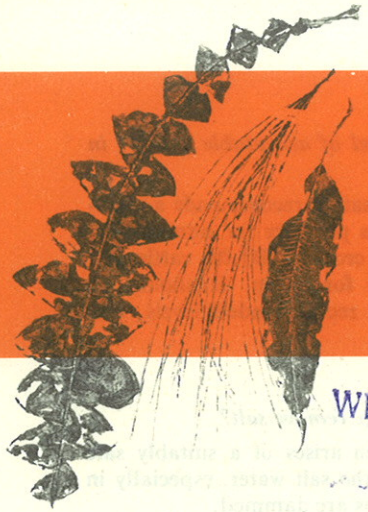

INFORMATION SHEET 43

REPRINTED JUNE 1983

SALINITY

Questions and Answers

The subject of salinity has become very topical in the late '70s, in connection with harvesting of southern forests, bauxite mining in northern jarrah forests, and the clearing of land for farming in some water catchment areas.

This information sheet attempts to answer, in simple terms, some of the frequent and important questions about salinity and defines some of the terms that are commonly used but not always understood.

1. What is salinity?

It is the term used to measure the quantity of salt, predominantly common salt (sodium chloride) present in stream, spring, reservoir or ground water or in the soil itself.

2. How is salinity usually measured?

It is measured by chemical analysis or by measurement of electrical conductivity, and is usually expressed in units of kilograms per hectare for soils, and milligrams per litre for water samples.

3. Where does the salt come from?

It is deposited as dust (dry fall) or dissolved in rainfall from air masses that have travelled across the Indian Ocean, and pass over the south-west of Western Australia.

4. How is salt stored in the soil?

When rain falls some of it penetrates the soil and the subsoil where it may move in underground stream flow or be accumulated. When plants grow they absorb water from the soil in a process known as transpiration. This process tends to remove the water and leave the salt behind, so that over thousands of years large quantities of salt may accumulate in certain subsoil types.

5. How much salt is deposited each year in the south-west of Western Australia?

The quantity varies with distance from the coast and may range up to hundreds of kilograms per hectare. Perth receives an average of 341 and Wiluna 11 kilograms/hectare/year. (Dept. of Agriculture Bull. 4048.)

6. How long has salt been accumulating?

Probably for thousands of years.

7. What are the total quantities of salt stored in soils of the South-West?

Again the quantity varies considerably, depending on soil type and rainfall, but rates of up to a million tonnes per hectare have been measured. Values in water tables have exceeded 20000 milligrams per litre and range from as low as 200. For example, at Belka Valley (near Merredin) the level is 625 tonnes per hectare in some soils.

8. What effect do tree crops have on saline water in the soil?

Because they are growing and transpiring nearly all the year round, they act as a "pump", tend to reduce the accumulation of water and lower the permanent level of the water table. Through this action, saline water does not rise toward the surface and salt is thus "stored" in the soil.

9. What happens when forest and shrub cover are removed?

The deep "pumps" are removed allowing more rainfall to reach the ground water. This has two effects:

(*a*) More ground water, which is saline, flows into streams, thus increasing stream salinity.

(*b*) The water table will rise and salts in the unsaturated zone above the water table will probably be incorporated in this ground water.

In some cases the water table may rise to the soil surface and salts will be concentrated even more, by evaporation. This is the cause of death or scalding of pastures.

10. Will annual crops and pastures achieve the same effect as trees?

No. They have a short, active growing season and mainly extract water near the surface because of their shallow root system. They therefore have minimal effect on ground water levels.

11. Will run-off drains and contour banks remove salt from the soil?

No. Cut-off drains will divert fresh or slightly saline rainfall away from the site and into existing drainage channels. In this way salt in the soil remains relatively immobile.

12. Can salt affected patches be reclaimed by planting trees again?

Some very hardy trees like *Eucalyptus sargentii* (salt river gum) and *Tamarix aphylla* (tamarisk) can be grown in salt "scald" areas and may, in combination with salt tolerant pasture plants, ameliorate the salt effects.

13. Will tree planting near the salt affected areas alleviate the problem?

If established trees are vigorous and planted in sufficient density to dry out the surface soil, they may eventually lower the saline water table as well. Similarly, if planted on intake areas or if deep rooted species, they will reach the ground water table and transpire from it.

14. Can salinity in stream water be prevented by planned and moderate removal of a proportion of forest cover?

Much research is under way to test this method. Indications are that retention of tree cover will do much to help the situation, but many years of study are still needed to calculate the desirable balance of cleared and uncleared land, or degree and pattern of clearing, and each individual drainage unit or valley could require a specific level of treatment.

15. What is the current level of acceptable salinity in water supplies?

The World Health Organisation recommends a maximum level of 500 milligrams per litre for human consumption, 500 for irrigated crops, 7000 for cattle and 10000 milligrams per litre for sheep. It should be remembered that these are recommended levels, and not absolute limits.

16. Can pumping or drainage remove salt?

Yes, but the problem then arises of a suitably safe way in which to dispose of the salt water, especially in catchments where the streams are dammed.

17. Are there any forest areas where salinity is not a problem?

Yes! Experience and research have shown that subsoils in the karri forest are relatively free from salt, as are the coastal plains, Donnybrook sunklands and the western parts of the Darling Range.

18. Which parts of the landscape are most affected when land is cleared?

Generally the valley bottoms become saline first, followed by a gradual extension on to the lower slopes.

TERMINOLOGY OF HYDROLOGY/SALINITY

AQUIFER A general term for free water within a soil profile.

BASE FLOW (*a*) The minimum dry season flow of a river or stream. (*b*) Ground water discharge from sustaining aquifers that are intermittently recharged during periods of rainfall.

BASE FLOW SALINITY A measure of total dissolved solids at base flow.

CONFINED AQUIFER Free water in a soil profile with its movement restricted by layers that are impervious to water.

CYCLIC SALT Refers to the salt in rainfall being recycled back to the ocean as part of the hydrologic cycle.

DISCHARGE RATE Quantity of river or stream water passing a given reference point over a measured time period.

DRY DUST Fine crystals of salt resulting from evaporation of a moist or saturated air mass.

EVAPOTRANSPIRATION The combined water loss by plants as a result of evaporation and transpiration.

GROUND WATER The free water which exists in a soil profile.

GROUND WATER TABLE The level at which free water exists in a soil profile.

GROUND WATER RECHARGE Restoration of winter levels of the ground water table by addition of rainfall.

HYGROSCOPIC WATER The water retained in a soil after drying has reached wilting point.

INFLUENT Addition of water to the ground water after winter rain.

PERCHED WATER TABLE A water table which is temporary and is not connected directly with the ground water table.

POTABILITY STANDARD The levels of physical, chemical and biological purity accepted for human water supplies.

SOIL WATER Water available to plants and above the water table.

SALINE SPRING A spring of water with significant content of dissolved salts.

SALT FALL The precipitation of saline rain and salt dust on the land.

TOTAL DISSOLVED SOLIDS (T.D.S.) Refers to the amount of dissolved salts or solids in a unit volume of water.

TRANSPIRATION The process that occurs mainly in the leaves of plants, whereby water vapour and oxygen are emitted from leaf surfaces.

TURBIDITY An expression of the amount of suspended matter, usually soil, in a water sample or stream. It can be measured through its effect on transparency.

UNCONFINED AQUIFER Free water in a soil that is not restricted between layers of impervious material.

WATER TABLE See GROUND WATER TABLE.

WILTING POINT The stage in soil drying at which a plant can no longer obtain water.

WINTER FLUSH The first strong flow of a stream after the opening of the rainy season.

FURTHER READING

JOURNAL OF AGRICULTURE—W.A. (1978). Volume 19, No. 4. Western Australian Department of Agriculture.

MALCOLM, C. V. "Salt land and what to do about it." Bulletin 4048. Western Australian Department of Agriculture.

SHEA, S. R., and HERBERT, E. (1977). "Managing jarrah forest catchments." *Forest Focus No. 19.* Forests Department of Western Australia.

SHEA, S. R., and HATCH, A. B. (1976). "Stream and groundwater salinity levels in the South Dandalup catchment of W.A." Research Paper 22, Forests Department, Western Australia.

BATINI, F. E., SELKIRK, A. B., and HATCH, A. B. (1976). "Salt content of soil profiles in the Helena Catchment, W.A." Research Paper 23, Forests Department, Western Australia.

WARD, D. (1977). "Tree Removal and Salinity in Helena Catchment, Western Australia." Research Paper 29, Forests Department, Western Australia.

HATCH, A. B., and SHEA, S. R. (1977). "Water quality in Allan Road catchment, Western Australia." Research Paper 30, Forests Department, Western Australia.

HERBERT, E. J., SHEA, S. R., and HATCH, A. B. (1978). "Salt content of lateritic profiles in the Yarragil catchment, Western Australia." Research Paper 32, Forests Department, Western Australia.

BATINI, F. E., HATCH, A. B., and SELKIRK, A. B. (1977). "Variations in level and salinity of perched and semi-confined groundwater tables, Hutt and Wellbucket experimental catchments." Research Paper 33, Forests Department, Western Australia.

BATINI, F. E., and SELKIRK, A. B. (1978). "Salinity sampling in the Helena catchment, Western Australia." Research Paper 45, Forests Department, Western Australia.

26739/6/83—5M—L/3471 WILLIAM C BROWN, Government Printer, Western Australia