Waterwatch Australia National Technical Manual
Module 4 - Physical and Chemical Parameters
Waterwatch Australia Steering Committee
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Teachers' Resource Sheet – Salinity [dissolved solids]

Salinity explained

You may already be familiar with the term salinity, which means the content of salts in soil or water. Soil salinity refers to the concentration of soluble salts in the soil, and the salinity of water refers to the concentration of salts in solution.

High levels of soluble salts in the landscape result in a reduction in the productive capacity of affected land and water, degradation of wildlife habitats, loss of water quality for household supplies and damage to household equipment. In some areas, production losses have caused significant social and economic hardship. This can occur in irrigated or dryland (non-irrigated) farming regions. Salinity problems occur mainly in Queensland, Victoria, South Australia and Western Australia.

Salts are a natural component of all landscapes. They result from the weathering of rocks and other sediments and are moved by water. The flow of water in a landscape determines the movement and final distribution of salts. Throughout the world, there are areas of naturally saline soils and waters where salinity has always limited their use. Occurrences of naturally salted land are in South Australia, Victoria and Western Australia with minor occurrences in Queensland.

What causes the salinity to change?

Sometimes salt levels in the local water can change. If too many trees have been cut down there is much less removal of water from the ground. The water builds up and eventually comes to the surface, bringing with it salts from the soil. Some irrigation practises can cause the watertable to rise bringing salts closer to the surface. Because the plants in the area are not suited to higher salt levels they die when this salty water gets to their roots. Ocean water spilling into areas where it has never been can also have the same effect.

How do we measure salinity?

Salinity can be measured in two ways:

The most common technique used to measure salinity was to evaporate a solution and weigh the salts remaining. If water is evaporated, any salt in the water will be left behind. You could try doing this by putting 200 mL of salty water in a shallow dish in the sun. If the salt that is left can be weighed then you will know how much salt is in 200 mL. If you then multiply this by five you will know how many milligrams of salt will be in one litre. This is one way of presenting the measure of salinity. The unit written as mg/L.

Measure the electrical conductivity of a solution. This method is a much quicker and more convenient way of measuring salinity. For a given level of salts dissolved in water, the electrical conductivity (ability to conduct electricity) increases with the concentration of the salts. The conductivity can be measured instantly with a portable instrument which reads how easily a solution will conduct an electric current. Units vary but commonly microsiemens per centimetre (S/cm) is used.
To convert from measurements from one unit to the other you can use the following formula:
mg/L = (0.64) x (S/cm)

Water Quality standards Table - S/cm Use

0 to 800
Good drinking water for humans (provided there is no organic pollution and not too much suspended clay material). Generally good for irrigation, though above 300 S/cm some care must be taken, particularly with overhead sprinklers which may cause leaf scorch on some salt-sensitive plants.
Suitable for all livestock.

800 to 2500
Can be consumed by humans, although most would prefer water in the lower half of this range if available. When used for irrigation, requires special management including suitable soils, good drainage and consideration of salt tolerance of plants.
Suitable for all livestock.

2500 to 10000
Not recommended for human consumption, although water up to 3000 S/cm can be consumed. Not normally suitable for irrigation, although water up to 6000 S/cm can be used on very salt-tolerant crops with special management techniques. Over 6000 S/cm, occasional emergency irrigation may be possible with care.
When used for drinking water by poultry and pigs, the salinity should be limited to about 6000 S/cm. Most other livestock can use water up to 10 000 S/cm

Over 10 000
Not suitable for human consumption or irrigation.
Not suitable for poultry, pigs or any lactating animals, but beef cattle can use water to 17 000 S/cm and adult sheep on dry feed can tolerate 23 000 S/cm. However, it is possible that waters below these levels could contain unacceptable concentrations of particular ions. Detailed chemical analysis should therefore be considered before using high salinity water for stock.
Water up to 50 000 S/cm (the salinity of the sea), can be used (i) to flush toilets provided corrosion in the cistern can be controlled and (ii) for making concrete, provided the reinforcement is well covered.

Questions

What do you think would happen if you watered a crop with groundwater that has high salinity?
How many mg/L of salt would you get from water measuring 200 S/cm?
How many S/cm in water measuring 1280 mg/L?