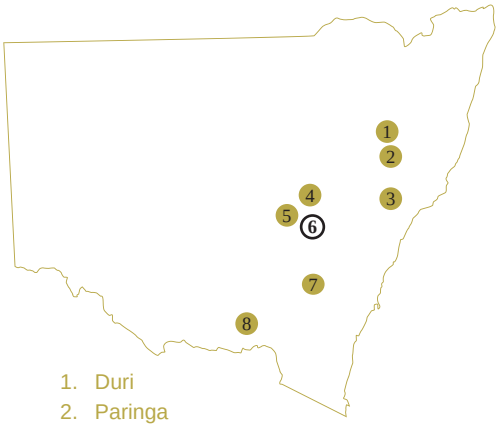
GUMBLE KEY SITE

WHAT ARE WE ASKING?

- Where does the salt and water come from, and where is it going?
- How do we account for water at a paddock scale and how does this relate to the catchment water balance?
- Are water and salinity models predicting results that are consistent with catchment observations?

WHY THE GUMBLE KEY SITE?

It is commonly accepted that planting perennial species will result in improved outcomes for water and salt management. Research at the Gumble Key Site suggests that an understanding of the hydrological processes is needed before investment in this type of intervention takes place.



1. Duri
2. Paringa
3. Hunter
4. Sloanes Creek
5. Baldry
6. **Gumble**
7. Boorowa
8. Livingstone Creek

The research demonstrates that investment based on sound understanding is necessary for improved catchment outcomes.

In this first order catchment it was expected that replacing annual crops on the mid slopes with perennial species would reduce the amount of recharge and consequently, the salt mobilised from the scald and entering the Brays Flat Creek.

Investigations have confirmed the scald is a result of rising groundwater. However, the origin of the water is outside the surface water catchment of Brays Flat Creek. This suggests it is an intermediate groundwater flow system and not a local system as would be commonly assumed in this area.

Replacing the annuals with perennials within the Brays Flat catchment would not result in a decrease in the groundwater discharge at the site and would have no effect on the size of the scald. In fact, it may have had a negative effect by reducing the volume of fresh dilution flows that currently minimise the impact of the scald.

THE GUMBLE SITE

Gumble is a first order catchment of approximately 740 ha located 20 km west of Manildra. The upper parts of the catchment form the boundary between the Lachlan and Macquarie catchments.

The Gumble Key Site covers the upper reaches of Brays Flat Creek and has a significant saline scald of approximately 10 ha in the lower part of the catchment. The site is typical of the upland dryland catchments in central west NSW.

The site was developed as part of NSW Government long-term approach to natural resource management and specifically to understand the role of landuse in mitigating dryland salinity. It now receives support under the National Action Plan for Salinity and Water Quality.

It was initiated in March 2004 by NSW Agriculture and funded by the NSW Salinity Strategy to develop appropriate farming systems for these landscapes. In 2004 the Gumble Key Site formed part of a CRC Salinity research project studying the integration of trees and perennial pastures. It is the main NSW research

Water makes for a happy hydrologist – Justin Hughes at the Gumble site after a significant rainfall event in 2004.

WHAT IS KEY SITES?

KEY SITES is generating new knowledge in priority dryland salinity areas of NSW.

It is a research project with eight sites across upland fractured rock aquifers in local and intermediate groundwater flow systems.

These areas have been identified as being major salinity sources for NSW.

Each site addresses a different and locally relevant gap in salinity knowledge. The sites are not simply eight replicates of a single methodology.

The impact of all major land uses is being investigated, including: *annual cropping, improved annual and perennial pasture, native pasture, native forestry, planted forestry and rehabilitated open cut coal mine.*

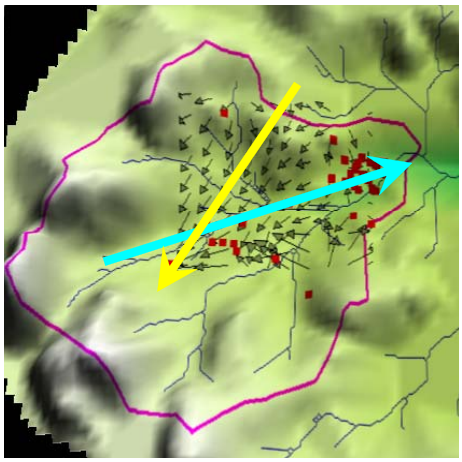
NSW DEPARTMENT OF
PRIMARY INDUSTRIES

site for the CRC Salinity Sustainable Grazing on Saline Lands project. In 2005 it became a part of NSW DPI Key Sites project.

Four different farmers own parts of this catchment, providing an opportunity to monitor the effects different management techniques and farming systems have on groundwater hydrology. The agricultural enterprises include lucerne, native/naturalised pasture, phalaris pastures and cropping. The catchment incorporates a range of tree-based systems including intact native vegetation stands, a treelot and treebelts.

An inspection of the site is likely to raise the common theory of salinity – that clearing native vegetation from the mid slopes has resulted in unused water accumulating in the low part of the catchment and causing the scald. The accepted approach to remediate this is to replant the mid slopes above the scald with perennial vegetation and trees.

WHAT HAS THE RESEARCH FOUND?



Conceptual model of the Gumble Key Site: The blue arrow indicates the direction of surface flow in the Gumble catchment, while the yellow arrow indicates the broad direction of the groundwater flow – the small arrows indicate groundwater flow direction calculated from individual piezometers represented by the red dots.

In the Gumble catchment the saline scald has been caused at least in part by a change in the groundwater discharge rather than a change in the groundwater recharge. Field investigations have confirmed the landholders' observations that an incised stream channel once existed at the site of the current saline scald and numerical modelling has shown that the infilling of the incised stream channel has resulted in a higher water table and scalding.

Numerical modelling has also shown that the change in land use within the watershed boundary from the original woody perennials to the current predominately annual agricultural land use has not contributed to the formation of the scald. Field water balance measurements and unsaturated zone chloride profiles confirm that the areas of the catchment under agricultural land use are not the source of the groundwater recharge. Analysis of groundwater flow indicates that the main recharge zone for the catchment lies outside the watershed boundary. This needs to be confirmed by further drilling. If this is the case, some form of recharge control in this area may be warranted.

Numerical modelling suggests that the rocky ridges covered by remnant native vegetation are a significant source of the groundwater recharge. A field monitoring campaign is currently under way to investigate the water balance of these areas and confirm this modelling.

WHERE TO FROM HERE?

At this stage it is unknown if the mechanism behind the formation of this saline scald is unique to this catchment or if it is further widespread.

The implication of this investigation is that the current salinity mitigation strategy of increasing perenniality in the landscape to minimise recharge is not going to alleviate the salinity problems in all catchments.

Given the predominantly dry conditions during the measurement period, our understanding of the processes governing the hydrology of the site will benefit from further monitoring during wetter conditions.

OUTCOMES AND OUTPUTS

- Collaborative and more effective research by combining 4 research projects in the same sub-catchment
- Increased understanding of the salt mobilisation processes
- The project challenges traditional ideas about salinity management, including that a saline scald will be ameliorated by upslope planting of perennials
- The scald was not caused by removal of perennials within the watershed but by infilling of a natural creek line
- The research challenges some of the assumptions behind the Australian Groundwater Flow Systems framework
- At least six collaborative field days have been held with SGSL and CRC Salinity
- Papers delivered at the Murray Darling Basin Groundwater workshop, September 2006
- PhD candidate Justin Hughes commences studies of the mechanisms of salt movement
- Poster presented at the American Geophysical Union Fall meeting, December 2006
- Papers delivered at a CRC Salinity workshop in Wagga Wagga during March 2007
- Several media releases

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Research at the Gumble Key Site has been made possible because of the support of local farmers who allow researchers access to their land; and the collaboration of many partners including Catchment Management Authorities; Department of Natural Resources, Charles Sturt University; CRC for Plant-based Management of Dryland Salinity; and local landcare groups.

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