

Saltland Scoring and Solutions

HOW TO IDENTIFY, RATE & SOLVE YOUR SALT LAND PROBLEMS

Areas with Rainfall Greater Than 600mm



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You are an inspiration to us all.

Your work and legacy will always live on.

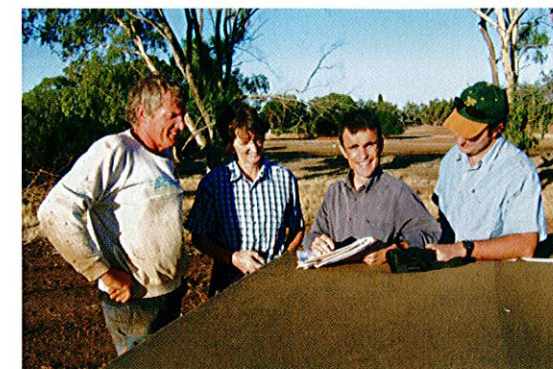
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- Clive Malcolm for text on pages 4-7.



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Steps to use this pocketbook

1. Take a look at the site, ideally when things are still actively growing in spring.
2. Turn to the reference chart (page 11).
3. Identify indicator plants growing now.
4. Consider the salinity conditions across the site and sketch their boundaries on a mud map.
5. Score the salinity condition for the site (pages 12-13).
6. Consider the improved plants that will grow there (note on your map).
7. Read a story of what another farmer with similar conditions has done (pages 8-10).
8. Consider the potential payback period and whether you will need to divide the site or treat as one unit (page 22).
9. Contact a farmer near you or a technical assistant to discuss their experiences (pages 23-24).



:: Assessing Saltland



All salt affected land, except the beds of salt lakes and desert areas, is capable of growing plants. Which plants will grow depends on a variety of factors some of which vary with season, position and depth making them hard to measure. What will grow also depends on the salt and waterlogging tolerance of the plants. The plants grown can be used for a variety of purposes. For example, on highly saline and waterlogged land it may only be possible to grow samphire which is too salty to be a good grazing resource but provides environmental benefits. Some areas will grow valuable forage.

Saltland treatment and use must be guided by the capability of the land. It may be possible to modify the capability by installing surface drains to reduce waterlogging and inundation. Saltland is often of irregular shape and the boundaries of the mild, moderate and severe sections may also be irregular and treatments must take this into account.

Are all plants salt tolerant?

Plants such as wheat, barley, oats, ryegrass, subclover and medic are of low salt tolerance and are called *glycophytes*. Even salt tolerant selections of glycophytes are only about a fifth as salt tolerant as *halophytes*, or 'salt plants'. Nature has

developed halophytes for growing on saline soils, and in salt affected areas the difference in salinity between the grassed and bare patches, compares with the difference in salt tolerance between glycophytes and halophytes. Halophytes vary in their tolerance to waterlogging.

Salt affected land

The simplest way to judge an area's capability is to look at what is growing there.

The most obvious feature of 'saltland' on farms is that it will not grow crop and pasture plants which are glycophytes. The performance of agricultural plants gets worse as you move from the edge of an affected area to the centre and ranges from:

- **MILD** – reduced productivity; to
- **MODERATE** – patchy growth; to
- **SEVERE** – no growth of glycophytes.

Factors which cause poor growth on saltland include:

- salt content of the soil
- degree of surface waterlogging
- inundation
- soil type - powdery, clayey, crusted
- acidity or alkalinity
- toxicity e.g. boron
- high exchangeable magnesium (often in grey clay soils).



:: Saltbush is the halophyte & acacia the glycophyte

:: Assessing Saltland Capability



The severity of a site is related to the depth to groundwater and its salinity but the soil type determines the height to which water can rise by capillary action. Dense clay has the potential to allow the highest capillary rise but the rate of water movement is so slow the watertable can be closer to the surface without causing a problem.

Some saltland is not caused by a high watertable but is the result of management of soils with high natural salinity (e.g. morrel soils in WA). Fallow and overgrazing on these soils can cause the salt to accumulate in the surface, turning the soils to powder and wind erosion to occur.

Plants and saltland

Plants respond to the salt, waterlogging, soil and climatic conditions at a site and show what can be grown. As glycophytes fail on saltland they are replaced by more tolerant glycophytes (such as cotula, sea barley grass) or halophytes (such as bluebush, salt spurry and goose foot). The changes in plant cover provide the easiest way to judge the site conditions.

Salt tolerant forage species (halophytic forages) can be recommended for a site on the basis

of that plant 'test' and the climate. Additional factors which must be considered are dangers of inundation and frost.

Failures

If an area fails to develop a cover of salt tolerant species it may be due to acidity, toxicity, soil instability or surface crusting. Soil tests can be conducted for acidity or toxicity.

What do you want from your saltland?

If saltland comprises a significant proportion of the farm it may be able to contribute to the production system by providing off-season grazing and supplementing the dry feed and/or stubble. If it is small and inconveniently shaped it may be best revegetated and left to provide environmental benefits. Severely salted and waterlogged land will usually only grow plants such as samphire, salt sheoak and *Melaleuca thyoides*. It may be best to fence off such land and leave it to revegetate naturally.



:: What was once a eucalypt woodland has now changed to casuarina & salt water couch.

What will your saltland grow?

Use the reference chart on page 11 to lead you to your solution.

:: Case Study



:: Perennial ryegrass germinating in rows, Sept 2004

Rodney Drage of Forest Hill (700mm) noticed a creekline where 50% of the trees had died due to waterlogging and salinity. The adjacent paddock also had areas affected by salinity which made management difficult. The decision was made to do some re-fencing and combine areas of similar salinity. The advantage of this is:

- Manage the creek and the more saline areas separately
- Easier to manage the fresher parts of the paddock as one unit.

With SGSL support Rodney wanted to increase production and stabilise the area with perennials. He also wanted to remove surface water to dry the land out a bit and give the perennials the best possible start.

The trial consisted of four areas:

1. mix of perennials, tall wheat grass, perennial ryegrass, kikuyu and balansa
2. saltbush (old man, river, wavy leaf) in alleys (5 rows) 10m apart with Evergreen mix in inter-row
3. Evergreen subtropical mix on slight salt area
4. control (no sowing).

Before any sowings took place, a number of surface drains were installed in the paddocks with the creekline made into a W-drain.

Results show that the creekline suffered some water erosion damage in 2005, a high rainfall year, due to increased runoff and freshly dug W-drains. In 2006 the erosion has stabilised. Rodney has also stabilised the creek with rock drop-down points. In hindsight, installing the W-drain was not the best option and a wide-based shallow drain would have been better.

Results from the perennial pasture sowings were:

- Perennial ryegrass was dominant when sown in a mixture. In future it would be sown on its own or left out of the mixture.
- Evergreen mix was very successful, with Rhodes grass and kikuyu being dominant. The other sub-tropical species in the mix did grow but represented a small percentage of the sward. In future the mix may be tried without Rhodes, to allow other species to grow. The Rhodes suffered from frost damage in 2006 and may not persist very well if frost occurs on a yearly basis. The kikuyu continues to survive despite the frost damage.



:: Saltbush mounds and seeding October 2004



:: Case Study

- Weed control prior to sowing is important. The Evergreen pasture sown in October was weed free enabling it to develop successfully.
- The C4 sub-tropical grasses established better when sown in spring rather than autumn. A pasture mixture containing kikuyu (C4), perennial ryegrass (C3), tall wheat grass (C3) and strawberry clover sown in autumn had zero kikuyu plants. The C3 temperate ryegrass dominated while sowing a mixture of kikuyu and Evergreen in spring resulted in all species growing.
- Saltbush seeded on mounds had a 60% take. Bare saltland areas came up with the poorer germination while areas containing mulch and organic matter provided favorable conditions and responded with good germination of wavy and river.
- Rotational grazing with adequate rest periods ensured perennials were well managed and maintained persistence within the sward.



:: Reference Chart

High Rainfall Zone

What is growing now?

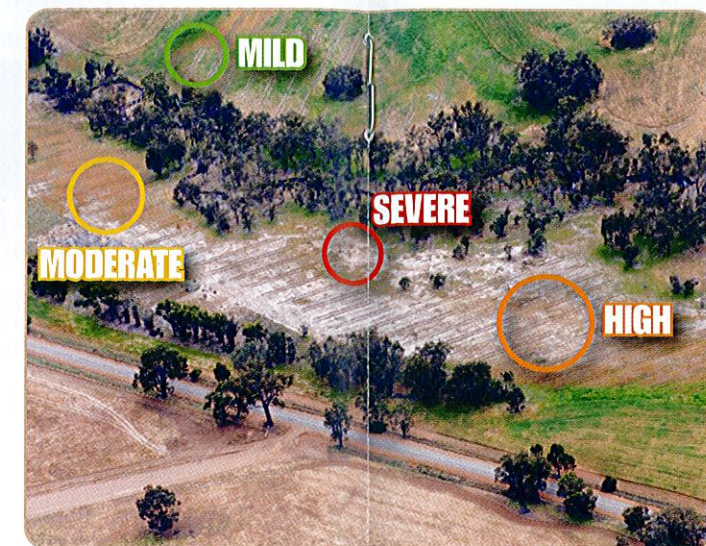
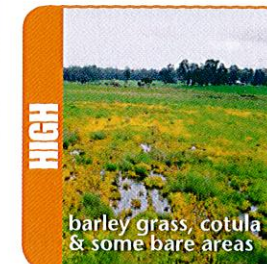
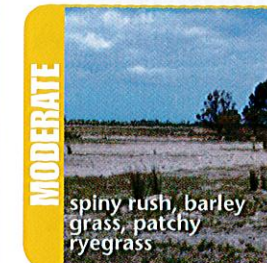
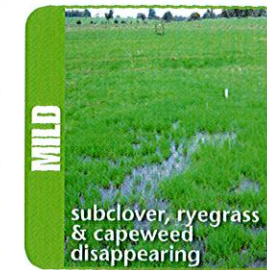
low yield crop	MILD	subclover ryegrass & capeweed disappearing, poor pasture growth
low-moderate waterlogging	MODERATE	spiny rush, barley grass, patchy ryegrass
highly prone to waterlogging	HIGH	barley grass, cotula & some bare area
frequently waterlogged & inundated	SEVERE	large bare areas with cotula & barley grass

What will it grow?

low yield crop	MILD	tall fescue, phalaris, kikuyu, eucalypts, lucerne, balansa, medics
low-moderate waterlogging	MODERATE	tall wheat grass, tall fescue, kikuyu, woolly clover
highly prone to waterlogging	HIGH	acacia saligna or casuarina with tall wheat grass & puccinellia inter-row
frequently waterlogged & inundated	SEVERE	puccinellia, salt water couch

:: A Picture of Saltland

Before Treatment



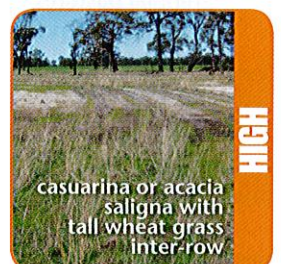
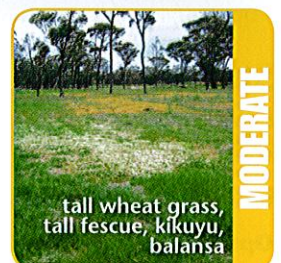
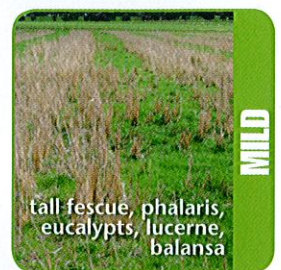
Aerial photographs
illustrate the severity
and variability in
saltland

To help identify indicator
species refer to:

Saltdeck, available from
Land, Water & Wool

Western Weeds, a guide to
the weeds of WA

After Treatment



Assessing the site
conditions helps
determine whether the
site can be treated as
one unit

To help identify planted
species refer to:

*Forage shrubs & grasses for
revegetating saltland.*
Bulletin 4153 Department of
Agriculture and Food, WA.



:: Mild



Strategies:

Establish perennial pastures to increase water use and produce feed from out of season rainfall.

EM38 Category: 25-100mS/m

Options:

- Perennial pastures which are tolerant to waterlogging and low salinity i.e. tall wheat grass, tall fescue, phalaris, kikuyu, lucerne, perennial ryegrass
- Trees i.e. *Eucalyptus camaldulensis*, *Eucalyptus globulus*, *Acacia saligna*
- Establish annual legumes for feeding value (crude protein) and nitrogen fixation for grasses.

Costs	Benefits
Perennials up to \$250/ha	Increases feed supply in autumn
Trees up to \$1000/ha	Possible timber
Drains over \$500/ha	Reduces impact of waterlogging thereby increasing success for plantings.

Comment:

This type of area is slightly affected by salinity and may not be noticed every year. These areas can easily be incorporated back into useful production by treating the whole paddock. Perennial pastures or tree crops are ideal for this situation. Managed well, these areas will not be problems but an asset.





:: Moderate



Strategies:

Establish perennial pastures to increase water use and produce feed from out of season rainfall.

EM38 Category: 50-150mS/m

Options:

- Perennial pastures which are tolerant to waterlogging and low salinity i.e. tall wheat grass, tall fescue, kikuyu
- Trees i.e. *Eucalyptus camaldulensis*, *Casuarina obesa*, *Acacia saligna*
- Engineering options i.e surface drains, grade banks.
- Annual legumes to provide crude protein to animals and nitrogen fixation for perennial grasses.

Costs	Benefits
Perennials up to \$250/ha	Increases feed supply in autumn
Trees up to \$1000/ha	May be possible to grow timber (eucalypt and casuarina species) but probably more suited to grazing
Grader built drains over \$250/km	Reduces impact of waterlogging thereby increasing success for plantings.

Comment:

This type of area generally under-performs in most seasons and in paddocks managed for annuals, hence the need to improve these areas to make them more robust and stop them from becoming worse. With some input these areas will increase in production and sustainability.

Delaying a decision with these areas will cost more and the degree of difficulty will increase.





:: High



Strategies:

Decrease waterlogging and surface water run-on. Establish trees or shrubs and a cover of plants. If area is large enough, fence off and manage separately.

EM38 Category: 150-300mS/m

Options:

- Perennial pastures which are tolerant to waterlogging and salinity. i.e. tall wheat grass, salt water couch, puccinellia
- Trees i.e. *Casuarina obesa*, *Melaleuca*
- Engineering options i.e surface drains, grade banks, wide raised beds if area is flat etc.

Costs	Benefits
Perennials up to \$250/ha	Potential to increase feed supply in autumn
Saltbush up to \$800/ha	Provide autumn feed
Trees up to \$1000/ha	Can be used in an alley type system to provide shelter
Drains over \$500/ha	Reduces impact of waterlogging thereby reducing the risk for plantings

Comment:

These types of areas frequently waterlog and have degraded since clearing for agriculture.

These areas can be fenced and left alone to regenerate. However if given some input they can be changed leading to improvements in productivity and sustainability.

Note:

Saltbush generally does not do well in high rainfall areas but has been successful in areas receiving less than 700mm.

If used for grazing, the area needs to be rotationally grazed to allow the feed to bulk up. Shorter grazing intervals and long rest periods are most appropriate.





:: Severe



Strategies:

Decrease waterlogging and surface water run-on. Establish a cover of plants. If area is large enough, fence off and manage separately either by planting or doing nothing.

EM38 Category: 300mS/m (or greater than)

Options:

- Perennial pastures which are tolerant to waterlogging and salinity i.e. tall wheat grass, saltwater couch, puccinellia, Trees i.e. *Casuarina obesa*
- Engineering options i.e surface drains, grade banks, wide raised beds if area is flat etc.

Costs	Benefits
Perennials up to \$250/ha	Potential to increase feed supply in autumn
Trees up to \$1000/ha	Permanent to provide shade and shelter
Drains over \$500/ha	Reduces impact of waterlogging thereby reducing the risk for plantings

Comment:

Many of these areas have originally been left un-cleared but have become saline since agriculture and hence there is a minimal impact on farm income.

If fenced and left alone most of these areas will start to grow some cover. However if given some input these areas can be changed leading to some improvement in productivity and large improvements in sustainability.

Note:

If used for grazing, the area needs to be left for lengthy periods to enable regeneration between grazings.

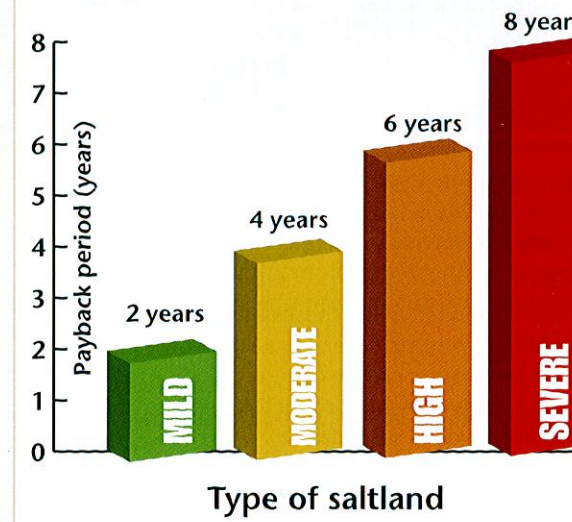
Nypa grass is showing signs of survival but is still in experimental stage.





:: Economics

Average number of years to payback establishment costs



**** By far the quickest return comes from improving the Mild areas due to the range of options available. As the salinity increases so do the costs associated with establishment.**

Based on economic analysis of SGSL producer sites in 2006 by Allan Herbert.

:: Farmers in Trial Areas

FARMER	LOCATION	PHONE	RAINFALL
Drage	Mt Barker	9851 1910	660
Nuske	Warnbro	9593 4455	630
Walker	Collie	9766 1051	740

