NEWSLETTER OF THE COOPERATIVE RESEARCH CENTRE FOR CATCHMENT HYDROLOGY

CATCHWORD

NO 75 AUGUST 1999

A NOTE FROM THE DIRECTOR

Professor
Russell Mein

Inside...

COOPERATIVE RESEARCH CENTRE FOR
CATCHMENT HYDROLOGY

COMMUNICATION: A PRIORITY FOR THE CRC

Communication is a general issue for all organisations; for large ones it is particularly so. In universities, for instance, it is a major challenge to achieve linkages between departments on the same campus, and more difficult still to bridge distances between remote campuses. For the large government departments that deal with land and water management, overcoming the changes caused by amalgamations, downsizing, decentralisation, and changed management structures, is yet another challenge for effective internal communication.

The CRC for Catchment Hydrology is far from being a large organisation, involving the equivalent of about 40 full-time staff. However, most contributions are made part-time, so the number of people involved in the CRC is closer to 100. This adds to the communications challenge, since most people are splitting their time between CRC and other employment activities.

So why spend time on communication? In the CRC, close relationships between collaborating Parties are the basis of its culture. It is linked closely to the CRC goal of adoption of research outcomes; a full involvement of user groups from the outset of research projects is essential for this aim. Effective communication over the life of a project will actually save time.

What are we doing about communication in the new CRC? Very soon, we'll be developing a formal Communication and Adoption strategy, with help from professionals in the field. The communications component will cover both external and internal communications, and linked closely to adoption of CRC research outcomes. In the meantime, we've started an internal email news brief (CatchUP), which is being sent to everyone in the CRC every two weeks. It isn't another *Catchword*, and not intended to be; CatchUP is targeted at providing a rapid means of communication of issues, opportunities, people changes, and forthcoming events linked to the CRC. It will help fill a gap in our communications area, but will be only part of the overall strategy of communicating with CRC people, our Parties and our other stakeholders.

David Perry, the Leader of our Communication and Adoption Program, has the facilitating role for communication in the CRC. He believes, as I do, that communication (both internal and external) will play a key role in the success of the new venture. We are certainly serious about this; the CRC is committed to an external review of the effectiveness of its communication activities at the end of Years 1, 3, and 5. If you have ideas that you think may help (we're always open to suggestions), please call David on 03 9905 9600.

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PROGRAM 1
PREDICTING CATCHMENT BEHAVIOUR

Program Leader
ROB VERTESSY

Report by Rob Vertessy

After a pretty intense period of email discussion, a subset of the Technical Advisory Group (TAG) for Program 1 (Predicting Catchment Behaviour) met in Canberra on 15 July. Twenty two people from ten of the CRC for Catchment Hydrology Parties, and a further two people from outside the CRC participated in the meeting. Through the course of the day we discussed the pros and cons of five project proposals. Below is a brief overview of each.

Project 1.1 Development of the catchment modelling toolkit

This is a software engineering initiative that intends to bring together a variety of modelling approaches and systems into a common, inter-connected framework. It would be a first step in enabling the CRC to conduct holistic analyses of catchment function across a range of catchment areas and timescales. The project would depend heavily on the process understanding and algorithm development emerging from almost all of the other projects across the CRC for Catchment Hydrology. Contacts for this proposal are Rob Vertessy (CSIRO) and Rob Argent (University of Melbourne).

Project 1.2 Scaling procedures to support process-based hydrologic modelling at large scales

This project deals with a fundamental scientific problem that besets almost all hydrologic modelling conducted at

Please note...

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

Additional copies of the July to September Publications List are available from the Centre Office.

large spatial scales; the manner in which we represent hydrologic processes and specify input parameters, which to date have been largely defined for small scale systems only. From this project we hope to develop a stochastic, distribution function approach that can be applied to a variety of large scale hydrologic modelling problems such as soil moisture and water yield prediction. Contacts for this proposal are Rodger Grayson and Andrew Western (University of Melbourne).

Project 1.3 Estimating the water storage and permeability of landscapes from local to continental scales

This project aims to develop a capacity to predict spatial patterns of soil depth, water holding capacity and permeability across large regions. It will rely heavily on high definition terrain analysis modelling, gamma radiometrics and a variety of remote sensing products. Our small scale modelling experience tells us that soil properties are a significant mediating influence on many hydrologic processes. The challenge in this project will be to develop distribution functions of soil properties that are relevant to the hydrologic function of large systems. Contacts for this proposal are Neil McKenzie and Geoff Pickup (CSIRO).

Project 1.4 Bayesian analysis of uncertainties in hydrological modelling and data

This project seeks to apply Bayesian analysis to the problem of specifying uncertainty in hydrologic data and model predictions. Currently, few of us put uncertainty limits on our model predictions as they are so difficult to calculate. Recent developments in the numerical solution of Bayesian statistics make this much easier to do now. The need for us to ascribe uncertainty limits to our predictions will only increase as we strive to produce multi-objective analyses of catchment function. The contact for this proposal is QJ Wang (DNRE).

Project 1.5 Predicting the extent and geometry of river networks for routing

In Program 2 (Land Use Impacts on Rivers) there will probably be a major initiative to model the movement of sediment and transformation of a variety of pollutants through river networks. Before this can be done, we need to be able to predict the extent and hydraulic geometry of the river network system. This project aims to provide that capability. The contact for this proposal is Ian Prosser (CSIRO).

I'd like to thank all of the TAG members for their input to the project scoping process in Program 1. I was really impressed by the quality of the ideas and the generosity of spirit that was displayed in the sharing of these.

In the meantime, the CRC will be reviewing the structure of our Programs and Projects. For those project ideas that do prevail, we will once again invite members of the land and water management industry and the hydrologic research community to help us work them up into fully-fledged project briefs for consideration by our Board in November.

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WORKSHOP ON

CONTINUOUS SIMULATION FOR DESIGN FLOOD ESTIMATION

Monash University, 23-24 Nov 1999
***Main presenter:* Dr Walter Boughton**

This workshop is intended for people experienced in flood design who are interested in applying the latest developments in flood estimation methodologies. The continuous simulation approach developed by Dr Boughton in association with the CRC allows estimation of design floods from frequent events to floods of 1 in 2000 AEP.

Please contact Virginia Verrelli at the Centre Office on 03 9905 2704 to register your interest. Further details will be included in the September issue of Catchword.

COPIES OF VIDEOS, REPORTS AND WORKING DOCUMENTS ARE AVAILABLE FROM THE CENTRE OFFICE AT $20 PER COPY UNLESS OTHERWISE NOTED AND CAN BE ORDERED BY CONTACTING:

VIRGINIA VERRELLI ON TEL (03) 9905 2704 or FAX (03) 9905 5033 EMAIL virginia.verrelli@eng.monash.edu.au

PROGRAM 2

LAND-USE IMPACTS ON RIVERS

Program Leader

PETER HAIRSINE

Report by Peter Hairsine
CSIRO Land and Water

A companion catchment in Sulewesi?

The Australian Centre for International Agricultural Research (ACIAR) recently approached the CRC for Catchment Hydrology about scoping a project that compared the whole-of-catchment behaviour of an Australian catchment with an Indonesian catchment. In recent years, ACIAR has broadened its portfolio of projects to include agriculture-related natural resource issues. In these early days of the new CRC, it seemed appropriate that we consider a companion project to our focus catchments in a very different climate setting such as Indonesia. A further incentive us considering such a venture is that ACIAR supports activities in Australia in such companion arrangements.

ACIAR's own network had established that the Tondano catchment in northern Sulewesi was a potential catchment for such a project. The advantages of this catchment are that it has a range of perceived off-site impacts of land, a group of local researchers, some existing hydrologic data and relatively easy access.

In early July, I joined Basanti Maheshwari, University of Western Sydney, Hawkesbury, Kep Coughlan ACIAR, Canberra, and Ron Rakiman, ACIAR's in-country manager, for a one week visit to the catchment. The Tondano Catchment occupies 50,000 ha, including a large natural lake, called Lake Tondano. The surface area of the lake is over 4500 ha, supporting a diverse aquaculture industry. The outflow of the catchment is used for hydroelectricity. The power company maintain good records of rainfall and lake discharge.

The main agricultural crops in the catchment include rice, corn, cloves and vegetables and cover a total of 31,000 ha. The area under forest and shrub is estimated to be 6000 ha. There are 92 villages in the catchment. The catchment has mainly young soil with little horizon development (regosol) – in this case associated with recent volcanic activity, and the annual rainfall varies between 2000-3000 mm.

The stakeholder groups we visited identified the following natural resource problems in the catchment:

- eutrophication of the lake with related impacts including large growth of floating weeds
- poor water quality delivered downstream of the Lake to the water supply intake of Manado and the bay with a major marine park in the vicinity
- major siltation of the lake leading to change in its storage capacity,
- siltation of the channel leading to the hydro power station,
- reduced water flow from the lake leading to less power production

Tractable research issues for the CRC for Catchment Hydrology appeared to be centred on sediment and nutrient movement. Water quantity research, while important, would be difficult in this setting, as the reduction of the forest cover in the catchment was largely complete by the time the hydrologic record commenced.

The landscape is steep relative to most Australian catchments, and streams are generally of high energy. The rainfall is high in intensity and in annual totals. In short, it is a very different environment for us to consider testing our methodologies.

The outcome of the visit was a report to ACIAR. In the coming months ACIAR will consider the recommendations concerning early steps in Sulewesi. It will some months before we know whether ACIAR will proceed with any activities following our visit.

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Murray Darling Basin Groundwater Workshop 1999

14-16 September 1999 Griffith, NSW

The conference will provide a forum to examine:

- current knowledge and research initiatives
- water policy developments
- groundwater management plans

Please contact Ms Anne Vince at Country Conferences on tel: 02 6772 8753; Fax: 02 6772 8330 or email: country@northnet.com.au for further details and registration.

CANBERRA TECHNICAL SEMINAR SERIES

PROCESSES OF SEDIMENT AND TURBIDITY GENERATION FROM STREAM BANK EROSION

Speaker:
Dr Ian Prosser
CRC for Catchment Hydrology
CSIRO Land and Water

Thursday 9 September 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.

See flyer with this Catchword for details

NEW INDUSTRY 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

PROGRAM 3

SUSTAINABLE WATER ALLOCATION

Report by John Tisdell

Staff involved in the water allocation program, as with staff involved in the other programs, have been actively developing projects for consideration by the CRC Board. The overall aim of the program is to develop principles, guidelines, procedures and practical management tools for policy makers and water managers that will provide a sound basis for managing water use in an efficient and environmentally sustainable manner under the new national property rights framework. Four integrated research projects are proposed to deal with the identified issues:

- *Project 3.1 Integration of Water Balance, Climatic and Economic Models.*
- *Project 3.2 Establishing Guidelines and Procedures for Trading Water Allocations.*
- *Project 3.3 Improving Operational Water Use Efficiency in Distribution Channels.*
- *Project 3.4 Community Participation and Fairness in Water Allocation.*

The objectives of Project 3.1 are to:

- assess the possibilities of integrating existing water balance models, such as IQQM and REALM, with climate and economic models
- develop integrated models that maximise the economic value of water, subject to hydrological and climatic constraints
- use the models to evaluate water-trading frameworks developed in Project 3.2 in terms of economic efficiency, meeting environmental flow requirements, hydrological constraints and uncertainties of supply
- develop water policy and management recommendations.

Project 3.2 proposes to:

- conduct a brief review of the COAG task force recommendations in respect to the integration of climatic, hydrological and economic processes and the current status of water trading in Australia
- develop principles for the conversion of traded entitlements to equivalent volumes and securities relevant to their new locations and users to ensure tenure and sustainability of the system
- review current water entitlement regimes for surface and ground water in the focus catchments in terms of their ability to take account of climate variability and hydrological constraints on catchment yield and water supply
- explore the hydrological, economic and social implications of alternative water allocation systems such as capacity sharing and continuous accounting
- evaluate alternative guidelines and procedures for trading water allocations with respect to water quality and environmental flow requirements
- simulate trade under alternative tradeable property right regimes, tariff structures, and climatic conditions for achieving optimal distribution of water resources, given hydrological constraints to trade, using game theory, experimental economics and Bayesian theory, and making policy recommendations and suggestions for trading rules between and within catchments.

Project 3.3 is proposed to operate in conjunction with the Strategic Investigation and Education project (SI&E) of the Murray Darling Basin Commission (MDBC). This project will address the following key objectives:

- Develop processes to map channel seepage and losses at the regional scale.
- Develop tools for water managers to quantify channel losses at a regional scale.
- Determine the relative exchange rates between two locations to assist the re-allocation of “saved” water and to assess the relative exchange rates for transfers of water entitlements between two locations.

Within these CRC Objectives, the project work to be resourced by the CRC will also provide input to the SI&E Project.

Finally, Project 3.4 proposes to:

- evaluate the fairness of water entitlements and trade structures in the focus catchments
- examine the role and impact of community participation in water policy using such processes as WAMPS or comparable alternatives
- examine the fairness issues of managing irrigation decline such as water movements from channels, maintaining supply to a district as water demand declines, and fairness issues associated with the closing of channels.

Project 3.4 will also examine the impact of trade on regional towns and communities under the guidelines developed and hydrologically modelled in Projects 3.1 and 3.2. Country towns in river catchments depend in a large part on the income and demand associated with irrigated production.

Integration of the projects within the program and with projects in other programs is seen as vitally important to maximise return to the research.

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PROGRAM 4

URBAN STORMWATER QUALITY

Program Leader

TONY WONG

Report by Tony Wong

Constructed Wetlands in Urban Development – Answers to some frequently asked questions

Recently Peter Breen (CRC Freshwater Ecology), Alf Lester (LFA Pty Ltd – Urban Designer) and I presented a very successful industry seminar series on Constructed Stormwater Wetlands in Melbourne, Canberra, Sydney and Brisbane. A number of questions were frequently asked during these seminars and we have prepared answers to six of the most frequently asked question. These questions and answers will be published in Catchword over the next few months. The first two questions of this list of six are discussed in this issue.

Question

How do climatic factors and catchment characteristics influence the design and operation of constructed wetlands?

Answers

- Climatic factors affecting the design of constructed wetland include the mean annual rainfall, seasonal variation of rainfall and the inter-event period.

  The inter-relationship between the required size of the wetland to meet a level of treatment (in terms of detention period) and the hydrologic effectiveness are influence by these climatic factors. For example, Auckland has a slightly higher mean annual rainfall than Brisbane (1330 mm vs 1150 mm) but a constructed wetland in Auckland need only be 40% of that in Brisbane to achieve the same treatment effectiveness because rainfall in Auckland is more evenly distributed throughout the year;

- The design of the inlet structure can be influenced by the intensity of typical rainfall events in the catchment. Catchments with higher rainfall intensities, and thus higher hydraulic loading of the system, may require the inlet zone to provide a higher level of "hydrologic pre-treatment" in the form of flow attenuation for the macrophyte zone

- The design and selection of the outlet structure can often be influenced by the climatic characteristics of the catchment. For example, regions with a distinctive wet and dry season may benefit from a siphon outlet structure which allows for a much longer detention of stormwater inflow during the dry season. This would also promote a more diverse botanical structure in the wetland;

- Catchment characteristics affecting the design of constructed wetlands include the land use, geology and terrain. Catchment landuse and geology affect the pollutant types and thus the target pollutant characteristics for configuring the constructed wetland, eg. on-line vs off-line systems, ponds vs wetlands and detention period. The terrain of the site can sometime preclude the construction of a wetland system and a pond system (with longer detention periods) may have to be employed.

Question

Land developers often view areas of open water (lakes and ponds) as more marketable in land development than areas of aquatic vegetation (wetlands). What are the issues to be taken into account when arriving at the right balance between these elements in a particular development?

Answer from a technical perspective

- Good site analysis and clear runoff treatment objectives are crucial to the appropriate selection of a stormwater treatment and management system.

- Well-designed constructed wetland systems contain many of the treatment features of ponds with some additional treatment mechanisms associated with wetland vegetation. So where space is available and topography is suitable, a constructed wetland system can potentially offer a greater range of treatment processes and improved treatment performance. However in steep terrain it may only be practical to utilize ponds. Similarly, in a catchment where the geology results in the production of coarse suspended solids with little associated nutrients, it may not be necessary to utilize the additional treatment mechanisms provided by a constructed wetland system. However, in catchments where significant quantities of fine sediments and nutrients are generated, it would be advisable to employ constructed wetlands if the topography was suitable.

- If ponds are employed, a number of issues need to be considered:

  1. Inlet and outlet structures need to be designed to minimize short-circuiting during periods of in-pond stratification
  2. The likely reduced removal efficiency for fine particles
  3. The organic loading to the system necessary to avoid the development of low sediment redox

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.

UPCOMING CANBERRA SEMINARS

MODELLING AND DECISION SUPPORT FOR INTEGRATED CATCHMENT MANAGEMENT - DO WE KNOW WHERE WE'RE GOING?

Speaker:

Dr Rob Argent
CRC for Catchment Hydrology
The University of Melbourne

Wednesday 6 October 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.

See flyer with this Catchword for details

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FAX (03) 9905 5033
EMAIL virginia.verrelli@eng.monash.edu.au

4. The likelihood that there will be at least some periods when water quality in the system will conflict with other beneficial uses, such as landscape and aesthetic values.

- Where constructed wetland systems are employed, the following issues need to be considered:

5. Inlet and outlet structures need to be design to minimize short-circuiting.
6. Wetland basin design has to be matched to catchment hydrology in order to produce a wetland hydrologic regime that will support and maximize vegetation diversity
7. The vegetated component of the system needs to be appropriately placed in the treatment train so it is protected from coarse sediments
8. The design needs to consider specific faunal habitats and conditions, eg. adequate mosquito predator habitat is required, whereas extensive water bird breeding habitat may jeopardize water quality objectives.

Answer from a landscape and urban design perspective

- This question can probably be best answered by looking at the planning stage of wetland development. It is critical that the overall form of the wetland is read in its surrounding context e.g. proposing places where most people will view the wetland (viewslots) will ensure that views will take in proportionally larger areas of clear water. This gives an impression of a larger expanse of water than might exist. The open water zone can be achieved by creating deep water relatively close to the edge, or by producing a "stepped" edge (shallow narrow shelf then a steep drop-off)
- Similarly, where most people have access to the waters edge, it may also be appropriate to create a clear water zone, giving a different visual impression of the wetland.
- The type and scale of wetland planting also plays a critical role in the end vision. Where water views are desirable, choose planting that does not become too tall or is submerged/semi-submerged. It is then possible to look over it to a larger expanse of open water. Wetland planting can also produce marked seasonal changes in the character of the wetland, as some species die down as other species proliferate. Hence the expanse of open water may vary throughout the year.
- In summary, some helpful hints are:

1. Examine carefully the site context of the wetland, taking into consideration the following:-
   - sites where the majority of people will be viewing the wetland
   - the shape of the wetland (manipulating where possible to allow for expanses of open water closest to public view)
   - allowance for access to a clear water zone eg. boardwalk, jetty, small boat ramp
2. Carefully select wetland planting types, particularly where it is important to create unobstructed views and take into account seasonal variations.

An alternative is to create an enlarged open water zone at the outlet end of the wetland, or even a create an additional downstream water body, which is specifically designed to be open water and provide landscape and aesthetic opportunities. Where land and economic constraints allow, this approach satisfies both recreational and visual criteria. These are important values when considering the placement of wetland systems within public open space, without jeopardizing these uses as a result of poor water quality

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UPDATE EVAPOTRANSPIRATION MAPPING PROJECT

We regret to advise that the publication of the evaporation maps has been delayed, likely for some months. On the virtual eve of printing the maps, we discovered an error in the computer program used to generate them. This error occurred after our quality assurance processes, including a comparison with Morton's original program to ensure identical output results, and hence escaped earlier detection. We are glad that the problem was found prior to distribution, and are now investigating options to re-do the maps. I'd like to thank Dr Roger Jones and Dr Nick Austin for help with identification of the error.

To those who are waiting on the maps, the CRC apologises for this delay; you can be assured that we will do our best to expedite the revision.

(PROJECT LEADER: Q.J.Wang)

PROGRAM 5

CLIMATE VARIABILITY

Program Leader

TOM MCMAHON

Report by Tom McMahon

As part of the process of developing the research activity in Program 5 - Climate Variability for the CRC for Catchment Hydrology - a Technical Advisory Group (TAG) meeting was held on 21 July 1999 at the University of Melbourne. Attendees at the meeting included Yahya Abawi (Department of Natural Resources, Queensland), Francis Chiew (CRC - University of Melbourne), Andy Close (Murray Darling Basin Commission), Janice Green (Department of Land and Water Conservation, NSW), Graeme Hannan (Goulburn Murray Water), Tom McMahon (CRC - University of Melbourne), Russell Mein (CRC - Monash University), Graham Mills (Bureau of Meteorology Research Centre), Rae Moran (Department of Natural Resources and Environment, Victoria), Rory Nathan (Sinclair Knight Merz), David Perry (CRC - Monash University), Bruce Rhodes (Melbourne Water), Mark Sallaway (Department of Natural Resources, Queensland), Alan Seed (Bureau of Meteorology), Sri Srikanthan (Bureau of Meteorology), John Tisdell (CRC - Griffith University) Rob Vertessy CRC - CSIRO) and Q-J Wang (University of Melbourne/Department of Natural Resources, Victoria).

Based on the projects developed at the Woodend meeting (February, 1998) by representatives of potential partners in the new CRC for Catchment Hydrology, and the planned research outline prepared for the Business Plan, the morning session of the TAG was taken up with presentations by a number of participants outlining details of those projects. The afternoon session was devoted to discussing the potential projects and examining the linkages with other programs and projects both within and outside the CRC.

At the end of the day, the TAG agreed that details of three potential projects should be prepared for consideration by the CRC Governing Board at its August meeting. Some details about the projects follow.

5.1 Linking numerical weather and hydrological prediction

- To validate the current soil moisture models used in the Bureau of Meteorology NWP (Numerical Weather Prediction) system
- To improve the land surface hydrology modelling in the NWP to provide improved simulation of the surface-atmosphere feedbacks.
- To develop the outputs from the Bureau of Meteorology's NWP system to provide input to hydrological models at high spatial and temporal resolution over basin and catchment scales.

5.2 National data bank of stochastic climate and streamflow models

- To develop new stochastic data generation models and refine existing ones for climate and streamflow data.
- To develop or incorporate Bayesian analysis to derive probability distribution of stochastic model parameters.
- To produce a suite of computer programs which can be easily applied by practitioners on a PC.
- To regionalise model parameters or produce a set of parameter surfaces for obtaining model parameters for a given point in Australia.

5.3 Modelling and forecasting hydroclimatic variables in space and time

- To develop space-time models of rainfall for various climate regions of Australia.
- To develop a predictive space-time rainfall model with up to three hours lead time.
- To develop a design flood estimation method that takes into account spatial variability in catchment rainfall.
- To develop a space-time method (in stochastic hydrologic/climate states) for forecasting rainfall and runoff (via rainfall-runoff model) several months in advance (especially for water allocation models).
- To test methods for forecasting rainfall and runoff (above method, Bayesian method and currently used methods) and recommend best methods for given objectives, noting the variation of hydroclimate/ENSO teleconnections across Australia
- To investigate the use of forecasts of hydroclimatic variables to help manage water resources systems (links to water allocation program).

These projects are an interesting blend of strategic and tactical research which offer a unique opportunity to provide outcomes of immediate benefit to stakeholders.

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NEW TECHNICAL REPORT

FOREST MANAGEMENT FOR WATER QUALITY AND QUANTITY PROCEEDINGS OF THE SECOND FOREST EROSION WORKSHOP - MAY 1999

by
J.Croke
P.Lane

Report 99/6

This report contains the Proceedings of the Second Erosion in Forests Workshop held in Warburton in May 1999. This volume of short papers and abstracts reflects the wide range of research approaches and tools currently used to measure and model the impacts of timber harvesting activities, including road construction and vegetation changes, on water quality and quantity.

Copies available for $20 from the Centre Office.

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

STREAM CONFERENCE

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.

Please contact Virginia Verrelli on 03 9905 2704 to order your copy.

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TEL (03) 9905 2704 or
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EMAIL virginia.verrelli@eng.monash.edu.au

PROGRAM 6
RIVER RESTORATION

Program Leader
IAN RUTHERFURD

Dr Jennifer Davis
University of Melbourne, Dept. of Civil & Env. Engineering)

The Granite Creeks Project

Background

The Granite Creeks Project is the abbreviated name given to the CRC for Freshwater Ecology's project 'Restoration of degraded rural streams: the Granite Creeks Landcare Project, North-East Victoria'. This project, which commenced in January 1998, was instigated by the project leader, Professor Sam Lake, to gain an understanding of the ecological impacts of sand slugs in rural streams and how such streams might be rehabilitated. The project was split into two components consisting of a biological investigation and a geomorphological investigation.

Biological research

The biological research component commenced in January 1998 and will continue until June 2000, during which time researchers aim to determine the extent of ecological damage caused by the sand slugs, the ecological indicators and targets for restoration and the possible measures for channel restoration. CRCFE staff working on the biological component of the project include Alena Glaister (Monash University) and Dr. Barbara Downes (University of Melbourne).

Geomorphological researcch

The geomorphological component of the Granite Creeks Project also commenced in January 1998 and officially ended in July 1999, with research being carried out by Associate Professor Brian Finlayson (University of Melbourne) and myself (Dr. Jennifer Davis). The main aim of the geomorphological component was to determine the levels of sediment input into selected streams from the catchments of the Strathbogie Ranges, and the movements of such sediments within the streams. An important part of the project involved identifying the implications of the results for stream rehabilitation. The results arising from this investigation have now been finalised and a report on this component, published jointly by the CRC for Freshwater Ecology and CRC for Catchment Hydrology, will be available shortly. A short summary is provided here.

Summary of results

Activities associated with European settlement in the Granite Creeks catchments, such as clearing of vegetation, agriculture, channelisation and channel dredging and clearing, have initiated erosion heads in the Granite Creeks. These erosion heads have caused extensive channel incision and gullying. While other forms of erosion have also occurred in the Granite Creeks catchments, it is erosion of gullies, streambeds and banks which has produced the majority of the sediment that now forms sand slugs in many of the Granite Creeks. Incision and gullying occurred in the Granite Creeks catchments prior to European settlement but it is probable that such incidents were either related to some external stimulus (such as climate change) or more commonly to specific local conditions. Erosion in the Granite Creeks catchments over the last 150 years appears to have been synchronised over a wide area and this synchronisation can be attributed to European settlement. The effects of settlement can be likened to a very substantial climate change.

Rehabilitation issues

Given the nature of erosion and sediment storage in the Granite Creeks catchments there are two main issues that need to be addressed in any rehabilitation program that is developed for the Granite Creeks:

1. Minimisation of further sediment inputs. Activities responsible for erosion head initiation today are channel dredging and clearing and uncontrolled stock access. These problems will be best dealt with via land holder education. Best practice land management techniques will also be important to minimise gullying that has resulted in the past from the combination of high rainfall totals and low levels of vegetative cover. While the upper catchment would appear to be more fragile and so in need of priority action, preventing erosion heads initiation in the lower reaches of the creeks will also be important.

2. Managing existing sand slugs. The most important aspect of managing the existing sand slugs is minimising the migration rate of the snout of the sand slug to protect unimpacted downstream reaches. It would appear that natural features of the Granite Creeks (e.g. anabranching, low gradients and discharge) help to slow the snout migration rate at the lower end of these systems. Any management strategies need to recognise this and seek to prevent channel enlargement and the restriction of flow to anabranches.

Rehabilitation activities on those sections of the Granite Creeks already affected by sand deposition should focus on the creation of better habitat conditions through the re-establishment of bed features such as pools. Observations made during this study suggest that the reintroduction of large woody debris (LWD) will assist the development of such bedforms, but further research is required in this area.

The planned River Restoration Program of the new CRC for Catchment Hydrology includes proposals to make Granite Creeks one of its focus sites (within the Goulburn-Broken) catchment. The plan is to develop and implement a habitat recovery plan (in association with the local management agency) and evaluate the physical and ecological impact of the plan in association with the Cooperative Research Centre for Freshwater Ecology.

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COMMUNICATION AND ADOPTION PROGRAM

Program Leader
DAVID PERRY

Report by David Perry

The Flow on Effect - August 1999

This month I have been busy planning the new CRC's Communication and Adoption Program as well as coordinating the production of some new CRC reports and videos. I'll use this month's column to describe some of these, and also some upcoming seminars.

Erosion in Forests

For those *Catchword* readers interested in the research outcomes from Dr Jacky Croke's project 'Sediment Sources and Movement in Forest Environments' (part of our old Forest Hydrology Program), there are two key products that will be available shortly. The proceedings from the Second Forest Erosion Workshop held in Warburton earlier this year will be available by the end of August. This CRC publication entitled 'Forest Management for Water Quality and Quantity' consists of 21 papers covering a wide range of research on the 'erosion in forests' issue. The report will be available from the Centre Office for $20. (I would like to acknowledge the contribution of Tanya Jacobson at CSIRO Land and Water for patiently compiling and formatting the papers to create the report over the last few weeks.)

The 'Erosion in Forests' workshop included a one-day field trip where participants met in the Mountain Ash forests around Noojee to discuss the CRC research and its implications for forest management. A number of sessions were presented in the field trip by speakers from forest research and industry organisations. Topics included an introduction to the forest and Victorian forest management practices, sediment generation and delivery, soils erosion hazard assessment, the role of buffer strips and a demonstration of the CRC rainfall simulator.

A professional video crew was also on site for the whole day and filmed each presentation and the group discussion that followed. A 160 minute video has been produced entitled 'Erosion in Forests – Management for Water Quality and Quantity'. It is available for $20 from the Centre Office. The video will be valuable to forest and river managers who have a professional responsibility or interest in reducing the level and impacts of erosion during forest management practices.

Upcoming Technical Seminars

The Canberra seminar series continues for 1999 with a presentation by Dr Ian Prosser on 'Processes of Sediment and Turbidity Generation from Stream Bank Erosion' scheduled for Thursday 9 September 1999. The seminar commences at 10.45 for 11.00am in the Conference Room, C.S. Christian Laboratory, CSIRO Land and Water, Black Mountain Laboratory, Canberra (Clunies Ross Street, Acton). Please see the seminar flyer with this *Catchword*.

Other upcoming seminars in the Canberra series include presentations in October by Dr Peter Hairsine (Program Leader, Land-Use Impacts on Rivers) and Dr Rob Argent from the University of Melbourne. Further details will be available in future *Catchword*s.

Industry Seminars in Adelaide and Perth

Following the success of the Industry Seminars 'Constructed Stormwater Wetlands: From Design to Construction' delivered by Tony Wong, Peter Breen and Alf Lester in Melbourne, Canberra, Sydney and Brisbane earlier this year, arrangements are being made to repeat this seminar in Adelaide and Perth during October. If you are interested in attending this seminar at either of these locations please contact me – details below.

Thank you to all our Catchword Readers

Thank you to all those *Catchword* readers who took the time to renew their subscription. Many hundreds of people have responded to our request to restate their interest in receiving *Catchword*, which is very satisfying. It has provided the opportunity to update our database and add a number of new readers. This month only those *Catchword* readers who responded will receive *Catchword*. Those we have not heard from will receive a letter explaining the requirement to contact us to continue to receive *Catchword.* Perhaps there are colleagues at your workplace who would benefit from receiving *Catchword*. Please let them know to contact the Centre Office.

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A number of people who replied have chosen to receive an email notification that *Catchword* is available on the web. Each month around the same time others receive *Catchword* by post a pdf version of *Catchword* is posted on our website at www.catchment.crc.org.au. A pdf file means that the issue of *Catchword* can be downloaded to your computer and read using the free software Adobe Acrobat (available through a link at the CRC website). The *Catchword* you receive this way looks exactly the same as the printed *Catchword* and parts or all of it can be printed on an standard office printer. If you would like to receive *Catchword* this way please contact Virginia at the Centre Office on 03 9905 2704.

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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.

INDUSTRY REPORT

MANAGING URBAN STORMWATER USING CONSTRUCTED WETLANDS

by

Tony Wong
Peter Breen
Nicholas Somes
Sara Lloyd

Report 98/7

The importance and relevance of the CRC's research in stormwater management using constructed wetlands is reflected in the registration of over 240 people at the recent CRC Industry Seminar 'Constructed Stormwater Wetlands: From Design to Construction'.

'Managing Urban Stormwater using Constructed Wetlands' provides a clear and concise overview of the hydrological and ecological principles required for effective design of stormwater wetlands.

This report is the seventh in the successful CRC Industry Report Series - over 2000 have been sold.

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

CRC PROFILE

Our profile for August is Geoff Love.

Geoff Love.

The hydrological cycle - that cyclic process whereby water changes phase between the liquid, gaseous and solid states is a truly marvellous thing. As a meteorologist my career has been build around improving the understanding, and forecasting, of all aspects of the hydrological cycle.

For over a decade I worked as a forecaster, researcher and ultimately Regional Director in the Bureau's Darwin Regional Office. My PhD studies were related to tropical cyclone formation and I have had an interest in better understanding and forecasting how some of that water which is resident in the oceans (around 96% of the Earth's total water content is in the oceans) becomes entrained into tropical cyclones. This entrainment then leads then to consideration of the processes which enable the gaseous water vapour (0.0001% of the Earth's water content) to condense thereby releasing the latent heat necessary to drive tropical cyclones (and in fact all weather systems). That .0001% of the Earth's water does a lot of good for the inhabitants of this planet!

Of course, for most hydrologists the interesting bit starts when the precipitation has fallen. When we think critically about water budgets it is clear that advection of moisture from the marine environment to the terrestrial is very important. It is useful to realise that over the oceans evaporation exceeds precipitation by around 110%, whereas over the landmasses evaporation is only 66% of precipitation. An important trick for meteorologists then is to be able to forecast the advection of moisture from sea to land. In practical terms while in Darwin I had to forecast where the tropical cyclones would landfall and how much rain they would drop - and to what extent associated flooding would occur and then warn threatened communities.

A wonderful tool for rainfall diagnosis and flood forecasting is the weather radar. Raindrops reflect radar signals, but the precise relationship between reflectivity (Z) and rainfall rate (R) varies between weather systems (and most studies have been mid-latitude based). For this reason, during my time as a forecaster, the rainfall rates available from radar were only approximate, and because of the mid-latitude bias in studies a gross underestimate actual rates. I look forward to the day when the realtime calibration of radar rainfall rates helps with early warning of disastrous floods, and I'm sure the CRC will have a big part to play in this process.

On leaving Darwin in 1987 I moved to Melbourne to head up the Bureau's National Meteorological Centre (NMC). NMC is the place where the Bureau's numerical models are run. As an operational forecaster it had always been clear to me that the Bureau does much better at forecasting temperature or even wind (speed and direction) than rainfall. As a scientist I have always been sure that it would be the large-scale numerical weather prediction systems running on supercomputers which would improve our ability to accurately diagnose, and forecast up to a week ahead, the hydrological cycle. The Bureau's current major computer runs at around 100 Gflops, with 8 Gbyte memory - and it is clear that if we want to forecast rainfall properly we need still more computation power. This said, we have come a long way in the last decade. In 1991 I caused a furore by predicting a major flood event on the basis of numerical model output, whereas today I hope it is generally accepted that the Bureau, through its modelling, has skill in rainfall forecasting. This improvement in skill has been achieved through the exhaustive process of incorporating the best science into the models, making forecasts twice daily, verifying the forecasts and then implementing better science as computing capacity allows. Forecast rainfall rates over broad areas now match the available observations well, however we still have work to do on the smaller scale weather systems (such as thunderstorms and large showers).

I am now the Bureau of Meteorology's Deputy Director (Services), with overall responsibility for seeing that the Bureau's services meet the public's needs. An important next step in the process of improving the Bureau's capability is to improve the ways our weather prediction systems are interfaced to decision support systems. Where we work with weather sensitive sectors such as emergency services or aviation the understanding, and interfacing with the decision support systems, is easier than with sectors such as agriculture and natural resource management, which have more diverse and diffuse requirements. I think there is tremendous potential to link both weather prediction and climate prediction systems to water balance models for catchments. This will allow us to diagnose in realtime, and to make short term (5-10 day) forecasts of, rainfall, evaporation, soil absorption of water, runoff and streamflow. There are also opportunities to make useful climate timescale forecasts of tendencies of these parameters. I hope that over the period of my involvement with the CRC for Catchment Hydrology we make substantial progress in meeting these challenges.

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WHERE ARE THEY NOW?

Report by Mehdi Yasi

Recently, in *Catchword* No. 70, Russell Mein commented on 'Rivers and friends'. I should add that the growing need for a cooperative and supportive interest in "river research and management" has been urgently recognised worldwide as a major new challenge at the turn of the century. In 1993, I was one of the young river fellows who came from Iran and joined the Dept. of Civil Engineering and the CRC at Monash University to undertake postgraduate study.

My prior degrees were in Irrigation Engineering at Shiraz University in Iran. In particular, I was encouraged by my supervisor, Dr Mahmood Javan, to study river flows, and my Masters thesis included an extensive field survey aimed at river training and streambank protection by bio-technical means. The outcome of this research on a 25-km reach of the Fahlian river has been honored by the water industry. Back in 1989, I was employed by Urmia University, in Iran, as a lecturer until I was awarded a scholarship to pursue my study in Australia, in 1992. Eventually, I started at Monash in 1993 with the help of Bob Keller and the CRC. My PhD research was on the river hydraulics and engineering. In particular, the thesis was aimed at the physical and numerical modelling of the flow and bed topography behind groynes (not groins!). I spent four years undertaking my degree, and lived almost six years in Australia along with my family (Shahla, Alireza and Hamid).

As part of the CRC, it was a great experience for me to find out how different scientific disciplines may interact and share their potential within a cooperative and friendly environment. A good example of such cooperation is that various contributions to river knowledge (including my PhD research) are being assembled in a Stream Restoration Manual that will soon be available worldwide.

After leaving Australia in 1997, I have resumed my former job at Urmia University, Iran, with a new position as assistant professor at the Dept. of Irrigation. Urmia, with a population of over half a million is one of the western cities of Iran near the Urmia lake, (one of the world's magnificent salty lakes hosting only brown algae, Artemia - people just love floating on the water). I am pleased to say, in this summer season in the north, it takes only half an hour for us to reach the beach (It might take longer for you!).

Currently, the Irrigation Department focuses on the B.Sc. and M.Sc. courses in the specific fields of Irrigation, Drainage, and Hydraulic structures. I am involved mainly in teaching Hydraulics and Sediment Transport, and am the only person in the Department with research activities directed towards river problems.

Here, there are friendly colleagues, research facilities, a large and well equipped hydraulic laboratory (larger than that in Monash) for physical river modelling. There is also extensive interest among water-related parties, and sound evidence of river problems within the state and around the borders. What is missing in this regard is a CRC that could join the groups together (i.e. we are far behind 1994 in the Australian river calendar!). The importance of cooperation with river systems shared by countries is very crucial in this region. The western state of Iran currently has three countries as neighbours: Azarbaijan (part of the former Soviet Union), Turkey and Iraq; most of them under seasonal political changes and instabilities. As water scarcities increase, there will be the risk of great conflict over the water in the transboundary rivers as well as in many underground aquifers. Examples are the Araz river which is a major natural borderline, and the Zab river that crosses the borderline. These clearly give a priority not only to our research but also show the major challenge is to work out water-sharing arrangements that seek to maximise benefits for all users. In this regard, a number of projects has been proposed and are under revision. I hope to be engaged in this.

Apart from work, it has been a great experience for the family settling in after six years away. Since leaving Australia, we have been trying to cycle around the country, also climbing mountains, floating on the Urmia lake and walking along the rivers to remind ourselves of being back home. Overall, all things seems pretty well with us where we have landed.

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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.

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