LANDSCAPE LOGIC
LINKING LAND AND WATER MANAGEMENT TO RESOURCE CONDITION TARGETS

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Contents

LANDSCAPE LOGIC is a research hub under the Commonwealth Environmental Research Facilities scheme, managed by the Department of Environment, Water Heritage and the Arts. It is a partnership between:

- six regional organisations – the North Central, North East & Goulburn–Broken Catchment Management Authorities in Victoria and the North, South and Cradle Coast Natural Resource Management organisations in Tasmania;
- five research institutions – University of Tasmania, Australian National University, RMIT University, Charles Sturt University and CSIRO; and
- state land management agencies in Tasmania and Victoria – the Tasmanian Department of Primary Industries & Water, Forestry Tasmania and the Victorian Department of Sustainability & Environment.

The purpose of Landscape Logic is to work in partnership with regional natural resource managers to develop decision-making approaches that improve the effectiveness of environmental management.

Landscape Logic aims to:

1. Develop better ways to organise existing knowledge and assumptions about links between land management actions and environmental outcomes.
2. Improve our understanding of the links between land management actions and environmental outcomes through historical studies of the effects of private and public investment on water quality and native vegetation condition.

Australian Government
Department of the Environment, Water, Heritage and the Arts

Green roads out of trouble

Prof Ted Lefroy, Director, Landscape Logic

Environmental management in Australia is not short of problems. We've become so used to criticism of the way funds are allocated, failure to use the best available evidence and the inability to keep track of where we've been that we tend to miss signs of progress.

The recent *Veg Futures* conference in Toowoomba provided an opportunity for some optimism. Eighteen years earlier, Greening Australia, the co-convenor of *Veg Futures* along with Land and Water Australia, hosted the first national conference of landscape restoration researchers and practitioners in Adelaide. Three changes stood out at the Toowoomba conference.

The first was the quality of the research presentations. The theme of the Adelaide conference was direct seeding and the mantra was local provenance. This was the height of the Landcare movement and the prevailing assumption was that awareness, education and inspiration were all it would take to motivate people to 'do the right thing'. Public funds would only be required to prime the pump of good will and the paths to adoption were straight and paved.

Most of the presentations at Toowoomba went beyond mechanisms for change, dealing with more sophisticated social and biophysical conceptual models of the problems at hand and acknowledging the importance of the value proposition – why should anyone do this, what is the cost, who pays? They typically also involved more than one discipline, considered multiple spatial scales in their diagnosis and impact, and involved partnerships between government and community or the private sector.

The emphasis on cost effectiveness and the nature of the partnerships revealed the second difference – the emergence of a new social contract in science. It is no longer acceptable for research to be carried out in isolation of the people for whom it is ultimately intended, or to assume that its someone else's job to promote or extend research findings.

The third big change was the growth of the private conservation sector. This reflects a global movement named Sustainable Alternatives Networks by the UN Environment Program. Virtually every sector of the economy now has a shadow in the form of these loose affiliations of groups developing alternative ways of carrying out what has been until now the province of government and big business. These networks are evident in agriculture, food production, housing, transport, energy and nature conservation. Many of these movements originated thirty years ago at the time of the last oil shock.

With the current intersection of concern over food, water, climate, oil and credit, these networks are coalescing and emerging as increasingly viable alternatives to the status quo. The private conservation sector in particular has shown itself to be a flexible, viable and well-organised manager and owner of conservation areas that now extend over hundreds of thousands of hectares in Australia and millions of hectares world-wide, complementing the public conservation estate.

The significance for environmental research is that both the public and private sectors are demanding evidence-based tools and techniques to guide managers and decision-makers and provide greater confidence for their investors.

Riparian veg survey of land-holders in Tasmania

Project 2:
Social research

The Landscape Logic Social Research CSU team (Project 2) has commenced research to better understand the factors affecting land-holder management of riparian land in six catchments in Tasmanian.

The selected catchments include two in the south (the Coal and Jordan Rivers), two in the northwest (the Inglis Flowerdale and Pet Rivers) and two in the mid-north (Quamby Brook and Macquarie River) regions of Tasmania.

Achievements to date

A mail survey was designed in collaboration with Landscape Logic staff and Tasmania's regional NRM organisations, and 'pre-tested' with a selection of Tasmania land-holders from the NRM Cradle Coast and NRM North regions. The survey will assist to identify key factors affecting land-holder implementation of recommended property management practices expected to improve water quality.

The principle topics included in the survey were:

- background socioeconomic and property data
- values attached to property
- short and long-term plans for the property
- assessment of issues affecting property and district
- management practices
- self-assessment of knowledge for different NRM topics
- views about the key natural resource management actions for riparian land
- possible constraints for riparian area management.

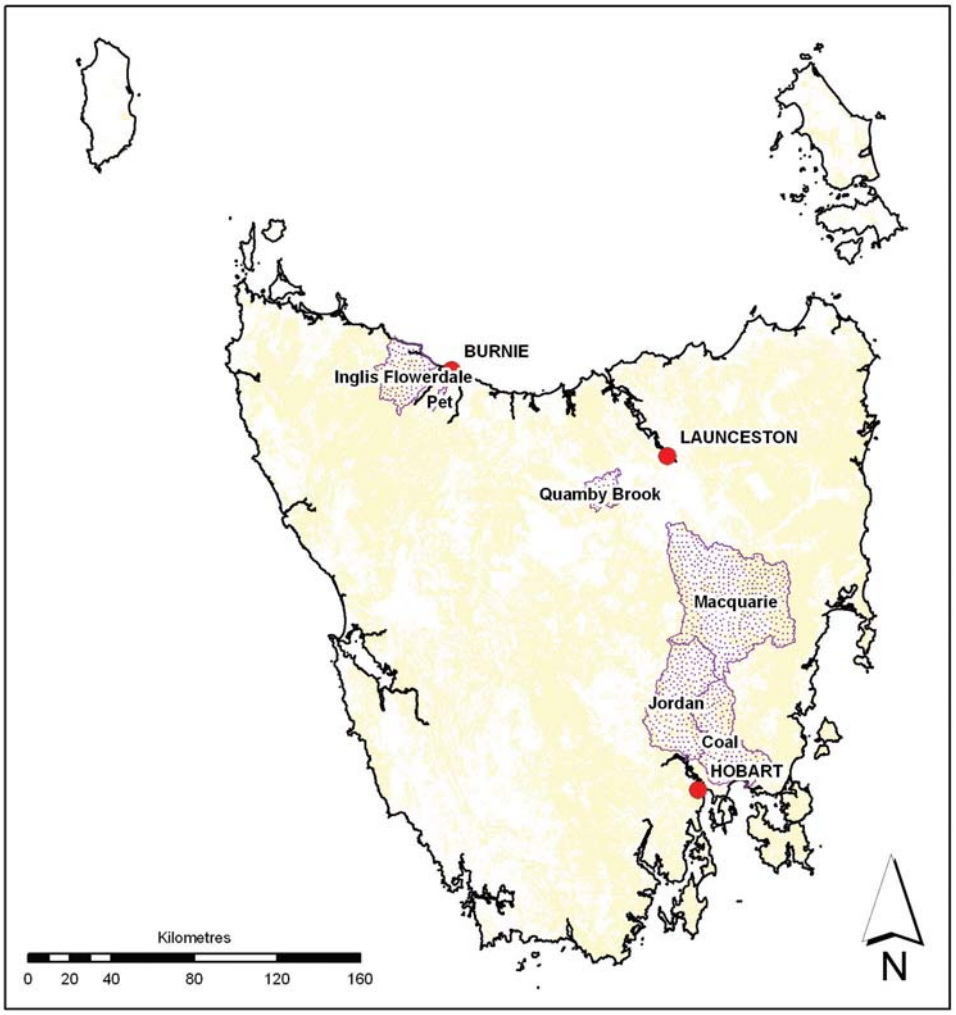
Response to the mail survey

A random selection of landholders identified as managing riparian land within the six catchments was drawn from a database provided by Landscape Logic researchers. This database was further revised to eliminate multiple listings and insufficient contact details. The process for the design and posting of the mail survey was based on the considerable experience of Allan Curtis, who has undertaken more than 20 surveys of catchment communities.

The process is almost finalised and has achieved a response rate above 60% that offers a level of confidence that the data obtained is representative of land-holders with riparian land in the six catchments.

The results from the survey will inform the next stages of Project 2's research under the Tasmanian retrospective program – in-depth interviews and stakeholder workshops to be conducted in early 2009.

Allan Curtis surveying the landscape in one of the LL catchments in Tasmania. The map shows the areas covered by the survey.



Farm forestry anticipates findings

By Asa Wahlquist. [Reprinted from The Australian*, 1 October 2008.]*

Farmer and academic Digby Race estimates he and his partner, Fleur Stelling, have planted 10,000 trees on their family farm near Beechworth, northern Victoria.

"Then we have another 10ha of native bush we are regenerating," Dr Race said. "Of the 10,000 we planted, Fleur grew most of those. She is a keen seed collector and grower."

The couple welcomed yesterday's final chapter of the Garnaut Report, which said biosequestration could transform the rural economy. "We have local native species we have been managing for high-quality timber," Dr Race said. "The sort of biosequestration that is talked about in the Garnaut report sits comfortably with us."

Their trees also match the Kyoto guidelines, having been planted since 1990 on cleared land. Dr Race said they planted the trees to build up the diversity of their 60ha farm, where they also run a small flock of sheep and cultivate a small vineyard. "We have integrated our tree-planting for wildlife as well as agricultural shelter benefit. We think that's what is supported in the Garnaut report." Professor Garnant wrote: "There is considerable potential for biosequestration in rural Australia... It would favourably transform the economic prospects of large parts of remote rural Australia."

His report estimates carbon farming, or planting 9.1 million hectares with trees, could remove 143 million tonnes of carbon dioxide equivalent from the atmosphere each year for 20 years. Ending land-clearing, restoring the mulga in the arid zone and regrowing other forest could greatly add to that total.

Dr Race said it was important to apply carbon accounting to a diversity of small-scale forests integrated into farms. This would provide other benefits such as wildlife diversity. "If it just becomes forestry that has to be monoculture, has to be industrial scale that only the corporates can engage in, then I think we would have missed a potentially tremendous opportunity."

He said the success of farm forestry in mitigating carbon pollution would rely on the carbon price and accounting that was not too complex or costly. Dr Race, a senior research fellow at Charles Sturt University, is organising next month's Australian Forest Growers National Conference.

"The emissions trading scheme and the sort of future that Professor Garnaut talks about that Australia needs to develop will be very much front and centre of the conversation at the conference," he said.

Professor Garnaut said the sheep, grain and beef industries were highly vulnerable to the impacts of climate change. Dr Race said revegetating the arid zone "may well be one of the few really positive opportunities for that vast area of inland Australia".

Digby Race from Landscape Logic Project 2, with his daughters Calista (left) and Alexis.

Vegetation change workshops in Victoria

In the last week of September, Landscape Logic's Digby Race (Social Research Team, Charles Sturt University), Garreth Kyle, David Duncan and Stephanie Spry (Victorian Retrospective Team, DSE) were having a breakfast meeting in Castlemaine.

On hearing that our project was looking at vegetation change in the local landscape an interested staff member and local resident exclaimed in frustration that these studies "never take account of the local history!" Ironically enough, that was the exact purpose of our meeting. We were planning the first in a series of regional workshops dubbed "rapid appraisals", seeking to understand the pivotal phases and drivers of vegetation change from 1946 to 2006. The workshops have proved highly informative and have enjoyed an enthusiastic response from the local community; thus the method we are developing may be of interest well beyond Landscape Logic.

Analysis of wooded native vegetation cover from aerial imagery during 1946 and 2004–7 indicated considerable change in the extent in native vegetation – both decreases and increases – in our three case study areas. Our rapid appraisals are designed to help us develop an understanding of when major changes occurred in the landscape and the drivers of those changes.

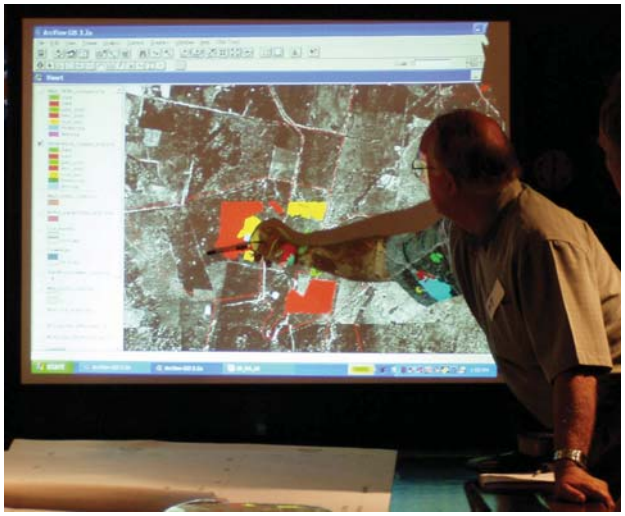
In order to understand the change, the rapid appraisal team, including members of the Knowledge Discovery, Social Research, Integration and Knowledge Broking projects, met with locals selected for their expertise in native vegetation, land management and local knowledge. The families of at least four guests at our Muckleford workshop had been in the local area since the 1850s!

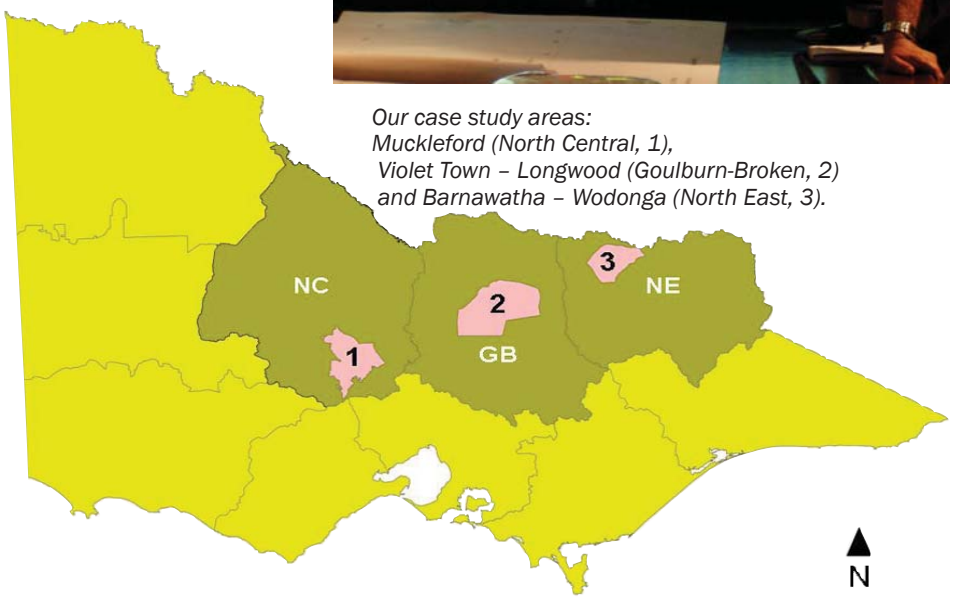
The benefits of this activity are many. Firstly, the objective was to get a landholder perspective about broad landscape change in native vegetation cover. This provides leads we can follow-up with further interviews, image analysis and modelling. Through this process we are also developing an approach to information gathering, a mixture of field visits and a three-hour workshop with a diverse mix of people with considerable local knowledge.

The workshops comprise facilitated discussion about major changes over the study period, in combination with discussion of provisional maps of vegetation change. We anticipate that this method may be of interest to other researchers and management agencies seeking to understand the longer-term patterns of landscape change and what challenges and opportunities it holds. The method is likely to be of interest not only because of the insights and data obtained but because the combination of historical air photos and interpreted maps stimulated enormous interest and contribution from the participants.

We are currently in the process of producing short reports to summarise the findings in the form of a text narrative, time-line and influence diagrams. These reports will be returned to the participants for their feedback and suggestions and they will then be made more widely available. A description of our method and suggestions for further developments will be released at the conclusion of this process as a short publication.

Above: Participants at the third Rapid Appraisal workshop held in Chiltern, north-east Victoria, on 25 November 2008, discuss a map showing native vegetation change from 1946–2004. From left to right: Kate Hill and Glen Johnson (DSE NE Area, obscured), Bill Hodson (life-long local farmer), Jim Blackney (Trust for Nature), Peter Ockenden (DPI Wangaratta), Digby Race (LL Project 2), Eileen Collins (life-long local farmer), and Jane Roots (Secretary of Chiltern Landcare Group and local resident).
Below: a provisional veg change map.
Photos: Wendy Merritt.





Our case study areas:
Muckleford (North Central, 1),
Violet Town – Longwood (Goulburn-Broken, 2)
and Barnawatha – Wodonga (North East, 3).

Spotlight on vegetation management at Veg Futures '08

Karyl Michaels, supported by Landscape Logic P1 team members Michael Lacey and Tony Norton, presented a talk entitled "Vegetation Futures for Tasmania" at the recent *Veg Futures 08* conference in Toowoomba.

The conference, convened by Greening Australia in partnership with Land & Water Australia, provided a platform for a range of international and home-grown experts to present their thinking on the most pressing challenges for vegetation management in regional and peri–urban landscapes.

It was a fantastic opportunity not only to talk about our research but to engage with the over 390 delegates involved in vegetation management, including regional Natural Resource Management (NRM) organisations and practitioners, regional planners, policy-makers, researchers and farmers.

Our presence in the session on 'The marriage of biodiversity and production – stories from those who have taken their vows' may have been somewhat premature but we took the opportunity to promote the results of our research as a possible contender for the 'farmer wants a wife'.

There is currently considerable interest in revegetation works, such as plantings for carbon credits. We suggested that protecting and enlarging small remnant patches of native vegetation (through supplementary planting around the perimeter) could be an important focus for revegetation activities aimed at connecting, enhancing and extending native vegetation for positive biodiversity outcomes.

Small remnant patches of native vegetation are keystone structures in agricultural landscapes. They provide important ecosystem services, function as stepping stones between larger blocks of vegetation, refuges from which vestiges of native populations of plants and animals may be able to recover and as a source for the colonisation of adjacent areas. They are invaluable if the goal is to restore biodiversity in the landscape.

Buffering these patches with mixed plantings for example could offset some of the negative impacts on biodiversity of the loss and fragmentation of agricultural habitats, could allow species to adapt to climate change and could positively contribute to the coherence of key biodiversity and protected area networks. Buffering could maintain and potentially increase the extent of native vegetation, increase connectivity and mitigate modification processes such as edge effects. It would also provide the landholder with tangible financial benefits.

If native vegetation is to be managed sustainably on agricultural land, the landholder should get recognition of the role it plays in providing ecosystem services and help to find it a protective partner. Our science-based approach provides the baseline needed to assess native vegetation remnants and their condition, and to identify opportunities and priorities for re-connecting landscapes. This information is of significance to natural resource management (NRM) regions, organisations involved in revegetation activities such as Greening Australia (Tas) (e.g. mixed planting) and others (e.g. Green Corps: re-veg, Private Forestry Tasmania (PFT: agroforestry) and particularly to landowners.

If you'd like to read more, our written paper will be on the Greening Australia website www.greeningaustralia.org.au in the near future.

Karyl Michaels

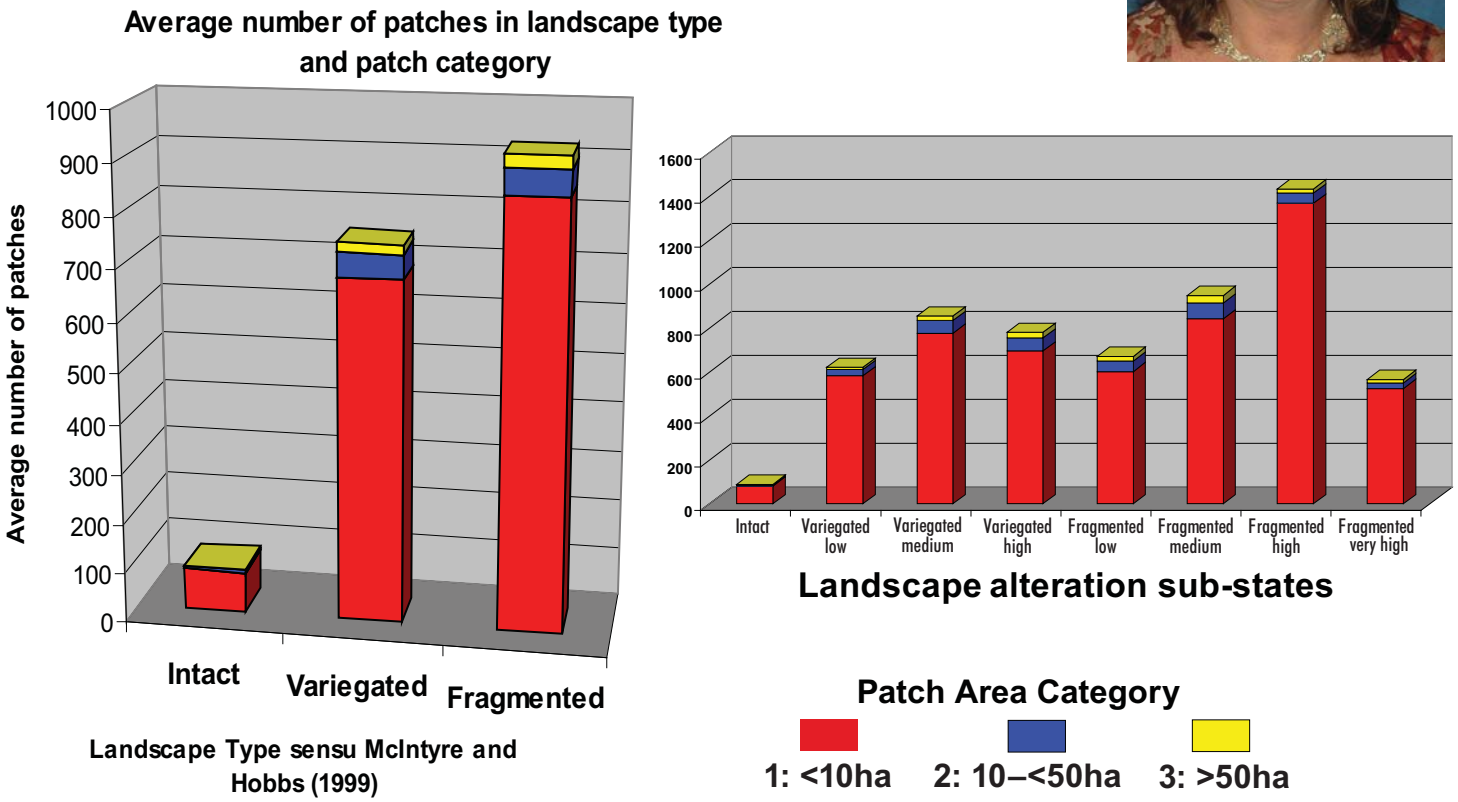


Figure 2. This photo shows a transect across the buffer with spot cultivation by a scoop-and-mound method that increased surface roughness and retained about 50% grass coverage. Note that the saturated riparian zone (indicated by tussocks) was planted to blackwoods, but not cultivated. Seedlings were planted on the mounds and protected from wildlife browsing by white tree-guards. The buffered zone will be fenced to exclude stock.

Early results from riparian forestry and buffering research

By Philip Smethurst

In August 2008 a stream-side buffer plantation of eucalypts and acacias was established on about 6% of the treated catchment (buffered) of the Willow Bend Farm paired-catchment study (Fig. 1).

So far, we have not detected any deleterious effect on water quality parameters. For example, despite steep slopes, soil disturbance due to cultivation, and cultivation as close as 1m from the saturated riparian zone, a turbidity signal was not detected during concurrent and subsequent storms.

In both the treated and untreated catchments, turbidity during base flow was less than 10 NTUs (nephelometric turbidity units) compared to and 20–30 NTUs during storm events. This lack of a turbidity signal during the establishment phase is probably related to the retention of grass, and the creation of surface roughness by the scoop-and-mound spot cultivation method employed (Fig. 2).

Continued monitoring will indicate if this result is maintained during subsequent storms and if turbidity increases in the un-buffered catchment relative to the buffered catchment when grazing recommences. The site of this experiment, which is near Cygnet, Tasmania, has also become the focus of a detailed nitrogen study that aims to quantitatively model the transport of nitrogen from the grazed hillslopes, through the stream-side buffer and into the headwater stream.

This research, and its expansion to provide more information on the water budget, involves detailed soil-water monitoring, that has kept our

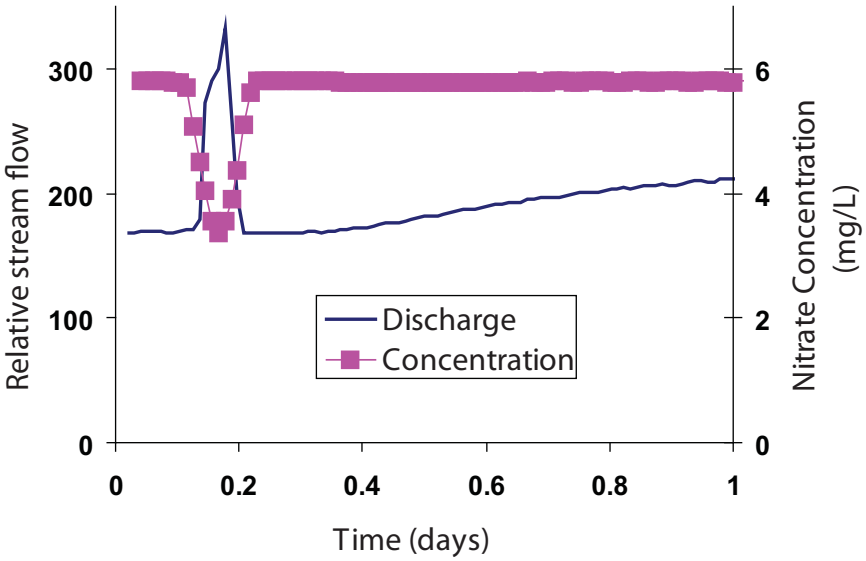
Figure 1. The paired catchments at Willow Bend Farm. The treated catchment is shown to the left with the 2008-planted buffer. Acacia melanoxylon (blackwood) was planted in the saturated riparian zone, Eucalyptus globulus was planted in the upper third of the buffer, and remainder is planted with E. nitens. The control catchment is immediately to the right of the treated catchment. Below these two catchments and in the gully to the left of the treated catchment buffers planted in 2007 are also shown.

Fig. 4. From left, Nico Marcar, Craig Baillie, Vijay Koul and Tivi Theiveyanathan installing TDR water monitoring equipment (or are they watching TV?).

team busy during the past few months (Figures 3 and 4). If this research is successful, the methodology will enable quantitative evaluation of nitrogen buffering effectiveness in a range of contrasting conditions which would be valuable for guiding NRM investment in this practice. The HYDRUS model is being used to simulate water and solute movement, while detailed nitrogen dynamics is provided by a module designed for constructed wetlands. Our research is the first attempt to apply this modelling combination to a hill-slope situation. Collaboration with the Austrian architect of this module, Dr Guenter Langergraber, has already produced a prototype simulation of nitrogen buffering. Current modelling is using HYRDUS to generate concentration-discharge patterns over timescales ranging from a few minutes to several months (Figure 5).

Figure 3. Dale Worledge installing a piezometer.

Figure. 5. Example of HYDRUS-simulated nitrate dilution in stream water during a storm. This pattern is similar to published patterns.



LL staff profile – Dr Regina Magierowski

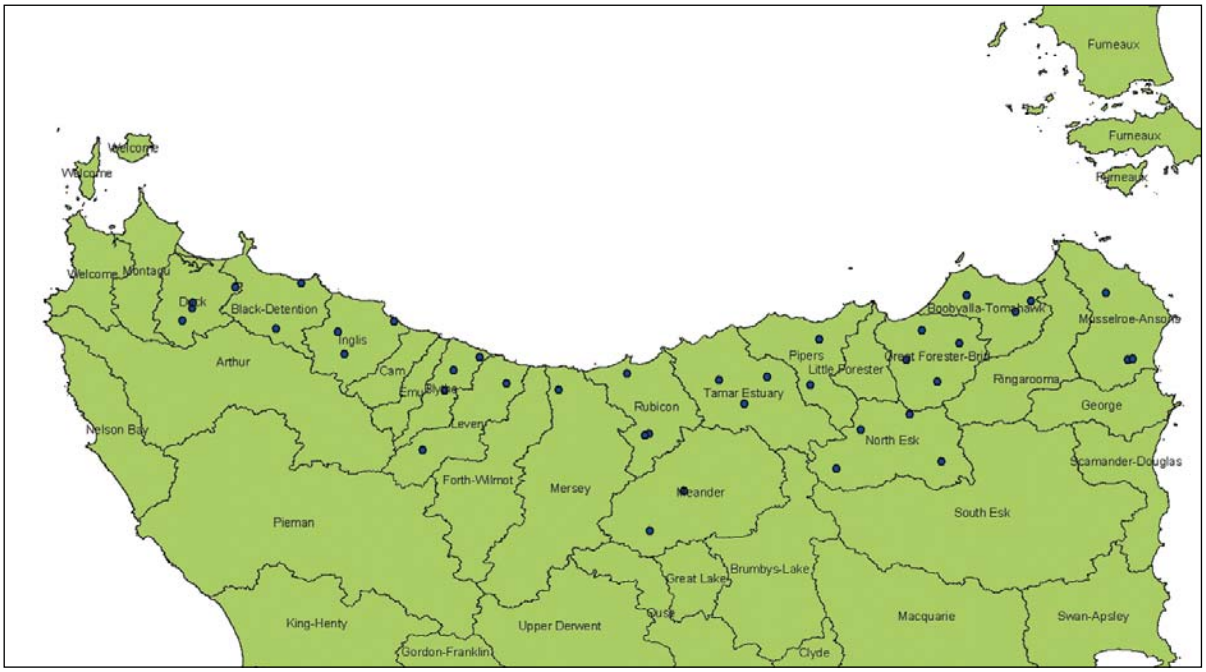
Regina joins Landscape Logic as a postdoctoral fellow with Project 4.2 (Tasmanian perspective – River Health). Her main research interests are community ecology and quantitative methodologies for examining community level processes. Her previous research has focused on species interactions, community assembly and stability and techniques for selecting surrogates of biodiversity.

Regina's work in landscape Logic will focus on identifying and quantifying correlations between land-use, water quality and habitat characteristics and key components of river ecosystem health via extensive field surveys. Regina continues the work of Dr Nelli Horrigan who examined similar correlations in existing qualitative data-sets from Tasmania.

Regina will kick-off her field campaign with a survey examining stream macroinvertebrate communities and stream metabolism at 40 sites across northern Tasmania. The sites have been selected because they lie along a gradient of percent area of river catchment identified as grazed by domestic livestock or pasture. One of the main outcomes of this survey will be an examination of how stream structure and function (e.g. photosynthesis, respiration and carbon sources) vary with changes in land-use.

Over the next 12 months, Regina will also focus on examining the occurrence of nutrient limited stream ecosystems in catchments of varying land-use types and correlating stream ecosystem structure and function with local and regional-scale catchment land-use, including local scale riparian interventions.

Sampling macroinvertebrates in the Gordon river.



Sites Regina plans to sample this summer.

George catchment values project

Landscape Logic PhD student, Marit Kragt, has been working on developing an integrated model for the George catchment in north-eastern Tasmania. Below is a short overview of her progress.

Background

NRM managers need information about people's environmental values in order to understand the likely impacts of their natural resource strategies. The aim of this PhD research is to assess the environmental and economic impacts of changed management in the George catchment. A model will be developed that integrates hydrology, ecology and socioeconomic processes.

Work in progress

Marit is using the CatchMODS framework to develop a prototype model that enables an assessment of the changes in nutrient and sediment loads to the George River and estuary under different management scenarios. These scenarios include changes in catchment land-use, fencing riparian zones and river engineering works. Marit is now calibrating the model using monitoring data (water quality and soil nutrient concentrations).

An aim of her PhD is to provide information about the costs and benefits of changing natural resource management decisions. In order to measure costs and benefits, information is needed on people's preferences. A non-market valuation survey technique called Choice Modelling is being used to assess the values people attach to environmental assets in the George catchment.

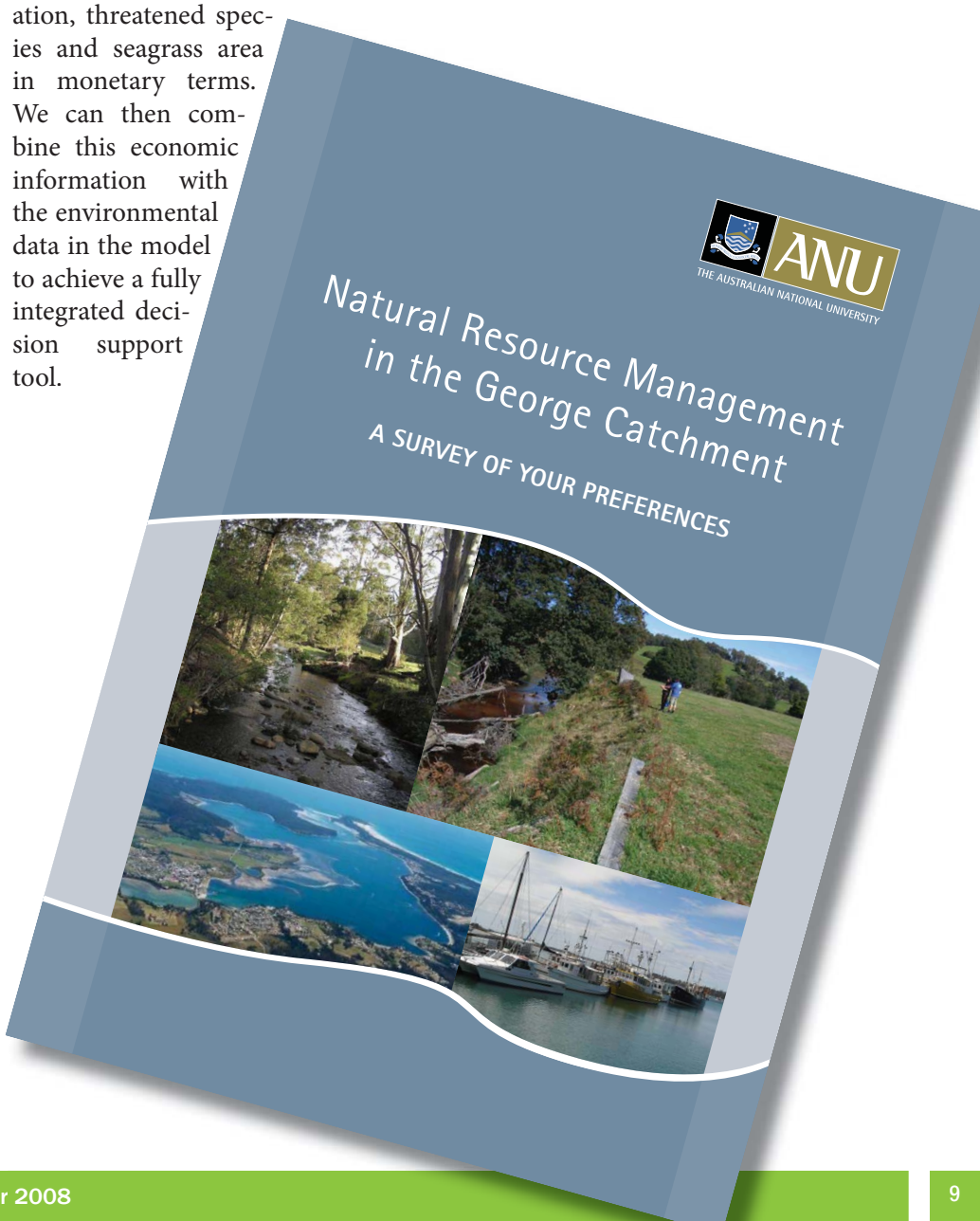
Several rounds of focus group discussions in Hobart, Launceston and St Helens were used to develop the survey. Important catchment assets were discussed including fish stocks, oyster beds, seagrass area, threatened species and native riparian vegetation. Given the limited quantitative information on fish stocks and the market values of oyster production, we decided to include the last three assets in the survey. An important innovation in this study is extensive analysis of the impacts of various catchment management scenarios on these environmental assets.

A Choice Modelling questionnaire was developed using the latest statistically efficient design techniques. A graphic designer produced some attractive survey booklets and information posters that accompany the questionnaires. Marit went to Hobart, Launceston and St Helens in early November to distribute the survey with the aid of local service clubs. The questionnaires and posters were delivered in November to a random sample of 1,500 residents.

Next steps

Socioeconomic data from the completed surveys will then be analysed using econometric modelling. Ultimately, the non-market valuation survey will provide information on the values people attach to native riverside vegetation, threatened species and seagrass area in monetary terms. We can then combine this economic information with the environmental data in the model to achieve a fully integrated decision support tool.

Marit's research is co-funded by the Environmental Economics Research Hub at the ANU Crawford School of Economics and Government and Landscape Logic. For more information on this project contact Marit Kragt on (02) 6125 4670 or marit.kragt@anu.edu.au.



Project 6 and Project 4: Plan of action

Project 6 (Integration team) and Project 4 (Tasmanian Retrospective team) had another fruitful joint workshop on 14 October 2008. The meeting objectives were to review integration needs for the Tasmanian retrospective project, discuss modes and methods of delivery of Project 4 outcomes via Project 6, and to agree on a time-line of activities ranging from now to 2010.

Outputs from P4 to P6

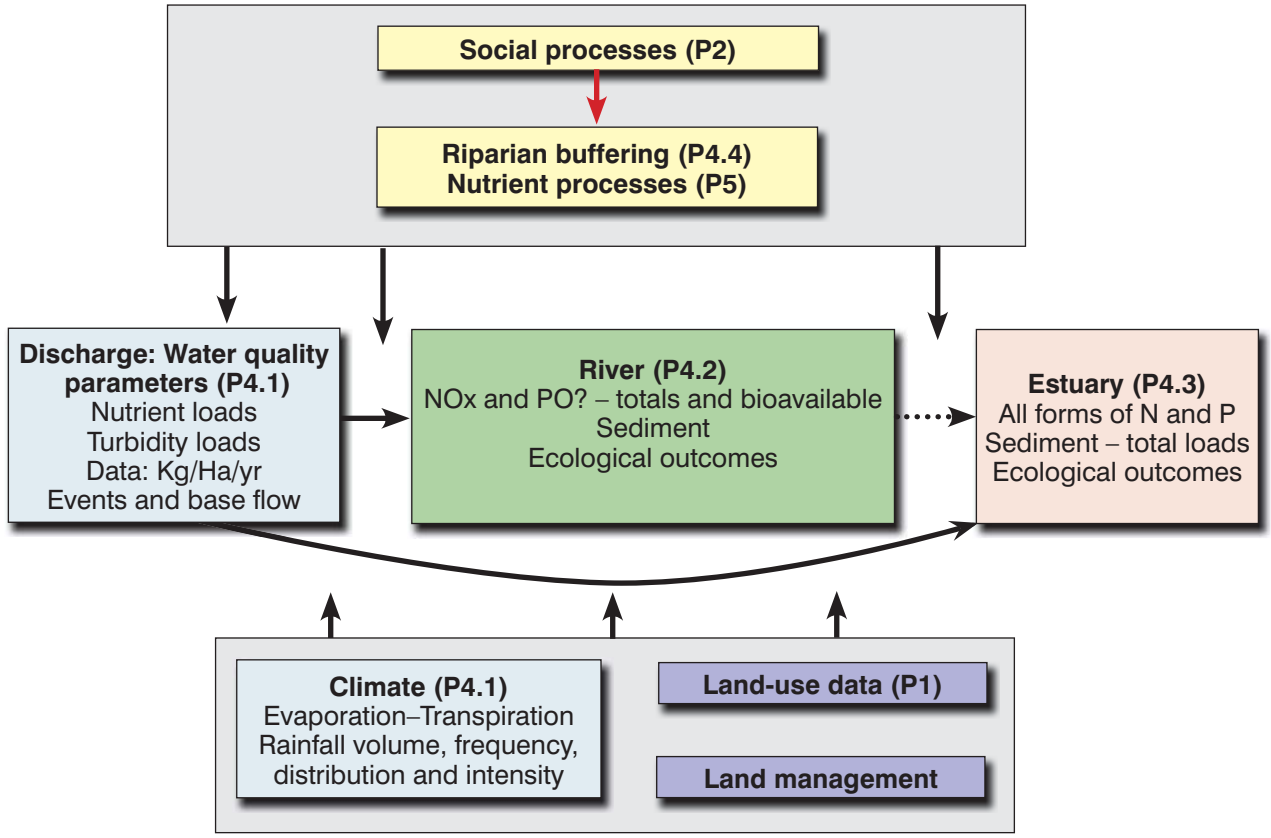
An updated vision of integration across Project 4, and it's interactions with other Landscape Logic projects, was developed, as shown in the diagram below.

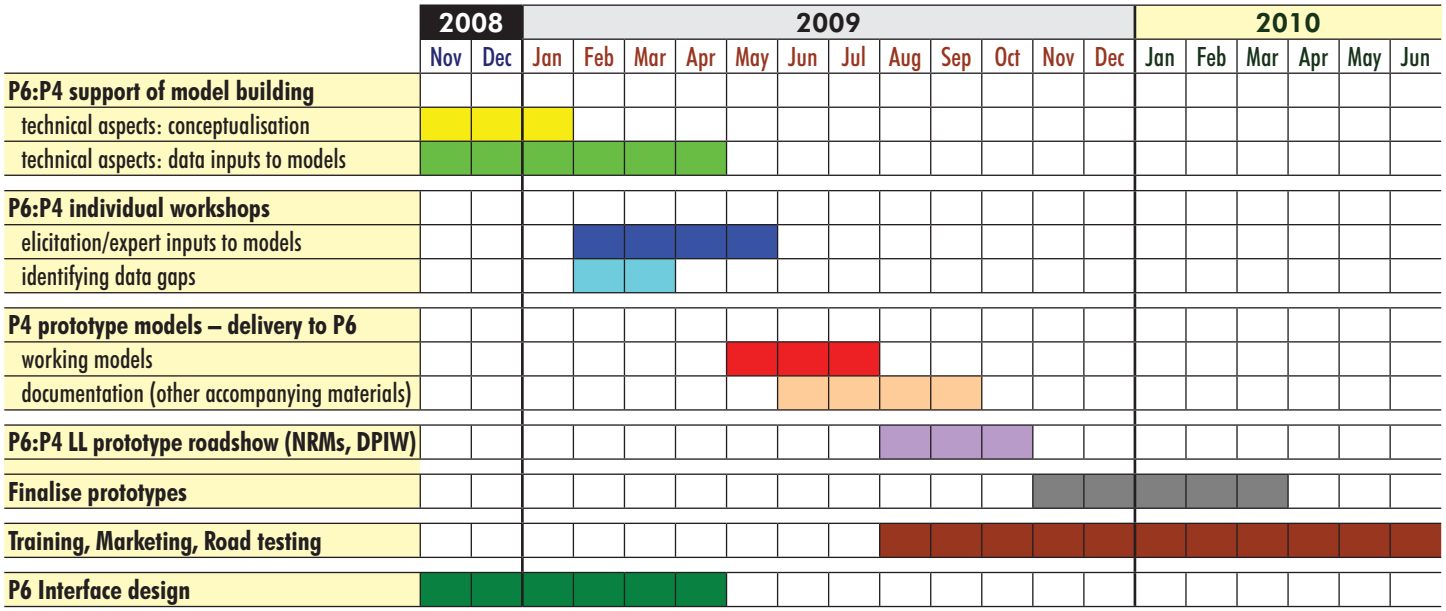
This diagram illustrate how Project 4's sub-projects interact and how the outcomes of each will be integrated by Project 6. It was noted that relationships between estuary and freshwater will be explored correlatively, rather than mechanistically.

Time-lines of Bayesian network development

The development of Bayesian networks will be ramped up from early next year. Project 6 will interact with the sub-projects to pull together and finalise influence diagrams, establish how data collected so far can generate probability distributions, and get expert input into models.

With the new agreed time-line, shown below, the first Project 4 prototype models will be completed by mid-2009.





Moving from creation to adoption

Some thoughts from the Knowledge Broking team

Landscape Logic (LL) has now passed the half-way mark and the knowledge broking team is working hard to support the adoption of research emerging from the diversity of knowledge discovery projects across the Hub.

The Project 7 team (Greg and Geoff) met recently in Launceston with the Hub coordination team (Ted Lefroy, Liam Gash and Rebecca Kelly) and Project 6 (Knowledge Integration) team to discuss the development of the LL Adoption Strategy. The meeting was extremely productive in shaping the framework for the strategy.

In essence the Adoption Strategy aims to:

1. Confirm the needs of our major stakeholders in relation to the key aims of Landscape Logic
2. Identify the tools and products in development and in what form they are most likely to be used
3. Develop a range of approaches to support the effective uptake and application of the emerging tools and products.

Over the coming months the Knowledge Broking (KB) team will meet with all LL project leaders and partners (including regional NRM partners, state and national agencies) and other key end-users to inform the development of our adoption approach.

Already many of the pieces are falling into place! The diagram below was developed at our Launceston meeting to summarise the hierarchy of datasets, products and approaches that will form parts of the pathway from creation to adoption in Landscape Logic.

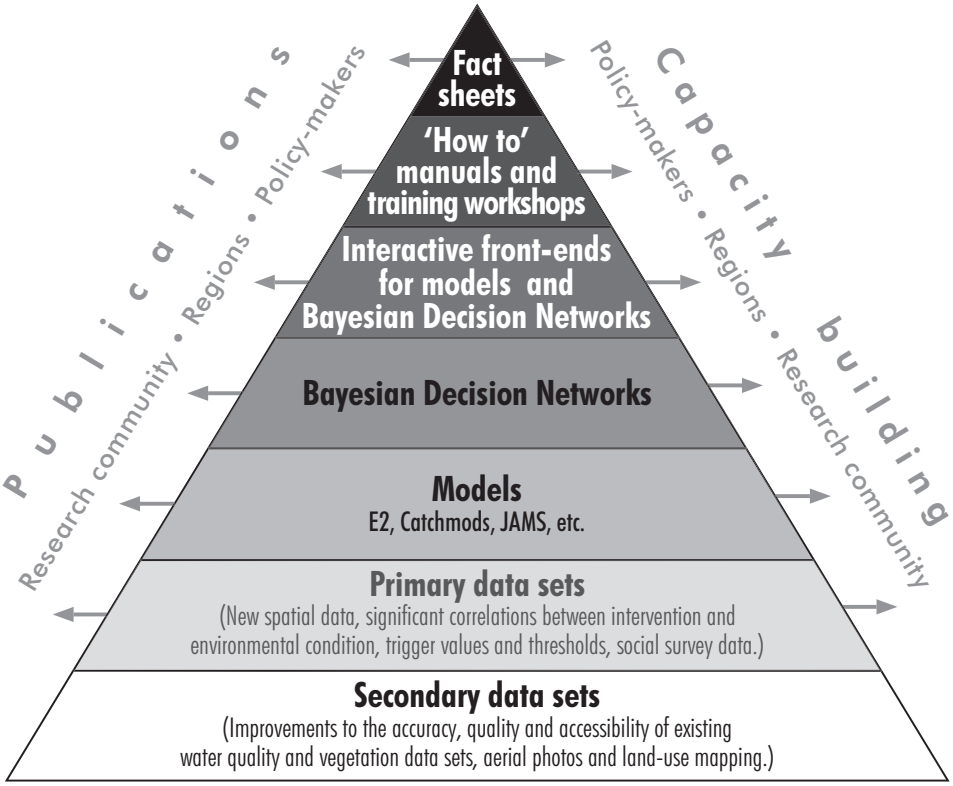
The KB team is keen to get your input and advice:

- ***How can we optimise for successful adoption?*** What approaches and strategies can we use to ensure that the products we develop are taken up and used effectively? We would be keen to discuss with you ideas about what works in different circumstances and with different audiences.
- ***Can you point us towards examples of what has worked successfully for you and/or in other programs and projects?*** We are currently examining examples of successful products from other programs (such as Grain and Graze, Land Water and Wool and the e-Water CRC).
- ***Do you have any urgent requirements for likely outputs/products from LL?*** Whilst some of the deliverables from LL will not be finalised and available for some time, we would like to know if there are things that may need to be made available in the short- to medium-term. The Knowledge Broking team has arranged a schedule of meetings with project leaders and partners over the next two months. These meetings will be important opportunities to complete a "stock-take" of tools and products flowing from LL projects and help us better understand the regional and state NRM needs and context.

We would welcome your thoughts and encourage you to contact either Geoff (0418 138 632 geoff.park@nccma.vic.gov.au) or Greg (0437 259 084 greg.pinkard@utas.edu.au).

Geoff Park, (North Central Catchment Management Authority)

Greg Pinkard, UTAS



Liz Farmer – new recruit in Project 1

Liz joins Landscape Logic from Geography Department of the University of Leicester, United Kingdom. Liz has over seven year's experience of teaching and research in geospatial information management, in particular GIS and remote sensing. Of particular interest to Liz is the application of these technologies to land-cover mapping. This research interest stems from Liz's PhD which focussed on issues of spatial scaling within land-cover mapping and the development of a 'building block' approach to land-cover survey.

The Hut on the Duck

The aim of LL Project 5 is to assist in prioritising investment to maintain or improve catchment and estuarine, water quality.

It will identify likely critical source areas for nutrients and sediments, and build conceptual 'models' of nutrient movement through the landscape and into rivers. This will include developing a better understanding of sources, sinks and flow paths of nitrogen, phosphorous and sediment.

Monitoring

Through the 'hut on the Duck', P5 is conducting high-frequency water-quality monitoring, including nitrate and ammonia, to explain the links between land-use management and water quality. The team are developing new methods for identifying the dominant hydrological and chemical processes to improve prediction of catchment-scale water quality responses. Their work will describe how nutrients and sediments move from different parts of the catchment to streams and so identify 'hot-spots' for nutrient pollution.

Publication

P5 are aiming to contribute to Landscape Logic's new Technical Report series. Their paper on the design of water-quality monitoring systems will be published in the new year.

Above: The equipment measures total phosphorus, total nitrogen, nitrate, nitrite, ammonium and phosphate. It can take measurements as frequently as every 15 minutes but is generally set at 1 per hour.
Below: The hut on the Duck team: (from left) Danny Hunt, Kirsten Verburg, Chris Drury, Seija Tuomi. [Not shown, Ulrike Bende-Michl.]

Nestled on the bank of the Duck River there is a splendid tin shed which houses two sophisticated 'Systea Micromac' nutrient analysers, capable of measuring ammonia, reactive P, nitrate, nitrite, total nitrogen and phosphorus down to parts per billion level.

There is also a 'S:CAN' spectrometer probe in-stream measuring nitrate, turbidity, TOC and DOC. These instruments and the associated peripherals, submersible water-sampling pump, filtering system and telemetry are serviced monthly by two of the Canberra team.

Chris and Danny built the shed, Danny organised the plumbing and Chris sorted out the electronics and the wireless communications. Seija keeps the Systea instruments running. Reagents are kindly made up for us by Val Latham in CSIRO Marine and Atmospheric Laboratories in Hobart. Every four weeks we fly to Hobart, pick up the reagents and drive to Smithton and spend a few days by the river servicing the instruments and enjoying the local hospitality.

Our first winter's monitoring brought some challenges, including our reagents freezing. However, heated ceramic plates designed for home brewing came to the rescue!

Come hail, rain or shine we are guaranteed entertainment by an ever-increasing display of platypus behavior as they go about their daily business in the Duck River. Every so often we are joined by a group of people who do longitudinal grab-sampling from designated spots in the catchment.

Landscape Logic – www.landscapelogic.org.au

Coordination	Prof Ted Lefroy	Director	(03) 6226 2626	ted.lefroy@utas.edu.au
	Liam Gash	Communications Manager	(03) 6226 1940	liam.gash@utas.edu.au
	Mignon Jolly	Administration Officer (Tues–Thurs)	(03) 6226 2372	mignon.jolly@utas.edu.au
	Rebecca Letcher	Science Coordinator	(03) 6331 0947	rebecca@isnrm.com.au
Spatial Analysis and Database (Project 1)	Prof Tony Norton	Project Leader	(03) 6430 4501	tony.norton@utas.edu.au
Social Research (Project 2)	Dr Allan Curtis	Project Leader	(02) 6051 9730	acurtis@csu.edu.au
Retrospective Victoria (Project 3)	Dr Adam Hood	Project Leader	(03) 9637 9021	adam.hood@dse.vic.gov.au
Retrospective Tasmania (Project 4)	Dr Bill Cotching	Project Leader	(03) 6430 4903	bill.cotching@utas.edu.au
Catchment Sediment and Nutrient Management (Project 5)	Dr Kirsten Verburg	Project Leader	(02) 6246 5954	kirsten.verburg@csiro.au
Knowledge Integration (Project 6)	Dr Tony Jakeman	Project Leader	(02) 6125 4742	tony.jakeman@anu.edu.au
Knowledge Broking (Project 7)	Dr Geoff Park	Project Leader	0418 138 632	geoff.park@nccma.vic.gov.au