Productive Saltland Pastures

Salinity Manual

Module 8

Salinity Identification

Gillamii Centre

Government of Western Australia
Department of Primary Industries and Regional Development

natural resource management program

All photos from SGSL DAFWA team

SALINITY

INTRODUCTION

To be able to use some basic indicators as a guide to recognise salinity and other NRM issues.

Salinity can be classified based on the effect it has on plants. A classification of Mild, Moderate and Severe is useful in understanding the severity of a site. Each of these classifications can be recognised in the field by the types of plants that' do or don't' grow on them these can be referred to as "indicator species" because they help confirm the classification of a site. These plants have differing tolerances to salinity and waterlogging, and fit into different niches in the saltland landscape. However the absence of indicators in a paddock is not unequivocal as the plants may not be present due to overgrazing.

SALINITY

MILD

The area is covered with annual pasture, there maybe some clover however the key difference between this type of salinity and non-saline land is the disappearance of healthy clover and ryegrass. In many situations the mild areas are cropped but may have a reduced yield.

Photo 1 - Healthy green pasture in the paddock in the foreground is in contrast with the poorer mildly salt affected pasture in the background.

MODERATE

These areas can be recognised as those with nil to minimal cover of clover, minimal ryegrass cover, large areas of barley grass; stay wet for longer periods and may have the early signs of areas going bare. Yield suppression due to salinity is notice if these areas are cropped (see photo 2).

Photo 2 - A thick cover of barley grass is a good indication of moderate saltland.

SEVERE

Is recognised by large areas of bare saltland, virtually no clover or ryegrass, plant species have changed to those that can handle saline conditions such as cotula, samphire and barley grass. These areas are not cropped due to poor growth and low grain yields (see photo 3).

Photo 3 - Samphire and bare saltland in the foreground reveal its severity while moderate salinity is expressed in the background where there is some growth of barley grass.

An understanding of the 'waterlogging - salinity' matrix may also help with recognising salinity and its severity.

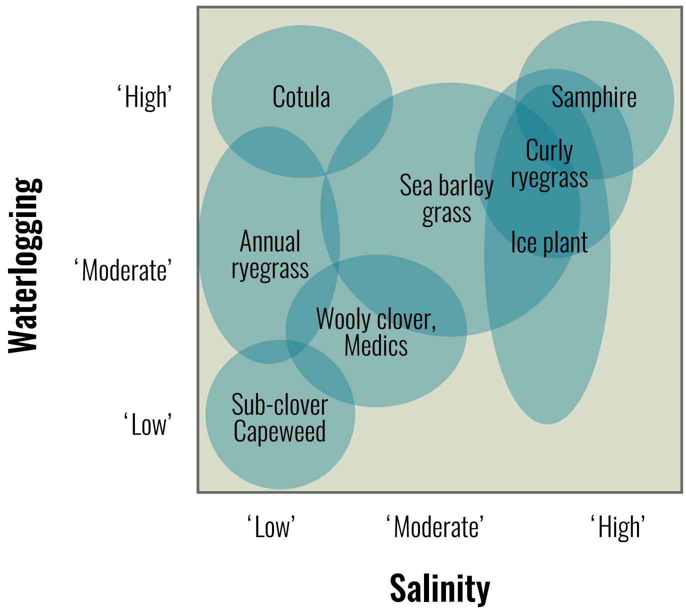

Figure 1. Common indicator plants that grow on saltland in the salinity/waterlogging matrix.

Common plant species are listed on a matrix against salinity and waterlogging and help give a visual of where species exist or drop out due to either component. For example, sub-clover's main niche is in low salt and low waterlogging conditions and ryegrass can tolerate more waterlogging. However, samphire is the last plant standing in the severe category and can tolerate high salt and high waterlogging.

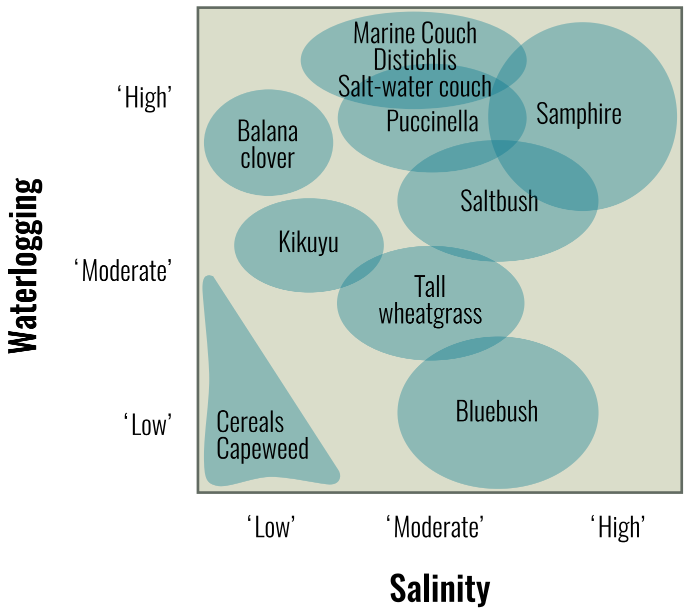

Figure 2. Common saltland pasture plants that can be successfully grown in the salinity/waterlogging matrix and provide many grazing productivity and environmental benefits.

More information can be found on the DPIRD salinity webpages:

https://www.agric.wa.gov.au/dryland-salinity-site-assessment

WATERLOGGING

Waterlogging typically occurs beneath the soil surface in duplex soils when soil moisture is restricted by a layer with lower hydraulic conductivity, eg sand over clay. Saturated conditions form above the layer come and go depending on amount of rain fallen over a period of time. Waterlogging is known to be intermittent i.e. It comes and goes depending on rainfall conditions.

Waterlogging results in insufficient oxygen in the pore space for plant roots to be able to adequately respire. Other gases detrimental to root growth, such as carbon dioxide and ethylene, also accumulate in the root zone and affect the plants.

In the field this can be recognised when plants show a yellow colour due to lack of nitrogen. Other signs are boggy conditions when traversing the site by car, squashy under foot or earthworm activity on the soil surface.

Photo 4 - This is a crop affected by waterlogging as shown by the leaf yellowing in the foreground as compared to the healthy crop in the background. The abrupt colour change between waterlogged and non-waterlogged corresponds with an increase in the dept of the topsoil.

Photo 5 - Generally crops and annual pasture begin to be affected by waterlogging when saturated conditions exist within 30cm of the soil surface.

FLOODING & INUNDATION

Inundation and flooding is a extension of waterlogging and occurs when: 1. surface water accumulates above the ground or runs on the surface; 2. the water reaches the soil surface. The water becomes visible and can remain for periods as it receeds either by evaporation, drainage or plant water use. Water can be moving or ponded.

Flooding is easily recognised by eye.

Photo 6. Depressions in the paddock near Darkan have been inundated and can be seen by the water sitting on the surface.

ACIDITY

Soil acidity is a major environmental and economic concern. Approximately 50% of Australian agricultural land or 50 million ha have surface pH values less than or equal to 5.5 (CaCl2) which is below the optimal level to for plant growth and leads to yield losses. If untreated, acidity will become a problem in the subsurface soils, which are more difficult and expensive to ameliorate. Subsurface acidity is already a major problem for large areas of Western Australia. It is estimated that 12 to 24 million ha is extremely to highly acidic with pH values less than or equal to 4.8 (NLWRA, 2001).

The acidifying process is compounded by agricultural production via product removal and the use of some nitrogenous fertilisers. Some sandier soil types were slightly acidic before agricultural production the while the granitic soil types were more neutral.

Acidic soils cause significant losses in production. In some cases the choice of crops is restricted to acid tolerant species and varieties. In pastures grown on acidic soils, production will be reduced and some legume species may fail to persist.

Degradation of the soil resource is also of wider concern and off-site impacts must be considered. Off-site impacts mainly result from reduced plant growth. Deep-rooted species required to increase water usage may not thrive, increasing the risk of salinity. Increased run-off and subsequent erosion has detrimental impacts on streams and water quality. Increased nutrient leaching may pollute ground water.

The best way to recognise soil acidity is to sample the soil and test for pH. It is difficult to recognise visibly.

SODICITY

Soil sodicity is related to soil salinity. The two are often confused, probably because both involve sodium, a metal widespread in Australian soils.

Sodicity may be the more obscure problem, but it is a more widespread form of land degradation. It affects nearly a third of all soils in Australia (including a third of all agricultural soils), causing poor water infiltration, surface crusting, erosion and waterlogging.

It costs agriculture as much as $2 billion each year in lost production (across Australia. And its impacts extend to water catchments, infrastructure facilities and the environment. Run-off from sodic soils carries clay particles into waterways and reservoirs causing water turbidity, or cloudiness. The effects of turbidity, and its removal, are very costly for industrial and domestic water users. Turbidity also causes environmental problems in rivers and wetlands. In addition, run-off from sodic soils is more likely to carry higher levels of nitrogen and phosphate into waterways and reservoirs. These are the nutrients that contribute to algal blooms, another significant environmental problem.

See DPIRD webpages on the identifying and managing sodic soils.

https://www.agric.wa.gov.au/dispersive-and-sodic-soils/dispersive-sodic-soils-western-australia

THE DIFFERENCE BETWEEN SALINE AND SODIC SOILS

In **saline soils**, sodium has a partner in crime, chloride gas, with which it forms a salt. The presence of salt in the soil reduces the availability of water to plants and at high enough concentrations can kill them.

In **sodic soils**, much of the chloride has been washed away, leaving behind sodium ions (sodium atoms with a positive charge) attached to tiny clay particles in the soil. As a result, these clay particles lose their tendency to stick together when wet – leading to unstable soils which may erode or become impermeable to both water and roots.

Sodic soils are usually identified by testing a sample of the soil. They will be 'sodic' if they have an exchangeable sodium percentage (ESP) between 6 – 15 and 'highly sodic' if the ESP is more than 15. There is a strong link between 'alkalinity' and sodicity. A soil with a pH above 8.5 will usually be sodic but not all sodic soils are alkaline.

Photos DAFWA SGSL team

REFERENCES

DPIRD webpages - identifying dispersive soils

Moore, G. 1998. Soil Guide. A handbook for understanding and managing agricultural soils. Bulletin 4343. Agriculture Western Australia.

Barrett-Lennard, E.G. 2003. Saltland Pastures of Australia. A Practical Guide.

QUESTIONS

1. **Why is it useful to classify a saline site?**
   - ❑ Soils are classified, therefore salinity needs to be classified'
   - ❑ It gives insights into how the salt got there.
   - ❑ It helps determine its severity and possible treatments.

2. **Soil sodicity affects a third of Australian soils?**
   - ❑ Don't know
   - ❑ True
   - ❑ False

3. **Soil acidity is easy to recognize in the field?**
   - ❑ Yes
   - ❑ No
   - ❑ Sometimes

4. **What is the difference between waterlogging and flooding?**
   - ❑ There is no difference, they both cause yield reductions.
   - ❑ Waterlogging only occurs with steady rainfall while flooding occurs when you get a huge downpour.
   - ❑ Waterlogging is excess water below the surface within the root zone and flooding is when water is sitting above ground level.

5. **How does agricultural production increase soil acidity?**
   - ❑ By product removal and nitrogenous fertilizer.
   - ❑ It doesn't, the soil is naturally acidic.
   - ❑ By not using enough rainfall and letting soil moisture go past the root zone.

NOTES

PRODUCTIVE SALTLAND PASTURES

www.gillamii.org.au

Design by: Synergy Graphics 0439 936 514