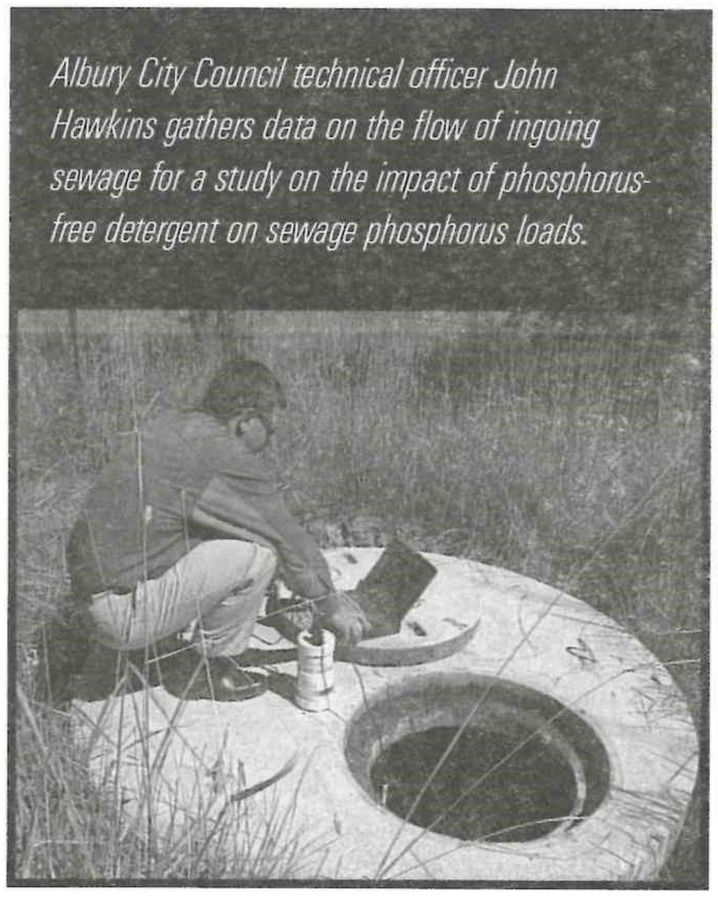
WaterShed

contents

The CRCFE was established under the Commonwealth Government's Cooperative Research Centre Program in July 1993.

The Cooperative Research Centre for Freshwater Ecology provides ecological understanding to improve inland waters through collaborative research, education and resource management.

Phosphorus–free laundry detergent could save communities $1000s



Albury City Council technical officer John Hawkins gathers data on the flow of ingoing sewage for a study on the impact of phosphorus-free detergent on sewage phosphorus loads.

The use of phosphorus–free laundry detergents may save communities tens of thousands of dollars each year in sewage treatment costs as well as significantly reducing the amount of pollutants that find their way into our waterways, a recent study conducted in Albury has found.

The study, *The effect on sewage phosphorus loads of using phosphorus–free laundry detergents*, found that the phosphorus in raw sewage was reduced between 24–47% when 64% of the community used phosphorus–free detergent. Of those who took part in the study, 25% were already using phosphorus–free products.

Funded by the NSW Department of Land and Water Conservation and the Albury–Wodonga–Corowa PhosWatch Campaign, the study investigated the contribution that laundry detergents make to sewage phosphorus loads.

It was conducted by CRCFE scientists in collaboration with Albury City Council laboratory staff and involved measuring both the flow and phosphorus concentration of sewage from a catchment of about 350 households in Thurgoona, near Albury.

Albury City Council engineer, Daryl McGregor, said that Albury had been very active in its attempts to improve urban water management. The PhosWatch campaign, an extensive education campaign aimed at changing the community's laundry and washing habits, saw sewage phosphorus levels going into the sewage treatment plant reduced by almost 20%.

"This campaign has increased community awareness about the role phosphorus plays in stimulating toxic algal blooms and causing other water quality problems," Mr McGregor said. "It also informed them about what they could do to minimise phosphorus entering our waterways.

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COOPERATIVE RESEARCH CENTRE FOR FRESHWATER ECOLOGY

The CRCFE is a collaborative venture between:

- *The ACT Government*
- *ACTEW Corporation*
- *CSIRO Land & Water*
- *EPA Victoria*
- *Goulburn–Murray Water*
- *La Trobe University*
- *Melbourne Water*
- *Monash University*
- *Murray–Darling Basin Commission*
- *Murray–Darling Freshwater Research Centre*
- *NSW Fisheries*
- *University of Canberra*
- *Southern Rural Water*
- *Sydney Water Corporation*
- *Wimmera–Mallee Rural Water*

Planning for the future

Director, Prof Peter Cullen

Having completed an outstanding Five Year Review, the CRC for Freshwater Ecology has lodged a bid for a further seven years funding under the Federal Government's Cooperative Research Centres Program. We have survived the first cull in the selection process and referees are now assessing our proposal. These assessments will be provided to the selection panels who meet mid January to select the proposals that go forward to interview. The interviews are scheduled for mid February, and it is expected that the Minister will announce the successful proposals late in March.

Our proposal is an exciting one. Three state land and water management agencies in Queensland, NSW and Victoria have all joined the proposal. If successful we intend to open a northern laboratory of the Murray-Darling Freshwater Research Centre in Goondiwindi. Modelled on the successful Mildura satellite laboratory, this new laboratory will allow us to conduct critical work on environmental flow needs in the summer rainfall streams of the northern Murray-Darling Basin. Griffith University and the NSW EPA have also joined to help this northern work. A community group, initially chaired by Leith Boully, has identified key issues and rallied support for this new initiative.

The research agenda for the new laboratory will focus on environmental allocations and the impacts and pathways of pesticides once they enter the aquatic system.

Another new partner is Sydney Water who want to develop research programs on catchment and storage management. The Victorian Department of Natural Resources and Environment has joined, contributing John Koehn and his fish ecology group who are a most welcome addition to the scientific capacity of the proposed new Centre.

The proposal also builds on fundamental new approaches being developed by the current CRCFE that are aimed at increasing the value generated by multidisciplinary research teams. We have found that building trust between the research staff from different disciplines and intellectual traditions has been important in establishing a foundation for multidisciplinary research. Activities such as our collaboration workshop and the development of a Quality Assurance Manual have prompted us to reflect on how we might do things better.

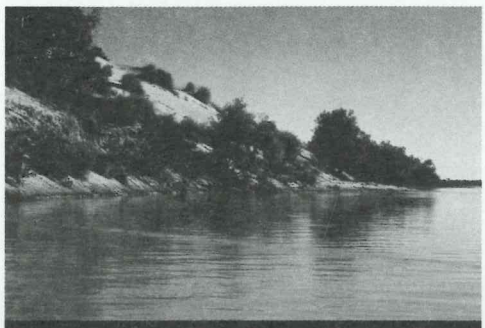
At the knowledge delivery end, the exciting new posts of knowledge brokers responsible for technology exchange with selected market segments is to be expanded.

A new Deputy Director will be recruited to oversee this important part of our activities. We have moved away from traditional concepts of technology transfer and now see our knowledge brokers being involved in technology exchange. Listening to and understanding the partners' problems and constraints is a prerequisite to finding a useful solution. With two knowledge brokers now operating we are developing the model further and improving the methods we use to deliver scientific value to our partners.

Our work with partners on developing knowledge strategies will be expanded. Working with partners to clarify what we know and what we need to know is a useful discipline in negotiating research agendas that will meet our partners' needs.

We have a way to go yet to make these dreams come true. We expect to have a five hour interview at which we will have to convince a sceptical selection panel that we can deliver excellent science and that our new ideas for managing and delivering the research will work to the national benefit.

Director
Peter Cullen



Gill netting for fish on the southern shore of Coongie Lake. Biological data was collected between 1986 and 1992 to develop a predictive model that will help water managers assess the impact of different irrigation flows on the river's animal life. Photo: Jim Puckridge

Modelling the impact of irrigation in the arid zone

A new computer model will help water and land managers assess the potential impact of irrigation on arid, inland river systems.

This model, developed by CRC for Freshwater Ecology scientists from the University of Adelaide in collaboration with the University of Melbourne's Department of Geomatics, is based on data collected over five years from the Coongie Lakes on the lower Cooper Creek.

Called DRY–WET, to reflect the drought/flood cycles typical of Australia's inland rivers, the model is packaged in a user-friendly format that provides geographical, biological and hydrological information about the region. In addition, the model provides the capacity to predict what impact different irrigation flows might have on the river's animals.

Principal scientific investigator for the project, Jim Puckridge, said that proposals to develop irrigation in Australia's arid regions highlighted an obvious gap in our knowledge about dryland rivers.

"There was just no information on exactly how irrigation would affect the biology of these rivers (Cooper and Paroo)," Jim Puckridge said. "If we're going to make wise decisions about using the waters of the arid zone we must understand the likely ecological costs.

"The biological data used in the model were gathered from 1986 to 1992 during a period that included extreme events from a serious drought (1992) to one of the biggest floods ever experienced on the river (1990). So we're confident that our predictions are robust.

"Our data focused on the upper part of the food chain and included fish, macroinvertebrates and zooplankton. These communities are likely to reflect significant changes that might be occurring further down the food chain."

In addition to the biological data, the model is based on 25 years of river discharge satellite data. It includes water regime measurements taken over five years in the Coongie Lakes wetlands. It defines 46 characteristics of river flow, such as rates of rise and fall, duration, frequency and magnitude of floods and periods of low flow.

The hydrology and biology in the model have been related using a neural networks method, a modelling technique that attempts to imitate (to some degree) the way that neurons work in the human brain. This will enable the user to determine how fish and other aquatic animals respond to changes in flow pattern.

Mr Puckridge said that extensive consultation with stakeholders, including pastoralists, conservationists and water resource managers, during the development of the model had made it more user friendly and relevant.

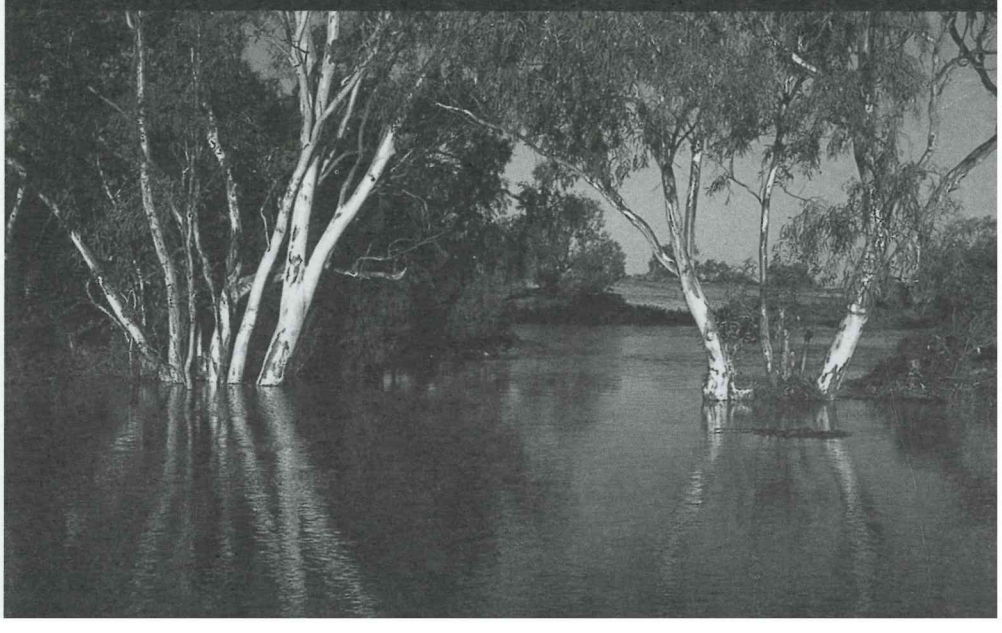
"We've increased the amount of explanation throughout the package and incorporated a users' guide," he said. "We've also provided interfaces for the predictive sections."

While the model will soon be available on the Internet and in a book form, it is currently available as a CD-ROM using Powerpoint 7, part of Microsoft Office 97.

WET–DRY was funded by the National Wetlands Research and Development Program, an initiative of Environment Australia, and the Land and Water Resources Research and Development Corporation. It was recently launched by the South Australian Minister for Environment and Heritage, Dorothy Kotz, at a function attended by about 70 stakeholders at the University of Adelaide.

CONTACT:
Jim Puckridge
PHONE: (08) 8303 5689 (work)
EMAIL: jpuckridge@zoology.adelaide.edu.au

North-west branch of Cooper Creek, upstream of Coongie Lakes system. A new computer model, Wet–Dry, will help water and land managers assess the potential impact of irrigation on arid, inland river systems. Photo: Jim Puckridge



Phosphorus–free laundry detergent could save communities $1000s

continued from page 1

"This campaign set the stage for the Thurgoona study because we needed a phosphorus–aware community to conduct the study. Without the community's commitment the study would not have been possible."

The Thurgoona project provided a follow-up to a similar study that was conducted in Whittlesea by Melbourne Water that showed that sewage phosphorus levels were reduced by about 25% when 79% of the community used phosphorus-free detergents.

About 230 occupied homes in the Corry's Wood and St Hilaire estates participated in the Thurgoona study which was conducted in three phases over six months during 1997.

The first phase, conducted during school term in March, was aimed at determining the community's normal usage pattern and data was acquired without the community being aware of the project.

The second phase started after Easter when the planned trial had been announced. Letters were delivered to households and community meetings held.

Households that agreed to participate in the study were given an eight-week supply of phosphorus–free laundry detergent. Sampling for this phase was conducted between April 22 and June 10.

The final phase of the study, the follow-up, was conducted from August 2–26 and was aimed at gauging whether the community had modified its washing habits as a result of the study. It was conducted eight weeks after the last distribution of laundry detergent to ensure that remaining supplies had been used.

The results indicated that the community mostly returned to normal washing patterns, with phosphorus loads only three percent down on those observed during the first phase of the study. However, a detailed analysis of the data showed that phosphorus concentration dropped by about 10% while flow increased by about 15%.

Project leader Prof Peter Morgan, from the University of Canberra, said that the data suggested that while the community had reduced its water conservation practices, it had also reduced its use of phosphorus-based detergents.

Prof Morgan said that sewage treatment plants were a major source of the phosphorus that entered our waterways from human activities. Most of the phosphorus in wastewater originated from human excreta and detergents.

"Phosphorus is an important nutrient that occurs naturally in our waterways," Prof Morgan said. "Excessive amounts of this nutrient do cause problems such as the increased growth of algae and other microorganisms that cause water quality to degrade. Agricultural and urban development during the last 200 years has certainly increased the amount of phosphorus entering our waterways. So in better managing our freshwater systems, we must aim to reduce phosphorus inputs so that natural levels in our rivers and streams are not significantly exceeded."

Prof Morgan said that sewage treatment plants, such as the one operated by Albury City Council, were required by the Environment Protection Authority to tertiary treat effluent to remove phosphorus from incoming sewage so that no phosphorus entered the environment. These chemical processes were expensive and introduced other salinity and pollution problems.

In addition, chemical removal did not stop phosphorus making its way into the environment when untreated water was released, as occasionally happened during times of plant failure or system overload, he said.

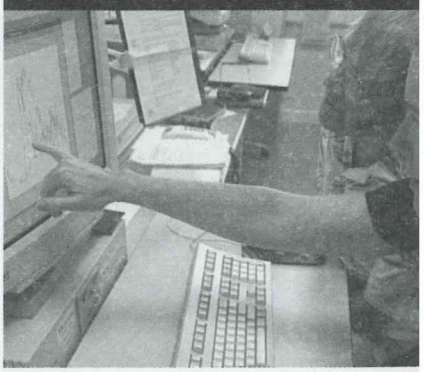
"By reducing the phosphorus in sewage before it gets to the plant, plant operators can save tens of thousands of dollars each year in chemical costs, as well as reducing the risk of salinisation that these chemicals pose to the environment," he said.

"The study highlights the need to review the operations of sewage treatment plants and the practice of chemically dosing the effluent."

The CRCFE has recommended that, should funding be available, the study be extended to the city of Albury to determine how the sewage treatment plant might be best operated under a reduced phosphorus load.

The report, ***The effect on sewage phosphorus loads of using phosphorus–free detergent***, is available from the CRC for Freshwater Ecology. Phone Claire Townsend on 02 6201 5424 to order, or EMAIL: claire@lake.canberra.edu.au

Gail Ransom and Peter Morgan, who authored the phosphorus-free detergent report in collaboration with Albury City Council, look at the change in sewage phosphorus levels as a result of the use of phosphorus-free detergent.



Drawing down on the pest species carp

Glenn Wilson is investigating the effect of lowering billabong water levels as a carp control technique. The two-year project is funded by the NSW Water Management Fund.

Lowering water levels in billabongs and lakes to dry out carp eggs is a technique being trialed by the CRC for Freshwater Ecology in a bid to control this pest species.

While similar studies in North America have produced positive results, it is the first time in Australia that hydrologic manipulation will be tested as a carp control tool.

Glenn Wilson is leading this two-year project, funded by the NSW Water Management Fund, which is being conducted at the Murray-Darling Freshwater Research Centre's Lower Basin Laboratory in Mildura.

Mr Wilson said that it was generally accepted that carp, like many native fish, preferred to breed in shallow waterbodies, such as billabongs.

"Their eggs are sticky and heavier than most native fish eggs, so they sink to the bottom around the perimeter of these shallow waterbodies, " he said. "We would only need to lower the water by up to 60 cm to dry out any recently laid eggs."

Before the hydrologic manipulation gets underway, however, the scientists are keen to increase their understanding of carp breeding and movement patterns.

"The success of this control method is likely to be closely tied to our ability to predict carp spawning times so that we can manipulate water levels at the most appropriate time," Mr Wilson explained.

The scientists hope to learn more about how factors such as flow patterns and water temperature affect carp breeding behaviour as well as the effect that water temperature, salinity and drying has on the eggs and early larval stages.

CRCFE honours student, Ben Smith, based at the laboratory over summer, will look at the factors that impact on egg and larval survivorship.

The project will be assisted by other carp work being conducted throughout south-east Australia. For example, the project has access to carp samples collected for the CRCFE and NSW Fisheries *NSW Rivers Survey*, including sites on the upper and lower Murray River, north-west Victoria and several sites on the Darling.

The CRCFE's Menindee Lakes project will also contribute data to the study, as will a project being conducted by the Victorian Marine and Freshwater Research Institute.

"The spread of sites allows us to look at carp recruitment patterns over a range of hydrological environments and climates," Mr Wilson said.

"We'll be ageing these carp samples by looking at their otoliths or ear bones in much the same way you would age a tree by examining its growth rings. These ear bones are structured in concentric rings which we count to age the fish."

The September floods have provided Glenn with an opportunity to verify this theory. He and a team from the Australian Trust for Conservation Volunteers, travelled up the River Murray, from Swan Hill to Echuca, to collect juvenile carp for otolith ageing.

"By ageing these juvenile fish we will be able to determine when they spawned and build a profile of recent spawning activity," Glenn explained.

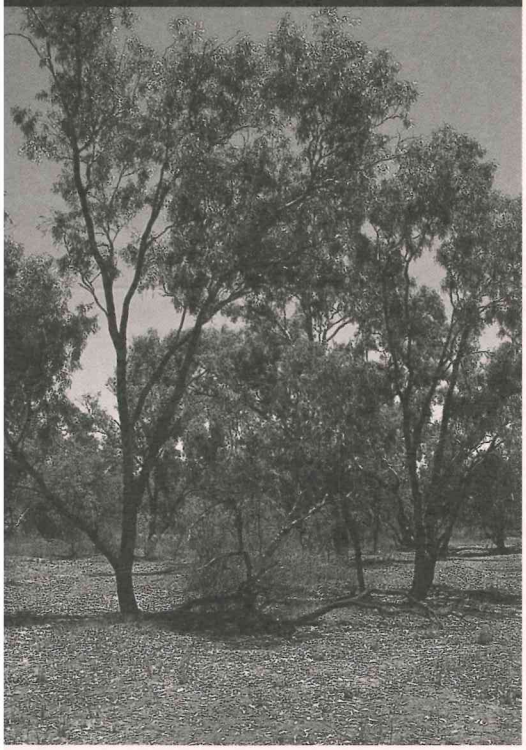
While hydrologic manipulation was unlikely to eradicate carp from Australia's inland rivers, it could be used in conjunction with other biological and physical control methods to effectively reduce carp in our waterways.

It certainly offers the advantages of being more cost effective than fishing out waterways and is less risky than introducing viruses or poisoning large tracts of waterways.

For more information contact: Glenn Wilson, MDFRC Lower Basin Laboratory, Mildura. PHONE: 03 5023 3870 EMAIL: gwilson@mdfrc.mildura.net.au

A bird's eye view of floodplains

– helping community decision making



Experimental work is looking at the long term storage of carbon and other nutrients in floodplain sediments. Differing temperature and wetting regimes will affect the rate at which nutrients are released from sediments.

Developing floodplain management strategies that meet environmental needs well as the consumptive demands of different users is a challenging exercise, particularly when there is no hard data on which to base information.

CRC for Freshwater Ecology scientists are hoping to provide that information through a three-year project which commenced earlier this year in south-west Queensland—a region where the community is grappling with the issue of how to allocate floodplain water resources.

The $320,000 project is funded by Environment Australia and the Land and Water Resources Research and Development Corporation in partnership with the Queensland Department of Natural Resources.

It is taking a bird's eye view of the Condamine-Balonne River and its floodplain functions.

Using satellite technology as well as aerial photographs, the project aims to identify the different physical components that make up a floodplain as well as those parts that are most essential in keeping our rivers and floodplains healthy.

The project integrates hydrological, cnemical and sediment work. It involves determining how these different floodplain units function in terms of their carbon, nutrient and water needs, as well as how much sediment is both deposited in and removed from these units during floods.

"We're looking at a range of temporal and spatial scales," says project leader Dr Martin Thoms from the University of Canberra. "We're taking sediment cores to assess the long term storage of carbon and nutrients in these floodplain units and we're also monitoring floods to work out exchanges during these events.

Artificial grass mats are being used to collect the sediment deposited in the floodplain units during floods. The sediment collected is then analysed for its carbon and nutrient content. Erosion, or scouring, is also measured thereby allowing the input and output of material to these same units to be examined during floods.

"Once we've determined the amount of sediment both eroded from and deposited on each unit we can work out a sediment and nutrient budget for the entire floodplain," Dr Thoms said. "It really is landscape work. Floodplains and rivers are all part of the one system, because the floodplain is the bed of the river when it floods."

The floodplains of the Condamine–Balonne River in south-west Queensland provide fertile agricultural land. The CRCFE is attempting to inject more science into the region's water allocations debate.

Experiments are also being conducted to assess how different soils respond to different inundation patterns.

"A lot of work previously focused on billabongs and wetlands, but these waterbodies are just one part of a complex floodplain that also includes features such as anabranches and secondary channels."

Historical and current flow records are being used to determine how river flows have changed in the Condamine–Balonne River during the past 100 or so years.

"We know what the current hydrology of the floodplain is and using historical flow data we can determine how the flooding of the lower Balonne has changed over time with resource development.

"A Geographic Information System (GIS) model is being used to determine how current flooding patterns have changed over time and what impact that has had on nutrient and sediment exchange between the floodplain and the river."

Using exclosures that prevent stock access in designated areas, the project will also examine how grazing effects the productivity of different units of the floodplain.

While the project is providing a valuable input to the Condamine–Balonne community's floodplain management strategy, its implications are much broader.

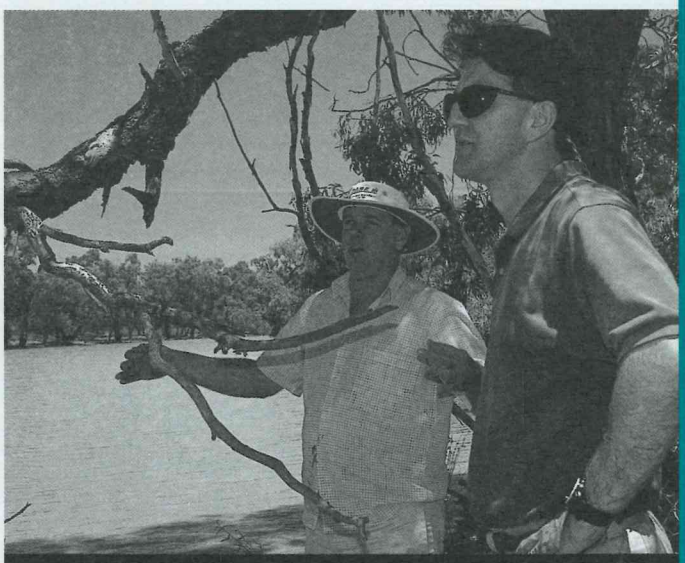
"We still know very little about how our inland rivers work, particularly in the northern part of the Murray–Darling Basin and in other dryland regions of Australia," Dr Thoms said.

"Rivers in the north operate in a summer dominated system which can be heavily influenced by monsoonal activity. The pattern and intensity of rain is different and the temperature is much warmer.

In the northern part of the Basin the floods happen during the summer when the soils and water are warmer which influences the rate of carbon and nutrient release from those soils."

The project is also providing an opportunity for several postgraduate and honours students to work on a multidisciplinary project that is being applied directly to current management needs.

For further information, contact:
Dr Martin Thoms
University of Canberra
PHONE: 02 6201 2933
EMAIL:
thoms@science.canberra.edu.au



CRCFE project leader Martin Thoms discusses water allocation issues with John Grabbe, the manager of Cubbie Station, a consumptive user of water from the Condamine–Balonne River system.

New contact details

Professor Barry Hart
Deputy Director/Research
Water Studies Centre
Monash University
Clayton Campus
CLAYTON VIC 3168
Ph: (03) 9905 4070
Fax: (03) 9905 4196
Email: Barry.T.Hart@sci.monash.edu.au

CONTACTS

Professor Peter Cullen
Director
University of Canberra
CANBERRA ACT 2601
Phone: (02) 6201 5168
Fax: (02) 6201 5038
Email:
cullen@lake.canberra.edu.au

Dr Terry Hillman
Deputy Director/ Program Leader
Floodplain and Wetland Ecology
Murray-Darling Freshwater Research Centre
PO Box 921
ALBURY NSW 2640
Ph: (02) 6058 2312
Fax: (02) 6043 1626
Email:
terryh@mdfrc.canberra.edu.au

Professor Barry Hart
Deputy Director
Research
Water Studies Centre
Monash University
PO Box 197
CAULFIELD EAST VIC 3145
Ph: (03) 9903 2326
Fax: (03) 9571 3646
Email:
Barry.T.Hart@sci.monash.edu.au

Surf freshwaters with the CRC

Research findings, technical reports, student and staff profiles and current and back copies of *Watershed* are some of the features of the CRC for Freshwater Ecology's new Web site that was launched at the recent opening of the Water Studies Centre's new premises.

In launching the site, CRCFE Chair Dr John Langford said that ensuring the Centre's research findings were communicated to the water industry, governments and the general public was critical to its success.

Technologies, such as the Internet, had an important role to play in the Centre's technology exchange program.

"This technology enables us to customise our information for specific audiences," Dr Langford said. "Water managers and other scientists can access the more technical information, while students will be able to find information and graphics that are suitable to use in their school projects.

"The CRCFE's Home Page is a dynamic information tool that will be constantly updated and developed.

"The site's Freshwater Explorer allows users to discover the research being conducted by the CRC in areas such as urban water management, floodplain and wetland ecology, environmental flows, dams and weir pools and nutrient cycling.

"CRCFE products, including tools such as the predictive AUSRIVAS models, will also be accessible through the Home Page."

Other features of the Home Page include information about the Cooperative Research Centres Program, the structure of the CRC for Freshwater Ecology and its partner organisations. It provides a gateway to the Australian water industry through links with the CRCFE's partner organisations.

Information is provided on the Centre's education activities, including its postgraduate program and the tertiary courses available through partner universities. Scholarships and jobs will be advertised on the Home Page as they become available.

Web surfers are invited to provide feedback on the Home Page which can be accessed at:

http://freshwater.canberra.edu.au

State of the art labs for Water Studies Centre

New, expanded premises at Monash University will allow the internationally-recognised Water Studies Centre to increase its capacity to conduct research that will improve our understanding of the chemistry and ecology of Australian aquatic systems.

The Water Studies Centre (WSC), which houses both CRCFE and Melbourne Water researchers and students, will now operate from the Clayton campus of Monash University where its researchers, other staff and students will have closer access to colleagues in associated departments.

The new premises were opened in December by the Vice Chancellor of Monash University, Prof David Robinson, who said that investment in the University's research capacity was vitally important. The reputation of the University, he said, rested on the quality of its research.

About 100 scientists, academics, students and CRC and industry colleagues attended the opening that was hosted by the WSC Director and CRCFE Deputy Director Research, Prof Barry Hart.

Above from left: CRCFE Director Professor Peter Cullen, Monash University Vice Chancellor Professor David Robinson, WSC Director Professor Barry Hart, Monash University Dean of Science Professor Ron Davies and CRCFE Chair Dr John Langford.

Established in 1976 at the former Caulfield Institute of Technology, the Water Studies Centre was, until November 1998, located on the Caulfield site of Monash University. Constructed in less than 12 months by the Monash Projects and Planning group, the $2 million complex on the ground flood of the Chemistry building, includes eight state-of-the-art chemistry and biological laboratories as well as computer facilities and office accommodation.

Editor:

Karen Markwort
Communication Manager
CRC for Freshwater Ecology
University of Canberra
CANBERRA ACT 2601
Email:
karenm@lake.canberra.edu.au