NEWSLETTER OF THE COOPERATIVE RESEARCH CENTRE FOR CATCHMENT HYDROLOGY

CATCHWORD

NO 87 SEPTEMBER 2000

A NOTE FROM THE DIRECTOR

Professor
Russell Mein

Inside...

COOPERATIVE RESEARCH CENTRE FOR CATCHMENT HYDROLOGY

RESEARCH PROGRAM OVERVIEW

'The Chance to Change'

Many readers of *Catchword* will already have seen the discussion paper with this title, written by Dr Robin Batterham, Chief Scientist of Australia. It assesses the state of this country's science, engineering and technology (SET) base, relative to other nations, and sets out the changes in direction needed for Australia to be a successful knowledge-based economy in the 21st Century.

The discussion paper is a compelling document, showing clearly that change is needed in our level of investment in the SET base. Batterham proposes that the drivers are:

(i) culture – the support needed at every level to inspire our children to study science and maths, and to continue with related studies in tertiary institutions;

(ii) ideas – a major improvement in the process by which ideas are generated, and translated into improvements in our health, environment, and economic growth;

(iii) commercialisation – the integration of the innovative process to realise the potential value of our SET knowledge base.

The Chief Scientist makes a number of recommendations of the changes he sees as needed for enhancement of Australia's SET base, including some related to Cooperative Research Centres.

Cooperative Research Centres (CRCs)

The discussion paper was strongly supportive of the CRC Program, and makes particular mention of the linkages between research and industry achieved in CRCs. 'The Review considers that the CRC approach to allocation of public funding delivers significant results in helping to raise awareness of the benefits of collaborative research environments and should be strongly supported'.

A point given some prominence is the involvement of small to medium sized enterprises (SMEs) in CRCs. The argument is made that SMEs do not have the resources (nor the security) to be able to commit for seven years as a core partner in a CRC, but potentially have a major role in developing the research ideas into practice. A major recommendation in the discussion paper is for 'greater SME access' to the CRC Program.

Specifically, Batterham recommends that the CRC Program be expanded, and additional funding provided, 'to enable CRCs to:

- develop more flexible operating arrangements and enhance opportunities for participation by SMEs;
- expand their activities beyond the core set of activities agreed at establishment;
- increase their collaboration with international research networks engaged in cutting edge research;
- encourage the CRCs to tap into more diverse sets of funding sources.'

CRC for Catchment Hydrology

It is reassuring that the Chief Scientist is so supportive of the CRC Program, widely regarded as a successful model for linking researchers with each other and with research users. In the CRC for Catchment Hydrology, the strength of such linkages far surpasses anything I've experienced in over 35 years of research and application in the hydrological field.

It is appropriate to consider the recommendations made for CRCs in 'The chance to change' in relation to the CRC for Catchment Hydrology.

(i) position on SMEs. The Chief Scientists comments perhaps are more pertinent for CRCs in commercial areas. The CRC for Catchment Hydrology has adopted a public good stance, and a policy to make available knowledge/data/tools widely (and at very nominal cost) to organisations outside the CRC. This is achieved through a range of reports and videos, field days and seminars, workshops and short courses; for example, SMEs have been particularly active in our Industry Seminars – we would want to build on those links.

(ii) expansion of activities beyond the 'core'. Our Business Plan focuses on a program of activities designed to achieve a capability for prediction at catchment scale. This is a broad and multi-faceted objective, always able to be enhanced by additional work. We are doing some of this already through a series of Associated Projects, but could certainly do more if the resources were provided;

(iii) collaboration with overseas networks. Readers of our Annual Reports will see many overseas organisations listed under research links and collaborations. Not surprisingly, most of this is initiated via personal contact, and this is important. Extra funds would enable extended interchanges by research teams, and greatly magnify the potential benefits;

CRC PUBLICATIONS LIST

Reports, videos and software, available from the CRC, are listed in our Publications List,

Copies of the Publications List are available on request from the Centre Office on 03 9905 2704 or can be downloaded from the CRC website at

www.catchment.crc.org.au

All prices listed include GST, postage and handling.

(iv) more diverse funding sources. As with all research organisations, funding is a challenge. To date we have been successful in attracting contract research money from a number of sources, and must continue to be successful to meet our research targets. The changes in the water industry in recent years has diversified the opportunities, and we certainly need to adapt to make the most of them.

CONCLUDING REMARK

The Chief Scientist had made a compelling case for change in the SET base to meet Australia's future needs. His discussion paper is open for comment until the end of October, and available for perusal on www.isr.gov.au/science/review. I urge you to read it; the section on CRCs I've highlighted above is only a small part of the document.

Russell Mein
Tel: (03) 9905 4980
Email: russell.mein@eng.monash.edu.au

PROGRAM 1
PREDICTING CATCHMENT BEHAVIOUR

Program Leader
ROB VERTESSY

SEQ Project – Stakeholders meetings

In my last contribution to *Catchword* (July 2000 issue) I described two new Associated/Additional projects in Program 1, both relating to water quality modelling tasks in the Brisbane River and adjacent catchment areas. These projects are jointly funded by the South East Queensland Regional Water Quality Management Strategy (SEQRWQMS) and the CRC for Catchment Hydrology. We are trying to build an Environmental Management Support System (EMSS) that can be used by catchment stakeholders to evaluate alternative management strategies to improve water quality. I and fellow team members Sue Cuddy, Joel Rahman, Fred Watson, Francis Chiew, Phil Scanlon and Alistair Gilmour have just returned from Brisbane where we held the first of four planned stakeholder consultation meetings.

At that meeting we presented a concept EMSS based on the Tarsier modelling system developed by Fred Watson, and asked the stakeholders what they thought about our ideas. The responses we got were variable, ranging from 'spot on' to 'pretty irrelevant'. Here, I'd like to refer to some of the tensions we face in producing an EMSS that will appeal to a broad stakeholder constituency characterised by a wide variety of needs. I believe that these tensions are not unique to this SEQ study, and that we will face these issues throughout the life of our new CRC in our quest to build catchment models.

Variety in model uses and user skills

One of the first tensions we face is developing a system with which people of different skill levels and interests can interact. At one extreme, educational and community groups want access to a system that simply describes the catchment management issues at play. This might entail a facility for the system to replay model scenarios that demonstrate the water quality consequences of changed catchment management, but this audience would not be expected to set-up and run models in the EMSS. At the other extreme, scientists and engineers want a framework for embedding their own sub-models of catchment function. For instance, other SEQ researchers are developing models of in-stream ecologic function and it is our hope that these may one day be incorporated into the EMSS. In the middle ground are agency staff and consultants who will want to calibrate and test the EMSS and run scenarios to yield results for presentation to stakeholders. Satisfying these diverse needs is a major challenge for the EMSS developers, but we have developed an approach that should offer a solution.

Levels of detail for models – space, time and processes

Another major tension relates to the level of detail that the model should provide, both in the spatial and temporal sense, as well as the process-representation sense. The main purpose of the EMSS is to provide a synoptic view of where the flows, sediment and nutrient loads arise from across the region, how they are conveyed to the coastal waters, and how they might be affected by management actions. Given the extent of the SEQ region (about 22,000 km^2) and the user demands for fast model execution times (20 year duration simulations that can be run repeatedly in a workshop), we are forced to adopt a lumped conceptual model approach. Our planned EMSS implementation might have 100 or so individual sub-catchments and the user will be able to specify relative areas for different landuses within these, but not say where they are in the sub-catchment. Similarly, they will be able to say how many and what kind of treatments are imposed in the sub-catchment but not specify where these are implemented. Understandably, some stakeholders, particularly those living high up in the catchment, desire more detailed tools that can provide spatial discrimination within their sub-catchments and possibly provide greater levels of process representation. We don't aim to provide these capabilities in the life of our SEQ project but do aim to design the EMSS so that 'limited-area' models of higher definition can be nested within the regional model. We believe that such models should be able to be run in isolation of the region as a whole.

Geographical boundaries

A final tension that makes life complicated for us is that different stakeholders put different geographical boundaries around their problem domain. Local councils, for instance, might think at the Local Government Area level which might straddle multiple catchments. Catchment and community groups will logically work at the catchment level, though the outlets of their catchments might not necessarily be the same ones we would use as hydrologists (ie. at flow gauging stations). Even though our models must run on a catchment basis, the EMSS needs to be pretty flexible to permit these different groups to specify management actions on these different domains.

Conclusion

In conclusion, if we want our modelling systems to have broad appeal, they need to be carefully designed so as to provide diverse operational features like those described above. I'm confident that the Tarsier system we are using to underpin the EMSS will put us in good stead for achieving this aim. Well beyond the life of our 15-month SEQ project, we will be dealing with this challenge in the development of the CRC for Catchment Hydrology's Catchment Modelling Toolkit.

Rob Vertessy
Tel.: (02) 6246 5790
Email: rob.vertessy@cbr.clw.csiro.au

PROGRAM 2

LAND-USE IMPACTS ON RIVERS

Program Leader
PETER HAIRSINE

Report by Bofu Yu

Evaluation of physically-based runoff and soil erosion models

Why physically-based models?

Runoff and soil erosion models are an important component of our ability to predict the impacts of land-use on rivers. In the last 20 years there has been a world-wide trend towards testing and using physically-based runoff and soil erosion models at both field and catchment scales. These physically-based models, often with an explicit attempt to describe runoff and erosion processes, are better equipped to evaluate the impacts of management intervention and environmental change at a range of temporal and spatial scales. In contrast to conceptual runoff and soil erosion models, there are at least three strong arguments in support of approaches based on physical principles and our understanding of the runoff and sediment generation processes. Firstly, physically-based models are more likely to succeed outside the environment in which they were developed, and hence are more likely to achieve broad applicability. Secondly, model parameters, having clearer physical meaning, could be estimated from measurable variables such as soil hydraulic properties, biomass, and various land-use attributes and management practices. Finally, to calibrate conceptual models, long-term experimentation is often required. For physically-based models, the period of experimentation, hence the cost, can be reduced considerably. In fact, rainfall simulators can be used effectively to measure runoff and sediment and nutrient loads in order to derive model parameters.

CRC Project 2.2

One of the primary objectives of CRC for Catchment Hydrology Project 2.2 'Managing pollutant delivery in dryland upland catchments' is to test and evaluate algorithms and/or models of generation and delivery of sediments and sorbed pollutants (including nutrients) to the edge of stream channels. Such tested algorithms or modules will eventually be incorporated in the toolkit being developed within the CRC for Catchment Hydrology. Table 1 summarises a number of approaches/models under consideration. At present, the Water Erosion Prediction Project (WEPP) and its applicability are being assessed at a number of sites along the western slopes of New South Wales.

PROJECT DETAILS ON OUR WEBSITE

The CRC has recently published 'project description sheets' for each research project on the CRC website.

The pages (also available as pdf files) give details of research objectives, expected outcomes, target problems, key tasks, links, staff involved and contacts for each project.

Click on 'Projects 1999-2002' on our website at www.catchment.crc.org.au

NEW CRC SOFTWARE

AQUACYCLE

Aquacycle is a daily urban water balance model which can be used to investigate the use of locally generated stormwater and wastewater as a substitute for imported water. Dr. Grace Mitchell developed Aquacycle during her postgraduate studies.

The Aquacycle includes the CD-ROM and a complimentary copy of the CRC Industry report 'The Reuse Potential of Urban Stormwater and Wastewater'.

A copy of Aquacycle can be ordered through the Centre Office. Users are requested to sign a User Agreement and a manufacturing and distribution cost of $27.50 applies to orders.

For further information visit www.catchment.crc.org.au/products

PLEASE NOTE: The Aquacycle software is currently only available for IBM compatible computers.

Table 1:Models and approaches under consideration

	USLE-derived, e.g. ANSWERS, AGNPS, CREAMS, CASC2D-SED	WEPP	LISEM	EUROSEM	GUEST/GUEPS
Mode of Operation	Event Continuous	Event Continuous	Event	Event	Event Continuous –TBD
Climatic data requirements	R-factor, Event EI_{30}, pluviograph, etc	Rainfall amount; Storm duration; Peak intensity; Time to peak	Pluviograph (break-point)	Pluviograph (break-point)	Rainfall amount Peak rainfall intensity
Hydrologic data requirements runoff generation	Peak flow rate, unit discharge, etc Curve Number, Green-Ampt	Runoff amount; Peak runoff rate Green-Ampt (Curve Number)	Runoff hydrograph Holtan; Green-Ampt; Richards	Runoff hydrograph Smith-Parlange	Runoff amount and effective runoff rate Water balance model coupled with a spatially variable
Main drivers for soil erosion	Unit and/or peak discharge	Rainfall intensity Peak runoff rate Sheer stress	Kinetic energy of rainfall Stream power	Kinetic energy of rainfall Stream power	Infiltration model Rainfall intensity Stream power
Size distribution	Up to three classes?	Three classes Hillslope/ channel	Single class	Single class	Continuous in principle
Catchment representation comments	Often RASTER-based Many in this category. Rigorous comparison can be difficult and probably unnecessary	Essentially does what RUSLE can do with added functionality	Plane/ channel Critically dependent on PC Raster, a standing-alone software, suitable for small watersheds	RASTER-based Similar in many aspects to LISEM, appropriate for small watersheds	TBD Considerable in-house know-how, but much yet to be fully developed

WEPP

WEPP is a process-based model for runoff and soil erosion prediction. While the universal soil loss equation (USLE) and the revised USLE (RUSLE) have been the most widely used erosion prediction model for agricultural land, WEPP represents a new generation of erosion prediction technology. WEPP attempts to model the fundamental erosion processes and to achieve broad applicability in a range of erosion environments such as rangeland, forests, and urbanised areas, in addition to the traditional farm fields. By design, WEPP has all the capabilities as USLE/RUSLE has, but with considerable added functionality. In particular, WEPP can handle complex hill slope profiles with ease and is able to address the effect of intrinsic or externally imposed climate variability on daily runoff, soil erosion and sediment yield.

Predicted and measured results

Figure A shows predicted event soil losses from bare fallow plots as a function of the average recurrence interval in comparison with the measured soil losses for the period from Jan 1981 to Jan 1987 at Gunnedah, New South Wales. Both actual tillage sequence and typical management scenarios (TMS) were considered. These fallow plots had a 9% slope and on average were harrowed about 10 times a year during the experiment period. Climate input variables included daily rain amount, rain duration, peak rain intensity, time to peak, daily maximum and minimum temperature, and daily solar radiation. Model parameter (e.g. effective saturated hydraulic conductivity, soil erodibilities) values were estimated from soil texture, soil organic matter content, and cation exchange capacity measured at the site. No parameter calibration was attempted, because we were interested in the potential of these physically-based models in a true predictive sense. It can be seen that predicted event soil losses closely match the measured values and that WEPP works quite well for the site.

Future work

There is much to be done to validate a variety of algorithms and models at a number of sites with a range of climates, topography, soils, land-uses, and management practices. In the longer-term, of particular interest are model performances for grazing lands - by far the most dominant land use in Australia in terms of its spatial coverage.

Bofu Yu
Griffith University
Tel: (07) 3875 5258
Email: b.yu@mailbox.gu.edu.au

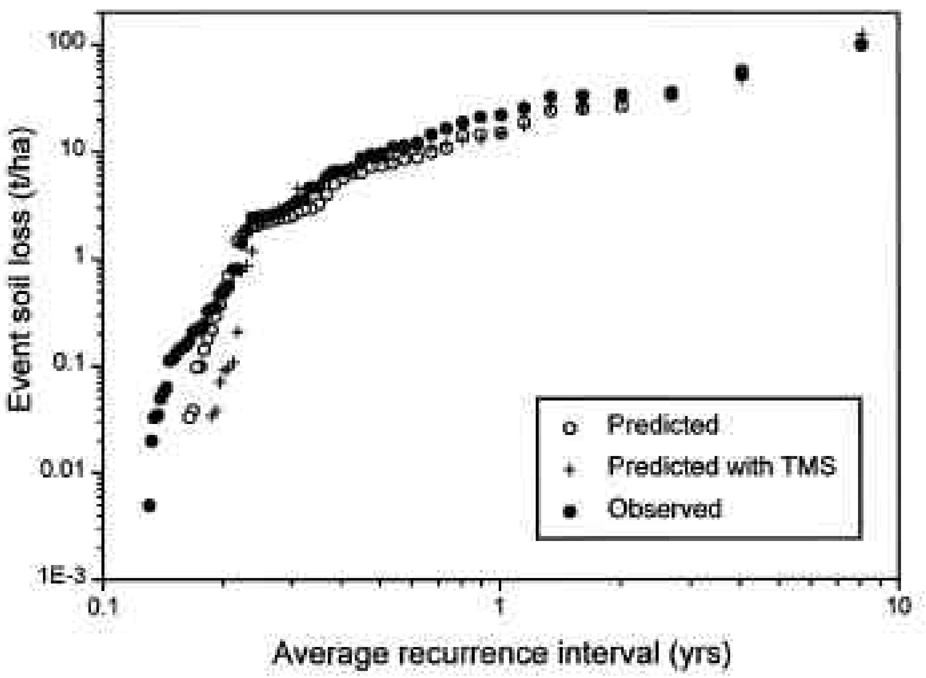

Figure A: Predicted and measured soil losses

NEW CRC PROGRAM SOFTWARE

Extreme Design Rainfalls for Victoria

The crcforge-extract computer program has been produced to facilitate the extraction of rare to extreme rainfalls from the (at present, Victorian) database, and to present the information in forms needed for hydrologic design.

For further information see our website at www.catchment.crc.org.au/news

To obtain a copy of crcforge-extract contact Virginia Verrelli at the Centre Office on 03 9905 2704 or email virginia.verrelli@eng.monash.edu.au

CANBERRA TECHNICAL SEMINAR

IRRIGATOR ATTITUDES TO WATER TRADING IN THE GOULBURN-MURRAY CATCHMENT, VICTORIA

by

Dr John Tisdell
Program Leader
CRC for Catchment Hydrology
Griffith University

Thursday 2 November 2000

TIME
10.45 for an 11.00am start

Tea/coffee on arrival

at
Conference Room
CS Christian Laboratory
CSIRO Land and Water
Black Mountain Laboratory
(Clunies Ross Street, Acton)

For further information contact Tanya Jacobson on 02 6246 5746

PROGRAM 3 SUSTAINABLE WATER ALLOCATION

Program Leader JOHN TISDELL

Irrigator and community attitudes to water allocation and trading

Fitzroy and Goulburn-Murray surveys

During the last two months we have been conducting a mail survey of irrigators and community members in the Fitzroy and Goulburn-Murray catchments. The surveys elicited responses on: irrigator and community attitudes to COAG reforms; temporary and permanent water trading; the role of the water authority in the market; and the environmental impact of trade. The surveys also explored irrigator and community attitudes to breaking the nexus between land and water, points of blockage in current water markets, and possible adjustments to trading rules and procedures.

Method of sampling

A stratified random sample of 1,000 irrigators was drawn from the Goulburn-Murray catchment using irrigation areas as stratums. Initial analysis of water trading data suggests that trade activity differs significantly across irrigation areas. The impact and attitudes to trade therefore may also differ across irrigation areas. Due to the small population of irrigators in the Fitzroy basin (popl. 388) the total population was sampled.

A stratified random sample of 1,000 community members was also drawn in both catchments. In sampling the communities, towns were used as sub-stratums within stratums as the impact of trade is expected to vary according to town size.

Findings, communication and adoption

Seminars are being organised to discuss the initial findings of the research with the CRC industry Parties. Once the analysis of the survey data is complete, a report will be released and an executive summary of the findings will be published in *Catchword* and sent to the survey respondents.

The combined findings of the surveys will provide input into the development trading rules and procedures for mature water markets. In phase 2 of the project, a series of experiments will be conducted to evaluate the efficiency and equity of these trading rules and procedures.

John Tisdell
Tel: (07) 3875 5291
Email: j.tisdell@mailbox.gu.edu.au

PROGRAM 4 URBAN STORMWATER QUALITY

Program Leader TONY WONG

Report by Sara Lloyd

The Construction of an Alternative Drainage Scheme at Lynbrook Estate

Introduction

Innovative stormwater management approaches using specifications from the initial CRC work have been introduced in a subdivision development at Lynbrook, east of Melbourne. This article aims to give a brief overview of the construction activities at the site over the last 6 months,

The Layout of Stage 12 at Lynbrook Estate

The alternative drainage scheme for the 93 allotments in Stage 12 of the Lynbrook Estate is now complete and Stage 13 under way. Over the last 6 months I have documented the construction activities of the swales, trenches, bio-retention system and wetlands incorporated into the drainage scheme. The purpose was to explore impediments in construction activities to the incorporation of Best Practice Management treatment measures in large scale residential developments. KLM Development and Barry Murphy Design Group are the engineering and landscape consultants respectively, for the Urban Land Corporation (ULC) at Lynbrook. The greatest challenge faced by the design team was in the transfer of the drainage design concepts to their sub-consultants (eg. drainage contractors).

The layout of Stage 12 is shown in *Figure B*. *Photo 1* (Lynbrook Boulevard) was taken prior to the site being developed. (For more information refer to the February, 2000 edition of *Catchword*.)

Construction of the Bio-Retention System

The design of the bio-retention system aims to delay, attenuate and treat runoff as close to the source as possible. Along Lynbrook Boulevard the cross-fall of the divided road is towards the median strip and no kerb and gutter system exists - thereby promoting the even distribution of road runoff into the bio-retention system. Road runoff is pre-treated by a grassed filter strip on either side of the bio-retention system extending to the road verge. The runoff is then infiltrated through the base of the swale and into a 600 mm deep gravel trench. *Photo 2* shows the construction of the gravel trench. Once the trench is excavated it is lined with geotexile fabric. Root barriers were used along the sections of the trench where

Photo 1: Lynbrook Boulevard - initial stage

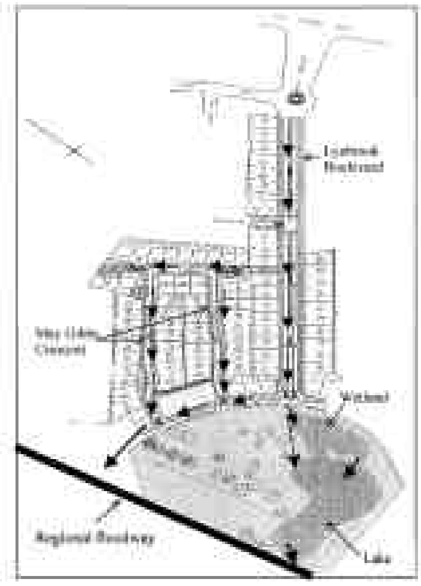

Figure B: Layout of Stage 12 at Lynbrook Estate (Lynebrook Boulevard)

Photo 2: Construction of gravel trench

Eucalypts would subsequently be planted. The white PVC pipe, which can be seen in the centre of the *Photo 2*, is the discharge point of the roof runoff directly into the gravel trench. A perforated pipe runs along the centre of the trench to collect and convey the infiltrated runoff downstream to the wetland system. The trench is then backfilled with 2mm – 7mm gravel screening.

To protect the trench from excessive sediment loads during the landscaping phase of the swale component of the bio-retention system, the geotexile was temporarily held in place over the trench. The geotexile fabric was later laid back and 10mm gravels were used to top-up the trench to create the base of the swale. The base of the swale was landscaped to form a meandering dry channel fringed by tussock grasses, Eucalypts and hardy turf grass.

Photo 3 shows the final result; a magnificent looking median strip along the entrance boulevard leading to the wetlands and lake. The design standards of the bio-retention system remain the same as for conventional drainage systems. The underlying gravel trench component is designed to convey the 3 month ARI event while the bio-retention system (ie. trench and swale) are designed to carry the 1 in 5 yr flow. The 100 yr ARI event are conveyed within the roadway.

Construction of the Grass-Swale and Trench System

The lower section of the Lynbrook development is considerably flatter than other areas of the estate and therefore presented numerous design constraints. At May Gibbs Crescent (refer to *Figure B* for location) a grass swale system and gravel trench system are used for drainage in the local access street. The design of the driveway crossovers was altered a number of times during the early stages of concept development to reflect the limitations on their design imposed by council and material suppliers.

NEW CRC TECHNICAL REPORT

WATER SENSITIVE ROAD DESIGN - DESIGN OPTIONS FOR IMPROVING STORMWATER QUALITY OF ROAD RUNOFF

by

Tony Wong
Peter Breen
Sara Lloyd

Report 00/1

This joint publication with the CRC for Freshwater Ecology investigates opportunities for incorporating stormwater quality improvement measures into road design practices for protecting aquatic ecosystems.

Copies of the report are available from the Centre Office for $27.50 (includes postage and GST).

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

QUESTION FOR THE CRC?

The CRC website Forum is now available for you to use at www.catchment.crc.org.au/forum

The Forum aims to assist you in understanding the CRC's research outcomes and their application by providing a direct communication link to the resources of the CRC for Catchment Hydrology.

You are welcome to use it anytime to answer your questions or to post requests for information.

Information on how to use the Forum is given on our website.

The flatter slope in May Gibbs Crescent meant the level of the centre of the swale was being constantly checked to ensure the correct grade of the swale, as shown in *Photo 4*. The swale system forms a shallow broad depression as part of the nature strip. The swale is 2m wide on either side of the gravel trench with a side slope of 1 in 13.

Photo 5 shows the rolling out of the geotexile to line the trench, which is subsequently backfilled with the gravel medium. The surface of the trench was covered with geotexile and sands used to provide a growth medium for the surface grass which forms the base of the swale. Rolled turf is used along the centre of the swale while the rest of the swale is hydro-seeded.

Photo 6 provides an example of the driveway crossover during construction. During high frequency, low magnitude runoff events - each section of grass swale - which forms the nature strip and is separated by the driveway crossovers, operates in isolation from the other. The road runoff kerb intake chute directs flows into the swale on the downstream side of each crossover. The runoff flows along the grass swale towards the downstream driveway crossover. On each crossover an inlet pit is located on the downstream side of the crossover. The grill of the inlet pit shown in Photo 6, sits flush with the surface of the driveway, which is gently graded to direct flows into the pit. Roof runoff is also connected to the inlet pit which functions as a pre-treatment device. The base of the pit is grated and lined with geotexile. It is expected the geotexile will require replacing once a year due to the potential for clogging with finely graded particulates. For larger storm events, open channel flow along the swale will convey excess stormwater along the swale to the discharge pits at the end of the street.

System Performance

– Storm event

A fortnight prior to the completion of Stage 12 the drainage system was tested under natural conditions with a storm event about the size of the 2 yr ARI event. The entire drainage system was in place but not fully stabilised, eg. hydro-seeding had not established grass in May Gibbs Crescent. As typically identified on construction sites, inadequate usage of silt fences, stabilisation works and vehicle access points resulted in the slumping and rilling of some batters during rain. The completion of the swales and use of geotexiles in the driveway inlet pits minimised the potential damage to the drainage system caused by the storm event. However, if the event had occurred at an earlier stage of the construction of the swale more damage would have been expected. It is imperative that Best Management Practices for construction sites are undertaken by the drainage contractors to ensure the protection of such drainage systems from excessive sediment loads, and for sediment control techniques to be enforced during house construction.

- Design issues

The storm event provided a great opportunity for the design team to assess the success of the system. The system performed as expected with both the grassed lined swale and swale component of the bio-retention system becoming engaged during some part of the storm event. Two relatively minor but important design issues were identified subsequent to the storm event:

- Scouring of the gravel medium where the slope steepened in the bio-retention system in Lynbrook Boulevard

Photo 3: Completed median strip

Photo 4: Graded swale

Photo 5: Geotextile placed

- Construction of the intake chutes at the downstream end of the driveway crossovers in May Gibbs Crescent did not satisfy the intent of the design. This resulted in the scouring of the swale section directly downstream of the inlet chute.

- Solutions proposed

To minimise the potential of scour in the bio-retention system, three basic solutions have been proposed. Additional boulders are to be placed in the base of the swale to break up the relatively steep section and encourage shallow ponding. Secondly the lip of the culverts, which convey surface flows under the vehicle turning points along Lynbrook Boulevard, will be raised slightly to encourage the ponding at the upstream side of each culvert. By encouraging ponding, the velocity of flow through these sections are reduced thereby minimising the risk of scour. Finally, the grading of the surface gravels will be increased from an average of 10mm in diameter to 15 mm.

The scouring of the swales in May Gibbs Crescent downstream of the inlet chutes was largely the result of the lack of ground stabilisation because the hydro-seeding had not established an adequate coverage of grass. What also became apparent during the rain storm was that the angle of the road runoff intake chute was greater than the fall of the road and consequently the velocity of flow was increased as the runoff entered the swale. On such flat terrain these design problems were exacerbated by the fact that the fall between the edge of the chute and the base of the swale was minimal. As a solution, the design of the swales will be modified to extend the gravel trench system out to the intake flute and the verge of the road, thereby providing a 2m by 1m gravel filled soakway to encourage the rapid infiltration of surface runoff into the underlying trench system.

Where to from here

Stage 13 at Lynbrook Estate, based on the Best Management Practice for drainage design, is expected to be completed by the end of this year. With the luxury of hindsight, many of the innovative design features of Stage 12 will be directly adopted in Stage 13 whilst the minor problems identified in Stage 12 will be addressed. The CRC will be involved in the design of the system for Stage 14.

Building on the issues from Stage 12, raising contractors awareness levels of the change in design intent before construction activities begin is vitally important for the future success of such projects. Education and awareness will enable the industry to adapt construction practices to

CRC SHORT COURSE

PLANNING AND DESIGN OF STORMWATER MANAGEMENT MEASURES

23-27 October 2000
Monash University
Clayton, Victoria

This short course on the planning and design of stormwater management measures is directed at professionals in the stormwater industry at a numbers of levels, including catchment planning and management, and, stormwater infrastructure design, construction, operation and maintenance.

For further information see our website at

www.catchment.crc.org.au/news

or contact Virginia on 03 9905 2704

CRC WORKSHOP

HYDROLOGY AND HYDRAULICS FOR FLOODPLAIN MANAGERS

Workshop No. 3 - Flood Level Estimation

The third workshop in this successful series will be held at Monash University during 4-6 October 2000

More information about the workshop program is available from Virginia Verrelli at the Centre Office on tel: 03 9905 2704.

Photo 6: Driveway crossover

minimise the risk of on-ground construction problems and embrace Best Practice Management treatment measures in residential drainage schemes. Using off-the-shelf materials in drainage treatment design will minimise costs and reduce contractors' apprehension of changes in drainage practices.

Sara Lloyd
Tel.: (03) 9905 3837
Email: sara.lloyd@eng.monash.edu.au

PROGRAM 5

CLIMATE VARIABILITY

Program Leader

TOM McMAHON

Report by Sri Srikanthan

Stochastic generation of annual, monthly and daily climate data: a review

Introduction

This article is an overview of a technical review carried out as part of the CRC for Catchment Hydrology Project 5.2: National data bank of stochastic climate and streamflow models. The purpose of the review was to present the state of research and practice in the stochastic generation of annual, monthly and daily climate data.

Types of rainfall models

The generation of rainfall and other climate data needs a range of models depending on the time and spatial scales involved. There are three broad types of rainfall models, namely, empirical statistical models, models of dynamic meteorology and intermediate stochastic models. The idea behind this classification is the amount of physical realism incorporated into the model structure. In the empirical statistical models, empirical stochastic models are fitted to the available data. The models for the generation of annual, monthly and daily rainfall and climate data are of this type. In the models of dynamic meteorology, large systems of simultaneous nonlinear partial differential equations, representing fairly realistically the physical processes involved, are solved numerically. These are generally used for weather forecasting and not for data generation. The intermediate stochastic models are only used to generate rainfall data and a modest number of parameters are used to represent the rainfall process, the parameters being intended to relate to underlying physical phenomena such as rain cells, rain bands and cell clusters. These types of models are used for the analysis of data collected at short intervals such as hourly. The models included in the review are empirical statistical models only.

Annual rainfall data

Surprisingly, very little work has been done since 1985 in stochastic generation of annual and monthly rainfall data. Because the generation of annual and monthly rainfall and streamflow are similar, streamflow generation models have been included in this part of the review. Most of the models used in the past do not take into account the year to year variations in the model parameters. They were assumed to be constant from year to year and only the within-year seasonal variations in parameters were taken into account. Long periods of wet and dry years were observed in the past and these need to be considered in the model structure. Recently, Thyer and Kuczera (1999), at the University of Newcastle developed a hidden state Markov model to account for the long term persistence in annual rainfall.

The review looked at the traditional time series models first and then the more complex models, which take account of long term persistence in the data.

Monthly rainfall data

Monthly rainfall data have been successfully generated by using the method of fragments. The main criticism of this approach is the repetition of the same yearly pattern when there is only a limited number of years of historical data. This deficiency was overcome by using synthetic fragments but this brings in an additional problem of generating the right number of months of zero rainfall. Here again, one needs to take into account year to year variation in model parameters and this has not been done before.

Daily rainfall data

Models for generating daily rainfall are well developed and a great deal of progress has been made recently in developing techniques for parameter estimation. The transition probability method appears to preserve most of the characteristics of daily, monthly and annual characteristics and is shown to be the best performing model. The main drawback with this method is the large number of parameters, which makes it almost impossible to regionalise the parameters. The two part model, in which the occurrence of rainfall is determined first and then the amount of rainfall later, has been shown to perform well in other parts of the world by many researchers. A shortcoming of the existing models is the consistent underestimation of the variances of the simulated monthly and annual totals. Recently, Wang and Nathan (2000) constrained a two part daily model within a monthly model and it appears to perform well. Also, Boughton (1999) has adjusted the generated daily rainfalls by a trial and error procedure to match the variance of the observed annual rainfall. As an alternative, conditioning model parameters on monthly amounts or perturbing the model parameters with the Southern Oscillation Index (SOI) result in better agreement between the variance of the simulated and observed annual rainfall; these approaches should be investigated further.

Climate data

A special characteristic that must be preserved in stochastic modelling of climate data is the cross correlation between variables. The models for generating climate data at annual, monthly and daily time intervals are reviewed in this section. As climate data are less variable than rainfall, but are correlated among themselves and with rainfall, multi-site models have been used successfully to generate annual data.

THREE NEW CRC VIDEOS

THREE NEW VIDEOS ARE NOW AVAILABLE FROM THE CRC. THE PRESENTATIONS WERE DELIVERED AS PART OF OUR TECHNICAL SEMINAR SERIES IN CANBERRA EARLIER THIS YEAR

($27.50 each - includes postage and GST).

CRC Video 00/2
WATER BALANCE AND GROWTH PERFORMANCE OF A BREAK OF SLOPE AGROFORESTRY SYSTEM

Dr David McJannet
CRC for Catchment Hydrology
Monash University
March 2000

CRC Video 00/3
HOW TO GET PERENNIAL VEGETATION BACK INTO AGRICULTURAL LANDSCAPES

Dr Richard Stirzaker
Project Leader
CSIRO Land and Water
April 2000

CRC Video 00/4
AN INTRODUCTION TO THE TARSIER MODELLING FRAMEWORK

Dr Fred Watson
Postdoctoral Research Fellow
California State University
Monterey Bay
May 2000

CRC VIDEOS CAN BE ORDERED BY CONTACTING VIRGINIA VERRELLI AT THE CENTRE OFFICE ON 03 9905 2704

RIVER MANAGEMENT MANUAL

A REHABILITATION MANUAL FOR AUSTRALIAN STREAMS VOLUMES 1 AND 2

by

Ian Rutherfurd
Kathryn Jerie
Nicholas Marsh

The two volume (550+pp) set costs $27.50 (inc. GST) plus $10 postage in Australia.

This joint CRC for Catchment Hydrology and LWRRDC publication is now available in hard copy from the Agriculture, Fisheries and Forestry - Australia (AFFA) Shopfront.
Phone 1800 020 157 or fax your order to the Shopfront on 02 6272 5771.

or download the manual as a pdf free from www.lwrrdc.gov.au

The monthly climate data can be obtained by disaggregating the generated annual data. On a daily time step at a site, climate data have been generated by using a multi-site type model conditional on the state of the present and previous days.

The generation of daily climate data at a number of sites remains a challenging problem. If daily rainfall can be successfully modelled by a truncated power normal distribution then the model can be easily extended to generate daily climate data at several sites simultaneously.

Rainfall and climate data under climate change scenario

Concerns over climate change caused by increasing concentration of CO_2 and other trace gases in the atmosphere have increased in recent years. A major effect of climate change may be alterations in regional hydrologic cycles and changes in regional water availability. The main sources of climate change projections are the general circulation models (GCMs). While current GCMs perform reasonably well in simulating the present climate with respect to annual and seasonal averages over large areas, they are considerably less reliable in providing the regional scale information that is necessary for hydrological studies. As a result, the climate change impact studies have had to use a spectrum of climate change scenarios. These are generally constructed using observed records of temperature and rainfall adjusted to reflect climate changes obtained from monthly average GCM results.

Most of the early work on the impacts of climate change used historical data adjusted for the climate change. The rainfall records were multiplied by the monthly precipitation ratios for the CO_2-doubling and control runs. The monthly temperature difference between the CO_2-doubling and control runs was added to the historical temperature data. The potential evapotranspiration (PET) was computed using the Penman equation for two different sets of monthly temperature data for the CO_2-doubling and control runs, while all other variables (wind speed, humidity, solar radiation etc) in the Penman equation remained unchanged. The monthly differences in PET were computed and the resulting differences were then added to the historic PET data.

In recent studies, the stochastic daily weather generation models are adapted for generation of synthetic daily time series consistent with assumed future climates. The assumed climates were specified by the monthly means and variances of rainfall and temperature. The greatest uncertainty in modelling climate data under climate change conditions is the uncertainty in the future climate predictions. The GCMs at present are able to provide either scenarios or projections of the future climate. If the future climate conditions are known with sufficient accuracy, the stochastic climate models available at present can be adapted to generate climate for the new conditions.

Summary

Since the rainfall and climate data are much less variable and less correlated than streamflow, the existing models can be used to generate these at annual and monthly level for single and multi-sites. As these models do not take into account long term persistence, hidden state Markov and other models need to be investigated. Regarding daily rainfall, the transition probability matrix method performs well, but is not suitable for regionalisation and with limited length of data. The Wang and Nathan approach appears to be promising.

The review makes recommendations on models to be adopted and models that should be further tested. The recommended models can be used to generate climate data under climate change conditions by adjusting the parameters appropriately.

References

Boughton, W. C. 1999. A daily rainfall generating model for water yield and flood studies. Report 99/9, CRC for Catchment Hydrology, Monash University, Melbourne, 21pp.

Thyer, M. and Kuzcera, G. 1999. Modelling long-term persistence in rainfall time series: Sydney rainfall case study. Hydrology and Water Resources Symposium, Institution of Engineer, Australia: 550-555.

Wang, Q. J. and Nathan, R. J. 2000. A daily and monthly mixed model algorithm for stochastic generation of rainfall time series. Manuscript.

Sri Srikanthan
Tel.: (03) 9669 4513
Email: sri@bom.gov.au

PROGRAM 6

RIVER RESTORATION

Program Leader

IAN RUTHERFURD

Report by Nick Marsh

Predicting Pre-Disturbance Large Woody Debris Loading and Distribution

I am getting toward the business end of my PhD. The general topic is large woody debris (LWD) for stream rehabilitation. The bulk of my research deals with providing a method for predicting the size of scour holes produced by LWD used in stream rehabilitation projects. Another component of my research – undertaken collaboratively with CRC for Catchment Hydrology Parties - is to develop a quantitative model of LWD loading, distribution transport and decay in lowland streams. Some results from this second part of my study that may be useful to stream managers for predicting LWD loading and distribution are presented here.

'Predisturbance' conditions or 150 years before

One of the starting points of many stream rehabilitation projects is to ask the question "What did this stream look like 150 years ago". A logical goal for stream rehabilitation is to try and make it look like an undisturbed stream. Providing there are no limiting features such as bad water quality or barriers to fish migration, then there is every chance that if the physical elements reflect the pre-disturbance conditions, then so to will the biological elements. In order to construct a picture of the pre-disturbance stream we often look upstream and downstream or in adjacent catchments for reaches that have so far escaped our well-meaning management strategies. Where there are no suitable template reaches we are then forced to rely solely on historical records. In many cases these historical records are sketchy and anecdotal evidence, whilst useful, can often be inaccurate.

Building a picture of predisturbance conditions

Much has been said about the importance of large woody debris (LWD) to native aquatic fauna and as a consequence the reintroduction of LWD is often a feature of stream rehabilitation projects. Whilst we may not be able to replicate the natural loading and distribution or clumpiness of LWD, from the outset it is useful to know what these natural conditions were. A knowledge of the natural conditions can provide an ultimate rehabilitation goal or a benchmark by which to assess the extent of rehabilitation. Given that it is often difficult to get a clear picture of the pre-disturbance stream conditions, we have collected data on LWD in a range of streams so that we can describe general trends in the loading and distribution that may help build a picture of the physical elements of a pre-disturbance stream.

Study sites

The Acheron River in central Victoria, Albert River in southeast Queensland, Cooper Creek in far western Queensland and the Edward River in south central New South Wales have been the key study sites. Reaches of lowland sections of each of these streams have been sampled. In all cases the riparian zone was dominated by River Red Gum, and the channel slopes were fairly flat (slope 1%-0.0004%). As is common with most field sampling, the data set is somewhat incomplete due to time constraints, accessibility of sites, and the gradual development of the sampling protocol. The database is likely to be increased over coming months, however some potentially useful trends in LWD loading and distribution have come to light thus far. These trends relate to questions of how much LWD is found in undisturbed reaches and how this LWD is distributed within the channel.

LWD loading

Data from our field work suggests that there is very little large-scale transport of LWD for lowland Australian streams, principally because of the complex branching shape of eucalypts and the relatively low energy of these

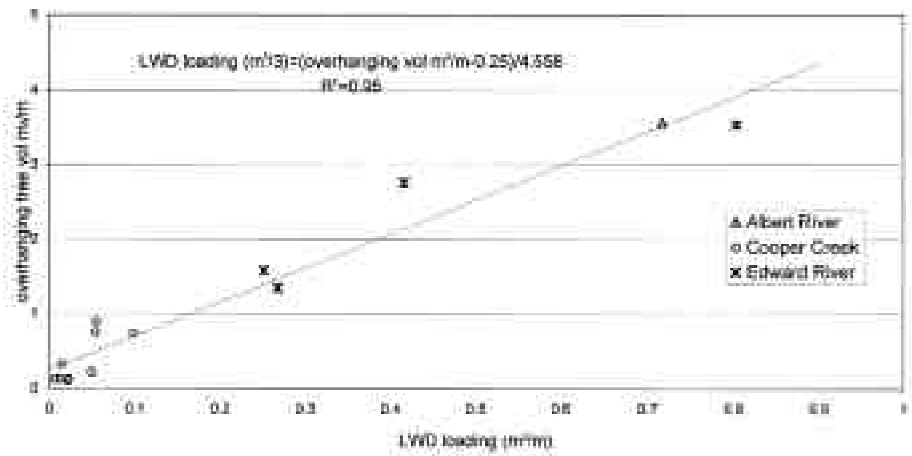

Figure C: LWD loading as a function of overhanging riparian vegetation

SUBSCRIBE TO CATCHWORD ONLINE!

Our new website at www.crc.catchment.org.au allows you to subscribe to our newsletter by post or email.

You can also register your interest online to receive notification of events relevant to your research interests.

LINKS TO KEY HYDROLOGY WEBSITES

We have recently updated our web links database. Our links pages feature a wide range of addresses and descriptions of key hydrological websites relevant to the land and water management industry.

If you want information about catchment hydrology, start with our website.

www.catchment.crc.org.au

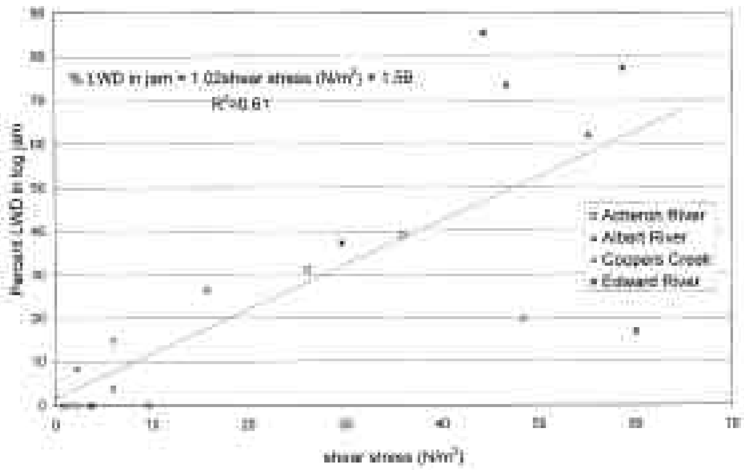

Figure D: Proportion of LWD in jams as a function of reach average shear stress.

streams. Given that LWD does not move over great distances, it is a reasonable assumption that the LWD loading in any particular reach is likely to be primarily related to the density of the riparian vegetation. *Figure C* illustrates just what this relationship is for our sample sites which are lowland streams with a River Red Gum dominated riparian zone.

The LWD loading data described in *Figure C* is the volume of LWD (greater 0.1m diameter and longer than 1m) per lineal meter of channel. The LWD volume is determined by the census method.

- Measuring riparian vegetation

The overhanging riparian vegetation volume is not a measure of the actual volume but simply the breast height cross sectional area of the trunk multiplied by the height of the tree (also per lineal meter of channel). Such a tree volume measurement assumes perfect cylinders for the full height of the vegetation which is clearly not the case, however we are interested in the relative difference in vegetation densities between reaches rather than the absolute value of vegetation density. The overhanging vegetation is defined as any vegetation that can fall directly into the stream, and in practice is any vegetation growing within the channel, and includes vegetation along the channel boundary.

- Applying the results

How does this help in stream rehabilitation? Firstly it is much easier to simply measure the diameter and height of bankside vegetation than it is to climb around in the river to measure snags, secondly it is much easier to find a reach of stream with relatively intact overhanging vegetation than it is to find one full of snags. Even if the riparian zone has been cleared, the fringing vegetation is often left intact. For a stream where this fringing vegetation is intact we can use *Figure C* to predict a general value for the pre-disturbance LWD load. It is our intention to head back out to the field and to collect a more comprehensive set of field data to see how broadly the relationship in *Figure C* can be applied.

LWD distribution

While we can describe the natural loading of LWD in a stream fairly well from *Figure C*, the next question is how it is distributed within the channel? That is, does the LWD appear as lots of isolated logs or as a series of log jams. There are several factors that determine how logs can be rearranged within a stream, however the principal one is likely to be the available energy of the stream to move individual logs to form jams. *Figure D* shows the proportion of logs in jams compared to the average shear stress for the sampled reaches.

- Trends for LWD distribution

The relationship for LWD distribution is not as clear cut as for LWD loading. This is largely due to the fact that there are several other relevant variables that determine LWD distribution. The main one being the relationship between log length and channel size. Logically, long logs in narrow channels will tend to get wedged between the banks irrespective of the available stream energy. Despite the scatter in *Figure D*, there is clearly a general trend showing that high energy streams tend to move more logs into jams than low energy streams. The implications for stream rehabilitation are that on a very low energy stream, the natural distribution of LWD would be mostly as individual pieces whereas high energy streams will be dominated by LWD jams.

Summary

Whilst the above relationships help us to describe what the natural LWD loading and distribution conditions may have been, they do not supersede the need to try and identify an undisturbed stream that can be used as a template for rehabilitation.

Nick Marsh
Tel. 07 3875 7101
Email: nick.marsh@mailbox.gu.edu.au

COMMUNICATION AND ADOPTION PROGRAM

Program Leader
DAVID PERRY

Report by David Perry

Communication for Adoption – why there are five types of people in this world...

As outlined in my June 2000 article, the CRC has developed a framework to guide our communication and adoption planning. This is aimed at focussing our communication activities towards adoption, and identifying and minimising any risks associated with the adoption of our research outputs.

Communication and Adoption Plan

In collaboration with our industry Parties, project teams are each creating a Communication and Adoption Plan that documents the background knowledge, strategy and implementation path for adoption of their research findings or outputs.

The purpose of each project plan is to:

- Provide a focus for dialogue, comments, improvements and updates from the research team, industry stakeholders, end-users and beneficiaries to better inform the strategy, and to assess any risks associated with the path to adoption
- Ensure the involvement of industry Parties in the planning and delivery of the communication and adoption strategy
- Define what are the most effective mechanisms to use throughout the communication and adoption planning process.

First Step…

Our first step in creating a successful communication and adoption strategy is to identify the various (target) groups involved in the path to adoption - from the scoping of the research, to its implementation by users and the evaluation of the research's impact. To do this we have defined five target groups relevant to communication and adoption plans in the CRC:

1. Researchers
2. Stakeholders
3. End users
4. Beneficiaries
5. Communicators

A successful strategy will address each of these target groups in terms of: their role in communicating research findings; their roles and responsibilities in facilitating adoption; and their characteristics in relation to their "stake" in the objectives of the research program. The groupings of people and organisations in the target groups are not mutually exclusive and there will be many instances where individuals and organisations undertake roles that overlap.

Researchers

In addition to the individuals or organisations that undertake the research in the CRC, there are also researchers (secondary in influence) in other research organisations and tertiary institutions not directly associated with the CRC. The commitment of researchers to communication is critical in a successful communication plan.

Stakeholders

For our planning process, the term 'stakeholders' is defined as individuals or organisations that have a direct vested interest in the CRC's research. Stakeholders may also include those that fund and advocate the research activities of the CRC. Obvious primary stakeholders for CRC research include the CRC's Board members. Board members may also choose to delegate their stakeholder's role to others in their organisations.

Community and industry leadership is a strength of this group in the adoption of advances in technology and best practice. Their continued support of the research program is an essential component to its success. The principal stakeholders require demonstrated justification for their investment in the CRC and focus on the value of the research outputs to their organisation. They are particularly interested in the ease with which industry can adopt the outputs into their day-to-day operation.

End-users

End-users are those 'hands-on' organisations and individuals who will use our research outputs as part of their professional role in land and water management. Generally, there is a diverse audience of possible end-users for our research. Conceptually, our planning process aims to produce the most effective and efficient way to maximise the adoption of the research. Identifying the priority end-user groups is a key step.

Beneficiaries

Since the CRC for Catchment Hydrology is a public good CRC, one could argue that the broader community and the 'environment' are the beneficiaries of our research. To focus our efforts, we define a beneficiary as 'an organisation or individual who will benefit from the research outputs, and has a key role in the implementation of the communication and adoption plan'.

SEPTEMBER 1999

WANT TO KNOW WHAT'S GOING ON?

The CRC event calender at www.catchment.crc.org.au allows you a 'sneak preview' of what is coming up month by month.

Details of CRC events (workshops, seminars, field tours etc.) are posted on the site as soon as they become available.

LOOK UNDER 'EVENTS' ON OUR WEBSITE.

RECENT INDUSTRY REPORT

THE REUSE POTENTIAL OF URBAN STORMWATER AND WASTEWATER

by

Grace Mitchell
Russell Mein
Tom McMahon

Report No. 99/14

This report deals with the feasibility of reusing stormwater and wastewater to reduce the demand on the potable water supplies in Australian cities. It also describes 'Aquacycle' - a model developed by the CRC to assist in this process.

Copies available for $27.50 (inc. GST) from the Centre Office.

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

Our beneficiaries are important because whilst they may not be directly applying or utilising the research itself, they are influential in creating a demand or a market for its use.

Communicators

Communicators are professionals from the CRC and industry who play a coordinating and driving role in delivering the plan. They also have a primary role in facilitating the development and implementation of the plan. Communicators are critical as they are often well networked within the industry, directly influence the flow of information within an organisation and often are in a position to catalyse or organise a response from the organisation.

Next Steps…

Once we have identified these five groups relevant to a research project (and confirmed our ideas with the groups themselves), we are in a position to start an ongoing process that focusses on the path to adoption of our research outputs.

David Perry
Communication and Adoption Program
Tel: 03 9905 9600
Fax: 03 9905 5033
email: david.perry@eng.monash.edu.au

POSTGRADUATES AND THEIR PROJECTS

Our postgraduate for September is:

Janice Green

Janice Green's interest in things hydrologic started at a young age. One of her earliest memories was of the revolving "Conserve Water" signs she saw on buses while on holiday in Adelaide in 1966. Holiday visits to Warragamba Dam and building sand dams and irrigation systems on various NSW beaches consolidates this interest. Her more formal hydrologic education commenced with a Bachelor of Natural Resources from the University of New England and a Master of Engineering Science from the University of New South Wales. After spending a couple of years working as a research assistant for David Pilgrim and Ian Cordery at the University of New South Wales, she joined the Hydrology Unit of the then NSW Department of Water Resources in 1989 (now the Department of Land and Water Conservation – DLWC).

Over the next ten years, Janice became increasingly involved in the estimation of extreme rainfalls and floods, and the assessment of the flood security of the Department's dams. She was responsible for Probable Maximum Flood (PMF) and dambreak studies and, more recently, risk assessment analyses for many of the DLWC's 30 or so dams, including Hume Dam. Over that time there was a shift from the "standards" based approach to spillway adequacy assessment of her early days with the Department, towards the risk based approach which is currently favoured. Janice was also a member of the committees responsible for revising Chapter 13 of Australian Rainfall and Runoff, the ANCOLD Guidelines on Selection of Acceptable Flood Capacity for Dams, and the NSW Dams Safety Committee Acceptable's Flood Capacity Technical Information Sheet.

In July 1999, Janice decided to take a sabbatical from life as a Public Servant and commenced a PhD entitled "Estimation of Extreme Rainfall Risks", with Erwin Weinmann as her supervisor, The objectives of her research are

- to reduce the uncertainty of the estimate of the Annual Exceedance Probability of the Probable Maximum Precipitation (PMP) epths provided by the Bureau of Meteorology, and
- to derive a more reliable probability distribution of extreme rainfalls up to, and possibly beyond, the PMP.

Her research forms one of two SPIRT funded projects that came from the recommendations made by Eric Laurenson and George Kuczera in their review of existing PMP risk estimation practices in Australia and overseas.

Janice's work builds on the joint probability approach developed by Mark Pearse, but adopts the method and data used by the Bureau of Meteorology when deriving PMP estimates using the Generalised Southeast Australia Method. The outcomes of her work will be generalised Depth-Area-Frequency curves which will be combined with the stochastic transposition work currently being undertaken at the University of Newcastle (as the second of the two SPIRT funded projects) to yield extreme rainfall probabilities for specific catchments.

Janice continues to work on a part-time basis for the NSW Department of Land and Water Conservation and finds this continued association to be invaluable in ensuring that her research maintains a practical focus and that the final outcomes will be of benefit to the water industry.

Away from Monash, Janice is gradually adjusting to life in Melbourne including hook turns (which she has yet to master), the vagaries of Melbourne weather (beautiful one minute, lousy the next), and the concept that 80,000 people will attend a Bledisloe Cup match, even though they don't understand the game of rugby. Living opposite Optus Oval has resulted in a switching of allegiance from the Swans to Carlton but she remains unconvinced that Port Phillip Bay can match Sydney Harbour. However, she will concede that Melbourne's tree-lined boulevards are more conducive to a café culture than Sydney's narrow roads, and that Lygon Street's baristes can produce cappuccinos which are on a par with those to be found in Newtown's coffee shops.

Janice Green
Tel: 03 9905 5578
Email: janice.green@eng.monash.edu.au

RECENTLY PUBLISHED

SCALING ISSUES IN HYDROLOGY:

Report of a Workshop held at the Bureau of Meteorology 28-29 June 1999

Edited by Alan Seed

Working Document 00/3

There is a high level of interest in the topic of scaling in hydrology and this workshop provided a forum for various issues to be discussed and debated.

The final session of the workshop attempted to summarise the current state of knowledge of various aspects of scaling in hydrology and to identify what further research is needed.

The report is a valuable resource for researchers and others interested in the field.

To order your copy of this report ($22 - includes postage and GST), please contact Virginia Verrelli at the Centre Office on 03 9905 2704 or email virginia.verrelli@eng.monash.edu.au

CRC PROFILE

Report by Pat Feehan

I am currently the Focus Catchment Coordinator in the Goulburn-Broken catchment. My involvement with the catchment goes back a long way, as you will see.

I was born and raised on an irrigated dairy farm just south of Tatura. After completing my schooling at a Melbourne boarding school I set off to the University of Melbourne to become a geologist. Some failures, much perseverance, lots of parties and part- time work as a barman later, I emerged with a Bachelor of Science in 1975 - perhaps more of a geographer. I also had a bent towards working along the coast.

My first posting with the then Soil Conservation Authority was to Ouyen, in the Victorian Mallee, about as far from the coast as you can get. Here I learned about wind erosion, whole farm planning, dryland salinity (before it was an issue) and designing farm water supply systems. From Ouyen, I moved to Bairnsdale, in East Gippsland, (where there is some coast) and discovered alpine grazing, forestry and water supply catchments. From Bairnsdale, we (family was expanding) moved on to Alexandra in the Upper Goulburn River catchment.

Here we discovered fogs that lasted for weeks, the need for erosion control, catchment management and treeplanting. The Alexandra district covered the catchment to Lake Eildon and had a long history of soil conservation works to protect water quality, especially sediment, in this large storage. As time went by I became more involved in alpine issues such as forestry, grazing, ski resort management and recreation, mainly in the country between Mansfield and Omeo. Our interest in these issues related to the protection of water quality, but it was also a wonderful opportunity to drive, walk, ski, ride and camp in some of Victoria's most spectacular scenery. This work eventually meant a shift to Benalla, where we managed to stay for about thirteen years.

Not long after the move to Benalla to work on alpine issues, natural resource management agencies were restructured into the Department of Conservation Forests and Lands. I went from dealing with alpine issues in the Upper Goulburn catchment to looking after public land, recreation and conservation issues along the Murray and Lower Goulburn Rivers. A few more job and Departmental name changes later found me working with landcare groups and dealing with dryland salinity, tree planting, farm forestry. Sourcing, and managing funding for these activities was a constant challenge, One of the exciting things I was involved with was the break of slope treeplanting and the development of farm forestry for dryland salinity control.

In 1994 Geoff Earl (CRC Board member) offered me a two year job, at Tatura, to prepare a water quality strategy for the Goulburn-Broken catchment. I returned to what was basically my home town - a most unexpected turn of events. The short-term two year position ended up becoming something more permanent and I now manage Goulburn-Murray Water's Natural Resource Unit at Tatura. Many of the catchment management issues I dealt with at Alexandra are now the issues I deal with at Tatura! The nineteen staff in the Unit manage, or coordinate, amongst other things, water quality, blue green algae, groundwater, salinity and sub surface drainage. The Unit has a big role in helping implement the Shepparton Irrigation Region's Land and Water Management Plan and we work closely with Catchment Management Authorities. Lots of the things the CRC is involved in relate directly to my Unit.

Since starting with G-MW I have worked with researchers - firstly with the National Eutrophication Management Program - as the Goulburn-Broken Catchment Coordinator and then with the CRC. The reason for this is that in developing strategies, or dealing with our catchment community, we keep asking hard questions which require the knowledge of researchers to answer. My skills are more in the areas of facilitation, coordination and persuading land managers to do things they might prefer not to, so I see myself as a middleman between researchers and resource managers.

I've been fortunate enough to live and work in the catchment for well over twenty years; I've worked from top to bottom, across lots of issues and developed lots of contacts. My wife tells me we've had enough of shifting around the countryside so it doesn't look as though I'll get to know other catchments as well as the Goulburn-Broken.

Pat Feehan
Tel: (03) 5833 5687
Email: pfeehan@g-mwater.com.au

WHERE ARE THEY NOW?

Report by Murray Peel

My PhD thesis "Annual runoff variability in a global context" (part of Project A4 in the initial CRC for Catchment Hydrology) was handed in and passed in early 1999. The main conclusions from my thesis were that annual runoff variability in temperate Australian and Southern African rivers is generally higher than that for rivers from other continents in a temperate climate zone, confirming and refining the earlier work by McMahon et al.

The primary cause of the variability differences was identified as the distribution of evergreen and deciduous vegetation, in association with the spatial distribution of mean annual precipitation. Temperate forests in the Southern Hemisphere are predominately evergreen, while those in the Northern Hemisphere are predominately deciduous. A modelling experiment (using Macaque) revealed that annual runoff variability was up to 50% less from deciduous vegetation than from evergreen vegetation, when the same annual precipitation variability was passed through the catchment. The percentage reduction in annual runoff variability increased as mean annual precipitation decreased.

Possible secondary causes were identified as:

- the El Niño - Southern Oscillation effects
- slightly greater reception of short-wave radiation in the Southern Hemisphere and,
- possibly greater evapotranspiration due to advection of hot dry air from the interiors of Australia and Southern Africa.

After spending five years slogging through mountains of data as a postgraduate at the Department of Civil & Environmental Engineering, Melbourne University, I was ready for a big change in life. So I moved offices from 4th floor D block to 3rd floor C block and became a Research Fellow in the same department.

Some of the recent work that I have undertaken is an application of the Macaque model to the Thomson and Maroondah catchments to predict the maximum impact of vegetation disturbance on water yield. This project was co-funded by the initial CRC for Catchment Hydrology, the Victorian Department of Natural Resources and Environment, and Melbourne Water. Some conclusions from this work were that the more productive the forest, the bigger the impact of disturbing that forest on water yield as the forest re-grows. Forest productivity in the Thomson catchment was often water (to dry) or temperature (to cold) limited. Forests growing in water or temperature limited areas displayed relatively smaller maximum impacts on water yield (about 250mm a year) when disturbed than forests growing in highly productive areas (not too cold, not too dry, just right). The maximum impact on water yield for highly productive areas, growing trees like Mountain Ash, was about 700mm a year of reduced water yield. As the forests aged the impact on water yield of vegetation disturbance tended toward zero as the forests returned to their pre-disturbance condition.

Present work with Macaque is a project funded by the Launceston City Council, which is to investigate the impact of vegetation disturbance on summer low flows in the North Esk catchment. Current vegetation disturbance includes tree harvesting in State forests and also the conversion of sheep grazing farms into tree farms.

Murray Peel
Tel: (03) 8344 5627
Email: m.peel@civag.unimelb.edu.au

DOWNLOAD SOFTWARE FROM OUR WEBSITE!

Continuous Simulation System for Design Flood Estimation

by

Dr Walter Boughton

The Design Flood Simulation Package is available as a FREE DOWNLOAD from the CRC website at http://www.catchment.crc.org.au/products/models/

The software is a simulation package, which generates rainfalls to route through a catchment model to estimate design floods. Dr Walter Boughton, Honorary Research Fellow (Griffith University and CRC for Catchment Hydrology) developed the package as part of his work in the (former) CRC project 'Holistic Flood Estimation'.

The aim in making the package available directly from our website is to encourage feedback and further applications of the novel technique.

Further information about the software is available on the CRC website.

COOPERATIVE RESEARCH CENTRE FOR
CATCHMENT HYDROLOGY

Print Post Approved
PP338685/00026

If undelivered return to:

Department of Civil Engineering
PO Box 60
Monash University
Vic 3800

Surface Mail

Postage
Paid
Australia

COOPERATIVE RESEARCH CENTRE FOR CATCHMENT HYDROLOGY

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

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

Associates: • SA Water • State Forests of NSW •

COOPERATIVE RESEARCH CENTRE FOR
CATCHMENT HYDROLOGY

CENTRE OFFICE:
CRC for Catchment Hydrology
Department of Civil Engineering
PO Box 60
Monash University, Vic 3800
Telephone: +61 3 9905 2704
Facsimile +61 3 9905 5033

http://www.catchment.crc.org.au