Ecological Issue:

Dry Land Salinity

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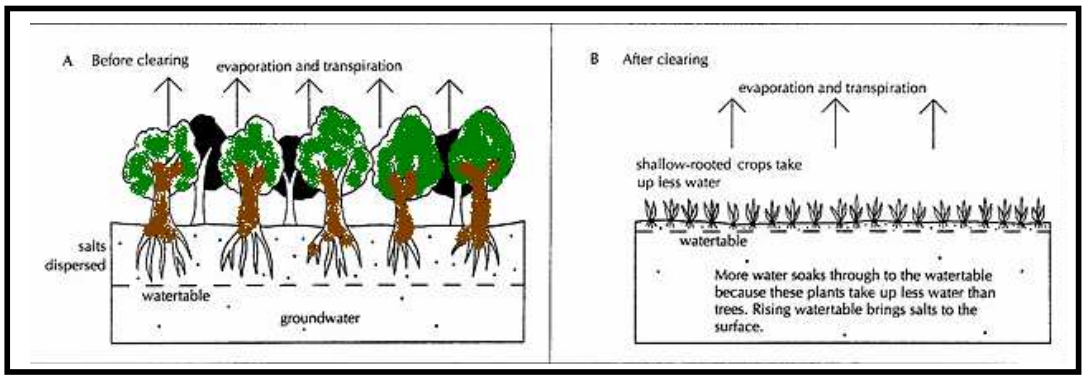
What is it?

There are two kinds of salinity - dryland and irrigation salinity. Both are about water management and maintaining the right balance or equilibrium. In Western Australia, they are affected mostly by dryland salinity, while in Victoria we are mainly affected by dryland salinity too. Dryland salinity occurs when salt stored in the soil profile over thousands of years is brought to the surface or close to the surface by rising groundwater levels. The extent and seriousness of salinity and in an area depends on land use, vegetation, geology, soils, climate, and salt sources. Each of these factors affects the rate of recharge, which therefore influences the rate of discharge. Recharge is the term used when soil pores are full, causing excess water to pass into groundwater. The term discharge refers to water leaving the groundwater system as flow to streams and rivers or as seepage or springs at the soil surface.

As long as the salt stays deep in the soil, it poses no problems - at this stage it is referred to as primary salinity. However changes have occurred on our land that's bringing the salt closer to the surface where it can cause major problems, hence causing the natural water balance to be disturbed. Native plants and trees in Australia are very efficient at using rain water, their leaves catch the rain, their roots draw water from deep in the ground and they use water all year so little of the rain water finds its way through to the groundwater.

Secondary salinity is the result of clearing native vegetation and replacing it with shallow-rooted annual crops and pasture that use less water and for only part of the year, causing changes to the hydrology of the landscape. Incoming rainfall that is not used or absorbed by annual crops (i.e. Lucerne) and pastures either runs off or infiltrates beyond the root zone and accumulates as groundwater, hence causing the groundwater to raise. As this level rises the groundwater dissolves the salt in the soil and brings it closer to the surface of the land. Eventually the soil develops a higher level of salt, than the plants can handle, and therefore begin to die. However plants are not only affected by the salt the also suffer from increased waterlogging. Saline groundwater's discharge at the soil surface is increased by evaporation, causing the salt to crystallise, and damaging soils on-site eventually draining into lakes, streams, and rivers, degrading water resources and wetland habitats. In towns, salt can damage roads, buildings, rail embankments and other infrastructure. It can be a very expensive problem!

This diagram represents the affect of clearing vegetation and hence causing the watertable to rise.



Impacts of salinity:

Soluble salts commonly associated with soil salinity affect growing plants in two ways. Firstly they attract water, raising the suction or intake of water held in the soil, thereby reducing a plants ability to extract water from the soil. This limits the plants energy and growth. Secondly soluble salts contain ions such as sodium, chloride and borates that are often toxic to crops. These ions are also often responsible for raising soil pH. Therefore all these nutrient increases and the increase of soil pH cause the soil to be unavailable for plant growth. As soil becomes increasingly sodic (soil containing so much exchangeable sodium that plant growth and soil stability are badly affected) it becomes subject to dispersion (breaking up into smaller particles) therefore been unstable and can be easily eroded by water. The quality of water becomes greatly affected due to the increase amount of salt. More than one-third (36%) of the south-west's surface water resource (suitable for domestic, agricultural or some industrial use) has become salty or saline and can no longer be used. A further 16 per cent is of marginal quality i.e. marginally better still salty. There is also a loss of native aquatic habitat as there ecosystem becomes to saline forcing the organisms to move to another are if possible or die off. The effect on biodiversity is huge as without intervention, 450 plant species endemic to the south-west agricultural region will become extinct and three-quarters of the region's waterbird species will severely decline (this figure is for western Australia).

What are we doing about it?

There is a general understanding about the causes of salinity in most parts of Victoria. However actual specifics will vary from site to site. Gaining an understanding of a specific problem can involve long periods of monitoring before any ground water trends can be predicted.

We can do a lot to diminish or limit salinity, however realistically; it is probably unfeasible and not possible, to revitalise the land that is already saline. Therefore we need a variety of ideas to combat the situation.

Containment

In some areas, there is no evidence of salinity or the problem is not very advanced. In these areas, if we can't overturn the salinity problem we may be able to manage it, to limit the affects.

For example, we might be able to:

- Pump water from the ground to keep the groundwater level from rising any further.
- Plant trees or plants in specific areas, to soak up the rainwater, before it reaches the waterways and groundwater.
- Use drainage to take away shallow groundwater from land that's at risk.

- Increase the amount of land covered by plants that use a lot of rain water (such as perennial crops or pastures and native vegetation i.e. gums, Lucerne etc) so we are not increasing the groundwater levels.

Recovery

Areas that are of very high value, whether been for ecological purposes or economic, which are only marginally affected by salinity, may be able to be reclaimed from the affects of salinity, and be restored to its previous state. To do this we could use similar solutions to that of containment.

Adaptation

Some areas are too saline to be reclaimed, or are not valuable enough to validate the amount of money it would cost to manage or rehabilitate the area. In these cases, we might be able to adapt the affected land. Examples are:

- Growing salt-tolerant or salt-resistant pasture or crops.
- Investing in saline aquaculture eg farming salt-water fish.
- De-salinatising some or all of the salty groundwater and use the desalinated water for stocks or crops i.e. irrigation.

Monitoring and Evaluation

Whatever the state, of the land we are working on, we need to monitor the environment; including groundwater levels, water quality and biodiversity. Through using data collected from tests i.e. groundwater levels and water quality tests, we can calculate the risk of salinity, work out the best solution to the problem and assess whether the treatments we are using are effective.

Groundwater monitoring includes:

- Conducting aerial surveys.
- Using satellite imagery to monitor the extent of salt affected land, areas at danger or threat of salinity.
- Measuring the height of groundwater in bores.

Water quality testing involves:
Measuring the salinity levels in waterways or groundwater, through measuring the electrical conductivity of the water

Cost of Salinity:

The cost and affect of salinity in the agriculture industry and community is of huge proportions. The agricultural zone of south-west Western Australia has the largest areas of dryland salinity in Australia. In the south west, 1.8 million hectares in the agricultural region are already affected by salinity to some extent. In the northern and central areas of Victoria alone, there has been an estimated cost of $30.6 million spent on the affects of salinity. The bulk of this cost is due to maintenance of land, preventive measures, plans to rehabilitate etc. Local governments incur a cost of $3.28 million per annum due the affects and presence of dryland salinity. It is estimated that current costs include $130 million annually in lost agricultural production; $100 million annually in damage to infrastructure; and at least $40 million in loss of environmental assets.[1] (Figures, from CSIRO[1]). In, towns, salt can damage roads, buildings, rail embankments and other infrastructure. It can be a very expensive problem! The overall cost of dryland salinity is not really known but it is an extremely costly problem that needs to fixed or sustained.

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