NEWSLETTER OF THE COOPERATIVE RESEARCH CENTRE FOR CATCHMENT HYDROLOGY

CATCHWORD

NO 126 APRIL 2004

A NOTE FROM THE DIRECTOR

Rodger Grayson

Inside...

COOPERATIVE RESEARCH CENTRE FOR

CATCHMENT HYDROLOGY

SPECIAL ISSUE - DEVELOPMENT PROJECTS UPDATE

It is with some awe that I sit to write my first "Note from the Director" on my first day in the hot seat. Awe at the fabulous successes to date and awe at the work ahead to maintain the stellar standards set by Rob Vertessy, Russell Mein and Emmett O'Loughlin. This is particularly so given that we are embarking on the exciting final phase of the CRC as an entity, where the three main objectives can be summarised as delivery, delivery and delivery! Delivery of the best research in a way that is usable and leads to improvement in Australia's land and water management.

This issue is dedicated to the flagship of our delivery activities - the Development Projects - and I will return to these shortly, but firstly a brief biography for those who don't know me. I have been involved in the CRC since the start in 1992, but always as part of my broader role as a researcher/academic at The University of Melbourne. I am an agricultural engineer by training, with PhD studies in hydrological and water quality modelling, undertaken as part of a very early collaboration between CSIRO, universities and industry funders during the 1980s. Throughout the CRC I have maintained these modelling and fieldwork interests via a number of projects, and many PhD students. Outside the CRC my interests have ranged from early collaborative work with community groups and management agencies on integrating R&D using computer models to assist with catchment management and target setting, to more fundamental field and analytical research on spatial variability and patterns in hydrology, both in Australia and overseas. Throughout all of that work, be it CRC or otherwise, a hallmark has been collaborative effort, and it is this that attracted me to the position of Director of what is amongst the best examples of collaboration in the Natural Resource Management (NRM) industry to date.

....and so to the Development Projects – collaboration at the coalface! These projects are a real litmus test for our mission to "...deliver to resource managers the capability....at the whole of catchment scale". Formally, the Development Projects aim to:

i) build capacity within our Industry Parties to apply the CRC's modelling tools,

ii) demonstrate the utility of the tools by applying them to a range of problems at the whole-of-catchment scale, and

(iii) provide our researchers with feedback from end-users on the suitability of the models for operational use.

So the Development Projects test not only the science and basic tools, but also the practical implementation – everything from software bugs and product support to the perception of our tools by those beyond the core project teams. The articles by our Focus Catchment Coordinators/Project Leaders highlight the joys and hardships of being the 'canary in the coalmine', but all point to some really outstanding results. Clearly there has been a huge effort in getting on top of data (with gaps!) and software (with bugs!), but most of the projects are now at a stage where Environmental Management Support System (EMSS) models are up and running. Scenario runs are underway and some are already linking results with other models such as IQQM (in the Murrumbidgee), reservoir models (in the Goulburn-Broken) and estuary models (in the Fitzroy). This illustrates the enormous potential of modelling when there are appropriate problems to solve and the tools and data are up to the task.

However what really stands out to me is how these projects are both building substantial capacity within CRC Parties as well as reaching beyond via various steering, reference and stakeholder groups. This 'flow on' of delivery beyond our immediate Parties augers well for the future uptake of products, but it brings with it great responsibility to ensure our products are sound. This is a serious challenge, particularly when much of our research focus is on new products and enhanced capability. A key message, reinforced by the project teams, is that we will be judged not by the theoretical capability of our products, but by how they are used and perceived by industry. This makes the Development Projects all the more important – they are a showcase for our tools in action and also provide an "on ground" assessment of the commitment and skills needed by users to maximise the utility of our products. This is information that will help us to continue to improve our delivery.

The Development Projects are also being undertaken in parallel with the rapid development of the Catchment Modelling Toolkit and all its associated features including training, user e-groups, documentation and so on. Hence there is direct feedback informing the design

ANNUAL REPORT ON-LINE

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of the whole Toolkit package as well as the new models currently being developed by the research projects – everything from new capabilities that are desirable, to interface and presentation issues. In summary, the Development Projects are a catalyst for collaboration at all levels - model developers, software engineers, research project teams, Party staff, broader natural resource management agencies and the wider community.

Since the Development Projects were first introduced back in the December 2002 edition of *Catchword*, there has been a terrific amount of work done by the project teams. This has been underpinned by a huge commitment by Industry Parties, culminating in the successes reported herein. The "development project paradigm" was a new idea back in 2002 but has now proven itself as a central element of our delivery activities. I would like to take this opportunity to thank all those involved in these projects for making this happen!

Finally, I am sure all will join with me in a wholehearted vote of thanks to Rob Vertessy for his outstanding leadership over the past couple of years. We wish him well in his new position as Chief of CSIRO Land and Water and look forward to his continuing interest and involvement in the CRC. I am relishing the challenge of completing the vision that Rob has so clearly articulated to date.

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Our Development Projects

FITZROY RIVER CATCHMENT PROJECT

Development Project Leader
BRUCE COWIE

Report by Chris Carroll and Bruce Cowie

Catchment overview

The Fitzroy basin covers a diverse and beautiful land and seascape, with distinctive rural and urban communities. In terms of catchment area, the Fitzroy catchment (142,000 km^2) is the largest river system running to the east coast of Australia, and is made up of the Nogoa, Comet, Mackenzie, Isaac, Dawson, and Lower Fitzroy sub-catchments. The Fitzroy discharges into the Great Barrier Reef lagoon that is the largest coral reef system in the world. The Fitzroy basin is home to approximately 140,000 people, covers ten percent of Queensland's land area and surrounds the Tropic of Capricorn. Apart from its major urban centre of Rockhampton (pop. 58,775) there is a low population density in the basin, particularly in the northern and western parts of the basin.

The community-based natural resource management group in the basin is the Fitzroy Basin Association (FBA). Their geographical area of influence includes the Fitzroy Catchment, a focus catchment for the National Action Plan for Salinity and Water Quality (NAPSWQ). The FBA has been in existence for about ten years, and during that time has led the community to develop and begin implementing the Central Queensland Strategy for Sustainability (CQSS). In 2002 the FBA was charged with responsibilities of a regional body under the National Action Plan for Salinity and Water Quality (NAPSWQ), and has released a second edition of the CQSS. In the second CQSS the natural resource management plan sets aspirational targets (50 year time-frame), resource condition targets (10 to 20 years) and management action targets (1 to 5 years) for the basin in partnership with indigenous, industry, agency, and community groups.

A requirement of the natural resource management plan is to produce an implementation plan and prioritise management actions within the Fitzroy basin; to achieve this, large-scale catchment modelling capabilities are required. The FBA acknowledged the important role of modelling, but equally emphasised the importance of having stakeholder participation. In response to these regional needs, the Fitzroy Development Project was established with the objectives to:

- Provide the capability to model the impacts of land-use and management activities on sediment and nutrient transport at a range of catchment scales (using the Environmental Management Support Systems (EMSS) and SedNet models).
- Link the component understanding, research activities, monitoring and local activities to consider management actions that can be used to set management and regional targets for the NAP.
- Provide the modelling capability to the Department of Natural Resources, Mines and Energy (NRME) and ownership in modelling outcomes in partnership with the Fitzroy Basin Association stakeholders.

Building regional capacity

The building of regional capacity to model land-use and management impacts on water quality has occurred in parallel with building regional and community capacity to understand and accept the role modelling can play in supporting current activities. The project has been considered a joint learning exercise.

Technical expertise in building and running the EMSS and SedNet models has been developed through training workshops and the Catchment Modelling School 2004. Members of all Development Project teams have met to attend several two to three day training sessions to build modelling skills such as rainfall-runoff calibration, deriving sediment and nutrient generation rates, data sets and formats, limitations and assumptions, sub-model functioning and implementation, and validating outputs. An active email discussion group has enhanced learning and problem solving. To-date, EMSS models have been built for three sub-catchments of the Fitzroy (Dawson 51,000 km^2, Nogoa 28,000 km^2 and Comet 17,000 km^2) and the Fitzroy as a whole catchment. Large data sets and long run times for the whole of Fitzroy catchment EMSS have forced a reduction in model resolution to make it workable.

Regional and community capacity building has progressed through the project steering committee. It is led by the FBA and has representation from Department of Primary Industries, Environmental Protection Agency (EPA), and Natural Resources, Mines and Energy (NRM&E) and sub-catchment community groups. The increased understanding of modelling has resulted in the team capturing and responding to the diversity of agendas within the group. For example, the relative biodiversity values in the catchment represented in the Biodiversity Assessment Map will be viewed and considered when targeting investment for water quality outcomes.

NEW TECHNICAL REPORT

The Effect of Afforestation on Flow Duration Curves

By

Patrick Lane
Alice Best
Klaus Hickel
Lu Zhang

Technical Report 03/13

This report is part of a series that bridges the gap between the science of catchment water balances and the management of rivers for a range of outcomes by considering the impact of afforestation on flow distribution throughout the year.

Printed and bound copies of this report are available from the Centre Office for $27.50. Contact Virginia Verrelli on 03 9905 2704 or email crcch@eng.monash.edu.au

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People outside the Development Project are becoming interested in using model predictions and some plan to develop their own modelling capacity. Staff working within NRM&E at Mackay plan to build an EMSS model for use in the Mackay / Whitsunday area. A group of interested community members in the Fitzroy have requested another workshop in response to the successful introductory workshop in mid February this year.

Linking component understanding

Over the last decade or so natural resource management has seen a shift away from paddock and farm-based understanding to a whole-of-catchment focus. Data from past regional land management and erosion studies have proved to be very important in providing information needed to drive the EMSS model. The data they provide on the different sediment and nutrient generation rates of good and poor land management will allow EMSS predictions of how improved land management will affect water quality on a catchment scale. Data on the generation rates from some land-uses and land management practices has been scarcer. Long term data from NRM&E's ambient stream monitoring network has been valuable here, though for some land-uses or managements the data is just plain poor. These data gaps revealed by the Development Project team highlight some priority research areas and efforts are being made to address them.

Building on partnerships

The strong partnerships developed between the FBA and the Fitzroy Development Project team continues to be productive. The Development Project team, the project steering committee (with local representatives from other state agencies), staff from the Environmental Protection Agency that lead the NAPSWQ Water Quality State Investment Project, and the FBA, recently agreed on a strategy that will guide investment to deliver the best environmental return. The strategy relies heavily on model predictions from the Development Project team (both EMSS and SedNet), but also requires local community input and consultation. The schematic diagram below illustrates the planned approach and some linkages with other activities that demonstrate an ongoing commitment to improve and continue to support local modelling capacity.

Of the 200 odd sub-catchment areas within the Fitzroy catchment EMSS model, the top 30 or 40 sediment and nutrient contributors will be identified. The relative contribution of the erosional processes (hill slope, gully or streambank) within each will then be explored using the SedNet model. The "hot spot" status of each catchment will be confirmed with the aid of other data (community or short term project), local knowledge and ground truthing. Community agreed ameliorative scenarios will then be assessed for their likely environmental benefit using EMSS modelling. Local community consultation will gather data on social and economic impacts that will be considered with the likely environmental benefits before final investment decisions are made in 20-30 strategic areas.

The strategy includes elements beyond guiding environmental investment. It shows an adaptive management approach that will fill some knowledge

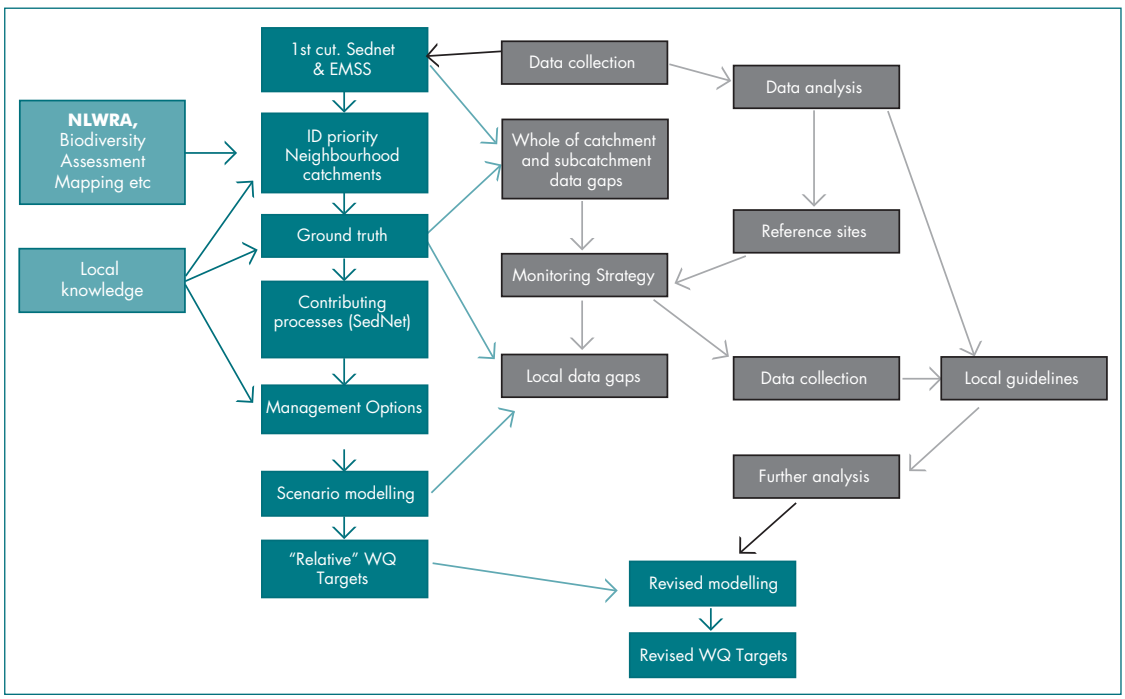

Figure 1.1, Schematic of Fitzroy target-setting process and modelling, monitoring, data analysis linkages

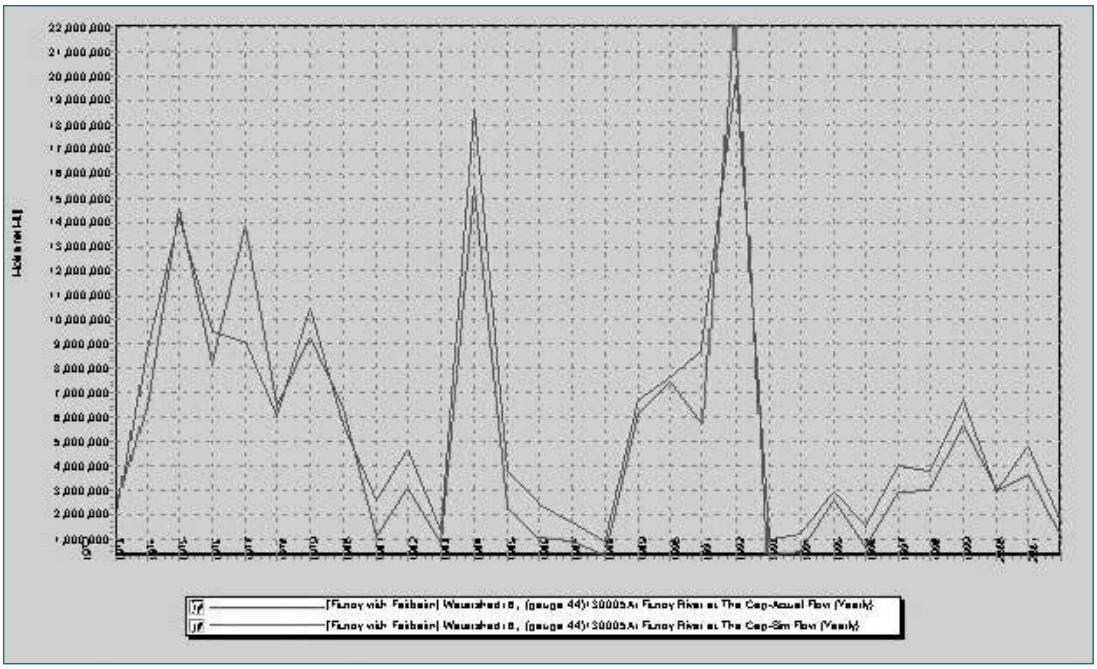

Figure 1.2, Comparison of measured and modelled annual discharge for Fitzroy River at The Gap

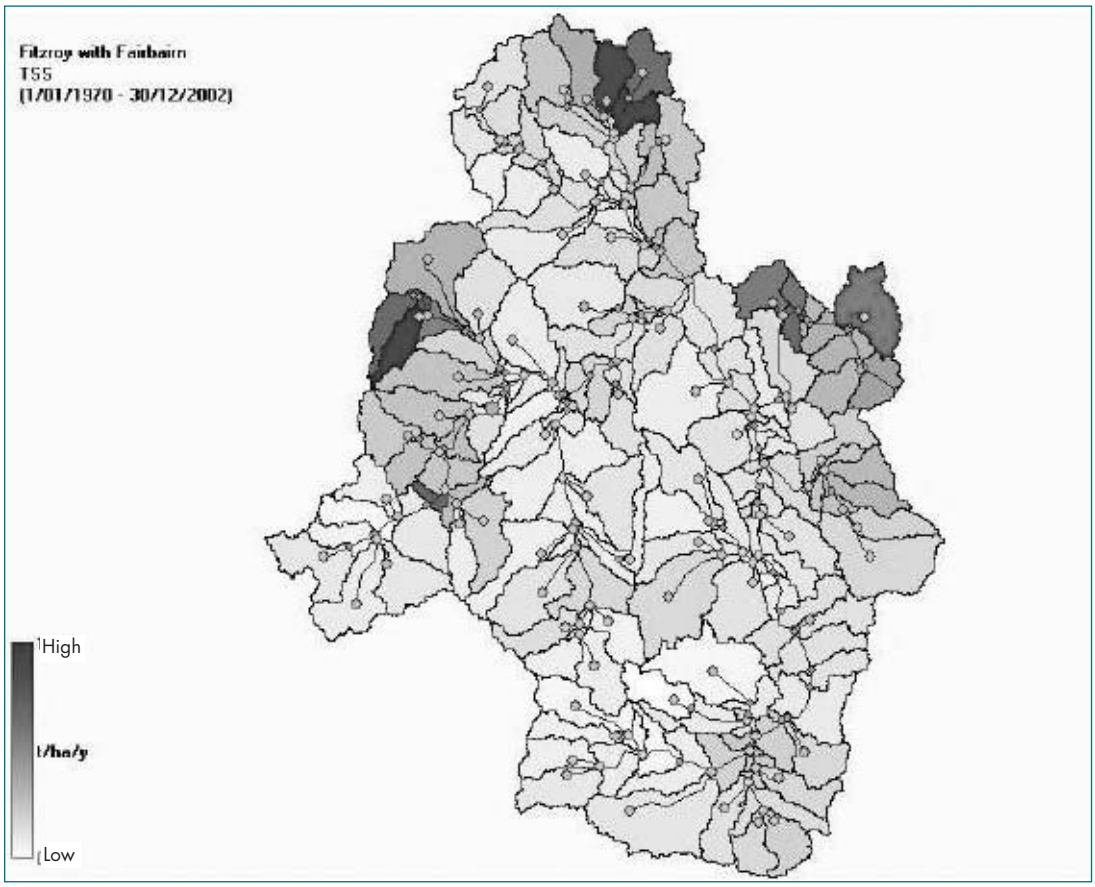

Figure 1.3, Predicted average annual sediment export per subcatchment, Fitzroy catchment

NEW TECHNICAL REPORT

The Impact of Rainfall Seasonality on Mean Annual Water Balance in Catchments with Different Land Cover

By

Klaus Hickel
Lu Zhang

Technical Report 03/11

Our understanding of catchment hydrology is approaching the point where we can confidently predict the partitioning of rainfall and how it changes when we change the land use. This report describes some of the research that supports this important development. By enabling the consideration of seasonality, it enables more confidence in our prediction of how catchment hydrology changes when land use changes.

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gaps so modelling can continue to be revised and improved. Opportunities to fill data gaps may come from the establishment of reference sites (a component in setting water quality targets) or through the revised monitoring network under the reef water quality protection plan.

EMSS modelled predictions of sediment and nutrient export will not only benefit land management planning. In a partnership with the CRC for Coastal Zone, Estuary and Waterway Management, the Development Project team plan to supply sediment and nutrient data as an input to model the biotic functioning of the Fitzroy estuary using the Simple Estuarine Response Model (SERM). The estuary includes about 60 km of the Fitzroy River below the barrage (at Rockhampton) and contains about 500,000 ML of water that ranges from fresh to saline depending on the river flow. It is an extremely productive system with a large mangrove delta that supports the fastest growing barramundi in the country.

Value of the development project

To maximise the regional benefit from our improved regional modelling capacity it is hoped that the project will be extended to June 2005. By that time we hope that the success of the strategy above will have guided initial investment; the agencies and community within the Fitzroy will have an acceptance of modelling approaches and support their continuation; and in partnership with additional and existing regional bodies the talented project staff will be addressing the next lot of water quality priorities using new tools such as the model "E2" currently under development within the CRC for Catchment Hydrology.

The Development Project has been a valuable process providing a tangible link between CRC products and industry partners who intend to use the products. Essentially the Development Project has provided an opportunity to beta test CRC products, particularly the EMSS. We believe this model of delivery can be successfully applied to a wider range of CRC products.

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NEW TECHNICAL REPORT

Changes in Flood Flows, Saturated Area and Salinity Associated with Forest Clearing for Agriculture

By
Richard Silberstein

Technical Report 03/1

This report presents results of an investigation into the connection between stream flow and the rise of watertables following clearing, and their fall after reafforestation. The main focus is to identify as well as possible the relationship between high flows and saturated area. While there remains work to be done to completely fulfil the aims of the project, a number of key results are reported.

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BRISBANE RIVER CATCHMENT PROJECT

Development Project Leader
TONY WEBER

Report by Tony Weber

Catchment overview

The Brisbane River catchment is one of several in South-East Queensland which have waterways that discharge into Moreton Bay, a sensitive receiving environment that supports a large commercial and recreational fishery, tourism, and 700-900 dugong. These catchments and waterways provide a variety of valuable services including irrigation water, potable water, recreational opportunities, flood conveyance and ecosystem functions.

The South-East Queensland Regional Water Quality Management Strategy (SEQRWQMS) was developed in order to address key waterway health stressors impacting on the waterways of the region, with the overall goal of to achieve the Healthy Waterways vision, i.e. "South-East Queensland's catchments and waterways will, by 2020, be healthy living ecosystems supporting the livelihoods and lifestyles of people in South East Queensland, and will be managed through collaboration between community, government and industry". The successor to the SEQRWQMS development team, the Moreton Bay Waterways and Catchments Partnership (MBWCP), was formed to implement the Strategy's actions and undertake further scientific research in support of the implementation.

In developing the SEQRWQMS, several projects were undertaken to better inform and support catchment managers in making decisions that may impact on receiving water quality. The CRC has been very active in undertaking projects as part of the strategy. One of these projects was to develop the Environmental Management Support System (EMSS) for the SEQ region.

Key catchment issues

The recent CRC Annual Workshop at the Yarra Valley this year gave us an opportunity to gather together for a visioning exercise on the Focus Catchments. For the Brisbane Focus Catchment, the key issues identified included:

- Land-use change
  - Increase in urban area by 100%
    - Coastal Development
    - Western Corridor
    - Logan-Albert

Figure 2.1, The SEQ Development Project is helping to protect the sensitive receiving waters of South East Queensland

MDBC-CSIRO-CRC TECHNICAL REPORT SERIES

Impact of Increased Recharge on Groundwater Discharge: Development and Application of a Simplified Function using Catchment Parameters.

By

Mat Gilfedder
Chris Smitt
Warrick Dawes
Cuan Petheram
Mirko Stauffacher
Glen Walker

Technical Report 03/6

This report describes the development of a simple approach towards estimating the response of groundwater systems to changes in recharge that arise from changes in land-use. The emergent properties of a groundwater system are examined using scaling arguments, by combining the effect of aquifer properties into a single dimensionless groundwater system similarity parameter (G).

This report is available as an Adobe .pdf file only.

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- Increase in agriculture intensity (but perhaps not area)
- Increased importance on open space

- Regulatory change
  - Water efficiency – urban, industry, agriculture
  - Water recycling
  - More emphasis on local government strategic plans
  - Carbon trading
  - Stop on tree clearing
  - Water, nutrient and sediment trading
  - Improvements in on-site sewage treatment regulation
  - Tightening point source discharge license conditions
  - Regulating groundwater (both agricultural and urban areas)
  - Public health emphasis
  - Risk management requirements
  - Requirements to undertake social and economic assessment

- Climate change
  - Increased variability
  - Increased wet and dry intensity
  - More storm surges
  - More uncertainty
  - Changes to air quality

These land-use and climatic changes are likely to result in a range of impacts that will have to be carefully managed to ensure that the Healthy Waterways vision can still be achieved. Some of the regulatory changes are being considered as non-structural measures to address these impacts, and considerable structural work, such as riparian rehabilitation and stormwater management devices (eg wetlands, water sensitive urban design etc) has also been implemented.

The South East Queensland Development Project

Following earlier work in developing the EMSS model for the region, the SEQ Development Project was set up to increase awareness and ownership of the model amongst stakeholders and build technical capacity in industry parties and other users. The aim of the project is to have these models applied in planning and prioritising water quality management actions to address the impacts outlined above. The implementation of the models is focussed on three case study areas, the northern catchments (eg Maroochy River), western catchments (eg Lockyer Creek) and the lower catchments (eg Lower Brisbane River). This work is being undertaken through a partnership between the Queensland Department of Natural Resources Mines and Energy, Brisbane City Council, and the Moreton Bay Waterways and Catchments Partnership (MBWCP).

Current Development Project Progress

The majority of the effort in the SEQ Development Project has been focussed on building the capacity of the project team through various training workshops in EMSS and lately SedNet. This has led to building and refining an EMSS model of the Maroochy River with the Maroochy Modelling Group. This group has been formed through the community, local government and state agency desire to establish a key reference point for stakeholders in the Maroochy region for catchment modelling. Group members have been trained in the building and use of the model and are working together to improve the EMSS and identify limitations that may be able to be addressed through further data collection or the use of different models. The objective of this work is to have one EMSS for the region that can be used by each of the stakeholders.

So far, the initial phase of the model was used in a project commissioned by the MBWCP to investigate sustainable loads into the Maroochy River estuary. This has focussed on the loads delivered by catchment and point sources in the region and has coupled the outputs of the EMSS to a receiving water quality model RMA-11. The results of this work have assisted in the strategic planning for wastewater treatment plant upgrades in Maroochy Shire and will be refined with further phases of the EMSS model. This has been a terrific outcome for the project, where a catchment model that has been built in partnership with the community is then used in strategic water management decisions by a government agency. Further work by the group will see the model refined further to be transferred to local government as custodians for the completed version.

Other activities within the Development Project have been designed to raise awareness of the EMSS through various forums. These have included presentations and training sessions as part of the MBWCP Implementation Group meetings, papers given at the Queensland Hydrology Symposium, International River Symposium, the Integrated Catchment Management Conference, and presentations at industry Party related meetings.

A sizeable component of the project has been providing training and support in the use of EMSS, especially in local government. For example, Gold Coast City Council are using EMSS to support catchment planning for several local waterways, Brisbane City Council are using it for both whole of region strategic water management and to support local creek rehabilitation planning and Toowoomba City Council are developing an EMSS to focus on management of their water supply catchments. The rate of adoption is gaining momentum

as a "critical mass" of users is developed in SEQ and is seeing CRC tools being applied to real world problems at a range of scales.

What's next with the Development Project?

The remainder of the activities within the Development Project will be focussed on continuing to build capacity amongst the industry parties and other interested catchment stakeholders (eg local government) and the establishment of a user group within the region so that a critical mass of users of the CRC's tools can get together to discuss local applications. Currently, Griffith University coordinates a MUSIC Users group for the region and it is hoped to use a similar format for the Development Project.

Other tasks will concentrate on the CRC's other catchment modelling tools such as SedNet and perhaps the upcoming "son of EMSS" – E2, depending on whether the project is extended.

Delivering the CRC Mission

The Development Project has highlighted the message that the CRC's tools can be used in supporting catchment management decisions within the region and has shown that the CRC mission is being delivered on the ground.

This project has largely been possible due to the high degree of cooperation between researchers, Industry Parties and the relevant stakeholders within the Focus Catchment and through the continued support of the CRC in assisting Development Project teams in applying the tools to each of the focus catchments.

Finally, the framework of the Development Projects has provided a different approach to communication and adoption of research within the Brisbane Focus Catchment and has led to the actual application of the research in real world situations. The challenge will be to continue this work for the remaining period of the CRC.

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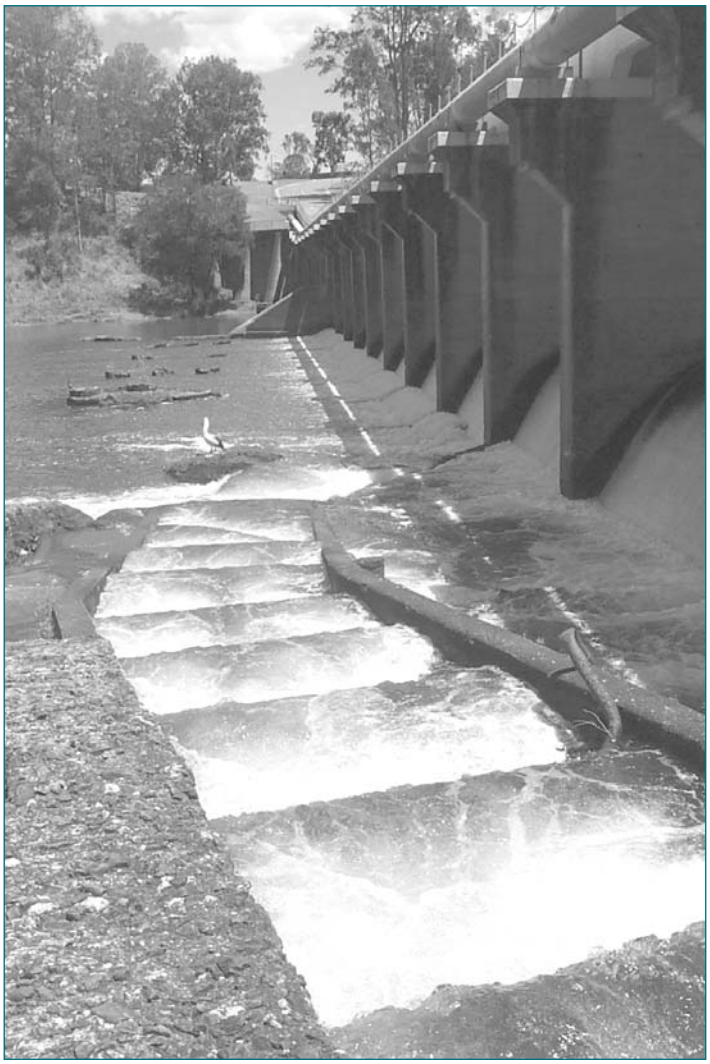

Figure 2.2, The Brisbane River provides a range of ecosystem services

NEW TECHNICAL REPORT

Nature, Preparation and Use of Water Accounts in Australia

By
Manfred Lenzen

Technical Report 04/2

This report on the nature and use of water accounts reviews major research activities and outcomes in this important area, especially the work carried out at ABS, CSIRO and University of Sydney in Australia. The report outlines the methodology to integrate water accounts into input-output transaction tables for water multiplier calculations, and highlights the data-intensive nature of input-output analysis and spatial issues associated with regional water accounts and input-output tables.

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MDBC-CSIRO-CRC TECHNICAL REPORT SERIES

Testing In-Class Variability of Groundwater Systems: Local Upland Systems.

By

Cuan Petheram
Chris Smitt
Glen Walker
Mat Gilfedder

Technical Report 03/8

This report assesses the extent information can be transferred between hydrogeologically similar catchments, by investigating in detail one set of similar catchments.

Assessment of Salinity Management Options for Kyeamba Creek, New South Wales: Data Analysis and Groundwater Modelling.

By

Richard Cresswell
Warrick Dawes
Greg Summerell
Glen Walker

Technical Report 03/9

This report describes a study of the hydrogeological factors influencing salinity in the Kyeamba catchment, located within the uplands of the Lachlan Fold Belt of south-eastern Australia.

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MURRUMBIDGEE RIVER CATCHMENT PROJECT

Development Project Leader
CAROLYN YOUNG

Report by Carolyn Young

The Location

The Murrumbidgee River is located in central southern NSW. Stretching 1,600 kilometres from its source in the Snowy Mountains to its junction with the Murray River, the Murrumbidgee drains a catchment of 84,000 square kilometres and is a major tributary of the Murray-Darling River system. The catchment waterways have undergone considerable modification with the damming and regulation of the Murrumbidgee River and its major tributaries. There are now 14 major dams, eight large weirs and over 10,000 kilometres of irrigation canals in the catchment.

The landscape varies from alpine in the east to semi-arid in the west. The land is mostly used for agriculture, with one of Australia's largest areas of irrigated agriculture in the semi-arid catchments. The Murrumbidgee catchment is one of the most densely populated regions in rural Australia - over 520,000 people, including the ACT, with a growth rate of 1.5 % pa.

The Murrumbidgee Development Project

Through the Murrumbidgee Development Project, we aim to make operational within the Department of Infrastructure Planning and Natural Resources (DIPNR) the sediment and nutrient models available through the CRC. By the end of the project, DIPNR will have EMSS and SedNet models of the Murrumbidgee valley and the capability to build these models in other catchments across NSW.

The Murrumbidgee Development Project commenced in January 2003 and is scheduled to run until June 2004. Should the project be a success in the Murrumbidgee, DIPNR has the option to roll out the capability to other catchments across NSW. The Murrumbidgee Development Project has so far attracted interest from three other DIPNR regions, all expressing an interest in SedNet. Extending the development project also provides the opportunity for DIPNR to learn about other models being made available through the Catchment Modelling Toolkit.

Project objectives

The objectives of the project are:

1 To build capacity within DIPNR to set up and use sediment and nutrient models developed as part of the CRC for Catchment Hydrology Catchment Modelling Toolkit in the Murrumbidgee Catchment and in other regions across NSW.

2 Through application of the models and expert knowledge, provide technical input to refine the water quality targets for the Murrumbidgee Valley.

3 Recommend a prioritisation of catchment management actions to meet the water quality targets.

4 Use the process of model application to engage with catchment stakeholders.

Project team

The Murrumbidgee Development Project is primarily made up of staff from the science division of DIPNR, which has a statewide responsibility. Carolyn Young is leading the project, with support from Christoph Zierholz and Guy Geeves. The project team has attended four EMSS workshops run by staff from the CRC's Predicting Catchment Behaviour Program. Each workshop was designed to step the project team through the process of building a model for a given catchment. Once the EMSS and SedNet models of the Murrumbidgee catchment are up and running, regional staff within DIPNR who have the role of providing advice to the local Catchment Management Authority, will be trained. The training, to be organised by the Murrumbidgee Development Project team, will teach the regional staff how to install the models, run the models for various purposes, interpret the results, and maintain the models as new versions are released and new data becomes available. The Development Project team will continue to provide on-going support to the regional model users.

Project stages

Like the other Development Projects, the Murrumbidgee Development Project team started working with EMSS first. We are building two EMSS models at a 250 m resolution, one representing the middle catchments and the other the upper catchments of the Murrumbidgee River. The middle catchments are those catchments including and upstream of Houlaghans Creek (near Wagga Wagga) to Burrinjuck Dam. The upper EMSS model covers the area upstream of Burrinjuck Reservoir to the headwaters of the Murrumbidgee River in Kosciuszko National Park. The total area being modelled by both models is approximately 27,000 square kilometres. We initially planned to have only one model representing the middle and upper catchments, but the size of catchment area and the amount of data needed to run the model made the model too large and time consuming to run. Another reason for the splitting of the model is to make it easier

to incorporate IQQM modelled outputs from Burrinjuck Dam (i.e. simulate flow release for downstream supply). IQQM is the water management model used by DIPNR. Compared to the current version of EMSS, IQQM has a greater capacity to model releases from the reservoir driven by irrigation demand and more complex environmental flow rules. The middle and upper Murrumbidgee models are nearly complete. Once the EMSS models of the Murrumbidgee are built, DIPNR regional staff will check that the model outputs make sense locally and then the project team will complete the model calibration.

We commenced work on SedNet in February 2004 after the team attended the CRC's SedNet workshop. We have prepared the initial set of coarse (250 m resolution) data ready for when the bugs in SedNet are fixed. Once the 250 m resolution SedNet model is running smoothly, we will build a model using 25 m resolution data enabling a better understanding of the sediment and nutrient budgets in catchments the size of 2000 square kilometres such as Jugiong Catchment.

Project steering committee

To guide the implementation and communication of the Development Project, a project steering committee was established. The committee meets every six months and consists of an independent scientist, a representative of the Murrumbidgee Catchment Management Authority, a DIPNR regional representative and a CRC representative not working directly on the project. Communication with our clients, the DIPNR Murrumbidgee Regional staff, has involved project briefing meetings, demonstrating the models and receiving feedback on the suitability of the models. A couple of DIPNR regional staff attended the SedNet training workshop in February 2004 and are helping to collect some of the data needed to run EMSS and SedNet. Having the project clients attend the workshop has given them a greater understanding of the model's capabilities and limitations, and the amount of data preparation needed in building a regional scale model.

Figure 3.1, The headwaters of the Murrumbidgee River at Long Plain, Kosciusko National Park. The Murrumbidgee River flows north through the Australian Capital Territory and then west through Gundagai, Narrandera and Balranald in NSW.

UPCOMING TECHNICAL REPORT

Integrated Stormwater Treatment and Re-use Systems - Inventory of Australian Practice

By

Belinda Hatt
Ana Deletic
Tim Fletcher

Technical Report 04/1

The aim of this research was to develop an inventory of technologies for the collection, treatment, storage, and distribution of general urban stormwater runoff and, where current knowledge allows, provide interim guidance on stormwater re-use implementation.

Printed and bound copies of this report will be available during May 2004 from the Centre Office for $27.50.

Contact Virginia Verrelli on 03 9905 2704 or email crcch@eng.monash.edu.au for further information.

Figure 3.2, Pollutant contributions to the Murrumbidgee River result from a range of land uses including urban and industrial development and rural agriculture

Objectives for applying the EMSS

A draft water quality target for the Murrumbidgee River and tributaries is set out in the Murrumbidgee Catchment Management Plan. The target, broadly worded, is aimed at reducing the suspended sediment levels in the Murrumbidgee River and its main tributaries. The target needs to be refined and broken down into more detail, with consideration also given to bedload sediment and nutrients. One part of the Development Project is to refine the water quality target with the assistance of modelling tools and expert knowledge. Refining the target is an iterative process.

The Development Project team, along with the project clients, will initially run the SedNet and EMSS models with current data to learn more about the current condition of the Murrumbidgee Catchment streams, in particular, sediment and nutrient loads, sources and sinks. Once the current condition is understood, the models will be run again under different scenarios to look at what management actions are needed to help meet the draft water quality target and start to refine the water quality target.

The Murrumbidgee Catchment Management Plan lists several management targets aimed at reducing the amount of suspended sediment and nutrients reaching the streams, and effectively move towards achieving the water quality target. One such management target is 'to protect and enhance 1500 kilometres of streambank using riparian vegetation for bank stabilisation and runoff filtration'. In this instance, SedNet can be used to help decide where best to 'enhance and protect' the riparian vegetation. Another example is to use EMSS or SedNet to examine the affect of predicted land-use change on sediment and nutrient delivery to the stream network. The SedNet and EMSS models will not tell the catchment managers exactly where on-ground works should be placed, but rather the models will help narrow down where investment in the catchment should be focused and what processes (i.e. gully vs. hillslope erosion) should be targeted.

Challenges and Outcomes

The Murrumbidgee Development Project team has learnt that the obtaining and formatting of data is the most time consuming part of model building, along with the iterative process of identifying bugs, notifying the software developing team, waiting for bugs to be fixed, then testing until the next bug is identified. This process is accepted as part of the learning in the Development Projects. The plus side of being a 'guinea pig,' so to speak, is that the Development Project team has had the opportunity to provide comment on the models and how they could be improved. We have also learnt that getting the right mix of skilled staff and training is crucial to a successful Development Project. To build an

EMSS or SedNet model, the development project team has needed a range of skilled people: hydrologists, high level GIS operators, soil scientists, geomorphologists, communicators and of course people with basic computer modelling understanding. DIPNR has needed to acquire some of these skills and hence the model building has taken longer than planned. Now that a lot of the hard learning is done, the next model building exercise will be substantially easier.

From a Focus Catchment Coordinator's point of view, the Development Project has provided a process by which to engage DIPNR staff in the CRC's research and research products. The Development Project concept is proving to be a winning formula for achieving research adoption. For the modelling types, the adoption formula could be written as:

Research adoption = research product, which can be custom-built + industry demand for the product + training and support from the researchers who developed the products + industry with the right skills mix and commitment.

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Figure 3.3, The Murrumbidgee Catchment Management Plan lists several management targets aimed at reducing the amount of suspended sediment and nutrients reaching streams in the catchment.

NEW TECHNICAL REPORT

Non-Structural Stormwater Quality Best Management Practices - Guidelines for Monitoring and Evaluation

By
André Taylor
Tony Wong

Technical Report 03/14

This report presents a new evaluation framework and guidance for measuring the effects and life-cycle costs of non-structural BMPs. This framework defines seven different styles of evaluation to suit the needs and budgets of a variety of stakeholders involved with stormwater management.

Printed and bound copies of this report are available from the Centre Office for $27.50. Contact Virginia Verrelli on 03 9905 2704 or email crcch@eng.monash.edu.au

This report is available as an Adobe .pdf file.

Visit www.catchment.crc.org.au/publications

GOULBURN BROKEN RIVER CATCHMENT PROJECT

Development Project Leader
PAT FEEHAN

Report by Pat Feehan

Introduction

The Goulburn Broken catchment is home to 189,500 people and is regarded by many as the "food bowl" of the Murray Darling Basin. The region's agricultural output is estimated to be worth $1.35 billion per year and this supports a regional economy that has an annual economic output of $7.8 billion and employs approximately 77,000 people.

This strong performance is due to the region's abundant natural resource assets. Managing these assets is critical to the future of the region and its community.

The Goulburn Broken catchment was included as a focus catchment for the CRC for Catchment Hydrology as part of the Centre's program to ensure integration of the various multi-disciplinary threads of our research programs, and to realise the holistic view of catchments desired by stakeholders.

Catchment issues

The various natural resource issues facing the catchment have been described in earlier editions of *Catchword*. More detailed information can be found in the Goulburn Broken Catchment Management Authority's recently finalised Regional Catchment Strategy. This can be found at www.gbcma.vic.gov.au/sub_strategy.html

More information about the CRC's Goulburn Broken focus catchment can be found on the CRC's website www.catchment.crc.org.au

Applying the CRC's Tools to Catchment Management – the Development Project

The Goulburn Broken Development Project was approved by the CRC for Catchment Hydrology's Board in November 2002 and good progress has been made to date. The project is titled "Modelling and managing land-use impacts in and around water storages in northern Victoria" and aims to inform the decisions natural resource managers make about land uses near major water storages and the impact of these uses. Further background information can be found in the December 2002 edition of *Catchword*.

The Development Project is giving resource managers a great opportunity to apply and test the CRC's modelling tools in real life situations. It is helping to develop and test a number of the CRC's modelling tools in two case study catchments:

- The upper-mid Goulburn catchment including Lake Eildon and Goulburn Weir (covering 10,700 sq km) and
- The catchment to Tullaroop Reservoir in the Loddon River Catchment (covering 730 sq km).

Progress to date

Despite a few hiccups, work has gone well. We now have working Environmental Management Support System (EMSS) models of our two case study catchments, and model outputs are being scrutinised to see what they can tell us.

We were fortunate to establish a collaboration with staff from Primary Industries Research Victoria (PIRVic) (formerly the Centre for Land Protection Research - CLPR at Bendigo). Geoff Savage, in particular, has been able to pull the right bits of data together at the right times to produce the two models. Geoff closely liaised with Joel Rahman (from the CRC's Predicting Catchment Behaviour Program) and other members of the CRC Catchment Modelling Toolkit team to work out some of the vagaries and subtle nuances of EMSS.

As part of the Project, a Stakeholder Reference Group was established. We wanted to ensure that relevant stakeholders, including municipalities, Catchment Management Authorities, Urban Water Authorities and other agencies understood what was being done and weren't surprised either by the models or their outputs.

The Reference Group process has led to a new cohort of Development Project and CRC supporters. Members of the Reference Group are urging Melbourne based agencies to have a close look at the CRC's models and how they might be used in state wide processes – a good way of achieving the CRC's mission.

The third element of the Goulburn Broken Development Project will be reservoir simulation models such as CAEDYM-DYRESIM and CAEDYM-ELCOM to enable the modelling of within storage movement of pollutants. Collaborative arrangements are being set up with the Centre for Water Research at the University of Western Australia for this to occur.

So where have we got to?

As mentioned above, we have two working EMSS models. Shane Papworth has been working to document the models, how they were constructed, the source of the underlying data, and the model calibration and validation process.

Shane has also tried to point out some of the assumptions and limitations in the process. Hopefully

users will recognise some of these short-comings and take these uncertainties into account in their decision making processes! He has also applied the models to see what they might tell managers (and to test and sanity check them from a management perspective).

For example, he has explored the idea of high, medium, and low priority sub-catchments for management works based on pollutants yields. Of the 41 sub-catchments draining to Tullaroop Reservoir, only four meet Shane's high priority criteria and eight are medium priority – very useful information for managers who need to demonstrate that works are going to achieve results.

He is also applying the model to some example management scenarios that future users will be able to use as case studies – they will be able to see how the model was used and then apply it to questions they generate for themselves.

Some preliminary results indicate:

- Large scale revegetation of the catchment for water quality improvement purposes is unlikely to be effective.
- Further clearing of existing forested areas could be expected to have proportionally high detrimental impacts on water quality
- Riparian zone management options seem to be somewhat more effective at reducing pollutant exports than other options.
- A very large proportion of total TSS, TN and TP loads exported from the catchment are trapped in Tullaroop Reservoir.

We'll soon take the model back to the Reference Group and have them utilise and play with the models.

Having got to this point we are now hoping to apply the process to other catchments in G-MW's region across northern Victoria. Given our experience with the Development Project so far and our current technical capability, the time frame for producing an EMSS for a new catchment could be as little as four to six weeks provided that data sets are available. The parallel process of engaging a range of stakeholder groups through a Stakeholder Reference Group is likely to extend that period, but ensures that the technical process undertaken has a realistic context.

Other CRC work in the Catchment

A number of the CRC's research programs have direct relevance to Goulburn Broken catchment issues and this is a good opportunity to highlight some examples:

Land-use Impacts on Rivers Program

Project 2.3: 'Predicting the effects of land-use changes on catchment water yield and stream salinity' investigated the effects of large scale afforestation development on flow regime and thus water allocation. The results showed that the maximum reduction in mean annual flow is 8% for Lake Eildon and 14% for Goulburn Weir if all suitable areas are planted to blue

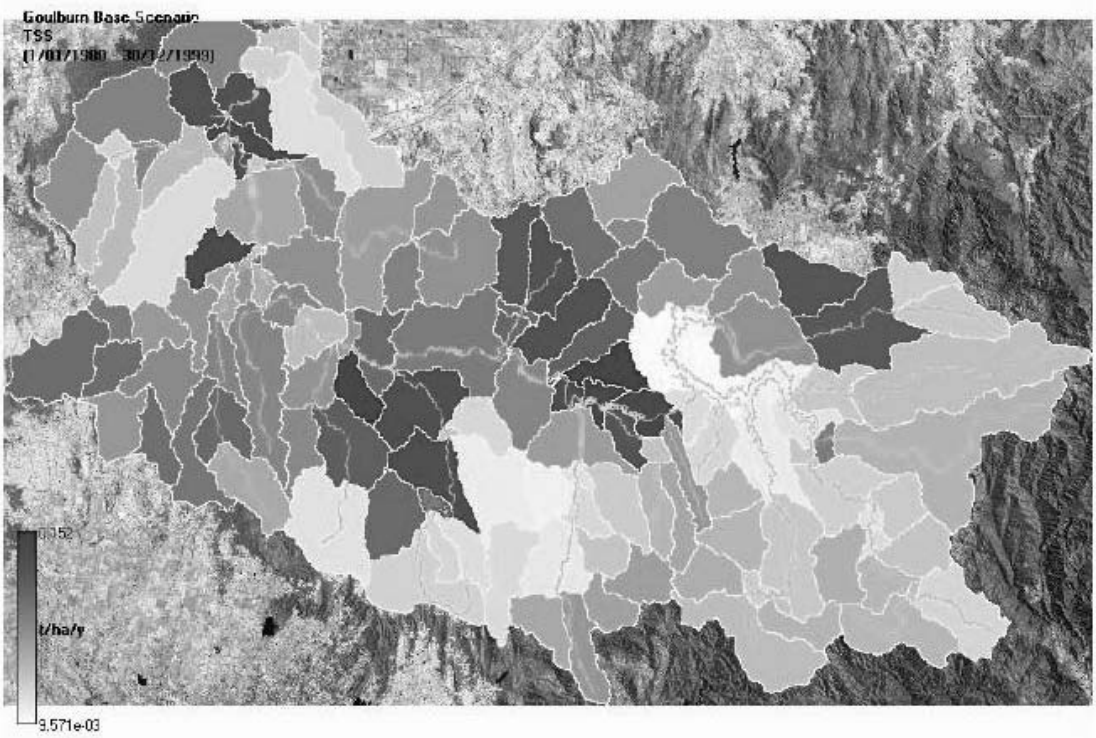

Figure 4.1, EMSS-Goulburn – Relative average TSS yield predictions (1980 – 1999) for Upper-Mid Goulburn subcatchments

URBAN STORMWATER SOFTWARE

Model for Urban Stormwater Improvement Conceptualisation (MUSIC) version 2

MUSIC is a decision-support system. The software enables users to evaluate conceptual designs of stormwater management systems to ensure they are appropriate for their catchments. By simulating the performance of stormwater quality improvement measures, music determines if proposed systems can meet specified water quality objectives.

MUSIC Version 2 is available as a free evalution version download from the Catchment Modelling Toolkit website at www.toolkit.net.au/music

The MUSIC evaluation version allows you to trial the MUSIC software for 6 weeks. During that period you are able to purchase the MUSIC software for $330. Discounts apply if you a current MUSIC version 1 user.

For further information visit the MUSIC web site at www.toolkit.net.au/music

Please note: You must be a registered Catchment Modelling Toolkit member to download the MUSIC evaluation version.

NEW TECHNICAL REPORT

Stochastic Generation of Climate Data

By

Ratnasingham Srikanthan
Senlin Zhou

Technical Report 03/12

This report describes stochastic climate data generation models for the generation of annual, monthly and daily climate data (rainfall, potential evapotranspiration, maximum temperature and other variables) that preserves the correlation between the different variables. The performance of the models are evaluated using climate data from ten sites located in various parts of Australia.

Printed and bound copies of this report are available from the Centre Office for $27.50. Contact Virginia Verrelli on 03 9905 2704 or email crcch@eng.monash.edu.au

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gum. However, under a more realistic scenario, the area of the blue gum plantation will be significantly smaller and as a result, reduction in mean annual flow is 2% at Lake Eildon and 4% at Goulburn Weir.

By linking flow duration curve analysis with data from paired catchment studies it was found that plantations would significantly reduce low flow and hence increase flow variability. When combined with the system simulation model for Goulburn, it was predicted that the fraction of time water allocations are less than 100% increases from current 3% to 7% under the maximum plantation scenario. The model also predicted that unregulated flows would decrease by 6% and 27% under the moderate and maximum scenarios, respectively.

The results from this study provide catchment and resource managers with useful insights into the hydrologic impacts of land-use change.

Project 2.19 (2A) entitled 'Reducing the impacts of irrigation and drainage on river water quality', aims to develop a module for the CRC Catchment Modelling Toolkit that will allow a simple description of irrigation as a land-use in the whole of catchment context. This is critical to the success of E2 (the next version of EMSS) in catchments such as the Goulburn Broken where irrigation accounts for 60 - 70% of water abstraction from rivers and is a substantial land-use.

Salinity will be included in the module as will nutrients, where feasible.

Models developed in Project 2.21 (2C): 'Predicting salt movement in catchments' will be evaluated in the Goulburn Broken later in the year.

Project 2.20 (2B): 'Improved suspended sediment and nutrient modelling through river networks' is building on SedNet modelling in the catchment previously carried out by Ian Prosser and Ron De Rose from CSIRO Land and Water, as part of the National Land and Water Resources Audit.

This has proven useful in identifying the dominant erosion processes and hotspots within the catchment so that erosion control works are planned to achieve maximum impact on sediment loads downstream.

SedNet is now available as an application in the Catchment Modelling Toolkit (www.toolkit.net.au/sednet). Colin Huggins from PIRVic at Bendigo attended a training workshop held in Canberra during February, 2004 and a model of the Goulburn-Broken catchment is being built using the software.

Having a SedNet model within the catchment agency will allow ongoing simulation of the outcomes of different management scenarios. It will also be a useful cross check against EMSS model outputs

River Restoration Program

Mike Stewardson and Ian Rutherfurd have utilised tools developed as part of the River Restoration Program in a study addressing environmental flow requirements for the Goulburn River below Lake Eildon. Mike and Ian have done some follow up work looking at uncertainties

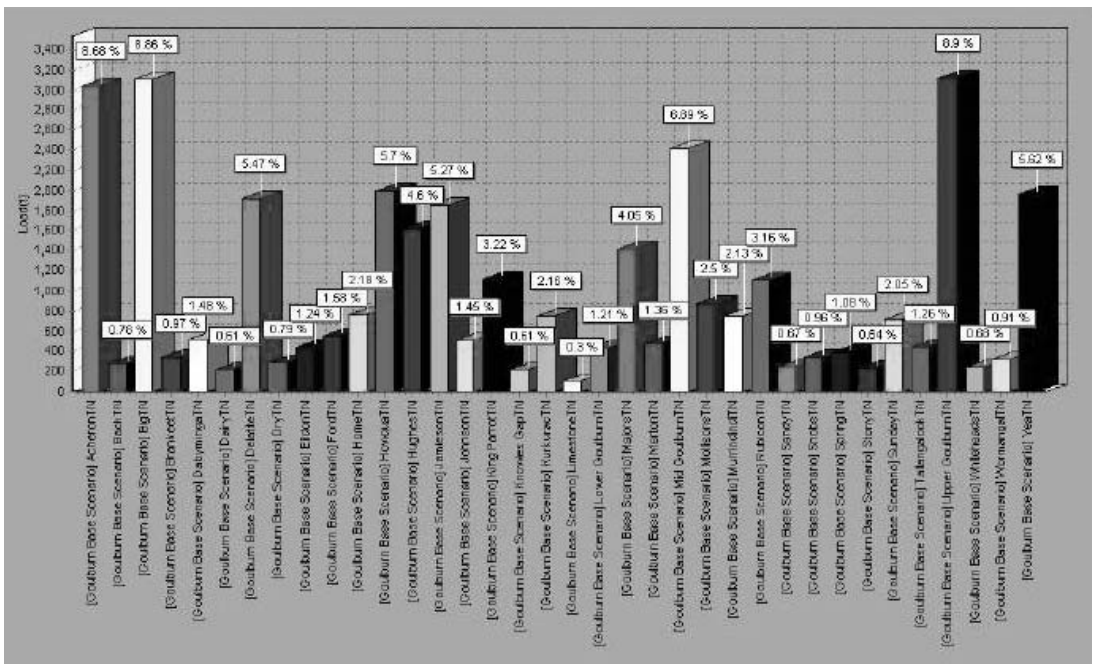

Figure 4.2 - EMSS-Goulburn – Relative average TN load predictions (1980 – 1999) for Upper-Mid Goulburn subcatchments

in the physical habitat assessments undertaken as part of that environmental flow study.

There is on-going work for the Granite Creeks project. Dan Borg has been continuously monitoring scour at an experimental large woody debris structure using a novel sensor technique. Work in the Granite Creeks area has been severely hampered by drought conditions resulting in very low, or no, flow in creeks – not ideal conditions for projects needing a range of flow to test hypotheses!

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NEW TECHNICAL REPORT

Calibrations of the AWBM for Use on Ungauged Catchments

By
Walter Boughton
Francis Chiew

Technical Report 03/15

This report presents an approach for using the daily rainfall-runoff model, AWBM, to estimate runoff in ungauged catchments.

The report describes computer programs that can be used to optimise three key parameters in AWBM against runoff data from gauged catchments, and provides calibrated parameter values and catchment characteristics for 221 Australian catchments. The report then recommends an approach for using the calibrated parameter values in these and other catchments to guide the choice of AWBM parameter values for use in ungauged catchments.

Printed and bound copies of this report are available from the Centre Office for $27.50. Contact Virginia Verrelli on 03 9905 2704 or email crcch@eng.monash.edu.au

This report is also available as a free Adobe .pdf download from www.catchment.crc.org.au /publications

YARRA RIVER CATCHMENT PROJECT

Development Project Leader
GRAHAM ROONEY

Report by Graham Rooney

Introduction

There are many rural reaches and tributaries in the Yarra River system but the lower reaches are practically all urbanised. The suburbs of Melbourne and the satellite towns make up an area of about 1,500 square kilometres. It is this strong urban influence that led to the Yarra River system being chosen as a focus catchment. Urban stormwater has been always regarded as a key research area in the CRC for Catchment Hydrology and Melbourne Water's participation in the CRC meant that a substantial end-user organisation was on hand to facilitate research and adopt findings.

More than 1.5 million people live within the Yarra catchment boundaries. Melbourne Water and local councils manage the Yarra River and its tributaries, with responsibilities depending upon size of stream catchment areas. The stream systems comprise over 5,000 kilometres of piped, channelled, modified and natural urban and rural channels. Since I wrote the last "integrated" *Catchword* article in December 2002, the Department of Natural Resources and Environment, Victoria has been re-structured into two departments: Sustainability and Environment, and Primary Industries. These new departments manage the catchments while the Port Phillip and Western Port Catchment Management Authority plays a coordination role.

The Victorian water industry is going through a substantial review of the way that water is managed and distributed. There is no doubt that the governmental "white paper" due shortly will have major implications for Melbourne Water and its business.

Concurrently there is a roll out of Regional River Health Strategies throughout the State, where targets for stream rehabilitation will guide the nature of future works. An ambitious target is proposed for the Yarra River - all natural channels in good condition by 2025. Addressing this target will mean not only additional stream rehabilitation research, but also some consideration of the techniques used to measure stream condition and especially agreement about condition attributes for streams passing through urbanised catchments.

Development Project

The Yarra Development Project is about adapting the Environmental Management Support System (EMSS) for the Yarra River and its catchment. Our primary objective for the project is to enable the prediction of water quality in the river at Yering Gorge. Water is pumped out of the river at this natural choke site and

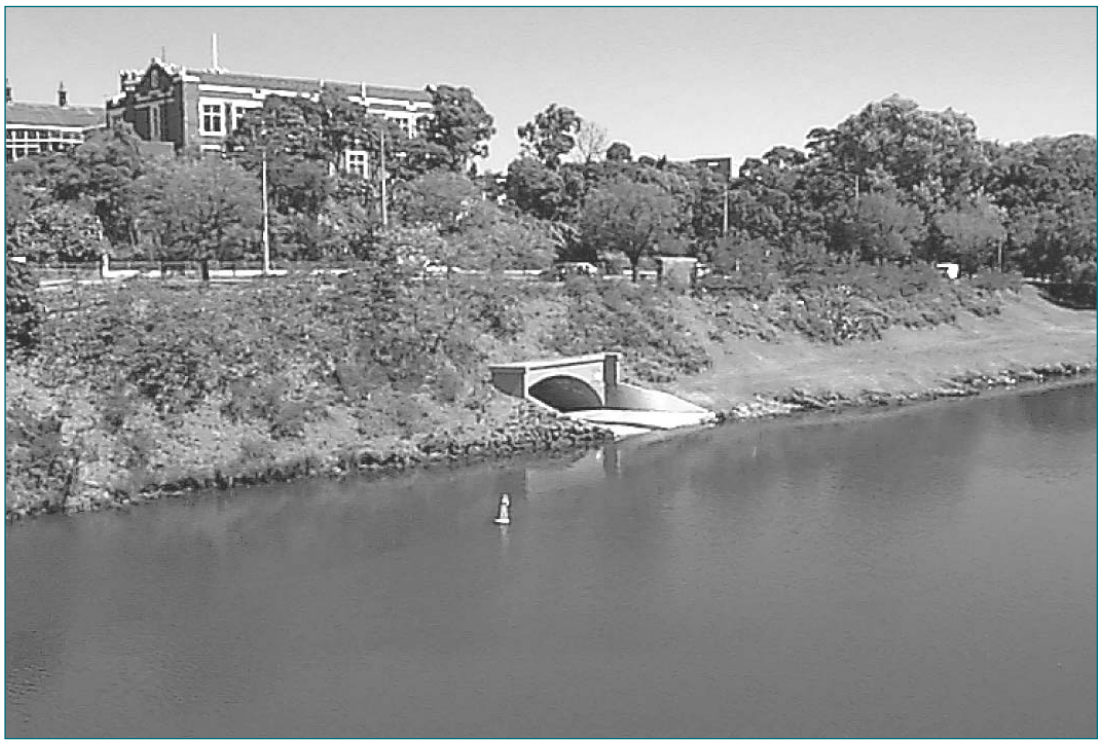

Figure 5.1, The Prahran Main Drain outlet to the estuarine reach of the Yarra River – a typical example of a pollutant source in extremely urbanised catchments

Figure 5.2, A sediment trap at the entry to the Ruffey Lake wetland. The stormwater receives treatment before flowing into Ruffey Lake in Doncaster. Below the lake, Ruffey Creek flows into the Yarra River at Templestowe.

transferred to Sugarloaf Reservoir, where it is stored, treated and distributed to augment Melbourne's drinking water supply.

The idea is to simulate the river and catchment on computer and then model scenarios of catchments and riparian zone changes in order to establish what river water quality changes occur, if any. Effective catchment management can then be assessed as a viable means of managing reservoir water quality and postponing potentially ineffective and/or expensive treatment works.

- Project stages

Our Development Project commenced after the others with Christine Hughes starting work full-time on this project in mid 2003. Christine is trained in hydrology and is working in a team that manages reservoir water quality issues.

The initial challenge was catching up with the other Development Projects. They had quite a head start and it was important to draw alongside so that the looming combined workshops on Development Projects could be meaningfully attended.

We negotiated an arrangement with the Bendigo office of Primary Industry Research Victoria (PIRVic, formerly the Centre for Land Protection Research). Christine worked with Geoff Savage of PIRVic for several days and developed a working knowledge of the model-build process, a land-use GIS layer, a digital elevation model for the Yarra River and catchment and rainfall fields from the SILO database.

- Problems encountered

We encountered problems with rainfall-runoff calibrations. This was resolved when a rainfall field misalignment bug was found and corrected. Additional calibration issues are being addressed with the assistance of Francis Chiew from The University of Melbourne (Program Leader, Climate Variability).

Melbourne Water utilises the MapInfo Geographic Information System (GIS) software, which proved problematic when it came to raster and shape file processing. These challenges certainly slowed the progress of the project. Three of the other focus catchment projects use ArcInfo or ArcView software. However Tony Weber (Brisbane River Focus Catchment Coordinator) also uses MapInfo. Tony provided assistance in processing the data by revealing some tricks, e.g. using Vertical Mapper as an intermediary processing tool.

- Pooling skills

Recently at the March CRC Annual Workshop in a special out-of-session meeting, we planned a workshop involving Christine, Joel Rahman and Tony Weber to address some of the outstanding issues slowing our progress. The objective was to pool their skills and knowledge, and build the first Yarra River EMSS over a three-day period. This outcome was achieved.

NEW TECHNICAL REPORT

Stochastic Models for Generating Annual, Monthly and Daily Rainfall and Climate Data at a Site

By

Ratnasingham Srikanthan
Senlin Zhou

Technical Report 03/16

One of the goals of the Climate Variability Program in the Cooperative Research Centre (CRC) for Catchment Hydrology is to develop computer programs for generating stochastic data at time scales from less than one hour to one year and for point sites to large catchments.

The first phase of the program (2000-2002) has developed models to stochastically generate rainfall and climate data for a site at annual, monthly and daily time scales. Different models have been tested using data from across Australia, and the results have been reported in a series of CRC for Catchment Hydrology reports and research papers.

The purpose of this report is to provide guidance on the use of the stochastic modelling software.

Printed and bound copies of this report are available from the Centre Office for $27.50. Contact Virginia Verrelli on 03 9905 2704 or email crcch@eng.monash.edu.au

This report is also available as a free Adobe .pdf download from www.catchment.crc.org.au /publications

Now we have a YarraSim model that looks like it does simulate the Yarra River and catchment. The Yarra Steering Committee has met once during the project and recently the second meeting was postponed till May, specifically to enable the Yarra model to be presented. The May Steering Committee meeting will include participants from the Port Phillip and Westernport Catchment Management Authority, the Environment Protection Authority, the Department of Primary Industries, the Department of Sustainability and Environment and Tom McMahon from The University of Melbourne.

- Proposed applications

So the project has regained much of its momentum and pursuing the prediction of stream water quality at Yering Gorge appears to be not far around the corner. Many other applications are possible. While there is multi-departmental agreement on nitrogen reduction strategies (through employing an earlier water quality model called Filter), comparing model outputs would be instructive. It is too late to use YarraSim for assisting with Regional River Health Strategy targets, but identifying sediment-generation hotspots has real value for stream ecosystem. YarraSim could also provide a means of integrating the scores of MUSIC models now existing within the basin.

We all believed that the chances for increased interest and adoption of YarraSim relied on building a model that looked like the Yarra River basin. Early indications are that this belief is indeed correct. Since we have been able to demonstrate the YarraSim model to a range of people, genuine interest has become apparent. With time, that interest should evolve into ownership and the generation of a family of applications.

Christine and I agree that a major limiting issue has been the difficulty of finding people close by who are familiar with the technical issues. There is a support network of CRC researchers and development project people available on-line or by phone, but they are not alongside on a day-to-day basis. A team of two where only one knows the intricacies of the software is not ideal. Being able to bounce ideas and problems off a Melbourne Water colleague in "real time" certainly yields timely solutions and approaches – as evidenced in many other work activities.

Other CRC research and products

Apart from the Development Project, other CRC products are infiltrating industry practices. MUSIC 2.0.1 was recently released and loaded by many users within Melbourne Water. The new version of CHUTE has been trialled and is used in the capital works design area.

Research into the role of wetlands in removing stormwater pollutants is being undertaken at sites in Melbourne, including the Ruffeys (Doncaster) and Hampton Park East wetlands. Preliminary results are supporting the parameters in MUSIC, although inter-event nitrogen processing may require additional research in different directions. To this end, Melbourne Water has begun funding microbial level research on denitrification rate variations and influences in wetlands.

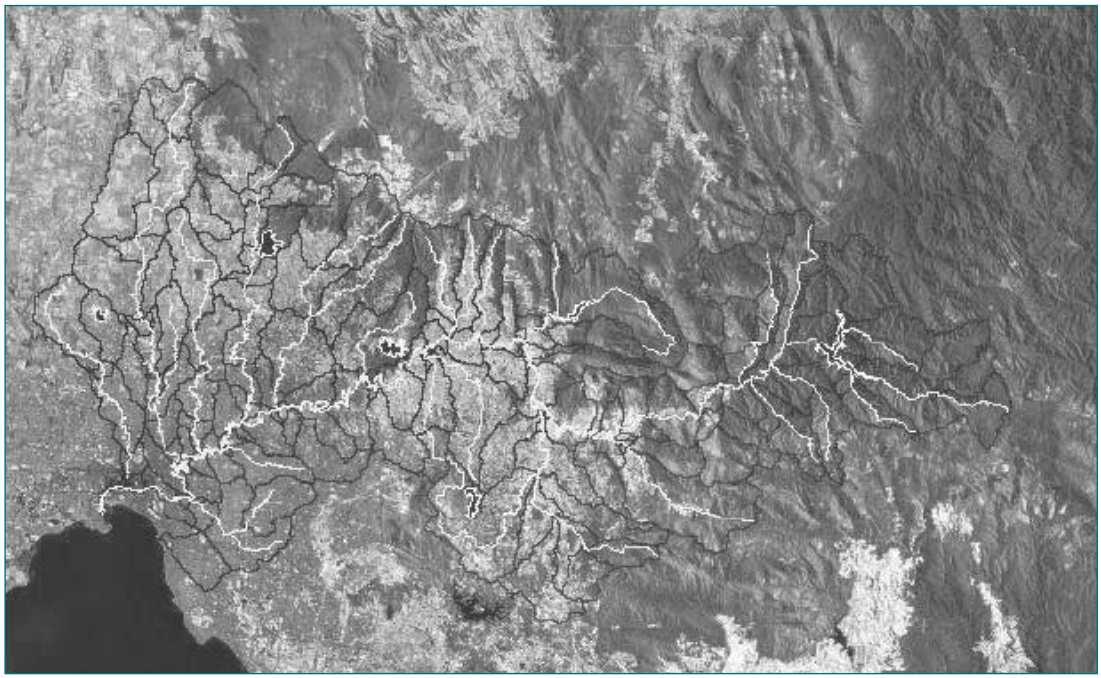

Figure 5.3, The YarraSim model is taking shape. Yarra Sim now incorporates a digital elevation model, a satellite image overlay, successful stream routing and rainfall fields that are being calibrated

We are also providing data and information to André Taylor for his research on life-cycle costs associated with stormwater treatment measures. There is real interest and industry "pull" for the life-cycle analysis module that will accompany the future MUSIC version 3 release.

Joint research between Catchment Hydrology and the CRC for Freshwater Ecology has been targeted at investigating the relationship between urban hydrology and stream health. The "Urbanisation and the ecological function of streams" project has shown an empirical relationship between the extent of connection of impervious surfaces to streams via stormwater pipes, and impacts on in-stream biodiversity as measured by macroinvertebrate community composition. Chris Walsh and Tony Ladson have plans about retrofitting selected estates to observe changes in adjacent streams.

In addition, Peter Cottingham (CRC for Freshwater Ecology) and I have re-convened the Yarra Forum. This forum allows researchers and managers to come together to reveal the investigational work they are doing, its findings and gaps in our knowledge. After a spell of just over a year, the 2004 forum was well attended and participants agreed that two meetings each year was a reasonable target.

Valuing the Yarra

As for future possibilities, our beautiful Yarra River has this muddy reputation, which we think is unwarranted. The nature of the soils in the river's catchment lend it to being naturally turbid; one stream manager inside Melbourne Water has a view that community perceptions can be modified so that the river is valued more for the way it is.

Interestingly, recent evidence has emerged that common galaxias ('spotted minnow') are spawning in the estuarine reach of the river, using the bluestone rocks that armour the banks. There has been discussion about defining the values of the estuarine stretch of the Yarra River and this discovery certainly demonstrates the value of these reaches.

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NEW TECHNICAL REPORT

Analysis and Management of Unseasonal Surplus Flows in the Barmah-Millewa Forest

By
Jo Chong

Technical Report 03/2

This report addresses a major threat to the Barmah-Millewa Forest; unseasonal flooding in the summer and autumn, when the forest would normally be dry. Based on analysis of pre-regulation conditions (1908-1929) and current conditions (1980 - 2000), forest flooding has increased from 15.5% of days to 36.5% of days between December and April.

In particular, small, localized floods, which inundate less than 10% of the forest, occur at least eight times more frequently now, than before regulation. Work by others has related these hydrologic changes to tree death and changes in floristic structure in wetlands.

Printed and bound copies of this report are available from the Centre Office for $27.50. Contact Virginia Verrelli on 03 9905 2704 or email crcch@emg.monash.edu.au

This report is also available as a free Adobe .pdf download from www.catchment.crc.org.au /publications

POSTGRADUATES AND THEIR PROJECTS

Geoff Vietz

Mountains or rivers were always going to be where I was going to end up working, no matter what vocation I chose. On open day the Environmental Engineering faculty at Melbourne University had some great pictures of students in scenic locations – I was sold! At the end of the degree looking through the yellow pages for my future company 'Snowy Mountains Engineering Corporation' was a standout, rivers at the backdoor and skiing after work – again I was sold! My first project was to help identify environmental flow releases for the Snowy River from Jindabyne Dam and subsequently I worked on river and environmental management projects throughout Australia and the world in Japan, Georgia (former USSR) and Indonesia. This was followed by a brief stint working with Fluvial Systems.

For a year or so it is a little more blurry while I was trekking through the European Pyrenees, the South American Andes and working as a ski instructor in Canada. When my brain started to turn mushy I returned to Melbourne to work for the Earth Tech Natural Resources Group (formerly ID&A) for a couple more very enjoyable years of work on rivers.

With a considerable amount of my time spent on working with technical panels to identify environmental flow regimes for rivers I decided more knowledge of the geomorphic aspects of this work was required. I was keen to improve the understanding of the link between river hydrology/hydraulics and geomorphology…enter the CRC and The University of Melbourne.

My thesis is focusing on a feature which is commonly utilised to define medium sized flows through these studies: the in-channel bench. These features are of ecological importance for river processes such as nutrient dynamics, vegetation zonation and woody debris recruitment yet they are poorly understood in terms of spatial and temporal variation. Not only is the link between these features and hydrology pertinent to environmental flow studies, but for the fluvial geomorphologist or river manager it leads to an understanding of river channel adjustment to the hydrologic regime. Initial results are already identifying that by classifying in-channel benches as proposed we obtain better relationships between these features and hopefully a better understanding.

I am currently in a phase of narrowing down my thesis question and heading out into the field. My research will be focused on Victoria but will hopefully include some work throughout Australia and internationally. Results from initial work will likely be coming soon to a conference near you!

With my focus firmly on my thesis, and the odd distraction of an overseas ski trip, I still maintain my 'real world' connections with some part time teaching and consulting. I look forward to discussing any of these ventures with interested parties.

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CRC PROFILE

Our CRC Profile for April is:

Ross Searle

In the beginning…..

T'was the 36th night before Christmas and not a creature was stirring not even a mouse… well, that is not strictly true. Apparently my good mother was writhing in the pains of labour on that night, in the baby booming suburb of Stafford in Brisbane some 34 years ago. Thus began my sojourn.

I was child number three of four to my Electrical Engineer father John and my Domestic Engineer mother Joan. Being child number three had the disadvantage that I had to learn from an early age to defend myself against the unwanted attentions of an older brother and sister. However, it did have the advantage of a poor defenceless younger brother being readily available upon whom I could vent my frustrations.

Childhood was pretty uneventful for me. Days pretty much filled with sporting pursuits, learning music and a bit of schoolwork thrown in to keep the parents happy, while my parents days were filled with running about madly taking kids to sporting events, working madly to keep up the supply of footy boots and musical instruments, and berating us to do some school work.

As the end of my schooling years drew to a close, the fear of the great beyond began to take hold. Not having much of an idea which way to jump, I serendipitously did year 11 work experience on a friend's dairy farm. One of the farmer's sons was doing Agricultural Science at UQ majoring in animal production. Sounds interesting I thought, so sign up I did.

In the middle…..

A less than spectacular result in first year biochemistry (there were extenuating circumstances - if only my lecturer could have been convinced !!) put an end to my dreams of spending a major part of my life with my arm placed in the posterior of ruminants. As one door closes another opens, and I went on to major in Land Resource Science. What girls wouldn't be impressed by a penniless Ag Science student who drove a beat up XA falcon and could wax lyrical on the virtues of a Solodised Solonetz at dinner parties. Well, as it turns out – none.

For a born and bred city boy, Ag science opened my eyes to a whole new world, one which I thoroughly enjoyed. It also gave me a good grounding in the science of landscapes, but alas, no job. At the end of our fourth year, the first round of what was then NLP funding had dried up, and so had the jobs for green young graduates. I was able to survive for the next 10 or so months due to the generosity of a lecturer who got me some part time work looking after regeneration trials on coal mines in Central Queensland. Eventually after about 30 or so polite but character building rejection letters I managed to land a job doing land resource survey work with the Department of Primary Industries in Bundaberg, and as they say… the rest is history.

While I have been in Bundy ever since, I have had a number of different roles. In my time with NRM&E and its many preceding incarnations, I have been involved in things such as soil survey, land resource assessment, landscape salinity modelling, natural resource information management, web GIS development and now catchment water quality modelling in Project 7.15 (7E): 'Enhancing stakeholder capacity in prioritising water operating management actions in southeast Queensland' of the CRC for Catchment Hydrology.

Along with offering me some really interesting and enjoyable work over the years Bundy has also given me a lot of other opportunities. I have recently finished renovating an old QLD'er after about four years of weekends on the tools. Now that I have all this spare time on my hands I have started learning how to surf and am currently doing a scuba diving course. I am also still playing rugby on the weekends much to my mothers chagrin, however I will definitely be retiring at the end of this season – I tell myself sternly, as I sit here typing this with ice liberally strapped to my thigh.

A bit closer towards the end… but hopefully not too close

I am currently working on developing an EMSS and Sednet model for the Maroochy Catchment on the Sunshine Coast – yes I know it is hard but someone has to do it. Being involved in the development projects (we are the ones who give Joel the grey hair) has been a good challenge and a lot of fun. It has given me the opportunity to work with some great people within the CRC as well as in the Maroochy catchment modelling team. It has also allowed me combine a lot of the skills and knowledge I have gained previously and apply them to a field that is new to me.

As good as it sounds, being based in Bundy and working on a project at the Sunshine Coast has its drawbacks. I haven't yet had the opportunity to put the board in the water down there yet, but a little better time management in the near future should see that problem rectified.

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OUR MISSION

To deliver to resource managers the capability to assess the hydrologic impact of land-use and water-management decisions at whole-of-catchment scale.

OUR RESEARCH

To achieve our mission the CRC has six multi-disciplinary research programs:

- Predicting catchment behaviour
- Land-use impacts on rivers
- Sustainable water allocation
- Urban stormwater quality
- Climate variability
- River restoration

CRC AUSTRALIA

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 Infrastructure, Planning and Natural Resources
Department of Sustainability and Environment, Vic
Goulburn-Murray Water
Griffith University
Melbourne Water
Monash University
Murray-Darling Basin Commission
Natural Resources, Mines and Energy, Qld
Southern Rural Water
The University of Melbourne
Wimmera Mallee Water

Associates:
Water Corporation of Western Australia

Research Affiliates:
Australian National University
National Institute of Water and Atmospheric Research, New Zealand
Sustainable Water Resources Research Centre, Republic of Korea
University of New South Wales

Industry Affiliates:
Earth Tech
Ecological Engineering
Sinclair Knight Merz
WBM