

400–600mm

# Saltland Scoring and Solutions

HOW TO IDENTIFY, RATE & SOLVE YOUR SALT LAND PROBLEMS

Areas with Rainfall 400–600mm



SGSL

## Acknowledgements

This book is dedicated to the inspiring “Salt Man” Clive Malcolm and all his hard work.

You are an inspiration to us all.

Your work and legacy will always live on.

- SGSL producer sites – photos & data.
- SGSL Producer Network team – Arjen Ryder, Justin Hardy, Jessica Johns, John Paul Collins.
- Clive Malcolm for text on pages 4-7.



## 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).

### \*\*\* Disclaimer

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## :: 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

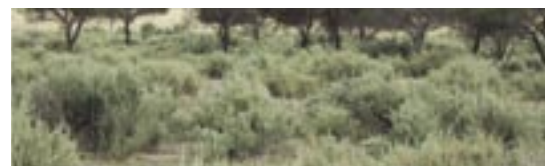
The simplest way to judge an area's capability is to look at what is growing there.

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



**T**he 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 sea barley grass) or halophytes (such as bluebush, cotula, 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 *Melaceuca thyoides*. It may be best to fence off such land and leave it to revegetate naturally.



:: Excessive grazing on saltland can reduce environmental benefits & plant density

### What will your saltland grow?

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



## :: Case Study



*:: Excellent germination & growth of tall fescue on 60% of the site*

**T**ambellup farmers George and Dean Hull witnessed salinity encroachment after buying the property in 1959, with about 80ha of the 485ha showing moderate to severe salt symptoms.

In 1990 they put in an inceptor bank to allow water to run off a block which borders the Tambellup West Road. This did appear to help ease the waterlogging problem but the 15ha site deteriorated to the point where it was basically unproductive land, varying from growing barley grass (moderate) to just bare salt scald (severe).

This site was selected in 2003 to become the Sustainable Grazing on Saline Lands (SGSL) trial. The main aim was to compare the effects of different surface drainage techniques.

Five different techniques have been used on the site which has been assessed for its pasture productivity, drainage properties and associated costs.

The techniques included:

1. disc-plough mounds at 5m spacing, which are cheap and can be done by the landholder however some subsoil is exposed
2. grader mounds at widths of 5m spacing, which are more expensive than plough-built but cheaper than raised beds and expose some subsoil
3. single furrows at 6m spacings which are cheap and quick but provide less surface drainage
4. raised and tilled beds at 1.8m furrow spacing, provide good drainage but most expensive to install
5. raised and no-till beds at 1.8m furrow spacings which provide efficient drainage but are expensive.

The drainage was installed between April and June 2004.

On July 16, 2004, the site was sown to a mix of perennial pasture species using a broadcast spreader and rubber tyred roller. The mix consisted of: 1.3kg/ha of Rhodes grass, 2.2kg/ha of Sequel lucerne, 1.2kg/ha of puccinellia, 8kg/ha of Tyrell and Dundas tall wheat grass, 5kg/ha of Advance tall fescue, and 2kg/ha of balansa clover.



*:: Disc-plough built beds*



## :: Case Study

**G**ermination was very low until April 2005 when 51mm fell over a couple of days and another 50mm a few days later. The dry conditions must have kept the seed viable and a good germination appeared after the rainfall. This experience demonstrates the resilience of seed if conditions are right and the ability of rainfall to flush salt from the soil surface.

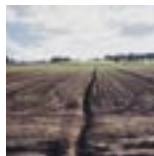
By the end of spring in 2005 the pastures had grown to yield an average of 6t/ha.

One of the main disadvantages with raised beds is the difficult trafficability when going across the beds to round up sheep. The plough-built and grader-built are easier to traverse at 5m spacing.

George has been a bit of a pioneer in the field using the concept of mounding soil over the years. He found that beds were best done 12 months in advance to ensure there was maximum leaching of salt from the soil.

The dry seasonal conditions in 2006 have been a good test for the performance of the permanent pastures and have been a great help for George and Dean in supporting livestock.

A 410-head mob of two-year-old wethers was let in to graze the trial on February 13 and taken out on May 18, 2006. They were weighed and condition scored as they went in and when they came out. Results show they maintained weight at an average of 58kg/head with condition score remaining the same. This meant George and Dean were able to keep their stock and sell when market prices were high.



## :: Reference Chart

### Medium Rainfall Zone

#### What is growing now?

low yield crop	<b>MILD</b>	clover & capeweed disappearing, poor pasture growth
low-moderate waterlogging	<b>MODERATE</b>	ryegrass on higher clumps, barley grass & some bare ground
highly prone to waterlogging	<b>HIGH</b>	patchy barley grass salt spurry, cotula, iceplant
frequently waterlogged & inundated	<b>SEVERE</b>	samphire, curly ryegrass

#### What will it grow?

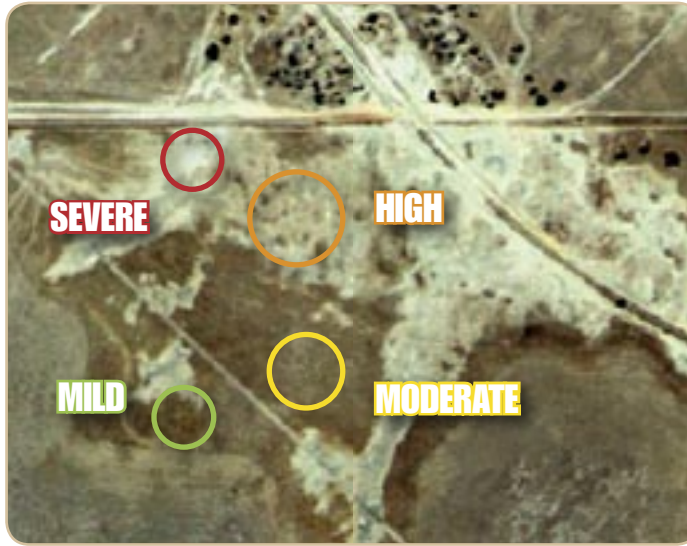
low yield crop	<b>MILD</b>	tall fescue, tall wheat grass, lucerne, bur medics
low-moderate waterlogging	<b>MODERATE</b>	tall wheat grass, saltbush, <i>Acacia saligna</i>
highly prone to waterlogging	<b>HIGH</b>	saltbush, casuarina, puccinellia, tall wheat grass
frequently waterlogged & inundated	<b>SEVERE</b>	samphire, puccinellia





**:: A Picture of Saltland**

**Before Treatment**



Aerial photographs illustrate the severity and variability in saltland

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

To help identify indicator species refer to:

*Saltdeck*, available from Land, Water & Wool

*Western Weeds*, a guide to the weeds of WA

To help identify planted species refer to:

*Forage shrubs & grasses for revegetating saltland.*

Bulletin 4153 Department of Agriculture and Food, WA.

**After Treatment**





## :: Mild



### Strategies:

Establish perennial pastures to promote autumn feed, increase water use and contain the spread of salinity.

**EM38 Category: 50-100mS/m**

### Options:

- Annual legumes can be introduced into perennials such as burr medics.
- Perennial pastures which are tolerant to waterlogging and some salinity i.e. tall wheat grass, tall fescue, phalaris, kikuyu, lucerne, Italian ryegrass.
- Trees and shrubs i.e. *Eucalyptus camaldulensis*, casuarina, *Acacia saligna* and saltbushes planted in wide alleys.
- Engineering options i.e. surface drains, grade banks.

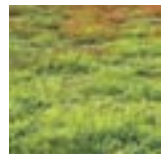
Costs	Benefits
Perennials up to \$250/ha	Increase feed supply in autumn. Provides vitamin E.
Trees up to \$500/ha	May be possible to grow production timber but probably more suited to grazing species or both can be combined in alleys.
Grader-built drains over \$250/ha	Reduces impact of waterlogging thereby increasing success for plantings.
Shallow furrows and spinner surface drains at close spacing Less than \$60/ha	Reduces waterlogging.

### Comment:

This type of area generally under-performs with annuals in most seasons hence the need to improve these areas to make them more robust and stop them from becoming worse. With standard pasture establishment techniques these areas will increase in production and sustainability.

Perennial pasture mixes are highly suited to these areas. Annual pastures can be added to increase productivity after one year.

Delaying action with these areas will increase the cost and the degree of difficulty.







## :: Moderate



### Strategies:

Establish a cover of plants. Decrease waterlogging and surface water run-on. Rotational graze to maintain ground cover.

**EM38 Category: 100-200mS/m**

#### Options:

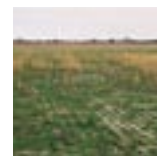
- Perennial pastures which are tolerant to waterlogging and some salinity i.e. tall wheat grass, puccinellia
- Trees i.e. *Eucalyptus camaldulensis*, casuarina, *Acacia saligna*
- Engineering options i.e. surface drains, grade banks
- Saltbush alleys
- Burr medic may persist in patches and should be included in sown mixtures
- Bluebush.

Costs	Benefits
Perennials up to \$250/ha	Increase feed supply in autumn.
Saltbush up to \$200/ha Depending on whether seeded or nursery raised seedlings	Provide autumn feed and vitamin E.
Trees up to \$500/ha	Useful for shelter and environmental benefits.
Grader-built drains over \$250/km	Reduces impact of waterlogging thereby increasing success for plantings.
Shallow furrows and spinner surface drains at close spacing. Less than \$60/ha.	Reduces waterlogging.

#### Comment:

These are the in-between areas with low clover content, that usually under-perform, but perform better than the bare salt areas.

Most are managed with areas of good pasture. If so, it is essential to improve these areas to make them more robust. With some input these areas will increase in production and will help stabilise the paddock. Annual pastures can be added to increase productivity.





## :: High



### Strategies:

Establish shrubs and a cover of plants. Decrease waterlogging and surface water run-on from higher in the landscape. Rotational graze to maintain ground cover.

**EM38 Category: 150-250mS/m**

### Options:

- Perennial pastures which are tolerant to waterlogging and some salinity i.e. tall wheat grass, puccinellia, saltbush, bluebush
- Alley system using saltbush species i.e. river, old man alleys close together
- Trees i.e. *Eucalyptus camaldulensis*, casuarina, *Acacia saligna*
- Engineering options i.e. surface drains, grade banks
- Introduce understorey species 2 - 3 years after saltbush alleys have been planted (Frontier balansa, tall wheat grass).

Costs	Benefits
Perennials up to \$250/ha	Increase feed supply in autumn.
Saltbush up to \$200/ha Depending on whether seeded or nursery raised seedlings	Provide autumn feed and vitamin E.
Trees up to \$500/ha	Useful for shelter and environmental benefits.
Grader-built drains over \$250/km	Reduces impact of waterlogging thereby increasing success for plantings.
Shallow furrows and spinner surface drains at close spacing. Less than \$60/ha.	Reduces waterlogging.

### Comment:

These are areas with increasing bare ground, usually under-perform, but performing better than the bare salt areas.

One characteristic is that many are managed with areas of reasonable pasture. If so, it is essential to decide whether they will be managed with the moderate areas or the severe areas.

With some input these areas will increase in production and will help stabilise the paddock. Annual pastures can be added to increase productivity.





## :: Severe



### Strategies:

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

**EM38 Category: 200-300+mS/m**

#### Options:

- Perennial pastures which are tolerant to waterlogging and salinity. i.e. saltwater couch, puccinellia, saltbush (river)
- Trees i.e. casuarina
- Engineering options i.e. surface drains, grade banks, wide raised beds if area is flat
- Mulching with hay, straw chaff or even wool can prevent salt accumulation allow species to germinate
- Nypa grass is showing signs of survival but still in experimental stage.

**NB: This is a high risk area for pasture establishment**

Costs	Benefits
Perennials up to \$250/ha	Stabilises area with possible feed supply in autumn.
Saltbush up to \$200/ha (This cost will depend on whether seeded or nursery raised seedlings are used).	Provide occasional autumn feed.
Trees up to \$500/ha	Useful for shelter and environmental benefits.
Grader-built drains over \$250/km	Reduces impact of waterlogging thereby increasing success for plantings.
Shallow furrows and spinner surface drains at close spacing. Less than \$60/ha.	Reduces waterlogging.

#### Comment:

These areas are usually the first to be identified as saline. If given some input these areas can become stable and may provide future productivity when managed. Remember the area affected by salinity is larger than the observed bare patch.

Saltbush can survive however avoid planting in very wet sites.

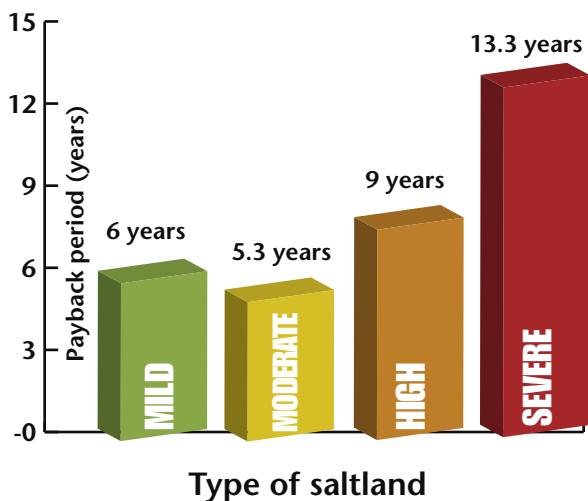
These areas can be left to revegetate on their own.





**:: Economics**

**Average number of years to payback establishment costs**



**\*\* Spending money on Mild and Moderate saltland areas will payback twice as quickly as money spent on Severe saltland areas.**

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

**:: Farmers in Trial Areas**

FARMER	LOCATION	PHONE	RAINFALL
Bell	Jerdacuttup	9075 1118	550
Bignell	Broomehill	9824 1270	450
Bradshaw	Tambellup	9825 3032	460
Bradshaw	Tambellup	9825 3032	460
Cunningham	Tambellup	9825 3061	425
Erickson	Bolgart	9627 5211	480
Farmer	Tambellup	9825 1277	430
Flugge	Albany	9892 8407	430
Hull	Albany	9841 7113	440
Hull	Tambellup	9825 1119	440
Jefferies	Tenterden	9851 7013	550
Kelly	Moora	9651 5050	480
Langridge	Gillingarra	9651 5076	525
Mader	Woodanilling	9862 5031	450
Mathwin	Kojonup	9832 8027	485
Rex	Wagin	9862 6067	490
Thomson	Woodanilling	9823 1549	450
Tonkin	Coomberdale	9651 8011	410
Toovey	Cranbrook	9826 8013	530
Walsh	Cranbrook	9826 1034	450
Watts	Wandering	9884 1051	580
Wilcox	Woodanilling	9823 1550	420



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