Managing Pastures for Soil Health

FACT SHEET 12

Livestock grazing is the primary agricultural land use in the North Coast. The management of the pastures these animals graze significantly impacts soil conditions in the region. The interaction of the grazing animal with pasture plants directly affects the root systems, which influence the surrounding soil health and function.

Regenerating soil with livestock

The grazing animal, through its effect on the plant has a significant impact on soil health. Traditionally this effect has often been seen in a negative light, however, grazing animals in tune with natural cycles and moving frequently across the landscape regenerates land and soil health.

Perennial grasses dominate pasture composition in the North Coast. They also provide the 'backbone' of any grassland environment. Perennial grasses are well adapted to tolerate defoliation by grazing animals and they are exceptional in their capacity to enhance soil conditions.

The interaction between the grazing animal and the pasture occurs one plant at a time. Although many thousands or millions of plants may constitute a pasture or grazing area the changes that occur in that area happen at the level of the individual plant.

Understanding the response of perennial grasses to defoliation is key to effectively managing the grazing process to regenerate soil and improve plant and pasture productivity. Since cattle are the primary grazers of the North Coast pastures and perennial grasses are the main contributors to pasture composition in the region, they will be the focus of this document.

Grazing livestock are the grazier's most valuable tool to regenerate soil

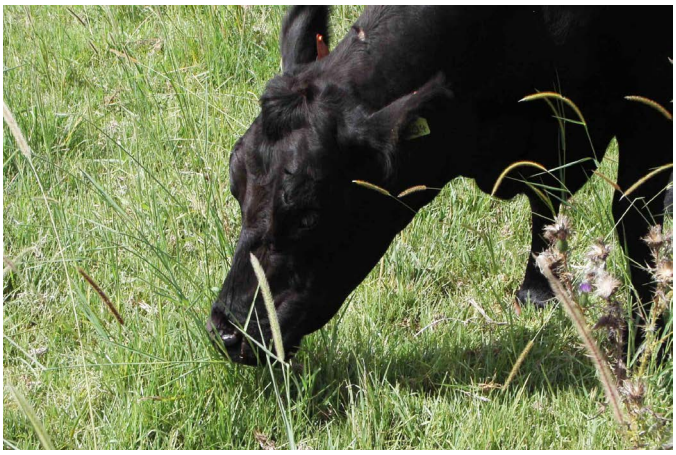

Figure 1: The interaction of the cow and the grass plant is critical for soil health.

Defoliation response

The immediate effect of defoliation is removal of a proportion of the leaf area of the grass plant. The severity or intensity of defoliation, the relative amount of leaf material removed has significant consequences for the root system of the grass plant. Note that other forms of defoliation include slashing and burning.

If sufficient green leaf is left on a grass plant after defoliation the energy for regrowth of the grass plant is provided from photosynthesis. There is relatively little or no impact on the size of the root system

However, if a grass plant is grazed severely, to where 5cm of green leaf or less is remaining, the carbon stores in the root system must provide the energy for regrowth. After severe grazing assimilates, including carbon, move quickly from the roots to shoots and root death may occur within 20-30 minutes.

The rate of regrowth of shoots of severely defoliated grass plants is much slower because regrowth will come from new, rather than existing plant tillers. The regrowth of roots may take up to 4-6 weeks after the regeneration of leaf area.

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Effect on root systems

The other aspect of defoliation that impacts perennial grass roots is the frequency of defoliation. Where plants are frequently grazed below 5cm height the result is a reduction in the root system. The photo below shows the roots of paddock lovegrass plants that were cut to 3cm height every 2, 4 and 8 weeks for a period of 12 months and the plant on the right was uncut. Cutting plants every 2 weeks reduced the root biomass by half compared to cutting every 4 weeks, which was half of those cut every 8 weeks. Uncut plants had about 30% more root biomass that those cut every 8 weeks.

Figure 2: The effect of defoliation frequency over 12 months on the root system of paddock lovegrass plants.

The root system is the most vulnerable organ of the perennial grass plant.

Perennial grass roots provide habitat, nutrients and energy to soil biota in addition to enhancing soil structure, porosity and soil water infiltration. Allowing sufficient time for perennial grass to recover from a graze event, regenerate leaf area and maintain maximum root biomass is critical to building soil health and achieving the productive potential of pastures.

There is a trade off between defoliation intensity and frequency. Where the intensity of grazing is such that no damage to the root system occurs then the frequency of grazing may be increased (shorter recovery period). Alternatively, if the intensity of grazing is severe a much longer recovery period will be required to allow the plant to regenerate leaf area and root system recovery.

Pasture dynamics

A feature of perennial grasses is that what you see above the ground in plant biomass is reflected in the root biomass below ground. It is difficult to manage what you can't see (root systems) and understanding this feature of perennial grasses allows more informed decisions regarding grazing and pasture management and the effects on soil health.

Figure 3: The biomass of perennial grass roots is equal to the biomass of above ground herbage.

The selective grazing of livestock impacts pasture dynamics. As plants are grazed one plant at a time the most palatable (usually the most productive) plants will likely experience more frequent and intensive defoliation. If these plants are frequently grazed below 5cm, their root biomass is reduced, the plants are weakened and over time, their number in pasture may decline. The pasture is then susceptible to less desirable species increasing their presence because they are largely ignored by grazing animals. Gaps may also occur in the pasture creating bare ground, which enables undesirable species to establish.

Focussing your attention on the desirable, deep rooted perennial grasses in the pasture as the basis for your grazing management decisions can improve plant density and soil health. By managing to maintain ideally 2,000 kg DM/ha and not less than 1,500 kg DM/ha plant growth rate, pasture production, plant root biomass, soil health and function of soil processes all improve.

Change in pastures is a continuous process and occurs one plant at a time.

Grass growth

All grasses go through three basic stages of growth. The timing of the initial phase will change between species depending on their predominant growth period. The dominant grasses of the North Coast region are summer active. These grasses will begin with a relatively slow growth rate in spring (Phase 1), maximum growth rate will occur through summer (Phase 2) and growth will slow after seeding (Phase 3) and potentially stop during winter.

Grazing to maintain pastures with herbage mass between 2,000 kg DM/ha (5-7 cm height) and 4,000 kg DM/ha (15-20 cm) will optimise potential regrowth and ensure the maintenance of healthy perennial grasses with vigourous root systems.

Figure 4:
The phases of growth and relative growth rate of perennial grasses over time.

In circumstances where pastures, or more specifically plants, are exposed to livestock for extended periods of time as in a continuous grazing or set stocking regime, it is not possible to control the actions of grazing animals. Only through control of the grazing process can the herbage mass targets defined above be achieved.

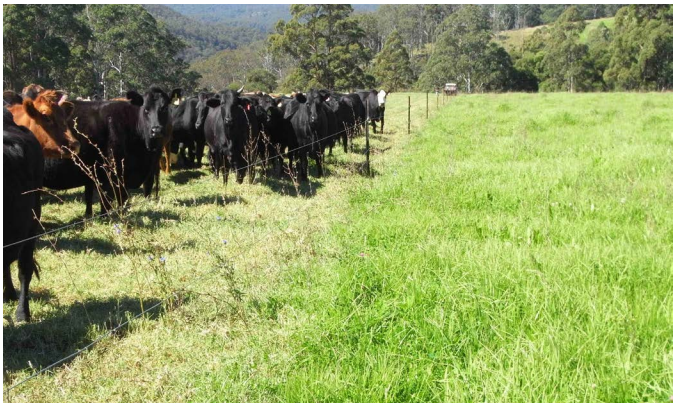


Figure 5: Controlling the grazing process allows active management of animal intake and recovery of plants.

Control of grazing

Control of the grazing requires management of the movement of livestock across the land to allow adequate plant recovery and maintain pastures at optimal growth rates. When this process is planned, based on pasture growth rate, pasture production is optimised and soil health is improved.

Control of grazing can only be achieved by controlling the grazing area allocated to animals. More paddocks per mob allows the use of stock density to control animal's pasture intake and utilisation. It also allows more effective planning to ensure adequate recovery for plants between graze events.

Utilisation represents the percentage of pasture growth over a period that is utilised by grazing livestock. Appropriate utilisation increases annual pasture production and ensures maintenance of adequate residual herbage to feed back into the soil system. The appropriate level of utilisation depends on pasture growth. In the North Coast region annual pasture production of between 8-10,000 kg DM/ha is a likely average. Under these conditions 65%utilisation will result in 2,800 – 3,500 kg DM/ha of residual herbage much of which will return to the soil system as organic matter to enhance soil processes.

With more paddocks per mob grazing will occur relatively infrequently. The effect of this 'pulse' grazing on plants is a flush of root exudates into the soil following defoliation. These exudates, rich in sugars, stimulate biological activity. Plants grazed above 5cm height will retain more root biomass, supporting more soil biology and improving soil structure through a greater volume of roots in the soil profile. In contrast, continuously grazed plants with relatively little root biomass have less capacity for production or contribution to soil processes.

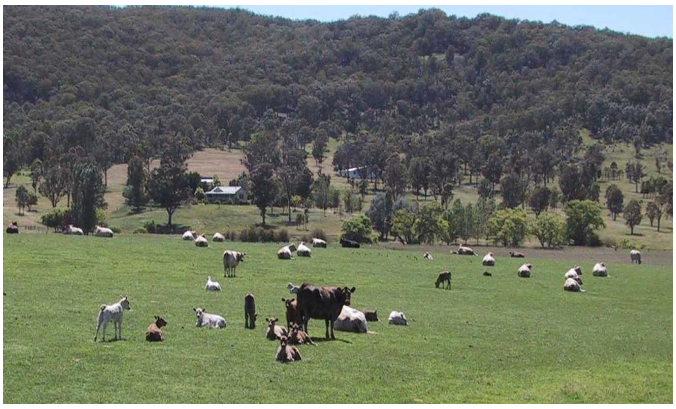


Figure 6: Overgrazed plants with shallow root systems have no capacity to enhance soil health.

Stock density

To effectively control the grazing and manage pasture intake, the ability to measure available herbage mass and pasture growth rate is required. There are a number of tools available to assist. Understanding the nutritional requirements of animals is also needed. Animal requirements are measured in DSE units. 1 DSE = 1 kg of dry matter (DM). For example, a 300kg steer @ 10 DSE requires 10 kg DM/day and a 500kg breeding cow's average intake is 15 kg DM/day equivalent to 15 DSE.

Stock density refers to the number of DSE that is grazing an allocated area or paddock on any one day. It indicates the amount of pasture dry weight the mob will remove each day based on their nutritional requirements. It is expressed as DSE, which is the kg of pasture dry weight consumed per hectare per day.

It differs from **stocking rate** which is the number of DSE carried on an area, and is usually calculated over a 12 month period. The area may be a paddock, a group of paddocks or the whole farm.

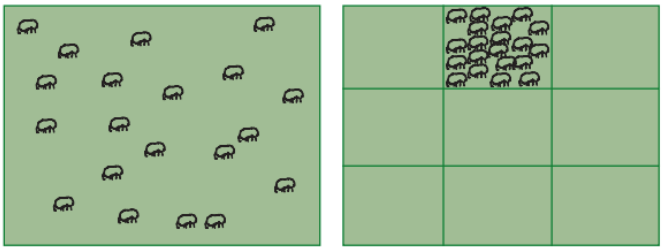
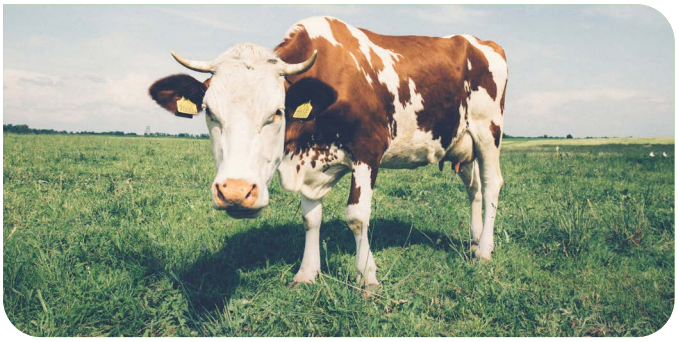


Figure 7: A single paddock (left) subdivided into 9 units (right). Stocking rate is the same, the stock density will be 9 times higher in paddock grazed on right.

Stocking rate must always be matched to the carrying capacity of the land but stock density is an effective tool land managers can use to improve pasture productivity and soil health. By using stock density to control utilisation and maintain adequate residual herbage mass post grazing, the pasture growth rate is improved, groundcover is maximised and potential damage to root systems is minimised.



Grazing – steps for soil health

1. Reducing the number of mobs allows more paddocks, and plants, to be resting at any point in time.

2. Increasing the number of paddocks per mob provides greater control over grazing. At least 15 paddocks per mob provides greater flexibility in management and control over the grazing process.

3. Base livestock movement on available herbage mass. Calculate the grazing days in each paddock based on available herbage mass and animal requirements to ensure the desired minimum residual herbage is present when animals leave.

4. Plan the movement of livestock based on herbage mass and pasture growth rates of different areas or paddocks to ensure appropriate utilisation of all areas. This allows you to identify more productive areas and prioritise areas for potential inputs.

5. Monitor pasture growth, utilisation, grazing days and paddock production. Frequent monitoring allows you to evaluate the performance of the land and livestock and will provide a sound indication of the health of your soil.

More Information

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© State of New South Wales through Local Land Services 2020. The information contained in this publication is based on knowledge and understanding at the time of writing September 2020. However, because of advances in knowledge, users are reminded of the need to ensure that the information upon which they rely is up to date and to check the currency of the information with the appropriate officer of Local Land Services or the user's independent adviser.

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