NATIONAL PROGRAM FOR Sustainable Irrigation

Fact Sheet

Understanding evaporation

Update on Research projects ***May 2006***

Right now, it is very difficult to accurately measure the water losses from evaporation on farm dams but a recent scoping study funded by the National Program for Sustainable Irrigation estimated the loss is as high as 7,000 gigalitres per year from Queensland's section of the Murray-Darling Basin alone. Given that water extracted from our waterways for all purposes is around 20,000 gigalitres per annum in the whole of Australia, the potential savings from addressing evaporation losses are obviously worth pursuing.

Over the past few years there has been a number of investigations into effective evaporation reduction systems. According to a Scoping Study commissioned by NPSI in 2005, such systems need to:

- reduce the amount of energy available to cause evaporation,
- restrict the boundary layer at the water surface, or
- modify the wind and humidity above the water surface.

Current evaporation programs include chemical monolayers, floating vegetation, assorted floating modular devices, air-tight surface covers, and shade-cloth. Further information on the findings from this scoping study can be accessed from the Knowledge Base on the NPSI website 'Scoping Study: Reduction of Evaporation from Farm Dams' Dr. Peter J. Watts; www.npsi.gov.au

Often the adoption of evaporation reduction systems is hindered because the various methods are deemed uneconomical. Any cost/benefit analyses that are done however are generally based on poor evaporation estimates. Predicting evaporation is difficult, and the complexities have not been well defined. For example, evaporation at night-time has been observed to be appreciable in farm dams in Western Australia due to local atmospheric instability near the surface (Hipsey et al., 2004). It is unclear how consistent this is in other climatic zones.

Similarly, the role of wind sheltering on evaporation can be significant (Hipsey et al., 2003; Condie and Webster, 1995). These factors are rarely accounted for in any quantitative assessment. There is therefore a need for improved estimates for evaporation and NPSI has commissioned two new research projects. These are:

A 'Ready Reckoner' to determine under what circumstances an evaporation reduction system would be economical

Project objectives

1. The development of a ready reckoner to determine under what circumstances an evaporation reduction system would be economical.
2. The ready reckoner is able to be utilised at the range of farm dam scales found in Australia's agriculture and takes into account Australia's different climatic zones, variability of climate and regolith.

The 'Ready Reckoner' is a model which performs a simple, site-specific economic assessment of the viability of evaporation mitigation systems. The user enters appropriate data to customise the 'Ready Reckoner' to their site. The 'Ready Reckoner' returns the volume of water saved (in ML) and the cost of the evaporation mitigation system used to save this water ($/ML/year).

The 'Ready Reckoner' is being developed as a Microsoft Excel™ spreadsheet for ease of use and portability. A reference manual is being developed to assist the user in the operation of the 'Ready Reckoner'.

The Principal Investigator is: Eric Schmidt, Director, National Centre for Engineering Agriculture

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The significance of night-time evaporation from Irrigation Farm Dams

Project objectives

1. To ascertain the importance of night-time evaporation from farm dams across a range of climatic zones.
2. To quantify the day-time vs. night-time losses in the different climatic zones and for different seasons.
3. To examine and quantify the sensitivity of evaporation predictions to humidity, temperature and atmospheric stability, dam morphometry, wind, wind-sheltering and cloud cover.
4. To assess the robustness of the current evaporation prediction framework outlined in the scoping study, and provide an improved framework for engineers to estimate evaporation given routine meteorological and morphological information.

The proposed project has the potential to deliver significant gains in understanding the evaporation process specific to rural dams. In particular, the project will provide a quantitative comparison of day- and night-time evaporation and how this varies across climatic zones.

Additionally, its sensitivity to various factors such as cloud cover, wind and wind-sheltering, and the ambient humidity and air temperature will be quantitatively examined. This understanding will be born out of an in-depth engineering analysis that accounts for many of the complicating factors that are typically overlooked such as accounting for the effects of non-neutral atmospheric conditions, dynamic coupling with a waterbody stratification model, and inclusion of low-wind and wind-sheltering algorithms.

The project will produce:

1. A detailed PDF report and an executive summary document intended for wide distribution.
2. A fast, easy-to-use, model and visualisation software package that could be used by competent engineers for on-the-ground evaporation assessments.

The Principal Investigator is: Mr Matthew Hipsey Senior Research Engineer, Centre for Water Research, University of Western Australia

The National Program for Sustainable Irrigation defines and commissions research that tackles critical emerging environmental management issues driving the development and adoption of sustainable irrigation practices in Australian agriculture. The $10m Program oversees 25 research projects across the country, working closely with industry to generate long-term economic, environmental and social benefits through better irrigation management in Australia. The project has 14 funding partners spanning commodity groups, water suppliers and Government. The Program is managed on behalf of the partners by Land & Water Australia.

For more information contact the Program Coordinator, Murray Chapman 03 5763 3214, rplan@benalla.net.au or visit the Program's website www.npsi.gov.au