



# PRODUCTIVE SALT LAND PASTURES

## Salinity Manual



## Module 1

### Terminology



Department of  
Primary Industries and  
Regional Development

natural resource  
management program








# SALINITY INTRODUCTION

## **INTRODUCTION**

The terminology used in this course is for a landholder and practitioner user audience and may not always follow strict hydro-geological definitions. The terminology aims to be consistent from region to region throughout Western Australia.

## **DEFINITION OF SALINITY**

Salinity is the excessive accumulation of salts (usually sodium chloride) in land and water to sufficient levels to impact on human, natural and non-biological assets (e.g. plants, animals, aquatic ecosystems, water supplies, agriculture or infrastructure).



Bare ground and patchy barley grass indicating the salinity encroachment on cleared, East of Wagin.

*Photo credit: DAFWA SGSL team*



Impact of salinity on uncleared bush in a Changerup reserve west of Kojonup with tree death and loss of understorey. Samphire, a salt tolerant plant species has started to colonise the area.

*Photo credit: DAFWA SGSL team*



# TERMS AND DEFINITIONS

Some common terminology used to describe salinity concepts and processes is defined in the table and diagram below.

TERM	DEFINITION
<b>Base flow</b>	Groundwater that discharges into a surface water body (creek, stream, river)
<b>Permeability</b>	The capacity of soil, rock or regolith to transmit water or other fluids
<b>Regolith</b>	Used to express a soil profile, typically from soil surface to basement rock.
<b>Discharge area</b>	An area of land where groundwater comes to the surface, either directly (to cause baseflow or via evaporation)
<b>Recharge area</b>	An area of land where surface water enters the ground and moves into a groundwater body
<b>Leakage</b>	Rainfall which has moved through the soil profile beyond the reach of plant roots.
<b>Lateral flow</b>	Groundwater movement in a sideways (lateral) direction usually measured in distance by time i.e. m/ day
<b>Water table</b>	The surface of an unconfined groundwater body, where the groundwater is at atmospheric pressure
<b>Unsaturated zone</b>	The area between the ground surface and the water table which is not saturated with water
<b>Saturated zone</b>	The area below the water table where all spaces in soil, sediment and rock are filled with water
<b>Capillary rise</b>	Upward movement of water (and all that is dissolved in it) in the soil due to surface tension in small soil pores. Driven by evaporation. Similar to the way water moves up into a dry sponge
<b>Playa</b>	A dry or ephemeral lake bed, also known as salt lake when connected to groundwater
<b>Saline seep</b>	Groundwater that is discharging onto the soil surface, mostly found in areas with greater than 500mm annual rainfall (post year 2000).
<b>Salt scald</b>	The bare area from which soil has been eroded often brought about by saline discharge and evaporation, mostly found in areas with less than 400mm annual rainfall



More definitions on DPIRD salinity related webpages:

<https://www.agric.wa.gov.au/resource-assessment/interactive-groundwater-and-salinity-map-south-west-agricultural-region>

<https://www.agric.wa.gov.au/report-card-conditions-and-trends/report-card-sustainable-natural-resource-use-agriculture-western>

<https://www.agric.wa.gov.au/report-card-conditions-and-trends/groundwater-trends-agricultural-areas-western-australia>



# SALINITY ORIGIN

Soil salinity may be primary or secondary in origin.

## **PRIMARY SALINITY**

Natural, or 'primary salinity' occurs throughout the world in arid climates, including about 29 million hectares in Australia: 14 million hectares as salt marshes, salt lakes and salt flats, and another 15 million hectares with naturally saline subsoil but no groundwater or perched water to take it to the surface. Moist and wet primary saline areas have very high natural diversity in Western Australia, but are at risk from increased flooding.

It is generally confined to the Zone of Ancient Drainage and areas where the annual rainfall is less than 350mm.



Areas of the Cobline were saline prior to clearing and samphire, such as here on the Nyabing Road, east of Katanning occurred naturally. This is known as primary salinity.

*Photo credit: DAFWA SGSL team*

## SECONDARY SALINITY

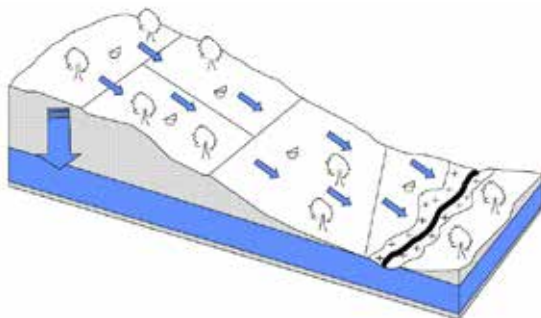
Salinity which has developed by changing land use and management is called secondary salinity. It is caused by the clearing of native vegetation and as such a change in the hydrological cycle, leading to more water in the soil and a rising watertable. This mobilises stored salts which rise with the watertable towards the surface. Clearing for agriculture has been the major cause of secondary salinity in Australia.



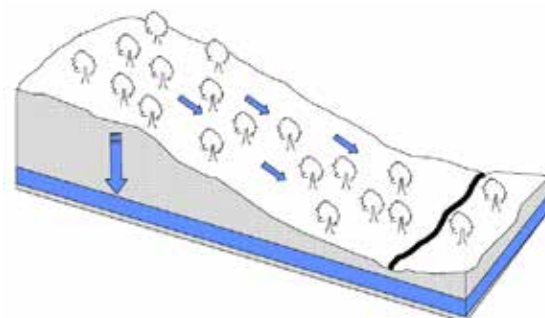
Landscape hydrology, towards a new balance



Landscape hydrology not in balance



Trees, deep-rooted perennials and native vegetation use most of the water that enters the soil resulting in less leakage past the plant root zone. Deep rooted perennials can access moisture stored deeper in the soil profile during dry periods.



Removing native vegetation and growing shallow-rooted annuals increases leakage to the groundwater system. As a result water tables rise mobilizing stored salt. New discharge areas are created leaving salt crystals on the soil surface due to annual evaporation being greater than rainfall.



More information can be found on the DPIRD salinity webpages:

<https://www.agric.wa.gov.au/report-card-conditions-and-trends/groundwater-trends-agricultural-areas-western-australia>



Salinity is usually noticed first when plants grow poorly and yields of farm plants (crops and pastures) are reduced by more than 25 to 30 %. In severe cases, bare patches develop with salt obvious on the surface. These patches are known as 'salt scalds' (dry) or seeps (wet).

Natural flora and fauna diversity on secondary salinity sites is lower than surrounding land.

About one million hectares of secondary salinity was estimated in Western Australia in 2000 using satellite imagery and the Land Monitor Project.





Once a healthy natural vegetated depression is now being slowly revegetated with trees, salt tolerant shrubs and puccinellia (south of Katanning). The impact of secondary salinity is seen by the dead trees and bare soil in the foreground.

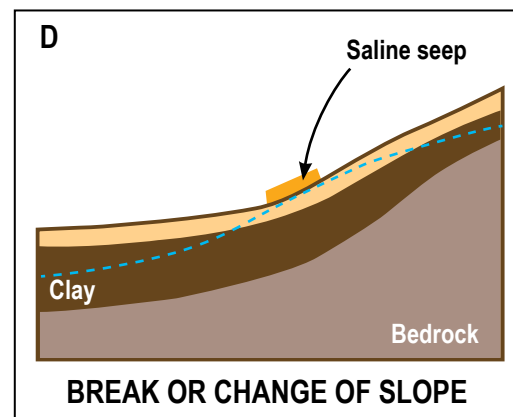
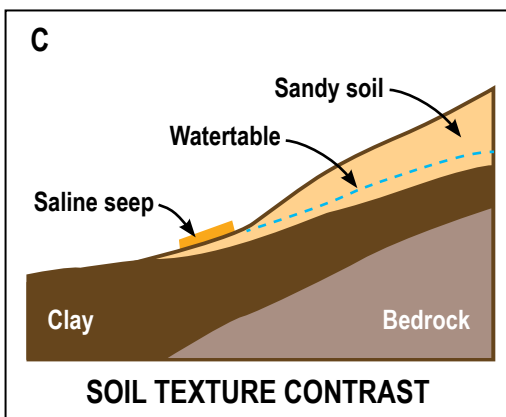
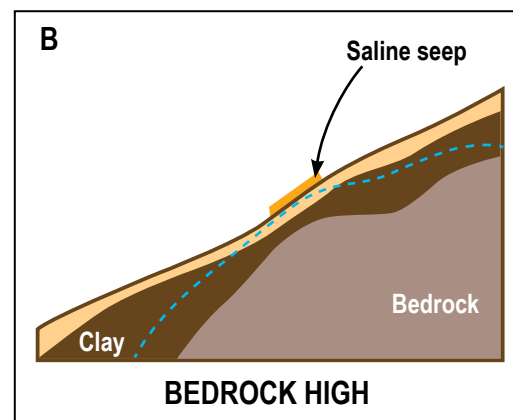
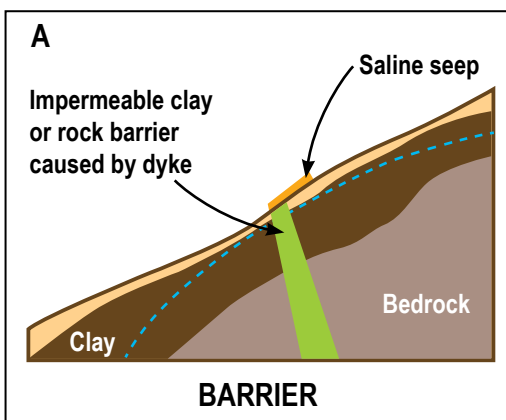
*(Photo: DAFWA SGSL team)*



# TYPES OF SALINITY

## CAUSES OF DISCHARGE AREAS

Discharge areas can be found in various parts of the landscape and are categorised by the mechanism that drives them. Saline seeps are driven by base flow discharging at the surface while saline scalds are driven by evaporation. Different types of saline seeps are often referred to by their location or cause. Some of the most common seeps found in the Avon catchment are listed in the Figures A-D below.



The landscape of the wheatbelt area of the SW catchments are relatively flat resulting in the formation of many lakes and lake systems. For most of the time, surface water and groundwater does not drain or reach the coast. It is only in times of large rainfall events (also known as episodic events) that the lakes fill and then connect with each other to form broad drainage lines. It is during these large rainfall events that groundwater levels can rise (by as much as 0.3 to 0.6m) and is associated with the spread of salinity.





Large rainfall events can result in extensive flooding with lakes filling up and connecting with each other to form broad valley rivers with some drainage to the coast.



Flooding of a lake

# REFERENCES

Blackwood Catchment Beaufort Zone (Zone 4) CATCHMENT APPRAISAL 2002, Department of Agriculture and Food of Western Australia.

September 2003 RESOURCE MANAGEMENT TECHNICAL REPORT 243 ISSN 1039-7205

<https://researchlibrary.agric.wa.gov.au/rmtr/222/>

Salinity in Western Australia – a situation statement.

<https://researchlibrary.agric.wa.gov.au/rmtr/73/>



# QUESTIONS

**1. What is “Secondary salinity”?**

- Areas of salinity prior to clearing.
- Salinity caused by a secondary treatment process.
- Saline land caused by altering the hydrological balance so that water tables rise.

**2. How many hectares of secondary salinity were estimated in WA in 2006?**

- 1,000
- 1mil
- 2mil

**3. What is the difference between a saline seep and salt scald?**

- A saline seep is caused by saline base flow while a salt scald is caused by evaporation leaving salt on the surface.
- Saline seeps are only found on a slope while salt scalds are in valleys.
- There is no difference they look the same and therefore are the same.

**4. Which statement below is not true following an “episodical” rainfall event?**

- Lakes fill up
- Broad valley floors flood with lakes connecting resulting in runoff out of the catchment.
- Groundwater levels fall.

**5. Do salinity impacts only occur on cleared land?**

- Yes, only cleared land is impacted by salinity.
- No, salinity impacts can also be seen within un-cleared native bush areas.









[www.gillamii.org.au](http://www.gillamii.org.au)