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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.

Living in interesting times

Three events this year have reinforced the purpose and relevance of Landscape Logic.

On February 11, the Australian National Audit Office released its report into the regional delivery model for the National Heritage Trust and the National Action Plan for Salinity and Water Quality (www.napswq.gov.au).

As with past audit reports of large public environment programs from Landcare to NHT2, the report claimed that while it was possible to report on outputs (kilometres of fence, hectares of wetland treated, number of volunteers engaged) it was simply not possible to report on what if any difference this activity has had on the state of the environment.

In the report's words "...it is not possible to report meaningfully on the extent to which these outputs contribute to the outcomes sought by the government."

It went on to identify 3 causes. Firstly, the long lead times involved in achieving national environmental outcomes. Secondly, the absence of consistently validated data which limits the ability of regional bodies to link the targets in their plans to program outcomes. Thirdly the lack of agreement on performance indicators.

The report could have added a fourth, the lack of monitoring frameworks set up at appropriate spatial and temporal scales to detect whether intervention is having any measurable influence on environmental condition. Given the long lead times, this is a vital step in closing the adaptive management loop and without we will not be able to report on any publicly funded environmental investment.

Landscape Logic was set up specifically to focus on the second of these problems as our sub-title indicates – *linking land and water management to resource condition targets* (see our Evaluation Plan at www.landscape

Prof Ted Lefroy,
Director,
Landscape Logic




logic.org.au under 'Publications'.)

It will also deliver useful knowledge on problems three and four related to monitoring by improving our understanding of the processes involved in water quality and vegetation condition.

After that announcement, the second should not have been a surprise. On March 14, the government announced the structure of the program that is to replace NHT and the NAPSWQ, *Caring for Our Country* (<http://www.maff.gov.au/media/releases/2008/024bj.html>).

The flavour of the new program is more focused investment with the government having greater say in priorities. It also adds a competitive element to the last 20 years of co-operative environmental federalism by opening up 40% of the funds previously allocated to regional bodies in 6 focus areas (the national reserve program, biodiversity and national icons, coasts and wetlands, Landcare and sustainable agriculture, NRM in remote and northern Australia, and community skills and engagement).

An announcement is due early in September on the specific outcomes the Commonwealth is seeking in each of these areas, with outcome reporting expected annually for every investment.

The third piece of news is that Landscape Logic will jointly host the 2009 Fenner Conference of the Environment with the AEDA (Adaptive Environmental Decision Analysis) CERF hub. This provides both organisations an opportunity to showcase our science and its relevance to the evolving world of public environmental programs and policy. 

Dr Kevin Petrone

Kevin Petrone is a much-travelled scientist. After completing his degree in biology at Hampshire College in Massachusetts, he gained a PhD at the University of Alaska Fairbanks in the biogeochemistry of catchments with discontinuous permafrost. After two years as Carl Tryggers Postdoctoral Fellow at the Swedish University of Agricultural Sciences, he's been working in Perth since 2006 for the CSIRO Division of Forest Biosciences.

Kevin is interested in biogeochemical cycles at the catchment scale, particularly how ecosystems retain and transport carbon and nutrients via hydrologic pathways, including linkages between soils, ground-water and streams. His research focuses on stream chemistry as an integration of catchment processes, as well as biological processes in streams that influence energy-nutrient cycling and downstream transport.



Kevin's role in *Landscape Logic* is to develop an understanding of the role of riparian vegetation in agricultural landscapes under Project 4.4 led by Philip Smethurst. This project will determine the role of microbial and plant processes in attenuating the flux of N and P in control and riparian-planted catchments that flow into the Cygnet estuary, southwest of Hobart.

Outside of the Cygnet catchment, Kevin is interested in how organic nutrient composition can be used to better inform water quality targets from various land-uses in the Tasmanian landscape (e.g. old-growth forests, wetlands, forest plantations and agricultural landscapes). Kevin would also like to expand this work in selected catchments that are currently exceeding ANZECC guidelines for total nitrogen concentration.

Landscape Logic to co-sponsor Fenner Conference

Landscape Logic and the Applied Environmental Decision Analysis (AEDA) research hub have been awarded co-sponsorship of the 2009 Fenner Conference on the Environment.

The Fenner Conference is an annual event run by the Australian Academy of Science and is the country's leading environmental science gathering.

To be held in February 2009 in the academy's Shine Dome, the conference has the working title of: *The art and science of good environmental decision-making.*

"This is a great opportunity to take the message of Landscape Logic to a wider audience," said Prof Ted Lefroy, Director of Landscape Logic. "This is a prestigious conference and it will bring together key decision-makers from all levels of government, natural resource management agencies and the scientific community. Since the conference will occur about three quarters of the way through the life of Landscape Logic it should provide an excellent opportunity for us to present our vision for an integrated scientific approach to catchment management in particular, and to environmental decision-making more generally", he said.

The aim of the conference is to showcase recent Australian research and selected international examples of environmental decision-making. Australia invests billions of dollars on restoring its landscapes, protecting its

biodiversity and managing invading weeds and pests. Are those resources well spent? Do we get good environmental returns on this investment? Are the decisions we make for the environment transparent, accountable and defensible? How could we do better? How do we make decisions in the face of growing uncertainty?

Many people would be surprised to learn that Australia leads the world in addressing many of these questions and this Fenner Conference on the Environment will explore the dynamic world of environmental decision-making and how science is helping to create the tools that are making a real difference. The conference will:

- provide a forum for scientists, planners, environmental managers and policy-makers to share their experiences of the effectiveness and efficiency of public investment in Australia's environmental management;
- present the latest Australian research on tools and approaches for improved environmental decision-making;
- present selected international examples of applied environmental decision-making; and
- produce a series of fact sheets on the conference's six themes aimed at policy-makers and managers.

We will be posting regular updates about the conference on our website:

www.landscapelogic.org.au 



Australian Academy of Science

Update from Project 7 – Knowledge Broking Project

By Geoff Park

An exciting addition to the Landscape Logic website www.landscapellogic.org.au is the new Spatial Mapping Tool, a web-based interactive mapper. The mapping tool can be accessed by registered users of the site and provides mapping views of both Tasmania and Victoria.

A range of spatial layers are available including administrative boundaries, roads, hydrology, native vegetation, wetlands and land-use. There is also a range of aerial photography and satellite imagery available, with this anticipated to evolve rapidly over the coming months.

The tool, which is based on technology developed in Victoria as part of the eFarmer project has some very useful functionality, including the ability to print annotated maps, data interrogation

tools, distance and area calculations and links to meta data. At this stage the tool has some basic analytical capabilities such as the ability to query and intersect data layers. This will be further developed over time following feedback from users. Over the next few weeks training and familiarisation will be offered to Victorian CMAs and Tasmanian NRM regions to assess the usefulness of the application and to gather feedback so it can be tailored to user needs. We also anticipate that Landscape Logic researchers may be able to use the tool for displaying information associated with their research activities.



Productive discussions have been held between the Victorian Department of Sustainability and Environment and the Tasmanian Department of Primary Industry & Water on the development of more advanced interactive mapping tools for farm and catchment planning.

For further information please contact Geoff Park, Knowledge Broking Project Leader on 0418 138 632 or geoff.park@nccma.vic.gov.au.

We'd like to welcome on board our new Knowledge Broker for Tasmania, **Greg Pinkard**.

Greg will start work at the end of April and joins us after 30 years working for the Department of Primary Industry and Water in Tassie.



LL staff profile – Dr Nelli Horrigan

Nelli comes to us from the Canadian Rivers Institute, University of New Brunswick, Fredericton, Canada. She has previously worked in Adelaide and Brisbane. Nelli has extensive experience in statistical modelling of ecosystem stress points, as well as traditional aquatic ecology.

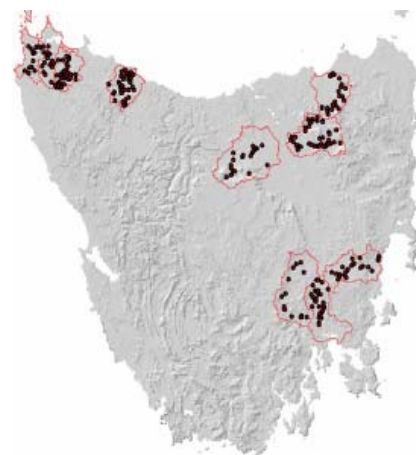
Landscape Logic funds Nelli's position with Forestry Tasmania where she is gathering data on the species present in selected Tasmanian rivers and estuaries. She has been examining the number and variety of species found and



how closely that data relates to water quality. Ten catchments across Tasmania have had a total of 497 sampling events between 1999 and 2006.

Her research is in agricultural and forested landscapes and includes information on land-use at collection sites (in broad categories), width and thickness of riparian vegetation, substrate composition, conductivity, turbidity,

and water temperature. Nelli's research will highlight the effects of forest management in a catchment, in the context of the effects of all other land uses.



Nelli Horrigan is analysing water data from these areas in Tasmania and studying the relationship between land-use, water-quality and freshwater biota.

On April 2 we had a successful **Advisory Board** meeting in Burnie with presentations by P4 and P5. Colin Steele from the Joint NRM Team in Canberra gave a very interesting outline of the new funding regime for CMOs.



From left: Shane Broad, P4; Kersten Verburg, P5; Uli Bende-Michl, P5; Richard Ingram, Cradle Coast NRM; Vanessa Elwell-Gavins, NRM South; Penny Wells, Department of Primary Industry and Water; Colin Steele, Australian Govt Joint NRM Team; Dr John Williams, Advisory Board Chair; Greg Pinkard, Landscape Logic Tasmania Knowledge Broker; Ted Lefroy; Tim Ellis, P5; Bill Cotching P4; Hans Drielsma, Forestry Tasmania.

Review of Project 6 – Knowledge Integration

On 28 February, Project 6 staff met with a panel of three external reviewers, Graham Harris (ESE Systems), David Rissik (Qld EPA) and Richard Stirzaker (CSIRO). The purpose was to review their progress to date and provide advice and guidance for their future work.

Under the leadership of Prof. Tony Jakeman (ANU), the aim of Project 6 is to use a range of integration approaches, including Bayesian Decision Networks (BDNs), to develop tools that include knowledge about environmental assets, management actions, incentive programs and rates of adoption to explore their net effect on resource condition.

A recurring theme in the discussion was whether the decision-network tools being developed were proving useful to catchment managers.

Review outcome

The review panel was generally pleased with progress, recognising the effort that had put been into exploring the scope and future use of these tools with catchment management organisations through 14 workshops over the last 18 months and the influence they were having on the whole research team in adopting BDNs as the integrating language across the Hub. In particular they observed that:

“In bringing together the knowledge and aspirations of implementers with the providers of resources and scientific knowledge, we need a system that can capture the best of both world views. Thus the LL decision-making procedures need to be, in order of importance:

- a system of clarity and transparency so participants can understand each other’s knowledge domains (most important)
- a system that makes everyone’s understanding of the problem explicit (no black boxes or complicated models)

- a system that shows how a decision was arrived at (even if it is wrong)
- a system that can be changed or added to as experience grows
- a system that gives the correct answer (least important).

It seems to us that Tony’s team is working towards a system that does deliver on the above, and in the correct order.”

BDNs and land management decisions

Across the range of catchment management organisations in the Landscape Logic partnership, there is a range of levels of engagement with BDN modelling from seeing it as possibly useful but being wary of time and data requirements, through to actively building their own BDNs.

It was generally acknowledged at the meeting that most CMOs see the approach as useful both for defining the boundaries, influences and desired end points of the systems they are managing, identifying knowledge gaps and sensitivities, and as a potential tool to assist planning, budgeting and investment.

If CMOs take on the systems modeling approach, provision may need to be made for back up and training by accredited consultants, perhaps in-house specialist staff in the larger organisations, web-based training tools (generic BDN online training already exists) and finding ways to maintain longer term relationships with research organisations.


What’s next

BDNs dealing with water quality for the three Natural Resource Management (NRMs) in Tasmania will be updated following very productive workshops with stakeholders and researchers on 26–27 February. In late March Project 6 will meet with Project 3 and Catchment Management Authority staff to discuss draft Bayesian Decision Networks for

vegetation condition in Victorian catchments. [The results of this meeting will be discussed in our next newsletter.]

This will be followed by a meeting with Project 2 to discuss BDNs for the social research project.

Future research tasks identified by Project 6 include:

- Expanding the capacity of our modeling to include spatial data, time and feedback in integrated systems models of catchments. Project 1 (Spatial Analysis) are assisting with mapping data gathered from a wide range of sources. This is being used to update land-use information and provide more accurate topographic data to improve the sensitivity of our catchment models.
- Carmel Pollino will be working on new models to characterise estuarine condition in Tasmania.
- Jen Ticehurst will lead a team to extend the studies of vegetation condition change in Victoria to include the impacts of climate and major land-use change on stream water yield. The aim is to improve a simple broad-scale water balance model (WATBAL) to perform better at finer temporal and spatial scales by accounting for vegetation and stream-flow information.
- Lachlan Newham, Marit Kragt and others are well advanced in their case study in the George’s River in Tasmania using choice modeling to integrate costs and benefits into catchment models. 

Project 6 review, February 28. From left to right: Graham Harris; Dave Rissik; Kirsten Verburg (P5); Adam Hood (P3); Laura Chant North East Catchment Management Authority; Bill Cotching (P4 and Cradle Coast NRM Region); Jen Ticehurst (P6); Carmel Pollino (P6); Dave Duncan (P3); Tony Jakeman (P6); Richard Stirzaker; Ted Lefroy.



Projects 4 and 5 workshop on February 27

Project 4 Leader, Bill Cotching, coordinated the meeting and gave a short introduction to each speaker, explaining how each researcher's work contributed to the 'rich tapestry' that is Landscape Logic.

Researchers in Projects 4 and 5 – our projects based in Tasmania – have now gathered considerable historical and new data and are planning the next stages of their work. The presentations provided a clear sense of how each of Project 4s sub-projects are being tackled and an overview of Project 5's work in the Duck River catchment in the north-west.

Discussion and interaction from researchers and catchment management staff provided useful feed-back to the presenters.

Shane Broad (Land-use/land management, sub-project 4.1) is looking at the extent to which the levels of nutrients in rivers correlates with land-use history.

Nelli Horrigan (River health, sub-project 4.2) is attempting to correlate AUSRIVAS and other historical data with catchment features, in particular land use and catchment area.

John Gibson (Estuarine health, sub-project 4.3) is data mining and collecting data from three focus estuaries. John is currently building an estuarine model based on the data he's collected and is now at the stage of plugging the gaps and identifying inconsistencies.

Phil Smethurst (Riparian buffers, sub-project 4.4) is studying the impact of stream buffers on nitrogen delivery to small streams in small agricultural catchments.

Marcus Hardie (PhD student at UTas Hobart) is researching preferred pathways for water and nutrient movement in duplex soil. His work is challenging accepted beliefs and making some interesting findings about the ability of preferential flow to deliver pollutants to groundwater and streams.

Kirsten Verburg (CSIRO) is leading Project 5 while Hamish Cresswell is seconded elsewhere in CSIRO. Project 5 is looking at catchment nutrient and sediment dynamics. The Duck River catchment in north-west Tasmania is the current focus. Her team has recently installed a high frequency monitoring station on the river and has an additional portable submersible nutrient analyser. They are measuring nitrate, nitrite, ammonia, total phosphorus, carbon and turbid-

Project 4 Leader,
Bill Cotching



ity to identify hotspots for investment.


The three NRM regions in Tasmania presented on their progress towards developing Bayesian Networks to guide their work. While the modelling had not progressed very far, the thinking has been useful in developing the logic behind their investment plans.

The afternoon was devoted to discussion about the Bayesian Decision Networks for the various research projects. As it is still early days in this work many of the networks are fairly complex. The aim is, over time, to do further research to test assumptions and simplify the BDNs to their essential elements. Further discussions also need to take place with stakeholder groups, especially CMOs, to make sure the BDNs are accurate and relevant.

Sue Botting mentioned that Cradle Coast NRM had developed a specific BDN to examine issues around the ecology of the Giant Freshwater Crayfish (*Astocopsis gouldii*). They had found it to be a useful and flexible tool to guide catchment management. Cradle Coast NRM were also looking forward to the addition of GIS and other mapping data in BDNs for their region.

All three NRMs and representatives from Victorian CMAs looked forward to closer collaboration during the remaining life of the projects. This process should be aided by the appointment of Greg Pinkard at Tasmanian Knowledge Broker for Landscape Logic [see article on page 3]. His role will solely be to provide an information conduit between Tasmanian NRMs and Landscape Logic.

Pat Feehan from Goulburn–Broken CMA commented on the relevance of the Tasmanian research to catchment management in Victoria. There was a general feeling that it would be useful to have more such meetings where researchers and catchment management staff and other stakeholders from the two states could get together to share ideas.

Thanks to Pat Feehan from Goulburn–Broken CMA for his contribution to discussion and his notes on the workshop. 

What is Project 4?

Project 4 will provide knowledge to catchment management agencies in Tasmania (NRMs) to improve assumptions about how rivers & estuaries respond to environmental management by:

- measuring the impact of historic change in land-use and land management on water quality and flows;
- identifying links between physical and chemical changes in water quality and the health of our rivers and estuaries.

How

- Data from catchments across Tasmania will be used to determine the range of water-quality and flow responses associated with different landscape types and land-use patterns.
- The predictive power of these responses will be tested in a small number of catchments with more complex land-use patterns and land-management history.
- Water quality and flow data will be related to key environmental functions for both riverine and estuarine systems, taking into account the differences between river and estuary types. Historic data will be verified with new data collected during this project.
- The impacts of past riparian management on river and estuary health will be investigated where NRM regions and others have invested in this intervention over longer periods.
- Physical processes involved in nutrient flows through landscapes will be investigated at a range of scales.

New faces

Since our last newsletter, the Landscape Logic office at the Sandy Bay campus of the UTas has employed two new staff.

Dr Corinne Jager has been employed as an admin officer, working Mondays and Fridays. She job-shares with Mignon Jolly who works Tuesday–Thursday.

Our new Communications Manager is **Liam Gash**. He is responsible for our website, publications, media liaison and collaborating with the Knowledge Broking team.



England's gain is Australia's loss

Chair of Landscape Logic's Technical Advisory Committee, Prof Graham Harris, has accepted a position as Director of the Lancaster Environment Centre at Lancaster University. Together with the co-located CEH lab it is one of the largest centres for environmental science in Europe. His sage advice will be much-missed, and we wish him well in his new position.



Publications

It seems certain that Landscape Logic and Applied Environmental Decision Analysis (AEDA) will have fruitful collaboration in the area of applying decision theory approaches to the management of native vegetation, rivers and estuaries, and riparian habitats. The first chapter of that collaboration, literally, has just been submitted for publication.



David Duncan (*pictured above*) and Dr Brendan Wintle (Assistant Director, AEDA CERF) have completed a chapter reviewing the extent to which adaptive management has been applied to regional management of native vegetation. This forthcoming chapter outlines the scope of the interaction between the two research hubs over the coming few years and will appear in the following book, which David Duncan is a co-editor:

Duncan D and Wintle B (in press), "Towards Adaptive Management of Native Vegetation in Regional Landscapes", in C Pettit, W Cartwright, I Bishop, K Lowell, D Pullar, D Duncan (eds) *Landscape Analysis and Visualisation: Spatial Models for Natural Resource Management and Planning*, Springer Verlag, Berlin.



Fieldwork begins!

Pilot field studies for the Victorian retrospective project began in early March 2008. This exercise involves training a field team to apply vegetation-assessment methods consistently and at the same time testing the sensitivity of vegetation assessment techniques to indicate change in a mature forest system, where little change is expected.

One of the persistent limitations of usefulness of vegetation metrics in resource change monitoring is the way that observers can interpret the same phenomena differently.

Above, ARI's Arn Tolsma steps through the procedure for field team members Libby Rumpff and Karen Muscat (obscured) so that there is a shared understanding of the method.

Landscape Logic - www.landscapellogic.org.au

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