PRACTICALITIES

The impact of trees on groundwater levels in a discharge area of the Merredin catchment

by Dawit Berhane

MERREDIN townsite is threatened by rising saline groundwaters. In 1986, a hydrogeological investigation was carried out which involved establishing a piezometric monitoring network. The bores were located along a transect stretching from the main recharge area (east of the sandplain ridge near the Narembeen road), through the townsite of Merredin, to the discharge area near Hines Hill in the west.

One of the main recommendations of this study was to plant trees in recharge and discharge areas at strategic locations. A high priority area recommended for revegetation was located immediately downslope of the town, in a salt-affected area. The Shire and LCDC organised a land swap to gain access to the required land. The trees were to provide recharge control and allowed to maintain sufficient cover to enable maximum water use.

In 1991, 70 ha of heavy-textured alluvial soils in a broad floodplain were planted with a range of eucalypt species over shallow (<2m) saline groundwater. The work was funded by 'One Billion Trees'. The site was chosen at a point where specific hydrogeologic conditions (basement ridge, narrow valley floor and permeable sediments) might allow watertable control to have maximum impact on the flow system.

Water levels prior to planting, 1985-91

There are two main aquifer systems in the vicinity of the revegetated area. In the shallower system, the Total Dissolved Solids (TDS) ranges from 15,000 to 25,000 mg/l, while the salinity of the deeper aquifer system is usually >35,000 mg/l. The net rise in water levels ranged from 0.2m in the lower parts of the catchment to 0.3-0.4m in the main recharge area. Prior to planting, part of the revegetated area was affected by saline groundwater discharge.

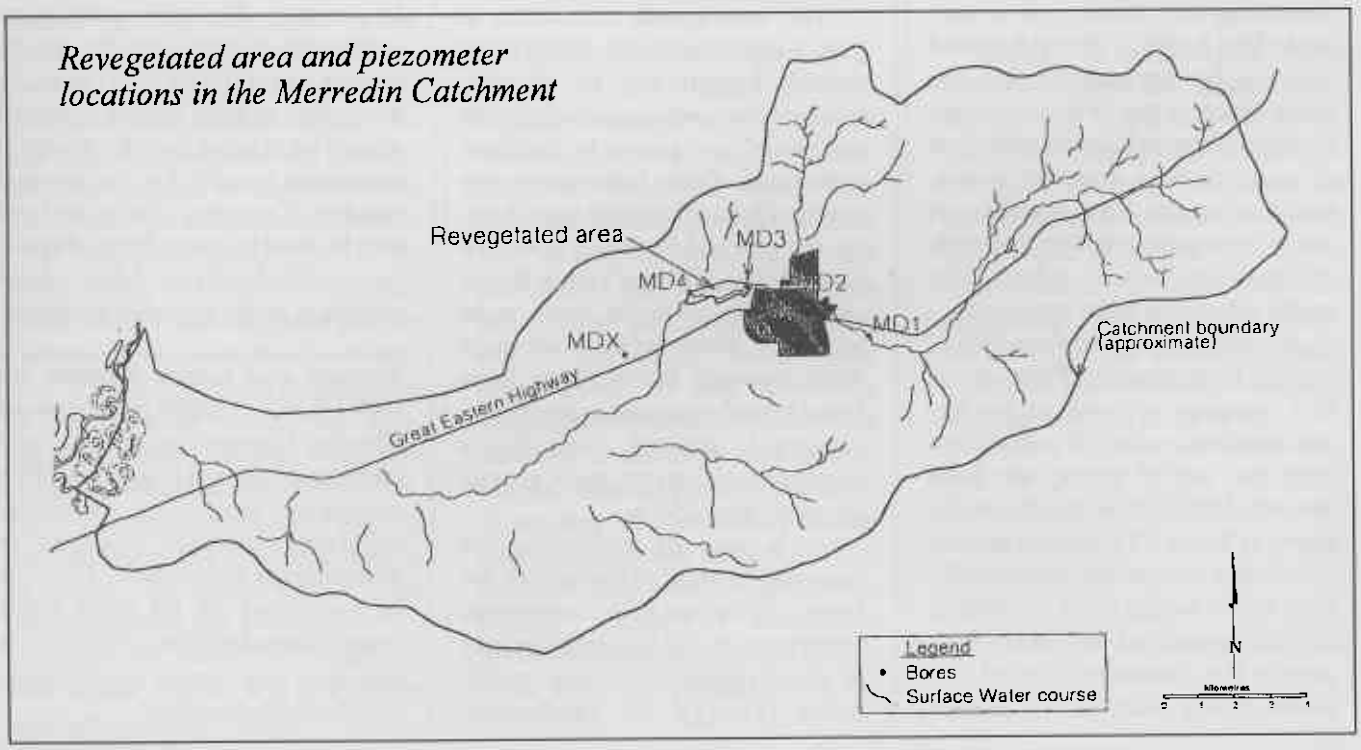
Water level change in the revegetated area, 1991-94

Two years after the trees were planted the water levels began to decline throughout the planted area (see graphs). During this period the trees started to establish and started a transition from a rising to a declining trend.

Water level change, 1994 - current

It is clear that this area at risk from salinity, downstream of Merredin townsite, has been successfully

Revegetated area and piezometer locations in the Merredin Catchment



Planting site from the air (photo: D. Saunders).

treated. The area continues to show improvement. The groundwater levels measured in Nov 1998 were about 2.5m lower than predicted from the pre-planting trend. The piezometric level is lower than the so-called 'critical water depth' below which the role of capillary action is insignificant.

It is probable that this decline in water table is due to a reduction in on-site recharge, rather than direct withdrawal from the watertable by trees. The extreme groundwater salinity probably prohibits direct use of the water by tree roots.

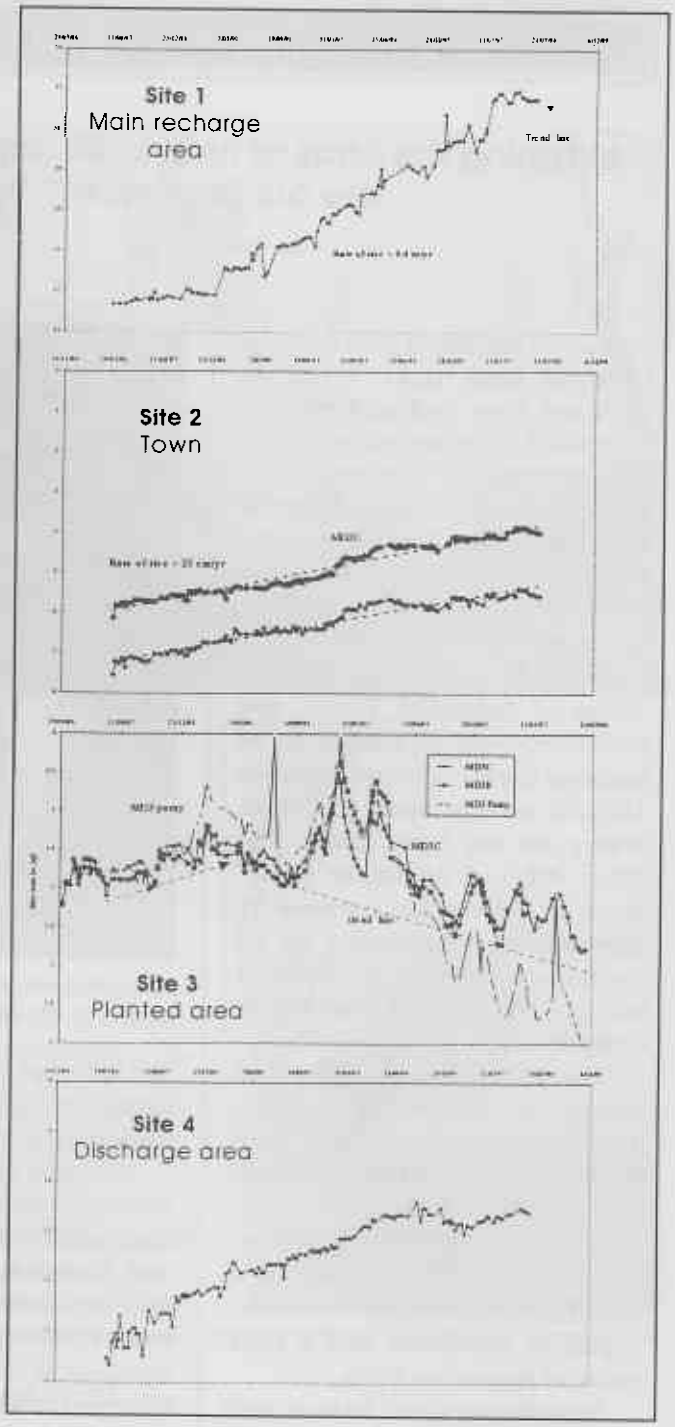
Discussion and conclusions

The Merredin project is a success case study in revegetation of a discharge area to prevent the surface expression of dryland salinity. However, the interactions between soil-water-plant are complex and there are a number of issues that require further monitoring and investigation.

One of the points of interest is whether the trees have a significant effect on the watertable more than 10-30m from the planted area. In many wheatbelt sites, this has not clearly been shown, but at Merredin, in a bore 3 km downslope of the revegetated area, the piezometric level increased as expected up to 1995. For the next three years, the trend reversed. At this stage, changes in inputs (rain) and outputs cannot explain the cause of this reversal - perhaps it is the effect of the trees?

Therefore, experience of the last decade has shown that tree planting in the area west of the town has resulted in a decline in watertables. However, to have any effect on the rising saline groundwater in the town itself, the trees need to be planted to the east - upslope. Extrapolating from current trends, the water table will come within 1m of the surface in eastern Merredin in 10 years, in the central business area in 10-12 years and in western Merredin by 12 years.

In order to have a significant impact on the watertable, a large proportion of the catchment, including the main recharge area, needs to be planted. Unlike the site of the



1991 planting, this land is still productive farmland, and so this option may not be economically feasible to landholders. Therefore, we may have to try to achieve maximum reduction in groundwater levels in the Merredin catchment by integrating both biological and engineering management options.

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More technical detail can be found in: George RJ & Frantom, PWC. 1990. Preliminary groundwater and salinity investigations in the eastern wheatbelt, 2 Merredin. AgWA Tech Rep 89. AND George et al 1998. Interactions between trees and groundwater in recharge and discharge areas - a survey of Western Australian sites. AgWA.