

Research Projects

Research Project
Information from
CSIRO
Land and Water

Sheet No. 22
October 2000



SWAGMAN[®] Series

CSIRO Land and Water is working with farmers and the irrigation industry to safeguard the environmental sustainability of Australia's irrigation sector and to address the problems caused by inefficient use of water, waterlogging, salinisation from rising groundwaters and uncertainty of the supply.

Give the pressure to improve the way water resources are being managed, the irrigation sector needs to put into practice concepts such as net recharge management, optimal irrigation intensities and ground water management zones.

Changes to water allocation and pricing are another factor that can limit the viability of irrigation areas if inappropriately or unfairly managed.

Effective management of natural resources requires a holistic approach, which incorporates a thorough understanding of the biological, physical, social and economic dimensions.

A suite of models created by CSIRO Land and Water has addressed this complexity by integrating the skills of hydrologists, economists, engineers, soil scientists and plant biologists.



CSIRO LAND and WATER



The SWAGMAN series of models provides the irrigation sector with tools that allow irrigators, resource managers and the community to make informed decisions about managing within the long-term limits of resource availability.

The models are simple and adaptable enough to capture and represent the essential elements of an irrigated paddock, farm or region. At the same time they also have the capacity to respond to changes in resources, environmental policies and financial information at a national and international level.

Irrigators, technical advisers and policy formulators can all benefit by improving their understanding of a complex system and exploring new options. This information can be used to solve the real life problems of maximising profits within resource constraints.

While the components of the SWAGMAN suite of models are interdependent, there is a consistent approach throughout. Each model is self-contained and designed to require minimum input of data, although some build on other models and hence summarise information that may be contained in them.

SWAGMAN Whatif

Taking Australia one step closer to restoring the balance of land and water resources was the impetus for the creation of a computer-based education package. SWAGMAN Whatif was designed to improve the understanding of the interaction between climate, soil types, water table depth, irrigation management and water salinity. It shows the consequences of irrigation practices on groundwater levels, rates of soil salinisation and crop yields.

SWAGMAN Destiny

This crop simulation model simulates the detailed interaction of the climate, soil, crop, salt, water and groundwater at a point in a paddock. It divides the soil profile into a number of layers to determine salt and water changes over time. Using this information, it is possible to understand the role of plants in



changing water content and movement of water to and from the water table. This model has been rigorously tested using lysimeter and field data. It has been applied to a range of situations in Australia and across the world.

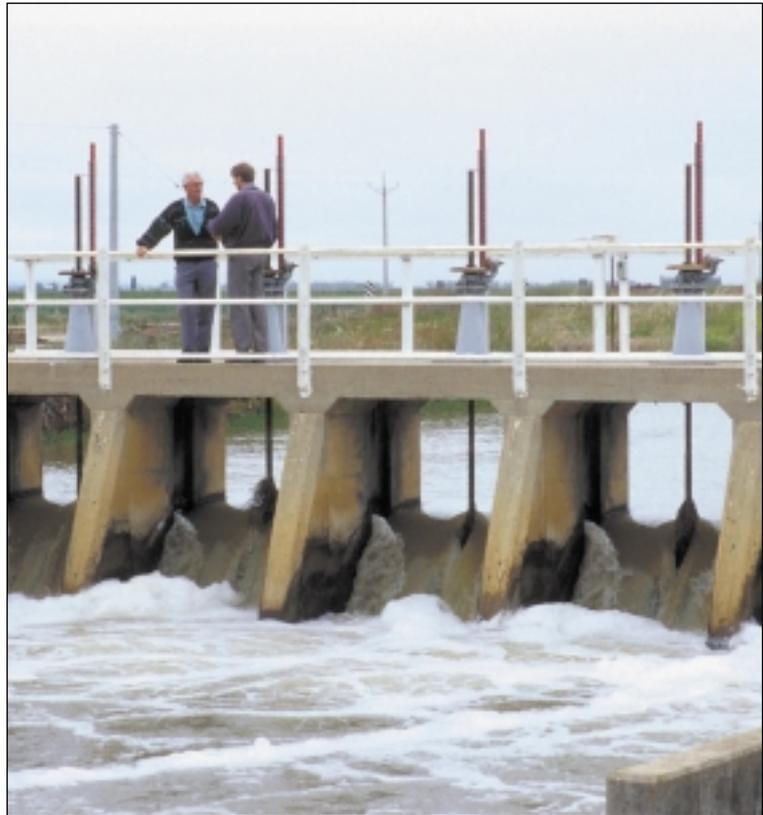
SWAGMAN Farm

Efficient management of irrigation areas can only be achieved with action at the farm level. Positive changes on farm should ensure the irrigation areas are environmentally sustainable and economically viable. SWAGMAN Farm determines the optimum mix of crops needed to make the best use of water, climate and groundwater conditions. It ensures a balance between sustainability indicators such as water table rise and soil salinity, and economically viable outcomes.



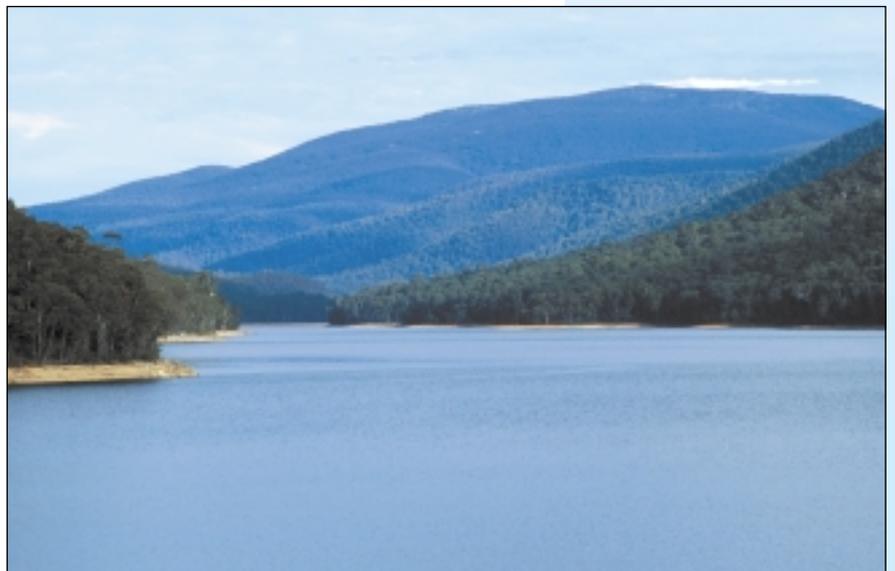
SWAGMAN Options

This model is used to investigate the interaction of a number of paddocks in an irrigation area to determine water use and cropping policies. Its outcomes are valuable in determining optimum policy decisions, including the restriction of areas under certain crops such as rice. The model is designed for policy formulators - for instance irrigation area managers and regulators - who use the information to ensure the future environmental sustainability of irrigation areas. SWAGMAN Options can help demonstrate how certain paddocks with high water use affect the surrounding region.



SWAGSIM

Management of shallow water table conditions in irrigation areas offers a challenge to hydrologists. They must integrate the water moving through the unsaturated zone from rain and irrigation with the dynamics of groundwater flow in aquifers. SWAGSIM is a spatially distributed groundwater model that is being used by agencies such as the Murray-Darling Basin Commission to investigate the connection between irrigation water use and regional groundwater.





Future developments

SWAGMAN Futures

Effective policies aimed at the sustainability and viability of irrigation areas demand the integration of hydrology with economics on a regional scale. SWAGMAN Futures was created to investigate potential changes in cropping patterns, drainage management, water trading and water reforms - predicting how these will impact on the future of the irrigation area. It was originally developed for the Coleambally Irrigation Area and there are plans to apply this model in other irrigation areas.

SWAGMAN FarmEd

The irrigation sector needs to attract bright graduates equipped with the skills to move into influential positions in the industry. SWAGMAN Farm Ed is being developed by information technology students at Charles Sturt University with the aim of providing a means of training agricultural science students in the complex and inter-related issues of irrigated agriculture. When completed, it will form an important part of education modules in irrigation science and will complement SWAGMAN Whatif.

SWAGMAN Basin

In response to a need to focus on the bigger picture for irrigation, CSIRO Land and Water scientists are working on a supply and use model for an entire river basin. This will represent the variation of flows in the rivers and its impacts on the irrigation areas. It will provide a means to translate the effects of farm-scale management practices to economic and environmental issues at the basin level.

CSIRO Land and Water researchers will continue to work on the SWAGMAN series, fine tuning the current models and extending the suite to include other situations. While these models indicate what could happen under different scenarios, they do not dictate solutions. The decisions are in the hands of regulators, managers and farmers. What these models do provide is the decision-support data needed to make informed choices.

Industry participation

CSIRO Land and Water researchers have worked closely with the farming community and irrigation management companies to ensure the models developed are accurate and relevant. On-going relationships with the Murray-Darling Basin Commission, Coleambally Irrigation, Murray Irrigation, Murrumbidgee Irrigation and Goulburn Murray Water have allowed these models to be tested in real life situations.



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