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tips&tools
NATURAL RESOURCE MANAGEMENT

Managing deep drainage

Deep drainage occurs when soil water moves beyond the reach of plant roots. This water is lost to pastures and trees, and joins local or regional ground water. It causes water tables to rise and, in some areas, can cause dryland salinity.

Key benefits

- Minimising deep drainage can help combat dryland salinity.
- Grazing management, including root depth of selected plants, pasture types used, planting of trees and knowledge of soil types can influence the water balance.

Tactics

Deep drainage is impossible to observe and very difficult to measure, making it the hardest element of the water cycle to understand and manage. The spread of dryland salinity across areas of southern Australia is strong evidence that deep drainage should be reduced using a combination of the following:

Maximise pasture water use – use as much rainfall as possible, leaving less for deep drainage, and more for increased pasture growth.

Increase tree and shrub numbers – use native species indigenous to your area, unless planting for commercial forestry, in areas of the farm likely to have high natural recharge due to porous/sandy subsoils, shallow soils over fractured rock or low productivity pastures. Revegetate riparian zones to increase water use, stabilise stream banks and restore habitat.

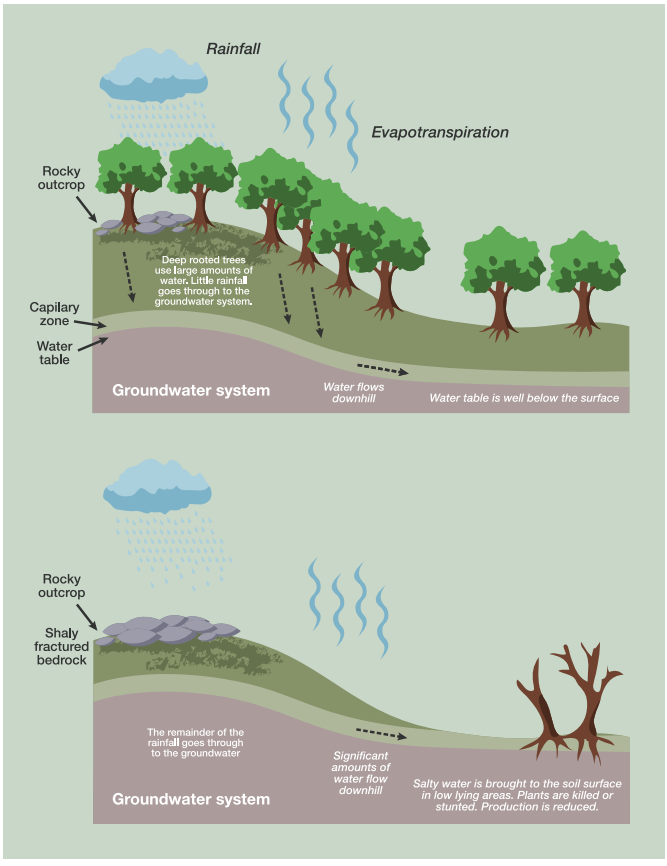
Manage pastures and grazing – use rotational grazing and fertiliser to maintain vigorous perennial grasses, and ensure good green leaf ground cover is maintained for as much of the year as possible.

Management considerations

Water balance factors that the grazing manager can control include:

Rooting depth

The soil's ability to hold water and the plant's root depth determines the amount of water held in the root zone. Rooting depth is greatest for trees and lucerne (>3m if the soil profile allows). Perennial pastures commonly have a root depth of 1.5–1.8m, while the root depth of annuals, such as annual ryegrass or sub clover, is



Rain can do one of four things when it hits the ground: it can run-off as surface flow, evaporate, soak into the soil (where it can be stored or used by plants) or leak into the groundwater system.

Groundwater recharge is the portion of rainfall that enters the groundwater. Recharge generally happens when soils are saturated (July–September).

usually only 0.6–1.0m. Total soil depth, and subsoil limitations (compaction, sodicity, acidity and salinity) often restrict root depth, so it is only partly under management control.

Pasture type

Annual pastures use the least water (similar to annual crops), produce the most deep drainage and make the largest contribution to dryland salinity.

Perennial pastures use more water and are therefore valuable for reducing deep drainage. Where summer rainfall dominates, perennial pastures can eliminate or reduce deep drainage. This is because rainfall and associated active pasture growth occurs when evaporation rates are high.

Perennial pastures in winter rainfall dominant areas cannot create a large enough soil water deficit over summer and autumn to store the rain that falls in winter/spring, when evapotranspiration is low. As a result, soils wet up and drain for long periods.

Much of the impact of perennials is due to their deeper root system, as well as an extended growing season and capacity to respond to summer rain. In general, actively growing introduced and native perennial grasses have a similar water balance, except for kikuyu and lucerne, which can be very deeply rooted. Most native grasses are capable of active summer growth and therefore are beneficial to managing deep drainage especially in the upper catchment.

Pasture/grazing management

Compared with differences in pasture type (annuals versus perennials), pasture and grazing management has a lesser (but positive) impact on the deep drainage and the water balance.

Rotational grazing increases water use (and reduces deep drainage) by allowing active plant growth between grazing periods. Although the effect on the water balance is not large (perhaps 10–20mm more water use per year), rotational grazing gives many production and pasture persistence benefits. Increased pasture production through fertiliser use can also have a small positive effect on water use (but a large positive effect on pasture production).

Trees

Plantation trees in high rainfall zones reduce the occurrence of both deep drainage and surface run-off. However, plantation forestry is not economic in many areas. So the impact of other tree-based solutions on the water balance must be considered.

Research from Meat & Livestock Australia's Sustainable Grazing Systems (SGS) program demonstrated that mature remnant trees in grazing systems can have a significant effect in southern, winter rainfall situations. A simulation model suggested that when annual pasture was replaced with a well managed, rotationally grazed phalaris based pasture, water use was increased by 50–100mm/year (average 86mm). For comparison, the measured water use by trees at one SGS site showed that about 14 mature trees per hectare, if equally spaced, could increase water use by about 50mm/yr.

Another option is commercial tree belts combined with pasture where it was found that ground water recharge ceased beneath the trees and 5m into the adjoining pasture, suggesting that tree belts need to be combined with perennial based pasture for effective deep drainage control. For example, if 10% of an annual pasture in a 750mm rainfall zone was planted to tree belts, ground water recharge would decline by around 30mm/ha/year. If the pasture between the trees was sown to a deep rooted perennial such as kikuyu or lucerne, recharge would decline a further 100mm/ha/year.

Soil type

Soil type determines what happens to rainwater that enters the system.

Deep, heavy clay soils can absorb a lot of water, allowing a perennial pasture to use up to 100mm/year more than on a sandy soil. Lighter, sandy soils not only store less water but have very high infiltration rates, resulting in little or no run-off, a large amount of deep drainage, and pasture plants drying off more quickly between rainfall events.

In southern Australia, common duplex soils tend to have a balance between drainage and run-off, whereas in the northern summer rainfall zone, these same soils produce run-off but very little deep drainage.

While little can be done about the impact of soil type on the water balance it is possible to improve soil structure and water holding capacity by increasing organic matter through improved pasture management.

Acknowledgments

PROGRAZE™ and PROGRAZE Update Course notes – segment 'Production, profit and sustainability'

Kathy Junor, technical editor

Further information

This *Tips & Tools* is one in a series on grazing management. For further reading, copies of *Towards Sustainable Grazing* can be purchased from MLA. To order MLA publications visit www.mla.com.au, phone 1800 675 717, or email publications@mla.com.au

For further assistance contact your local pasture or livestock advisor.

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