Newsletter of the Cooperative Research Centre for Catchment Hydrology

CATCHWORD

NUMBER 73, JUNE 1999

A NOTE FROM THE DIRECTOR

Professor
Russell Mein

Inside...

Annual Workshop - Beechworth

Every twelve months or so, the CRC arranges a workshop of its core participants. The purpose is to bring researchers, industry staff, and postgraduate students together for a structured program of information exchange and planning. With the CRC running five research programs with people located at several locations, the establishment and renewal of personal contacts is in itself an important outcome.

This year's workshop was held on 11-13 May at Beechworth (Vic.), at the conference centre situated in the Latrobe University Campus. The facilities and surrounding environment were ideal for the 60-70 participants we had in attendance during the three day workshop.

The new CRC

For most people there, it was the first opportunity to brief them on the details of the CRC's successful bid in the 1998 Application Round. Presentations from the Leaders of the new Programs:

- Catchment Prediction (Rob Vertessy)
- Land-use Impacts on Rivers (Peter Hairsine)
- Water Allocation (John Tisdell, acting)
- Urban Stormwater Quality (Tony Wong)
- Climate Variability (Tom McMahon), and
- Stream Restoration (Ian Rutherfurd)
- Communication and Adoption (David Perry)
- Education and Training (Rodger Tomlinson)

were the stimuli for a great deal of discussion. The challenge of prediction at catchment scale, the plans to link the Programs together, the inclusion of socio-economics, the use of adoption of CRC outcomes as the key performance indicator, the expansion of capabilities brought by the new Parties – and other aspects – clearly conveyed the message that we were looking at a new CRC.

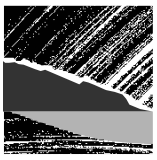
We took the opportunity to run a couple of discussion sessions on what was proposed. One involved facilitators getting groups to think through the implications of such things as communication (more people, expanded geographic coverage), the cultural differences of CRC Parties, and how to achieve integration of the research. The information provided in earlier presentations from representatives of two new Parties (Griffith University and the Department of Natural Resources, Qld), which included a description of the Fitzroy River in Qld. (a focus catchment), was good background material for participants.

On the last morning, after everyone had had time to think about the new bid, Rob Vertessy chaired a SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis of the new CRC. Rob had planted a few 'devil's advocates' in the audience, so the discussion in this session was pretty lively (and brought out many useful contributions).

Outcomes from the 'old' CRC

At each CRC Workshop, we include a Program Round-up. This year featured the outcomes of the finishing projects, and reinforced the belief that we are a CRC that 'delivers'. A special presentation on the Tarago Project, which won the CRC Association Technology Transfer Award, demonstrated how community involvement in the management of a project can lead to very effective and efficient adoption.

Each of our postgraduate students gave a short presentation on their work. It was soon clear to everyone, if they didn't know already, just how great is the contribution by this group to our research programs. Many of these postgraduates are near completion, and had 'final' results to relate; others will continue their work under the auspices of the new CRC. (With a new intake scheduled for the beginning of next year, the strength of our graduate program will remain high).



Please note...

CRC publications and videos are listed in a separate document "CRC Publications"

Updates are available every three months

Copies of the April to June CRC Publications List are available free of charge from the Centre Office

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Concluding comment

Communication in a CRC is special challenge, due to the differences in participating organisations and in their locations. The annual workshop series is part of our strategy to meet this challenge and, as judged by participants, very effective in this regard. We'll be continuing the series in the new CRC.

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PROGRAM *roundup*

SALINITY PROGRAM

Program Leader:

GLEN WALKER

Report by Ian Jolly

Project S2: Managing Disposal Basins for Salt Storage within Irrigation Areas

Highly successful disposal basin workshop at Tatura

Restrictions on the export of salt from irrigation areas has resulted in increases in the number of small-scale on-farm and community disposal basins in the Riverine Plain of the Murray-Darling Basin. The existing design and management of both types of basin vary widely as they have been developed under different administrative frameworks. Currently there are no generic guidelines for the use of disposal basins which apply across varying settings and administrative boundaries.

For the last two years, Project S2 - in collaboration with the Murray-Darling Basin Commission and other agencies - has been investigating the siting, design and management conditions under which small-scale basins can be successfully used by individual or groups of landowners. The biophysical and other technical information obtained in this Project have been used to define a robust set of guiding "principles" for responsible basin use.

Stakeholders

A workshop entitled "The Use of On-Farm and Community Scale Salt Disposal Basins in Irrigation Areas of the Murray-Darling Basin" was held on 30 March this year at Goulburn-Murray Water in Tatura. The workshop was attended by some 40 people representing a wide range of stakeholders groups such as government resource and policy agencies, community and environmental groups, water supply corporations and local government.

Principles

A set of "principles" for responsible disposal basin use was put forward by the project team and the thrust of these were generally accepted by the workshop. In addition, several new issues were raised, some of which were broader than the scope of the project. The workshop also proved to be an effective forum in which technical information from the project was transferred to prospective clients. The final version of the "principles" report will be published in the coming weeks. This report underpins more prescriptive technical and economic "guidelines" which will be prepared in report form over the last six months of the project.

Thanks

We would like to thank Peter Box who very skillfully facilitated the Workshop, and Bill Trewhella (and other Goulburn-Murray Water staff) who provided an excellent venue and catering.

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Report by Cuan Petheram

Project S3: Salt exports from dryland catchments

Estimating future salt loads from dryland catchments

Loads from current and alternative land uses

A significant outcome of Project S3 (Salt Exports from Dryland Catchments) was to confirm that salt loads and salt concentrations leading from non-irrigated catchments in the Murray-Darling Basin are increasing (Jolly et al, 1997a,b). This has led to the obvious questions: "What will future salt loads from non-irrigated catchments be under current land use?" and "What would the level of impact be under alternative land uses?"

Modelling to date

Much of the work in groundwater and water balance modelling has been done in small, intensively studied catchments, using complex process-based models that require a considerable amount of data. However, when these models are applied to larger less well-documented catchments, confidence in the results is very low due to the assumptions needed to overcome data scarcity. Australia-wide there are only a few catchments that have sufficient spatial data to enable predictive modelling with a reasonable degree of certainty. Most catchments have little or no data, due to the high costs and the time required in its procurement.

Because of this paucity of data and in response to the urgent need to predict salt loads from a wide range of catchments, recent studies have concentrated on estimating future salt loads using only data that are widely available and variables which are easily measured.

Scale issues

To date, the scale at which many of these studies have focused has been too large (i.e. regional) to enable a reliable conceptualisation of groundwater processes. For example, the methods used neglected lateral groundwater flow processes or made assumptions such as, "the future rates of groundwater rise will be equivalent to the historical rates".

Conceptual processes in modelling framework

To improve confidence in the results and to be able to assess the impacts of land use change on future salt loads, it is necessary to incorporate key conceptual processes into the predictive framework. This will be done in my thesis which aims at estimating the salt loads from dryland catchments of the Middle Murrumbidgee under current and alternative landuse, relying on available data and a minimal amount of fieldwork.

To encompass all the key processes involved in salt mobilisation, I plan to integrate a simple generic groundwater model with a geographical information system. In order to account for lateral flow processes, it will be necessary to:

1. Take a step down in scale i.e., look at 3rd degree instead of 1st and 2nd degree catchments like the Murray and Murrumbidgee respectively.

2. Acquire 'additional' data to parameterise the simple generic groundwater model (i.e., data that are often not available, such as saturated hydraulic conductivity) - without having to conduct extensive field work.

Overcoming data scarcity

It has been suggested that data scarcity can be overcome by following the framework of the National Classification of Catchments for Land and River Salinity Control (Coram 1998 ed.). This classification assumes that groundwater processes involved in, and the key factors contributing to, the mobilisation and redistribution of salts will be similar in catchments of the same hydrogeological type. It is proposed that this scheme would enable data and concepts from well-documented catchments to be transferred to poorly documented catchments.

Assessing catchment classification approaches

The degree to which the catchment classification can be used to transfer information from well-documented catchments to poorly documented catchments has not been assessed. Prior to using the catchment classification to estimate future salt loads in the Middle Murrumbidgee, I shall assess the utility of the classification for type III catchments (see Coram 1998 ed.). This will form a major part of my thesis.

NEW TECHNICAL REPORT

IMPLICATIONS OF IRRIGATION BAY MANAGEMENT FOR SALT EXPORT - A Study of Irrigation Bay Processes in the Barr Creek Catchment

by

M. Gilfedder
L.D. Connell
R.G. Mein

Report 99/4

This report presents details of the CRC irrigation bay experimental monitoring program aimed at determining the processes for the flow of water and transport of salt to surface drainage from an irrigation bay.
How these irrigation bay flows related to soil properties and irrigation practices is linked to improved understanding of the wider issue of salt export processes.

Copies available from the Centre Office.

NEW TECHNICAL REPORT

IRRIGATION BAY SALT EXPORT AND SALINITY MANAGEMENT

by

M. Gilfedder
L. Connell
J. Knight

Report 99/5

This new Industry Report presents the results of a CRC study of salt export from the Barr Creek catchment in northern Victoria; a large net exporter of salt to the Murray River.

The study focused on the measurement of salt export from an irrigation bay and the results have allowed assessment of the impacts of possible changes to improve farm irrigation management. In particular the report identifies the effects of reducing total irrigation volumes, and the impacts of the irrigation runoff reuse to reduce farm salt export.

In keeping with the Industry Report format and style, the report features clear and concise details of the research and outcomes with numerous illustrations and explanations.

It is available from the Centre Office for $20 by contacting Virginia Verrelli on tel: 03 9905 2704 or by email: virginia.verrelli@eng.monash.edu.au

References

Coram J. (1998 ed.). A Catalogue of Groundwater Systems Responsible for Dryland Salinity in Australia - a first step towards a National Classification of Catchments for Land and River Salinity Control, AGSO, Canberra.

Jolly, I., Morton, R., Walker, G., Robinson, G., Jones, H., Nandakumar, N., Nathan, R., Clarke, R., McNeill, V. (1997a). Stream Salinity Trends in Catchments of the Murray-Darling Basin. Technical Report 14/97. CRC for Catchment Hydrology and the Division of Land and Water, CSIRO.

Jolly, I.D., Dowling, T.I., Zhang, L. Williamson, D.R. and Walker, G.R.. (1997b). Water and salt balances of the catchments of the Murray-Darling Basin Technical Report 14/97. CRC for Catchment Hydrology and the Division of Land and Water, CSIRO

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FOREST HYDROLOGY PROGRAM

Program Leader:

ROB VERTESSY

Project FO1: Sediment sources and movement in forestry environments

Report by Jacky Croke

Erosion in Forests Workshop

The Forest Erosion team has recently returned from Warburton in Victoria where we held our 2nd Erosion in Forests meeting with over 90 people attending the three day workshop from a wide range of state agencies and organisations. Following on from the first workshop two years ago in Bermagui NSW, we took this opportunity to critically review our impact on the management of forest environments in Australia.

Forest management research – impacts on water

The first day consisted of short oral presentations on various aspects of forest management research. Whilst we maintained the general theme of erosion in forests and its associated impacts on water quality, we also heard reports on studies looking at potential impacts on water quantity and in-stream values such as macroinvertebrate diversity. This reflects the general trend to review the impacts of a particular land use on environmental values in terms of a range of indices and not just physio-chemical parameters such as turbidity. We heard the results of the Karuah paired catchment-monitoring study on turbidity levels following roading and harvesting, and we also heard about a simple empirical model for predicting hydrological impacts of land cover change over large areas.

Sediment production

There were a number of papers looking at sediment production from disturbed areas such as roads and tracks and many provided positive contributions to the sort of management practices that are required to prevent potential off-site impacts. There was also a lot of interest in applications of GIS to manage roading and prevent channel development at road drainage outlets and in predictive approaches to preventing runoff reaching stream areas. The downstream impacts of forestry and agricultural practices were reviewed in Peter Wallbrink's presentation from the Murrah River in NSW.

Field tour

On the second day we headed into the beautiful Mountain Ash forests around Noojee where we spent many hours looking at logging practices and management regimes for the protection of water quality. The group got the opportunity to participate in discussions on forest buffer strips, roading and soil erosion hazard assessment schemes and the contrasting experiences of inter-state participants made for some lively and constructive discussions.

Rainfall simulator demonstration

We also demonstrated the large rainfall simulator on a hillslope segment where soil infiltration properties proved to be too high to generate continuous surface overland flow.

Review papers

The final day concluded with additional papers including two review papers by myself and Rob Vertessy which attempted to synthesise our current understanding of the impacts of forest

harvesting practices on water quality and quantity as determined from the international literature.

The workshop proceedings will be available as a CRC report within the next month following some editorial and reviewing changes. In addition, the field day was videoed and will also be available for general distribution through the CRC centre office at Monash.

Thanks

Finally, I would like to say a huge thanks to all the people who participated in the workshop - the venue at Green Gables in Warburton proved a very peaceful spot to contemplate the issues of forest harvesting practices, and everyone's willing participation contributed to a very successful event. I am particularly grateful to Pat Lane and Paul Dignan from CFTT DNRE Victoria who co-organised the event with us and provided much assistance in planning the field day.

The efficient and dedicated contributions of Tanya Jacobson and David Perry were much appreciated and as usual my thanks to the hard working efforts of Jim Brophy, Danny Hunt, Simon Mockler, and Jamie Margules, Peter Fogarty, David McJannet and Peter Hairsine.

Industry Report

We hope to end the forestry project in June 1999 with the production of an industry report outlining the key findings of the project and implications for management. We will also be involved in a number of industry seminars on these aspects some time in late August.

If you have any questions about the workshop or the project in general please feel free to contact me.

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WATERWAY MANAGEMENT PROGRAM

Program Leader:

PETER HAIRSINE

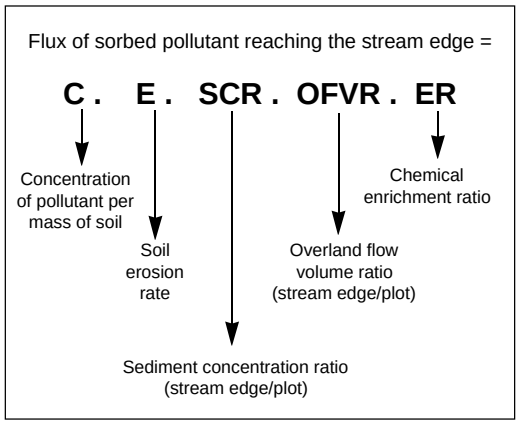
Program review

Getting the balance correct

We are in the last month of the current CRC for Catchment Hydrology and I want to spend this month's article looking back on the balance of research we have done in the program concerning pollutant movement to streams. My aim is to do a stocktake in preparation for our new centre, where predicting the impact of land use on rivers is one of our major themes.

Sediment/pollutant 'balance' equation

Are you a person who attends seminars, sees the first equation come up and then quietly slips out of the room? If you are, hang in there. The equation below is a formal statement of the balance we need to achieve if we are to have equal emphasis on all the component influences on the amount of sediment-attached pollutants (like most phosphorus or many agri-chemicals e.g. endosulfan) that enter our streams.



Here I will consider each term in the following equation in turn and comment on the adequacy of our existing knowledge and identify the research we have done to address each of these components.

Soil pollutant concentration

The first term is the concentration of a potential pollutant in the soil. It is the combination of the

NEW TECHNICAL REPORT

THE HYDROLOGIC IMPACTS OF FORESTRY ON THE MAROONDAH CATCHMENTS

by

F.G.R. Watson
R.A. Vertessy
T.A. McMahon
B.G. Rhodes
I.S. Watson

Report 99/1

This report documents the analysis of 30 years of hydrographic data from the high-rainfall, ash forest areas, which comprise much of water supply catchments for Melbourne. Fred Watson and Rob Vertessy (Project Leader), with strong input from the other named authors, have produced a report which has important ramifications for the management of forested catchments generally, but particularly for ash species.

Copies available for $20 from the Centre Office.

STREAM CONFERENCE PROCEEDINGS

The Proceedings of the Second Australian Stream Management Conference held in Adelaide recently are available through the CRC Centre Office for $95.

The two volumes (750+pp) consist of over 150 papers covering all aspects of stream management.

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naturally occurring levels of that chemical such as 'native' phosphorus, and those chemicals added in the form of fertiliser, pesticides or other soil additive. The CRC has done no substantial research in this area and relies on external knowledge concerning the concentrations and dynamics of this quantity for input to our predictions.

Soil erosion rate

The second term is the soil erosion rate in the form of sheet and rill erosion, gullies, streambanks retreat and landslips. There has been a huge effort in Australia and elsewhere to quantify the rates of soil erosion as influenced by land management practices and in a range of environmental settings. There is a large group of hillslope erosion models and a lesser set of models concerning gullies and streambanks that we can draw on. CRC researchers have added some new data to this base in some aspects where knowledge has been poor.

Roads

Roads as a sediment source have been addressed by researchers in both the forestry and waterways management programs (See Jacky Croke's article in the March 1999 issue of ***Catchword***). The analysis of Simon Mockler and Jacky Croke concerning the initiation of gullies below road drain outlets is also a major contribution to this component.

Stock tracks

Stock tracks, though not an especially big source of sediment, have also received attention (see my article in the December, 1997 edition of Catchword). The importance of stock tracks is realised by combining their erosion rates with their delivery ratios OFVR and SCR (see below). The CRC for Catchment Hydrology is also the home of leading edge research concerning gully erosion through Ian Prosser at CSIRO Land and Water and the stream bank erosion through Bruce Abernethy and Ian Rutherfurd at Monash University.

Sediment concentration ratio (SRC)

SCR is the ratio of sediment concentration in overland flow at the edge of the land use (or plot) to that of water as it flows into the stream network. Clearly, for gully and stream bank erosion SCR is 1! The delivery of sediment from sources not at the edge of the stream has been experimentally examined by three major exercises in the CRC. Firstly, work in the Tarago catchment examined the effectiveness of the buffer strips of grass and near-natural riparian forests in mitigating the flow of sediment and sorbed pollutants from simulated runoff events on two cultivated soils. Secondly, as part of the LWRRDC National Riparian Zone Program, Ian Prosser and Lucy McKergow together with collaborators in QNR and WADA monitored the effectiveness of a variety of permanent buffers in North Queensland and South West Western Australia. Finally, Linda Karrsies and Ian Prosser performed a series of laboratory experiments addressing the knowledge gap of finite sediment storage of grass buffers in high land slope environments. Ian Prosser and myself are involved in the development of deterministic models of the sediment transport through such buffers. These models aim to predict SCR and the sediment sorting associated with buffers, an aspect vital to predicting the chemical enrichment ratio, ER.

Overland flow volume ratio

The overland flow volume ratio, OFVR, is a concept we have addressed separately from SCR in some of our research. Most researchers lump SCR and OFVR together to get a sediment delivery ratio. Use of OFVR explicitly recognises that there is considerable potential to infiltrate the runoff generated on land surfaces before it reaches streams. The clearest example of this is when well-placed drains guide road runoff in forestry environments to dispersal on hillslopes with high infiltration capacities. I recently presented a simple model of this phenomenon to the CRC for Catchment Hydrology 'Erosion in Forests' workshop. Use of data from the Croke et al. rainfall simulator experiments enabled the model to predict the length of hillslopes required to infiltrate all road runoff coming from road drains.

Enrichment ratio

The final term ER is the enrichment ratio for sediment-sorbed pollutants. The enrichment ratio is the concentration of the pollutant per

gram of sediment in the overland flow as it falls into the river compared with the concentration of the pollutant per gram of soil as it eroded. This term has been found to vary in the range of 1 to 20 for a variety of soils and situations. High numbers are normally associated with sandy soils with low SCR values. This result is caused by coarse sediment carrying a small portion of the pollutant load and being preferentially trapped - compared with fine sediment which has a higher surface area and often a much higher pollutant concentration. Our CRC research has confirmed that many current management practices such as narrow buffer strips are very effective in trapping coarse sediment. Explicit prediction of enrichment ratios is a challenge for our future research.

Future challenge

The summary presented above is a reductionist's approach. It demonstrates we have had some balance in addressing the overall sediment-sorbed pollutant delivery issue and identifies some areas requiring more attention. It has some value in guiding predictions we propose to make in our new CRC's research programs. However, evaluation of the overall approach is difficult without some holistic measures of sediment movement. The reconnaissance sediment survey approach of Ian Prosser and the sediment tracer analysis of Fiona Dyer, Peter Wallbrink and Antony Motha are methodologies to integrate across the whole equation for large catchments.

Our challenge in our future work is to combine the reductionist and integrative methodologies into a single more robust methodology.

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Report by Bruce Abernethy

Project W3: Rehabilitation and management of riparian lands: sediment, nutrients and erosion

Are rooted riverbanks reliably reinforced?

In a previous ***Catchword*** article, I presented the results of a field investigation into the strength and distribution of Swamp Paperbark (*Melaleuca ericifolia*) and River Red Gum (*Eucalyptus camaldulensis*) roots. This time around I will assess the contribution that tree roots make to the stability of riverbanks under a range of natural conditions.

Reinforcement from tree roots

Root reinforcement varies with the density of the root network and the strength of individual roots. For both of the above species, the root reinforcement of bank sediments conformed to a negative exponential function of depth below the soil surface and distance away from the tree trunks. By incorporating the functions for each of the trees within the slope stability model GWEDGEM, I was able to assess the stability of 24 bank sections surveyed along the lower Latrobe River, near Rosedale in Gippsland. Bank material consisted of silty loam with little variation in particle size through the bank profile. There is, however, quite a range in bank angle (varying from 23–55°, mean 42°) and bank height (range 2.9–5.5 m, mean 4.0 m)

Assessing bank stability safety factor

GWEDGEM assesses the bank stability by calculating a safety factor (Fs) which is defined as the ratio of forces resisting failure to forces promoting failure. When the forces are balanced, i.e. Fs = 1, mass failure is imminent. GWEDGEM simulations of the surveyed bank profiles without root reinforcement showed that the banks were stable; Fs ranged from 1.24 to 2.40 with a mean of 1.70. In all cases, adding root reinforcement (from either species) improved the stability of the bank profile. Swamp Paperbark roots improved stability by 8–97%, mean 29%, while River Red Gum roots improved stability by 10–110%, (mean 37%).

Impact of erosion on bank stability

While the above improvements in safety factor indicate the great potential of root reinforcement for increasing bank stability, the strength of the bank material alone was enough to ensure that all surveyed profiles were stable. River channels are prone to fluvial erosion, however, and stability is a transient state. By lowering the points that represent the riverbed, I simulated 1.3 m of bed scour adjacent to one of the surveyed bank profiles (Figure 1). This

INDUSTRY SEMINAR VIDEO

REHABILITATING STREAMS IN YOUR CATCHMENT - PRIORITIES AND POSSIBILITIES

Dr Ian Rutherfurd
(CRC for Catchment Hydrology, Monash)
Prof. Sam Lake
(CRC for Freshwater Ecology, Monash)
and
Dr Peter Breen
(CRC for Freshwater Ecology, Melbourne Water)

present a seminar designed to provide practical information for those involved in urban and rural stream management.

A video of this popular seminar is available. Orders can be made by contacting Virginia Verrelli at the Centre Office on tel: 03 9905 2704

TECHNICAL REPORTS

REMOVAL OF SUSPENDED SOLIDS AND ASSOCIATED POLLUTANTS BY A CDS GROSS POLLUTANT TRAP

by

T. A. Walker
R. A. Allison
T. H. F. Wong
R. M. Wootton

Report 99/2

This report describes an extensive monitoring program to assess the efficiency of a CDS gross pollutant trap in removing suspended solids and nutrients.

URBAN STORMWATER QUALITY: A STATISTICAL REVIEW

by

Hugh P. Duncan

Report 99/3

This report describes the analysis of stormwater quality data from over 500 Australian and overseas studies. The report summarises stormwater concentrations of 21 water quality parameters, and examines the relationships between contaminant concentrations and physical and climatic characteristics.

Copies of these Reports are available for $20 from the Centre Office.

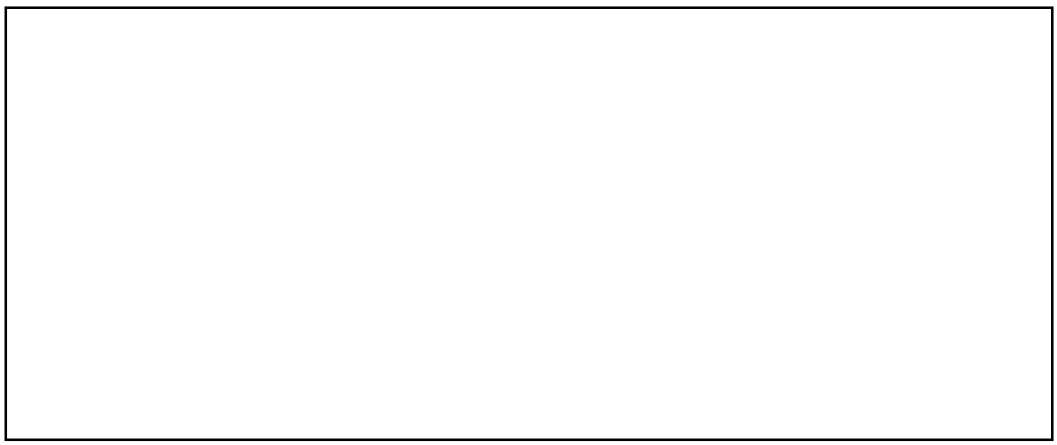

Figure 1: The effect of River Red Gum position on critical failure plane position.

produced critical stability conditions in the non-reinforced profile. Shown in Figure 1 and Table 1 are the effects of adding the root reinforcement of a typical Swamp Paperbark stand and individual River Red Gums to this otherwise unstable bank section.

Improving bank stability with tree roots

Both species improve the stability of the heightened bank section and cause potential failure planes (marked a to h in Figure 1) to move deeper into the bank profile compared to the failure plane predicted under bare conditions. That Swamp Paperbark can be established low on the bank, such that high root densities reinforce potential failure planes near to the toe, bears out the local river management authority's faith in the species as a bank stabilising agent. Where the bank is reinforced by River Red Gum roots, the degree of additional stability is influenced by tree position. Locating the tree near where the failure plane would otherwise intersect the floodplain surface (position c, Figure 1) returns the greatest factor of safety and forces the failure plane well out onto the floodplain.

Table 1: Effect of River Red Gum position on stability.

Simulation (Figure 1)	*Tree position (from crest)*	*Safety factor*
bare	—	1.00
a	15 m left	1.26
b	10 m left	1.43
c	5 m left	1.61
d	1 m left	1.43
e	At crest	1.48
f	1 m right	1.48
g	2 m right	1.51
h	Swamp Paperbark stand	1.48

Choice of safety factor

In the usual sense of bank stabilisation and protection works, project costs are directly related to the safety margin required of the bank. A value of Fs marginally above unity (say 1.05 to 1.10) might be acceptable where the potential loss from bank failure is small. However, where extensive damage to property may result, Fs = 1.40 or more may be necessary for an adequate level of protection. My results suggest that either Swamp Paperbark or River Red Gum provide high levels of bank protection.

Conclusions

The modelling framework, outlined here, provides a quick and accurate method of establishing the safety factor of a given bank section. The shape of the predicted failures broadly conform to those observed in the field.

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URBAN HYDROLOGY PROGRAM

Program Leader:

TOM MCMAHON

Urban Hydrology Program - Thanks

As this is the last ***Catchword*** before we embark on our 'next life' as the new CRC and as Leader of the current Urban Hydrology Program, it is appropriate that I take this final opportunity to thank my colleagues who have made this Program a great success.

First of all I must say how much I have appreciated Francis Chiew's contribution, not only for the enormous enthusiasm he injected into the projects, but also for his good humor and willingness to be supportive and active in the many other activities that occur in an active research environment.

In the new CRC, Francis will have a smaller role in the new urban stormwater quality activity, most of his time being spent as an active researcher in the Climate Variability Program.

During the last few years Tony Wong has been able to take a more active role in the Urban Program and was appointed in 1998 as Leader of Project U1: Gross pollutant management and urban pollution control ponds. We congratulate him and wish him well in his appointment as the Leader of the Urban Stormwater Quality Program in the new CRC. Tony has written an article below outling the objectives of the new program.

Support for core activities

The core program activities were supported in recent times by Chris Gippel, Tracey Walker, Sharyn Ross-Rakesh and Hugh Duncan, who was seconded for much of the life of the CRC from Melbourne Water. Other major contributors to the urban activity were PhD students Robin Allison, Jim Gippel, John Marsh, Grace Mitchell, Phil Scanlon, Wendy Smith, and Jai Vaze. We all appreciate their input and output.

Achievements

At the end of the day the researchers in the Urban Hydrology Program can be proud of their efforts. During the past seven years they have lifted the level of understanding in several major areas of urban hydrology - gross pollutant management, pollutant sources and movement, urban pollution control ponds, estimating stormwater water quantity and quality, and water and sediment balance. They have provided an excellent backdrop from which the new program under Tony Wong's direction can take off.

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The new CRC Program – Urban Stormwater Quality

(Leader: Tony Wong)

Main Objective

The purpose of this program is to develop urban stormwater management systems to better protect environmental and community values of urban aquatic ecosystems.

Building on knowledge gained

The research effort will build on knowledge gained on the performance of a number of individual stormwater management measures and the different types of treatment processes being supported by these measures.

Decision support system

The new program will involve the development of a decision support system that integrates our understanding of urban stormwater management techniques into urban design. This will be developed through a whole-of-catchment, multiple-disciplinary approach which encompasses urban hydrology, ecological sustainable land development, landuse planning, urban landscape architecture and socio-economic issues.

The decision support system will utilise a modelling approach to provide a quantitative basis for predicting the performance of stormwater management measures and defining their appropriate design standards for optimal resource management and economic risk outcomes.

UPCOMING WORKSHOP

Workshop on

SCALING ISSUES IN HYDROLOGY

Mon 28 June - Tues 29 June 1999

at
Bureau of Meteorology, Melbourne, Victoria

The CRC is pleased to extend an invitation to all researchers working in the areas of statistical description of geophysical fields and hydrological processes.

For further information please contact Virginia Verrelli on 03 9905 2704.

WATER VICTORIA EMAIL (WAVE) LIST

The WaVE list (formerly known as VicWater) has been set up to facilitate the discussion of water related issues.

The list is free and can be used to advertise seminars, workshops, job vacancies, to solicit information on any range of water related topics or any other appropriate use. Posters should keep matters relevant to the state of Victoria, Australia. The list is closed, which means that only those on the list can post a message, but it is open for anyone to subscribe or unsubscribe as desired.

To subscribe, send subscribe to:
wave-request@eng.monash.edu.au

To send a messages, send an email to:
wave@eng.monash.edu.au

The list is maintained by Peter Hill at Sinclair Knight Merz. Any queries should be directed to:
phill@skm.com.au.

WaVE is supported by the Victorian Water Engineering Branch of the Institution of Engineers and the CRC for Catchment Hydrology.

Other Program objectives

Specific objectives of the program include:-

1. Identifying current world best practice in the management of urban stormwater for the protection of aquatic ecosystems.
2. Monitoring stormwater quality treatment facilities in the field for their pollutant removal efficiencies and understanding of the physical and biochemical factors influencing their performance as stormwater treatment facilities.
3. Determining critical pollutants and target concentration and/or load for improving or protecting aquatic ecosystems.
4. Formulating world best practice design guidelines for stormwater management techniques applicable to Australian conditions.
5. Developing predictive models for individual stormwater quality treatment techniques.
6. Integrating the process models of individual stormwater quality treatment techniques into a decision support system.
7. Developing strategies to facilitate effective (and unambiguous) adoption of research findings into practice.

Research strategy

The strategy towards achieving the above objectives will involve research undertaken to extend our knowledge of stormwater pollutant characteristics. Major elements will be pollutant sources and pathways, and impacts on the aquatic ecosystem through multi-disciplinary research (eg. system hydrology, waterway hydraulics, aquatic chemistry and freshwater ecology).

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FLOOD HYDROLOGY PROGRAM

Program Leader:

RUSSELL MEIN

Monash Award for Santosh Aryal

Late last month, Santosh Aryal was announced the winner of the 1998 "Professor K H Hunt Award" for excellence in research. This Award is made annually to the graduating student in the Faculty of Engineering (Monash University) whose thesis is judged to be the best submitted in the calendar year preceding the award. The Faculty's Research Committee makes this judgement based on examiners reports.

This is a prestigious award by the Faculty for proficiency in research. Our hearty congratulations to Santosh for his fine achievement.

Santosh's thesis – "Similarity approach"

For those of you who missed the description of Santosh's research given in ***Catchword*** last October, his thesis was titled "A similarity approach to characterise the hydrologic behaviour of hillslopes". Emmett O'Loughlin (former CRC Director and CSIRO scientist, now retired) and Russell Mein were his supervisors.

Main hypothesis

Santosh developed general equations for saturated area on single hillslopes in terms of measurable characteristics (slope, conductivity, rainfall, evaporation, plan geometry, profile shape, etc). These were expressed in dimensionless form, so that the one relationship actually applied to a large range of simple hillslopes. His hypothesis was that the behaviour of a larger catchment (having a number of single hillslope components) could be obtained by simple addition. This was tested using data from catchments in the Brindabella ranges, with good results.

Another key contribution

Santosh's other key contribution was in the delineation of 'effective length', a concept applicable for hillslopes whose evaporation exceeds rainfall. For such cases, much of the

shallow groundwater percolating from the upper slopes evaporates before it reaches the lower hillslope zone. In terms of its contribution to the saturated area of a hillslope, in such cases the upper area will be 'ineffective' for most of the time. Santosh established a probabalistic approach for this problem, and so defined the proportion of the catchment which influences runoff behaviour.

Three research papers, and a CRC Research Report, are soon to be submitted on his work.

Extreme Rainfall Data for South Australia

Regular readers of this column will know that four States of Australia are currently applying the CRC-FORGE technology developed by the CRC. By the end of this year design data for extreme rainfalls (in the range 1% to 0.05% AEP) are expected to be widely available on CD-ROM for Queensland, NSW, Victoria, and Tasmania.

It is a pleasure to record that SA Water are making arrangements (with the CRC) to have consultants apply the CRC-FORGE methodology to South Australian rainfalls. (By way of reminder, this technique is one which pools the information from the often long periods of record available for data rainfalls in Australia. In a homogeneous area – in rainfall terms – the effective length of record at a site can increase to the extent of allowing quite reasonable estimates of rare events. Hence, the pooling of data greatly increases the degree of confidence in estimating the 1 in 2000, or 0.05%, AEP event)

The level of take-up of the research outcomes of this project by State agencies not involved initially in this CRC Project has been very satisfying. Their efforts will soon have the design data available in a user-friendly form for general use. With SA Water now joining the four States that are already committed to this work, the CRC Project (led by Erwin Weinmann) has certainly made an impact.

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TECHNOLOGY TRANSFER & COMMERCIALISATION PROGRAM

Technology Transfer Coordinator:

DAVID PERRY

The Flow on Effect - June1999

On the road again

The last few weeks have again been very busy (and very rewarding) in the Technology Transfer and Commercialisation Program. Technical and Industry Seminars on a variety of issues have been presented in Melbourne, Canberra, Sydney, Brisbane, Kerang and Tatura (regional Victoria) and Griffith in New South Wales.

1. Constructed Stormwater Wetlands: From Design to Construction

Following the success of this Industry Seminar in Melbourne last November (240 people attended), arrangements were quickly made to present similar seminars in Canberra, Sydney and Melbourne during May 1999. This Industry Seminar was an excellent example of collaboration between key stakeholders to present an integrated approach to stormwater wetland design and construction. Assoc. Prof. Tony Wong (Project Leader, Urban Hydrology) teamed up again with Dr Peter Breen (Melbourne Water and CRC for Freshwater Ecology) and Alf Lester from LFA Pty Ltd (a planning and design consultancy based in Canberra and Sydney).

Participation levels

Each of the speakers brought their own perspective and expertise to the 'big picture' and allowed participants to see the links and benefits of a multi-disciplinary approach to wetland design and construction. Over 350 people from councils, consultancies and state government agencies attended one of the three seminars. The registration cost included a copy of the relevant CRC industry report 'Managing Urban Stormwater using Constructed Wetlands' - a joint publication by the CRC for Freshwater Ecology and CRC for Catchment Hydrology. More than 900 copies of the Industry report have now been

NEW TECHNICAL REPORT

A TECHNIQUE TO INPERPOLATE FREQUENCY CURVES BETWEEN FREQUENT EVENTS AND PROBABLE MAXIMUM EVENTS

by

L. Siriwardena
P.E. Weinmann

Report 98/9

A key research outcome from the CRC Project D3 'Probability and Risk of Extreme Floods' has been methodology to extract more information from daily rainfall data. With this methodology (CRC-FORGE), more reliable estimates of long duration rainfalls for rare design events are now possible.

This report deals with the interpolation range for even rarer events.
Here the authors address the issue of a consistent and acceptable way to construct frequency curves where no data are available.

Copies of these Reports are available from the Centre Office.

UPCOMING CANBERRA SEMINAR

ANTICIPATING THE NEGATIVE HYDROLOGIC EFFECTS OF PLANTATION EXPANSION: RESULTS FROM A SIMPLE GIS-BASED ANALYSIS ON THE MURRUMBIDGEE BASIN.

SPEAKER:

Dr Rob Vertessy

CRC for Catchment Hydrology
CSIRO Land and Water

THURSDAY

1 JULY 1999

at Conference Room
C.S. Christian Laboratory
CSIRO Land and Water
Black Mountain Laboratory,
Canberra
(Clunies Ross Street, Acton)

TIME:
10.45am for 11.00 am start

Tea/coffee on arrival.

sold, and after some minor additions will be reprinted later this year.

The seminar speakers prepared 'frequently asked questions' (FAQs) to discuss at the end of the formal presentation. It was during the informal question period that the collaborative approach proved particularly worthwhile. Participants asked questions of interest and received an integrated answer from the speakers. Additional information also came from participants, providing a practical and technically sound response on each occasion. The FAQ's proved very popular and will be incorporated into the reprint of the Industry Report.

Thanks

The success of these Industry Seminars is due to the efforts and commitment of the three speakers who volunteered their time over the three days. I would also like to thank Tanya Jacobson at CSIRO Land and Water for her invaluable contribution to making the seminars a success and assisting with logistics. Thanks also to Virginia Verrelli at the Centre Office who registered participants and payments (Virginia was still taking names the day before the seminar in Sydney!)

Future examples to use

These seminars are an example of how the CRC can bring together different disciplines and provide land and water managers with an integrated and practical approach to implementing best practice – a good example of what to expect from the new CRC commencing in July this year.

2. Irrigation Bay Salt Export and Salinity Management – Regional seminars and an Industry Report.

Earlier this month Dr Mat Gilfedder (Project Researcher at CSIRO Land and Water and former CRC postgraduate) presented a series of seminars in Kerang, Tatura and Griffith. The seminars generated valuable discussion at each location. Participants included representatives from state agencies, water authorities, consultancies and the farming community.

Industry Report

Mat, Luke Connell (former CRC Project Leader) and John Knight (Project Leader, CSIRO Land and Water) recently completed an Industry Report on 'Irrigation Bay Salt Export and Salinity Management'. This was the eighth in the CRC's series of Industry Reports. The Industry report presents the results of a CRC study of salt export from the Barr Creek catchment in northern Victoria, a large net exporter of salt to the Murray River.

The study (reported in earlier ***Catchword***s) focused on the measurement of salt export from an irrigation bay and the results have allowed assessment of the impacts of possible changes to improve farm irrigation management. In particular, the report identifies the effects of reducing total irrigation volumes, and the impacts of the irrigation runoff reuse, to reduce farm salt export. In keeping with the Industry Report format and style, the report features clear and concise details of the research and outcomes with numerous illustrations and explanations. It is available at $20 per copy from the Centre Office by contacting Virginia Verrelli on telephone: 03 9905 2704 or by email: virginia.verrelli@eng.monash.edu.au

To promote the seminars and the Industry Report in the local community, the CRC engaged a publicity and media consultant to prepare and distribute a media release. During the three days on the road, Mat gave four radio interviews with the CRC about the results of his work. (These were with 3ONE Shepparton, 2RG Griffith, Radio ABC Shepparton and Radio ABC Griffith). Media articles are being published in a number of newspapers including the Weekly Times, the Shepparton News, the Area News (Griffith) and the Tatura Guardian.

Acknowledgements

Again a number of people were involved in making these seminars a success, particularly John Ginnivan and Geoff Earl at Goulburn-Murray Water, Evan Christen at CSIRO Land and Water at Griffith, Alfred Heupermann from the DNRE Institute for Sustainable Irrigated Agriculture at Tatura and of course Mat Gilfedder who prepared and presented three excellent seminars.

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CRC Technology Transfer Coordinator
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POSTGRADUATES & *their projects*

Our postgraduate for June is Leanne Haupt.

Leanne Haupt

I graduated from Melbourne University in 1995 with a BE (Hons) in chemical engineering and ventured directly into the workforce. My first job was as a Research Engineer at Comalco Research Centre where I worked on the development of a composite coating for cathodes in aluminium cells. This new technology had the potential to save the world copious amounts of electricity, but the project ended abruptly in July 1997 with the retrenchment of most of the project personnel, myself included. I then transferred to Boyne Smelters in Gladstone, Qld where I spent 18 months working as a Process Engineer in the warm climate. (This Melbourne winter is a bit of a shock!). In February 1999, I returned to Melbourne to complete the minor thesis component for my Master of Engineering Science degree on a full-time basis at Monash University.

I chose chemical engineering in preference to environmental engineering for my undergraduate degree to give myself a broader base. However my love of the outdoors attracted me to water engineering and I began studying for a Masters degree in Water Engineering part-time in 1997.

The purpose of my masters project is to investigate the impacts of rock ramp fishways on the rating curves of stream gauging weirs. Numerous gauging weirs form barriers to fish migration in Australia. There is presently a drive to construct fishways over these barriers to combat this problem and restore our native fish populations to inland waterways. A rock ramp fishway is a sloping ramp of rocks (about a 1 in 20 gradient) leading up to a weir crest from downstream. This is similar to a natural rock riffle and permits fish to swim up and over the weir crest. The construction of such a device in close proximity to the weir crest alters the discharge rating curve of the weir. I am investigating the effect of two alternative fishway designs on a weir rating curve using a 1:9 physical model of Cowwarr Weir on the Thomson River in Victoria.

My project supervisor is Bob Keller, and additional project funding is coming from the Department of Natural Resources and Environment.

Leanne Haupt
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Introducing the CRC for Catchment Hydrology - a guide

- **What is catchment hydrology?**
- **What is a CRC?**
- **What is the CRC for Catchment Hydrology?**
- **What makes the CRC different from other research organisations?**
- **How do I find out about the research outcomes?**
- **How can I get involved in the CRC's research program?**

The CRC for Catchment Hydrology has published a brochure introducing the CRC and its research, education and technology transfer programs. Designed to raise awareness of the CRC and its research relevant to the land and water industry, the brochure outlines the aims of each research program, lists each core project and provides details of key contacts.

If you would like to get copies to distribute to colleagues or as a reference, the CRC would be delighted to send them.

Please contact Virginia Verrelli at the Centre Office by phone on: 03 9905 2704, by fax: 03 9905 5033 or by email: virginia.verrelli@eng.monash.edu.au

TECHNICAL REPORT

JOINT PROBABILITY APPROACHES TO DESIGN FLOOD ESTIMATION: A REVIEW

by

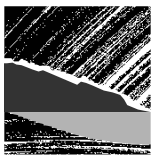
A. Rahman
T.M.T. Hoang
P.E. Weinmann
E.M. Laurenson

Report 98/8

This report is a review of joint probability approaches that consider the combination of factors producing flood flows.

Copies of the report are available for $20 from the Centre Office.

Please contact Virginia Verrelli on tel 03 9905 2704 or email virginia.verrelli@eng.monash.edu.au



CRC *profile*

Our profile for June is Ross Young.

Ross Young

Ross is the General Manager of Melbourne Water's Waterways and Drainage group. The Waterways and Drainage group is responsible for the following functions within an area of 7,800 km^2 which encompasses almost the entire catchments of the Port Phillip Bay and Western Port:

- Flood protection
- Waterway management
- Water quality management
- Flood plain management
- Servicing the land development industry
- Operations, flood warning, pollution spills

With the possible exception of Brisbane City Council, Melbourne Water operates the largest stormwater system in Australia.

The area of operation includes both urban and rural areas with Melbourne Water being responsible for the major (or trunk) components of the drainage system (which generally have catchments greater than 60 hectares) and local municipalities being responsible for the local drainage systems. Assets managed by the Waterways and Drainage group includes 1,103 km of underground drains, 5,200 km of waterways, 119 retarding basins, 153 telemetry stations, 22 pumping stations, 193 km of levee banks, 4 tidal gates, 46 bridges; and numerous natural and artificial wetlands and silt and litter traps.

Ross has held the position of General Manager for nearly five years. During this time he has overseen the development of the Waterways and Drainage group as a stand alone product group within Melbourne Water. Previous to the formation of the Waterways and Drainage Group, drainage and waterway issues were dealt with concurrently with water supply and sewerage issues. This often resulted in drainage and waterways issues not receiving the consideration that they deserved. A dedicated Waterways and Drainage group, along with reforms in the planning and management of the stormwater system now ensures there is a dedicated focus on these issues, particularly minimising the deleterious impact of stormwater on receiving waters.

Ross fell into his career by accident. He grew up on a farm in Central Victoria and always had an affinity with the land and natural resource management. At the time he left secondary school he had a particular interest in trees and this was the reason that he pursued his first tertiary education in horticulture. Ross found horticulture a rather narrow and limiting discipline and decided that he needed to broaden his skills base. He was working in various roles in Melbourne Water's Parks system. Ross went back to university and obtained a Bachelor of Science. Soon after completing this degree, Ross obtained his first job with Melbourne Water in a field that related to the management of water rather than land.

This opened up a whole new area of interest for Ross as he was fascinated by the science, the economics, the politics, and the legal and social aspects of managing and allocating water in situations where it was not possible to assign property rights.

Ross then returned to Monash University and over a three and a half year period completed his MBA on a part time basis. The numerous legal issues that Ross became exposed to whilst managing the Waterways and Drainage business stimulated him to complete a Graduate Diploma in Natural Resources Law at Melbourne University almost immediately after he completed his MBA.

Ross is a Board member of both the CRC for Catchment Hydrology and the CRC for Freshwater Ecology. He finds these roles to be stimulating as he is exposed to the existing and emerging land and water resource management issues in Australia. The leading edge research that is being undertaken has also provided a better knowledge base for developing solutions. Ross believes that the CRCs are an invaluable asset to organisations such as Melbourne Water as they provide the knowledge base upon which better management decisions can be made. Ross is looking forward with great excitement to the new CRC for Catchment Hydrology and in particular the research programs that are focusing on the urban stormwater issues.

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WHERE ARE THEY NOW?

Report by Fred Watson

Back in about 1995, I mentioned to a panel of external reviewers of the CRC that 'Here is heaven'. That statement got a lot of mileage, but eventually, I had to leave heaven to see what was on the other side of Cloud Nine. So where am I now?

We'll... after leaving the Partridge Family, kicking my methamphetamine habit, and living off the royalties from a nationwide 'Hydrologists say no to drugs' television campaign, I've washed up hosting a small cable TV show out of Nebraska.

Just kidding.

In truth, I spent exactly four years working within the CRC towards being a Post Hole Digger at Melbourne Uni., and about a year awaiting examination. In that year, I did a bit of research consulting in Victoria and China, before taking up a postdoc position at California State University Monterey Bay.

Its a huge change. The university is only four years old, with 2000 students, two post-docs, no other foreigners, not much university support for research, and no postgraduate program. This, in some ways, is a good thing. It forces you to be independent and allows you to make up the rules as you go along. It's a challenge. Essentially, we have to build ourselves a research group from the ground up.

The work itself is also challenge. It's a NASA funded project where we're applying Macaque, Tarsier, and BGC. I work under Lars Pierce, an ecosystem modeller who cut his teeth in Montana. So we're both foresty types. Our study area, however, is largely a huge, flat Californian valley which produces as much if not more food than any other place on earth. Up to four crops a year are harvested from land which would barely support a cow if it were not for massive irrigation and fertilisation. At the same time, Silicon Valley, just up the road, is booming more than ever, and its population is spilling south towards us causing population increases of around 1.5% per year. There are two problems, which arise mainly from the 'fertigation'. The water is mined from the ground, a finite source. It runs off very quickly, taking much of the land with it, and spilling into Monterey Bay, a unique marine sanctuary full of whales and things. The fertiliser takes up to 50 years to get to the groundwater, but it does get there. The delay just makes it harder to manage. Town drinking supplies have been cut off as a result. It's your typical Californian stuff, and we're trying to model one small part of the effect of long-term land use change on some of the processes involved.

I have always wanted to be a full time research scientist, and I have always wanted to work overseas. The CRC for Catchment Hydrology gave me what I needed to fulfil that dream, for which I am eternally grateful. I continue to work very closely with a number of CRC and related projects. In particular, we're using Macaque and Tarsier to estimate water yield subject to forestry and fire in the Thomson catchment in Victoria (Murray Peel, Alex Lau, Rob Vertessy, Mike Sutton, Ian Watson, Bruce Rhodes). Then there's the Gippsland Lakes hydraulics visualisation (Rodger Grayson), and the Moo model (Peter Hairsine).

And then there's the real reason I'm here in Monterey. Every lunch time I get to play. Most days it's paddling one of my kayaks on Monterey Bay with grey whales, humpback whales, seals, sea lions, pelicans, and infinite ocean swell. Sometimes it's running and mountain biking on the endless single tracks within the fort where we work and live. Then there's camping in the Ventana Wilderness, 45 minutes away, skiing and rafting in the Sierra's, or trips to the big smoke in LA or San Francisco.

The thing I miss most? They don't have morning tea here... yet.

Dr Fred Watson
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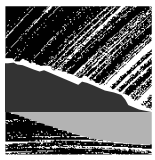

COOPERATIVE RESEARCH CENTRE FOR
CATCHMENT HYDROLOGY
If undelivered return to:
Monash University
Department of Civil Engineering
Clayton Victoria 3168

Surface Mail

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P338685/00026

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

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

ASSOCIATES

Department of Natural Resources, Qld
Hydro-Electric Corporation, Tas
State Forests of NSW

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