phosphorus and a range of other nutrients for plant growth. Soil micro-organisms convert organic matter into the minerals that comprise it to obtain carbon, nitrogen and other nutrients for their own metabolism and growth.

Soil structure

Organic Carbon promotes soil structure by holding the soil particles together as stable aggregates, and improves soil physical properties such as water holding capacity, water infiltration, gaseous exchange, root growth and ease of cultivation.

Biological soil health

Organic Carbon is the food source for soil fauna and flora, which serve important functions such as nutrient cycling and availability, assisting root growth and plant nutrient uptake, creating burrows and even suppressing crop diseases.

Soils with higher carbon levels store more moisture.

Primefact 735 at: www.dpi.nsw.gov.au/primefacts
Increasing soil organic carbon of agricultural land
Dr Yin Chan Principal Research Scientist (Soils), Richmond

How to do the Assessment

In a 20ha paddock the 200gms of soil you send for soil testing represents about 2,000mt of soil in the top 100mm of the paddock. So it is important to get a good number of samples from across the paddock.

1. Make 35ml of a 0.02M Potassium Permanganate solution in a clear container with a lid
2. Collect a soil sample of about 100gms (half a handful) from each of 14 locations
   - Scrape the surface to remove litter and plant material
   - Dig a wedge of soil with the spade to 100mm at each sampling site, then take a slice about 20-25mm thick from the side of the hole and put it in a bucket
   - Mix all 14 samples.
3. Take a handful of soil and spread it on some newspaper to air dry for a few minutes.
4. Take 5gms (a teaspoon) of the dried soil sample and put it in the potassium permanganate solution. Shake it for 5 minutes.
5. After 5 minutes shaking, compare the colour with the chart below.
6. Record the result in the Recording Sheet.

Poor soil Quality	Fair Soil Quality	Good Soil Quality	Excellent Soil Quality	
>0 to 450 kgs AOM per Ha	450 to 900 kgs AOM per Ha	to 1800 kgs AOM per Ha	>1800 >kgs AOM per Ha	Active Organic Matter (AOM)
0 to 14 kgs per Ha available N	14 to 29 kgs per Ha available N	29 to 45 kgs per Ha available N	>45 kgs per Ha available N	Available Nitrogen (N)

Adapted from Soil Quality test Kit: A simple test for active organic matter as a measure of soil quality, Ohio State University

pH

The pH of a soil is a description of its acidity or alkalinity. It is a measure of the number of Hydrogen ions in the soil: the higher the number of Hydrogen ions, the lower the pH and the more acidic the soil. The pH is measured on a scale from 1 (strongly acid) through 7 (neutral) to 14 (strongly alkaline).

What it shows

Low pH can inhibit plant growth by:

- Reducing the availability of nutrients
- Reducing the amount of nutrients held in the soil
- Creating toxic concentrations of nutrients
- Reducing the number and activity of beneficial micro-organisms.

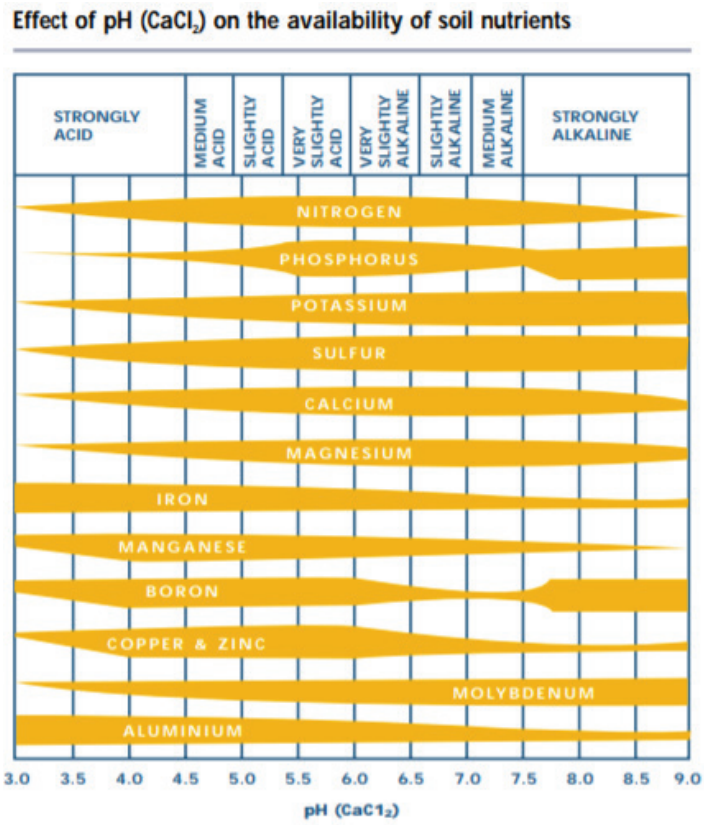
Many Australian soils are naturally acid, and the incidence of highly acid soils is increasing in areas of cultivation and annual pastures. The soils of the NSW north coast are prone to Aluminium toxicity when pH below 5.0 occurs.

Why it is important

Soil pH affects the soil's physical, chemical, and biological properties and processes, as well as plant growth. The nutrition, growth, and yields of most crops decrease where pH is low and increase as pH rises to an optimum level.

Nutrient availability to plants varies with pH, as shown in the diagram below. Nutrient availability and microbial activity are both highest at a pH of around 5.5 to 6.0 (where the yellow lines are thickest).

Understanding Soil pH https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/167187/soil-ph.pdf



The thicker the line, the greater the availability of the nutrient

How to do the Assessment

The home Soil pH Test Kit was developed by CSIRO and is very simple to use. Just follow the directions on the box.

- Collect a handful of soil, and make sure the sample is free of grass, roots or mulch.
- Crush the soil so it is crumbly and place about a dessert spoon of soil on the plastic card.
- Wet the soil with the indicator liquid and mix it into the soil with the plastic stirrer.
- Dust the soil sample with the white powder (barium sulphate) and leave it for a minute or two for the powder to change colour.
- Compare the colour of the powder to the colour chart to determine pH.

The pH of the top-soil gives an indication of possible soil acidity. If the pH is less than 5.5 with the field kit, an acid soil problem may exist but further tests are required to determine the extent of the problem.

NB: pH measurements using the field test kit will be around 0.5 lower than pH as measured in a laboratory soil test
A laboratory soil test will provide an accurate measure of pH on which agronomic recommendations can be based.

Farm Water

Stockwater

Water is essential for all animals for life and production. If water quality is poor, livestock may drink less than they need or sometimes stop drinking altogether. When animals drink less, they will eat less and lose condition.

Livestock get water from digestion of feed and drinking water. Good green pasture can supply all of an animal's water needs, while dry pasture requires stock to drink more water so that they can utilise the less digestible fodder.

Cattle are sensitive to water taste and odour and will drink less and eat less if the water is unpalatable.

Good quality stockwater is clean, clear, odourless, palatable, free from toxins and has a low mineral content. Some problems may be obvious (e.g. cloudy water or algae) while others may require more extensive analysis (e.g. pH or toxic compounds).

Why it is important

Canadian research shows that cattle provided with clean water gain 20% more weight than cattle provided with dam water. Research indicates that cattle, when provided with high quality water, will drink more, eat more and ultimately, gain weight more quickly.

It has also been found that when dam water was pumped to a trough, it was preferred over dam water, suggesting that cattle prefer to drink from a trough and avoid entering a dam. If stock rely on dam water, consider restricting stock access to dams to minimise contamination and prevent livestock from getting bogged.

Stock will drink around 10% of their bodyweight per day, and a common figure is that a 400kg animal will drink between 40 and, on a hot day, around 100 litres per day.

Generally, animals prefer cool water. The optimum temperature of drinking water with regard to performance of cattle is about 16–18°C.

Water requirements for sheep and cattle 3 NSW Department of Primary Industries, July 2014

Heavy usage by stock

Light to moderate usage by stock

Access by stock is controlled

Photos from User guide for assessing riparian condition and water quality risk, Sydney Catchment Authority

Unrestricted stock access can lead to loss of protective riparian vegetation, and soil erosion. This in turn leads to poor water quality, weed invasion and loss of in-stream habitat. Stock can also become bogged and drown.

Installing reticulated water within a grazing system can be effective in improving water quality and animal performance, altering distribution patterns of cattle, and reducing the potential impact of grazing on sensitive riparian areas.

A reticulation system with troughs can increase the flexibility of the grazing system and improve production.

With a reticulated watering system, producers have a greater ability to match their grazing system with animal needs according to the season and the amount of feed on offer.

Pasture utilisation can be improved when animals do not have to travel far for water.

http://agriculture.vic.gov.au/agriculture/farm-management/soil-and-water/water/farm-water-solutions/how-can-i-more-efficiently-use-my-farm-water/stock-perform-better-when-drinking-from-troughs

Farm dams can also be well managed without the need for fences as shown here. The unfenced dam has a grassed bank and spillway but without trees and shrubs. This approch maintains the integrity and function of these structures. Reeds and rushes are present at the inflow to trap nutrients, sediment, and animal droppings. A small stock shelter (left background) and various shade trees are located away from the dam. This protects water quality by encouraging stock to use shade areas away from the dam itself.

From: https://www.waternsw.com.au/__data/assets/pdf_file/0008/113687/FarmDamFinalLR.pdf

How to do the Assessment

Ask yourself the questions (below) for each and tick each answer.
Record the number of YES ticks for each as your score in the Recording Sheet.

Stockwater condition	yes	no
You have observed your stock drinking, and they drink enthusiastically, taking 20 or more big gulps.		
Stock access to dams, waterways and wetlands is controlled by fencing or management (i.e. so that stock are not able to stand in the water).		
The edges of dams have a fringe of native sedges, rushes or water loving plants.		
Floating plants (such as Azolla or Duckweed) or algal blooms may occur on dams, but never cover more than half the surface of the water.		
Stock camps, if located within the catchment of a dam, are more than 100 metres away from the dam.		
Water flowing into a dam does so over a dense pasture. There are no eroding gullies upstream of the dam.		
Dam spillways are well grassed and show no evidence of scouring or erosion.		
The temperature of stock water in troughs on hot days is below 25 degrees^{oC}.		
When you extend a yellow tape measure to 40cms below the surface of the water, you can still see the end of the tape measure.		
There is room for 8 - 10 animals to drink at once, and the floats in troughs are protected from damage by stock.		
Your water storage (or supply) holds at least 700 litres for each of the number of adult stock being carried (i.e. 100 litres per animal for per day for seven days).		
Total number of YES ticks		

Troughs are prefrerred over dams

Waterways

Waterways include permanent streams, ephemeral streams, wetlands, billabongs and gullies (drainage lines). Waterways provide water for drinking and for recreational activities like swimming, boating, fishing or just connecting to nature.

The land alongside waterways is called the riparian zone. Healthy riparian land has vegetation which creates a micro-climate that benefits stock, wildlife and fish by reducing air and water temperatures in hot weather and buffering cold winds and rain when the weather is cold.

Why it is important

Riparian land is possibly the most productive land on the farm, with deeper soils and higher moisture content, green feed in dry times with shade and shelter.

But it is also the most vulnerable to damaging impacts of stock including eating and trampling of vegetation, and depositing of nutrients in dung and urine which readily reach the water.

Some of the impacts of loss of riparian vegetation include:

- Loss of shade and shelter
- Soil loss through erosion
- Reduced biodiversity from loss of habitat (both on the land and in the water) and changes to conditions (such as increased water temperatures which affect fish and other aquatic species).
- Spread of disease and parasites (The manure of young or lactating stock contains significantly more pathogens which infect humans, so only dry, mature animals should be allowed to graze in riparian land.)
- Declining stock and drinking water quality
- Weed invasion

Managing stock access to riparian land can have a number of benefits for farm management and production:

- no loss of stock on steep, unstable banks
- better biosecurity for you and your neighbours
- nutrients in dung and urine can be better spread around the paddocks to grow more grass
- better control over when you graze.

How to do the Assessment

Ask yourself the questions (below) for and tick each answer.

Record the number of YES ticks for each as your score in the Recording Sheet.

Waterway condition	yes	no
More than 50% of any stream has a buffer of native vegetation with 40 - 80% native vegetation (See below)		
More than 50% of any stream has a buffer of native vegetation with more than 80% native vegetation (See below)		
Buffers of native vegetation are more than 10 metres wide on each side		
There is an under-storey of native shrubs and groundcover within the buffer of native trees		
Weeds are absent, occur only occasionally, or occur only around the edges of the native vegetation		
All waterways are fenced for stock control		
All streambanks are stable – none are eroding or collapsing		
Stock have access to shade other than that provided by streambank vegetation		
Stock have access to water other than that in the stream (e.g. troughs, dams)		
Water draining from your property or paddock to the stream after moderate or heavy rain is clear (i.e. not dirty)		
Total of YES ticks		

<40% vegetation

40-80% native vegetation

>80% native vegetation

Photos from User guide for assessing riparian condition and water quality risk, Sydney Catchment Authority

Native Vegetation

Bushland condition

Native vegetation commonly contains a mix of trees and shrubs which provide shelter and habitat for native animals. Grazing enterprises may have reduced the amount of native vegetation to encourage greater grass growth to provide fodder for stock.

Some of the patches of native vegetation may include threatened vegetation communities and/or threatened plant or animal species.

Native vegetation in good condition contains a diverse mix of trees, shrubs, grasses vines, herbs and forbs.

The types of vegetation communities which may occur on your property include forest woodland, open woodland, rainforest, heathland and native grassland. Together with fallen logs and tree hollows, native vegetation provides important habitat for native wildlife.

Why it is important

Understanding the value and extent of native vegetation will help retain local native birds, animals and plants in the landscape through weed and feral animal control, maintaining and protecting identified important remnant vegetation, while maximising the benefit in agricultural productivity.

These natural ecosystems and the plants and animals they contain, support agriculture in many ways:

- Shade in hot weather, and shelter from wind, rain and hail
- Better pasture and crop growth through shade and shelter
- Better pollination, by providing habitat for insects and birdlife
- Reduced salinity, water logging, wind and water erosion
- Timber for on farm use

What it tells you

The assessment for vegetation in the landscape provides an indication of the extent to which your native vegetation provides for the needs of native animals (habitat and movement) and shade and shelter for stock.

It also provides an indication of how healthy the bushland is – is it self-maintaining or trending downwards?

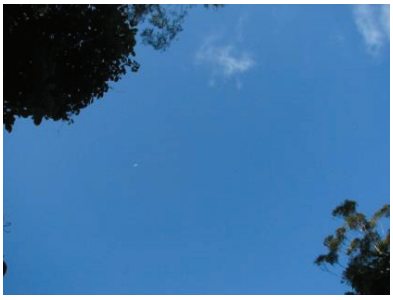
How to do the Assessment

Move close to a patch of bushland and then to some paddock trees so you can look closely at them.

Ask yourself the questions (below) and tick each answer.

Record the number of YES ticks for each as your score in the Recording Sheet.

Bushland condition	Yes	No
Stock access to bushland is controlled by either fencing or management		
There is a mix of mature tree species of varying age classes, with good foliage cover, flowers, fruits and nesting hollows present		
There is regeneration of young trees and shrub, including recruitment of canopy species (i.e. seedlings of the main tree species)		
There is a diverse range of groundcover and shrub species present, and a groundcover of leaves, bark and twigs (including logs and fallen branches)		
There is more than 50% canopy cover within the bushland (see pics below)		
Weeds are absent, uncommon, sparsely scattered or only around the edges of native vegetation		
The patches of native vegetation are round-ish or square-ish rather than long and thin		
The area of single patches of native vegetation is more than 1 hectare each		
The remnant patches are linked to other native vegetation by corridors (e.g. roadside or riparian vegetation) or scattered trees less than 30m apart		
You know the name of the vegetation community, and whether there are threatened or endangered species present		
Total of YES ticks		



15% canopy cover

50% canopy cover

90% canopy cover

Photos from User guide for assessing riparian condition and water quality risk, Sydney Catchment Authority

Paddock tree condition

Why it is important

Stock

Shade in paddocks provided by paddock trees or shelterbelts can reduce the level of heat stress in cattle. Heat stress is determined by the Temperature Humidity Index (THI) which combines relative humidity with ambient temperature. In general, a THI over 72 is the threshold for heat stress in cattle.

As an example, in the Dungog area the average maximum temperature exceeds the high end of the comfort zone for cattle of around 24 degrees C for the 7 months between October and April.

Adapted from http://www.nadis.org.uk

Relative Humidity %

C	20	30	40	50	60	70	80	90	100
22	66	66	67	68	69	69	70	71	72
24	68	69	70	70	71	72	73	74	75
26	70	71	72	73	74	75	77	78	79
28	72	73	74	76	77	78	80	81	82
30	74	75	77	78	80	81	83	84	86
32	76	77	79	81	83	84	86	88	90
34	78	80	82	84	85	87	89	91	93
36	80	82	84	86	88	90	93	95	97
38	82	84	86	89	91	93	96	98	100
40	84	86	89	91	94	96	99	101	104

No heat stress
Moderate heat stress
Severe heat stress
Fatal

As an example, using the table, the Bureau of Meteorology shows a temperature on 23 February 2016 at 3pm of 32 degrees celcius and a Relative Humidity of 34%.

So the THI is 77. This is towards the top of the range of THI described as 'Moderate Heat Stress'.

At this THI, cows would begin to show symptoms of heat stress.

Biodiversity

Paddock trees are also very valuable for wildlife in many ways:

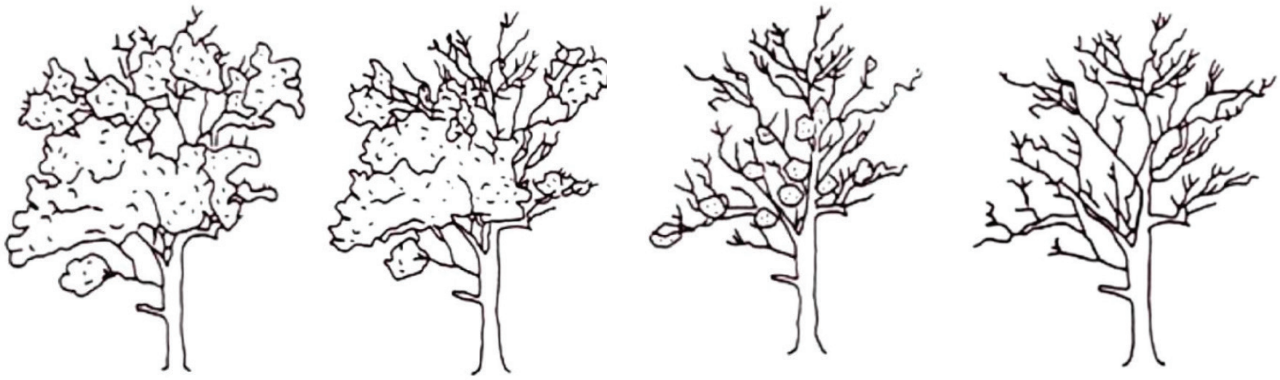
- Hollows in trees and their branches, which can take decades to form, provide homes for many creatures
- Crevices in trees and their bark provide habitat for many small animals, reptiles and insects.
- Patches of native vegetation can be connected by paddock trees which act as stepping stones for animals and birds to move safely between patches
- The flowers of paddock trees can provide nectar and pollen for species which rely on these, such as honeyeaters and sugar gliders.

How to do the Assessment

Move close to a patch of bushland and then to some paddock trees so you can look closely at them.
Ask yourself the questions (below) for each and tick each answer.
Record the number of YES ticks for each as your score in the Recording Sheet.

Paddock tree condition	Yes	No
Paddock shade trees and stock camps are fenced, or they are not used by stock continuously or for long periods		
There is no evidence of ringbarking by stock or rubbing on trunks		
There are young trees coming along to replace aging trees		
There are fewer than 20% of paddock trees at Stage 4 of dieback (See page 33)		
There are fewer than 20% of paddock trees at Stage 3 of dieback		
There are less than 20% of trees at Stage 2 of dieback		
There are fewer than 20% of paddock trees at Stage 1 of dieback		
Eucalypt trees have seeds on them		
There is more than 2sq m of shade in summer per animal in each paddock		
There is more than 4 sq m of shade in summer per animal in each paddock		
Total of YES ticks		

Four stages of dieback in paddock trees



Stage 1:
Branch tips die

Stage 2:
Extensive loss of leaves

Stage 3:
Epicormic regrowth (from buds under the bark)

Stage 4:
Tree death

From Land for Wildlife Note 34. Department of Natural Resources and Environment

Other assessments you can make

Soil

Soil texture text
https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0005/164615/determining_soil_texture_using_-ribboning_technique.pdf

Infiltration tests (double ring)
http://www.fao.org/3/S8684E/s8684e0a.htm

Chemical soil test
https://www.dpi.nsw.gov.au/about-us/services/laboratory-services/soil-testing

Biological soil test
https://www.soilfoodweb.com.au/

Visual Soil Assessment – Field Guide
https://www.landcareresearch.co.nz/publications/books/visual-soil-assessment-field-guide/download-field-guide

Pasture

Pasture meter (kg DM/ha)
https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0020/163316/managing-pastures-allocate.pdf

Pasture (forage) quality test
https://www.dpi.nsw.gov.au/about-us/services/laboratory-services/feed-quality-service/feed-quality-service-test-list

Legume nodulation (if present)
https://grdc.com.au/__data/assets/pdf_file/0022/244057/GRDC-Tips-and-Tactics-Legume-and-Nitrogen-Fixation-2017-Web-low-resolution-version.PDF

Native vegetation

Checking for Change
https://biocollect.ala.org.au/project/index/2e680d3d-050b-404c-8a12-a3a2a7eef30a

Water

Water quality test
https://www.dpi.nsw.gov.au/about-us/services/laboratory-services/water-testing

Recording sheets

Photos: **Site 1** **Name** **Date**

	Landscape photo
	Mid-distance photo
	Ground photo

Soil					Pasture			Water		Native Vegetation	
Structure	Penetration cms	pH	Infiltration rate mm/hour	Active Organic Matter kgs per Ha	Pasture condition % 3P DM	Ground-cover %	Soil surface condition	Waterway Condition	Stockwater Condition	Bushland Condition	Paddock Tree Condition
Excellent	>36	>6.0	>300	>1800	>80	100	10	10	10	10	10
Good	32 to 36	5.8	250 - 300	900 - 1800	80	95-100	9	9	9	9	9
	28 to 32	5.6	200 - 250		70	90-95	8	8	8	8	8
	24 to 28	5.4	150 - 200		60	85-90	7	7	7	7	7
Moderate	20 to 24	5.2	125 - 150	450 - 900	50	80-85	6	6	6	6	6
	16 to 20	5.0	100-125		40	75-80	5	5	5	5	5
	12 to 16	4.8	75-100		30	70-75	4	4	4	4	4
Poor	8 to 12	4.6	50-75	0<450	20	65-70	1	1	1	1	1
	4 to 8	4.4	25-50		10	60-65	0.5	0.5	0.5	0.5	0.5
	0 to 4	4.2	<25		<10	<60	0	0	0	0	0

Site name	
Date	
Notes	

Photos: **Site 2** **Name** **Date**

	Landscape photo
	Mid-distance photo
	Ground photo

Soil					Pasture			Water		Native Vegetation	
Structure	Penetration cms	pH	Infiltration rate mm/hour	Active Organic Matter kgs per Ha	Pasture condition % 3P DM	Ground-cover %	Soil surface condition	Waterway Condition	Stockwater Condition	Bushland Condition	Paddock Tree Condition
Excellent	>36	>6.0	>300	>1800	>80	100	10	10	10	10	10
Good	32 to 36	5.8	250 - 300	900 - 1800	80	95-100	9	9	9	9	9
	28 to 32	5.6	200 - 250		70	90-95	8	8	8	8	8
	24 to 28	5.4	150 - 200		60	85-90	7	7	7	7	7
Moderate	20 to 24	5.2	125 - 150	450 - 900	50	80-85	6	6	6	6	6
	16 to 20	5.0	100-125		40	75-80	5	5	5	5	5
	12 to 16	4.8	75-100		30	70-75	4	4	4	4	4
Poor	8 to 12	4.6	50-75	0<450	20	65-70	1	1	1	1	1
	4 to 8	4.4	25-50		10	60-65	0.5	0.5	0.5	0.5	0.5
	0 to 4	4.2	<25		<10	<60	0	0	0	0	0

Site name	
Date	
Notes	

Photos: **Site 3** **Name** **Date**

	Landscape photo
	Mid-distance photo
	Ground photo

Soil					Pasture			Water		Native Vegetation	
Structure	Penetration cms	pH	Infiltration rate mm/hour	Active Organic Matter kgs per Ha	Pasture condition % 3P DM	Ground-cover %	Soil surface condition	Waterway Condition	Stockwater Condition	Bushland Condition	Paddock Tree Condition
Excellent	>36	>6.0	>300	>1800	>80	100	10	10	10	10	10
Good	32 to 36	5.8	250 - 300	900 - 1800	80	95-100	9	9	9	9	9
	28 to 32	5.6	200 - 250		70	90-95	8	8	8	8	8
	24 to 28	5.4	150 - 200		60	85-90	7	7	7	7	7
Moderate	20 to 24	5.2	125 - 150	450 - 900	50	80-85	6	6	6	6	6
	16 to 20	5.0	100-125		40	75-80	5	5	5	5	5
	12 to 16	4.8	75-100		30	70-75	4	4	4	4	4
Poor	8 to 12	4.6	50-75	0<450	20	65-70	1	1	1	1	1
	4 to 8	4.4	25-50		10	60-65	0.5	0.5	0.5	0.5	0.5
	0 to 4	4.2	<25		<10	<60	0	0	0	0	0

Site name	
Date	
Notes	

Photos: **Site 4** **Name** **Date**

	Landscape photo
	Mid-distance photo
	Ground photo

Soil					Pasture			Water		Native Vegetation	
Structure	Penetration cms	pH	Infiltration rate mm/hour	Active Organic Matter kgs per Ha	Pasture condition % 3P DM	Ground-cover %	Soil surface condition	Waterway Condition	Stockwater Condition	Bushland Condition	Paddock Tree Condition
Excellent	>36	>6.0	>300	>1800	>80	100	10	10	10	10	10
Good	32 to 36	5.8	250 - 300	900 - 1800	80	95-100	9	9	9	9	9
	28 to 32	5.6	200 - 250		70	90-95	8	8	8	8	8
	24 to 28	5.4	150 - 200		60	85-90	7	7	7	7	7
Moderate	20 to 24	5.2	125 - 150	450 - 900	50	80-85	6	6	6	6	6
	16 to 20	5.0	100-125		40	75-80	5	5	5	5	5
	12 to 16	4.8	75-100		30	70-75	4	4	4	4	4
Poor	8 to 12	4.6	50-75	0<450	20	65-70	1	1	1	1	1
	4 to 8	4.4	25-50		10	60-65	0.5	0.5	0.5	0.5	0.5
	0 to 4	4.2	<25		<10	<60	0	0	0	0	0

Site name	
Date	
Notes	

For more information about Hunter Local Land Services:

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