GROUND COVER WORKSHOP BY JIM VIRGONA, GRAMINUS CONSULTING

This is the first workshop of the Healthy Soils Project. In it we will consider ground cover – its management and measurement. Much of what is presented below is sourced from the work of Lang (e.g. Lang 1998) and has been presented in an Agfact devoted to the subject (https://www.dpi.nsw.gov.au/__data/assets/pdf_file /0018/162306/groundcover-for-pastures.pdf). Much of what follows is a summary of this Agfact.

WHAT IS GROUND COVER?

Ground cover is defined as **any material on or near the soil surface that protects the soil against the erosive action of rain drops and overland flow**. This can include plant cover – both alive and dead, litter, dung, loose stones and even, snow. When we are considering the extent of ground cover it is common to think in terms of percent of the surface that is covered.

WHY IS IT IMPORTANT?

- Raindrops can break down soil structure and detached soil particles can be transported.
- Detached particles can form a seal that reduces infiltration rates – and increases run-off. Reduced infiltration has a marked impact of pasture growth!
- Soil loss (in low cover situations) can be up to 100 t per Ha per annum – i.e. around 1 mm of soil over a hectare = 10 t. The rate of soil formation is much slower.

WHAT IS THE RELATIONSHIP BETWEEN GROUND COVER AND SOIL LOSS?

The results in the graph below from work in the upper Hunter on country with a 10% slope and 625 mm annual average rainfall show that 70% ground cover should be targeted as a minimum in terms of run off and soil loss.

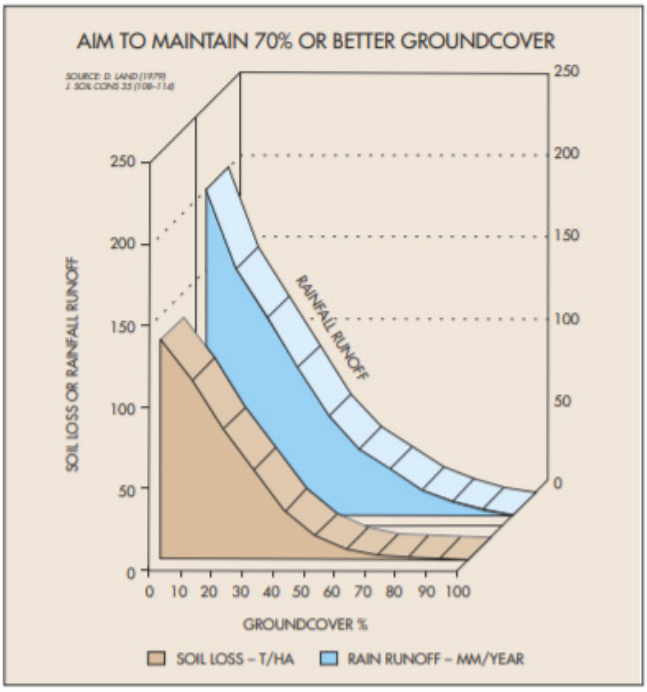

Figure 1 – Relationship between Ground Cover and soil loss and water runoff in a pasture system (From Lang and McDonald 2005)

The geometric pattern of bare ground and cover explains why at high cover small patches of bare ground have little influence on run off. As cover declines, these bare "islands" join up allowing water to flow more freely and erode soil.

Managing ground cover is more crucial over the summer-autumn months because most soil loss occurs in relatively few high intensity storms. The 70% level is a generalisation and further modelling that is more specific to the south west slopes produced the results shown in the table below.

Table 1 Minimum ground cover levels for the southern and central slopes and plains of NSW (Land and McDonald 2005)

Wagga Wagga, Deniliquin		Paddock slope			
Erodibility	**Typical soil types**	**Flat**	**Gentle**	**Moderate**	**Steep**
Low	• deep sands	60 (40)	60	65	85
Low—moderate	• sandy loams, light clays • uniform clays, kraznozems and euchrozems (ferrosols)	60 (40)	60	70	90
Moderate—high	• loams • self-mulching black earths (vertosols)	60 (40)	60	75	90
High	• silts, fine sandy loams • red-brown earths (chromosols), red and yellow earths (kandosols) • solodics (sodosols)	60 (40)	65	80	95
Low—high	• drainage lines (all soil types)	100	100	100	100

ARE GROUND COVER AND PASTURE DRY MATTER CLOSELY RELATED?

The short answer to this question is NO! Lang (1998) used the figure below to demonstrate differences between pasture species and ground cover. To an extent it makes sense – Lucerne is upright and competes with volunteer species over summer, leaving much of the ground bare whilst native grass species tend to be more prostrate and have higher levels of litter. However, when Lodge and Murphy (2002) investigated the relationship between ground cover and pasture (herbage) mass for native pastures on the Northern Slopes, they concluded that "herbage mass could not be used as a surrogate measure of ground cover or litter mass". This means that in order to manage ground cover we need to measure it directly

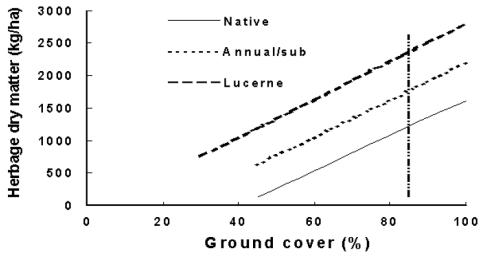

Figure 2 Herbage dry matter versus ground cover of different pasture types (Lang 1998).

HOW IS GROUND COVER MEASURED?

Ground cover is best measured by visual estimation. This allows a quick determination on many samples but the operators need to be trained briefly before undertaking visual estimates. This "training" need only be observing reference quadrats which can be compared to photographic standards (e.g. Murphy and Lodge

2002). The reference quadrats should cover the range of ground cover at the site. Observers can then apply their scale to the site. The need for the following will be discussed:

- It is best to have a quadrat to focus on a known area – quadrats usually vary in area from 0.1-0.25 m^2
- Using a quadrat means taking many samples – so an unbiased sampling procedure is required
- Through time observers need to calibrate against levels of known cover – using photographs or other methods (see below)

GROUND COVER MANAGEMENT

Having found a level of ground cover what can we do about managing it? There are short term and long term approaches. In the short term, manipulating stocking rate – even down to zero is the only option when ground cover is near the critical level. Under drought conditions this means resorting to drought lots. Over the longer term, cover is higher in perennial pastures – so, where possible pastures based on perennial species need to be established. Even in low rainfall years, well fertilised perennial pastures will provide ground cover for longer (at a given stocking rate) than any other production system.

EXERCISE

The exercise today will include five steps

1) In a defined area with a broad range of cover and no training, participants are asked to nominate a cover level after 5 minutes of walking around and general observation
2) Participants will then be asked to agree on levels of cover for 5 reference quadrats using the photographic standards over and other material made available on the day. It is worth noting here that previous research (Murphy and Lodge 2002) found that observers tend to underestimate ground cover in the 20-80% range.
3) Using the scale for the reference quadrats, each participant will estimate ground cover on 50 samples inside the defined area.
4) Finally each participant will be calibrated using a simple procedure that compares their estimate to a measure of actual ground cover on 20 calibration quadrats. The measure of ground cover will use a 100 square mesh (5 cm x 5 cm squares), in each of the squares ground cover will be assessed as mostly bare or mostly covered – the aggregate count of covered squares will be interpreted as % ground cover. Each participant will then have their scores on these 20 quadrats compared to actual, using a simple spreadsheet.
5) Review – a comparison of the first notional observation with the average of the trained observations will be made. Likewise, for each individual we will examine the relationship between their estimates and actual levels of cover – revealing any biases that need to be worked on.

REFERENCES

Lang RD (1998) Pasture management for both production and stability. Proceedings of the Ninth Australian Agronomy Conference, Wagga Wagg pp. 349-50

Lang RD and McDonald W (2005) Maintaining groundcover to reduce erosion and sustain production. Agfact P2.1.14. NSW DPI.

Lodge GM and Murphy SR (2002) Ground cover in temperate native perennial grass pastures. II Relationships with herbage and litter mass. Rangelands Journal 24: 301-312

Murphy SR and Lodge GM (2002) Ground cover in temperate native perennial grass pastures. I. A comparison of four estimation methods. Rangeland Journal 24: 288-300

20%

40%

50%

80%

90%

100%