COOPERATIVE RESEARCH CENTRE FOR
CATCHMENT HYDROLOGY

Project 2.3
Predicting the Effects of Land Use Changes on Catchment Water Yield and Stream Salinity

Project Objectives

Agricultural cropping has led to land and water salinisation in many areas; one suggested remediation strategy is to convert some areas to plantation forestry and perennial species. Our objective is to predict the regional scale impacts of such land use changes on mean annual and seasonal catchment water yield, groundwater recharge, and stream salinity, and thereby help to optimise site selection.

Expected Outcomes

- Increased understanding of hydrologic processes operating at catchment scales
- Enhanced capacity to predict the impacts of land use changes on catchment water yield
- Increased capacity to estimate groundwater recharge under different land use and climate conditions
- Enhanced capacity to parameterise landscape water storage and permeability using current and new forms of land resource data
- Improved confidence in the predicted responses of catchments under conditions of changed land use and/or climate

Target problems

The massive land use change in Australia associated with agricultural development has caused an imbalance in the hydrological regime of catchments over large areas. This imbalance has resulted in increased land and water salinisation in many areas. Tree plantations and conversion of pastures from annual to perennial species have been considered as management options for salinity control within the Murray-Darling Basin Commission Salinity and Drainage Strategy and are llikely major future land use changes in southern Australia. According to 'Forest Plantations 2020 Vision', a major initiative of the Commonwealth and State governments, the area of tree plantations by the year 2020 will treble. The economic and environmental benefits that could accrue from this development include timber production, salinity control, carbon credits, riparian zones, and biodiversity.

Careful site selection for tree plantations is necessary to ensure that they can provide the greatest benefit to the environment. One of largest determinants of suitability of a site is rainfall, as it affects the commercial viability of plantings, the change in water yield, and is strongly related to the change in salt load. Pasture or cropping systems will use much less water than trees in higher rainfall zones, whereas for the lower rainfall zones, some perennial systems may use approximately the same amount of water as trees. There is some evidence that changing from annual pastures to perennial pastures in these lower rainfall areas can reduce catchment water yield and groundwater recharge. If implemented, these government initiatives will have significant impacts on catchment water yield and salinity.

Research Plan

This project will provide understanding of the water balance-vegetation relationships through the different parts of the landscape, and examine the likely trade-offs between economic viability and environmental benefits. We plan to investigate the response of mean annual water yield to

The Cooperative Research Centre for Catchment Hydrology is a cooperative venture formed under the Commonwealth CRC Program between:

- Brisbane City Council
- Bureau of Meteorology
- CSIRO Land and Water
- Department of Land and Water Conservation, NSW
- Department of Natural Resources, Qld
- Department of Natural Resources and Environment, Vic
- Goulburn-Murray Water
- Griffith University
- Melbourne Water
- Monash University
- Murray-Darling Basin Commission
- Southern Rural Water
- The University of Melbourne
- Wimmera Mallee Water

Associates:

- Hydro-Electric Corporation, Tas
- SA Water
- State Forests of NSW

vegetation changes at catchment scale and develop relationships for partitioning of rainfall into surface runoff and groundwater recharge. The project will also study the effect of water storage and permeability on water balance vegetation relationships. We aim to develop the predictive capacity for assessing the impacts of land use changes on catchment scale water yield and stream salinity, as outlined in the following research tasks.

Key Research Tasks - 2000-2003

- Development of water balance models for predicting the impact of vegetation and other land use changes on mean annual catchment water yield
- Estimating the water storage and permeability at catchment scale
- Partitioning of non-transpired water into groundwater recharge and surface runoff, including that under pasture
- Extension of the simple water balance model to account for spatial and temporal variability in catchment properties and climate
- Prediction of the effect of land use changes on saturation areas and runoff generation

Linkages

This project is closely linked to the following CRC for Catchment Hydrology projects and an associated project:

- Project 1.1 Development of a catchment modelling toolkit
- Project 1.2 Scaling procedures to support process-based modelling at large scales
- Project 2.2 Managing pollutant delivery in dryland upland catchments
- Project 3.1 Integration of water balance, climatic and economic models
- Catchment Characterisation Project funded by Murray Darling Basin Commission

Staff Involved

Project Leader Dr Lu Zhang (CSIRO Land and Water)

Researchers
Dr Neil McKenzie (CSIRO Land and Water)
Dr Richard Silberstein (CSIRO Land and Water)
Dr Rob Vertessy (CSIRO Land and Water)
Andrew Bradford (CSIRO Land and Water)
Dr Mark Littleboy (Department of Land and Water Conservation, NSW)
Dr Hamish Cresswell (CSIRO Land and Water)
David Jacquier (CSIRO Land and Water)
Warrick Dawes (CSIRO Land and Water)
Dr. Glen Walker (CSIRO Land and Water)
Brendan Christy (Department of Natural Resources and Environment, Vic)
Dr Craig Beverly (Department of Natural Resources and Environment, Vic)
Dr Jim Morris (Department of Natural Resources and Environment, Vic)
Dr Pat Lane (Department of Natural Resources and Environment, Vic)
Mark Hocking (Department of Natural Resources and Environment, Vic)

Participating Organisations

CSIRO Land and Water • Department of Land and Water Conservation, NSW • Department of Natural Resources and Environment, Vic • Goulburn-Murray Water • The University of Melbourne

For Further Information: Dr. Lu Zhang Cooperative Research Centre for Catchment Hydrology
CSIRO Land and Water GPO Box 1666, Canberra, ACT 2601
Tel: 02 6246 5802 • Fax: 02 6246 5800 • Email: lu.zhang@cbr.clw.csiro.au

www.catchment.crc.org.au/landuseimpacts