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LMD CMA FACT SHEET No 32
Cropping, Soil and Recharge Monitoring Project
Deep Drainage Component.

Introduction

Groundwater recharge occurs when soil water drains through the soil profile and into a water table or aquifer. Under native vegetation, recharge rates were <1mm per year due to the rooting depth of native vegetation (10m) (Cook and Walker 1989). Native vegetation is able to intercept and use most of the soil water before it has a chance to drain to an aquifer or water table. With the introduction of clearing and cropping, native vegetation was replaced by annual crops and pastures, which have shallow rooting depths (less than 2m).

Cropping practices have traditionally centred on the practice of long fallows, which increases stored soil water. This increase in stored soil water has the potential to lead to soil water draining beyond the root zone of annual crops and pastures and is referred to as deep drainage. Once deep drainage reaches a water table or aquifer, it has the potential to cause water table rising (dryland salinity) and/or an increase in the hydraulic gradient causing saline groundwater to flow towards the Murray River, reducing water quality. A major catchment target for the Lower Murray Darling Catchment Management Authority (LMDCMA) is to show that between 2002 and 2012 dryland cropping does not increase the risk of river and land salinity.

Background Information

Within the LMD CMA project - *'Cropping, Soil and Recharge Monitoring'*, there is a component which focuses on deep drainage. The collaborating agencies involved with the project are the LMD CMA, NSW DPI[1] and DNR[2]. The aim of the project is to monitor progress made towards achieving the salinity target and to report the status of the risk of salinity in the CMA area to the Board, to landholders and to the community.

A network of 87 neutron probe sites covering 39 properties has been established across the LMD catchment area, with 78 sites on cropping land and 9 sites in the rangeland. The network uses sites established by previous projects undertaken by the SWLMG[3] and MSF[4] Inc., as well as 18 new sites established by the LMD CMA in 2005 (Fig 1).

The monitoring sites were established in paddocks with varying cropping histories, including time since clearing and range of crops grown. Of the 18 new sites established, 9 sites are located in the area west of the Darling/Anabranch in the rangelands for the purpose of comparing soil water with cropping sites. No sites were previously established in this area.

The sites have been grouped according to vegetation communities that occurred prior to clearing and cultivation because it was suggested that vegetation type may characterise soil to depth and these could relate to deep drainage. The sites form a network that is assessed on an annual basis to monitor long term trends in stored soil water. The majority of sites located in cropping paddocks provide information on soil water conditions following clearing and cultivation. Sites located in the rangelands provide an opportunity to undertake comparisons of stored water and soil chloride between cleared and natural vegetation.

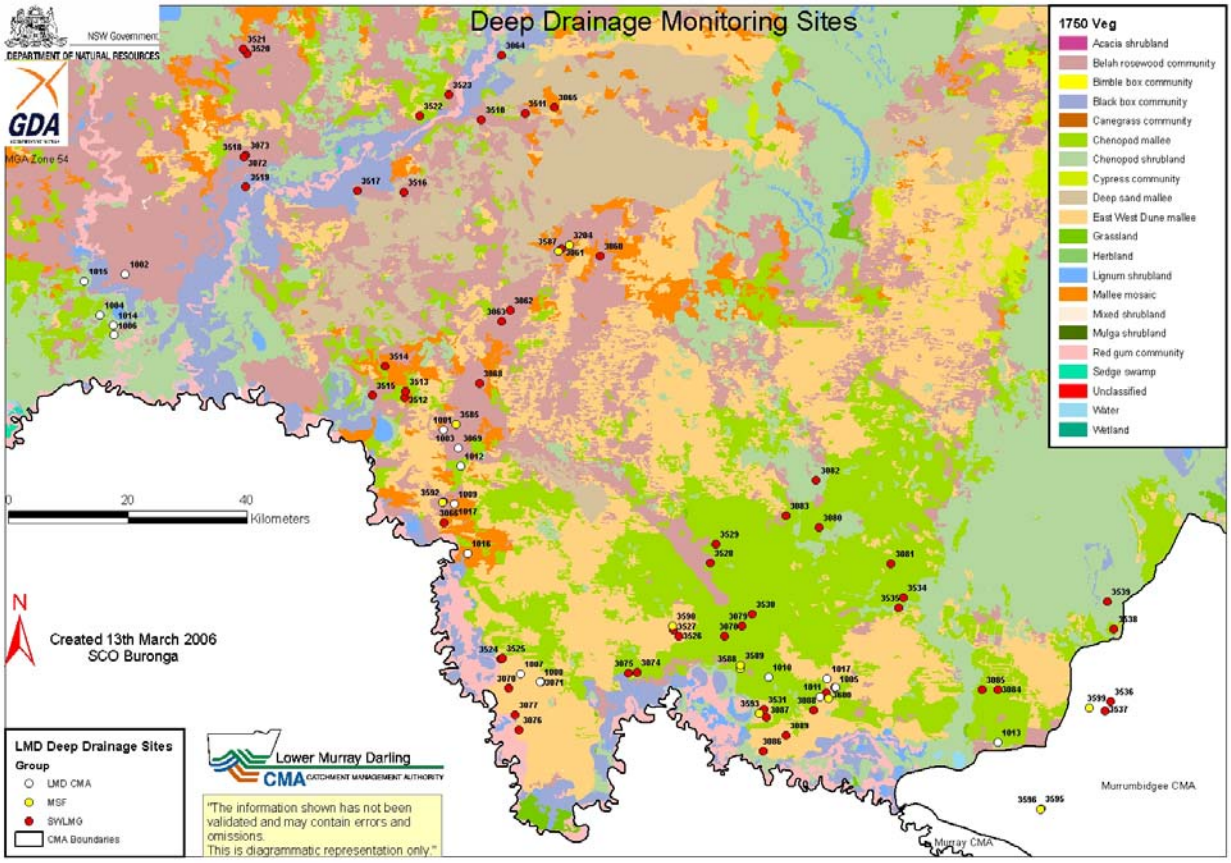

Figure 1 - Deep Drainage sites across the Lower Murray Darling Catchment.

Figure 2 - Measuring stored soil water using a neutron probe.

Method

Stored soil water at each site is measured with a neutron probe[5] down to a depth of 6 metres in April of each year prior to winter sowing (Fig 2). Stored soil water and soil chloride data are used to better understand the deep drainage process in relation to land management and climate. Information for each site can be used to indicate levels of stored soil moisture in the profile and the risk of that site contributing to deep drainage.

Results

To date, the results show that during the period 1997 to 2005, there has been a decrease in the risk of deep drainage occurring on dryland cropping paddocks. The lower risk of deep drainage is believed to be as a result of below average rainfall that has been experienced across the catchment between 1997 and 2005 and not due to a shift in land management practices.

With the introduction of cropping, the deep drainage rate increased by 100 fold to 8mm/year, which demonstrates the impact that a change in land use from native vegetation to annual crops and pastures can have on deep drainage. Prior to clearing and cropping, the deep drainage rate under native vegetation was <1mm per year.

Conclusion – Benefits of the Project from a Land Management Perspective

From the information gathered by this project and other related cropping projects, the LMD CMA, NSW DPI and MSF Inc are able to encourage landholders to improve their land management/cropping practices, which in turn will improve water use efficiency by crops, based on information that has been collected from the various cropping projects being conducted across the catchment. The results from the cropping projects will help landholders in making informed decisions about cropping/land management practices on their properties.

The ongoing support of the 36 landholders participating in this work is acknowledged and appreciated.

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Lower Murray Darling CMA

Respect for our communities & the environment

NSW Government
DEPARTMENT OF NATURAL RESOURCES

NSW DEPARTMENT OF PRIMARY INDUSTRIES

MALLEE SUSTAINABLE FARMING INC. SA NSW VIC

Key References:

Cook, PG & Walker, GR (1989) *Groundwater recharge in south western New South Wales: A report on results of a drilling project carried out at field sites near Euston and Balranald. Report. No.9 Centre for Research in Groundwater Processes*, CSIRO, Adelaide. 31 pp

Murphy, SR, Leys JF and Biesaga, KM (2006) Cropping, soils and recharge project – deep drainage. New South Wales Department of Primary Industries, Orange.

NSW DPI[1] – NSW Department of Primary Industries

DNR[2] – Department of Natural Resources

SWLMG[3] – South West Land Management Group

MSF Inc[4] – Mallee Sustainable Farming Inc

Neutron Probe[5] - The neutron probe was first developed in the 1950's and since then has gained widespread acceptance as an efficient and reliable technique of measuring soil moisture is the field. The instrument consists of two main components:

- A probe, which is lowered into an access tube that sits vertically in the ground. The probe contains a source of fast neutrons (usually helium nuclei, which emit alpha particles) and a detector of slow neutrons.
- A scalar or ratemeter to monitor the flux of slow neutrons scattered by the soil.

The fast neutrons are emitted radially into the soil, where they encounter and collide with various atomic nuclei. The amount of soil moisture is measured by the rate of outgoing fast neutrons to the reflected slow neutrons. The neutrons interact with water molecules which are reflected back at a slower rate, whilst the soil particles are absorbed and not reflected back to the probe. Therefore, the higher the count of reflected neutrons, the wetter the soil.

NOTE - This document was current at time of production; please check latest details with LMD CMA.