



MACKAY WHITSUNDAY REGION *SUSTAINABLE GRAZING GUIDE* 2018 UPDATE



Queensland Government



ACKNOWLEDGEMENTS

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Updates have been completed by Reef Catchments Sustainable Agriculture team Mandy Jeppesen and Tegan McBride.



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INTRODUCTION

The Mackay Whitsunday Region Sustainable Grazing Guide provides relevant information and tools to assist graziers in achieving sustainable management of their land, whilst maintaining or enhancing farm efficiency and productivity. It is designed to be a resource for finding information rather than a comprehensive manual on grazing management. Therefore, each section provides web site links, case studies and references to published data and identifies interactive tools including Apps and software.



WEB SITES



CASE STUDIES



PUBLISHED DATA



APPS AND
SOFTWARE TOOLS

This guide has been written for beef cattle producers in the Mackay Whitsunday region. It links to the *Mackay Whitsunday ABCD Management Practice Framework for Grazing: 2018 Update* (Reef Catchments, 2018) and therefore, the 'A' Class or innovative practices from the ABCD Framework are identified throughout this document.

REGIONAL GRAZING SNAPSHOT

The Mackay Whitsunday region includes the catchments of the Pioneer, O'Connell, Plane, and Proserpine River systems and covers an area of approximately 9000 square kilometres. The climate is subtropical to tropical with a distinctive wet season. The average annual rainfall is 1300 to 2000 millimetres and over 50% of this falls in three months between January and March.

Grazing is the largest single land use in the Mackay Whitsunday region, followed by sugarcane and natural areas. This is shown in Figure 1. Heavy cattle such as cull cows and bullocks are sold primarily through export abattoirs at Bakers Creek or Rockhampton. Growing cattle are sold through saleyards at Rockhampton, Sarina and Nebo or by private treaty with livestock agents and return property buyers from areas as widespread as the Burnett and Clermont districts (Dodt, R 2016, pers. comm., 10 February).

The cane and cattle industries are closely linked with more than 50 percent of the region's beef cattle owned and managed by integrated cane and beef enterprises.

Land use: 9000 square kilometres

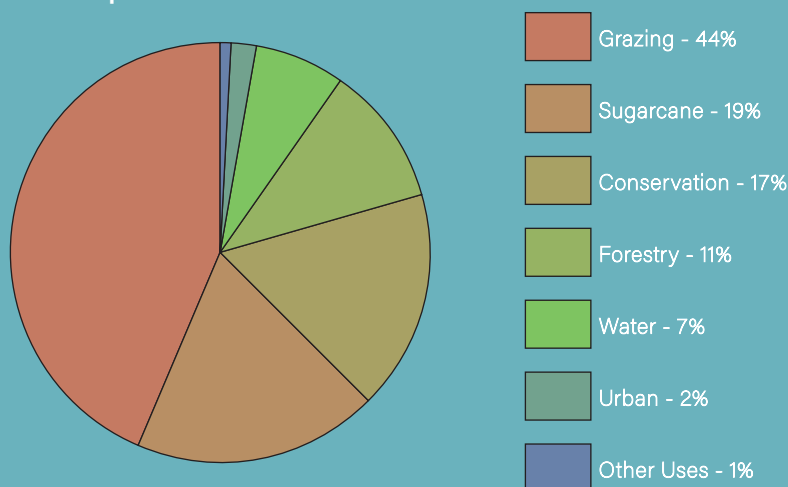


Figure 1: Mackay Whitsunday land use as a percentage of total area, sourced from Packett et al (2014).

LAND CONDITION

Land condition is a relative measure of the health of grazing lands and is related to the capacity of the land to produce useful forage for animal production, minimise runoff, prevent soil erosion and sustain biodiversity. Soil, pasture and woodland condition all contribute to land condition (DPI&F, 2006; DNRM, 2013; Grazing BMP, 2014).

It is well documented that when safe carrying capacity is exceeded there is a downward spiral in land condition and stability and consequently the viability of a grazing enterprise can be impacted. Land condition is directly related to income derived from a grazing enterprise because land condition ultimately drives weight gain as shown in Figure 2.



Figure 2: Relationship between land condition and weight gain.

The rolling ball model illustrates that not all changes in land condition occur at the same rate (as illustrated in Figure 3). The further land condition declines, the more energy and resources will be required to reverse the damage. A reduction in land condition reduces carrying capacity and consequently long-term productivity.

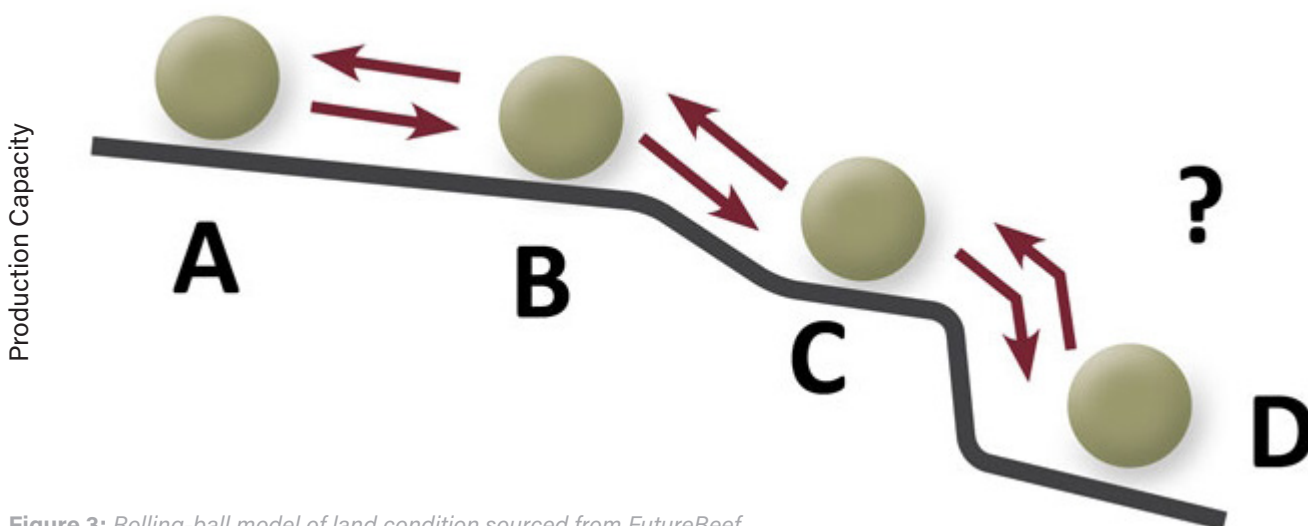


Figure 3: Rolling-ball model of land condition sourced from FutureBeef.

Land Condition	Description
A	Stable land condition
B	Susceptible to a relatively quick decline into C condition Reverting back to A condition can be relatively quick through management changes
C	Susceptible to falling quickly into D condition Reverting to B condition will require major management changes and some time to occur
D	Reverting to C condition requires large inputs of time and money Damage may be irreversible if soil condition is severely degraded

LAND CONDITION ASSESSMENT

The ABCD land condition assessment framework was developed by the Queensland Department of Primary Industries to evaluate land condition in Queensland.

Soil condition determines the capacity of the soil to absorb and store rainfall, to store and cycle nutrients, to provide habitat for seed germination and plant growth and to resist erosion.

Pasture condition determines the capacity of the pasture to capture sunlight and convert its energy into palatable green leaf, to use rainfall efficiently, to conserve soil condition and to cycle nutrients.

Woodland condition determines the capacity of the woodland to grow pasture, to cycle nutrients and to regulate ground- water.

Perennial grasses are a key determinant of land condition. Perennial plants live for more than a year, regenerate from tussocks as well as seed and hence have greater capacity to protect the soil from erosion compared to annuals.

Perennial grasses vary in the value they offer a grazing system. The most important and preferred are the 3P grasses – those that are productive (produce a high volume of leaf matter), perennial (live for more than one year) and palatable (preferred by stock).

Land condition is classified as A, B, C or D with A being the most productive.



Plate 1: Pasture monitoring site.



Stocktake Plus App (Future Beef) Ground Cover App (Namoi Catchment) FarmGraze App (Aber Trading Ltd)

Grazing Calculator App (Louise Hathaway)

VegMachine (CSIRO)

MLA Stocking Rate Calculator

www.mla.com.au/extension-training-and-tools/tools-calculators/stocking-rate-calculator

MLA Feed Budget and Rotation Planner

www.mla.com.au/extension-training-and-tools/tools-calculators/feed-budget-and-rotation-planner

MLA Pasture Improvement Calculator

www.mla.com.au/Extension-training-and-tools/tools-and-calculators/pasture-improvement-calculator

'A' condition land

Good or 'A' condition land has all the following features:

- Good coverage of perennial grasses dominated by those species considered to be 3P grasses for that land type; organic ground cover greater than 50% at the end of the dry season.
- Few weeds and no significant infestations
- Good soil condition, no erosion and good soil surface condition
- No sign or only early signs of woodland thickening

Land in 'A' condition is associated with minimal runoff and high infiltration rates. Any runoff after large rainfall events generally has low concentrations of sediment.

'B' condition land

Fair or 'B' condition land has at least one or more of the following features:

- Some decline of 3P grasses; increase in other species (less favoured grasses, weeds) and/or organic ground cover of 40– 50% at the end of the dry season.
- Some decline in soil condition; some signs of previous erosion and/or current susceptibility to erosion is a concern.
- Some thickening in density of woody plants.

'C' condition land

Poor or 'C' condition land has one or more of the following features:

- General decline of 3P grasses; large amounts of less favoured species and/or organic ground cover of 20–40% at the end of the dry season
- Obvious signs of past erosion and/or current susceptibility to erosion is high
- General thickening in density of woody plants.

'D' condition land

Very poor or 'D' condition land has one or more of the following features:

- General lack of any perennial grasses or forbs.
- Overpopulated with annuals or weed species (sickle pod, lantana or GRT common in this region) to the point where grazing value is severely diminished.
- Severe erosion or scalding, resulting in hostile environment for plant growth.
- Thickets of woody plants cover most of the area.



Plate 2: *Alluvial Flats in A condition.*



Plate 3: *Alluvial Flats in B condition.*



Plate 4: *Alluvial Flats in C condition.*



Plate 5: *Alluvial Flats in D condition.*

PHOTO MONITORING

The Stocktake website (www.stocktakeplus.com.au) provides detailed instructions on photo monitoring of land types as part of an annual land condition assessment. It recommends taking trayback and landscape photos as shown in Figure 4.

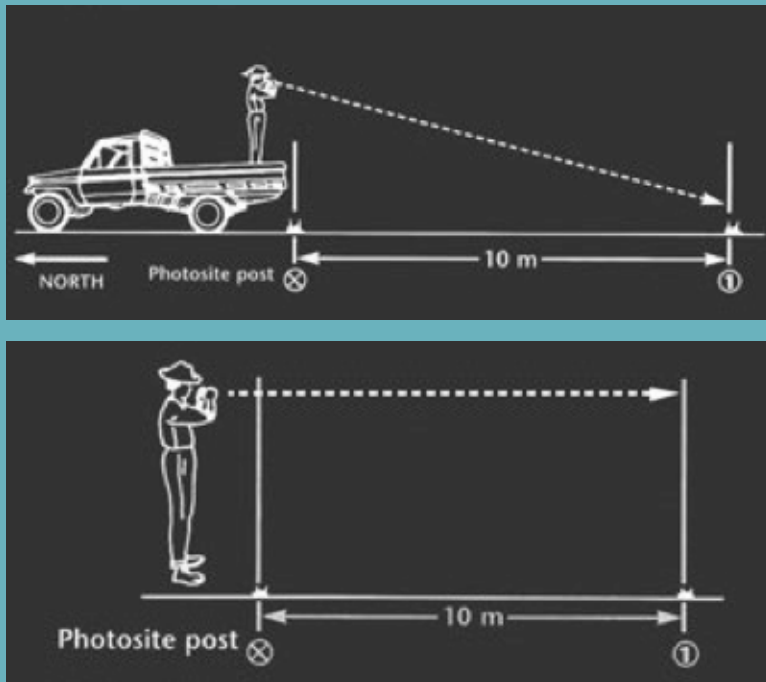


Figure 4: Photo monitoring techniques recommended by the Queensland Government (sourced from www.stocktakeplus.com.au).

Photo sites are an accurate and objective method of monitoring land condition at a particular point in time. Photos need to be supported by written observations, named and filed chronologically and should be georeferenced to ensure photos can be taken in the same location in subsequent years.



13,378 kg/Ha



13,378 kg/Ha



8,811 kg/Ha



8,811 kg/Ha

Figure 5: Examples of photo monitoring sites and associated available forage measurements.



Mackay Whitsunday Land types

<https://www.futurebeef.com.au/knowledge-centre/grazing-land-management/land-types-of-queensland/mackay-whitsunday/>

Photo Standards

<https://www.futurebeef.com.au/knowledge-centre/pastures-and-forage-crops/pasture-photo-standards/>

MLA

www.mla.com.au/research-and-development/Environmental-sustainability/Sustainable-grazing-a-producer-resource/

www.mla.com.au/Extension-training-and-tools/More-beef-from-pastures



DAF, (2017), Improved Practice Catalogue: Best Management Practices for Maintaining and Improving Land Condition on Grazing Lands. Queensland Government

DERM. (2011). Managing Grazing Lands in Queensland. Queensland Government.

Karfs, R., Holloway, C., Pritchard, K. & Resing, J. (2009). *Land condition photo standards for the Burdekin Dry Tropics Rangelands: a guide for practitioners*. Burdekin Solutions Ltd & State of Queensland, Department of Primary Industries and Fisheries. Townsville.

MLA. (2006). *Grazing land management, sustainable and productive natural resource management*. Meat and Livestock Australia Limited.

O'Sullivan, G. & Fitzroy Basin Association. (2008). *Ground cover standards for central Queensland grazing lands*. Fitzroy Basin Association Limited.

PHASES OF PASTURE GROWTH

Pasture growth follows a generalised pattern through the growing season and is divided into four distinct phases. Producers need to be aware of the characteristics of each phase in order to maximise production while also maintaining adequate land and pasture condition.

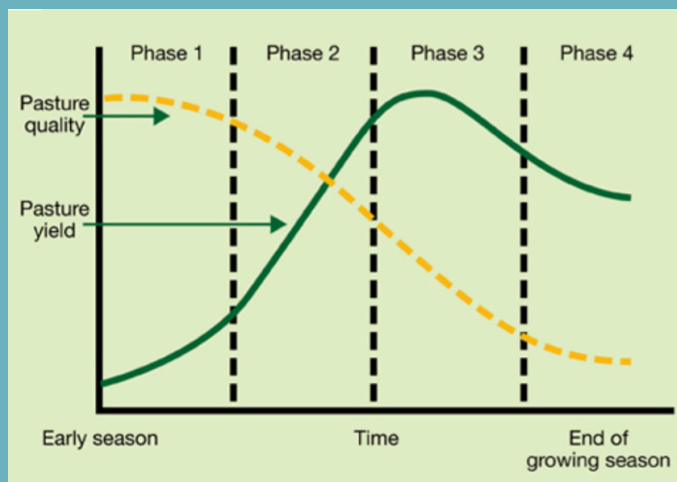


Figure 6: Source: MLA. 2016. <https://www.mla.com.au/research-and-development/Grazing-pasture-management/native-pasture/pasture-growth/>

Phase 1: short, leafy growth phase, moderate growth rate, high quality, low yield, highly sensitive to grazing pressure

Phase 2: well-developed leafy tussock, high growth rate, good quality, moderate yield, moderate sensitivity to grazing pressure

Phase 3: reproductive phase, low growth rate, moderate to low quality, maximum yield, low to moderate sensitivity to grazing

Phase 4: Dormant phase, little or no growth, low to very low quality, low sensitivity to grazing pressure

The importance of maintaining land in good condition is critical; not only for ecological stability, but also for business viability. Overutilization (overgrazing) will increase live weight gains per hectare in the short-term but negatively impacts pasture production and land condition, which results in lower live weight gains long term. Overgrazing reduces the leaf material of the plant, which subsequently diminishes its capacity to photosynthesise. This diminishes ecological function because the roots don't establish which limits the plant's ability to take up water and nutrients. This subsequently limits the plant's ability to grow leaf matter. Reduced organic matter and nutrient cycling then impacts on soil health and function and creates an ecosystem vulnerable to weed incursions.

The impacts of overgrazing can be demonstrated by comparing plant root systems and above-ground biomass from three different grazing pressure scenarios (Figure 7).

Figure 7: Comparison of three grass plants that have been grazed down to 5 cm in height every week (left), every two weeks (middle) and every four weeks (right), demonstrating the effect of grazing pressure on root development and above-ground biomass (Photo credit: <http://onpasture.com/2013/04/30/collect-more-sunshine-to-grow-more-grass>)



GROUND COVER

Maintaining sufficient groundcover (at least 70%) is essential to maximizing rainfall infiltration into the soil and reducing the risk of sediment loss. Ensuring adequate groundcover leads to increased farm productivity as well as improvements in the quality of water entering waterways, and eventually the Great Barrier Reef.



Figure 8: (a) 20% ground cover

(b) 50% ground cover

(c) 80% ground cover

(Source: MLA. 2013. Assessing Groundcover. <http://mbfp.mla.com.au/Pasture-growth/Tool-22-Assessing-ground-cover>)



Future Beef: Grazing Land Management

<https://www.futurebeef.com.au/knowledge-centre/grazing-land-management/>

Pasture Management for Drought Recovery

<https://www.futurebeef.com.au/knowledge-centre/grazing-land-management/pasture-management-for-drought-recovery/>

RCS Australia

<http://www.rcsaustralia.com.au/resource-toolbox/>

VegMachine

<https://vegmachine.net>

Queensland Government

<https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/grazing-pasture/sustainable-grazing>

Grazing BMP Grazing land management module

https://www.bmpgrazing.com.au/images/module/modules/2014/glm_2014.pdf

Grazing Best Practice

<http://www.grazingbestprac.com.au/bestpractice/graziers/pasture-management.html>

To prevent a decline in land condition, it is critical to balance pasture production (kg/ha) with pasture intake (kg/ha). To do this, the long-term carrying capacity (LTCC) of each land type needs to be known. Determining long-term carrying capacity entails assessment of the expected level of pasture production (kg/ha) by monitoring pasture to determine available forage and considering long-term weather forecasts, then matching that to expected pasture intake (kg/ha) of livestock using animal equivalent (AE) tables.

Strategies for managing beef cattle herd nutrition to achieve production and land condition goals are discussed further in the Herd Nutrition Management section.



Grazing BMP. (2014). *Grazing BMP self-assessment, Grazing Land Management, Northern Australia Module*. State of Queensland, Department of Agriculture Fisheries and Forestry.

DERM. (2011). *Managing grazing lands in Queensland*. State of Queensland, Department of Environment and Heritage Protection

DNRM. (2013). *State Rural Leasehold Land Strategy, guidelines for determining land condition*, Version 3.0. State of Queensland, Department of Natural Resources and Mines.

DPIF. (2007). *PASTURES: Mackay Whitsunday Region; A Guide for Developing Productive and Sustainable Pasture-fed Grazing Systems*. The State of Queensland. Department of Primary Industries and Fisheries.

MLA. (2006). *Beef Cattle Nutrition, an introduction to the essentials*. Meat and Livestock Australia Limited.

MLA. (2014). *The Northern Beef Report*. Meat and Livestock Australia Limited.

National Research Council. (1994). *Rangeland Health: New Ways to Classify, Inventory and Monitor Rangelands*. National Academy Press. Washington, DC.

Society for Range Management. (1995). New concepts for assessment of rangeland condition, *Journal of Range Management*. 48:271-283.



Landholder: Michael Shanks

Location: Palmyra

Case Study: http://reefcatchments.com.au/files/2015/12/RCLCASESTUDY_GRAZING_Michael-Shanks1.pdf



Landholder: Bob Harris

Location: Glencoe Station (Bowen)

Case Study: http://reefcatchments.com.au/files/2015/12/RCLCASESTUDY_GRAZING_BOB_HARRIS.pdf

PASTURE MANAGEMENT: 'A' (ASPIRATIONAL) CLASS PRACTICES

1. Stocking rates are based on consideration of longer-term climatic data for all grazing land types.
2. Long-term carrying capacity is known for all grazing land types but stocking rates are adjusted seasonally to achieve ground cover targets (2025 target of 90% of grazing land with 70% ground cover in the late dry season).
3. Soil testing is georeferenced and monitoring sites established for each land type.
4. Nutrient deficiencies remedied based on soil tests and subsequent professional recommendations.
5. Stock requirements seldom exceed pasture availability.
6. Seasonally tailored supplement programs match results of soil tests, faecal NIRS sampling, pasture monitoring or blood samples.
7. Improved pastures are sown specifically for heifers and sale stock (steers and culls females).
8. Paddocks are subdivided into areas that optimise resource utilisation.
9. Joining, weaning and stock sales are planned around seasonal pasture production and strategies are in place to respond to seasonal conditions.
10. Vulnerable overgrazed areas are fenced off to allow pasture recovery.



Plate 6: Steers produced for the Jap Ox export market.

Through Reef Rescue we have turned one large open paddock into five smaller paddocks with off-stream water. The improvements we have seen are great. The cattle are now utilising the areas they hadn't grazed before. Overall the future productivity of the property is looking better.

– Ben Ferdinand



Landholder: Dale and Jane Gronow

Location: Murray Creek

Case Study: http://reefcatchments.com.au/files/2015/12/07CASESTUDY_Gronows_SS2015.pdf



Landholder: Rodney and Sharon Dallas

Location: Yalbaroo

Case Study: http://reefcatchments.com.au/files/2015/12/RCLCASESTUDY_GRAZING_Rodney-and-Sharron-Dallas.pdf

PASTURE RECOVERY (SPELLING): 'A' CLASS PRACTICES

1. Appropriate planning is conducted for all land types.
2. Grazing strategies implemented during the growing season.
3. Stocking numbers per paddock are recorded electronically and compared across different seasons and various years.
4. Long-term weather forecasting is used to make decisions on stocking rates and buy and sell trigger points.

RIPARIAN MANAGEMENT: 'A' CLASS PRACTICES

1. Independent grazing management is applied to encourage natural regeneration (weed control) or revegetation of a native riparian vegetation buffer at least 10m wide from the top of the bank.
2. Stock are excluded while native riparian vegetation buffer is established up to 5m tall. The native riparian vegetation buffer consists of local native trees & shrubs consistent with the original regional ecosystem.
3. Seasonal grazing consistent with 'B' class practice can be implemented to manage pasture grass adjacent to the native riparian vegetation buffer, once established.

GRAZING BMP

The Grazing BMP program is a voluntary, industry led process, which helps graziers to identify improved practices that aid in sustaining the long-term profitability of their enterprise. It also identifies the steps you need to take to incorporate best management practices into your enterprise. In time it will also allow the grazing industry to demonstrate good environmental management to the wider community.

Grazing BMP has two distinct phases. The first phase is completing the five self-assessment modules where graziers can benchmark and adjust their performance as required. The second phase involves accreditation where self-assessment information is validated through an external review process.

The Grazing BMP Modules for self-assessment can be downloaded from the program's website (www.bmpgrazing.com.au) and can be completed individually online or by attending a Grazing BMP workshop. The accreditation process involves an external audit to validate a grazier's evidence against the best practice standards for Grazing BMP.

On successful completion, graziers are recognised as a Grazing BMP Accredited Producer. The individual accreditation provides confidence that graziers performance is endorsed, scientifically robust and recognised. It is envisaged that the accreditation, could be used by graziers to endorse, or recommend their performance or product, in an identified market and the broader community. This accreditation is valid for three years.

The Mackay Whitsunday ABCD Management Practice Framework for Grazing: 2018 Update incorporates management practices that are considered above industry standard in the Grazing BMP modules to ensure that consistent messages are being communicated to the beef cattle industry.

The five modules are:

1. Animal health and welfare
2. Animal production
3. Grazing land management
4. People and business
5. Soil health



Grazing BMP www.bmpgrazing.com.au

Animal Health and Welfare www.bmpgrazing.com.au/images/module/modules/2014/aw_2014.pdf

Animal Production www.bmpgrazing.com.au/images/module/modules/2014/ap_2014.pdf

Grazing land management www.bmpgrazing.com.au/images/module/modules/2014/glm_2014.pdf

People and business www.bmpgrazing.com.au/images/module/modules/2014/pb_2014.pdf

Soil Health www.bmpgrazing.com.au/images/module/modules/2014/soil_2014.pdf



Landholder: Kel and Amanda Tennent

Location: Eungella

Case Study: http://reefcatchments.com.au/files/2015/12/RCLCASESTUDY_GRAZING_Ken-and-Amanda-Tennent.pdf

CLIMATE AND SEASONAL FORECASTING

North-eastern Australia and particularly coastal central Queensland has amongst the most variable rainfall patterns globally (Cliffe, N 2016, pers. comm., 08 February). Extremes of drought and flood occur naturally in our region so it is essential to plan and manage for them. Seasons of above and below average rainfall will happen frequently and therefore should not have disastrous consequences. If properties are managed for drier- than-average years, better seasons become a bonus for both production and the landscape.

The SOI and ENSO

Monitoring seasonal forecasts based on the Southern Oscillation Index (SOI) and other measures of the El Niño-Southern Oscillation phenomenon (ENSO), particularly sea-surface temperatures, help to give an outlook for future seasonal conditions. ENSO fluctuates from one year to the next and the SOI is most strongly related to rainfall and climate from winter through to summer.

The SOI measures the differences in air pressure between Tahiti and Darwin. The index scale ranges from about +30 to -30. When the SOI is strongly positive (i.e. greater than +5, referred to as a La Niña phase) south-easterly trade winds blow strongly across the Pacific Ocean picking up moisture. In a La Niña phase, much of eastern Australia has a chance of receiving greater than average rainfall and higher number of tropical cyclones. With a strongly negative SOI (i.e. less than -5) usually referred to as an El Niño, south-easterly trade winds weaken or reverse. This results in a stronger probability of below average rainfall across eastern Australia and lower number of tropical cyclones.

MJO

The 40 day wave or MJO (Madden Julian Oscillation) is a periodic wave of low pressure that travels west to east across the Indian and Pacific oceans. Its passage is often linked to the timing and strength of rainfall events in Queensland, particularly in spring and summer and it can stimulate tropical cyclone development during the monsoon season (Cliffe, N 2016, pers. comm., 08 February).

Drought Planning

As drought conditions develop, it is important to adopt a strategy early while options are available. Stocking rates should be managed according to what pasture is available and the condition of that pasture. Stock should be sold or agisted early in the dry season while they are still in good condition and fit to travel and the pasture is not yet overgrazed.



Bureau of Meteorology

www.bom.gov.au

Queensland Government Climate Forecasting

www.qld.gov.au/environment/climate/forecasting

Elders Weather

www.eldersweather.com.au/

Australian Severe Weather Australian charts

www.australiasevereweather.com/links/ozcharts.htm

The Long Paddock

www.longpaddock.qld.gov.au

Queensland Drought Mitigation Centre

www.longpaddock.qld.gov.au/dcap/qdmc/

Water and the Land

www.bom.gov.au/watl/

Other useful websites

Climate/rainfall outlooks ECMWF

<http://www.ecmwf.int/en/forecasts/charts/seasonal/>

MJO (Bureau of Meteorology)

<http://www.bom.gov.au/climate/mjo/>

NOAA

http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CLIVAR/clivar_wh.shtml

Weekly Tropical Climate Note (BoM)

www.bom.gov.au/climate/tropical-note

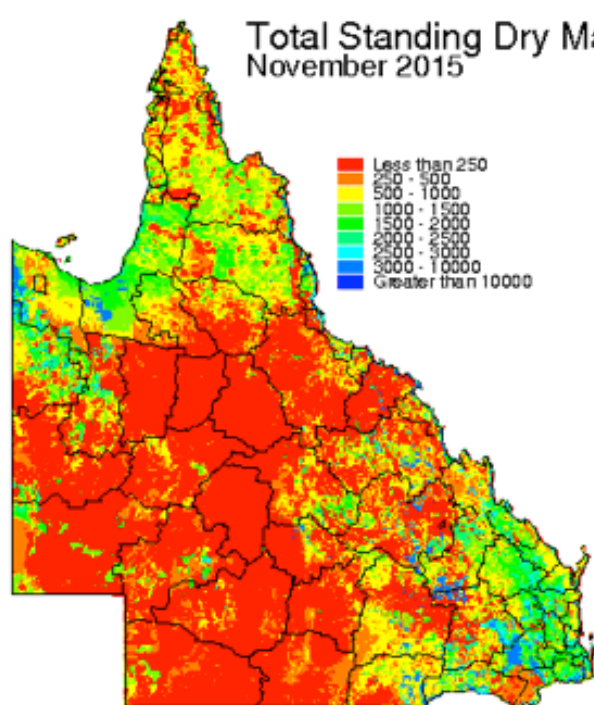
Available Tools

Valuable tools that can be used to manage climatic risk are available on the Long Paddock website. For example, the AussieGRASS model shows predicted pasture growth estimated by considering soil type, pasture type, tree cover and expected rainfall, temperature, humidity and grazing pressure.

The Long Paddock website also provides information on:

- seasonal climate outlooks—based on the SOI (SOI Phase Scheme) or sea-surface temperatures (SPOTA-1 scheme which stands for Seasonal Pacific Ocean Temperature Analysis version 1);
- rainfall maps from 1890 to present;
- pasture growth, relative to pasture records from 1957 to present (will be progressively added to the website using the simulation model AussieGRASS).

Access to the FORAGE system, which provides information relating to climate and pasture condition at user-specified locations, is also available from the Long Paddock website. FORAGE can be used to assess climate risk and land condition and to help make management decisions. The system provides a Rainfall and Pasture Report and a Ground Cover Report, as well as products based on satellite imagery of ground cover.



www.LongPaddock.qld.gov.au



Rainman Streamflow 4.3

AussieGRASS model

FORAGE

How Often?

SILO Climate database

CliMate App

Figure 9: Example of data obtained from the Long Paddock website (www.longpaddock.qld.gov.au).

An additional software package that provides valuable climate information is Rainman Streamflow 4.3. This program contains long-term historical rainfall data for some 3800 locations throughout Australia. The computer program HowOften? is also a useful tool for providing climate information.

TROPICAL PASTURE IMPROVEMENT STRATEGIES

Improved pastures can increase biodiversity; introduce perennial, productive and persistent (3P) species that can out-compete weeds; and increase the legume:grass ratio. It is estimated that improved sown pasture systems provide approximately 90 percent of grazed forage demand with 10 percent supplied from remaining areas of native pastures in the Mackay Whitsunday region (Bishop, 2007).

Pasture improvement is a valuable tool for grazing properties because it can have the following benefits:

- Greater feed supply (above ground biomass) leading to higher carrying capacity;
- Accelerated response to rainfall;
- Better and more consistent feed quality leading to higher reproduction rates and better weight gains per hectare;

- Target weights are achieved at a younger age leading to improved cash flow and the ability to reduce stock numbers more easily during extreme climatic experiences;
- Improved ground cover, organic matter, soil fertility and structure;
- More competition for weeds;
- Reduced erosion.

Pasture improvement may take the form of fertiliser applications to promote existing grass and legumes, direct drilling seed into established pastures or by preparing a fully cultivated seed bed. Pasture improvement programs should aim to achieve a mix of grasses and legumes for quality, longer seasonality and natural nitrogen fixation.

Grass-legume mixed pastures have many advantages. They provide nitrogen, improve diet quality and digestibility and slow or prevent soil fertility decline and pasture run-down. However, grass-legume mixed pastures require very careful grazing, fertiliser and weed management. Optimum grass-legume balance is around 60 to 40 but even 20 percent legume (by dry matter yield) will significantly contribute to pasture and animal production in the Mackay Whitsunday region (Bishop, 2007).

'Pastures Mackay Whitsunday: A guide for developing productive and sustainable pasture-fed grazing systems' by Harry Bishop has extensive information on grass and legume species, pasture improvement strategies and managing special purpose pastures in this region. However, it is strongly recommended that you seek advice specific to your property, because several parameters need to be considered including: climate; soil type; sex, class and breed of stock; grazing system; paddock sizes; planting method and feed demand. Agronomists and seed companies can provide advice on what to sow and when to plant.

Pasture Condition:

Pasture in good condition has the capacity to capture solar energy and convert it into palatable green leaf, the capacity to use rainfall effectively and the ability to conserve soil condition and to cycle nutrients. Maintaining a high density of 3P grasses (perennial, palatable and productive) is the key to good land condition. 3P grasses:

- Capture energy efficiently and promote energy flow through both grazing animals and soil organisms;
- Keep moisture and nutrients in the paddock; and
- Maintain soil organic matter, thereby stimulating soil organisms and promoting soil structure (MLA EdgeNetwork – Grazing Land Management workshop notes. 2007).

Examples of 3P grasses in the Mackay Whitsunday region are Rhodes grass (*Chloris gayana*), signal grass (*Brachiaria decumbens*), pangola grass (*Digitaria eriantha*), Tully humidicola (*Brachiaria humidicola*) and creeping bluegrass (*Bothriochloa insculpta*).



Bishop, H, Pastures Mackay Whitsunday: A guide for developing productive and sustainable pasture-fed grazing systems

www.futurebeef.com.au/wp-content/uploads/Pastures_Mackay_Whitsunday_Region.pdf

Productive Persistent and Profitable Pastures

www.mla.com.au/Research-and-development/Environment-sustainability/Sustainable-grazing-a-producer-resource/Productive-persistent-profitable-pastures



Better Pastures for the Tropics and Subtropics

www.tropicalgrasslands.asn.au/pastures/

Pasture Picker

www.tropicalgrasslands.asn.au/pastures/pasturepicker.htm

Managing Grazing Lands in Queensland

www.qld.gov.au/environment/assets/documents/land/soil/managing-grazing-lands-in-qld.pdf

Diversity of Plant Species:

Having a range of plant species within pastures maintains a healthy ecosystem and enhances the quality of diet for stock. Having an understanding of what plant species dominate a paddock will allow landholders to assess its grazing value.

Plant Basal Area and Health:

Basal area (or crown cover) of the plant is the area of the soil surface where living plants are attached. It is regarded as an important indicator of pasture health because it has the ability to drive potential new forage growth and subsequent yield, and slow overland flow of water, and trap and cycle nutrients (Stocktake Plus, 2004).

Pastures in good condition have high basal area and healthy grass tussocks that are free from disease and pests, have many growing points preserved and grow new shoots from the entire area of the tussock, not just around the edges.

Assessing Pasture Condition:

1. Determine the proportion of 3P grasses that make up total dry matter pasture yield and rate the health of the plants by assessing crown (basal) cover.
2. Check to see if there are any other pasture indicators (see table below) are present and if so, determine roughly what proportion of pasture they comprise.
3. Compare your estimates against the table below and decide the most appropriate rating.

	3P Grasses		Annual grass	Undesirable grasses	Species Diversity
Condition Rating	% DM Yield	Crown Cover	% DM Yield	% DM Yield	Desirables
1	> or = 80%	Dense and plants healthy	< or = 20%	< or = 20%	> 5 species
2	60 – 80%	High to moderate Density and some plants unhealthy	20 – 40%	20 – 40%	3 – 5 species
3	10 – 60%	Moderate to low density and some plants dead	40 – 70%	40 – 80%	2 – 3 species
4	< 10%	Sparse and many plants dead	> 70%	> 80%	1 or no species

Figure 10: Pasture Condition Assessment Table (Source: Stocktake – Balancing Supply and Demand. DPIF, 2004)



DPI&F. 2004. Stocktake – Balancing Supply and Demand: Users Manual.

[www.stocktakeplus.com.au/
wp-content/uploads/2013/01/
Stocktake-users-manual.pdf](http://www.stocktakeplus.com.au/wp-content/uploads/2013/01/Stocktake-users-manual.pdf)



How do I assess pasture condition?

[www.stocktakeplus.com.au/
faqs/how-do-i-assess-pasture-
condition/](http://www.stocktakeplus.com.au/faqs/how-do-i-assess-pasture-condition/)

“The most significant change I’ve seen from planting improved pasture is the response that we get from rain. Improved pastures hold more water - especially your stoloniferous varieties – which reduces run-off into the Great Barrier Reef and results in better grass growth”

Bob Bennett

HERD NUTRITION MANAGEMENT

Management of herd nutrition through seasonal supplementation programs can increase productivity whilst utilising resources more effectively. The high rainfall and high temperatures typical of the Mackay Whitsunday region result in a significant body of feed by the end of the wet season, which is in phase four of the pasture growth cycle or commonly referred to as 'rank' pasture. This consequently has low nutritional value but can be economically utilised with appropriate supplements.

As pasture feed reaches maturity, the available digestible energy and protein levels fall. Digestibility of pasture is related to the stage of growth of the plant. As pasture matures, digestibility declines and energy and crude protein content falls as shown in Figure 11.

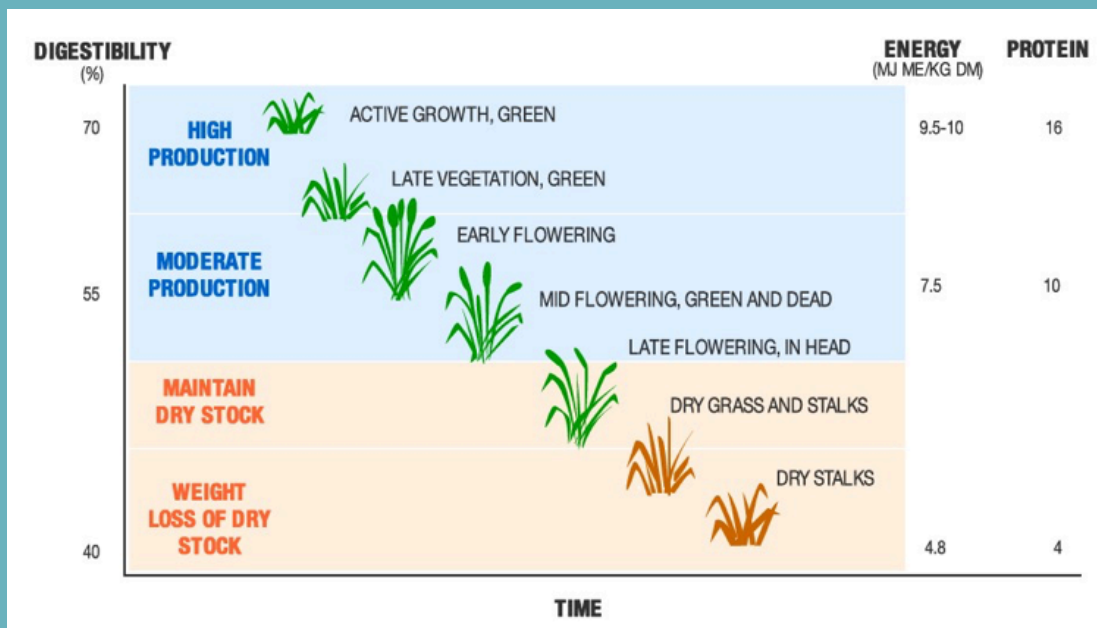
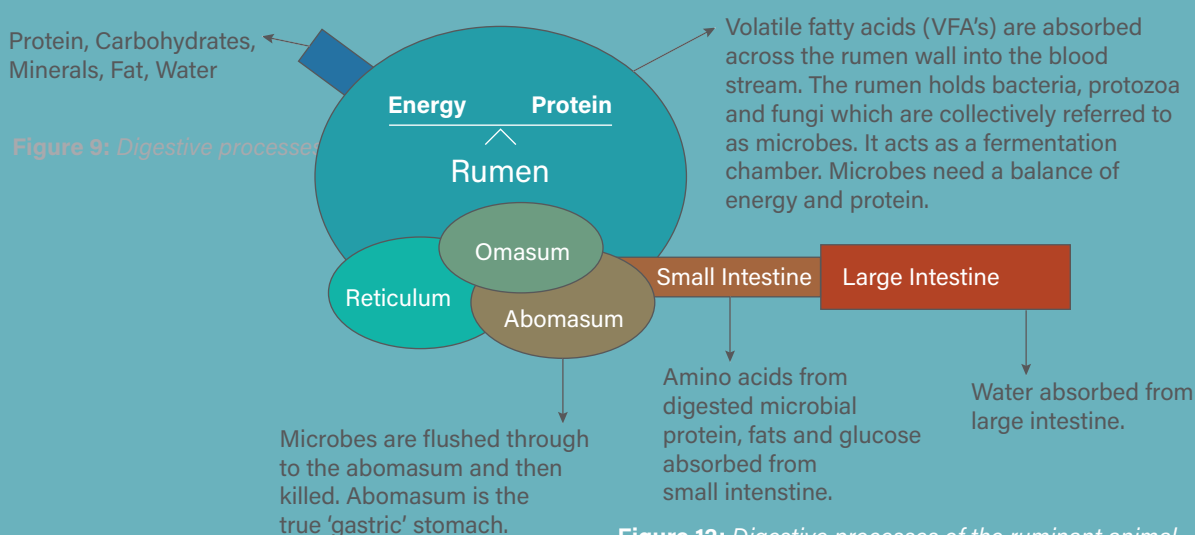


Figure 11: Plant digestibility, energy and protein content as pasture matures (sourced from: www.int.net.au/why-supplement.html, adapted from: NSW PROGRAZE Manual, NSW Agriculture).

Rumen Function

Cattle are ruminant animals and therefore have four stomachs: the rumen, the reticulum, the omasum and the abomasum, as shown in Figure 12. Herd nutrition is essentially about balancing the protein and energy levels in the rumen to meet microbial requirements and then addressing any limiting factors created by an imbalance in nutrients. Energy is not a discrete substance and it is not a nutrient (even though it is often listed with nutrients when describing diets and supplements). Energy content of a feed or diet is made up of carbohydrate, fat and protein.



Microbes in the rumen feed on ingested forage and through a fermentation process, produce end products that are utilised by the animal. The major end products of microbial fermentation are:

- ammonia (used to manufacture microbial protein which is then broken down into amino acids and then ammonia later in the digestive tract);
- volatile fatty acids (butyrate, propionate and acetate), which are then absorbed by the animal; and
- gases.

The animal obtains protein from the forage it eats and from the microbes moving out of the rumen. Microbes are flushed through to the abomasum where they die and are digested, and then absorbed into the bloodstream in the small intestines. To optimise animal performance, you need to balance the nutrient requirements of the microorganisms within the rumen as well as the nutrient requirements of the animal.

Supplement Programs

Supplementation of cattle needs to address the 'primary limiting factor.' This is frequently illustrated by a leaky barrel, as shown in Figure 13. If the top of barrel in Figure 10 represents the optimum performance level of the animal, then a supplementation program aims to bring all dietary elements up to that level. However, the barrel leaks from the lowest point and therefore, if protein is the limiting factor, you will not see a response from feeding phosphorus until the protein requirements are met.



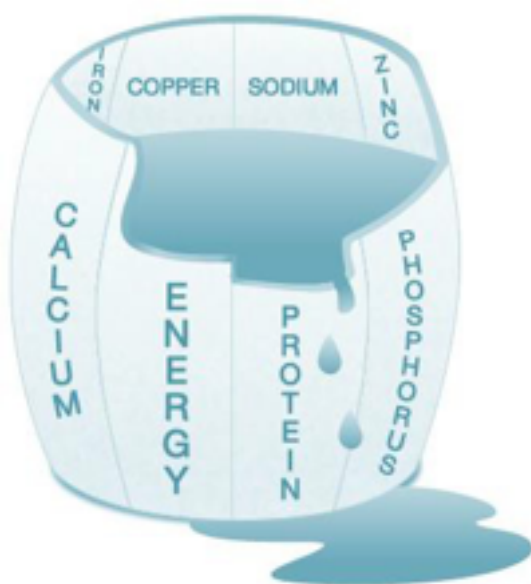
MLA. 2006. *Beef Cattle Nutrition, an introduction to the essentials*. Meat and Livestock Australia Limited.

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Moran, J. (2004). How the Rumen Works. In: J. Moran, ed., *Tropical dairy farming: feeding management for smallholder dairy farmers in the humid tropics*, 1st ed. Landlinks Press.



iHerd
(Will Wilson, Calliope Grazing)



"At Rangemore we manage our supplement program differently between wet and dry seasons.

Supplement programs need to be specific to the type of cattle, pasture quality, availability and in some instances certain paddocks. This could be as simple as more or less of a single ingredient, but you need to experiment until consumption is adequate.

We find wet season supplementation with high phosphorus licks is essential to achieving high calving percentages and high weaner weight. In our area, most soils are highly deficient in P and a much cheaper option than applying P to paddocks is feeding the animal direct. Each paddock has covered lick sheds and is serviced weekly to avoid spoilage."

Bill Davies

Figure 13: Primary limiting factor in cattle diets
(adapted from MLA, 2006)

In the Mackay Whitsunday region, soils can be low in phosphorus (P) and therefore P can be the limiting factor when pasture is lush and growing. During the dry season, protein or nitrogen (N) is more likely to be the limiting factor and animals won't show a response to P supplements without addressing N requirements.

Molasses is the cheapest energy supplement available for cattle producers in the Mackay Whitsunday region because of proximity to sugar mills. Laing (2015) recommends that when properly mixed with urea, and with or without protein meal, fortified molasses can address protein deficiencies, while also supplying an energy supplement.

Laing (2015) goes on to state that feeding molasses-based supplements like M8U will result in cattle remaining 'stronger for longer' during dry times. Attention should be paid to stocking rates and pasture spelling as molasses supplementation can result in more pasture being consumed, potentially leading to reduced ground cover. Molasses-based supplements can be a very useful production tool but will not replace good herd and land management practices.

Attention should be paid to stocking rates and pasture spelling as supplementation, especially with urea, can result in more pasture being consumed, potentially leading to reduced ground cover. At high intakes (0.5kg or more) molasses will reduce the intake of pasture. This is known as substitution. As molasses costs 3-4 times what it costs to grow an equivalent quantity of dry matter it is cheaper to feed pasture than molasses, provided sufficient residual pasture remains at the end of the supplementation program (Dodt, R 2016, pers. comm., 09 February). Supplements can be a very useful production tool but will not replace good herd and land management practices.

SOIL AND GULLY MANAGEMENT

Sustainable grazing management to maintain ground cover, prevent erosion and improve soil organic matter and soil structure is a critical component of holistic property management in the Mackay Whitsunday region because of the high and intensive rainfall patterns.

Soil Management for Improved Land Condition

To maintain suitable land condition for sustainable production, the grazing system needs to be managed to ensure there are high levels of organic matter, good soil structure and minimal erosion. Organic matter is improved by the pasture management practices described in this document. If plants are allowed to retain leaf matter and build root systems that facilitate healthy plant function this will build above ground litter and stimulate growth and function of soil microorganisms.

Soil structure refers to how soil particles are arranged into individual aggregates and the pores that exist between these aggregates. Well-structured soils have well distributed pores which allow effective drainage and root growth. Compaction from hoof impact causes soil structure to decline. Reducing grazing pressure when soils are wet, particularly soils with high clay content, reduces compaction. Even distribution of grazing and more watering points also help to reduce compaction pressures.

Options for repairing a compacted soil can be biological or mechanical or both. While clay soils are most susceptible to compaction, many have an in-built mechanism to repair structure degradation. They swell and shrink on wetting and drying, which causes cracking and breaks up the compacted soil (Qld Government, 2015).

The Queensland Government's web page on soil management describes the various forms of erosion (www.qld.gov.au/environment/land/soil/erosion/types/).

Erosion can be:

- Hillslope erosion
 - Sheet erosion: occurs when a thin layer or sheet of topsoil is removed over a large area
 - Rill erosion: happens when water forms small channels and it concentrates down a slope
- Gully erosion: occurs when run-off concentrates and creates gullies. It more severe than rill erosion and the gully can form in an uphill direction (the gully head erodes away) as well as downhill.
- Scalding: occurs when wind and water erosion removes the topsoil and exposes saline or sodic soils.
- Tunnel erosion: occurs when water penetrates to the subsoil, which is dispersive. The surface layer of soil can remain for some time.
- Streambank erosion: is when the streambank slumps into the flowing water.

By maintaining good ground cover, (grass) and enough vegetation (trees and shrubs) to hold together the subsoil, erosion is prevented. In the Mackay Whitsunday region, the high intensity rainfall events that occur over the wet season pose a significant risk of erosion.

Soil Structure and Texture

Soil structure refers to the way soil particles are held together and arranged. Soils with poor structure are at a greater risk of being overused by livestock and machinery, and therefore more prone to erosion and compaction. Areas of poor soil structure need to be identified and grazing management altered to avoid soil condition decline.

Soil texture relates to the relative proportions of sand, silt and clay in a soil. Texture determines the amount of water a soil can hold, rate of water infiltration through the soil and the workability and fertility of the soil. All of these characteristics influence pasture growth and therefore, decisions about grazing management.

Soil texture can be determined in the paddock by placing 2 (two) tablespoons of soil in the hand and adding water, a drop at a time, working the mix until it reaches a sticky consistency. The soil is then squeezed between the thumb and forefinger to form a flat ribbon. Soil texture is based on the length of ribbon that can form without breaking.

Figure 14: Soil Texture Characteristics

Length of ribbon (mm)	Soil Texture	Properties
< 15	Sand	Little resistance to root growth, high infiltration rate, low plant available water.
15 - 25	Sandy loam	Highly susceptible to mechanical compaction, may be hard-setting, moderate infiltration rate, moderate plant available water.
25	Loam	Moderately susceptible to mechanical compaction, moderate infiltration, moderate plant available water.
25	Silty loam	Moderately susceptible to mechanical compaction, low to moderate infiltration, moderate plant available water.
40 - 50	Clay loam	Moderately susceptible to mechanical compaction, moderate to high plant available water
50 - 75	Clay	Root growth restricted, moderately to highly susceptible to mechanical compaction, periodic waterlogging, moderate to high plant available water
>75	Heavy clay	Root growth moderately to severely restricted, highly susceptible to mechanical compaction, water drains very slowly

Source: Queensland Government. 2016. *Soil Texture*. <https://www.qld.gov.au/environment/land/soil/soil-properties/texture>



Types of Erosion: www.qld.gov.au/environment/land/soil/erosion/types

Soil Compaction: www.qld.gov.au/environment/land/soil/soil-health/compaction/

Soil Management: www.qld.gov.au/environment/land/soil

Australian Soil Resource Information System: www.asris.csiro.au/

Australian Collaborative Land Evaluation Program: www.clw.csiro.au/aclep/



SoilMapp (CSIRO)
Queensland Globe



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Landholder: Darryl and Hannah Trimble

Location: Gibson Creek

Case Study: http://reefcatchments.com.au/files/2015/12/CASESTUDY-GRAZING_Trimble_FINAL_20JUNE2017-1.pdf



GULLY MANAGEMENT: 'A' CLASS PRACTICES

1. Stocking rates are based on consideration of seasonal variability and monitoring in critical periods conducted for grazing land types in the active gully catchment.
2. Annual or biannual wet season spelling or complete exclusion is conducted for grazing land types within the active gully catchment during the rehabilitation period.
3. Identify all at risk soil types via soil mapping.
4. Professional advice informs appropriate mix of strategies to improve areas of gully erosion, which may include stock exclusion, mechanical reshaping of gully heads and sides and the installation of porous check dams.
5. Investigate methodologies of gully management such as:
 - Placement of debris or silt traps at bank toe to facilitate sediment and seed deposition to encourage vegetation regeneration
 - Engineered stream bank toe protection or bed protection using rock or timber structures and/or battering and revegetation.
 - Construction of porous check dams using fallen timber and metal mesh on the gully base

CHEMICAL (NUTRIENT & PESTICIDE) MANAGEMENT

Regulations in the Mackay Whitsunday Region

There are reef protection requirements under the Environmental Protection Act 1994 and the Chemical Usage (Agricultural and Veterinary) Control Act 1988 and associated regulations. Under the regulations, graziers in the Wet Tropics, Burdekin and Mackay-Whitsundays (with properties greater than 2,000 hectares) are required to:

- Keep records of fertiliser and agricultural chemical use.
- Follow specific controls when using herbicide products containing tebuthiuron (including prescribed user training qualifications, no-spray windows, and restrictions on use near waterbodies).
- Apply no more than the optimum amount of nitrogen and phosphorus (if using fertiliser for improved pastures).

All graziers in any catchment are also required to follow product label instructions when using agricultural chemicals such as herbicides and insecticides.

Cattle graziers in regulated catchments are required to hold recognised training qualifications in weed control and in the handling, preparing, applying, transporting and storing of chemicals.

All graziers in the Wet Tropics, Burdekin and Mackay Whitsunday catchments are required to observe mandatory requirements when using herbicides that contain ametryn, diuron or hexazinone. These include not applying within 20 metres of all down-slope water bodies, or at the time of spraying, have a 5m effective vegetated treatment area (EVTA) between the edge of the down-slope water body and any point where low-flow run-off exits the inter-row furrows.

Pesticide Management in Grazing Systems

When applying chemicals for woody weed control, the regulations described above must be adhered to. Alternative management techniques for woody weed control, such as fire and improved pastures, should also be considered.

PESTICIDE MANAGEMENT: 'A' CLASS PRACTICES

1. NIR detection and control of weeds.
2. Low rates of nitrogen are used to fertilise pastures so they can outcompete low level weed infestations.
3. Use of drones to map problem weeds and to spray inaccessible places.
4. Spatial recording of the control of major weeds species with GPS.
5. Understanding form and function of plants, including weeds, and how their presence/absence relates to soil condition.

Fertiliser Use in Grazing Systems

If appropriate soils are available, a beef cattle enterprise in the Mackay Whitsunday region can establish a finishing system that incorporates fodder crops or fertilised pasture. Those systems will incorporate the application of nutrients such as nitrogen (N), phosphorus (P), potassium (K), sulphur (S) and calcium (Ca). On some soil types, soil ameliorants can also be used to achieve desirable pH levels.

Fertilising pastures can provide an economic return in the Mackay Whitsunday region but if not managed appropriately, it can also increase nutrient loads in waterways. Fertiliser (nutrients) should be applied in response to soil tests and subsequent professional recommendations. Timing of nutrient applications should be based on seasonal conditions, rainfall probabilities and appropriate ground cover density. Typically, nitrogen is applied at the end of the wet season and phosphorous is applied prior to the wet season. Adherence to these principles reduces nutrient runoff and improves water quality.

The ratio of legumes to pastures is very important in the Mackay Whitsunday region because when there is too much legume, there can be too much nitrification. Nitrogen in the system stimulates grass growth and cattle preferentially graze the grass, which allows the legume to dominate. Subsequent increases in soil nitrogen can lead to nitrogen loads in waterways and therefore a decrease in water quality.

Soil pH

pH is a measure of the concentration of hydrogen ions in the soil and determines how acid (<7 pH) or alkaline (>7 pH) a soil is. pH influences the availability of different nutrients to plants and can change through the soil profile. A pH of 6.0 to 7.0 is optimal for most plants.

Strongly acidic soils (pH < 5.5) are common in the Mackay Whitsunday region. Soils of this pH can 'lock up' up to 90% of phosphorus applied in fertilizer, making it unavailable to plants. Acid soils can be remediated through the application of lime, gypsum or dolomite, with the amounts required varying depending on individual soil test results.

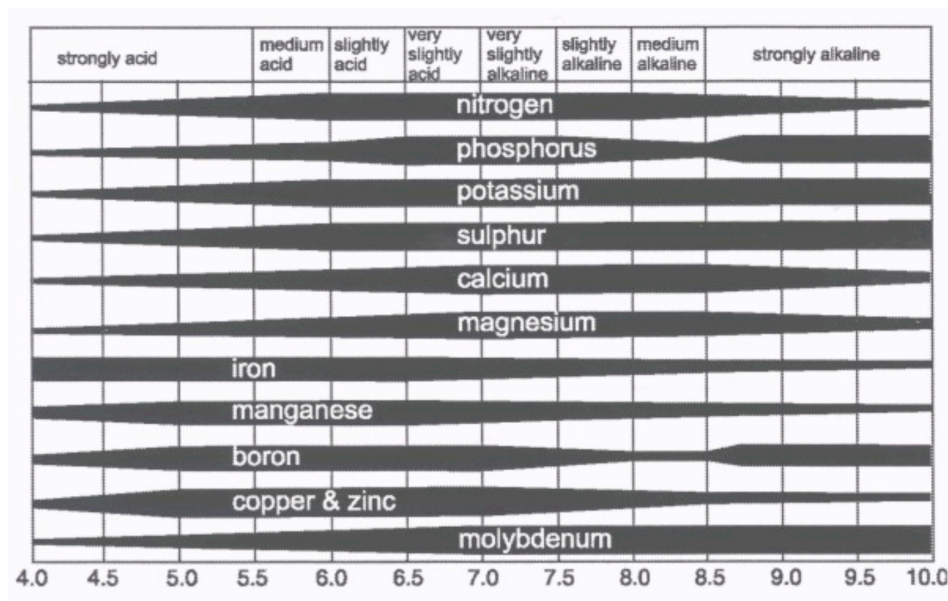


Figure 15: Soil pH and Availability of Soil Nutrients.

The width of the bars indicate the relative availability of plant nutrients. The optimal availability for most nutrients lies in the range of pH 6.5 to 7.0. (Source: Ward, 1998)

Sodic and Saline Soils

Sodicity is the accumulation of sodium ions in a soil layer. Exchangeable Sodium Percentage (ESP) is a measure of the sodicity of a soil. Soils with an ESP of between 6 and 15% are considered sodic, while those with an ESP of > 15% are considered highly sodic. Sodic soils are highly dispersive as the sodium bound to clay particles causes the particles to dissolve in water. Sodic soils are at risk of erosion, have low water infiltration rates and display surface crusting, therefore management decisions must be directed at minimising machinery or ground cover disturbance. Sodic soils can be remediated through the application of lime or gypsum.

Saline Soils contain an accumulation of dissolved salts in a soil layer. High levels of salinity can be directly toxic to plants, prevent water uptake by roots and restrict rooting depth. Salts generally accumulate in the sub-soils of landscapes used for agriculture and pasture due to their water-solubility (Grazing BMP. Grazing Land Management).

SOIL NUTRIENT MANAGEMENT: 'A' CLASS PRACTICES

1. Soil testing is georeferenced and monitoring sites established for each land type.
2. Nutrient deficiencies remedied based on soil tests and subsequent professional recommendations.
3. Apply variable fertiliser rates between paddocks based on representative soil type.
4. Soil ameliorants are used to achieve desirable pH.
5. Planned pasture renovation based on analysis of soil compaction measurements then treatments are appropriately timed
6. Even application of fertiliser is achieved through regular calibration.
7. If appropriate soils are available, a finishing system of high input pasture or fodder crop paddocks is used to finish sale stock to genetic potential
8. Use of recycled organics to build soil and substitute synthetic fertilisers.
9. Use of new legume and grass cultivars matched to soil fertility and used to improve soil properties.

FIRE MANAGEMENT

Manipulating fire to create desirable landscapes is an integral part of land management. In the Mackay Whitsunday region, Reef Catchments partners with the Rural Fire Brigades to work across the three tiers of fire management: achieving primary production outcomes, protecting life and property, and biodiversity conservation.

If managed appropriately, fire can be a beneficial tool for graziers and land managers in achieving desirable primary production outcomes such as:

- controlling weeds such as lantana, rubbervine, prickly acacia and mimosa;
- controlling native woody vegetation that is thickening and suppressing pasture growth;
- removing rank grass so stock can graze more nutritious plant material;
- stimulating new growth including seedling regeneration in some species;
- evening out patchy grazing by encouraging stock onto burnt areas.

Fire can be detrimental to the landscape or to specific ecosystems if not managed appropriately and the excessive use of fire long-term can also impact on surface soil structure and native fauna.

Reef Catchments has published the '*Clarke Connors Range Bushfire Consortium Fire Management Guidelines*' which is a detailed set of guidelines on fire management for land types specific to the Mackay Whitsunday region. This can be found online at <http://reefcatchments.com.au/files/2013/01/ClarkConnorsRangeGuidelinesWeb.pdf> and is an excellent source of information for this region.

Landowners in the Mackay Whitsunday region need to obtain permits for fires bigger than 2m x 2m x 2m. You need to contact your local fire warden to obtain a permit and coordinate a team to oversee the burn. Holistic fire management across multiple properties is much more effective than individual property management so it is recommended that you join the rural fire brigade in your area. Warden's numbers for each area can be found online at: www.ruralfire.qld.gov.au/Pages/fw_finder.aspx



North Australia Fire Online Fire Scars and Hotspots

<http://www.firenorth.org.au/nafi3/>

Clarke Connors Range Bushfire Consortium Fire Management Guidelines

<http://reefcatchments.com.au/files/2017/01/Clark-Connors-Range-Fire-Management-Guidelines.pdf>

Reef Catchments

<http://reefcatchments.com.au/fire/>

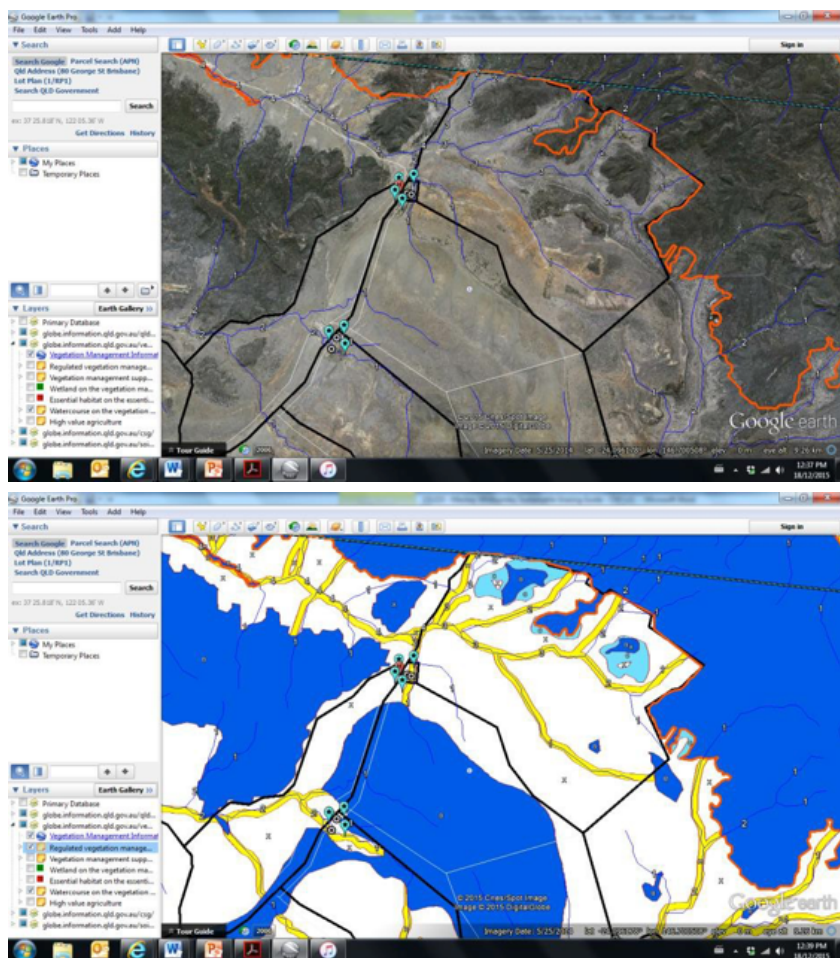
PLANNING AND RECORD KEEPING

Effective planning and record keeping practices and tools, are essential for implementing good grazing management strategies.

Property Maps

The basic element of property resource planning is a property map that identifies paddocks, land types and infrastructure. Electronic maps can then be used to calculate areas of paddocks and land types, distance from waters, width of riparian zones, spacing between infrastructure and areas affected by erosion or scalding.

Google Earth and associated layers produced by the Queensland Government such as Queensland Globe, Vegetation Globe and Gas Globe allow landholders to create paddock maps on Google Earth Imagery and then view information such as lot and plan numbers, land types, regional ecosystems, bores, roads and rivers through the various globes.



Globes for download: <https://data.qld.gov.au/dataset/queensland-globe>

QSpatial: <http://qldspatial.information.qld.gov.au/catalogue/custom/index.page>

Vegetation Maps: www.qld.gov.au/environment/land/vegetation/map-request

AgData Mapping Software: www.agdata.com.au/products/production/mapping/

Farmmap 4D Mapping: www.farmmap4d.com.au/



Measure Your Land App
Google Earth
Queensland Globe
Vegetation Globe
Gas Globe

YouTube Tutorials
Stocktake Plus App (Future Beef)
Ground Cover App (Namoi Catchment)
GrassSnap (University of Nebraska-Lincoln)

PLANNING AND RECORD KEEPING: 'A' CLASS PRACTICES

1. High quality, formal electronic records kept.
2. Develop and implement a grazing land management plan which is updated regularly, including a plan for water infrastructure.
3. Identify grazing land types, pasture types, weed pressure and variability within each paddock using GPS and mapping technology.
4. Electronic farm map.
5. Records kept in computer database.
6. Business regularly benchmarked using tools such as 'Profit Probe'
7. GPS tracking of livestock (i.e. virtual fencing).



Landholder: Greg McLean

Location: Gargett

Case Study: http://reefcatchments.com.au/files/2013/02/REEF-PROGRAMME_Case-Studies_McLean.pdf

CONCLUSION

Sustainable grazing practices result in improved water quality and environmental outcomes as well as better production outcomes. There are a number of resources available for landholders who are looking to integrate more sustainable practices into their operation. Some of these resources have been identified throughout this document. The contacts list on the following page also provides options for seeking further information.

Reef Catchments Limited is the natural resource management group for the Mackay Whitsunday region and have a range of resources and incentives for landholders who want to improve land condition and environmental outcomes such as biodiversity and water quality. The services offered by Reef Catchments Limited also include workshops and field days for interactive learning. Refer to the Reef Catchments Limited web site for current and upcoming activities.

CONTACT LIST

Reef Catchments

07 4968 4200

Suite 1/85 Gordon Street Mackay QLD 4740

www.reefcatchments.com.au

Department of Agriculture and Fisheries Mackay

13 25 23

30 Tennyson St, Mackay QLD 4740

www.daf.qld.gov.au

Grazing BMP

PO Box 13186

North Bank Plaza Brisbane, Qld, 4003

www.bmpgrazing.com.au

AgForce

AgForce Central

PO Box 1324, Rockhampton, Qld, 4700

Mobile: 0427 021 370

Future Beef

13 25 23

www.futurebeef.com.au

Meat and Livestock Australia (MLA)

1800 023 100

www.mla.com.au

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