NEWSLETTER OF THE COOPERATIVE RESEARCH CENTRE FOR CATCHMENT HYDROLOGY

CATCHWORD

NO 97 AUGUST 2001

A NOTE FROM THE DIRECTOR

Professor Russell Mein

Inside...

EVAPOTRANSPIRATION MAPS FOR AUSTRALIA

One of the projects from the initial CRC for Catchment Hydrology was brought to a successful conclusion last month with the publication by the Bureau of Meteorology of a book of evapotranspiration maps for Australia. These were officially 'launched' at a joint CRC/IEAust seminar on 5 July 2001, following introductions by Dr John Zillman (Director of the Bureau of Meteorology) and myself. Some 50-60 people were present to hear Francis Chiew do a great job in explaining the technical basis for, and potential use of, the maps.

Hydrologists know that evapotranspiration (ET) is the largest component of the water balance after rainfall. For the Australian continent, nearly 90% of the rainfall moves back to the atmosphere through ET, leaving only some 10% to flow to the oceans via streamflow. Despite this importance, there is no direct way to measure ET at meaningful space or time scales, and indirect methods must be used.

These indirect methods have ranged from measuring the other components of the water balance (eg rainfall and runoff) and estimating ET from the difference of the two. More direct measurements have used evaporation pan data, with coefficients being applied to compensate for differences between evaporation from a pan and ET from a catchment. The old Climate Atlas of the Bureau of Meteorology included evaporation maps based on pan data.

The new maps provide a considerable improvement on the old, and provide for three types of ET estimates. These are:

(i) areal actual ET – the ET that actually occurs (from an area large enough that boundary conditions such as wind can be ignored).

(ii) areal potential ET – the ET that would take place if there were an unlimited supply of water, again in an area large enough to ignore boundary transfers (as for areal actual ET)

(iii) point potential ET – the ET that would take place if there were an unlimited supply of water, but from an area small enough for the evaporated water vapour to be swept away.

These definitions, and some guide as to when to use each ET estimate, are given in the Evaporation Atlas; clearly (iii) is normally greater than (ii), and (ii) greater than (i).

The maps comprise both annual and monthly estimates for each ET type, a total of 39 maps. They are also available on the Bureau website [www.bom.gov.au - look under Climate, then Climate Averages]. For higher precision, gridded digital values have been produced; these will be valuable for use in spatially distributed models. The Bureau website gives details as to how to get copies of the map or digital forms.

It is a pleasure to acknowledge the cooperative effort that produced these maps. Drs QJ Wang, Francis Chiew, and Fiona McConachy from the University of Melbourne worked with Ross James, Graham de Hoedt, and Bill Wright from the Bureau of Meteorology. Broadly speaking, the first group produced the ET estimates, and the second turned these into maps. In the process, independent reviews were commissioned to provide expert assessment.

A particularly pleasing outcome is the release of the ET maps as part of the Bureau's Climate Atlas series. [Those who haven't seen the Rainfall Atlas have missed a first rate publication]. Because the same period was used for the raw data, the ET and Rainfall estimates from these two publications are completely compatible.

I think the ET maps are an important contribution to hydrology, and commend them to you. The mission of the current CRC is to provide predictive capability of catchment behaviour for land and water managers. The outcome of the collaborative effort involved in producing these maps is entirely in keeping with that mission.

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CRC 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.

The Centre's products can be ordered through the Centre Office.

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PROGRAM 1

PREDICTING CATCHMENT BEHAVIOUR

Program Leader
ROB VERTESSY

Report by Rob Argent

Project 1.1: 'Development of a catchment modelling toolkit' is in the midst of a broad range of testing and development activities at the moment as we start to move away from our largely internal focus on the software engineering, and move towards more development and communication. Recent and upcoming activities include:

USA travelling show

The Rob's Vertessy and Argent, along with other toolkit people (Roger Braddock, Sue Cuddy, Joel Rahman and Shane Seaton) recently participated in a whistle-stop tour of the USA, largely courtesy of a travel grant from DISR. Our first stop was one day with the ArcModel development group at ESRI, in California. Those readers familiar with Arc products (eg ArcView, ArcInfo) will have realised that recent software releases from ESRI have introduced a significant change of software engineering, with adoption of some of the component-based and accessibility principles that we are promoting in Project 1.1.

Our visit to ESRI was undertaken to get some first-hand experience with the current state of development of ArcModel, which is one of our candidate frameworks. An interesting outcome of this day was a clearer understanding of the ArcHydro data model that underlies part of the ArcModel development. We pursued this further at our next stop; a visit to David Maidment and the Center for Research in Water Resources at the University of Texas at Austin. David's group was largely responsible for development of the ArcHydro data model, and we had the opportunity to show some of our modelling wares and to also explore some of the finer details of the development. This data model promises to be of considerable use to Project 1.1 - stay tuned over the coming months for more details.

Our final stop in the US was a week at the International Institute for Ecological Economics at the University of Maryland, in Solomons, Md. This idyllic site, at the confluence of Chesapeake Bay and the Patuxent River, is the birthplace of another of our candidate frameworks, the Spatial Modelling Environment (SME). While in Solomons, we spent a couple of days undertaking a spatio-temporal model development in three alternative frameworks, vis. SME and our own two, ICMS and Tarsier. This test of frameworks, along with input from Larry Band (who joined us for a couple of days), highlighted clearly some of the simple modelling problems that we need to solve in the Modelling Toolkit, such as specification and selection of cell routing routines.

Overall, the trip was an excellent opportunity to fine tune some of our toolkit concepts and to get some hands-on experience with a few candidate frameworks.

Information bulletins

We are preparing a series of information bulletins to try to bring many of our stakeholders up to speed with some of the toolkit concepts and language. Our intention with these bulletins is to provide a ready source of information that stakeholders can keep close at hand, and hopefully keep in mind when they are thinking about modelling developments and linkage projects. These bulletins represent our first serious attempt at disseminating material to an audience wider than that which we have reached to date at meetings and conferences.

The first bulletin, which covers some of the basic principles of the toolkit project, is nearing completion. It will be widely distributed once it is available. The second bulletin will cover the language of toolkits - over recent editions of Catchword you will have seen words such as "toolkit", "framework", "model", "module" and "ignorant mongrel bastard" bandied around. Bulletin 2 will explain what these terms mean to us, and what they should mean to you. A third bulletin, covering concepts and application of 'good modelling practice' is in the planning stage, and should be in production later in the year.

Software training and workshops

The coming months will see a series of training workshops for both ICMS and the EMSS implementation of Tarsier modelling software. A variety of ICMS workshops, for both internal (CSIRO) and external audiences will be held over September - December, culminating in a workshop as part of the MODSIM conference, in December 2001.

A three-day training session on EMSS is planned for Brisbane in September 2001.The first day is aimed primarily at model application users and scenario exploration. The second day will include more issues relating to model testing and parameterisation, and the final day will get down to the nitty-gritty of developing, setting up and calibrating models.

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PROGRAM 2

LAND-USE IMPACTS ON RIVERS

Program Leader
PETER HAIRSINE

Report by Christy Fellows and Heather Hunter

Riparian buffer zones: hydrology and water quality

Previous Catchword reports on Project 2.5: "Nitrogen and carbon dynamics in riparian buffer zones" (May and December 2000) discussed why increased nitrogen loading to streams can be detrimental and how riparian buffer zones can potentially reduce those inputs. In this report, we provide an overview of the project and outline some of the work completed to date.

Project aims

The overall goal of the project is to enhance the management of riparian buffer zones to help protect downstream water quality and aquatic ecosystem health. Specific aims of the project are to:

- Determine how riparian buffer zones function in removing nitrogen from groundwater that flows through them to streams.
- Identify the key factors, or processes, affecting nitrogen transport and removal in riparian zones, including the role of organic carbon.
- Use conceptual and numerical models to describe how these processes interact and to predict the effects at a catchment scale.
- Enhance guidelines for riparian restoration and management by taking account of the requirements for removing nitrogen from groundwater inflows.

Why riparian zones?

Because of their location, riparian zones can provide a protective buffer between streams and adjacent land-based activities. This is particularly important for the networks of small streams in catchments, since these collectively receive most of the direct drainage from contributing land areas and provide much of the flow for larger stream channels further downstream.

Several biological processes in riparian zones can remove nitrogen from groundwater, including uptake by trees and other vegetation. Denitrification (conversion of nitrate to nitrogen gas) is of particular interest because it effectively results in a permanent removal of nitrogen to the atmosphere. Organic carbon is important because it is closely involved in denitrification processes.

A key finding of the literature review conducted for this project is the importance of subsurface hydrology in determining denitrification activity in riparian buffer zones. A reduction in nitrogen levels can only occur if groundwater flows through the riparian zone prior to discharging to streams. Our conceptual models of riparian zone functioning focus on whether or not water tables lie within organic-carbon rich zones, and on the direction of groundwater flow (*Figure 2.1*). Potential riparian zone influence on surface water quality is maximised when organic-rich zones are saturated and groundwater flows toward streams. If groundwater flow is away from streams, and/or the water table is well below organic-rich zones, subsurface riparian processes may have little influence on stream water chemistry.

Why nitrogen?

Nitrogen has been identified as a major problem nutrient in coastal systems in eastern Australia, including Moreton

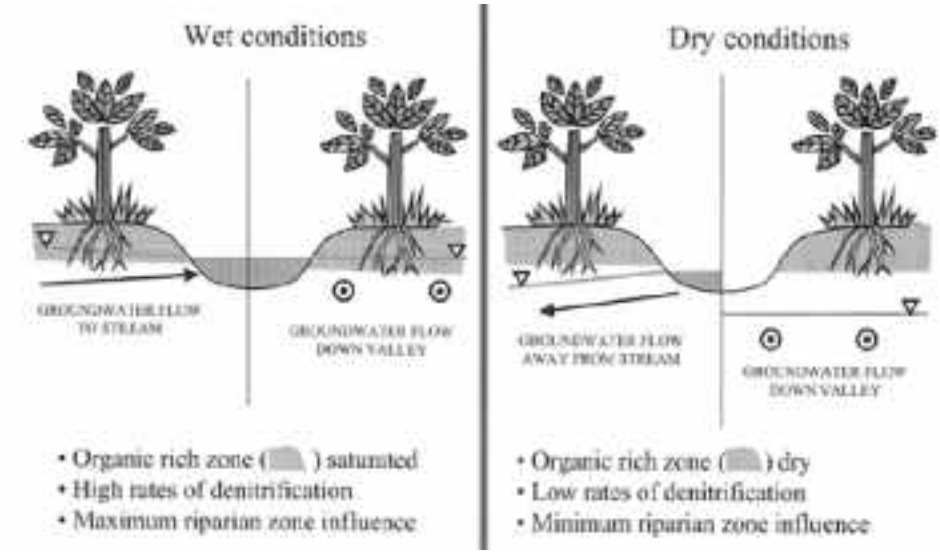

Figure 2.1 Conceptual models

FLOODPLAIN MANAGEMENT WORKSHOP

24-25 September 2001

Griffith University, Brisbane

A two day workshop 'Design Flood Flow Estimation for Floodplain Management' will be held at Griffith University, Brisbane on Monday 24th - Tuesday 25th September 2001.

Presenters include Prof. Russell Mein, Dr Ian Rutherfurd Erwin Weinmann and a number of Queensland experts and practitioners.

A detailed flyer outlining workshop sessions, presenters, accommodation and a registration form is available for downloading at

http://www.catchment.crc.org.au/events/abstracts/qld_fe_flyer.pdf

Please note that places are limited and registrations close by 7 September 2001.

For further information, please contact Ms Kathryn Norton, IEAust Queensland Division on (07) 3832 2101.

CONFERENCE PROCEEDINGS

THE THIRD AUSTRALIAN STREAM MANAGEMENT CONFERENCE - THE VALUE OF HEALTHY STREAMS

27-29 August 2001

Brisbane, Queensland

Copies of the recent Stream Management Conference proceedings are now available for sale from the Centre Office.

The 700+ page, two volume set contains over 120 papers. Copies cost $110 (includes GST and postage) and can be ordered by contacting the

CRC Centre Office

tel 03 9905 2704
fax 03 9905 5033
email
virginia.verrelli@eng.monash.edu.au

Note: Limited copies of the Second Australian Stream Management Conference ($104.50 including GST and postage) are also available.

Bay. Furthermore, recent research suggests that algal growth in some Australian river systems and reservoirs may be triggered by nitrogen supply. Thus, input of extra nitrogen to these systems is likely to boost algal growth, to the detriment of ecosystem health. This is particularly the case for readily bio-available forms of nitrogen such as nitrate and ammonium, which can constitute a significant proportion of the total nitrogen loading in some streams.

Research plan

Riparian zone hydrology and water quality is being investigated at several different scales, using a combination of field and modelling methods. Information on specific groundwater flowpaths and nutrient transformations will be gained from intensive monitoring at networks of wells and piezometers established at field plots, located along relatively short (50 m) reaches of small streams (first and second order). Less dense networks of wells established over an area up to 0.5 km or more from these plots will help define boundary conditions both in terms of groundwater table elevation and water chemistry.

Using these techniques, we hope to identify important features of riparian zones that, with appropriate management, can increase denitrification and thus reduce nitrogen delivery to streams. Robust and relatively simple experimental methods developed at our pilot sites will allow the key processes to be assessed easily at other sites. At a catchment scale, we plan to use modelling techniques to identify those stream reaches where groundwater inflows through the riparian zone are likely to be significant, at least on a seasonal basis. This will provide guidance on the priority areas where riparian management activities can be most effective in reducing nitrogen inputs to streams.

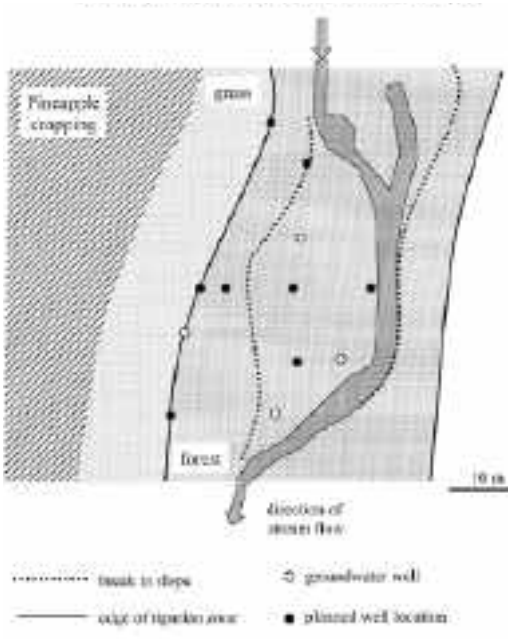

Figure 2.2 Coochin creek tributary field site

Activities to date include:

Water quality survey

To put the research in context, an initial review was conducted of existing water quality data for South-east Queensland. This helped in identifying sites with elevated nitrogen concentrations and in assessing the importance of nitrogen as an issue for water quality management in various parts of the region.

Our review found relatively high nitrogen concentrations in surface waters and groundwaters at some locations. These high levels indicate cause for concern, particularly for the protection of aquatic ecosystems in surface waters and (in some instances) the use of groundwaters for domestic purposes.

It is probable that some of the elevated concentrations in surface waters were associated with point sources of pollution such as discharge from sewage treatment plants, while in other instances the nitrogen may have been linked to runoff and drainage from nearby land-based activities. It is in these latter situations of diffuse (or non-point source) pollution that well-vegetated riparian buffer zones may play an important role in reducing the amount of nitrogen transported to streams.

Coochin Creek field site

The Coochin Creek catchment, which drains to the Pumicestone Passage in Moreton Bay, was chosen as a location for the study. It was suitable because of the very good condition of riparian zones along the creek, the sandy sediments, and the relatively shallow groundwater table.

A catchment-wide 'snap-shot' survey of stream water quality along Coochin Creek and its tributaries was carried out in May 2001 to assess nitrate concentrations and to gauge the representativeness of our selected pilot site. All twenty-six sites were sampled on the same day, with accessibility being a major factor determining site selection. Nitrate concentrations in Coochin Creek were in the range, 2.4 - 3.6 mg/L nitrate-N, considerably higher than the guideline trigger value of 0.06 mg/L nitrate-N, recommended for protection of aquatic ecosystems in lowland Queensland streams (ANZECC & ARMCANZ 2000), and higher than the median value of surface water in SE Queensland from our survey of existing data. Sources of the high nitrate levels are not known. Concentrations in some tributaries were much lower than those in Coochin Creek.

Pilot study on Coochin Creek tributary

Instrumentation of a pilot field site on a small tributary of Coochin Creek is now underway (*Figure 2.2*). We obtained estimates of the depth and direction of groundwater flow and characterised the groundwater chemistry from the first four groundwater wells installed. Water table elevations in April and June 2001 suggest that groundwater flows from the pineapple field, through the riparian zone, to the stream, with a strong down-valley component to flow. Groundwater nitrate concentrations were lower inside the riparian zone than outside the zone, suggesting nitrate removal in the riparian zone. However, the highest nitrate concentrations were found in the surface water.

Future work

The results from the Coochin Creek water quality survey and the tributary pilot study pose some interesting questions. Since the riparian zone along much of Coochin Creek is relatively intact, is it being effective in (partially) reducing nitrate loadings from inflowing groundwater (ie, would stream concentrations be much higher if it wasn't there)? Or is the nitrate bypassing the riparian zone in some way as it enters the stream? Or is the riparian zone ineffective in reducing nitrate loads? We aim to investigate these questions in the next stages of the project. Possibilities for including additional sites along Coochin Creek and for sites in at least one other catchment in South-east Queensland are being explored.

Reference

ANZECC & ARMCANZ. (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

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PROGRAM 3

SUSTAINABLE WATER ALLOCATION

Program Leader
JOHN TISDELL

Report by Teri Etchells and Hector Malano

Project 3.1: Integration of water balance, climatic and economic models

Developing a methodology to calculate exchange rates for water trading

Water markets and market failures

The rationale for developing water markets under the COAG guidelines is straightforward: to allocate water to the use where it will be valued most highly. However, designing and implementing a market for water entitlements that is efficient, equitable and sustainable, is very difficult. The main problems arise from market failures. A simple system allowing people to buy and sell water with no outside intervention does not take account of issues such as losses incurred in supplying the entitlement at the new location, changes in security level or third party impacts such as return flows and environmental degradation. The cumulative effect of unconstrained trade could reduce the value of existing entitlements, decrease system reliability and jeopardise ecosystems.

Exchange rate mechanisms

Many market failures can be addressed through the design of an exchange rate system. Such a system would apply a conversion factor to the traded entitlement volume to account for the impacts caused when the water is consumed in a new location. In other words, an attempt is made to provide 'water currencies' so that traders can convert the value of a water volume provided in one location to its value in another place and time (given changes in aspects such as availability/security of supply, and losses as the water is transferred via rivers and channels). Exchange rates could adjust (reduce or increase) the entitlement volume to ensure that the traded entitlement can be adequately supplied, and to minimise third party impacts.

Framework for exchange rates

A framework for exchange rates needs to encompass all of the parties involved in an entitlement trade. Clearly, the exchange rate between the individual buyer and seller is critical to 'doing the deal' and becomes a means to translate the volume of entitlement to take into

NEW EVAPOTRANSPIRATION AND RAINFALL MAPS FOR AUSTRALIA

Where to get them!

The CRC for Catchment Hydrology and the Bureau of Meteorology have recently completed a project to produce national maps of evapotranspiration for Australia.

The map set is now available for $33 plus postage and packaging.

They can be purchased from:

1. **Publications Section, 9th floor, 150 Lonsdale St Melbourne. tel: 03 9669 4000 (main switch) and ask for Publications**

OR

2. **Bureau Regional Offices (all capital cities) Contact details for each Regional Office are available at http://www.bom.gov.au/inside/contacts.shtml**

Information about the climate atlas map sets and the digital map data sets can also be obtained from: National Climate Centre Ph: 03 9669 4072 Email: webclim@bom.gov.au

Technical queries about the evapotranspiration modelling can be referred to Dr Francis Chiew at The University of Melbourne email f.chiew@civag.unimelb.edu.au

Any technical queries about the mapping should be referred to Graham de Hoedt tel 03 9669 4714 email: g.dehoedt@bom.gov.au

consideration system losses, security of entitlements and other environmental factors such as in-stream requirements and water quality. Additionally, each time an entitlement is traded into or out of a region, there are consequences for basin authorities and state authorities: for instance, with respect to storage accounts and the Murray-Darling Basin Cap on diversions. Thus, exchange rates need to apply typically at three levels: individual, area and State. *Figure 3.1* illustrates a potential framework for exchange rates.

Exchange rate approaches for different systems

Methodologies for calculating exchange rates have been developed on an ad-hoc basis, using water allocation models to calculate exchange rates for specific water supply systems, and are being trialled on a pilot basis for interstate trading. However, a methodology developed for one system will often not apply more broadly due to differences in assumptions and complexity. A clear methodology that can be applied to any system needs to be developed. Exchange rates need to be consistent between systems as trade is opened up and entitlements move from one system to another. Exchange rates are also needed to improve the robustness of the operating rules built in to the existing water allocation model through better representation of trading mechanisms.

Next steps

This project will examine a variety of trade scenarios that might occur within and between catchments and States. Exchange rates will then be determined to account for and prevent the negative impacts of trade and a generic methodology developed.

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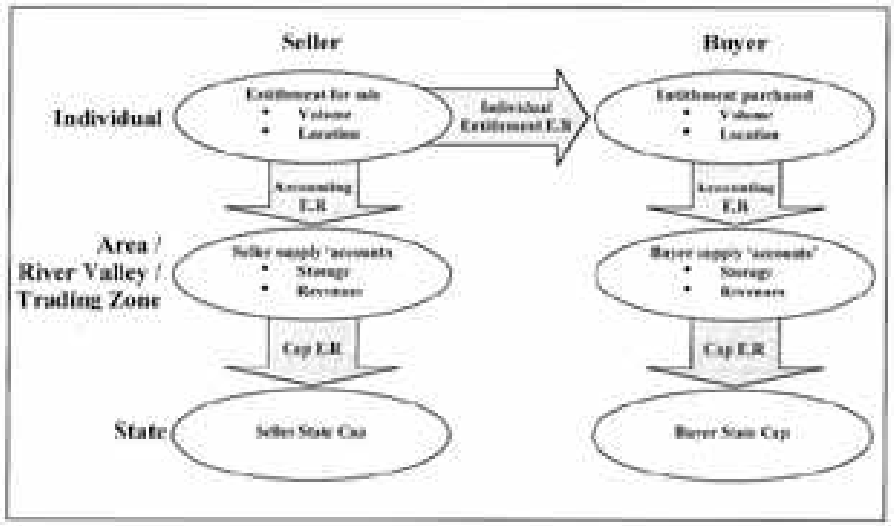

Figure 3.1 Framework for exchange rates

NEW WATER ALLOCATION RESEARCH REPORTS

Two new reports from the Sustainable Water Allocation Program are now available.

IRRIGATOR AND COMMUNITY ATTITUDES TO WATER ALLOCATION AND TRADING IN THE GOULBURN BROKEN CATCHMENT

by
John Tisdell
John Ward
Tony Grudzinski
Geoff Earl

Report 01/3

IRRIGATOR AND COMMUNITY ATTITUDES TO WATER ALLOCATION AND TRADING IN THE FITZROY CATCHMENT

by
John Tisdell
John Ward
Tony Grudzinski

Report 01/2

These reports describe the results and findings of a survey of irrigator's and community members attitudes to COAG reforms in the Goulburn Broken and Fitzroy catchments respectively.

The cost of $27.50 includes postage and handling and GST in Australia.

For further information contact Virginia Verrelli on 03 9905 2704 or email virginia.verrelli@eng.monash.edu.au

PROGRAM 4

URBAN STORMWATER QUALITY

Program Leader
TONY WONG

Report by Margaret Greenway and Peter Pollard

Identifying sources of water pollution in catchments with multiple land use – two case studies from South East Queensland

Water quality and ecology

The impact of water quality on aquatic ecosystem health is an issue of concern nationally and internationally. Increases in nutrients, suspended solids and organic matter can all have detrimental impacts on our streams, rivers, estuaries and bays. Increased nutrients can cause eutrophication and algal blooms (growth of organisms which can produce their own food due to photosynthesis i.e "autotrophic" organisms), however suspended solids increase turbidity and limit photosynthesis. Organic particulates provide an abundant food source for heterotrophic micro-organisms (organisms which consume other organisms or sources of organic carbon - non-photosynthetic) but increased respiration potentially reduces available oxygen for macro invertebrates and fish. Eutrophication often results in an upper photosynthetically active autotrophic zone and a lower non-photosynthetic heterotrophic zone. Light and inorganic nutrients are essential for autotrophic production whereas heterotrophic production is dependent upon organic nutrients. Organic sources maybe derived from the autotrophic organisms themselves or terrestrial input via leaf litterfall or runoff from surrounding land use. A knowledge of nutrient speciation, ie the various forms of inorganic and organic nutrients and the proportion of inorganic and organic particulates in suspended solids, is crucial for understanding potential impacts on ecological processes and ecosystem health.

Potential sources of pollution

Catchment studies are important for assessing potential sources of pollutants. Point sources of pollution such as wastewater from sewage treatment plants or abattoirs, are easily identifiable and require a licence to discharge into waterways. Today's water quality discharge standards include good secondary and often tertiary treatment processes, producing an effluent water quality of a high standard : nutrients < 5 mg TN (total nitrogen) and < 2 mg TP (total phosphorus); suspended solids < 10 mg TSS (total suspended solids)). Non-point sources of pollution include runoff from both agricultural and urban land use, industrial and commercial activities as well as atmospheric deposition. Pollutant loading from these sources are usually episodic and directly related to rainfall intensity and duration. Atmospheric deposition is also related to land use – sources of nitrogen include NOX (nitrogen oxides) from industrial air pollution and NH3 (ammonia) from volatilisation of organic nitrogen in wastewater lagoons or manure applied as fertiliser. Non-point sources are usually difficult to identify. Their impacts are often chronic degradation rather than acute, but they may have a pronounced impact during storm events.

Water quality monitoring

An important step in the identification of sources, and the assessment and management of water pollution problems is a water quality monitoring program. Typically water quality parameters measured include physico-chemical parameters such as dissolved oxygen, turbidity, pH, conductivity, suspended solids and nutrients; and biological parameters such as chlorophyll, coliform bacteria. Rarely are ecological processes such as autotrophic and heterotrophic production measured. However in some systems the latter may provide a better understanding of the types of nutrients ie inorganic v organic, and whether they are generated by instream processes or derived from catchment runoff.

Case Studies

Two case studies will be presented here describing the procedures undertaken to identify sources of water pollution in two waterways in the catchment of Moreton Bay, South East Queensland. The first focuses on the monitoring of physico-chemical parameters, the second focuses on quantifying microbial ecological processes.

Native Dog Creek

Basis for initial monitoring

Native Dog Creek a tributary of the lower catchment of the Logan River, receives runoff from urban and rural land use as well as natural bushland, the lower reaches pass through the Carbrook Wetlands, an extensive Melaleuca swamp forest. The East Branch has a 712ha catchment – mainly natural bushland, with low intensity agricultural and rural residential properties. The West Branch has a 1896 ha catchment – landuse includes extractive industries, a poultry processing plant, grazing and urban development in the upper reaches; rural residential, grazing, horticultural nurseries in the mid reaches; natural bushland and Melaleuca swamp forest in the lower reaches. The upper reaches of both tributaries are in Redland Shire, and the mid and lower reaches in Logan City. The zoning scheme for Redland Shire allows for

WATER QUALITY IN URBAN ENVIRONMENTS

IMPROVEMENT STRATEGIES FOR PLANNERS AND OTHER PROFESSIONALS

Wednesday 12 September 2001

Leonda on Yarra
Hawthorn, Victoria

Cost - $80-100 (depending on membership status)

A seminar and trade fair providing an overview of stormwater management issues, practices and urban processes and the opportunity to liaise with numerous stakeholders.

Speakers from wide ranging fields of expertise will present on topics ranging from the strategic aspects of catchment planning and management to more specific issues associated with the effective, appropriate and sustainable management of urban water resources - particularly stormwater.

Presented by the Stormwater Industry Association and the Australian Water Association.

With the support of: Melbourne Water and the Victorian Department of Infrastructure.

For further information contact the organisers:
email siavictoria@stormwater.asn.au
tel 03 9509 8243

WATER SENSITIVE URBAN DESIGN

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

residential development whereas Logan is zoned rural and conservation. An investigation into the water quality status of Native Dog Creek was catalysed in 1997 by two events: 1. a rezoning application in Redland Shire for further residential development and a golf course in the West Branch, and a new residential development in the upper reaches of the East Branch; 2. the occurrence of extensive cyanobacterial blooms (blue-green algae) in the mid reaches of the West Branch.

Community concerns with potential water pollution problems arising from the proposed developments, and their impact downstream on the nationally significant Carbrook Wetlands, Logan River and Moreton Bay, prompted Griffith University and the local community to apply for Coastcare funding to monitor water quality. This resulted in a three year water quality monitoring programme involving student and community participation.

Catchment issues – downstream focus

In the first year, monitoring was conducted within Logan City and included sites above and below the Carbrook Wetlands. In the West Branch sites receiving runoff from roads, grazing and horticulture were specifically targeted. The study confirmed that the East Branch had good water quality with most nutrients in the organic form (Total N < 1.5 mg/L with no measurable NH_4 and < 4% NO_X; Total P < 0.2 and < 25% PO_4) and suspended solids with 80% organic particles. By contrast, water entering the mid-reaches of the West Branch at the Shire boundary was very high in inorganic soluble nutrients (Total N 9 mg/L with 40% NH_4, Total P 4.7 mg/L with 85% PO_4); 50% of suspended solids were inorganic particles. Fortunately water quality gradually improved downstream particularly with respect to ammonium loss, and prior to entering the Carbrook Wetlands was 2.5 mg/L TN (26% NH_4) and 2.5 mg/L TP (80% PO_4).

Monitoring in second year – mid reaches

Year 2 focussed on sampling the mid-reaches of the West Branch within Redland Shire including a western tributary from the residential development and an eastern tributary adjacent to a sewage pumping station. Results showed that the residential development was not the culprit for high nutrients, with post-storm runoff in the western tributary of TN 1.3 mg/L (6% NH_4, 1% NO_X); TP 0.2 mg/L (10% PO_4). TSS however was high at 212 mg/L, with 83% being inorganic particles. The presence of a series of natural shallow ponds and dense sedges in the stream channel downstream of the urban runoff undoubtedly contributed to the improved water quality in this western tributary. The eastern tributary, prior to its confluence with the western 'stormwater' tributary, still had high nutrients: TN 13.3 mg/L (67% NH_4; 4% NO_X); TP 7.4mg/L (90% PO_4) however the source could not be attributed to the sewage pumping station nor a leaky sewer line. A minor upstream tributary was found to be carrying the high nutrient load. Stormwater flows into this tributary, from further residential development, were not contributing to the high nutrient concentrations.

Year 3 monitoring – upper reaches

Year 3 focussed on sampling the upper reaches of this tributary above the residential development in an attempt to identify the source of nutrient input. Four minor tributaries from the hill slopes of Mt Cotton were sampled – three tributaries had total N< 1.6 mg/L, however the fourth had consistently high concentrations of TN (30-90 mg/L) with 50-98% ammonium. Maximum ammonium concentration of 58 mg/L occurred after heavy rainfall. Total P at this site was also extremely high ranging from 6-36 mg/L with maximum 32mg/L PO4-P. Further investigations into the land use activities around this site revealed that a poultry processing plant was spray irrigating its wastewater effluent onto the surrounding hill slopes. Discharge licence limits approved by the EPA for this effluent irrigation are TN 100mg/L and TP 10mg/L, however the form of nutrients is not specified. The high concentrations of ammonium and ortho-phosphate in surface runoff suggest that spray irrigation is not an appropriate disposal mechanism.

Conclusions for Native Dog Creek

Our study concluded that this 'point source' was the cause of high nutrient concentrations in the entire upper and mid reaches of the West Branch, and a major concern to aquatic ecosystem health. Redland Shire Council and Qld EPA were informed of the monitoring outcomes and the wastewater treatment facilities have been upgraded.

Bremer River

Catchment aspects

The Bremer River, a major tributary of the upper Brisbane River, receives runoff from a wide range of uses from light and heavy industry, the Ipswich CBD, residential, agriculture and grazing land, but more than 60% of the 2035 sq km catchment is bushland. The lower reaches are tidally influenced up to 17km from the junction with the Brisbane River, but exchange is slow in the dry season. There are three licenced discharge points – two sewage treatment plants and an abattoir. A hardboard processing factory has a licence for land based discharge.

Microbial ecology in the Bremer River

In 1999, the Moreton Bay Study described the Bremer River estuary as 'extremely degraded, high inorganic and organic nutrient loadings, high heterotrophic bacteria and

low phytoplankton production'.... 'and the overall ecological health is very poor'. One of the main aims of the Coastal Zone CRC Bremer River study was to identify potential sources of pollution by monitoring water quality parameters and quantifying microbial ecological processes. Heterotrophic bacterioplankton (non-photosynthetic bacteria in the water column) production is supported by the flow of organic matter from the primary producers that are dominated by phytoplankton(photosyntheic bacteria and algae in the water column). But does the microbial ecology of the Bremer River follow this classic model? What processes are driving heterotrophic bacterial metabolism? Do they depend on an organic or inorganic source of nutrients? For an ecosystem to be classified as 'heterotrophic' on the basis of microbial activity, organic material must serve as both an energy and carbon source.

Understanding microbial processes

Measuring water quality parameters alone is not sufficient to understand the dynamics of microbial processes. Hence a 12 month study of the Bremer was conducted using in situ assays to quantify primary productivity and heterotrophic bacterial productivity, bacterial biomass and numbers. This information was used to determine the trophic dynamics (carbon flows) in the ecological processes as well as the carbon balance to help determine if the system is "heterotrophic" in dry and wet seasons.

Sampling Stations

Eight sampling stations, approximately 2.5km apart, were established within the first 17.7km at strategic locations – the junction of the Brisbane River, upstream and down stream of the abattoir and sewage treatment plants, downstream of Bundamba Creek tributary and within the Ipswich CBD. A ninth sampling site the 'Bremer control' located 37km upstream, only receives runoff from the surrounding rural areas during the summer wet season.

Physico-chemical water quality parameters provided limited information on potential sources of nutrients or suspended solids. Our measurements of low primary production and high heterotrophic bacterial production confirmed preliminary findings. Heterotrophic production was 2 to 3 fold higher in the summer wet samples.

Sources of organic carbon

Autotrophic production (the use of light, CO_2 and inorganic N and P) by the phytoplankton in the river generates organic matter. This in turn generates dissolved organic carbon (DOC) that helps provide heterotrophic bacteria with their energy and carbon source for heterotrophic production. Generally the pool of DOC in the Bremer River is constant between 5 and 7 mg Carbon/L (15 $gC.m^{-2}d^{-1}$), concentrations often seen in river systems. However, the high rate at which the heterotrophic bacteria are using DOC ($5gC.m^{-2}.d^{-1}$ bacterial production plus $3gC.m^{-2}.d^{-1}$ of CO_2 produced in respiration) implies a high and constant rate of removal of DOC from the water column. On a daily basis this cannot be accounted for by either autotrophic production, licenced point sources or other processes in the river such as release from sediments. This suggests that there are other non-point sources in the catchment supplying the organic carbon that is driving the high rates of heterotrophic bacterial production. This would not have been obvious if only physico-chemical water quality parameters were measured. The next step for future management options is to identify and quantify these sources of organic carbon.

Conclusions

These two case studies demonstrate that water quality monitoring programs need to identify not only inorganic and organic sources of nitrogen and phosphorus, but also carbon sources. The latter is particularly important for assessing microbial ecological processes and the relative significance of autotrophic versus heterotrophic production. Point sources of nutrients and organic matter can be managed by legislation, however management solutions to eutrophication problems are difficult where they are caused by diffuse sources or in- stream processes.

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VICTORIAN FLOOD CONFERENCE

The next Victorian Flood Management Conference is being held in Traralgon from 10–12 October 2001. The conference, which is held only once every two years, is being hosted by the West Gippsland Catchment Management Authority and Latrobe City Council.

The theme for the conference, Planning for the Inevitable, is intended to highlight the importance of planning to good floodplain management.

If you would like to be placed on the mailing list for conference information, please contact the Chairman of the conference organising committee, Wayne Gilmour, on telephone (03) 5175 7800 or email wayneg@wgcma.vic.gov.au

WATER AND THE ENVIRONMENT:

POLICY AND PRACTICES IN THE WATER INDUSTRY

ANNOUNCING THE INAUGURAL RMIT AND UNIVERSITY OF CALIFORNIA WATER ENVIRONMENT WORKSHOP.

24 - 25 September 2001

Storey Hall
RMIT University
376 Swanston Street
Melbourne

A detailed program is available at www.waterworkshop.rmit.edu.au

Who should attend?

Mid to higher level managers, technical specialists, policy developers and planners in the water sector are encouraged to attend.

For further information contact:

Lisa Deylen
tel 03 9925 7726
email lisa.deylen@rmit.edu.au
www.waterworkshop.rmit.edu.au

PROGRAM 5
CLIMATE VARIABILITY

Program Leader
TOM McMAHON

Report by Sri Srikanthan and Tom McMahon

Project 5.2: National data bank of stochastic climate and streamflow models

Modelling annual and daily rainfall

One aspect of the research carried out to date is the modelling of annual rainfall data. This work is nearing completion for 40 rainfall stations located across Australia. The following three models were applied and evaluated:

- Lag one Markov model
- Autoregressive moving average model
- Hidden state Markov model

Limitations of Markov model

The lag one Markov or the first order autoregressive model has been widely used to generate annual rainfall data (Srikanthan and McMahon, 1985). The main drawback with this model is that it cannot model the long wet and dry spells observed in the data. It is effective in preserving the low order moments and short term persistence as measured by the lag one autocorrelation coefficient. This model was applied to annual rainfall data from 40 stations and several parameters were estimated for evaluating the results.

Generalised linear model

The autoregressive moving average (ARMA) model of order (p,q) is a generalised linear model used to model time series data in many fields including hydrology. The lag one Markov model is a special case of the ARMA family of models. Under certain conditions, the ARMA process can model time series exhibiting pseudo-periodicity. When the characteristic equation of an ARMA model has complex roots, then the model will generate data with pseudo-periodicity. Because of this capability, ARMA(p,q) model was fitted to annual rainfall data by the method of maximum likelihood. The order of the model was chosen by using the corrected Akaike information criterion (Hurvich and Tsai, 1989). For 23 stations, a white noise model was found to be adequate. The selected model was different from AR(1) for 14 of the remaining 17 stations and eight stations required models of order 2. However, only two (Emerald and Bingara) of the 8 stations had complex roots for their characteristic equations. The pseudo-periodicity estimated for Emerald and Bingara were 4.8 and 10.5 years respectively. Annual rainfall data were generated for the 14 stations and parameters were estimated from the generated data for model evaluation as before.

Calibration of the Hidden state Markov (HSM) model

As reported in the April 2001 issue of Catchword, the HSM model was calibrated to 40 rainfall stations. As fairly long lengths of data are needed to detect the presence of long term persistence, the stations were classified into the following three categories based on the posterior probability distributions of WADSI, P(W Æ D) and P(D Æ W).

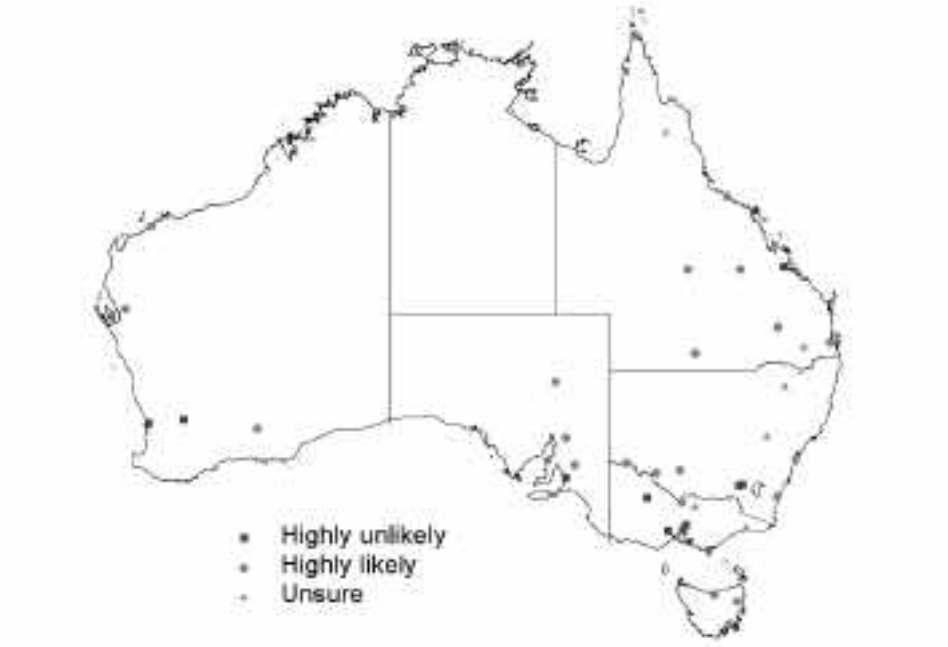

Figure 5.1 shows the posterior probablility distributions of WADSI

1. Highly unlikely to have two-state persistence
2. Highly likely to have two-state persistence
3. Possibly have two-state persistence

Based on this classification, 9 stations fall into category 1 and these are marked as squares in *Figure 5.1*. Hence, the HSM model was applied to the remaining 31 stations to generate annual rainfall data and several parameters were estimated for model evaluation.

The model evaluation results are being summarised at present and the outcome will be published shortly as a CRC for Catchment Hydrology Research Report.

At the daily level, twenty-one rainfall stations have been selected from the high quality stations identified by the Bureau of Meteorology Research Centre. The transition probability matrix method (Srikanthan and McMahon, 1985) has been used to generate daily rainfall data for these 21 stations and several statistical parameters were estimated for model evaluation. The Wang-Nathan model (developed by Dr Q-J Wang and Dr Rory Nathan) has also been applied to the above 21 stations. Evaluation of the daily models is underway..

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Srikanthan, R. and McMahon, T. A. 2000. Stochastic generation climate data: A review. CRC for Catchment Hydrology Report 00/16, Monash University, Clayton, 34pp.

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PROGRAM 6
RIVER RESTORATION

Program Leader
IAN RUTHERFURD

Report by Rebecca Bartley

Scientific communication in the field of river restoration… and beyond

"There can be no doubt that the failure of scientists to communicate their findings effectively across disciplines as well as to managers and decision makers has contributed to progressive environmental degradation"
Petts et al., 1995

Background

Ian asked me to write an article on the results of my research for the Program 6 section of *Catchword* for this month. To tell the truth, after a few big months getting a full draft of my PhD completed, I am so sick of my data (and the words sediment slugs and geomorphology), that I have decided to write something more contemplative: about my experiences with public presentations and the media.

A thankyou

Most of you would be aware from previous editions of *Catchword* and Catch-up, that I was awarded the Young Water Scientist of the Year Award and the best presentation at the CRC Annual conference in Perth for my presentation titled 'Giant slugs attack Australian Streams - research to the rescue!'. I would like to take this opportunity to publicly thank a number of people who assisted with both the written and oral presentations for both of these events. I definitely didn't do it all on my own. To Dave Perry, Ian Rutherfurd, Russell Mein, James Whelan, John Fien, David McJannet and Tom McMahon – Thank you.

Public presentations – some observations

I would also like to take this opportunity to highlight the impact that a good public presentation can have on your research opportunities and influence. I have had the chance to see a number of really good (and not so good) presentations at both these conferences, and I thought that it would be appropriate to share some of my observations with others.

As most of you would be aware, scientists are no longer individuals working alone in their labs or offices, rarely communicating with the outside world. Today, scientists are expected to be multi-skilled, which includes having the ability to deliver presentations to a wide range of audiences. Whether you are presenting to your research team, students, funding organisation, farmers or politicians, there are a number of things to think about when giving a good presentation:

NEW RIVER RESTORATION PROGRAM SHEET

Printed versions of the recently completed River Restoration Program Sheet are available from the Centre Office.

The brochure describes the rationale and key elements of the CRC's River Restoration Research led by Dr. Ian Rutherfurd.

Readers will find information on the Program's target problems, research objectives, expected outcomes and contact details for project leaders.

Copies are available by contacting Maeve or Jill at the Centre Office on 03 9905 2704 or email virginia.verrelli@eng.monash.edu.au

This information is also available on our website at www.catchment.crc.org.au/riverrestoration

PREFER YOUR *CATCHWORD* BY EMAIL?

Almost one third of Catchword readers receive their copy by email. Each month the Centre sends out a pdf copy of Catchword to email subscribers as well as a link to the CRC website from which Catchword can be downloaded.

If you would like to reduce the paper on your desk please contact the Centre Office on 03 9905 2704 or email virginia.verrelli@eng.monash.edu.au

Over 1200 people receive Catchword each month.

- Be passionate and enthusiastic!!! I know most researchers and managers love their work, but many of the presentations I have sat through over the years look more like the speaker was being tortured rather than presenting work that they enjoy. Even the most drab of topics can be made sound exciting with a little effort.
- Know who the audience will be. Presentations should be carefully targeted to influence your audience. For example, different presentations should be given to students, politicians or to farmers.
- Use humour. I know it is not easy to be amusing, particularly when you're discussing technical or important information. However, humour can make the presentation much more bearable for both the audience, and you as the presenter. If you are unsure whether something is funny, practice on a colleague first.
- Show the application of your research. Even at technical conferences, I always find the presentations that show the application of their research much more interesting than just pure science.
- Use personal experience. This allows the audience to relate to what you're doing. They may not understand the differential equations you used to derive the hydraulic model, but they will connect with comments you make about the bakery you visited whilst undertaking fieldwork collecting the data for the model.
- Engage your audience. Even if you have rehearsed the presentation and memorised it word for word, try not to show that you have a good memory by regurgitating the presentation. Try and engage with the audience, possibly linking an example you have in your presentation with someone else's talk earlier in the day, or some recent topical current affairs. This also shows that you have been listening and thinking about the presentations!
- Practice, practice, practice. Even less significant presentations should be rehearsed out loud at least a couple of times, and at least 10 times for more important presentations;

Some expert advice

The presentation I did at the CRC Association conference in Perth was meant to be targeted specifically towards the media. Having never done such a presentation before, I decided to get some expert advice. I contacted Dr Paul Willis of the ABC (most of you would know of him from programs such as Quantum. Paul was also one of the judges at the Young Water Scientist Award). I asked Paul what the ABC considered to be a good presentation from the media's perspective. Some of his comments were as follows:

- Don't read!!! Even if you have memorised it, vary your voice and projection.
- Avoid jargon, and if you have to use it, explain it carefully.
- Use anecdotes and humanise the presentation. Use stories to bring it to life.
- Use colloquialisms, BUT avoid cliches.
- Use 'hooks', which are witty or humorous sayings (roughly every 1.3 minutes!).
- Any presentation given for the media should be focused at a comprehension level of a 12 year old!

Questions to ask yourself

I would never have considered myself to be a great presenter, however, by following some of the points outlined above, it is possible to put together an award winning presentation. In the end, the main questions you need to ask yourself when you are preparing your presentation are: "Would I want to sit through this presentation? Would I be informed and entertained or would I fall asleep?" It is also important to be critical of other peoples presentations (in your own head, not necessarily out loud!). By being critical you can then adopt approaches of other presenters that you have enjoyed, and avoid incorporating the same components of presentations you didn't like.

With the increased work load being put on most researchers and managers today, it is easy to become complacent about preparing and giving presentations. However, from my experiences over the last six months, people from all over the country and at all levels of influence seem to remember a GOOD presentation.

Reference

Petts, G., Maddock, I., Bickerton, M. and Ferguson, A.J.D., 1995. Linking hydrology and ecology: the scientific basis for river management. In: D.M. Harper and A.J.D. Ferguson (Editors), The Ecological Basis For River Management. John Wiley and Sons, pp. 1-16.

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PROGRAM 7

COMMUNICATION AND ADOPTION

Program Leader
DAVID PERRY

The Flow on Effect – August 2001

Communications review

Late last year the CRC engaged an independent consultant to review of our communication activities. Many *Catchword* readers will be aware of the review through their participation in the survey or from Russell's Mein's article in the July 'Director's Note'. The Executive Summary from the consultant's final report is available to view at www.catchment.crc.org.au/commreview.shtml

In this article some background to the review is provided By selecting relevant parts of the final report, I have aimed to give a picture of the 'potential for adoption' of our research outcomes based on the review's findings. The report goes some of the way to answering the question 'is the CRC's research likely to be adopted by the land and water managers that it targets?'

For our research to be applied by end-users (or even have the potential for adoption) our CRC must meet some key criteria:

- Our communication must target those people that we (and they) consider to be potential adopters of the research (end-users).
- Our research must be considered relevant and useful by end-users.
- Our communication must be considered relevant and useful by end-users.

The criteria listed above relate to a simplistic description of the complex process that leads to adoption of research. Nevertheless they are basic or necessary yardsticks for research organisations such as ours.

The Review brief

The brief for the consultant, a Brisbane based company called Econnect Communications Pty Ltd, was to:

•Assess and review the effectiveness of the CRC for Catchment Hydrology's communication activities against:

(a) its Business Plan objectives as set out in the Commonwealth Agreement (the contract with the Commonwealth Government); and

(b) current best practice of similar organisations;

and make recommendations for any required improvements.

- Establish and benchmark reliable performance measures for the CRC's communication activities that can be used to judge performance in subsequent reviews.

Stakeholder responses

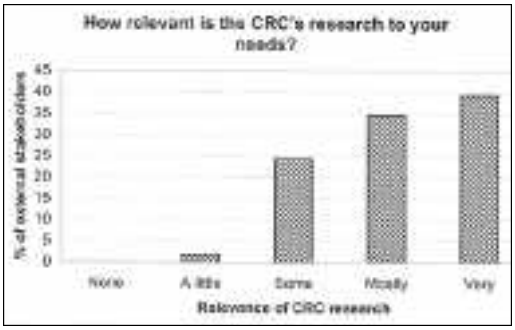
This article focuses on the effectiveness aspects and reports results from 'external stakeholders' i.e. survey respondents who are not directly part of the CRC. The review also considered internal communication activities (through a staff survey), as well as key investors in the CRC (which included CRC Board members and senior management of related organisations). These results will form another *Catchword* article in the future.

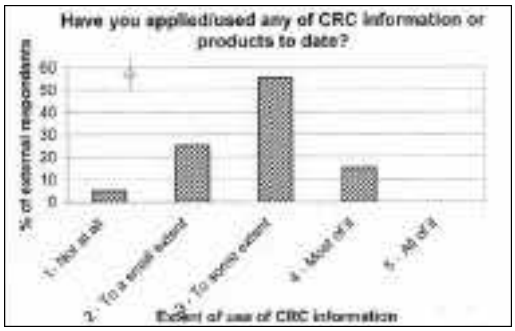
Methodology

Econnect emailed CRC external stakeholders a survey form with a series of questions about the CRC's communication and adoption performance. The *Catchword* email and the events notification databases were used. A total of 621 emails were sent out and 28% (from 175 respondents) were returned.

Who are we communicating with?

Of the survey respondents, 87% were considered potential end-users of the CRC's research and 80% described themselves as consultants, catchment or river managers, or state policy or local government staff. Overall a good indication that our regular communication is targeting the key people who can utilise our research. Victorian (45%), New South Wales (20%) and Queensland (15%) respondents totaled 80% of the responses.





CRC COMMUNICATIONS REVIEW

Thank you to all those *Catchword* readers who participated in the recent review of the CRC's communication activities.

The executive summary of the review report is available online at http://www.catchment.crc.org.au /commreview.shtml

Further information about the communication review outcomes is available from David Perry tel. 03 9905 9600 or email david.perry@eng.monash.edu.au.

Over the next few weeks, the Communication Review subcommittee will review the reports recommendations and begin implementing the highest priorities.

WHAT'S HAPPENING WHEN?

FIND OUT ABOUT CRC ACTIVITIES BY EMAIL

THE CRC WILL NOTIFY YOU OF AN UPCOMING CRC ACTIVITY IN YOUR AREA OF INTEREST

You can register to receive this information on line at www.catchment.crc.org.au/subscribe

or you can contact Virginia Verrelli at the Centre Office on 03 9905 2704.

Useful and relevant research?

The survey asked how relevant is the CRC's research to the respondent's needs and/or the issues facing catchments in Australia. The intensive consultation process used to derive the CRC's programs has obviously been worthwhile as 74% described the CRC's research as 'very or mostly relevant'. A further 24% described the research as 'some of it is relevant'. No respondents described the research as irrelevant. This also suggests the research we are undertaking has the potential for adoption.

Useful and relevant communication?

Survey participants were asked to rate the usefulness and relevance of those CRC communication activities that they had seen or had been involved in eg. *Catchword*, the website, reports, videos, seminars and short courses. (A rating scale of one to six was provided - one was ineffective or useless, and six was very effective or very useful). The average results for each communication type ranged from 4.25 for our website to 4.84 for our Industry seminars. All other communication had averages between these values.

Have you used any of the CRC's research?

To gauge the extent of adoption of CRC products (ie are external stakeholders utilising what we produce?), the survey asked 'Have you applied/used any of the information or products that the CRC has generated to date?'. 15% of participants responded that they had used 'most of the CRC's information or products', 55% said 'to some extent' and 25% reported 'to a small extent'. 5% replied that they had not utilised any of the CRC's research outputs. Not surprisingly, no one reported they had used 'all of the research'.

And relative to similar organisations?

Participants were also asked rate the CRC's communication activities against those of other similar research and development organisations. Using the same scale (one for ineffective and six for extremely effective), 82% of respondents rated the CRC's performance at four or above.

Summary views

The review results suggest that we are on the right track in communicating with land and water managers and that there is significant potential for the adoption of our research.

As *Catchword* readers would understand, the task now is to turn that potential into practice. And if I reflect on all those people who form the CRC for Catchment Hydrology and then consider their range of skills and commitment… Well, just watch this space!

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POSTGRADUATES AND THEIR PROJECTS

Our postgraduate for August is:

Margaret Gooch

I am a PhD student at Griffith University in Brisbane, and hold a Catchment hydrology CRC scholarship. I have a degree in Australian Environmental Studies and a diploma of teaching, both attained at Griffith University, as well as a Masters in Tropical Ecology, from James Cook University in Townsville. My career began as a secondary school teacher, followed by work for several years as a conservation officer for the Queensland Environment Protection Agency. This work encompassed national and marine park management, community nature conservation and community education. In recent years I worked as a casual lecturer and tutor in the areas of natural resource management and sustainable development, at the University of Queensland.

I have a personal interest in the role of communities in natural resource management, and through my research, would like to raise the profile of community networks that contribute to catchment management. Such community groups and networks are potentially very influential. They can provide mediation between the government and individuals, and have the capacity to initiate social change. I believe that the benefits to society through community-based environmental care groups are enormous, not just in terms of their contributions to natural resource management but to the overall quality of life for members of the wider community in which such groups exist.

The purpose of my study is to strengthen the position of such groups and networks to enable them to extend their valuable work. My research program has four phases in all, and combines quantitative and qualitative methods. I plan to use surveys, interviews, cases studies and discussion groups to answer the following four major research questions:

- What factors influence the perceived effectiveness of community-based environmental care groups?
- How do key stakeholders see community-based environmental care group contributing to their local communities?
- How does community group effectiveness influence volunteers, social learning and social capital building?
- How might the effectiveness of community-based environmental care groups/networks be strengthened?

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CRC PROFILE

Report by Jon Olley

Water.

I have always loved water. For as far back as I can remember I have loved being around water. Perhaps because I am an Aquarian. I often fall asleep in the shower, standing in the corner with the water running down my back. I love fishing, not the act of catching the fish, but just standing on a riverbank with the water running past. Fishing for me is just an excuse to be near water. I love swimming. I like the rush of water along my body. I swim twice a week with my father. We have done that for as far back as I can remember. Fortunately for me, my wife and boys also like water and so fishing and swimming are a big part of our family life.

Perhaps my love of water comes from my place of birth, a small village in the northwest of England. "It were always raining in Newton-le-Willows except on days it were fine. That's if you can call drizzle fine" (apologies to Michael Palin). I was born in February, English winter 1961, to a small tribe of English nomads. This tribe had consisted of one until the year previous when my dad married my mum. My coming along made it three. When my first brother was born we achieved the critical mass for migration and the tribe began to wander. I was 2 when we first landed in Australia. By the time I was 10 the tribe had grown to 5, we had been around the world twice, and through both the Suez and Panama canals. We spent 4 years in a New Zealand fishing village and time elsewhere, but Australia always seemed to draw us back. Perhaps because you get to enjoy the water and stay warm.

Currently I am the leader of Environmental Hydrology Research Group in CSIRO Land and Water and Project leader for the river project (2.1) in the CRC for Catchment Hydrology. Like fishing, it's a good excuse to look at rivers. The group is trying to understand how rivers work and how climate, landuse and landform influence the form and health of a river system. The team is making real progress but we have lots to learn. So I think I will be looking at water for some time yet.

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WHERE ARE THEY NOW?

Report by Renuka Sabaratnam

I am one of those who have made the transition from the big smoke to a small town in the northern part of Victoria with a population of about 2000. Here I hide, living a more tranquil and slower life working in the natural resource department of Goulburn-Murray Water (G-MW). Life here is lot less hectic than the one I led whilst completing my masters degree and working in a lingerie department in Melbourne. Hate to disappoint you Dave McJannet (*Catchword* Dec 2000) and most other males with this misconception, working in a lingerie department is not all that it is cracked up to be.

My days at G-MW are spent working for both Pat Feehan and Graeme Wilkinson (who has one foot in the Goulburn Broken Catchment Management Authority and the other in G-MW) doing a variety of catchment and water quality related projects. My work includes a range of tasks: implementing a water quality database; the continuous monitoring of both water quality and blue green algae results and informing relevant stakeholders about the results; providing technical support/advice for projects that could potentially affect our assets; being involved in the formulation of Campaspe Shire Stormwater Management Plans; and the approvals of planning permits. These tasks have taken me to, or at least past, a number of interesting country towns many of which I did not know existed. It certainly has been a good way of getting to know the northern part of Victoria.

I guess my pet project would have to be the work I have been doing for the last six month at Nagambie. As part of this project I am working closely with a number of landowners rehabilitating the perimeter land around Lake Nagambie. This work relates to the Water Quality and Biodiversity Strategy set out by G-MW about four years ago. Works on the perimeter land have included:

- grading/repair of severely eroded banks;
- the use of logs to reduce the severity of wave erosion (whilst establishing these areas with both terrestrial and aquatic plants);
- implementing stock watering points where frontage has been fenced off for the rehabilitation works.

I can also proudly say that I have driven a twelve tonne excavator and tip truck and used a chain saw.

In contrast to comments prior to entering the work force, working with these landowners has been a pleasure. Their cheerfulness, willingness to get involved in the works, and their hospitality has been very encouraging. Nonetheless, the learning curve in the last six months has been steep, but it has also been gratifying to apply some of the knowledge gained whilst completing my masters degree. It is also reassuring to see a number of organisations such as the Department of Natural Resources and Environment, Catchment Management Authorities and consultants along with G-MW, actively striving to address a number of catchment issues and promoting the sustainable use of our natural resources.

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

Associates: SA Water • State Forests of NSW