THE AUSTRALIAN NATIONAL UNIVERSITY

SCHOOL OF RESOURCES, ENVIRONMENT & SOCIETY

YEARBOOK 2006

ANU COLLEGE OF SCIENCE

http://sres.anu.edu.au

Cover:
SRES teaching and research focuses on the relationships between people and the environment: how societies shape and are shaped by the environment, how societies manage and use natural resources, and how people impact on the environment. SRES draws on both the natural and social sciences to address the challenges of sustainability.

Photos:
Thanks to the many students and staff who contributed photos to this Yearbook.
The winner of this years photo competition is Toby Roscoe (front cover).
This image is of a rainforest gully in *Corymbia maculata* forest, taken during SRES course 'Landscape Ecology' at Kioloa Coastal Campus.

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The School of Resources, Environment and Society (SRES) at The Australian National University (ANU) is a significant national and international centre for research and learning. Our focus is on the relationships between people and the environment: how societies shape and are shaped by the environment, how societies manage and use natural resources, and how people impact on the environment. SRES draws on both the natural and social sciences to address the challenges of sustainability. This Yearbook introduces our staff and graduate students, their work over the past year, and overviews the School's teaching programs.

Our staff, students and graduates work together in undergraduate and graduate coursework programs that record high levels of satisfaction and employment, and in world-leading research, to help governments, businesses, communities and individuals meet the many challenges of working towards sustainability.

The School's activities in teaching and learning are organised around five undergraduate Program areas - Forestry, Geography, Human Ecology, Resource and Environmental Management, and Sustainability - and in related graduate coursework and research degree programs. At the undergraduate level, SRES offers BA, BSc, B Interdisciplinary Studies (Sustainability), BSc(Forestry), BSc(Resource and Environmental Management) and associated joint degrees. At the graduate level, SRES offers programs leading to Graduate Certificate, Graduate Diploma, Masters and PhD degrees. These are summarised on page 4 of this Yearbook and detailed in our Undergraduate and Graduate Program Handbooks, available both on our website **sres.anu.edu.au** and in hard copy from the SRES office.

The research work of SRES staff and students is diverse and wide-ranging, but united by its focus on addressing the challenges of sustainability. Most of our research is conducted in partnership with national and State agencies, businesses, communities and landowners, ensuring its relevance and maximising the benefits of research outcomes. Within the ANU, SRES works closely with partner Schools, Centres, Departments and Institutes across the ANU to achieve synergies and efficiencies. SRES also continued to house the ANU National Institute for Environment, and to work closely with CRES and other members of the ANU NIE Board, to progress the Institute's agenda.

SRES celebrated its fifth birthday in July 2006. During our fifth year, our staff maintained their high international and national profiles and productivity, publishing 4 books, 24 book chapters, 35 journal papers, and 42 conference papers. Our teaching and learning programs continued to evolve, and to be recognised for their quality and innovation. SRES staff and students attracted more than $1.9 million in new external grants to support their research. Some 38 graduate students, 17 Honours, and 50 SRES-based undergraduates completed their degrees.

If you're interested in working with SRES, in research or in collaborative learning, please contact us to discuss how we might progress our common interests in addressing the challenges of sustainability. We look forward to working with you.

Professor Peter Kanowski

Head
School of Resources, Environment and Society
June 2006

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Prospective undergraduate students should see:

- The *Study@ANU* website **info.anu.edu.au/studyat**
- The *ANU Undergraduate Handbook* **www.anu.edu.au/sas/handbook**
- The ANU *Undergraduate Student Guide* **www.anu.edu.au/psi/publications/publications.html**
- The Faculty of Science website **science.anu.edu.au**
  - Faculty of Science *Faculty Guide* **www.anu.edu.au/psi/publications/publications.html**
- The Faculty of Arts website **arts.anu.edu.au**
  - Faculty of Arts *Faculty Guide* **www.anu.edu.au/psi/publications/publications.html**
- The SRES website **sres.anu.edu.au**
  - The *SRES Undergraduate Handbook* and *SRES Honours Handbook* **sres.anu.edu.au/publications/index.html#ughbook**
  - Programs fact sheets for Forestry, Geography, Human Ecology, Resource & Environmental Management, and Sustainability **sres.anu.edu.au/publications/index.html#factsheets**

Prospective graduate students should see:

- The *Study@ANU* website **info.anu.edu.au/studyat**
- The ANU Graduate School website **www.anu.edu.au/graduate**
  - The Graduate School Research Student Prospectus **www.anu.edu.au/graduate/pubs/prospectus**
  - The Graduate School Coursework Student Prospectus **www.anu.edu.au/graduate/pubs/coursework_prospectus**
  - Graduate Coursework Guide **info.anu.edu.au/StudyAt/050PP_Graduate_Coursework/index.asp**
  - The Graduate Studies in Environment (including Resource Management) website **info.anu.edu.au/StudyAt/_Graduate_School/Study_Fields/_environment/index.asp**
  - The Graduate Studies in Geographical Sciences website **info.anu.edu.au/StudyAt/_Graduate_School/Study_Fields/_geography/index.asp**
- The SRES website **sres.anu.edu.au**
  - The *SRES Graduate Programs Handbook* **sres.anu.edu.au/publications/index.html#pghbook**

Some of the School's new students on an introductory field class, March 2006

SRES offers a range of undergraduate and graduate degree programs:

- Bachelor and Honours degrees in Forestry, Resource & Environmental Management, and Sustainability;
- Geography and Human Ecology programs as part of Bachelor or Honours degrees in Arts or Science;
- Coursework graduate programs leading to Graduate Diploma or Master degrees;
- Graduate research degrees at Master or PhD level.

All programs are available full- or part-time, and are described in the respective Handbooks, available both on our website http://sres.anu.edu.au and in hard copy from the SRES office.

UNDERGRADUATE DEGREES

1. BA, BSc and associated joint degrees

All courses offered by SRES can be taken as part of a BSc degree, and all Geography and Human Ecology course have status for the BA degree. Geography and Human Ecology courses offer students the opportunity to explore a wide range of human environment issues. The programs:

- stress the importance of literacy and numeracy, graphical, verbal and analytical skills, and competence in report preparation and presentation;
- include an integral fieldwork component in most courses.

SRES administers Science Majors in Forest Science, Geography, Human Ecology, and Sustainability Science, and Arts Majors in Environmental Studies, Geography, Human Ecology and Human Sciences.

2. Bachelor of Interdisciplinary Studies (Sustainability)

The three-year BIS (Sustainability) and the four-year direct Honours entry BIS Honours (Sustainability) degrees:

- offer students an innovative, interdisciplinary, research-intensive program focused on addressing the challenges of sustainability;
- are structured around core knowledge, learning and research skills, and teamwork;
- the degrees require that you develop some knowledge of each of Asia-Pacific, natural and built environments, and the social sciences and humanities;
- they allow you to specialise in two majors that span the university's strengths in Asia-Pacific, Arts, Economics and Commerce, Engineering, and Science.

3. BSc (Resource & Environmental Management)

The three-year BSc (ResEnvMan) degree:

- offers students the opportunity to develop an individually-structured program which best meets their interests in the environmental sciences and resource management;
- comprises a small core of courses, around which students can develop knowledge of a diverse range of themes, including:
- environmental policy
- forest science
- geographic information systems
- regolith studies
- soil conservation and land management
- sustainable agriculture
- vegetation management
- wildlife science
- land management.

4. BSc(REM) jointly with Bachelor of Laws

The five-year BSc(REM)/LLB degree:

- links these two complementary degrees, and is well suited for students wanting to develop careers in the emerging fields of environmental regulation.

5. BSc (Forestry)

The four-year BSc (Forestry) degree:

- offers students a challenging education in forest science and forest management, with broad application in environmental science and resource management in Australia and abroad.
- is directed primarily to educating forest scientists and professional foresters, but its graduates are also attractive to a wide range of employers in environmental science and resource management.

The curriculum comprises:

- the basic physical and biological sciences relevant to forest ecosystems,
- the applied sciences and technologies which support sustainable forest management,
- their application in the context of the political, economic and social dimensions of resource use, emphasises field-based learning, and combines a broadly-based education with specific specialisation opportunities.

6. BSc (Forestry) jointly with BEconomics, BScience, BArts, BArts (Visual), BAsianStudies, BCommerce, BInformationTechnology

These five-year double degrees:

- complement and enhance the Forestry program by combining it with a range of disciplines in other degrees,
- offer graduates particular employment opportunities which capitalise on these complementarities.

7. Honours degrees

Each of the degree or double degree programs can be taken with Honours, requiring:

- achievement of sufficient academic standard in coursework, as the basis for admission,
- completion of an individual research project,
- an additional year of study, or - for the Forestry program - concurrent enrolment in Honours in the 4th year.

Honours degrees can offer graduates a competitive edge in employment, and direct admission to MSc or PhD programs.

GRADUATE DEGREES

SRES offers:

a. Coursework-based programs

- Graduate Certificate (one semester of coursework)
- Graduate Diploma (one year of coursework)
- Master (One year of coursework and individual research)

In
- Environmental Science
- Forestry
- Geographical Sciences
- Resources, Environment and Society

b. Research-based programs

- Master of Philosophy. Two years of individual research
- PhD. Three years of individual research

NON-DEGREE PROGRAMS

We offer a range of non-degree programs - including workshops, lecture series and short courses - on a variety of topics.

Please contact us for further information.

SRES in 2006

The School of Resources, Environment and Society (SRES) at The Australian National University (ANU) celebrated its fifth birthday in July 2006. Over the period since its establishment, SRES has substantially enhanced its research performance, consolidated and integrated its teaching and learning programs, and progressively strengthened its connections with partners within and outside ANU. This report summarises activities and achievements in SRES' fifth year, and our priorities for the year ahead.

The SRES community

In July 2006, SRES comprised 15 academic and 12 support staff; 30 research and visiting fellows, 60 graduate and 21 Honours students, and around 240 undergraduates enrolled in one or more of our courses. 13 PhD, 15 Masters and Graduate Diploma, 17 Honours, and 50 SRES-based undergraduate students completed their degrees in our fifth year. One of our Honours graduates, Carola Kuramotto de Bednarik, was awarded a University Medal. As we're often reminded by the many who keep us informed of their progress, our graduates continue to be successful in gaining employment of their choice, and in advancing in their chosen careers.

There were a number of significant staff achievements and changes at SRES during the past year. In chronological order:

- Wendy Merritt moved in July 2005 from SRES, where she had been working with Cris Brack to apply her mathematical modelling skills to forests, to iCAM, where her work focuses on modelling to improve the management of coastal lakes and catchments;
- Lachlan Newham was promoted to Research Fellow, Janette Lindesay to Associate Professor, and Brendan Mackey to Professor in the 2005 promotions round;
- Digby Race accepted an appointment at Charles Sturt University from September 2005, after making substantial contributions to research and teaching in farm and social forestry as a CRC Sustainable Production Forestry Research Fellow over 7 years;
- Jacki Schirmer joined SRES as a CRC Forestry Research Fellow in October 2005;
- Cathy Gray joined SRES' administrative team in October 2005
- Chris Tidemann retired as Senior Lecturer in December 2005, after 34 years' work at ANU, 18 of them conducting research and teaching in wildlife management at SRES. Chris continues with SRES as a Visiting Fellow;
- Chris McElhinny was appointed Lecturer in Forest Silviculture and Stand Dynamics from January 2006, in a position jointly funded by the Australian Greenhouse Office;
- Bob Newman, SRES Visiting Fellow, was awarded The Medal of the Order of Australia in the 2006 Australia Day Honours List for his services to forestry and the community;
- Brian Lees accepted the Chair in Geography at the University of NSW - Australian Defence Force Academy, and left SRES in January 2006 after 21 years service to the ANU, including chairing the Kioloa Management Committee for 14 years. Professor Lees continues his association with SRES and ANU as a Visiting Fellow;
- Rob Dyball was appointed to a Lectureship in Human Ecology in January 2006, continuing the role he had filled on a fixed term basis for 5 years;
- Peter van Diermen accepted a senior position in AusAID, and left SRES in April 2006 after 8 years of lecturing in the geography of SE Asia;
- Catharina Williams was appointed as lecturer in the geography of SE Asia for Semester 1 2006;
- Panit Thamsongsana accepted a position in the Faculty of Science office, leaving SRES in April 2006 after 4 very efficient years as Student Programs Administrator; she was succeeded by Mayumi Hay;
- Mark Lewis left SRES and the ANU in April 2006, after 4 years as SRES' Finance Manager; he was succeeded, temporarily, by Georgia Foster on secondment from the Faculty of Science, and subsequently by Sarah O'Callaghan, in a shared role with the Department of Earth and Marine Sciences;
- Jon Marsden-Smedley left SRES in March 2006, to take up a postdoctoral position in the Department of Geography and Environmental Studies at the University of Tasmania, after one year as a Research Fellow in SRES' Bushfire Research Group;
- Ian Davies joined the Bushfire Research Group as a Research Fellow in June 2006;
- Tiffany Brown completed a 2-year appointment as a research assistant in the Wildcountry Research Hub in June 2006;
- Robyn Harris completed her period of appointment as Education Officer for the CRC Greenhouse Accounting in June 2006;
- Ryde James retired as Senior Lecturer in June 2006, after 14 years of research and teaching in forest management, and continues with SRES as a Visiting Fellow;
- John Marsh retired as Senior Laboratory Analyst in June 2006, after 31 years of service to ANU in the former Department of Forestry and SRES.

During the past year, SRES and other schools in the Faculty of Science formed, with the seven science-focused Research Schools of the ANU, the new ANU College of Science. Establishing the functionality of the new College in ways which facilitate realisation of its potential has occupied substantial time and effort. SRES, and our colleagues in the Centre for Resource and Environmental Studies, also remained a central partner in the ANU Institute for Environment. Under the leadership of the new Director of ANUIE and CRES, Professor Will Steffen, the Institute focused its efforts on developing ANU research activities around a limited number of core research themes. In the international context, ANU Vice-Chancellor Ian Chubb assumed leadership of the new International Association of Research Universities, and SRES staff engaged with those at a number of IARU partners, particularly the National University of Singapore, to begin to give effect to IARU's goals of strengthening research and the education of future leaders. Closer to home, SRES staff and students demonstrated their practical commitment to the environment by sharing top rank in the ANUgreen Green Office Ratings.

Visiting Fellows

SRES continued to host a large number of Visiting Fellows, who play active and significant roles in research, supervision of students, and teaching. Those appointed for varying periods in our fifth year were Lihui Chen (Yunnan University), Rosie Cooney (formerly The Precautionary Principle Project), Clem Davis (formerly Bureau of Meteorology), Alfredo Fantini (Universidade Federal de Santa Catarina - Brazil), Jim Gould (CSIRO), David Jupp (CSIRO), Will Osborne (University of Canberra), Carolyn Raymond (Forests NSW) and Andre Zerger (CSIRO)

Research

SRES staff and students – at PhD, Masters, Honours and undergraduate levels – continue to work on a wide range of research topics – in bushfire science, environmental policy and regulation, global change and climate science, geographical information sciences, human ecology, forest science and management, landscape ecology and integrity, soil science and land management, and integrating knowledge and learning across disciplines. Much of SRES' research continues to be done in partnership – with other areas of the ANU; through the Cooperative Research Centres in Bushfire, Desert Knowledge, Forestry, Greenhouse Accounting, Landscape Environments and Mineral Exploration; and with many external partners, including CSIRO Divisions, Australian and State government agencies, NGOs, and the Research and Development Corporations. We thank all of our research partners for their collaboration. In particular, we note the generous support of the Australian Greenhouse Office which has co-funded the SRES lectureship in Forest Silviculture and Stand Dynamics.

Notable research achievements included:

- SRES staff and students published 4 books, 24 book chapters - including a number of contributions to the book co-edited by SRES PhD graduate and Research Associate David Carpenter, *Sustainability in the Australian University Context* - 35 journal articles, and 42 conference papers (see pages 121-126);

- one of the journal articles, from Chris McElhinny's PhD research, and written jointly with Phil Gibbons, Cris Brack and Juergen Bauhus - *Forest and woodland stand structural complexity: its definition and measurement* - was among the most downloaded papers in the highest impact forest science journal, *Forest Ecology and Management* (volume 218, 1-24);
- SRES staff and students were awarded around $1.9M in external research grants. These included a $270K grant from the NSW Department of Environment and Conservation to SRES' bushfire research group led by Geoff Cary, to develop fire models for the Sydney Basin, and a $110K grant for Chris Tidemann's work on pest birds;
- an Australian Greenhouse Office – SRES research team, of which Cris Brack, Gary Richards and Rob Waterworth were members, were finalists for the 2005 Eureka Science Prize for their collaborative research on Carbon Accounting in Australia;
- Richard Greene received an Australian Academy of Science Travelling Scholarship to enable him to spend two months' study leave working on the genesis, formation and stability of Aeolian dust particles with colleagues at the University of Wisconsin- Madison;
- Cris Brack spent a very productive six months of study leave in Hobart, hosted jointly by the University of Tasmania and Forestry Tasmania, working on both forest measurement and modelling and urban forestry topics.

Teaching and learning

SRES staff played leading roles in the development and introduction of two new degrees in 2006 – the Bachelor of Interdisciplinary Studies (Sustainability) and the Bachelor of Global and Ocean Sciences (Honours), each of which reflects particular strengths in SRES and particular collaborations with other partners in ANU. We also completed a major curriculum revision for 2007, further consolidating and integrating SRES' teaching into four theme areas, and delivering two of our 1st year courses jointly with the Department of Earth and Marine Sciences. SRES' new curriculum structure is summarised on page 16 of this Yearbook. As in previous years, a number of staff from other areas continue to teach SRES courses: we particularly thank Sara Beavis, Steve Dovers and Ian White of CRES, and Bryant Allen, Kirsty Hobson, Geoff Hope and Deirdre McKay of RSPAS, for their significant contributions. The Bureau of Rural Sciences continued to offer its Summer Scholarship Program, and many employers continued to offer internships and vacation employment of various forms to SRES students, complementing their classroom learning.

SRES students continue to report generally high levels of satisfaction with SRES courses and programs, both in direct course evaluations and in assessments after graduation. We expect the new curriculum to retain these strengths whilst delivering more coherent learning outcomes. Our new curriculum structure is also intended to address a decline in SRES undergraduate enrolments, which fell below our target load in 2005. This fall in enrolments was very marked for the Forestry Program in 2006; as a result, SRES is leading the development of a joint forestry coursework program with a group of other universities active in forestry education.

SRES further developed its capacity for education about resources, environment and society in the Asia-Pacific region, offering a South-East Asian Field School in early 2006 and a new Vietnam Field School, jointly with ANU Arts and Asian Studies and with Da Nang University, in late 2006. We hosted a reciprocal visit by a graduate student class from Mahidol University, Thailand, our partners in the South-East Asian Field School, in March/ April 2006. We hope to build on our emerging collaboration with the National University of Singapore to offer future field courses in Asia with them.

In 2005, Dr Richard Baker was appointed as the Faculty of Science Associate Dean for Teaching and Learning, a particularly challenging role in the context of the emergence of the College of Science. In this role, Richard has been instrumental in fostering good practice and in sharing learning about teaching across the College of Science. His considerable efforts to facilitate more effective teaching and learning within SRES were recognised in SRES sharing a Dean's Award in the Faculty of Science for systematically using peer and student feedback to improve teaching and learning outcomes.

SRES' Honours Program and students continued to be vibrant and vigorous in our fifth year, with Honours students' final seminars and theses both demonstrating the very effective learning which SRES Honours provides through both academic and peer support. Janette Lindesay, SRES' Honours Convenor, and John Field and Ken Johnson continued to be instrumental in the success of the Honours Program, as were the contributions of supervisors and examiners external to ANU, and the role was the Robin Tenant-Wood played in coordinating SRES' Independent Research Topics courses. Similarly, Sue Holzknecht's work as SRES Academic Skills Advisor continued to be instrumental in enabling the learning of many coursework graduate students, another strong and visible cohort in the School.

Graduate and Honours students

A record number of 13 SRES students were awarded their PhD in SRES' 5th year – Hidayat Alhamid, David Carpenter, Gae Gowae, Diana James, Dana Kelly, Ernst Kemmerer, Chris McElhinny, Angela Newey, Jacqui Russell, Karim Sabetraftar, Sunil Sharma, Doug Somerville and Sanjeev Srivastava – and Peter Deane and Aru Mathias completed their MPhil. Their thesis abstracts are presented on pages 100-106. Recent SRES PhD graduate David Forrester received a Max Jacobs Award to support his research, and SRES PhD Scholar Melissa Burgess received the award for the best presentation at the 7th Annual Postgraduate Law Conference.

We congratulate them, and the similarly large cohort of graduate coursework students – Sunit Adhikari, Ari Arifah, Jhuma Dewan, Catherine Gross, Francina Kesaulija, Angus McIntrye, Muhummad Muttaqin, Kala Perkins, Julia Pickworth, Sue Powell, Sonam Phuntsho, Laxman Shrestha, Niranjan Shrestha, Ramkaji Shrestha, Karma Tempa, Nima Tshering, Suhella Tulsiani, Arief Utomo, Alvin Valerio, Rinchen Wangdi and Stephanie Wiedemann – who completed their Graduate Diploma or Masters degrees. Catherine Gross was awarded a Land and Water Australia PhD scholarship, and Sue Powell Cotton Catchment Communities CRC and CSIRO Water for A Healthy Country scholarships, to continue their research at SRES.

The thesis abstracts of the Honours students who completed their degrees in SRES' fifth year are presented on pages 117-120.

The achievements of outstanding undergraduate and Honours students were recognised in prizes and awards. Those for 2005 were:

- ACTION Trust Scholarships: Eleanor Sobey and Jonathan Edwards
- Australian Institute of Agricultural Science and Technology Prize: Elizabeth McMillan
- Howlett Honours Prize for Geography: Janet Finn
- Institute of Wood Science Prize: Geoffrey Kay
- M R Jacobs Prize in Silviculture: Melinda Mylek
- Schlich Memorial Trust Prize: Melinda Mylek
- W P Packard Prize in Geography: Mark Grant

SRES' sixth year

The theme of further strengthening collaboration in research and teaching – with others at ANU, particularly the Department of Earth and Marine Science, the Centre for Resource and Environmental Studies, the Research School of Pacific and Asian Studies, and others through the ANU Institute for Environment; and outside ANU, particularly with partners in the International Association of Research Universities - will be strong in SRES' sixth year, as we seek to build on the achievements of our first five years, and both contribute to and capitalise on the evolution of the university's collegiate structure and its external partnerships.

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Adjunct Professor
P.Cornish BScAgr(Hons) (Sydney), MScAgr(Sydney), PhD(UNE)
M. McAleer BEc(Monash) PhD(Queens)
P.C.Young BTech.(Hons I), M.Sc.(Loughborough), PhD(Cambridge)

Visiting Fellows
R. Evans BSc(ANU)
N. Hall BSc (Hons), GradDip(Oxford), PhD
D. Post BSc(Hons) (Newcastle), PhD(ANU)

Administrative Staff
S. Kelo

Research Assistants
A. Andrews

PhD & MPhil Students:

Philip Alcorn	PhD
Kerry Arebena	PhD
Glen Bann	PhD
Liliana Baskorowati	PhD
Lara Boyd	PhD
Matthew Brookhouse	PhD
Melissa Burgess	PhD
Kylie Carman-Brown	PhD
Peter Dostine	PhD
Steven Douglas	PhD
John Drewry	PhD
Rory Eames	PhD
David Eastburn	PhD
Saan Ecker	PhD
Susan Emmett	PhD
Sue Feary	PhD
Karen Fisher	PhD
Baihua Fu	PhD
Nicholas Gellie	MPhil
Martin Golman	PhD
Simon Gordon	PhD
Susan Gould	PhD
Quintin Gravatt	PhD
Catherine Gross	PhD
Sarah Hemmingsen	PhD
Cameron Holley	PhD
Kevin Jeanes	PhD
Stuart Johnston	PhD
Stefan Kaufman	PhD
Carola Kuramotto de Bednarik	PhD
Adam Leavesley	PhD
Alex Lee	PhD
Lynette Liddle	PhD
David Little	PhD
Kirsten Maclean	PhD
Kate Park	PhD
Susan Powell	PhD
Ida Aju Resosudarmo	PhD
Jacqueline Russell	PhD
Birte Schoettker	PhD
Catherine Simpson	PhD
Matthew Taylor	PhD
Geraldine Teakle	PhD
Kylie Theakston	PhD
Philip Townsend	PhD
Thi Thu Ha Tran	PhD
Renee Visser	PhD
Lyndsey Vivian	PhD
Robert Waterworth	PhD
Edward Webber	PhD
Wendy Welsh	PhD
Vanessa Wong	PhD

Masters Students:

Sarah Goldin	MEnvSc
Francina Kesaulija	MEnvSc
Kim Marchiori	MRES
Jennifer McMillin	MRES
Luke Pinner	MEnvSc
Indra Prachhai	MF
Enesh Seitmuradova	MEnvSc
Arief Utomo	MF
Alan Wigg	MEnvSc

Graduate Diploma Students:

Muhammad Arshad	GDipEnvSc
James Berrell	GDipSc
Isreal Bewang	GDipF
Ravindra Birua	GDipEnvSc
Alexander Johnson	GDipRES
Gemma McBride	GDipEnvSc
John McRae	GDipEnvSc
Elizabeth Noble	GDipRES
Deazy Trisatya	GDipEnvSc

Honours Students:

John Bennett

Rachel Bessell

Paul Cheeseman

Serena Chen

Amy Davidson

Graham Fifield

Adam Flanagan

Waverney Ford

Hannah Hueneke

Emma Jacobs

Juliana Lazzari

Heather Mason

Emily May

Melinda Mylek

Nilmini Ponnamperuma

Jason Raappana

Millie Rooney

Robyn Sakkara

Eleanor Sobey

Daisy Summerfield

Benjamin Weilinga

Staff, students and visitors at SRES weekly morning tea

SRES Head, Peter Kanowski, congratulates Bandara Kangane, one of 13 SRES students who have successfully completed their PhD this year

SRES Forestry students represent ANU at the
33rd International Forestry Students' Symposium in Melbourne

John Banks Court Wollemi Pine

Margaret and Lynette Banks plant a Wollemi Pine in
John Banks Court, assisted by ANU Vice Chancellor Ian Chubb

SRES staff succesfully completed (and survived)
remote area first aid training

Farewell Panit

After four years administering SRES Students Programs, SRES farewelled Panit Thamsongsana who has been promoted to the Faculty of Science office

SRES Scholarship Awards

ANU Vice Chancellor Ian Chubb (2nd from left), and Head of SRES Peter Kanowski (right) celebrate with ACTION scholarship recipients SRES students Ellie Sobey and Jonathon Edwards

SRES International Lunch

Each year our international students prepare a huge banquet to the delight of all SRES staff and students

Thai Delegation Visits SRES

Staff and students from Thailand's Mahidol University in Australia for a two week Industrial Ecology course hosted by SRES

SRES Wins ANU Green Award

SRES tied for first place with ANU Facilities and Services for the inaugural ANU Green Award

- for our use of recycled paper
- double sided printing and photocopying
- paper recycling
- environmentally friendly photocopying practices
- computer screen sleep mode active
- no disposable mugs used
- recycling stations

2006 SRES Green Initiatives

In January 2006 SRES introduced a new printer-quota system to encourage responsible usage of printers within the School.

New SRES Green Vehicle

SRES staff complete a victory lap in the inaugural Tour de SRES

Field-based learning is one of the strengths of SRES' teaching programs, helping students connect theory and practice in partnership with environment and resource management professionals and prospective employers.

Here is a sample from recent SRES field courses

Resources Environment and Society
(SRES1001)

SRES students undertake a forest assessment exercise at Kioloa Coastal Campus that includes mapping the understorey-canopy distribution and performing an analysis of the vegetation history (burning, grazing, and other disturbances).

photos - from top:
- Getting to know each other at the start of the course
- Reading the forest landscape to understand its management history
- Prof. Alistair Greig explaining the settlement history of the south-east Australian coast, on the beach at the Coastal Campus

Australia's Forests
(FSTY1004)

The Australia's Forests field course is conducted in partnership with public and private land managers on NSW's western slopes and with day visits around the ACT. It introduces students to many of the issues in managing forests and woodlands for conservation and production.

Human Ecology
(ECOS2001)

This course explores the interrelationships between cultures and ecosystems

A favourite component is the extended fieldtrip to Kosciuszko National Park in the Snowy mountains where these complex issues are experienced first hand

photos - clockwise from left:
- Big landscape
- Cold but tastey
- Significant human impact

Vietnam Field School (GEOG2017)

ANU October 28-29, 2006
Vietnam November 26 - December 10, 2006

This course explores the development of South East Asia through an intensive two week field school. The emphasis will be on integrating formal learning with first hand experience (fieldtrips, village stay and language training).

Offered jointly by the Faculties of Science, Arts & Asia Studies.

Water Resource Management
(SRES3005)

This course emphasises the interdisciplinarity of water resource management and focuses on integrated assessment, which is a method that seeks to solve water management problems by investigating the physical, economic, social and institutional components of a problem.

Environmental Biogeography & Global Ecology
(GEOG3011)

Practicals are based on the application of GIS to modelling plant-climate relations. These computer-based practicals are complemented by field-based investigations

photos:
Measuring tree height and cover abundance in Monga National Park

Environmental Biogeography students hard at work investigating trophic interactions deep in a south coast forest ecosystem

Honours

An individual research project - structured research training - the path to postgraduate study

photos:
Investigating the role of dingoes in the conservation of endangered fauna through their impact on feral cat and fox populations

Recording GPS locations of the remains of a shepherd's hut in the central highlands of Tasmania

SRES 2007 Courses

* *ITALICS* - offered biennially: *(year next offered)*
** from 2008, semester 1

	SOCIAL SCIENCES	METHODS, APPROACHES AND INTEGRATIVE PRACTICE	ENVIRONMENTAL SCIENCES	
THEME	**People and Environment**	**Quantitative, Qualitative and Integrative Methods**	**Global Change Science**	**Landscape Systems and Processes**
Year/semester 1/1	SRES1001 Resources, Environment and Society: Geography of Sustainability			SRES1004 Australia's Environment
1/2	SRES1008 Australia, Asia and the Pacific	SRES1003 Environment and Society Research Methods	GEOL1006 The Blue Planet	
Intensive Courses	SRES2010 Australia's Forests (Winter - July) SRES2017 Vietnam Field School (Spring - Nov/Dec)	SRES2012 Cities and their Hinterlands (Winter - July)		SRES2008 Hydrology for Natural Resource Management (Summer - Jan/Feb)
2/1	SRES2007 Economics for the Environment	SRES2011 Human Ecology		SRES2016 Landscape Systems 1: Landforms and Soils SRES2019 Landscape Systems 2: Vegetation Ecology
2/2	SRES2013 People, Environment and Development	*SRES2009 Ecological Measurement and Modelling (2008)* SRES2014 Qualitative Research Methods for Sustainability SRES2015 Introduction to Remote Sensing & GIS	SRES2004 Weather, Climate and Fire	
Intensive Courses	SRES3007 Participatory Resource Management (9-13 July, S2) SRES3033 International Environmental Policy (Feb+S1 taught in 3 blocks)	SRES3023 Agroecology and Sustainable Systems (Spring - Nov/Dec)	SRES3026 Geomorphology (Summer - Feb)	SRES3008 Fire in the Environment (Summer - Jan/Feb)
3/1	SRES3028 Environmental Policy and Planning SRES3151 Advanced Valuation of the Environment		SRES3029 Palaeo-Environmental Reconstruction	** SRES3002 Soil Resources (2007)* SRES3014 Vegetation Management
3/2	SRES3018 Policy and Institutional Analysis ** SRES3031 Murray-Darling Basin Field School (2008)*	SRES3024 Applied Geographic Information Science SRES3021 Human Futures	** SRES3013 Climatology (2008)* ** SRES3020 Greenhouse Science and Policy (2007)* SRES3022 Environmental Biogeography and Global Ecology	SRES3004 Land & Catchment Management ** SRES3005 Water Resource Management
3	**Independent Research Projects and Special Topics offered in all SRES Programs**			
	Forest Science, Policy and Management			
4/1	SRES4006 Forest Policies and Practices			SRES4004 Farm and Urban Forestry ** SRES4007 Forest Conservation and Production Genetics (2008)*
4/2				SRES4002 Sustainable Forest Management SRES4003 Sustainable Forest Planning SRES4008 Forest Products ** SRES4009 Forest Operations (2007)*
4	**HONOURS OFFERED IN ALL SRES PROGRAMS**			

for updates & course descriptions please refer to **http://sres.anu.edu.au**
last update 30 August 2006

Dr Richard Baker

Geography Program Convenor

Reader
Environmental Policy and Planning, Indigenous Resource Management Issues, Environmental Education, University Teaching Methods

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Career Brief

Richard was born and bred in Canberra. In 1981 he was awarded the ANU University Medal for his combined Honours degree in Archaeology and Physical Geography. He then worked as an archaeologist and oral historian for the NT Museum before completing a PhD in Human Geography at the University of Adelaide. From 1990 to 1993 he was the inaugural head of the People and the Environment section of the National Museum of Australia. He has taught Geography at ANU since 1994. He was awarded the ANU Vice-Chancellor's award for teaching excellence in 1996 and 2002 and was a National Finalist in the 2002 Australian Teaching Awards. The first SRES course that he coordinates won a 2003 National Teaching award.

Research, Teaching & Professional Activities

My teaching at ANU has included coordinating the first year SRES course "Resources, Environment and Society" running "Independent Research Project" (an advanced 3rd year research based course) and co-teaching the 3rd year course "Environmental Policy and Planning". I have carried out research into teaching methods and been invited to speak on teaching related issues at many forums. In 1999 I took up a visiting fellowship at the University of Washington, Seattle Center for Instructional Development and Research. In 2000 I became the inaugural chair of the ANU Teaching Forum, a group of award winning ANU teachers dedicated to promoting excellence in teaching and learning at ANU.

My research focuses on community participation in resource management and environmental policy. I have worked on these issues in Australia and south-east Asia. I have worked in Viet Nam with the IUCN (World Conservation Union) on issues related to community participation in wetlands management. My work in Australia has focused on Indigenous communities and land management issues. This has been written up in two recent books:

Land is Life (published in 1999 by Allen and Unwin) which examined the historical and cultural geography of Aboriginal-European relationships since first contact in the Gulf of Carpentaria region of the Northern Territory and *Working on Country* (published in 2001 by Oxford University Press) which examines contemporary Indigenous management of Australia's lands and coastal regions.

Further personal details, links to publications, recent graduate student details and on line articles on teaching methods are available at http://sres.anu.edu.au/people/baker/index.html

Selected Publications

Baker, R.M. 2003 Yanyuwa classical burning regimes, Indigenous science and cross-cultural communication, pages 198-204 in Australia burning: fire ecology, policy and management issues CSIRO publishing, Collingwood Victoria ISBN 0 643 0 06926 7

Robinson, C, Liddle, L. and Baker, R.M 2003 Journeys through an Australian Sacred landscape, with, *Museum International*, 218: 74-77

Baker, R.M., Davies J. and Young, E. (eds) 2001. Working on Country: Contemporary Indigenous Management of Australia's Lands and Coastal Regions, Oxford Uni Press

Baker, R.M. 1999. *Land is Life*: *From Bush to Town - the story of the Yanyuwa people*. Allen and Unwin, Sydney

Baker, R.M. 1999. *Aboriginal Cultural Landscapes*, *Elaine Stratford, Australian Cultural Geographies*. Oxford University Press, Geography Meridian series.

Baker, R.M. 1997. Landcare: Policy, Practice and Partnerships: *Australian Geographical Studies*, 35(1) 61-73.

Baker, R.M. 1996. Coming In: The Yanyuwa as a case study in the geography of contact history, 123-166, in Chapman, V. and Read, P. (eds) *Terrible Hard Biscuits*. Allen and Unwin, Sydney.

Baker, R.M. 1996. Landcare groups and university students working together, in V. Brown (ed.), *Landcare Languages: A Communication Manual for Landcare*. Canberra, Commonwealth of Australia, 128-134.

Selected Student Theses

Horowitz, L 2003 Stranger in one's own home: A micropolitical ecological analysis of the engagements of a Kanak community with a multinational nickel mining project in New Caledonia (PhD thesis)

Measham, T 2003 Learning and change in rural regions: understanding influences of sense of place (PhD thesis)

McGowan, B. 2002 Dust and Dreams: A regional history of mining and community in SE NSW 1850-1914. (PhD thesis).

Gullett, W. 2001 Environmental decision-making in a transboundary context: principles, challenges and opportunities for precautionary environmental impact assessment. (PhD thesis).

Cooper, D. 2000. An unequal coexistence: From 'station blacks' to "Aboriginal custodians' in the VRD, Northern Australia. (PhD thesis).

Gill, N. 2000. Outback or at home? Environment, social change and pastoralism in central Australia. (PhD thesis).

Woodhill, J. 1999. The Landcare paradox: sustaining rural Australia. (PhD thesis).

Ellemor, H. 1999. Place and natural resource management: The case of the Barmah-Millewa Forest, Australia. (PhD thesis)

Scroope, S. 2003 Indigenous protected areas (Honours thesis)

Cozens, Z. 2003 Aboriginal participation in resource management on the NSW South Coast. (Honours thesis).

Hill, A 2003, Social economies in the Southern Tablelands of NSW. (Honours thesis).

Duus 2002 Dispute resolution in environmental management. (Honours thesis).

Blanch. L. 2001 Good cops, bad cops: contemporary alliances of the Australian environment movement. (Honours thesis).

McMaster, K 2000. Interpretation for summer recreation in the Kosciuszko Area. (Honours thesis).

Arkle, P 2000 Physical impact of tourism on the Kosciuszko summit. (Honours thesis).

Dr Cris Brack

Forestry Program Convenor

Senior Lecturer
Forest Inventory, Forest Mensuration, Carbon Sequestration and Accounting, Forest Modelling, Forest Planning, Urban Forestry

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Career Brief

As a NSW forestry trainee, Cris completed his undergraduate studies at ANU in 1982. After graduation, he was a field forester in the biggest plantation district in NSW. He then joined the Planning Division in Sydney as the Forest Inventory Officer for plantations, where he designed inventories and information systems. He continued his studies on management and inventory with a PhD in Canada and returned to Australia as the Senior Inventory Officer for State Forests of NSW with responsibility for supporting the management of plantations and multiple-use native forests. He joined ANU Forestry in June 1994. Cris has subsequently undertaken extensive research and consultancy work throughout Australia as well as New Zealand, Malaysia, PNG, Germany and USA.

Research, Teaching & Professional Activities

My most significant research contributions have been the development of optimal sampling strategies, modelling tools, and decision-support systems for trees at stand, landscape and continental scales. This research integrates knowledge of and innovation in applied statistics (for model-based and unequal probability sampling), data acquisition (from remotely sensed imagery and ground-based surveys), modelling (of tree and stand dynamics, fauna and flora habitat supply), and expert and decision-support systems (as integrating methods). The research has broad application in both natural and urban environments, and is novel in its integration of quantitative and qualitative information; it has significant national and international standing as a result. My work has been influential in development of the Australian Greenhouse Office's National Carbon Accounting System, and in catalysing the development and adoption of new approaches by forest and land managers and policy makers including the Bureau of Resource Sciences, National Forest Inventory, Canberra Parks and Places, Department of Sustainability and Environment (Victoria), Forestry Tasmania and Private Forests Tasmania. I am involved in teaching and learning in all these areas for undergraduates and post-graduates.

I am also a member of the CRC for Greenhouse Accounting; member and past Chairman of the Research Working Group on Forest Measurement and Information Systems; Chairman of the IUFRO Group 4.02.03 – Inventories on Successive Occasions, and Deputy Chairman of 6.15.00 – Improving Education and Further Education in Forestry.

During 2005 my research focused on: improving our ability to measure and report on the carbon sequestration at a national level; determining the environmental and economic value of urban forests; enhancing inventory data collection (including the use of LIDAR and ground-based lasers); and determining the impact of uncertainty on making good management decisions. I continued as a member of the *Expert, Independent Advisory Panel* to monitor the annual performance of the Department of Sustainability and Environment.

Selected Publications

(see also http://sres.anu.edu.au/associated/mensuration/BRACKPUB.HTM)

McElhinny, C., Gibbons, P., Brack, C.L. and Bauhus, J. 2005. Forest and woodland stand structural complexity: Its definition and measurement. *Forest Ecology and Management* 218: 1 – 24.

Lorenz, M., Varjo, J. and Bahamondez, J. 2005. Forest Assessment for changing information needs. Contributing authors: C.L. Brack, M. Clarke, M. Gillis, H. Hironen, C. Kleinn, A. Riebau, H. Sase and T. Totsuka. In *Forests in the Global Balance - Changing paradigms*. G. Mery, R. Alfaro, M. Kanninen and M. Loboviko (eds). IUFRO World Series Volume 17: 139 - 150.

Brack, C.L. 2005. Environmental, Amenity and Habitat Values of an Urban Forest: How to determine and manage for them in Canberra. Proceedings of the 9th Annual ISAAC National Conference. Launceston, Tasmania. September 30th - October 5th, 2005. P 19

Brack, C.L. 2004. Projecting native forest inventory estimates from public to private tenures. *Australian Forestry* 67(4): 230 - 235.

Richards, G.P and Brack, C.L. 2004. A continental biomass stock and stock change estimation approach for Australia. *Australian Forestry* 67(4): 284 - 288.

Richards, G.P and Brack, C.L. 2004. A modelled carbon account for Australia's post-1990 plantation estate. *Australian Forestry* 67(4): 289 - 300.

J.L. Kesteven, J.L., Brack, C.L. and Furby, S.L. 2003. Using remote sensing and a spatial plant productivity model to assess biomass change. In: Advances in Forest Inventory for Sustainable Forest Management and Biodiversity Monitoring. P. Corona, Michael Köhl and Marco Marchetti (Eds). Kluwer Academic Publishers, Dordrecht. p 33 - 56. ISNB 1-4020-1715-4.

Banks, J.C.G. and Brack, C.L. 2003. Canberra's Urban Forest: Evolution and planning for future landscapes. *Urban Forestry & Urban Greening* 1(3): 151 - 160.

Brack, C.L. 2002. Pollution mitigation and carbon sequestration by an urban forest. *Environmental Pollution* 116(1): 195 – 200.

Brack, C.L. and Richards, G.P. 2002. Carbon accounting model for forests in Australia. *Environmental Pollution* 116 (1): 187 - 194.

Selected Student Theses

McElhinny, C. 2005. Quantifying stand structural complexity in woodland and dry sclerophyll forest, south-eastern Australia. (PhD).

Gowae, G. 2005. A Cohort Model for Pometia genus in the lowland tropical rainforests of Papua New Guinea (PhD).

Kemmerer, E. 2005. Optimising sawlog production in even-aged eucalypt stands. (PhD)

Andriyana, W. 2004. Testing the feasibility of centroid and importance sampling for estimating volume of standing trees in a tropical forest context. (Masters by research)

Angombe, S. 2004. Site Form and improving volume estimation of uneven-aged forest stands in northern Namibia. (Masters by research).

Gilbert, M. 2004. Trends in Urban Tree Removal on Leased Land across Canberra, ACT. (Honours)

Soraya, E. 2004. Management models for rattan gardens of Kedang Pahu West Kutai, East Kalimantan, Indonesia. (Masters by research)

Getting into the tree crowns: urban forestry and biomass studies

Dr Geoff Cary

Senior Lecturer
Fire Science

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Career Brief

Geoff graduated with BAppSc (Environmental Biology) (Hons), University of Technology Sydney in 1992 and completed his PhD in ecology at the Research School of Biological Sciences, ANU, in 1998. Since his appointment in 1996, Geoff has been the lecturer in fire science and has also been a lecturer in environmental modelling and coordinator of the first year forestry field trip at various times.

Research, Teaching & Professional Activities

Geoff convenes the second year course *Fire, Flood and Drought*, which covers weather, and the behaviour, prediction and suppression of fires. He convenes the third year course *Fire in the Environment* which deals with fire history, fire ecology, mapping and modelling fire regimes, Aboriginal fire regimes, sensitivity of fire regimes to natural and management factors, integrated risk management and ongoing research from the Bushfire Cooperative Research Centre and ANU Research schools. He also contributes a module on modelling net primary productivity and dynamics of the terrestrial carbon cycle in the third year course *Environmental Biogeography*.

Geoff is a researcher in Project B.1.2 (Managing bushfire risk in a changing world) of the Bushfire CRC. His work with Dr Ross Bradstock (NSW Department of Environment and Conservation), Dr Rod Weber (ADFA/UNSW), Dr Karen King (BF CRC Postdoctoral Fellow), Dr Malcolm Gill (Visiting Fellow, SRES) and Dr Jon Marsden-Smedley (SRES) addresses the effectiveness of a range of approaches to bushfire management for the reduction of risk of unplanned fires and adverse outcomes relating to a range of values.

Prescribed fire for fuel reduction in urban bushland

Geoff co-leads an international group of researchers who are comparing the behaviour of landscape-fire-succession models and are funded by a variety of sources including the US National Centre for Environmental Analysis and Synthesis and the Canadian Forest Service. He is an Associate Editor for the International Journal of Wildland Fire, and a member of the NSW Parks and Wildlife Advisory Council (and the associated subcommittees on Reservation & Conservation Planning and Research & Policy). He also represents The ANU on the Bushfire CRC Stakeholder Advisory Council. Recently, Geoff has been invited to present at fire conferences in the United Kingdom, Japan, China, Canada and Australia.

Selected Publications

Cary, G. J., Keane, R. K., Gardner, R. H., Lavorel, S., Flannigan, M., Davies, I. D., Li, C., Lenihan, J. M., Rupp, T. S. and Mouillot, F. 2006. Comparison of the sensitivity of landscape-fire-succession models to variation in terrain, fuel pattern, climate and weather. *Landscape Ecology* 21: 121-137.

Cary, G.J. 2005. Modelling applications of the Australian Forest Fire Danger Index. *Proceedings of Fifth National Research Institute of Fire and Disaster Symposium*, November, Tokyo.

Cary, G. J. 2005. Research priorities arising from the 2002/2003 bushfire season in south-eastern Australia. *Australian Forestry* 68: 104-111.

Dovers, S., Cary, G. and Lindenmayer, D. 2004. Fire research and policy priorities: insights from the 2003 National fire forum. *The Australian Journal of Emergency Management* 19: 76-84.

Keane, R. E., G. J. Cary, I. D. Davies, M. D. Flannigan, R. H. Gardner, S. Lavorel, J. M. Lenihan, C. Li, and S. T. Rupp. 2004.A classification of landscape fire succession models: spatial simulations of fire and vegetation dynamics. *Ecological Modelling* 179: 3-27.

Cary, G., Lindenmayer, D., Dovers, S. (Eds.) 2003. Australia Burning: Fire Ecology, Policy and Management Issues, 268 pages. CSIRO Publishing, Melbourne. (See also Chapters 8, 12, 36 & 38).

Keane, R.E., Cary, G.J. and Parsons, R. 2003. Using simulation to map fire regimes: An evaluation of approaches, strategies and limitations. *International Journal of Wildland Fire 12, 309-322.*

Cary, G.J. 2002. Importance of a changing climate for fire regimes in Australia. In *Flammable Australia: The Fire Regimes and Biodiversity of a Continent.* (Eds R.A. Bradstock, A.M. Gill, J.E. Williams). Cambridge University Press.

McCarthy, M.A. and Cary, G.J. 2002. Fire regimes of landscapes: models and realities. In *Flammable Australia: The Fire Regimes and Biodiversity of a Continent.* (Eds R.A. Bradstock, A.M. Gill, J.E. Williams). Cambridge University Press.

Selected Student Theses

de Ligt, R. 2005. Patterns in the probability of burning with time-since-fire in the greater Sydney region (Hons).

Kuramotto de Bednarik, C. 2005. Determinants of fire severity in the Cotter River catchment, Canberra region (Hons).

Vivian, L. 2005. The influence of fire on boundaries between sub alpine eucalypt stands (Hons).

Kelly, C. 2004. The effects of fire frequency on the understorey of a subalpine snow gum forest (Hons).

Almeida, A. 2003. Application of a process-based model for predicting and explaining growth in Eucalyptus plantations. (PhD).

King, K. 2003. Simulating the effects of anthropogenic burning on patterns of biodiversity. (PhD).

Dr Bruce Doran

Lecturer
Geographic Information Systems

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Career Brief

Bruce was born in Swaziland and spent much of his childhood in Zimbabwe and Tanzania, returning to complete his final two years of school in Canberra. He studied at SRES from 1996-2004, completing a BSc(REM) and a PhD. After obtaining his PhD, Bruce moved to a different part of the ANU and spent eighteen months as a postdoctoral fellow at the Regulatory Institutions Network (RegNet), within the Research School of Social Sciences (RSSS).

Research, Teaching & Professional Activities

My initial GIS-based research focused on wildlife management issues. My honours project involved a spatio-temporal investigation of car-kangaroo collisions in the Australian Capital Territory. When undertaking a PhD, I adapted some of the analytical techniques used in my honours research to look into spatio-temporal aspects of the fear of crime in Wollongong, NSW. The focus of the thesis was to develop a GIS-based analytical framework to look at collective responses to fear of crime in the Central Business District of Wollongong. The information resulting from the spatial analysis of fear of crime, in particular mapping the spatio-temporal distribution of collective avoidance behaviour, provided a means of investigating links between fear of crime, disorder and the actual occurrence of crime. Interpreted in relation to The Broken Windows thesis and other "disorder decline" models, the results gave rise to a range of new insights and strategic management implications for the organisations responsible for addressing the problem. As a postdoctoral fellow, I assisted in developing GIS-based methodologies with which to investigate gambling accessibility. At SRES, I aim to continue developing GIS-based approaches to biophysical and social issues through teaching and research initiatives.

My teaching centres around two GIS courses. "Introduction to Remote Sensing and Geographic Information Systems" provides a theoretical background to the area as well as a practical basis for using GIS to assist in decision making. "Applied Geographic Information Systems" exposes continuing students to a more sophisticated range of applications to investigate biophysical and urban problems.

Selected Publications

Doran, B., McMillen, J. and Marshall, D. A GIS-based investigation of gaming venue catchments Forthcoming, *Transactions in GIS*.

McMillen, J. and Doran, B. 2006. Problem gambling and gaming machine density: Socio-spatial analysis of three Victorian localities, *International Gambling Studies*, Vol. 6(1).

Doran, B. and Cherney, A. 2006. Crime Mapping and CPTED: Measuring Impact and Fear of Crime Outcomes. *The Australian & New Zealand Society of Criminology 19TH Annual Conference Criminology and Human Rights*, 7-9th February, 2006.

Doran, B and Lees, B. 2005. Investigating the spatio-temporal links between disorder, crime, and the fear of crime. *The Professional Geographer*, 57 (1): 1-12.

Doran, B and Lees, B. 2003. Using GIS to investigate spatio-temporal links between disorder, crime and the fear of crime. Presented at: *Graffiti and Disorder*: *Local Government*, *Law Enforcement and Community Responses*. Brisbane, Australia, 18-19 August 2003. http://www.aic.gov.au/conferences/2003-graffiti/doran.html

Olsen, P. and Doran B. 2002. Climatic modelling of the Australian distribution of the grass owl *Tyto capensis*: is there an inland population? *Wildlife Research*, 29: 117-125.

Doran, B and Lees, B. 2000. Modelling the ecology of fear: an analysis of car-kangaroo collisions in an urban area, paper presented at the *4th International Conference on Integrating GIS and Environmental Modeling* (GIS/EM4): Problems, Prospects and Research Needs. Banff, Alberta, Canada, September 2 - 8, 2000.

This photograph was taken during field work to collect information on the spatial distribution of crime and disorder. The area, part of the Central Business District of Wollongong, later proved to be a hotspot in terms of both fear of crime and the actual occurrence of crime.

Mr David Dumaresq

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Career Brief

David studied physics and maths at the University of Melbourne before moving to philosophy and social theory at the University of Queensland graduating in 1973. He then spent six years in the Philosophy Department in the Research School of Social Sciences here at ANU working on environmental philosophy, ethics, philosophy of science and social theory. During this time he also took up organic agriculture and the practical application of sustainable production systems. During the 1980s he had a range of part-time teaching positions in the Human Sciences program at ANU while also developing and operating commercial organic farms. In 1986 he completed the first international short course on Agroecology, at the University of California, Berkeley and Santa Cruz campuses. From 1987-90 he was a member of the National Executive of the National Association for Sustainable Agriculture, Australia. In 1987 he took up a part-time lectureship in the Human Sciences Program to teach agroecology and sustainable systems. In 1991 he took up a full-time academic position in the Human Ecology Program. He has been Program convenor since 1992. He is actively involved with a range of research and extension projects with farmers and with the wider organic agriculture industry.

Research, Teaching & Professional Activities

My research and teaching is based around three main areas.

Investigating sustainable systems, including whole farm systems and measuring environmental, economic and social impacts, in particular the sustainability of alternative management practices, especially organic farming. Within farming systems I am researching particular agroecological interactions between farming operations, plant growth and soil ecological function. I am completing a 10 year project comparing the sustainability of organic and conventional wheat farming in Australia. Across wider agricultural systems operations I am investigating farmer's ecological behaviour and its relationship to the development of regulatory frameworks for national and international sustainable agriculture.

Within urban systems I am involved in the application of sustainability criteria for planning and construction of human scale communities.

I am developing the role of transdisciplinary studies in environmental research and teaching. This involves collaboration with graduate students in the investigation of the foundations and methods of interdisciplinary science, the development of transdisciplinary methodologies and their application to postnormal science and the development of policy. These studies include the development of human ecology as an approach to understanding social and ecological linkages.

Thirdly I have maintained a strong interest in environmental philosophy, in particular in the ethics of eating including the relationship between ecologically and ethically sound consumption. Other ethical issues of concern include the development of transgenics and the ownership of life.

Selected Publications

Dumaresq, D & Greene, R. 2001 *Soil Structure, Fauna and Phosphorus in Sustainable Cropping Systems*. RIRDC 01/130. 44p

Derrick, J.W. & Dumaresq, D. 1999 'Soil chemical properties under organic and conventional management in southern new South Wales' *Aust. J. Soil Res.*, 37, 1047-55.

Dumaresq, D., Greene, R. & van Kerkhoff, L. (eds) 1997 *Organic Agriculture in Australia*. RIRDC 97/14. 220p.

Dumaresq, D. 1997 'Industry Profile' in Dumaresq, D., Greene, R. & van Kerkhoff, L. (eds) 1997 *Organic Agriculture in Australia*. RIRDC 97/14: 1-4.

Dumaresq, D. & Greene, R. 1997 'Review of the Organic Industry', in Dumaresq, D., Greene, R. & van Kerkhoff, L. (eds) 1997 *Organic Agriculture in Australia*. RIRDC 97/14: 95-109.

Dumaresq, D. & Greene, R. 1997 *From Farmer to Consumer: the Future of Organic Agriculture in Australia*. RIRDC 97/13. 40p

Dann, P., Derrick, J., Dumaresq, D. & Ryan, M. 1996 'The response to superphosphate and reactive phosphate rock by organic and conventionally grown wheat', *Aust. J. Experimental Agriculture*, 36: 71-78. (C1)

Carruthers, G. & Dumaresq, D. 1994 'A Controllable and Consistent Method for the Extraction of Soil Fauna', in Pankhurst, C. E. *et al* (eds) *Soil Biota: Management in Sustainable Farming Systems*, CSIRO. pp 103-5.

Ryan, M., Chilvers, G. & Dumaresq, D. 1994 'Colonisation of wheat by VA-mycorrhizal fungi was found to be higher on a farm managed in an organic manner than on a conventional neighbour', *Plant and Soil* 160:33-40.

Dr Robert Dyball

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Career Brief

Robert grew up in London, England escaping to Australia in 1981. In Sydney he worked for the NSW Tourism Commission and completed first year Philosophy and Anthropology at the University of Sydney. In 1994 he transferred to Canberra and the ANU, majoring in Philosophy and Human Ecology and graduating with Honours in Human Ecology in 1998. Robert obtained his PhD at the Centre for Resource and Environmental Studies (CRES), whilst lecturing in the Human Ecology program in SRES. His PhD was titled A Critical Analysis of Human Ecology, which involved the application of dynamic systems thinking to the conceptual structure of Human Ecology to create a powerful means of understanding the characteristic changes in human-ecological situations. Robert continues to lecture in the Human Ecology Program. He lectures in Human Ecology, Urban Ecology, Sustainable Systems and Ecology and Social Change.

Research, Teaching & Professional Activities

Current research is on furthering the application of dynamic systems thinking in Human Ecology and in understanding socio-biophysical interactions more generally. Much of this work involves collaboration with Dr Barry Newell from the Faculty of Engineering and Information Technology and with various colleagues in CRES.

Robert is on the board of the international Society for Human Ecology

Selected Publications

Dyball, Robert, Brown, Valerie A., and Keen, Meg (forthcoming, 2006) Five Strands of Social Learning, in *Social Learning*: *Towards a More Sustainable World*: *Principles*, *Perspectives and Praxis* Wals, Arjen (ed), Wageningen, Netherlands.

Dyball, Robert and Carpenter, David 2006. Human Ecology and Education for Sustainability, in *Sustainability in the Australasian University Context*, Carpenter, David and Filo, Walter, Frankfurt, Peter Lang.

Dyball, Robert 2005. Understanding Obesogenic Environments from the Perspective of Human Ecology, in *Proceedings of the 2nd State of Australian Cities Conference*, Brisbane, currently published as CD.

Keen, Meg, Brown, Valerie A., Dyball, Robert (eds) 2005. *Social Learning in Environmental Management*: *Towards a Sustainable Future*, London, Earthscan

Sustainable urban development: O'Connor wetlands

Dr John Field

Science Faculty Student Adviser,
Resource and Environmental Management Program Convenor

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Earth Sciences, Farm Forestry, Soil Formation and Management, Biota and Regolith / Soils, Regolith and Landscape Evolution, Sustainable Land Management

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Career Brief

I grew up in Sydney and was educated at Sydney Boys High, and then the UNSW where I studied pedology, geomorphology and geology, completing a 4 year concurrent Honours in Science in 1973. I moved to UNE at Armidale and wrote a PhD on the hydro-bio-geochemistry of small rural catchments. After 6 years' teaching in the Faculty of Natural Resources at UNE, I joined CRA (now RTZ) Exploration in Canberra as an in-house geomorphologist / consultant in their Research Group. In 1986, I joined the then ANU Forestry Department to teach soils to forestry and resource management students. I own and manage a grazing property on which I am practising what I preach by planting trees to demonstrate the integration and viability of agroforestry and farm forestry while maintaining successful cattle, sheep and goat enterprises. I continue to act as a consultant and advisor to the landcare, agricultural, forestry, mining and land development industries. I am also very interested in student services at ANU and advise students on degrees, courses and careers as student advisor to the School.

Research, Teaching & Professional Activities

Soils and landscapes, and any aspect of their formation, evolution and management is a fair summary of my research interests. In this context, I was a founding member of CARS (Centre for Australian Regolith Studies) and then CRC LEME Mk I and Mk II (Landscape Environment and Mineral Exploration) and continue to work with them in soils, regolith and landscape evolution research and applications.

My fundamental interest in agriculture and forestry is the critical relationship that exists between plants (trees) and soil - the ways in which soil controls the growth of plants, but also the effects that trees have on the formation and evolution of soils and regolith. Other biotic factors are also important to the formation and evolution of soils, regolith and landscapes and these are also the subjects of my research and that of the postgraduates I supervise.

I have a continuing interest in multipurpose and sustainable utilisation of trees in agricultural and forest land management, planning and development. To this end I lead a major RIRDC funded project on "The Management of Privately Owned Dry Sclerophyll Forests". I am also interested in the "intangible values" of privately owned forestry and farm forestry including environmental services, capital value of land and aesthetic values.

Courses I coordinate, or in which I teach, include: Global Change, Australian Soils and Vegetation, Agroecology and Soil Management, Regolith, Soil Resources, Land and Catchment Management and Farm Forestry. Each of these courses is also offered at the graduate level and some are offered in professional, short course and in web based format.

Selected Publications

Newham, L., Buller, C., Barnett, P. and Field, J.B. 2001. *Land-use change assessment tools*. Report to Environment ACT, Canberra

Schirmer, J. & J. Field, 2000. *The Cost of Revegetation*. Final Report. ANU Forestry and Greening Australia. Environment Australia, Canberra.

Field, J.B. and J.C.G. Banks. 1998. Effects of Silvicultural Treatments on Growth Rates of Trees and Diversity of Understorey in a Private Dry Sclerophyll Forest, Southern Tablelands, NSW. *Practising Forestry Today*, 18th Biennial IFA Conference, Hobart.

Field, J.B. and G. R. Anderson, 2003. Biological Agents in Regolith Processes: Case study on the Southern Tablelands, NSW.CRC LEME Conference, Canberra, November

Field, J.B. 2004. Geomorphology and the Biota. ANZGG Conference, Mt Buffalo, Victoria, February.

Selected Student Theses

Walker, M.J. 2004. A Property Valuation Framework for the Southern Tablelands. Hons thesis, SRES, ANU, Canberra

King, C.A. 2002. Evaluating the tangible and intangible values of privately owned dry sclerophyll forest, Southern Tablelands, New South Wales. Hons thesis, SRES, ANU, Canberra

Barnett, P. 2000. Assessing the degradation of function in ecosystems affected by dryland salinity. Hons thesis, Dept Forestry, ANU, Canberra

Otsub, M. 2000. The effects of farm forestry on public roads within the southern tablelands of New South Wales. Hons thesis, Dept Forestry, ANU, Canberra.

Webb, R. 2000. Commercial native species selection for farm forestry on the southern tablelands of New South Wales. Hons thesis, Dept Forestry, ANU, Canberra.

Scown, J. 1999. The influence of livestock dung on earthworm distribution. Hons thesis, Dept Forestry, ANU, Canberra.

McIntosh, C. 1999. Rock weathering, soil formation models and the implications for mineral exploration at Boorowa, NSW. Hons thesis, Dept Forestry, ANU, Canberra

O'Grady, C.M. 1999. Community participation in NSW local government land use policy development processess: Implications for farm forestry. Hons thesis, Dept Forestry, ANU, Canberra.

Dr Richard Greene

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Soil and Land Management

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Career Brief

Richard grew up in Perth, Western Australia, with an architect father, and was a keen member of the army reserve and swimmer at Perth's beaches during his university studies. After completing a BSc (with honours in Physical and Inorganic Chemistry) in 1970 from the University of Western Australia, Richard undertook a PhD in Soil Science from 1971-1975, also at the University of Western Australia. He then joined the Victorian Department of Agriculture, and from 1975 to 1985 worked as a soils research officer at the Irrigation Research Institute, Tatura. Then from 1985 to 1993, he worked as a Senior Research Scientist in the CSIRO Division of Wildlife and Ecology, firstly at Deniliquin, NSW, and later in Canberra, ACT. In 1993 he joined the Australian National University as a Lecturer in Soil and Land Management in the School of Resources, Environment and Society.

Research, Teaching & Professional Activities

Research and consulting experience includes:

Rehabilitation of degraded lands: as a Senior Research Scientist with the CSIRO Division of Sustainable Ecosystems, responsible for supervising investigations into methods of rehabilitating degraded rangelands, and later with the ANU involved with evaluation of rehabilitation techniques used to prevent erosion in alpine and sub-alpine areas.

Development of sustainable cropping enterprises: examples include: (i) potato production in high rainfall areas, (ii) cotton production under irrigation in semi-arid areas, and (iii) dryland cereal production under conventional and organic systems of agriculture.

Minesite rehabilitation: at Woodlawn mine co-supervision of research projects investigating (i) methods to stabilise the rock dump, and (ii) effects of acid mine drainage on bioreactors.

Research on aeolian dust implications: as a member of the Cooperative Research Centre for Landscape Environments and Mineral Exploration (CRCLEME), responsible for investigating how aeolian dust accessions can (i) be detrimental to mineral exploration by masking underlying ore deposits, and (ii) contribute to environmental problems of erosion and salinity.

Carbon sequestration: with other staff from the CRC for Greenhouse Accounting, supervising two PhD students researching the effects of land management on carbon sequestration.

Other Experience

- Consultancies with TRANSGRID on erosion evaluation and EMBRAPA (Brazilian federal research organisation) on management of hardsetting soils.

- Author of approximately 50 refereed publications in clay colloid chemistry, amelioration of soil structure, rehabilitation of degraded lands, and the development of sustainable cropping systems.

- Invited keynote speaker at international conferences on vegetation patterning, erosion processes and management of hardsetting soils.

- Currently federal president Australian Association of Natural Resource Management and member of the McKell Medal Committee for Landcare.

- Funding from competitive research grants from the NSCP, RIRDC, HRDC, ARC.

My current research supervision includes seven PhDs and three honours students. I also lecture in four undergraduate courses in soil/land/regolith management.

Selected Publications

Butterworth R., C.J. Wilson, C.J., Herron, N.F., Cunningham, R.B., and Greene, R.S.B. (2000). Geomorphic controls on the physical and hydrologic properties of soils in a confined stream valley in NSW Australia. *Earth Surface Processes and Landforms* 25, 1161-1179.

Greene, R.S.B., Valentin, C. and Esteves, M. (2001). Runoff and erosion processes. In *Banded Vegetation Patterning in Arid and Semi-arid Environment-Ecological Processes and Consequences for Management.* (Eds. C. Valentin, D. Tongway, J. Seghieri and J.M. d'Herbes), Springer-Verlag. *Ecological Studies* 149. (pp. 52-76).

Greene, R.S.B., Gatehouse, R., Scott, K.M., and Chen, X.Y. (2001). Symposium report: Aeolian dust-implications for Australian mineral exploration and environmental management. *Australian Journal of Soil Research*, 39, 1-6.

Valzano,F.P., Murphy, B. W. and Greene,R.S.B. (2001). The long-term effects of lime (CaCO3), gypsum (CaSO4.2H2O), and tillage on the physical and chemical properties of a sodic red brown earth. *Australian Journal of Soil Research*, 39, 1307-1331.

Valzano, F.P., Greene, R.S.B., Murphy, B.W., Rengasamy, P., and Jawal, S.D. (2001) Effects of gypsum and stubble management on the chemical and physical properties of a sodic grey vertosol in Western Victoria *Australian Journal of Soil Research*, 39, 1333-1347.

Greene, R.S.B. (2001). Hardsetting soils. In: *The Encyclopedia of Soil Science.* (Ed. R.Lal). Marcel Dekker, Inc.

Greene, R.S.B., Eggleton, R.A. and Rengasamy, P (2002). Relationships between clay mineralogy and hardsetting properties of soils in the Carnarvon Horticultural District of Western Australia. *Applied Clay Science* , 20, 211-223.

Johnston, S.W. Greene, R.S.B., Banks, J.C.G., and Good, R.B. (2003) Function and sustainability of Australian alpine ecosystems: studies in the tall alpine herbfield community, Kosciuszko National Park, NSW, Australia. In *Ecological and Earth Sciences in Mountain Areas* (Eds L. Taylor, K. Martin, D. Hik, and A. Ryall).226-234.

Mays, M.D., Nettleton, W.D., Greene, R.S.B., and Mason, J.A. (2003). Dispersibility of glacial loess in particle size analysis, USA. *Australian Journal of Soil Research*, 41, 229-244.

Mason, J.A., Jacobs, P.M., Greene, R.S.B., and Nettleton, W.D. (2003). Sedimentary aggregates in the Peoria loess of Nebraska, U.S.A. *Catena*, 53, 377-397.

Little, S.A., Hocking, P.J., and Greene, R.S.B. (2004). A preliminary study of the role of cover crops in improving soil fertility and yield for potato production. *Communications in Soil Science and Plant Nutrition.* 35, 471-494.

Greene, R.S.B., and Hairsine, P. (2004). Elementary processes of soil-water interaction and thresholds in soil surface dynamics: a review. *Earth Surface Processes and Landforms* Special Issue. 'Soil Surface Characteristics: dynamics and impact on soil erosion' (Eds Auzet A.-V., Poesen J., Valentin C), 29, 1077-1091.

Selected Student Theses

Tate, S.E. (2003). Characterisation of aeolian materials in the Girilambone Region, north-western Lachlan Foldbelt, NSW. (ANU honours thesis, unpublished).

Webb, J. (2003). The role of shrink-swell soils: an investigation of the Fowlers Gap patterned ground. (ANU honours thesis, unpublished).

Professor Neil Gunningham

Environment Regulation, Management and Policy

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Career Brief

Neil Gunningham obtained the degrees of LLB (Hons) and MA (Criminology) from the University of Sheffield, UK, and is a Barrister and Solicitor (ACT). He also holds a PhD from the ANU. Although initially trained in law, his subsequent post-graduate work was in interdisciplinary social science, and for the last ten years he has applied that training principally in the area of environment, with a focus on regulation. He joined SRES in January 2002. Previously he was Foundation Director of the Australian Centre for Environmental Law at the ANU, Visiting and Senior Fulbright Scholar at the Center for the Study of Law and Society, University of California, Berkeley, and Visiting Fellow at the Centre for the Analysis of Risk and Regulation at the London School of Economics. He is also a recent consultant to the Organisation for Economic Cooperation and Development (OECD), and to various environmental regulatory agencies in Australia.

Research, Teaching & Professional Activities

My research and teaching interests focus on environmental regulation, management and policy. One strand of my research has been concerned to identify the contribution that broader, innovative forms of regulation can make to environmental law. This includes the potential roles of community participation, information based strategies, environmental partnerships and various forms of co-regulation. I have also sought to explain the interrelation between such mechanisms; and to identify the comparative advantage of different instruments in different institutional, economic and social contexts and to argue the case for developing an optimal regulatory mix.

Another research agenda is to explain why some business enterprises do far more to protect the environment than others, and to understand how regulation could best be designed to address such variability. For example, my work on the pulp and paper industry internationally suggests that improvements in environmental performance over time were associated with increasingly stringent demands from legal and social actors but that remaining variation is associated with 'corporate environmental management style' measured in terms of corporate attitudes, commitments and practices. This raises questions about how and why corporate environmental management styles arise, how they can be facilitated or encouraged by governments, regulators, environmental advocacy organisations or others, and about whether, and under what circumstances, such efforts are likely to succeed.

Most recently, I and my colleagues researched the effectiveness of current regulatory, quasi-regulatory and other policy strategies for water quality management in urban catchments (including total/integrated catchment management), with a focus on the Swan-Canning river system in Western Australia, and under a current ARC Linkages Project in collaboration with the Victorian Environment Protection Authority, I am taking this a step further by examining collaborative decision-making mechanisms across a range of institutions.

Selected Publications

Books:

Gunningham, N Kagan R and Thornton, D 2003. *Shades of Green: Business, Regulation and Environment*, Stanford University Press, USA.

Gunningham, N and Sinclair D 2002. *Leaders and Laggards: Next Generation Environmental Regulation*, Greenleaf, UK.

Gunningham, N. and Johnstone, R. 1999. *Regulating Workplace Safety: Systems and Sanctions*, Oxford University Press, UK.

Gunningham, N. & Grabosky, P. 1998. *Smart Regulation: Designing Environmental Regulation*, Oxford University Press, UK.

Articles:

Gunningham and Sinclair Policy Instrument Choice and Diffuse Source Pollution 2005. *Journal of Environmental Law*, Vol 17, No 1, 51-81;

Gunningham, Thornton, Kagan, Motivating Management: Corporate Compliance in Environmental Protection *Law and Policy*, Vol 27 No 2, April 2005; 89-316;

Gunningham, Kagan, & Thornton 2004. Social License and Environmental Protection: Why Businesses Go Beyond Compliance. *Law and Social Inquiry* 29: 307-341.

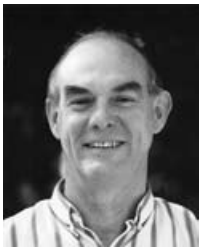
Gunningham and Sinclair 2004. Curbing Non-Point Source Pollution: Lessons from the Swan-Canning *Environment and Planning Law Journal*, 21: 181-199.

Gunningham, 2003. Voluntary and Negotiated Agreements in Agriculture: Towards a Partnership Approach to Resource Management *Australasian Journal of Natural Resources Law and Policy* vol 8. No 1, 1-28.

Gunningham, 2002. Regulating Small and Medium Sized Enterprises *Journal of Environmental Law*, Vol 14 (1), pp1-32,

Gunningham N. & Young, M. 1997. Mixing Instruments and Institutional Arrangements for Optimal Biodiversity Conservation in *Investing In Biological Diversity*, OECD, Paris, 1997, 141-165.

Mr Ken Johnson



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Career Brief

Ken studied geography and economics at the University of Queensland before moving to a research-teaching position at the University of Glasgow in the Department of Social and Economic Research. During this time his interests focussed on the economics and location of distribution, first of retailing and then wholesaling and intermediate warehousing. As transport systems changed the importance of these activities became paramount. On return to Australia and the Urban Research Unit of the ANU the knowledge gained was extended to research into the processes of urban development, with a particular focus on Melbourne. In this work interests of the research group ranged from the policy and planning of public authorities to processes of residential selection and property markets. Since joining the Department of Geography in 1972 Ken has taught in a wide range of courses from urban geography to the geography of Australia, and, more recently extended to longer term variation in climate as seen in the instrumental record.

Research, Teaching & Professional Activities

Over this wide ranging career my interests have regularly returned to the issues of policy and planning. This involves the institutions and instruments by which our society organises itself. Tracing the changes of policy and planning in both urban and rural areas from the 1950s to the deregulated days of the turn of the century is fascinating. Seeking to interpret and explain the changes for people and the landscapes of the places where we live is a continuing challenge.

Teaching and research have come together from a deep interest in data analysis. Creating information from data has always posed problems and the development of analytical systems has extended the frontiers of teaching and research. My teaching-research program deals with temporal and spatial data. One of the greatest problems facing data analysis is understanding environmental change, and climate in particular. The record is complex and widely applied techniques inflexible and the outcomes not "user friendly," for the wider community. Developing ways of teaching the nonlinear and nonparametric techniques of the 1990s and researching the information the records contain has been a focus of my attention. The challenge of teaching the techniques and the interpretation of the results led to a deep interest in the nature of human intelligence and its development for these ends.

Selected Publications

Johnson, K.M. 1994. Creating place and landscape. Chapter 3 in Stephen Dovers, *Australian environmental history*. Oxford University Press, Melbourne.

Johnson, K.M. 1992. *The AUSMAP atlas of Australia*, Cambridge University Press, Melbourne.

Johnson, K.M. 1991. The long-term variation of seasonal rainfall in the Darling basin. Proceedings of the 2nd Australian conference on agricultural meteorology.

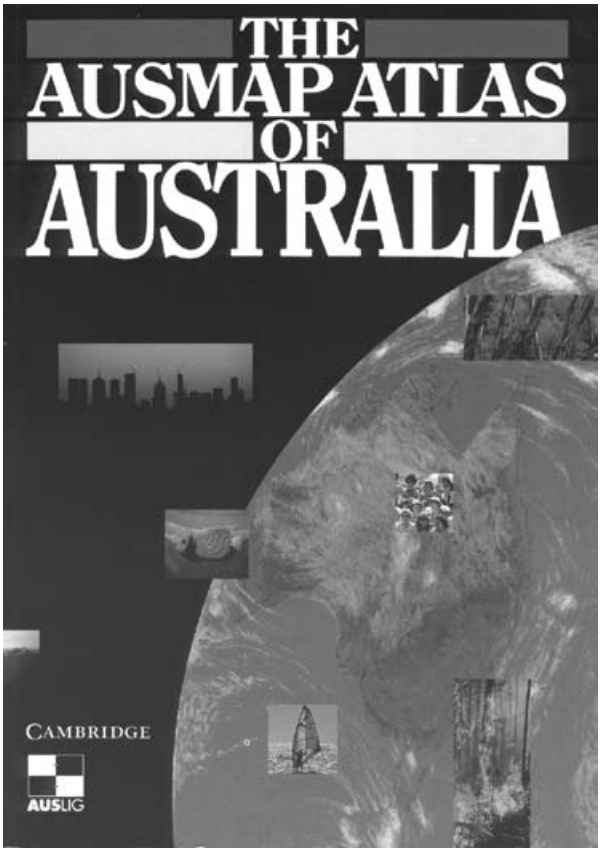
Johnson K.M. and H.C. Garnett. 1970. *The economics of containerisation*. Allen and Unwin, London

Selected Student Theses

Lloyd, A. 1999. Community and environment in the Burra valley of NSW. Honours thesis, Department of Geography, ANU.

Quinn, M.J. 1995. Possessing the west; the public management of the Western Division of NSW. PhD thesis, Australian National University

Lane, R. 1995. Local environmental knowledge and perspectives on change; a case study of the Tumut district. MA thesis, Australian National University



Professor Peter Kanowski

Head of School

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Career Brief

Peter Kanowski has been Head of the School of Resources, Environment and Society since it was established in 2001. Peter was appointed Professor of Forestry at ANU in 1995, and was Head of the ANU Department of Forestry from 1996 -2001. He was Co- Convenor of the ANU Institute for Environment in 2004, and has been Deputy Director since 2005. In 2003/4, Peter was a member of the panel conducting the Council of Australian Governments' National Inquiry into Bushfires. He was a member of the Steering Committee for the ACT's post-bushfire Non-Urban Land Use Study in 2003, a member of the ACT International Arboretum Jury and then Interim Board in 2004-6, and was a member of the ACT Water Supply Catchment Management Advisory Committee in 2005.

Peter grew up in country Queensland, with a forester father, schoolteacher mother and six siblings - all helpful background for a forestry academic with administrative responsibilities. He was Schlich Medallist at the ANU Department of Forestry and a Rhodes Scholar at Oxford University; his honours and doctoral work were both in forest genetics. Peter worked as both a forest and a research program manager with the Queensland Department of Forestry, before moving to Oxford University's Forestry Institute in 1988, where he lectured in forest policy and forest genetics.

Since returning to Australia in 1995, Peter has chaired or co-facilitated a number of community engagement processes about forest conservation and management, including the Southern Regional Forest Forum and the NSW Western Regional Assessment community fora. He has continued to work internationally, in forestry education and in intergovernmental forest policy processes.

Research, Teaching & Professional Activities

My research and teaching interests and activities cover both forest and environmental policy, and forest genetics. My work in policy addresses a range of topics, including plantation and farm forestry, forest conservation and management, and forest policy processes. In association with colleagues in Canberra and elsewhere, I have undertaken reviews of each of these topics, and attempted to transfer ideas into practice by working with partners in government, industry and non-government and community organisations.

My research in forest genetics began with Honours and Doctoral work in quantitative genetics and its implications for tree breeding strategies. In association with colleagues in Oxford, my interests expanded to cover forest population and conservation genetics; I have written both specific and review papers in each of these topics. As with my work in forest policy, my principal concern is in transferring knowledge and ideas into practice.

Some of my work in forest policy is now part of the research program of the Cooperative Research Centre for Forestry, for which I also chair the education program. I manage two ACIAR-sponsored research projects: one on hybrid eucalypts for marginal farmlands in Australia and South Africa, in collaboration with Dr Dominic Kain from SRES and colleagues from CSIRO, State Forests of NSW, South Africa's CSIR and the University of Stellenbosch; the second, with Hartmut Hozknecht and colleagues at ANU and in PNG, is addressing constraints to incorporating commercial tree growing into PNG farming systems. Other work has been conducted as commissioned studies for agencies such as the Australian Departments of Environment & Heritage and of Agriculture, Fisheries and Forestry, the International Institute for Environment and Development, and the World Bank.

My teaching reflects these diverse interests: I coordinate or contribute to undergraduate and graduate courses in Australia's environment, forest and environmental policy, and forest genetics.

Selected Publications

Kanowski, PJ, Holzknecht, H and Perley, C. 2005. Oceania – islands of contrasts. Chapter 17 in: G Mery *et al* (Eds). *Forests in the global balance: changing paradigms*. IUFRO, Vienna. 280-302.

Kanowski, PJ. 2005. *Intensively managed planted forests*. Paper for *The Forests Dialogue*. http://research.yale.edu/gisf/tfd/impf%20scoping.html

Burley, J and Kanowski, PJ. 2005. Breeding strategies for temperate hardwoods. *Forestry* 78: 199-208.

Schirmer, J and PJ Kanowski. 2005. A mixed economy Commonwealth of States: Australia. Chapter 5 in: M Garforth and J Mayers (Eds). *Plantations, privatisation, poverty and power. Changing ownership and management of State forests*. Earthscan. 101-125.

Ellis, S., PJ Kanowski and R Whelan. 2004. *National Inquiry on Bushfire Mitigation and Management*. COAG, Canberra. www.coagbushfireinquiry.gov.au

Kanowski, PJ and Borralho, NMG. 2004. Economic returns from tree breeding. In: J Burley *et al* (Eds). *Encyclopedia of Forest Sciences*. Elsevier.

Kanowski, PJ. 2003. Multiple values, partial use and restrained yield: where to from here for Australian forestry, 30 years on? In: J Dargavel (Ed). *Win lose or draw: the fight for the forests*. http://cres.anu.edu.au/fffweb

Kanowski, PJ. 2003. Challenges to enhancing the contributions of planted forests to sustainable forest management. Paper to UNFF Experts Meeting – *Planted Forests*. http://www.maf.govt.nz/mafnet/unff-planted-forestry-meeting/index.htm

Kanowski, PJ. 2001. Plantation forestry at the millennium. Chapter 8 in: GM Woodwell (Ed). *Forests in a full world*. Yale. 97-109.

Kanowski, PJ. 2001. Forestry education in a changing landscape. *International Forestry Review* 3: 175-183.

Williams, J. et al. 2001. *The contribution of mid- to low-rainfall forestry and agroforestry to greenhouse and natural resource management outcomes*. AGO and MDBC. 72 p. http://www.greenhouse.gov.au/land/gh_land/pubs/abs_lowrainfall.html

Kanowski, PJ. and Buchy, M. 2001. Advances in research and development - social sciences: context, critique and evaluation. In: M Connell et al (Eds). *Intensive management of regrowth forest for wood production in Australia*. CSIRO. 78-84.

Kanowski, PJ. 2000. Politics, policies and the conservation of genetic diversity. In: AM Young, DH Boshier and TJ. Boyle. (Eds). *Forest conservation genetics: principles and practice*. 275-287.

Kanowski, PJ., Sinclair, D. and Freeman, B. 2000. Establishing comparability and equivalence amongst forest management certification schemes. AFFA. 46 p.

Dargavel, J., Proctor, W and P. Kanowski. 2000. Conflict and agreement in Australian forests. Ch. 6 in: L. Tacconi (Ed.). *Biodiversity and ecological economics*. Earthscan. 101-115.

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Kanowski, PJ. and Boshier, D.H. 1997. Conserving the genetic resources of trees in situ. In: N Maxted et al (Eds). *Plant conservation: the in situ approach*. Chapman and Hall. Ch 13.

Dr Janette Lindesay

SRES Honours Coordinator

Senior Lecturer
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Career Brief

Janette grew up in Swaziland and South Africa, and obtained her Honours degree, Postgraduate Teaching Diploma and Doctorate from the University of the Witwatersrand in Johannesburg. All her graduate work was in the field of statistical and dynamical climatology. She worked as a research scientist in the Climatology Research Group at Wits, while lecturing in climatology at the same university, and became Deputy Director of the group in 1991. She was instrumental in developing and coordinating the multi-national, multi-disciplinary SAFARI-92 biomass burning research program in southern Africa in 1992.

Janette came to the ANU in 1993 to teach climatology in the Department of Geography. She was seconded to the Cooperative Research Centre for Greenhouse Accounting for the period 2001-2003, in the position of Education Manager. She retains that administrative position, and is now also undertaking teaching and research in atmospheric science and climatology in SRES.

Research, Teaching & Professional Activities

My principal research interests are in climatic variability during the period of instrumental record, characterising the nature and degree of variability and also investigating climate impacts. Much of my research has focussed on the El Niño Southern Oscillation phenomenon; I am currently studying low-frequency fluctuations in ENSO. I am also interested in applications of Global Climate Models in the study of climatic variation and its impacts.

My experience in multi-disciplinary biomass burning research in southern Africa and my interest in climate variability impacts have led to my current involvement in studying climatological aspects of bushfires in Australia. Another area of research interest is thermo-topographic boundary layer effects. My interest in this area began with a study of sea-breeze regimes in the Namib Desert, south-western Africa; a recent research project investigated damaging advective frost events and their impact on viticulture in the Canberra region. I also contribute to informing the policy debate in the area of drought.

In my undergraduate courses in atmospheric science and climatology, and in my contributions to other undergraduate courses, I aim to develop students' understanding of atmospheric processes, weather and climate, and their impacts and significance for the Earth system. I have a particular interest in Greenhouse science and climate change, and the role and impacts of climatic variability in earth system processes and human affairs. The importance of understanding atmospheric and climatic processes and incorporating that understanding in policy formulation and decision making in natural resource management is a theme in much of my teaching and research.

After coordinating the Geography Honours program for several years I am now SRES Honours Coordinator, and am also active in supervising postgraduate students. At postgraduate level I teach a Masters course on understanding climatic variability and change, and offer an online Masters course on Greenhouse science. In my role as Education Manager in the Cooperative Research Centre for Greenhouse Accounting I have developed and coordinated a number of professional short courses on aspects of carbon accounting.

I have contributed to the ACT Region State of the Environment reporting process for the last 11 years, and served for two years as President of the Canberra branch of the Australian Meteorological and Oceanographic Society. I am a member of three professional meteorological societies, and am on the editorial boards of two international atmospheric science journals.

Selected Publications

Lindesay, J.A. 2004. Climate and drought in the subtropics: the Australian example, in *From Diaster Response to Risk Management*: *Australia's National Drought Policy*, Botteril, L.C. and Wilhite, D.A. (eds), Springer, Dordrecht, pp. 15-36.

Lindesay, J.A. 2003. Climate and drought in Australia, in *Drought in Australia*: *People*, *Policy and Place*, Botterill, L.C. and Fisher, M. (eds), CSIRO Publishing, Melbourne, pp. 21-47.

Lindesay, J.A. 2003. Fire and climate in Australia, in *Australia Burning*: *Fire Ecology*, *Policy and Management Issues*, Cary, G., Lindenmeyer, D. and Dovers, S. (eds), CSIRO Publishing, Melbourne, pp. 32-40.

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Hobbs, J.E., Lindesay, J.A. and Bridgman, H.A. (eds). 1998. *Climates of the Southern Continents*: *Present*, *Past and Future*, John Wiley and Sons, Chichester, 297 pp.

Lindesay, J.A. 1998. Present climates of southern Africa, in *Climates of the Southern Continents*: *Present*, *Past and Future*, Hobbs, J.E., Lindesay, J.A. and Bridgman, H.A. (eds), John Wiley and Sons, Chichester, 161-206.

van Wilgen, B., Andreae, M.O., Goldammer, J.G. and Lindesay, J.A. (eds). 1997. *Fire in southern African Savannas*: *Ecological and Atmospheric Perspectives*, Witwatersrand University Press, Johannesburg, 256pp.

Reason, C.J.C., Allan, R.J. and Lindesay, J.A. 1996. Dynamical response of the oceanic circulation and temperature to interdecadal variability in the surface winds over the Indian Ocean, *Journal of Climate*, 9: 97-114.

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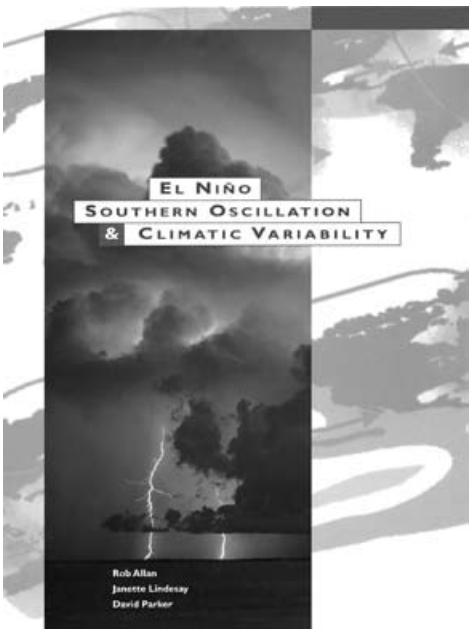

Dr Brendan Mackey

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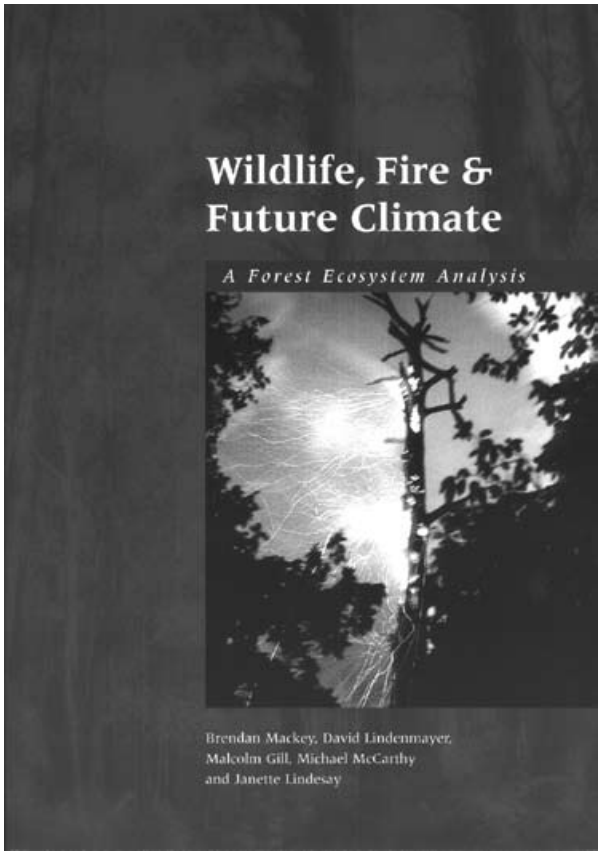
Career Brief

Brendan has a PhD in plant ecology from the Australian National University. He has worked as a research scientist with the CSIRO and the Canadian Forest Service.

Research, Teaching & Professional Activities

Brendan is Director of the ANU *WildCountry* Research and Policy Hub. He is principle Chief Investigator for ARC Linkage research project LP0455163 which is investigating connectivity processes important for conservation assessment and planning, including: continental landscape productivity; dispersive fauna; biodiversity decline in extensive country; and trophic regulation by meso-predators. He is a member of the Earth Charter International Council; co-chairs the IUCN (World Conservation Union) Ethics Specialist Group; and is a member of the *WildCountry* Science Council. Brendan is an Associate Editor for *Environmental Conservation*, an international journal of environmental science published by Cambridge University Press. He teaches the following courses: Introduction to Global Change; Introduction to Greenhouse; Environmental Biogeography and Global Ecology.



Selected Publications

Mackey, B.G., Soulé, M.E., Nix, H.A., Recher, H.F., Lesslie, R.G., Williams, J.E., J Woinarski, C. Z.R., Hobbs, J. and Possingham, H.P. (in press). Towards a scientific framework for the WildCountry project. In. *Key Topics and Perspectives in Landscape Ecology*. Cambridge University Press. Edited by Jianguo Wu and Richard J. Hobbs.

Mackey B.G. and Su W. 2005. Dynamic Landscape Models for Tropical Rainforests. In. *Tropical Rainforests: Past, Present, and Future*. Edited by Eldredge Bermingham, Christopher Dick, and Craig Moritz. The University of Chicago Press, Chicago.

Mackey, B.G. 2004. The Earth Charter and ecological integrity – some policy implications. *WorldViews: environment, culture, religion*: 8(1): 76-92.

Mackey B.G., Lindenmayer D.B., Gill A.M., McCarthy A.M. and Lindesay J.A. 2002. *Wildlife, fire and future climate: a forest ecosystem analysis*. CSIRO Publishing.

Mackey B. G. and Lindenmayer, D.B. 2001. Towards a hierarchical framework for modelling the spatial distribution of animals. *Journal of Biogeography* 28:1147-1166.

Mackey B.G. and Laffan S. 2002. Case studies in GIS and environmental modeling. Chapter 10 In. *Geographic Information Systems and Environmental Modeling*. Edited by Keith C. Clarke, Brad E. Parks and Michael P. Crane. Prentice Hall.

Selected Student Theses

Sabetraftar, Karim 2005. The Hydrological flux of Organic Carbon at the Catchment Scale: a Case Study in the Cotter Catchment, Australia (PhD thesis).

Panghas, Ninna 2003. Ecological restoration of Philippine *Diptocarp* forest (PhD thesis).

Nunan, Donna 2001. Frogs and farm (PhD thesis).

Lesslie, Robert 1997. A Spatial Analysis of Human Interference in Terrestrial Enviornments at Landscape Scales (PhD thesis).

Payne, Karen 1998. Genetic algorithms, remote sensing and vegetation modelling. (PhD thesis).

Nelder, John 1996. Vegetation modelling in Cape York. (PhD thesis).

Dr Mahen S. Mahendrarajah

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Career Brief

As well as being a senior lecturer in the School of Resources Environment and Society, Mahen is also a Research Associate of the Division of Economics of the Research School of Pacific and Asian Studies (RSPAS), ANU. His previous appointments include Research Fellow in Economics, RSPAS, ANU, and Senior Lecturer in Economics at Victoria University of Wellington. His research experience has also included a spell in Sri Lanka. He holds a Masters degree in agricultural development economics and a PhD in economics, both from ANU.

Research, Teaching & Professional Activities

The degradation of natural resources and environment, if unchecked, can be the single most important factor that impinges on the wellbeing of future generations. My research interests over the past few years have been concerned with optimal resource use; resource degradation issues and their mitigation such as land degradation and deforestation; the transfer of village level coconut oil extraction technology invented at the ANU for rural development, mitigation of deforestation and closing the energy cycle in the South Pacific island economies; carbon offset and biomass energy, firewood plantations; off-site nutrient externalities, and environmental accounting and environmental macroeconomics. My teaching includes both undergraduate and graduate courses in economics of forestry and environment.

Recent supervision of graduate student research has covered areas such as economics of multiple use forest management in Victoria, incentives and mechanisms for promoting forest plantations in Australia, economics of reclamation of imperata infested lands in the Philippines, the impact of economic reform on deforestation in Vietnam, bio-energy potential of camphor laurel in NSW, firewood plantation in Nepal, and property rights and incomplete contracts in sustainable community forest management.

Selected Publications

Rasiah, V., Armour, J. D., Yamamoto, T., Mahendrarajah, S., and D. H. Heiner. 2003. Nitrate dynamics in shallow groundwater and the potential for transport to off-site water bodies. *Water, Air, and Soil Pollution* 147:183-202

Wilman, E. and S. Mahendrarajah. 2002. Carbon Offsets. *Land Economics* 78(3):405-416.

Mahendrarajah, S., Jakeman, A.J. and M. J. McAleer. Eds. 1999. *Modelling Change in Integrated Economic and Environmental Systems*, John Wiley & Sons, Chichester.

Etherington, D.M. and S. Mahendrarajah. 1998. *Economic Benefits of Direct Micro Expelling Coconut oil in the South Pacific*. Proc. of the International Cashew and Coconut Conference Topper, T. et al. (eds). Dar es Salaam, BioHybrids International Ltd, Reading. 457-468.

Townsend, P. and S. Mahendrarajah. 1997. The Economics of ***P. radiata*** Farm Forestry. In Bachelard, E.P., Brown, A.G. (eds) *Preparing for the 21st Century*. Proc of the ANZIF Conference 97 Canberra. 277-285.

Thampapillai, D.J. and S. Mahendrarajah. 1997. *Environmental Macroeconomics: Some illustrations with reference to the Indonesian Economy*. Research Report, GSE Publication 9702, Macquarie University, Sydney, 14p.

Mahendrarajah, S., Jakeman, A. J. and P.C. Young. 1996. Water supply in monsoonal Asia: Modelling and predicting small tank storage. *Ecological Modelling* 84: 127-137.

Mahendrarajah, S. 1995. Evolution of Institutions and efficiency in the Management of Common Pool Flux Water Resources. In: Tharun, G., Bautista, M., Calilung, E. and Canillas, D.B. (eds) *Experiences in the Development of Small-Scale Water Resources in Rural Areas*. Carl Duisberg Gesellschaft, South East Asia Program Office, Bangkok. 37-48.

Mahendrarajah, S. and P.G. Warr. 1993. Accounting for Environmental Resources: Land Degradation. In: *Modelling Change in Environmental Systems*. Jakeman, A.J., Beck, M.B. and McAleer, M.J. (eds). John Wiley & Sons, 557- 579.

Mahendrarajah, S., Warr, P.G. and A.J. Jakeman. 1992. Optimal Extraction of Small-Scale Surface Water Storage in Asia. *Water Resources Research*. 28(5):1207-1219.

Natural resources and rural poor

Dr Chris McElhinny

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Career Brief

Chris initially worked as a furniture designer and maker, having studied at the John Makepeace School for Craftsmen in Wood in the UK. From 1983-1991 Chris was lecturer in the Wood Department of the Canberra Institute of Arts. His furniture is held in private and public collections, including the New Parliament House Canberra, for which he designed and made the President of the Senate's personal suite of furniture.

In 1995 Chris changed from a career working with the products of dead trees to one concerned with the sustainable management of whole ecosystems. He was Schlich Medallist at the ANU Department of Forestry in 1998, and was awarded an ANU University Medal for his Honours Degree in Forestry in 1999. He completed a PhD in Resource and Environmental Management at the ANU in 2004. Since July 2005 Chris has held the position of Lecturer in Forest Ecology and Silviculture.

Research, Teaching & Professional Activities

My research focus is the development and application of stand scale biometrics to improve the management of native vegetation. Currently I am collaborating with the Australian Greenhouse Office to model the effects of forest silviculture on nitrogen and carbon cycles in commercially managed native forests. This project will inform the further development of the AGO's FullCAM Carbon Accounting Model.

I am also collaborating with Forestry Tasmania and the Bushfire CRC to develop metrics for quantifying structural complexity in the tall wet sclerophyll forests of south-eastern Tasmania. This work follows from recently completed research in which I proposed and tested a methodology for quantifying stand structural complexity as a basis for informing the on-ground management of dry sclerophyll forests and woodlands. This research contributed to the BioMetric Decision Support Tool, which underpins the NSW Vegetation Conservation Act (2003), and to the development of a user friendly Tool Box for landowners as part of a Joint Venture Agroforestry Program (RIRDC, L&W Australia and FWPRDC) dry sclerophyll forest project.

I have an ongoing interest in research to diversify silvicultural practices in multiple-use forests. I am an active member of the Native Forest Silviculture Research Working Group (RWG#4), a panel of representatives from Commonwealth, State and University forest research agencies, which coordinates silvicultural research priorities. In my own silvicultural research, I have used crown interactions to model stand development as a basis for optimising Group Selection management in spotted gum (*Corymbia maculata*) forests. I have critiqued the silviculture of Tasmanian mixed forest, and have supervised research into silvicultural options for increasing rainforest regeneration in clearfelled coupes. I have contributed to research concerning options for mixed species management in northern NSW hardwood forests. In addition to silvicultural research I have co-authored information sheets for landowners on silvicultural topics such as site preparation, regeneration surveys, uneven-aged management and the maintenance of structural complexity. I have also incorporated stem taper equations into a simple spreadsheet tool to enable landowners to conduct an inventory of their forest as a basis for developing management plans.

My teaching mirrors my research interests, and I convene and contribute to undergraduate courses concerned with vegetation ecology and management at a patch or stand scale.

Selected Publications

McElhinny, C., Gibbons, P., Brack, C., and Bauhus, J. 2006. Fauna-habitat relationships: a basis for identifying key structural attributes in temperate Australian forests and woodlands. Pacific Conservation Biology, In Press.

McElhinny, C., Gibbons, P. and Brack, C. 2006. An objective and quantitative methodology for constructing an index of stand structural complexity, In Review.

Tabor, J., McElhinny, C. and Hickey, J. 2006. Colonisation of clearfelled coupes by rainforest tree species from mixed forest edges, In Review

McElhinny, C., Gibbons, P., Brack, C., and Bauhus, J. 2005. Forest and woodland stand structural complexity: its definition and measurement. Forest Ecology and Management, 218: 1-24.

Bauhus, J., McElhinny, C.M. and Alcorn, P. 2002. Stand structure and tree growth in uneven-aged spotted gum (Corymbia maculata) forests: some implications for management. Forestry 75(4), 451-456.

Bauhus J., McElhinny C.M. and Allen G.M. 2000.The effect of seedtrees on regrowth development in a mixed-species eucalypt forest. Australian Forestry 63, 293-296.

Selected Student Theses

Tabor, J. 2004. Colonisation of clearfelled coupes by rainforest tree species from mixed forest edges. Honours Thesis, School of Resources Environment and Society, ANU

Dr Sandra Berry

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Career Brief

Sandy grew up in Bundanoon, southeast NSW and Toowoomba, southeast Queensland where she obtained an Associate Diploma in Laboratory Techniques from the Darling Downs Institute of Advanced Education. For a decade she worked as a laboratory technician in a range of research institutions. An interest in bushwalking led to a deepening interest in the Australian vegetation and the physiology of plants, and undergraduate studies at Macquarie University.

After completing an Honours degree Sandy came to ANU in 1988 to work as a Technical Officer with the Ecosystem Dynamics Group in the Research School of Biological Sciences. After several years of providing support for field related research she enrolled in a PhD, finally producing her magnum opus: *A study of the relationships between climate, carbon dioxide and the vegetation over the Australian continent at the present and the Last Glacial Maximum* in 2002. This led to a 3 year post-doctoral fellowship at RSBS with the Cooperative Research Centre for Greenhouse Accounting.

Research, Teaching & Professional Activities

My research is supported by an ARC Linkage Grant between ANU and the Wilderness Society through the *WildCountry* project. It is concerned with investigating how vegetation cover and productivity changes over time over the whole of Australia, and the impact that this may be having on animal, and particularly bird, distributions. I am particularly interested in how plants and the vegetation respond to the direct effect on photosynthesis of the increasing concentration of carbon dioxide in the atmosphere, and the consequences of this for the fauna.

I currently serve as the ACT Regional Councillor for the Ecological Society of Australia.

Selected Publications

Berry, S.L., Farquhar, G.D. and Roderick, M.L. 2005. Co-evolution of Climate, Vegetation, Soil and Air, In: *Encyclopedia of Hydrological Sciences*, pp. 177-192, Volume 1: Theory, organisation and scale (eds: Blöschl, G. and Sivapalan, M.). John Wiley and Sons Ltd, Chichester, United Kingdom.

Berry, S.L. and Roderick, M.L., 2005. Tansley Review - Plant water relations and the fibre saturation point. *New Phytologist*, 168, 25-37

Berry, S.L., Roderick, M.L. 2004. Gross primary productivity and transpiration flux of the Australian vegetation from 1788 to 1988 AD: effects of CO2 and land use change. *Global Change Biology* 10, 1884-1898.

Berry, S.L., Roderick, M.L. 2002. CO2 and land use effects on Australian vegetation over the last two centuries. *Australian Journal of Botany* 50, 511-531.

Berry, S.L., Roderick, M.L. 2002. Estimating mixtures of leaf functional types using continental-scale satellite and climatic data. *Global Ecology and Biogeography* 11, 23-40.

Roderick, M.L., Berry, S.L. 2001. Linking wood density, tree growth and environment: a theoretical analysis based on the motion of water. *New Phytologist* 149, 473-485.

Roderick, M.L., Farquhar, G.D., Berry, S.L., Noble, I.R. 2001. On the direct effect of clouds and atmospheric particles on the productivity and structure of the vegetation. *Oecologia* 129, 21-31.

Roderick, M.L., Berry, S.L., Noble, I.R. 2000. A framework for understanding the linkage between environment and vegetation based on the surface area to volume ratio of leaves. *Functional Ecology* 14, 423-437.

Roderick, M.L., Berry, S.L., Noble, I.R. 1999. The relationship between leaf composition and morphology at elevated CO2. *New Phytologist* 143, 63-72.

Roderick, M.L., Berry, S.L., Noble, I.R., Farquhar, G.D. 1999. A theoretical approach to linking the composition and morphology with the function of leaves. *Functional Ecology* 13, 683-695.

Roderick, M.L., Berry, S.L., Saunders, A.R., Noble, I.R. 1999. On the relationship between the composition, morphology and function of leaves. *Functional Ecology* 13, 696-710.

Berry, S.L. and Mulvaney, M. 1995. *An environmental weed survey of the Australian Capital Territory.* A report prepared for the Conservation Council of the South-East Region and Canberra.

Dr Dominic Kain

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Forest Genetics and Tree Breeding

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Career Brief

Dominic completed a BSc (Forestry) with honours at the Australian National University in 1997. His honours research investigated the quantitative genetics of wood characteristics, and early selection, in *Pinus radiata*. His PhD research, at ANU and North Carolina State University, USA, examined the genetics of wood and growth traits in the *Pinus elliottii* x *Pinus caribaea* hybrid, in collaboration with the Queensland Forestry Research Institute. Dominic completed his PhD in early 2003, and was a geneticist with the CRC for Sustainable Production Forestry in Hobart, based at the ANU, until late 2003. He is now a Postdoctoral Fellow supported by the Australian Council for International Agriculture Research (ACIAR).

Research, Teaching & Professional Activities

My research interest is in all aspects of the genetic improvement of trees, with a focus on breeding and selection strategies for inter-specific hybrids, and the genetic improvement of wood quality. Developing breeding objectives, integrating quantitative and molecular genetic selection technologies, and breeding eucalypts that tolerate dry and saline conditions are other topics I am working on collaboratively or developing research proposals to address.

Currently, my main activity is within an ACIAR-funded collaborative research project involving ANU, the CSIRO and its South African equivalent, the CSIR. The project aims to develop high performance eucalypts and eucalypt hybrids for marginal lands in south and eastern South Africa and southeastern Australia. Eucalypt hybrids, for example *E.grandis* x *E. camaldulensis*, often outperform both parental species in environments intermediate between those typical of the parents. My role in the project is to analyse data from eucalypt hybrid trials in South Africa - possibly the most extensive set of eucalypt hybrid trials in the world - to develop knowledge of the genetic mechanisms underlying hybrid performance. We are using this knowledge to develop efficient selection strategies for future improvement of the most promising species combinations.

I also supervise two postgraduate students in tree breeding, contribute to teaching courses in forest genetics at ANU and at the CSIR, South Africa, and present at conferences in the fields of quantitative genetics, wood quality improvement and hybrid breeding.

Selected Publications

Kain, D.P. (2003). Genetic parameters and improvement strategies for the *Pinus elliottii* var. *elliottii* x *Pinus caribaea* var. *hondurensis* hybrid in Queensland, Australia. PhD thesis, Australian National University, 460p.

Shepherd, M., Cross, M., Dieters, M.J., Harding, K., Kain, D. and Henry, R. (2003). Genetics of physical wood properties and early growth in a tropical pine hybrid. *Canadian Journal of Forest Research* 33: 1923-1932.

Kain, D.P., Harding, K.J., Dieters, M.J. and Li, B. (2005). Early selection and rapid field screening for genetic improvement of wood density and spiral grain in pines. Canadian Journal of Forest Research (submitted).

Kain, D., Dieters, M.J., Harding, K.J., and Li, B. (2005). Genetic parameters for wood quality and growth traits in *Pinus elliottii* var. *elliottii*, *P. caribaea* var. *hondurensis*, and their F1 hybrid. Canadian Journal of Forest Research (submitted).

Dr Karen King

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Fire Ecology,
Landscape Simulation Modelling

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Career Brief

In 1991 Karen graduated with a Bachelor of Applied Science in Medical Laboratory Science from the University of Canberra. From 1991-2000 she worked as a Technical Officer with the Developmental Physiology Group at the John Curtin School of Medical Research, ANU. Karen graduated with a Graduate Diploma in Resource and Environmental Science at the ANU in 2000. In February, 2004, she completed a PhD at the ANU titled '*Simulating the effects of anthropogenic burning on patterns of* biodiversity'.

Research, Teaching & Professional Activities

I commenced a Postdoctoral Fellow position with the Bushfire CRC Project B1.2 in February 2004. The objective of this project is to investigate managing bushfire risk to identified values in a changing world. Four Australian study landscapes have been selected for investigation in this project - south west Tasmania, Southern Highlands, Sydney basin, and arid Australia. These represent a diversity of ecosystems and human value systems (eg property, biodiversity, water and air quality). My work involves using computer simulation modelling to explore fire regime dynamics, and to investigate the effects of a range of management options (alternate combinations of prescribed burning and suppression variables) on fire dynamics in these landscapes.

Dr Wendy Merritt

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Career Brief

After completing a Bachelor of Science degree in Natural Resource Management at the University of Western Australia, Wendy Merritt undertook her PhD at the Centre for Resource and Environmental Studies at the Australian National University. Wendy's thesis involved the development and testing of biophysical models for assessing land and water resource management options in rural catchments in northern Thailand. On completing her PhD, she worked for 13 months as a Post Doctoral Fellow at the Department of Forest Resource Management at the University of British Columbia in Vancouver, before travelling around Canada for approximately three months. Research conducted at UBC involved the development of hydrologic models of the Okanagan Basin, a major horticultural and agricultural centre in British Columbia, and application of the models under scenarios of climate change. Wendy has been employed as a Post Doctoral Fellow at SRES since October 2003.

Research, Teaching & Professional Activities

My research interests are in the broad field of resource assessment and modelling, particularly water and forest resources. Currently, I am working on a project funded by the Department of Sustainability and Environment (DSE) in Victoria. The objectives of the research are to review the State-wide Forest Resource Inventory (SFRI) implemented by DSE and to develop approaches for estimating the extent of inaccuracies in the SFRI resource estimates and gauging the sensitivity of scheduled yields to these inaccuracies.

Selected Publications

Cohen, S., Neilsen, D., Smith, S., Neale, T., Taylor, B., Barton, M. Merritt, W.S., Alila, Y., Shepherd, P., McNeill, R., Tansey, J., and Carmichael, J. Learning with local help: expanding the dialogue on climate change and water management in the Okanagan region, British Columbia, Canada. *Climatic Change*, (in press).

Croke, B.F.W., Merritt, W.S., and Jakeman, A.J. 2004. A dynamic model for predicting hydrologic response to land cover changes in gauged and ungauged catchments. *Journal of Hydrology*, 291, 115-131.

Letcher, R. A., Jakeman, A. J., McKee, L. J., Merritt, W.S., Eyre, B. D., and Baginska, B. 1999. *Review of techniques to estimate catchment exports*. Technical Report, NSW EPA.

Letcher, R.A., Croke, B.F.W., Jakeman, A.J., Merritt, W.S., and Perez, P. 2002. IWRAM: an integrated modeling toolbox for considering impacts of development. *Proceedings International Environmental Modelling and Simulation Society* (*iEMSs*) *Conference*, Lugano Switzerland 24-27 June 2002, vol 1, pp. 97-102.

Merritt, W.S., Croke, B.F.W., and Jakeman, A.J. 2001. *Tools for assessing the nutrient and sediment components of water quality: a review*. Prepared for the Sydney Catchment Authority, July 2001.

Merritt, W.S., Letcher, R.A., and Jakeman, A.J. 2003. A review of erosion and sediment transport models. *Environmental Modelling and Software*, 18: 761-799.

Merritt, W.S., Alila, Y., Barton, M., Taylor, B., and Cohen, S. 2003. Exploring impacts of climate change on the hydrology of the Okanagan Basin. *Proceedings of the 56th Canadian Water Resources Association Annual Conference*, 11-13 June, Vancouver, Canada.

Merritt, W.S., Croke, B.F.W., Jakeman, A.J., Perez, P., and Letcher, R.A. 2004. A biophysical toolkit for assessment and management of land and water resources in rural catchments in northern Thailand. *Ecological Modelling*, 171: 279-300.

Merritt, W.S., Croke, B.F.W., and Jakeman, A.J. 2005. Sensitivity testing of a model for exploring water resources utilisation and management options, *Environmental Modelling and Software*, 20, 1013-1030.

Merritt, W.S., and Alila, Y. 2004. Chapter 7. Hydrology. In Cohen, S., Neilsen, D., and Welbourn, R. (eds.) *Expanding the dialogue on climate change and water management in the Okanagan Basin*, *British Columbia*, *Final Report*, 63-88.

Merritt, W.S., Y. Alila, M. Barton, B. Taylor, and S. Cohen. Hydrologic response to scenarios of climate change in the Okanagan Basin, British Columbia, *Journal of Hydrology* (submitted).

Neilsen, D., Koch, W., Merritt, W.S., Frank, G., Smith, S., Alila, Y., Carmichael, J., Neale, T., and Welbourn R. 2004. Risk assessment and vunerability - case studies of water supply and demand. In Cohen, S., Neilsen, D., and Welbourn, R. (eds.) *Expanding the dialogue on climate change and water management in the Okanagan Basin*, *British Columbia*, *Final Report*, 115-135.

Perez, P., Ardlie, N., Kuneepong, P., Dietrich, C., and Merritt, W.S. 2002. CATCHCROP: Modelling crop yield and water demand for an Integrated Catchment Assessment in northern Thailand. *Environmental Modelling and Software*, 17: 251-259.

Dr Jacqueline Schirmer

Research Fellow
Socio-economic impact assessment for resource-dependent industries, participatory resource management, environmental conflict, forest policy, fisheries policy

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Career Brief

Jacki has been undertaking research on social dimensions of natural resource management for seven years. After completing undergraduate degrees in Forestry and Economics at ANU, she worked as a consultant in forest economics at FORTECH (now URS Forestry) before returning to SRES to complete her doctorate. From 2003 to 2005 she was a scientist with the Social Sciences Program of the Bureau of Rural Sciences. She has co-taught SRES3007 'Participatory Resource Management' since 2003. Jacki currently leads the 'Communities' project of the Cooperative Research Centre for Forestry. The Communities project includes researchers at ANU, the University of Melbourne, University of Tasmania and Southern Cross University.

Research, Teaching & Professional Activities

My research interests are primarily in the area of studying the socio-economic impacts of changes in land use and access to natural resources such as fish stocks. I have spent most of the last seven years undertaking research examining the social issues that emerge as a result of rapid land use change – for example, disputes and conflicts arising out of land use change from traditional agriculture to plantations. As well as undertaking qualitative studies of people's perceptions of land use change impacts, I was recently lead author of a Bureau of Rural Sciences study aiming to better understand if the perceptions commonly held in rural communities about impacts of plantation expansion are borne out by independent data on population and employment change in the regions experiencing these shifts.

I have a particular interest in exploring and extending approaches to combining the use of qualitative and quantitative methods to examine impacts of land use and resource access change. My current work with the CRC for Forestry 'Communities' project is further exploring how the use of statistics from sources such as the ABS can be usefully combined with qualitative data drawn from residents of rural communities to obtain a more comprehensive understanding of impacts of land use change.

Selected Publications

Schirmer, J. and Pickworth, J. 2005. *A social assessment of the contributions of commercial fishing to the Gippsland Lakes region of Victoria.* Case study report for FRDC Project 2003/056 A social assessment handbook for use by Australian fisheries managers in ESD assessment and monitoring. Bureau of Rural Sciences, Canberra. URL: < http://www.affashop.gov.au/product.asp?prodid=13281>

Schirmer, J. and Pickworth, J. 2005. *A social assessment of the Marine Scalefish Fishery of South Australia.* Case study report for FRDC Project 2003/056 A social assessment handbook for use by Australian fisheries managers in ESD assessment and monitoring. Bureau of Rural Sciences, Canberra. URL: < http://www.affashop.gov.au/product.asp?prodid=13282>

Schirmer, J.; Parsons, M.; Charalambou, C.; and Gavran, M. 2005. Socio-economic impacts of plantation forestry in the Great Southern region of WA, 1991 to 2004. Report produced for FWPRDC Project PN04.4007. Forest and Wood Products Research and Development Corporation, Melbourne URL: < http://www.affashop.gov.au/product.asp?prodid=13290>

Schirmer, J.; Parsons, M.; Charalambou, C.; and Gavran, M. 2005. Socio-economic impacts of plantation forestry in the South West Slopes of NSW, 1991 to 2004. Report produced for FWPRDC Project PN04.4007. Forest and Wood Products Research and Development Corporation, Melbourne URL: http://www.affashop.gov.au/product.asp?prodid=13295

Schirmer, J. and Casey, A.M. 2005. *Social Assessment Handbook: A guide to methods and approaches for assessing the social sustainability of fisheries in Australia.* FRDC ESD Reporting and Assessment Subprogram Publication No. 7. Bureau of Rural Sciences and Fisheries Research and Development Corporation, Canberra. URL: < http://www.affashop.gov.au/product.asp?prodid=13168>

Tonts, M. and Schirmer, J. 2005. Managing social conflict in the tree plantation industry: growing consensus or deepening divisions In Cryle, D. and Hillier, J. (eds) *Consent and consensus: politics, media and governance in twentieth century Australia.* API Network, Perth. pp. 275-296.

Schirmer, J. and Kanowski, P. 2005. A mixed economy Commonwealth of States: Australia. In Garforth, M. and Mayers, J. (eds) *Plantations, privatization, poverty and power.* Earthscan, London. pp. 101-125.

Schirmer, J. and Roche, M.M. 2005. Corporatization, commercialization and privatization: New Zealand. In Garforth, M. and Mayers, J. (eds) *Plantations, privatization, poverty and power.* Earthscan, London. pp. 200-222.

Schirmer, J. and Tonts, M. 2003.. Plantations and sustainable rural communities. *Australian Forestry* 66: 67-74

Schirmer, J. 2002. Plantation forestry disputes: case studies on concerns, causes, processes and paths toward resolution. Technical Report No. 42 (Revised), Cooperative Research Centre for Sustainable Production Forestry, Hobart.

Schirmer, J. Kanowski, P. and Race, D. 2000.. Factors affecting adoption of plantation forestry on farms: implications for farm forestry development in Australia. *Australian Forestry* 63: 44-51

Schirmer, J. Kanowski, P. and Race, D. 2000. Landholders' reasons for adopting or rejecting plantation forestry on farms in north-east Tasmania. *Rural Society* 10(3)

Mr Darren Sinclair

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Environment and Safety: Regulation, Law and Policy

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Career Brief

Darren completed a Bachelor of Science (Hons) at the University of Sydney in 1990. He then worked for the Commonwealth Department of Industry, Science and Technology for six years. During that time he had responsibility for developing environmental policy from an industry perspective, including the creation of a national scheme to phase out the use of ozone depleting gases in industry, and representing Australia at international climate change negotiations (pre-Kyoto). In particular, he was involved in the development of the policy of 'joint implementation', the precursor to an international carbon-trading scheme. In 1995 and 1996 Darren completed a Master of Environmental Law at The Australian National University, and subsequently took up a position as Senior Research Associate at the Australian Centre for Environmental Law, in the Faculty of Law at the Australian National University. In that capacity, he worked on a number of environmental regulation and policy research projects, and was a consultant to several government agencies and industry associations. He has been a Research Fellow at SRES since mid 2003.

Research, Teaching & Professional Activities

I am currently involved in an Australian Research Council funded research project investigating the safety, health and environmental performance of the mining sector (in conjunction with the National Occupational Health and Safety Commission).

Selected Publications

Books, reports and chapters:

Gunningham, N. and Sinclair, D. 2002. Leaders and Laggards: Next Generation Environmental Regulation, Greenleaf, UK.

Gunningham, N and Sinclair, D. 2002. Environmental Partnerships: Combining Sustainability and Commercial Advantage in the Agricultural Sector, Rural Industries Research Development Corporation, Canberra

Kanowski, P., Sinclair, D. and Freeman, B. 2000. Establishing Comparability and Equivalence amongst Forest Management Certification Schemes, Agriculture, Fisheries and Forestry – Australia, Canberra.

Kanowski, P., Sinclair, D. and Freeman, B. 1999. International Approaches to Forest Management Certification and Labelling of Forest Products: A Review, Agriculture, Fisheries and Forestry – Australia, Canberra.

Gunningham, N. and Sinclair, D. 1999. Chapter 10 in Hutter, B. (ed) *A Reader in Environmental Law*, Oxford University Press, UK.

Gunningham, N. and Sinclair, D. 1998. Chapters 2, 3 (with Grabosky, P.) and 6 in Gunningham, N. and Grabosky, P. Smart Regulation: Designing Environmental Regulation, Oxford University Press, UK.

Gunningham, N., Sinclair, D. and Burritt, P. 1998. On-the-spot Fines and the Prevention of Injury and Disease: The Experience in Australian Workplaces, National Occupational Health and Safety Commission, Canberra.

Gunningham, N and Sinclair, D. 1997. Barriers and Motivators to the Adoption of Cleaner Production Practices, Environment Australia, Canberra

Articles:

Gunningham, N. and Sinclair, D. 2005. "Regulating Intensive Agricultural Pollution" Australian Journal of Environmental Management, Vol 12.

Gunningham, N. and Sinclair, D. 2005. "Policy instrument choice and diffuse source pollution" Journal of Environmental Law, Vol 17, No 1.

Gunningham, N. and Sinclair, D. 2005. "Regulating water pollution from light industry: Lessons for the Swan-Canning" Environmental and Planning Law Journal, Vol 22, No 4.

Gunningham, N. and Sinclair, D. 2004. "Curbing non-point pollution: Lessons for the Swan-Canning" Environmental and Planning Law Journal, Vol 21, No 3.

Gunningham, N. and Sinclair, D. 2004. "Non-point pollution, voluntarism and policy failure: Lessons for the Swan-Canning" Environmental and Planning Law Journal, Vol 21, No 2.

Gunningham, N. and Sinclair, D. 2002. "Partnerships, Management Systems and the Search for Innovative Regulation in the Vehicle Body Shop Industry" Business Strategy and Environment, Vol 11.

Gunningham, N. and Sinclair, D. 2001. "Environmental Regulation and Cleaner Production Partnerships with Small and Medium Sized Enterprises: A Case Study" *Environmental and Planning Law Journal*, Vol 18, No 4.

Gunningham, N. and Sinclair, D. 2000. "Promoting Cleaner Production in South East Asia: A Case Study of the Philippine DTI/BOI Environmental Unit" Asia Pacific Journal of Environmental Law, Vol 5, Issue 3.

Gunningham, N. and Sinclair, D. 1999. "Integrative Regulation: A Principle-Based Approach to Environmental Policy" Law and Social Inquiry, Vol 24, No 4.

Gunningham, N. and Sinclair, D. 1999. "Regulatory Pluralism: Designing Environmental Policy Mixes" Law & Policy, Vol 21, No 1.

Gunningham, N. and Sinclair, D. 1999. "Next Generation Environmental Policy" Melbourne University Law Review, Vol 22, No 3.

Gunningham, N. and Sinclair, D. 1999. "Environmental Management Systems, Regulation and the Pulp and Paper Industry: ISO 14001 in Practice" Environmental and Planning Law Journal, Vol 16, No 1.

Sinclair, D. 1997. "Self-regulation Versus Command and Control? Beyond False Dichotomies" Law & Policy, Vol 19, No 4.

Professor Jürgen Bauhus

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Silviculture, forest dynamics, nutrient cycling

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Career Brief

Jürgen studied Forestry in Freiburg, Vienna, and Göttingen and worked in Germany and Canada before he worked in the ANU Forestry Program between 1996 and 2003. Since June 2003 he has held a professorship and the Chair of Silviculture in the Faculty of Forest and Environmental Sciences at Freiburg University, Germany. His research focuses on ecology and silviculture of native forests, carbon and nutrient cycling, dynamics of mixed-species stands, structural diversity and coarse woody debris. He is section editor of the European Journal of Forest Research, Associate Editor of the Canadian Journal of Forest Research and an associate of the Cooperative Research Centre for Greenhouse Accounting. At Freiburg University, he is directing the International PhD Program "Forestry in Transition", the German-French binational PhD program in "Risk Management in Forestry", and the new international MSc course "Forests, Environment and Bioresourcs".

Research, Teaching & Professional Activities

My research interests are primarily in the effects of forest management practices on forest ecosystem properties and processes, in particular forest structure, eco-physiology of trees and carbon and nutrient cycling.

Current projects:

An ARC funded project in collaboration with State Forests NSW aims at "Guiding early silvicultural interventions through predicting canopy and crown dynamics in plantations of sub-tropical eucalypts". Specifically the project investigates the plasticity of green crowns of different species as affected by stand density, and the response of trees to green pruning (see also PhD student Philip Alcorn).

European Union Project with partners in Spain, The Netherlands, Brazil, Ecuador, Peru and Bolivia examining the role of smallholders in the sustainable management of forested landscapes in the Amazon basin.

European Union Project with partners in India and The Netherlands investigating the importance of plantations in a "crowded world", in particular in the provision of ecosystem goods and services. This also includes the development of a graduate course on this topic.

Exploring the use of Near-Infrared-Spectroscopy in fine-root studies. In particular, this DFG-funded project investigates the quantification of fine roots and the separation of the fine roots of different species using spectral properties of these tissues.

Determining the decay rates of coarse or woody debris of the most important central European tree species. Decay rates will be quantified by measuring respiration and mass loss in different decay phases and the process modelled in relation to climatic variables and log properties.

A number of PhD projects such as "Litter decomposition in mixed species of beech and spruce", "Tree growth in logged-over rainforest in south-east Kamerun" and "The effects of different fire regimes on soil fertility and vegetation diversity in dry dipterocarp forests in Thailand".

My teaching covers forest dynamics, silviculture and ecosystem management at undergraduate and postgraduate levels (see: http://www.waldbau.uni-freiburg.de/Mitarbeit/bauhus.html)

Selected Publications

Forrester, D.I., Cowie, A.L., Bauhus, J., Wood, J.T., Forrester, R.I. 2006. Effects of changing the supply of nitrogen and phosphorus on growth and interactions between Eucalyptus globulus and Acacia mearnsii in a pot trial. *Plant and Soil* 280: 2677-277.

O'Hara, C.P., Bauhus, J., Smethurst P.J. 2006. Role of light fraction soil organic matter in the phosphorus nutrition of *Eucalyptus globulus* seedlings. *Plant and Soil* 280, 127-134.

Forrester, D. I., Bauhus, J. , Cowie, A.L. 2005.. Nutrient cycling in a mixed-species plantation of *Eucalyptus globulus* and *Acacia mearnsii. Canadian Journal of Forest Research* 35: 2942-2950.

Hopmans, P., Bauhus, J., Khanna, P.K., Weston, C. 2005. Carbon and nitrogen in forest soils: Potential indicators for sustainable management of eucalypt forests in south-eastern Australia. *Forest Ecology and Management* 220: 75-87.

McElhinny, C., Gibbons, P., Brack, C., Bauhus, J. 2005. Forest and woodland stand structural complexity: Its definition and measurement. *Forest Ecology and Management* 218, 1-24

Forrester D.I., Bauhus J., Cowie A.L. 2005. On the success and failure of mixed-species tree plantations: lessons learned from a model system of *Eucalyptus globulus* and *Acacia mearnsii. Forest Ecology and Management* 209, 147-155.

Chen W., Zhang Q., Cihlar J., Bauhus J. and D.T. Price 2004. Estimating fine-root biomass and production of boreal and cool temperate forests using aboveground measurements: A new approach. *Plant and Soil* 26, 31-46.

Bauhus J., Vor T., Bartsch N. and A. Cowling 2004. The effects of gaps and liming on forest floor decomposition and soil C and N dynamics in a *Fagus sylvatica* forest. *Canadian Journal of Forest Research* 34, 3, 509-518.

Bauhus J., van Winden, A. P. and A. B. Nicotra 2004. Above-ground interactions and productivity in mixed-species plantations of *Acacia mearnsii* and *Eucalyptus globulus*. *Canadian Journal of Forest Research* 34, 686-694.

Selected Student Theses

Forrester, D. 2004. Mixed-species plantations of nitrogen-fixing and non-nitrogen-fixing trees (PhD thesis)

McElhinny, C. M. 2005. Quantifying stand structural complexity in woodland and dry sclerophyll forest, south-eastern Australia (PhD thesis)

Dr U.N. Bhati

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Economics and marketing

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Career Brief

U.N. Bhati's formal education is in agriculture and economics, and he has taught and carried out research in these subjects in India, Malaysia and Australia.

About sixteen years ago, while at the Australian Bureau of Agricultural and Resource Economics (ABARE), he had a chance encounter with forestry economics and marketing. He quickly found them to be professionally both challenging and satisfying subjects. Since then, U.N. has become hooked on these topics. He has done some teaching but most of his time has gone into research on subjects such as forestry market outlook, forest plantations and farm forestry. He has written articles, conference papers, consultancy reports, inquiry submissions and monographs.

Research, Teaching & Professional Activities

During 2006, I will mainly be working with colleagues on research that we began in 2005, i.e. analysing the forest products market in India. And, under this broad topic, we will be focusing on aspects of India's paper and paperboard market, including the opportunities for Australia in this market.

From mid 1997 to the end of 2004, I devoted almost all of my time to the ANU Forestry Market Report Project. The project had the objectives of preparing and disseminating nationally quarterly market reports on forest products and inputs for Australian forest growers. The market reports were primarily for small-scale growers. By December 2004, thirty market reports had been completed. They covered topics such as: China: a market for Australian exporters of forest products; Australian Pine Log Price Index; Australia's competitors in the Japanese woodchip import market; stumpage trends in Western Australia; cabinet timbers; exports of Australian forest products; trends in log prices in Tasmania; stumpage prices over the next 10, 20, 30... years; consumption of sawnwood and wood based panels; salinity credits; firewood market; stumpage trends in South Australia; Japanese woodchip import market; carbon credit markets; market trends in the 1990s; market for forest products in South Korea; trends in sawnwood market; cost of log transport; log exports; cost of tree seedlings and cuttings; log and agricultural product prices beyond 2000; structural timber prices.

Forestry and agricultural newsletters and magazines have published these reports. They are also available on web sites of ANU (http://sres.anu.edu.au/associated/marketreport/index.html) and other organisations.

Selected Publications

Bhati, U.N. and Kwon, K.W. 2004. *The Forest Products Market in Korea*. School of Resources, Environment & Society, Faculty of Science, The Australian National University, Canberra, August.

Bhati, U.N. 2004. Market report for Australia's small-scale cabinet timber growers. In Suh, J., Smorfitt, D.B., Harrison, S.R. and Herbohn, J.L., Eds. *Marketing of Farm-grown Timber in Tropical North Queensland*, Cooperative Research Centre for Tropical Rainforest Ecology and Management, Cairns.

Bhati, U.N., Kanowski, P. and Ragg, W. 2002. ANU Forestry Market Report Project: Looking to the Future. In Wettenhall, D. (ed.), *Private Forestry – Sustainable, Accountable and Profitable*, Proceedings of Australian Forest Growers 2002 National Conference, 13–16 October 2002, Albany, Western Australia, stream session paper number 271.

Bhati, U.N. 2001. The ANU Market Report Project. In Herbohn, J., Harrison, S., Herbohn, K. and Smorfitt, D. (eds) *Developing Policies to Encourage Small-Scale Forestry*, IUFRO Research Group, Proceedings from International Symposium, Kuranda, Australia, 9–13 January 2000, pp. 27–29.

Dargavel, J., Conley, K., Proctor, W., Ferguson, I. and Bhati, U.N. 1999. *Direct and Indirect Employment in the Forest Sector and Forest Sector Employment as a Proportion of Total Employment*, Montreal Process Project 6.5a, Final Report, School of Forestry and Resource Conservation, The University of Melbourne, January.

Bhati, U.N., Mahendrarajah, S. and Evans, P.D. 1998. Australian woodchip export markets. In Dyason, R., Dyason, L. and Garsden, R. (eds), *Plantation and Regrowth Forestry: A Diversity of Opportunity*, Australian Forest Growers Biennial Conference Proceedings, 6-9 July, Lismore NSW, pp. 177–88.

Shand, R. and Bhati, U.N. 1997. *Pakistan: Economic Profiles in South Asia*, Australia South Asia Research Centre, Research School of Pacific and Asian Studies, The Australian National University, Canberra, March.

Shand, R. and Bhati, U.N. 1997. *Nepal: Economic Profiles in South Asia*, Australia South Asia Research Centre, Research School of Pacific and Asian Studies, The Australian National University, Canberra, July.

Bhati, U.N., Hafi, A., Hooper, S., and Stanford, L. 1996. *Papaya Fruit Fly: Cost-benefit Analysis of the Proposed Eradication Campaign*, ABARE project 1380, an ABARE consultancy report to the Australian Quarantine and Inspection Service, Canberra, February.

Wilson, S., Whitham, J., Bhati, U.N. and Tran, Y. 1995. *Trees on Farms: Survey of Trees on Australian Farms, 1993-94*, ABARE Research Report 95.7, Canberra.

Bhati, U.N. and J. Whitham. 1994. Farm forestry in Australia. In ABARE, *Quarterly Forest Products Statistics*, September quarter, 1–3.

Bhati, U.N. and Rose, R. 1992. Prospects for Australia's wood based industry: Effects of some microeconomic policy reforms. ABARE Conference Paper 92.22 presented at 'Australia's Timber and Forest Industry: A Strategy for the Future' Conference, Sydney, 28–29 May.

Bhati, U.N., Klijn, N., Curtotti, R., Dean, M. and Stephens, M. 1991. *Financial Mechanisms for and Structural Impediments to the Development of Commercial Plantations*. ABARE consultancy report to the National Plantations Advisory Committee, Canberra, May.

O'Regan, M. and Bhati, U.N. 1991. *Pricing and Allocation of Logs in Australia*, ABARE Discussion Paper 91.7, AGPS, Canberra.

Dr Janis Birkeland

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Career Brief

Dr Birkeland qualified and practiced as an artist (BA Bennington, 1966), architect (MA University of California, Berkeley, 1972), lawyer (JD University of California, Hastings, 1979), and city and regional planner (PhD University of Tasmania, 1993). She worked consecutively as an advocacy planner, architect, urban designer, city planner and attorney in San Francisco (1969–80). In 1981 she moved to Tasmania where she raised children and did her PhD in environmental planning and governance. She taught architecture in Tasmania and then at the University of Canberra (1992–2000), where she later initiated postgraduate courses in eco-innovation and sustainable development. She also served as senior environmental education officer for Environment Australia. In 2002, she published *Design for Sustainability*: *a Sourcebook of Integrated Eco-logical Solutions*. She is currently writing a book called *Positive Development*: *from vicious circles to virtuous cycles*.

Research, Teaching & Professional Activities

Selected Publications

Birkeland J. and J. Schooneveldt 2003, Mapping Regional Metabolism: A Decision-Support Tool for Natural Resource Management, Land and Water Australia (first published as a report in 2002) Canberra, Act.

Birkeland J 2002, Design for Sustainability; a sourcebook of eco-logical solutions, (Earthscan UK).

Birkeland J. and J. Schooneveldt 2002, ACT Sustainability Audit: A material Flows Analysis of the Residential Sector of Canberra, ACT Planning and Land Management Authority, Canberra.

Dr Ross Bradstock

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Fire science and management, plant ecology

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Career Brief

Ross graduated with a B.Sc.(Hons) and PhD from the University of Sydney. He has worked as a research scientist with the NSW National Parks and Wildlife Service (currently NSW DEC) for over 20 years.

Research, Teaching & Professional Activities

Ross is on the Editorial Advisory Committee for the Australian Journal of Botany and the International Journal of Wildland Fire. He has given lectures on fire science and plant ecology at the University of Wollongong, ANU, University of Western Sydney, University of New South Wales and Macquarie University. In 2004, Ross was a visiting course convenor for SRES3008 *Fire in the Australian Environment* with Dr Geoff Cary.

Ross is leader of the Bushfire CRC Project B.1.2. that includes Dr Geoff Cary, Dr Rod Weber (ADFA), Dr Malcolm Gill and Karen King, and is based in SRES. The project will develop optimal solutions for the sustainable management of bushfire risk in a range of ecosystems. Ross' other research interests include plant species and community dynamics in mesic and semi-arid shrublands; investigation of heat related germination cues in seeds of a broad range of species; soil heating patterns in relation to fire and fuel characteristics; spatial modelling of risk of extinction of plant and animal populations; spatial modelling of bushfire risks posed to human assets; modelling of the sensitivity of fire interval and intensity in relation to ignition rates and weather; and the use of remote sensing to measure and model fire severity patterns.

Selected Publications

Bradstock, R.A. (2003). Protection of people and property: towards an integrated risk management model. In *Australia Burning*: *Fire Ecology*, *policy and Management Issues* (eds. G. Cary, D. Lindenmayer and S. Dovers) pp. 119-123, CSIRO Publishing, Melbourne.

Bradstock, R.A. and Kenny, B.J. (2003). Application of plant functional traits to fire management in a conservation reserve in south-eastern Australia. *Journal of Vegetation Science* 14, 345-354.

Bradstock, R.A. and Cohn, J.S. (2002). Demographic characteristics of mallee pine (*Callitris verrucosa*) in fire-prone mallee communities of central New South Wales. *Australian Journal of Botany* 50, 653-665.

Bradstock, R.A., Williams, J.E. and Gill, A.M. (eds.) (2002) *Flammable Australia*, *The Fire Regimes and Biodiversity of a Continent*. Cambridge University Press, Cambridge

Bradstock, R.A. and Cohn, J.S. (2002) Fire regimes and biodiversity in semi-arid mallee ecosysgtems. In *Flammable Australia*: *The Fire Regimes and Biodiversity of a Continent*, (Eds. R.A. Bradstock, J.E. Williams and A.M. Gill). pp. 238-258. Cambridge University Press, Cambridge.

Bradstock, R.A. and Cary G. (2001). What governs fire regimes? In "*Bushfire 2001*" pp. 182-189. Proceedings of the Australasian Bushfire Conference, July 2001, Christchurch NZ.

Bradstock, R.A. and Gill, A.M. (2001). Living with fire and biodiversity at the urban edge: in search of a sustainable solution to the human protection problem in southern Australia. *Journal of Mediterranean Ecology* 2: 179-195.

Selected Student Theses

Richards, R. 2000. The sensitivity of snow gum to fire scarring in relation to Aboriginal landscape burning. (Honours thesis).

King, K. 2003. Simulating the effects of anthropogenic burning on patterns of biodiversity. (PhD thesis, under examination).

Emeritus Professor Valerie A. Brown

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Career Brief

Val Brown holds an undergraduate degree in Ecology from Queensland University, a Graduate Diploma in Adult Learning from the University of Canberra, a Master of Education Degree in Integrative Studies from Endicott College, USA and the inaugural PhD in the University's Human Sciences Program, thesis topic "Holism in the University Curriculum". During 1979-84 she helped established the B.App.Sc.(Health Education) now B.Ed (Community Development) at the University of Canberra. From1984-89 she established and directed the Health Advancement Services of the ACT, and has since worked in projects to link public health and environmental governance in Australia, Malaysia, Fiji, and China, including the National Local Government Environmental Research Network at CRES 1989-95. She has introduced teaching programs linking Environment and Health to the Tribhuvan University, Nepal, and the University of Western Sydney. Foundation Professor of Environmental Health at the University of Western Sydney 1996-2002, she is now Emeritus Professor from that University and Visiting Fellow and Director, Local Sustainability Project, at the School of Resources, Environment and Society, Australian National University. In 1999 she was appointed an Officer of the Order of Australia for international and national contributions to public health and environmental health, and advocacy for and contributions to, sustainable development.

Research, Teaching & Professional Activities

My research applies integrative methods to exploring the construction of knowledge in generating locally sustainable responses to global social and environmental pressures. Past research programs have addressed the capacity for achieving integrative decision-making in the Local Government sector, the community sector, public health, and the environmental sciences, respectively. My current projects include principles for collaborative engagement for the Murray-Darling Basin; an interactive knowledge management framework for sustainable development in the local government sector; the introduction of sustainable development principles into the national Public Health post-graduate curriculum; and Indigenous communities' environmental health workforce development.

Selected Publications

Brown Valerie A, Grootjans J, Ritchie J, Townsend M, and Verrinder G. 2005 *Sustainability and Health*: *Supporting global ecological integrity in public health*. Allen and Unwin. Sydney. Earthscan, London 360pp

Keen, M., Brown Valerie A. and Dyball, Robert 2005 *Social Learning in Environmental Management*. Earthscan, London. 250 pp.

Aslin, H and Brown, Valerie A. 2004 *Towards Whole of Community Engagement. A practical toolkit*. Murray Darling Basin Commission, Canberra

Brown, Valerie A. Thinking globally and acting locally: Environmental health practice and climate change. *Environmental Health* 4. 1 2002, p5-13

Nicholson, R., Stephenson. P., Brown, Valerie. A. and Mitchell, K. 2002. *Common Ground and Common Sense*: *a commmunity-based environmental health action handbook*. Department of Health and Ageing, Canberra 220pp.

Brown, Valerie A. Planners and the Planet: Reshaping the people/planet relationship: do planners have a role? *Australian Planner* 38 3 2001 67- 73

Brown, Valerie A Monitoring Changing Environments in Environmental Health in *Environmental Health*, 1.1 2001, p21-34

Brown, Valerie A. Stephenson. P., Nicholson, R., and Smith, J. 2001. *Grass Roots and Common Ground*: *community-based environmental health action planning*. Department of Health and Aged Care, Canberra 106pp.

Brown, Valerie A., Love, D., Griffiths, R., Powell, J., Murphy, A., and Walsmley, A. 2000. *Western Sydney Regional State of the Environment Report 2000*. Western Sydney Regional Organisation of Councils, Blacktown, 250pp.

Brown, Valerie A. 1996. *Managing for Local Sustainability*: *policies*, *problem solving*, *people and place*. National Office of Local Government, Canberra. 314pp.

Brown, Valerie A., Smith, D.I., Weissman, R., and Handmer, J. 1995. *Risks and Opportunities*: *managing environmental conflict and change*. Earthscan, London . 213pp.

Brown, Valerie A. 1995. *Landcare languages*: *talking to each other about living with the land*. National Landcare Program, Department of Primary Industry. Canberra. 215pp.

Brown, Valerie A. 1995. *Turning the tide*: *integrated local area management for Australia's coastal zone*. Department of Environment, Sport and Territories, Canberra, 175pp (second printing).

Selected Student Theses

Greg Paine *Parts*, *wholes and sustainable development*

Jennifer Scott *Integrating Sustainability Provisions into Contemporary Decision Making*

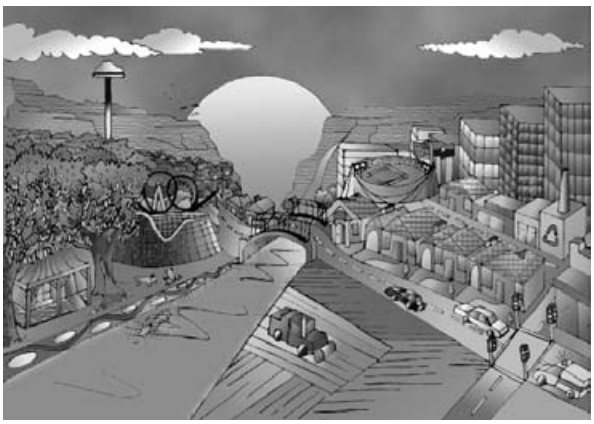
Rodney Griffith: *How Shall We Live? Sustainable Development as transformational change*

Brian Dwyer *Attitudes to Remediation in the Murray-Darling Basin*

Mazrura Suhani *Separate Realities*: *community-based environmental management for health*

Fred Lehmann *Weight Load Carry*: *the physiology and politics of the army backpack.*

Sarah Kelly *Construction of sense of place in the era of globalisation*: *a case study*



Lawrence Issa

Dr David Cook

Adjunct Senior Lecturer
Invasive species management

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Career Brief

David was born and raised in the Great Southern region of Western Australia. He completed a Bachelor of Economics degree with Honours at Murdoch University in 1995. Between 1996 and 2004 he worked as a Regional Economist for the Department of Agriculture Western Australia in Bunbury. During this period David completed a PhD with The University of Western Australia's then School of Agricultural and Resource Economics (1999-2001), and worked as a postdoctoral research assistant at the Wye campus of Imperial College London (2003-2004). In 2005 David moved to Canberra to take up a Research Economist position with CSIRO Entomology, and an adjunct appointment with SRES.

Research, Teaching & Professional Activities

David's research interests centre around biosecurity issues. Much of his work has involved invasive species affecting agricultural industries, ranging from vertebrates, invertebrates, weeds, pathogens, fungi, aquatic and marine species. He has completed economic analyses on many different incursion responses, and on-going management strategies for naturalised pest species of regional, state and national significance. He has also investigated the social welfare implications of quarantine restrictions for various pests and diseases, comparing the traditional gains from trade and the increase in expected damage from exotic species capable of utilising the trade link as an entry pathway. David maintains a keen interest in environmental issues, many of which concern species introductions. He will be working in the newly-formed CRC for National Plant Biosecurity to investigate multi-criteria analytical frameworks to include environmental and socio-economic information into the formation of invasive species risk management policies.

Selected Publications

Cook, D.C. 2005. The 'Paradox of Thrips': Identifying a Critical Level of Investment in Pest Exclusion Activities in Western Australia. *Australasian Agribusiness Review* 13, http://www.agrifood.info/Publications_Review/Cook.htm. ISSN 1442-6951.

Cook, D.C., Fraser, R.W., Wilby, A, Waage, J.K. and Mumford, J.D. (2004). Beyond the Biosecurity Horizon. In: *Research Papers: Economic Services Group and Regional Economists*, R. Kingwell (Ed.). Government of Western Australia – Department of Agriculture, South Perth. pp. 87-98.

Cook, D.C. (2003). Devising a Method of 'Expected Damage' Estimation for a Polyphagous Invertebrate Pest Exotic to Western Australia". In: *Research Papers: Economic Services Group and Regional Economists*, R. Kingwell (Ed.). Government of Western Australia – Department of Agriculture, South Perth. pp. 160-175.

Cook, D.C. and Fraser, R.W. (2002) Exploring the Regional Implications of Interstate Quarantine Policies in Western Australia. *Food Policy* 27 (2): 143-157.

Cook, D.C. 2001. An Economic Evaluation of the Benefits from Import Clearance Activities in Western Australia. *Australasian Agribusiness Review* 9, http://www.agribusiness.asn.au/. ISSN 1442-6951.

Cook, D.C. (2001). *Impact and Beneficiary Analyses for Agricultural Protection Activities in Western Australia: Varroa Bee Mite, Tracheal Bee Mite and Bee Louse*, Miscellaneous Publication No. 5/2002. Department of Agriculture Western Australia, South Perth. 26 p. ISBN 1326-4168.

Mumford, J.D., Knight, J.D., Cook, D.C., Quinlan, M.M., Pluske, J. and Leach, A.W. (2001). *Benefit Cost Analysis of Mediterranean Fruit Fly Management Options in Western Australia.* Imperial College, Ascot. 52 p.

Dr Rosie Cooney

Visiting Fellow
Biodiversity conservation, management, and trade; environmental policy at international and national level; conservation and human livelihoods

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Career Brief

Rosie completed Honours in Law and Science (in BoZo) at ANU in 1995 before carrying out a PhD in evolutionary ecology at Cambridge, the recipient of a Commonwealth Scholarship. Since completion in 1999 she has been working on biodiversity-related research and policy development for a range of international environmental organisations, including WWF, IUCN-The World Conservation Union, Flora & Fauna International, TRAFFIC, and ResourceAfrica. For WWF she led the development of policy on wildlife trade and CITES, and in recent years she has led an international collaborative initiative developing policy guidance on the implementation of the precautionary principle in biodiversity conservation and natural resource management.

Research, Teaching & Professional Activities

Current research focusses on two (linked) areas: how decision-making and policy responds to the uncertainty and complexity of ecological systems, examining in particular world trade rules as they relate to invasive alien species; and the potential for commercial sustainable use to contribute to biodiversity conservation and rural livelihoods, in Australia and overseas. She is an active member of the IUCN Species Survival Commission's Sustainable Use Specialist Group.

Selected Publications

Cooney R (2006) A long and winding road? Precaution from principle to practice in biodiversity conservation. In Von Schomberg R, Fisher L & Jones J (Eds) *Implementing the Precautionary Principle: Perspectives and Prospects*, Edward Elgar: Cheltenham, UK and Northampton, MA, US.

Cooney R & Jepson P (2006) The international trade in wild birds: what's wrong with blanket bans? *Oryx* 40(1): 18-23

Cooney R (2005) From promise to practicalities: the precautionary principle in biodiversity conservation and natural resource management. In Cooney, R and Dickson, B (Eds) *Biodiversity and the Precautionary Principle: Risk and Uncertainty in Conservation and Sustainable Use*. Earthscan, London, pp 3-17

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Cooney R (2004) *The Precautionary Principle in Biodiversity Conservation and Natural Resource Management: An issues paper for policymakers, researchers and practitioners* IUCN Policy and Global Change series, No. 2. IUCN, Gland, Switzerland and Cambridge, UK

Cooney R (2003) *Looking ahead – international wildlife trade regulation and enforcement. In Oldfield S The Trade in Wildlife: Regulation for Conservation.* Earthscan, London, pp 196-204

Dr John Dargavel

Visiting Fellow
Forest history & Forest policy

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Career Brief

John has degrees from the Universities of Edinburgh and Melbourne and from the Australian National University. He has worked in the forest service in South Australia and for twenty years in Victoria as an industrial forester mainly concerned with management planning. He has lectured on forest economics, resource and management planning in the Department of Forestry, and has researched issues of forest policy as a Fellow in the Centre for Resource and Environmental Studies.

Research, Teaching & Professional Activities

My research interests lie in forest history and in the political economy of the forest sector. I have written extensively and critically on forest policy, the Regional Forest Agreement process, environmental conflicts and employment. A large part of my academic life has been concerned with convening groups of people with different perspectives and disciplines concerned with policy and history.

I enjoy the variety of disciplines that forest history draws me into. Currently I am writing a biography of Charles and Ruth Lane Poole. Charles was the Commonwealth's first forester and Ruth was the interior decorator who designed the furniture for the Prime Minister's and the Governor-General's residences that were opened in Canberra in 1927. Charles Lane Poole is particularly relevant to SRES as he ran the Australian Forestry School in Canberra from 1927 to 1944. Forestry training was transferred to the new Department of Forestry at ANU in 1965, and is now part of SRES.

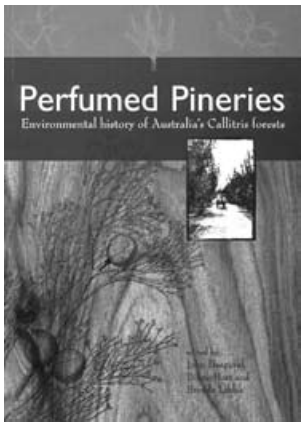
Selected Publications

Dargavel, John, Mauro Agnoletti and Elisabeth Johann. 2005. Layered cultures of forestry. *News of Forest History* III(36/37)-part 1, pp.25-35.

Dargavel, John 2005. Forestry, in *Short Overviews* (ed. John Dargavel). Australia and New Zealand Forest Histories (Australian Forest History Society, Occasional Publications No. 1). Kingston, ACT: Australian Forest History Society, pp.25-32.

Dargavel, John 2005. Managing amidst conflict: the Huon District forests of Tasmania. In *In search of excellence: exemplary forest management in Asia and the Pacific* (Patrick B. Durst, Chris Brown, Henrylito D. Tacio and Miyuki Ishikawa). Bangkok: Regional Community Forestry Training Centre for Asia and the Pacific, FAO, pp. 239-250.

Dargavel John 2005. Charles Lane Poole in the transition from Empire. In Calver, Michael, Bigler-Cole, Heidi, Bolton, Geoffrey, Dargavel, John, Gaynor, Andrea, Horwitz, Pierre, Mills, Jenny, and Wardell-Johnson, Grant (eds) *A forest conscienceness: Proceedings of 6th National Conference of the Australian Forest History Society Inc.* Rotterdam: Millpress, pp.65-74.



Dargavel, John. 2004. The Fight for the Forests in retrospect and prospect. *Australasian Journal of Environmental Management* 11(3), pp.237-244.

Dargavel, John. 2004. Persistence and transition on the Wangites-Wagait Reserves, 1892-1976. *Journal of Northern Territory History*, 15: 5-19.

Mr Clem Davis

Visiting Fellow
Climate trends of the Canberra region

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Career Brief

I am a retired meteorologist from the Bureau of Meteorology where I worked as an operational meteorologist (forecaster) for over 33 years. I worked for the Bureau in Western Australia, Northern Territory and the ACT and at the time of retirement in June 2005 I was Officer in Charge of the Canberra Meteorlogical Office, a position I had held for the last 9 years.

As a visiting fellow at SRES, I am carrying out research in conjunction with Associate Professor Janette Lindesay into the climate trends of the local region as well as providing assistance to research students and staff on issues related to weather and climate. I will also be presenting occassional guest lectures and will be helping SRES and the ANU with external programs such as Science Week.

Mr Jim Douglas

Visiting Fellow
Economics of forests, the international dialogue on forests and development, and natural resources policy issues.

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Career Brief

Active since late 1970s in international forestry, with assignments for FAO as project manager, ANUTECH in consultancy, and the World Bank. Recently retired as Forests Advisor with the latter organization, after a 15 year engagement.

Research, Teaching & Professional Activities

Major responsibility for research, technical and operational programs in forests in the World Bank. Teaching and training responsibilities for technical and operational staff in the Bank, and in client country organizations; some short term teaching assignments at Johns Hopkins and Georgetown Universities in Washington, while serving with the Bank.

Selected Publications

Numerous reports, conference papers and technical reports authored while with the Bank; primary responsibility for drafting the new Bank Forest Sector Strategy, and Operational Policy, approved by the Board of Directors of the Bank in 2002, and published by the Bank.

I contribute to the academic mission of the SRES through research in the areas of interest identified, and teaching, supervision, discussion and government advisory assignments as determined by the head of SRES.

Professor Philip Evans

Director of Centre for Advanced Wood Processing at UBC

Adjunct Professor
Surface modification of wood, relationships between structure and function and properties of wood and wood composites

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Career Brief

Phil took a first class honours degree in Wood Science from the University of Wales (Bangor). He obtained a PhD, also from the University of Wales, in 1984. He worked as a postdoctoral fellow at Abertay University Dundee, Scotland, before joining the ANU as a Lecturer in 1986. He was promoted to Senior Lecturer in 1992 and Reader in 1998. In 2000 he was appointed as Director of the University's Centre for Science and Engineering of Materials. Phil took up his current position as Professor and Director of the Centre for Advanced Wood Processing at UBC (Canada's national centre for education extension and research for advanced wood processing industries) in November 2001. He was appointed as an Adjunct Professor at ANU in 2002.

Mankind faces many significant challenges over the coming century arising from its profligate use of natural resources and unwise choices in the conversion of natural resources into materials or products that are incompatible with or deleterious to natural systems. The development of advanced wood and biobased composites materials that can more effectively compete with plastics, metals and ceramics, materials that cannot be produced on a sustainable basis, can make a positive contribution to rectifying some of the damage to the environment that is now self evident. Developing advanced bio-based materials with similar cost and performance characteristics as plastics, metals and ceramics is, however, a tremendous challenge. Surface modification of wood is a cost effective way of upgrading some characteristics in which wood is deficient, ie UV resistance, and has been one of my major research areas todate. A greater understanding of the relationship between the structure of wood and wood composites and their function and properties could lead to the development of new biocomposites with enhanced mechanical properties, and this is an area I'm currently exploring with colleagues in the Department of Applied Mathematics in RSPhysSE. My research interests and continuing involvement in the teaching of forest products in SRES maintain my link with ANU. At UBC my position as Director of the Centre for Advanced Wood Processing involves a great variety of tasks mainly focussed at assisting the Canadian forest products industry to make the transition from a commodity-based industry to one that concentrates on value and quality.

Selected Publications

Heady, R.D., Evans, P.D. 2005. Wood anatomy of Actinostrobus (Cupressaceae). *IAWA Journal* 26(1):79-92.

Roberts, R. J., Evans, P.D. 2005. Effects of manufacturing variables on surface quality and distribution of melamine formaldehyde resin in paper laminates. Composites, Part A: *Applied Science and Manufacturing*. 36A(1):5-104

Orton, C.R., Parkinson, D.Y., Evans, P.D., Owen, N.L. 2004 Fourier transform infrared studies of heterogeneity, photodegradation, and lignin/hemicellulose ratios within hardwoods and softwoods. *Applied Spectroscopy*. 58(11):265-1271.

Semple, K.E., Cunningham, R.B.,Evans, P.D. 2004. Manufacture of wood-cement composites from Acacia mangium: Mechanistic study of compounds improving the compatibility of Acacia mangium heartwood with Portland cement. *Wood* & *Fiber Science* 36:250-259.

Kataoka, Y., Kiguchi, M., Evans, P.D. 2004. Photodegradation depth profile and penetration of light in Japanese cedar earlywood (*Cryptomeria japonica* D Don) exposed to artificial solar radiation. *Surface Coatings International Part B: Coatings Transactions* 87(3): 187-193.

Evans, P.D., Donnelly, C., Cunningham, R.B. 2003. Checking of CCA-treated radiatapine decking timber exposed to natural weathering. *Forest Products Journal*. 53(4):1-6.

Evans, P.D. 2003. Emerging Technologies in Wood Protection. *Forest Products Journal*. 53(1):14-22.

Cabangon, R. J., Cunningham, R.B., and Evans, P.D. 2002. Manual Strand Orientation as a Means of Improving the Flexural Properties of Wood-Wool Cement Boards in the Philippines. *Forest Products Journal*. 52(4):53-59.

Heady, R.D., Banks, J.G., and Evans, P.D. 2002. Wood Anatomy of Wollemi Pine (Wollemia Nobilis, Araucariaceae). *IAWA Journal*. 23(4)::339-357

Evans, P.D., N.L. Owen, S. Schmid, S. and R.D. Webster. 2002. Weathering and photostability of benzoylated wood. *Polymer Degradation and Stability*. 76:291-303.

Semple, K.E., Cunningham, R.B., and Evans, P.D. 2002. The Suitablity of Five Western Australian Mallee Eucalypt Species for Wood-Cement Composites. *Industrial Crops and Products Journal*. 16:89-100.

Kiguchi, M., P.D. Evans, J. Ekstedt, R.S. Williams and Y. Kataoka. 2001. Improvement of the durability of clear coatings by grafting of UV-absorbers on to wood. *Surface Coatings International Part B: Coatings Transactions*. 84(B4):243-336

Evans, P.D. (2001). Wood Products: Weathering. 6pp. In: The *Encyclopedia of Materials Science and Technology*. Buschow, K.H.T., Cahn, R.W., Flemings, M.C., Ilschner, B., Kramer, E.J., Mahajen, S. (Eds.). Elsevier Science, Oxford.

Selected Student Theses

Roberts, R. 2004. Liquid penetration into paper, Ph.D

Cabangon, R. 2004. Flexural visco-elastic properties of wood-wool cement boards, Ph.D

Semple, K. 2004. The compatibility of eucalypts and acacias with Portland cement, Ph.D

Dr Alfredo Fantini

Visiting Fellow

Management of non-timber forest products, Indicators of environmental performance

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Career Brief

Alfredo worked from 1979 to 1983 as a technician at The Santa Catarina Research Station, a branch of the National Sugar Cane Improvement Program of the Brazilian Ministry of Industry and Commerce. A walk through a sugar cane plantation during a hot summer day made him realize that he should go for a higher degree. He graduated in Agronomy in 1987, and two and a half years later completed MS in Plant Breeding. However, just after joining the Universidade Federal de Santa Catarina-UFSC, in 1989, he started working with his colleagues on a research project to develop guidelines for managing non-timber forest products from the Brazilian Atlantic Forest. In 1995 he moved to Wisconsin-USA, where in 1999 he completed a PhD in Forest Ecology and Management. Back to UFSC, he joined the graduate programs on Plant Genetic Resources and on Agroecosystems.

Research, Teaching & Professional Activities

The management of non-timber forest products from the Brazilian tropical forest has been one important subject of my research and teaching work at UFSC, which has been done in collaboration with colleagues from the Nucleus of Research on Tropical Forests. The other subject of my interest is the development of conceptual and methodological tools to evaluate environmental performance of humans when using natural resources, a work done in collaboration with colleagues from the Nucleus of Studies on Environmental Monitoring and Appraisal. Some indicators already developed: Indicator of Sustainability in Systems of Interest; Indicator of Regularization of Surfaces Hydrology; Indicator of Life Quality and of Living Conditions; Indicator of the Quality of Water Use. Transdisciplinarity is at the core of my teaching and research work.

Selected Publications

D'Agostinti, L.R.; Fantini, A.C. 2005. An Index of Convergence of Priorities in Participatory Planning: indicator of sustainability in systems of interests – ISSI. *Revista de Economia e Sociologia Rural* 43(3). [In Portuguese]

D'Agostini, L. R. ; Fantini, A. C. ; Alves, J. M. 2005. Indicator of the Regularization of Surface Hydrology (IRHIS). In: *IV Symposium on Riparian Forests*. Marechal Cândido Rondon, Brazil. [In Portuguese]

Rocha, A E., Fantini, A.C., Muniz, F.H. 2005. The Conservation of a Riparian Forest as a Strategy of Food-Security in the Community of Morros – MA. *Eisforia* 2(2) p.1 – 18. [In Portuguese]

Lopes, C.; Shanley, P.; Fantini, A.C. (Org.). 2004. *Riches of the Forest: Fruits, Remedies and Handcrafts in Latin America*. Jacarta: CIFOR. 141 p.

SIMINSKI, A. ; FANTINI, A. C. 2004. Classification of the Brazilian Mata Atlântica in the Santa Catarina Atlantic C into Successional Stages: adjusting the law to the ecosystem. *Revista Floresta e Ambiente* 11(1). [In Portuguese]

Fantini, A.C. 2004. Palm Heart: a delicacy from the forest. In: Lopes, C.; Shanley, P.; Fantini, A.C. (Org.). *Riches from the Forest: Fruits, Remedies and Handcrafts in Latin America*. Jacarta: CIFOR. p. 70-72.

Oliveira, C.L. ; Fantini, A.C. 2003. From Sacred Caw in India to Consecrated Bull in the Amazon: the irresistible ascend of the zebu. *Eisforia* 1(2): 172-196. [In Portuguese]

Siminsky, A., Fantini, A.C. 2003. Slash and burn agriculture in the Atlantic Coast of Santa Catarina State: co-evolution between the culture and the environment. *In: I Simpósio de Etnobiologia e Etnoecologia da Região Sul: Aspectos Humanos da Biodiversidade*. Universidade Federal de Santa Catarina, Florianópolis (electronic media). [In Portuguese]

Dr Ross Florence

Visiting Fellow
Ecology & silviculture of eucalypt forests; forest policy & planning

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Career Brief

Ross graduated in 1952 (Queensland University, Australian Forestry School) and joined the Queensland Department of Forestry as a research forester, concerned mainly with native forest silviculture. He was appointed to the Department of Forestry, ANU in 1965 where his main teaching and research interests have been in the ecology and silviculture of eucalypt forests, and forest policy and planning. Ross retired in 1995 and was appointed a Visiting Fellow.

Research, Teaching & Professional Activities

I am the author of Ecology and Silviculture of Eucalypt Forests. I see the eucalypt forests and woodlands as a fascinating response to environmental stresses associated with continental drift. Present-day species and community patterns are seen in terms of the progressive adaptation of the eucalypt progenitor(s) to declining soil nutrient and water status. Adaptation to a dry environment is particularly remarkable given that the eucalypt remains a mesophyte - albeit a drought tolerant mesophyte. An appreciation of the evolutionary history and physiological attributes of the eucalypt should provide a salutory lesson for the forester: ecologically sustainable forest management must be based on an appreciation of natural community patterns and structures, and the consequences for stand dynamics and health of departing too far from these patterns and structures.

My teaching in areas of policy and planning, and many submissions on these matters to conferences and inquiries, have long focused on the essential need for Australian forestry to adapt to changing social circumstances, and particularly, to develop more environmentally sensitive approaches to native forest management. We are seeing movement in this direction but there remains quite some way to go.

Selected Publications

Florence, R.G. 1996. *Ecology and Silviculture of Eucalypt Forests*. CSIRO Australia 413pp.

Florence, R.G. 1994. The ecological basis of forest fire management in NSW. In *The Burning Continent: Forest Ecosystems and Fire Management*. Current Issues. Institute of Public Affairs, Perth. pp.15-33.

Florence, R.G. 1993. Forestry in transition in Australia: from the primacy of wood production to ecologically sustainable development. *Commonwealth Forestry Review* 72: 321-337.

Florence, R.G. 1991 Planning for sustainable development. In *Directions in Forestry: Costs and Benefits of Change* Whyte, A. and Allen, J. (eds), ANZIF Conference, Christchurch, N.Z. pp.173-181.

Dr A. Malcolm Gill

Visiting Fellow
Fire ecology, fire weather, fire behaviour, fire at urban-rural interfaces and fire management

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Career Brief

After an undergraduate degree in agriculture Dr Gill completed MSc and PhD degrees in forest ecology at the same university, the University of Melbourne. Two years were then spent at the Harvard Forest of Harvard University in USA, studying north temperate tree growth, and a further two and a half years at Fairchild Tropical Botanical Garden in Miami, Florida studying tropical tree growth. Appointed in 1971 to the staff of CSIRO Plant Industry, he has spent over 35 years on matters relating to bushfires in the Australian landscape.

Research, Teaching & Professional Activities

My research interests have largely concerned the inter-related topics of fire ecology, fire weather, fire behaviour and fire management. Over the past few years my research has included matters relating to fires at the urban-rural interface – stimulated by the widespread and severe fires around Canberra in January 2003.

Selected Publications

Gill, A.M. 2005. Landscape Fires as Social Disasters: An Overview of 'the Bushfire Problem' *Global Climate Change B. Environmental Hazards* 6, 65-80.

Gill, A.M., Good, R., Kirkpatrick, J., Lennon, J., Mansergh, I. and Norris, R. 2004. *Beyond the Bushfires 2003, Environmental Issues in the Australian Alps*. Australian Alps Liaison Committee, 2004.

Gill, A.M., Allan, G. and Yates, C. 2003. Fire-Created Patchiness in Australian Savannas. *International Journal of Wildland Fire* 12, 323-331.

Bradstock,R.A., Williams, J.E. and Gill, A.M. (eds) 2002. *Flammable Australia: The Fire Regimes and Biodiversity of a Continent*. Cambridge University Press.

Mackey, B., Lindenmayer, D.B., Gill, A.M., McCarthy, M.A. and Lindesay, J. 2002. *Wildlife, Fire and Future Climates*. CSIRO Publishing, Melbourne.

Gill, A.M. and Bradstock, R.A. 2003. Fire regimes and biodiversity: a set of postulates. In: G. Cary, D.B. Lindenmeyer and S. Dovers (eds) *Australia Burning: Fire Ecology, Policy and Management Issues*. Pp. 15-25. CSIRO Publishing, Melbourne.

Bradstock, R.A. and Gill, A.M. 2001. Living with fire and biodiversity at the urban edge: in search of a sustainable solution to the human protection problem in southern Australia. *Journal of Mediterranean Ecology* 2, 179-195.

Gill, A.M. 2001. A transdisciplinary view of fire occurrence and behaviour. In: G. Pearce and L. Lester (eds) *Bushfire 2001*. Proceedings of the Australasian Bushfire Conference, Christchurch, New Zealand. Pp. 1-12. Rotorua, New Zealand.

Gill, A.M. 2001. Economically destructive fires and biodiversity conservation: an Australian perspective. *Biological Conservation* 15, 1558-1560.

McCarthy, M.A., Gill, A.M. and Bradstock, R.A. 2001. Theoretical fire interval distributions. *Int. J. Wildland Fire* 10, 73-77.

McCarthy, M.A., Possingham, H.P. and Gill, A.M. 2001. Using stochastic dynamic programming to determine optimal fire management of *Banksia ornata*. *J.Appl. Ecol.* 38, 585-592.

Mr Ken Groves

Visiting Fellow
Forest analyses for industrial uses, wood harvesting and processing, marketing forest and wood products

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Career Brief

From 1952 to 1963 Ken worked as a Harvesting and Sawmill Manager in Rhodesia (now Zimbabwe) during which time, apart from his normal duties, he was co-opted to a three-man research team investigating the relationships between silvicultural treatments in pine plantations and the volumetric and grade recovery of sawn timber.

From 1963 to 1967 he was in charge of research into hardwood logging and timber supply economics with the Forestry and Timber Bureau in Australia. During this time, he was also responsible for investigating occupational health and safety in the harvesting and sawmilling sectors.

From 1967-1989, he lectured at the ANU Department of Forestry in Forest Harvesting and Engineering but subsequently, and additionally, at various times, in Wood Science; Wood Conversion and Utilisation; and Production Economics. During his tenure at ANU he conducted numerous research and consultancy projects, including supervising over 20 postgraduate and fellowship research programs. In 1989, he worked in Malawi for two years as a Forest and Wood Production Economist.

In 1992 he joined Margules Groome Pöyry (now Jaakko Pöyry Consulting) as a Senior Consultant and from then until April 1999 worked continuously in a range of projects with major emphases on resource analyses for specified end uses; feasibility studies of various wood conversion processes; and in marketing, strategic development and investment programs.

He has been a free-lance consultant since April 1999 and a Visiting Fellow in the School of Resources, Environment and Society at the Australian National University since 2002. He has further developed a useful role in providing the link between growing wood and harvesting and processing.

Research, Teaching & Professional Activities

He has written, or helped to write as part of a team, over 100 consultancy reports for private, government and international bodies entailing field work in many countries including Australia, Malawi, Italy, Norway, Bangladesh, Malaysia, the Philippines, Papua New Guinea, Solomon Islands, Vanuatu, Fiji, Laos and Vietnam.

Selected Publications

Balfas J, Groves K W, and Evans P D, 1993: Bonding surface modified karri (*Eucalyptus diversicolor*) and jarrah (*E. marginata*) with resorcinol formaldehyde, Holz als Roh- und Werkstoff 5 pp 253-259.

Groves K W, 1990: "Seasoning and Preservation", Ch 22 in *Trees for Rural Australia*, ed Cremer K, Inkata Press.

Alexiou P N and Groves K W, 1990: Effect of pre-steaming on moisture gradients, drying stresses and sets, and face checking in regrowth blackbutt (*Eucalyptus pilularis* Sm.), *Wood Sc. Tech.*

Groves K W and Chivuya A, 1989: "Fuelwood Evaluation" Ch 16 in *Trees for the Tropics*, ed Boland D, Australian Centre for International Agricultural Research.

Wingate-Hill R and Groves KW 1988: Compression dewatering of green wood, *APPITA* 41(2).

Groves K W, Pearn G J and Cunningham R B 1987: Predicting logging truck travel times and estimating costs of log haulage using models, *Aust. For.* 50(1).

Groves K W and Banana A Y, 1987: The effect of weathering on the microstructure of radiata pine, *Jour. Inst. Wood Sc.* 10(5).

Wingate-Hill R and Groves KW, Compression dewatering of green wood, 41st Annual APPITA General Conference.

Dr Roger Heady

School Research Associate
Wood Anatomy, Electron Microscopy

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Career Brief

Roger grew up on a dairy farm in Jarrah-Karri timber country near Margaret River, Western Australia, and left school at 14 years of age. He joined the RAAF and spent the following 12 years on various airforce stations in Australia and south-east Asia. Roger was awarded the Australian Active Service Medal for one year of duties on the US airbase at Ubon during the Vietnam War. After discharge from the RAAF in 1968, he came to Canberra to work as an electronics technician at the Satellite Tracking Station at Orroral Valley. While employed tracking satellites, he studied part-time and obtained a Degree in Applied Science, a Graduate Diploma in Resource Management, and a Graduate Diploma in Electronics from CCAE (now University of Canberra). On the closure of the Tracking Station in 1983, he commenced employment as a Technical Officer at the ANU SEM Unit, which was at that time, located in the Forestry Engineering Wing. In 1991, he began part-time research on the wood anatomy of *Callitris* (cypress pine) using electron microscopy, for which he was awarded a PhD in 1997.

Roger is currently employed full-time as a senior technical officer at the ANU Electron Microscopy Unit, located in the Research School of Biological Sciences.

Research, Teaching & Professional Activities

I am often the first point of contact for ANU staff and postgraduate students wishing to make use of the facilities of the Electron Microscopy Unit for their research. The Unit offers a range of imaging and analysis techniques: transmission and scanning electron microscopy, light microscopy, and x-ray analysis (EDXA). I give assistance to those wishing to use these facilities, provide help with specimen preparation, and initialise and operate equipment for specific tasks. I am conversant with the cryogenic techniques required for EM investigations of delicate biological specimens such as leaves and flowers.

My main interest is in the use of scanning electron microscopy (SEM) for the study of wood anatomy. I find that SEM is ideally suited to this application and there is ample scope for high-resolution microscopy studies of the wood of many Australian species. I am particularly interested in the wood anatomy of Cypress pine and Wollemi pine.

During the past year I conducted the Forest Products (FSTY 3016) practical classes in wood identification. I am currently involved in writing a paper on the wood anatomy of the Western Australian conifer *Actinostrobus*.

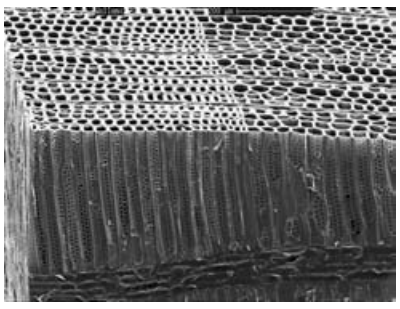
Selected Publications

Heady, R.D., J.G. Banks and P.D. Evans. 2002. Wood Anatomy of Wollemi Pine (*Wollemia nobilis*, Araucariaceae). *IAWA Journal* 23(4): 339-357.

Heady, R.D. and P.D. Evans. 2000. Callitroid thickening in Callitris. *IAWA Journal* 21(3): 293-319.

Ride, W.D.L., Pridmore, P.A., Barwick, R.E., Wells, R.T. and R.D. Heady. 1997. Towards a Biology of *Propleopus oscillans* (Marsupialia: Propleopinae, Hypsiprymnodontidae). *Proc Linn. Soc. NSW*, 117: 243-328.

Heady, R.D., Cunningham, R.B., Donnelly, C.F. and P.D. Evans. 1994. Morphology of warts in the tracheids of cypress pine (Callitris Vent.). *IAWA Journal* 15(3): 265-281.



Scanning Electron Micrograph of the wood of Wollemi Pine

Dr Hartmut Holzknecht

Ressearch Fellow
Social anthropology, Melanesia, land and other natural resource use and tenure systems, community and rural development, institutions and institutional change, policy development, socio-economic persistence and change

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Career Brief

Hartmut Holzknecht grew up in Papua New Guinea and is a Papua New Guinea citizen. He did his secondary and tertiary education in Australia and completed a PhD in social anthropology at The Australian National University in Canberra. He speaks a number of local Papua New Guinea languages as well as the national *lingua franca*, Melanesian *Tok Pisin*, German and some French. Hartmut has excellent communication, training and liaison skills that are critical at a number of different levels across the whole range of his activities and involvements.

Hartmut Holzknecht is a social anthropologist with major interests in natural and human resource management issues, in resource use and tenure systems and property relations, in socio-cultural, socio-economic and socio-political persistence and change, in community and rural development issues and in the nexus between human societies and natural resource management. The main area of focus is the Melanesian region of the southwest Pacific.

Research, Teaching & Professional Activities

As both an academic and an applied anthropologist for almost 30 years, I have been involved in a wide range of activities - mostly focussed in Papua New Guinea and the southwest Pacific - in research, teaching, training, publications and writings, administration, private enterprise, consulting and project work. I have been an active and widely-known consultant in Papua New Guinea and the South Pacific (at a number of levels in government and non-government engagements, in private enterprise, in aid organizations and multilateral institutions). He continues all these activities as and when required.

I have also worked in private enterprise (as managing director of a large group of companies in Papua New Guinea; member on a number of boards of directors and committees, including a large agricultural cooperative), in the public service (provincial planner then First Assistant Secretary, Policy, Planning & Coordination in one Papua New Guinea provincial government) and in working in various activities to find ways of making a wide range of appropriate information and support services accessible to the general public and assisting people to get systems and processes to work more to their and their communities' benefit.

At SRES, I am also supervising graduate students up to PhD level. I am currently preparing a multi-year research programme, 'Land in Melanesia: Foundations for Governance, Security and Economic Growth in Papua New Guinea, Vanuatu and Solomon Islands'. An ACIAR-funded study, 'Papua New Guinea Agroforestry', will begin on May 1st, 2005.

Selected Publications

Holzknecht, H. [in press] 'The "Rural Development" Session'. *Development Bulletin*, Special Edition – 'The Good News Conference.

Mandan, T. and H. Holzknecht [in press] 'Burum Development: *Nanak Mutuk*'. *Development Bulletin*. Special Edition – 'The Good News Conference.

Kanowski, P., H. Holzknecht and C. Perley [in press] 'Oceania: islands of contrasts', Chapter 18 in G. Mery *et al.* (eds.) World Forests, Society and Environment

Project. Helsinki: International Union of Forest Research Organizations.

Holzknecht, H. 2005 Session Opening and Closing Remarks, 'Overcoming Constraints in Papua New Guinea'. February 18. Lowy Institute for International Policy, Sydney.

Holzknecht, H. Presentation 'Oceania: islands of contrasts'. IUFRO-WFSE Policy Workshop, January 12-16, Victoria, B.C., Canada [preparing policy brief to accompany WFSE volume for the IUFRO World Congress, Brisbane, August 2005].

Holzknecht, H. 2004 [November 24-26] 'Good News' Conference, Divine Word University, Madang and State, Society and Governance Project, The Australian National University.

Holzknecht, H. A. 2003 Customary Land Tenure Systems: Resilient, Appropriate and Productive. Pp. 18 - 23 in T. Curtin, H. Holzknecht & P. Larmour, Land Registration in Papua New Guinea: Competing Perspectives. *Discussion Paper 2003/1*. Canberra: State, Society and Governance in Melanesia, Research School of Pacific and Asian Studies, The Australian National University.

Holzknecht, H. A. 2003 "Customary Land Issues affecting Peri-Urban areas in Melanesia". Keynote presentation to the Colloquium on Peri-Urban Customary Land Issues in Papua New Guinea. Melanesian Land Studies Centre, PNG University of Technology, Lae, Papua New Guinea.

Holzknecht, H. A. 2003 Report II: Social and Community Issues in Middle Ramu and Approaches to Development Options. Report for ACIAR Project FST 98-118. Canberra: Bureau of Rural Sciences.

Holzknecht, H. A. 2002 Land, people and governance: Conflicts and resolutions in the South Pacific. Pp. 8 - 12 in Development Bulletin, Vol. 60 (Dec. 2002; Theme: 'South Pacific Futures'). Canberra: Development Studies Network.

Holzknecht, H. A. 2002 Afterword / *Las Tok*: Why? What? When? Where? How? Who/By whom? Pp. 257 - 269 in N. Sullivan ed. Culture and Progress. The Melanesian Philosophy of Land and Development in Papua New Guinea. (Papers from the Divine Word June 2001 Land Symposium). Madang: DWU Press.

Holzknecht, H. A. 2002 Invited participant, South Pacific Land Tenure Conflict Symposium. The University of the South Pacific, Suva, Fiji. Two presentations: "Regional Contribution: Papua New Guinea' and 'Opportunities, Potentials and Problems in Customary Land Tenure in Forestry-related and other Developments in the South Pacific' (also session chair, discussant and facilitator). [see http://www.usp.ac.fj/landmgmt/symposium/pacificnetworklinks.htm]

Holzknecht, H. A. 2002 Historical Aspects of State Dealings with regard to Registration of Customary Land [June; unpublished]

Holzknecht, H. A. 2002 Land, People and Governance: Conflicts and Resolutions in the South Pacific. Paper presented at the Foundation for Development Cooperation's Development Research Symposium: 'South Pacific Futures'. Brisbane, 22 - 24 July, 2002.

Holzknecht, H. A. 1999 Customary Property Rights and Economic Development in Papua New Guinea. Pp. 139 -164 (Ch. 5) in T. van Meijl & F. von Benda-Beckmann, eds., Property Rights and Economic Development: Land and Natural Resources in Southeast Asia and Oceania. London: Kegan Paul International.

Holzknecht, H. A. 1999 Past, Present and Future: Building on Papua New Guinea's Customary Strengths in Resource Management. Pp. 29-31 in *Development Bulletin*, Vol. 50 (Oct. 1999; Theme: 'Development: Papua New Guinea perspectives'). Canberra: Development Studies Network.

Holzknecht, H. A. 1999 Papua New Guinea's Rainforests: Policy, Practice, Stakeholders and Resource Management. Pp. 107 - 120 in Environment Papua New Guinea, Collected Papers Series, Volume 1. J. Rivers, F. L. Bein and P. Siaguru, eds. Lae: Environmental Research and Management Centre, Papua New Guinea University of Technology and New Delhi: UBS Publishers' Distributors.

Holzknecht, H. A. 1999 Starke Traditionen. Landbesitz und Landrechte in Papua-Neuguinea. Chapter 6 [pp.67-86] in "Unser Land - Unsere Seele". Pazifikstaaten und Ihre Landrechte, G. Vanselow, editor. Pazifik-Informationsstelle. Neuendettelsau: Pazifik Netzwerke e.V.

Holzknecht, H. A. 1998 Arentz, F., B. Brunton, A. Carothers, L. Cortesi, H. Holzknecht and C. LaFranchi, Sustaining Papua New Guinea's Natural Heritage. An Analysis of the Papua New Guinea National Forest Plan. Boroko: WWF South Pacific Program and Gerehu: Greenpeace Pacific.

Mr Neil Humphreys

Visiting Fellow
Management systems, forest operations and farm-based plantations

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Career Brief

Neil's (Curly) career started in 1950 as a forestry trainee with the Forestry Commission of NSW. Following graduation from the University of Sydney he worked on the North Coast of NSW and later in the Marketing Division in Sydney. His interest centred on forest harvesting. In 1979 he was employed by Australian Newsprint Mills (ANM) at Albury to manage the greenfield newsprint mill's wood supply which used fully mechanised harvesting systems. He later managed the Forest Management Division of ANM in Tasmania before moving to Malaysia to develop forest plantations for Fletcher Challenge. Since 1999 he has been program director of the Forest Technology Program and Senior Fellow at the University of Melbourne. He also became Visiting Fellow at the Australian National University where he now lectures in Forest Operations.

Research, Teaching & Professional Activities

My experience has centred on forest operations and during the last twenty-five years I have concentrated on industrial forestry.

Thus my involvement at ANU as a Visiting Fellow brings with it a culture which is commercial rather than academic. This juxtaposes two cultures - one that emphasises the importance of money and management structures with one that emphasises research and teaching.

Universally, the interface of cultures generates a hive of activity, mostly for the good. Where the various cultures have mutual understanding and respect, the interaction is positive and exciting.

I accepted the School's invitation to be a visiting fellow because I believe that forestry and society gain considerably through the positive interaction of academia and business.

Dr Robert Coutts, a highly respected wood scientist who, until recently was with CSIRO, put it so well when he said, "In this day and age of information technology, facts are easy to come by, but real knowledge is gained only from exposure and experience." My contribution to forestry is now directed to transferring some of my experience to those studying at ANU.

Dr Ryde James

Visiting Fellow
Plantation management, silviculture to improve wood quality

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Career Brief

Ryde began his career in forestry in 1960 with the New Zealand Forest Service, subsequently receiving scholarships from the NZFS and NZ Government to study botany at the Victoria University of Wellington and forestry at the ANU. After graduation, he worked in forest planning at the NZFS Head Office, then as a scientist at the NZ Forest Research Institute. He took leave to obtain a Doctorate from Oxford University. Returning to the NZ FRI, he eventually became Program Manager for the Plantation Management Research Group. Ryde later took up a position in the Department of Forestry, ANU, in 1992.

Research, Teaching & Professional Activities

My research falls into three categories: silviculture and the manipulation of plantation crops, forest planning, and urban forestry.

Recent silvicultural research has involved the analysis of growth response over twenty years to unconventional thinning treatments aimed at restricting the diameter distribution of crop trees; and the influence of tree breeding on the quality of trees and logs in tree crops. I am an associate member of the CRC for Sustainable Forestry Landscapes where my contribution involves an ARC funded project investigating the response, through crown dynamics, of the application of silviculture to two species of sub-tropical eucalypts.

A newly established stand of *Eucalyptus globulus* in Western Australia. Since 1996 the proportion of new plantation forest which has been established in hardwoods has increased markedly.

Forest planning describes activities at a range of scales from the International to the compartment level in the field. My work has concentrated on the higher levels. I recently spent time with the FAO in Rome using their data base to estimate the potential of the worlds plantation forests to produce the type of high value timber products which could substitute for wood from natural forests. With Dr Brian Turner, I was involved in providing the official estimates of wood flows by region, through time, for forest plantations in Australia. This work required the application of forest growth models, yield models and the informed interpretation of outputs from these models.

Urban forestry represents a new research initiative for myself and colleagues, Dr Cris Brack and the late Dr John Banks. We have developed a computer based management system for urban tree assets with the street as the basic unit and are working on the development of management systems at other levels.

Selected Publications

Ryde James and Alberto Del Lungo, 2005: The potential for fast-growing commercial forest plantations to supply high value roundwood. Working Paper WP/33, Forest Resources Division, FAO, Rome (Italy)

Turner B and James R, 2002: Derivation of indicative yields for major plantation species. Chapter 5, pp93-111, In Richards G.P. (ed) *Biomass Estimation: approaches for assessment of stocks and stock change*. National Carbon Accounting System, Technical Report 27, Australian National Greenhouse Office.

James, R.N. 2001: Defining the product - Log Grades used in Australia. RIRDC publication 1/161. ISBN 0 642 58380 3, ISSN I 440 6845.

Kramer, H. and James, R.N. 2000. Neuer Wald fur neue stadt. *Forstarchiv* 71:158-164.

Banks, J.C.G., Brack, C.L. and James, R.N. 1999. Modelling changes in dimensions, health status and arboricultural implictions for urban trees. *Urban Ecosystems* 3(1).

James, R.N. 1998. Planted forests - Factors to be considered in planning. In Chan et al. (eds) Proceedings of a conference *Planted forests in Sarawak*. Forest Department Sarawak.

James, R.N. 1998. Evaluation of diameter distribution as a criterion for selecting crop trees in a pulpwood regime. *NZ Journal of Forestry Science* 28(2): 195-201.

Maddern, L. and James, R.N. 1998. The effect of tree breeding on size and utilisation potential of radiata pine in two research trials. *Institute of Foresters of Australia Newsletter* 39: 41-47.

James, R.N. 1997. The effect of thinning regime on production of wood with 'mature' properties in plantation grown radiata pine in NZ. In Népveu, G. (Ed), *Connection between silviculture and wood quality through modelling approaches and simulation softwares*. Conference held under the auspices of IUFRO WP S5. 01-04, South Africa, August 1996.

Turner, B.J. and James, R.N. 1997. *Australian Forest Plantations - How much wood will they produce*? Proceedings of the 4th Joint Conference of the Institute of Foresters of Australia and the NZ Institute of Forestry, April 1997.

Selected Student Theses

Ford, A. 2004: Site quality for *Pinus radiata* D.Don : Southern Tablelands NSW.

Packer, A. 2004: The use of eucalypt regeneration as a bio-indicator for assessing effectiveness of cording in Southern Tasmania.

McWilliam, R. 2003: An Investigation of the suitability of a power assisted tool for pruning Australian plantations.

Blessington, L.J. 2003: Using retrospective sampling to develop growth trends for *Pinus radiata* (D. Don) and *Eucalyptus globulus* on low rainfall sites in South Australia.

Klootwijk, T. 2002: Modeling crown rise in *Eucalyptus grandis* W. Hill ex Maiden (Flooded Gum) on the northern coast of NSW.

Tappe, J. 2000: The seasonal growth of *Pinus radiata* (D. Don) in the Canberra region.

Kearney, D.E. 1999: Branching patterns, initial stocking and silviculture for *E. grandis* and *E. pilularis* plantations, NSW.

Professor Brian Lees

Visiting Fellow
Geographical information science, geomorphology

Professor of Geography, School of Physical, Environmental and Mathematical Sciences, Australian Defence Force Academy

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Career Brief

Brian was initially commissioned as a regular officer in the RAF, serving in the Middle East, Europe and Africa. After gaining civil commercial pilot's and flight navigator's licences he flew with ADASTRA on mineral exploration and mapping projects. He subsequently took a first-class honours degree in geomorphology from the University of Sydney. From 1977 he worked on a number of joint-venture projects becoming a director of two small exploration companies and the exploration manager of a third. This led him to form a company to carry out environmental and exploration services for larger organisations. Brian obtained a PhD, also from the University of Sydney, in 1984. He joined the ANU in 1985. Brian has received a number of awards for his work including the Australasian Institute of Spatial Information Science and Technology (AISIST) Prize in recognition of a "substantial contribution to the study of the science of Urban and Regional Information Systems", 1997; the Land Victoria Fellowship, University of Melbourne, 1999 and the Eminent Individual Award; Australasian Urban and Regional Information Systems Association (AURISA) 1999. He is an editor of the International Journal of Geographic Information Science, is on the editorial board of GEOINFORMATICA and has just completed a term on the editorial board of Transactions in GIS. He is a Member of the International Association of Science and Technology for Development (IASTED) Technical Committee on "Modelling and Simulation".

Research, Teaching & Professional Activities

I maintain an active research and teaching program focused on aspects of Global Change. The first phase was the construction of a database of geomorphic evidence for past climate change across northern Australia. In the second phase I set up a research program to improve the reliability of change detection techniques. This led to work in adapting inductive and data driven modelling techniques to the predictive mapping of land cover and land degradation. My students and I have built up comprehensive GIS databases based on a range of field sites. These have been used to test, and refine the use of inductive learning, and other artificial intelligence techniques such as neural networks and genetic algorithms, for environmental management. They have been very successful. My research activity continues to be the development and application of tools to carry out integrated analysis of global data. My teaching is intimately linked with this research.

Selected Publications

Lees, B.G. 2006. Timing and formation of coastal dunes in northern and eastern Australia. *Journal of Coastal Research*.

Doran, B. and Lees, B.G. 2005. Investigating the spatio-temporal links between disorder, crime and the fear of crime. *Professional Geographer*. 57(1),1–12.

Huang, Z and Lees, B.G. 2005. Representing and reducing error in natural resource classification. *International Journal of Geographic Information Science*.

Huang, Z and Lees, B.G. 2004. Combining Non-Parametric models for multisource predictive forest mapping. *Photogrammetric Engineering & Remote Sensing*. 70(4), 415-427.

Laffan, S. and Lees, B.G. 2004. Predicting regolith properties using environmental correlation: a comparison of spatially global and spatially local approaches. *Geoderma*, v120(3-4), pp 241-258.

Lees, B.G. 2002. Australian Geography and GIS. *Australian Geographical Studies*, 40(1); 33-47.

Selected Student Theses

Shawn Laffan BSc (hons)(ANU). 'Data-driven models for predicting mineral grade: Weipa.' 2001.

Kimberley Patrow van Neil BSc, MSc (Utah). 'Reconciling Geographical and Ecological Paradigms in modelling species distribution'. 2003.

Zhi Huang BSc.Msc(UNSW) 'Modelling uncertainty in complex forest mapping: an integrated application of AI and GIS'. 2003.

Bruce Doran BSc(hons)(ANU) ' Modelling the Ecology of Fear'. 2004.

Dr Edward Linacre

Visiting Fellow
Climatology

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Career Brief

Edward Linacre obtained physics degrees from Edinburgh (M.A) & London (B.Sc., M.Sc., PhD.) and had an early career in UK involving physics applied to radar and problems of the steel, coal and chemical-engineering industries. He joined CSIRO in 1960 and became a Principal Research Scientist, studying physics aspects of irrigation agriculture, especially water evaporation rates. They depend on the climate, and climate estimation became a preoccupation. In 1969 he was appointed inaugural Associate Professor of Climatology at the new Macquarie University. There followed 17 years of research and teaching, pioneering distance-teaching of the subject. There were lecture tours in several countries, notably Brazil, Bali, the Philippines and China. Retired in 1986 to complete his second book, which was eventually published in 1992. That year he escaped Sydney to Canberra and became a Visiting Fellow in the then Geography Department at ANU. There he has given numerous lectures in the introductory climatology course etc, revised his first book, a textbook on climatology, and published more research papers, as well as being consulted by other researchers.

Research, Teaching & Professional Activities

Climate has many aspects, as indicated in the following list of my more significant publications. On my starting in Sydney, there was an initial interest in the meteorology of air pollution, and also in the newly emerging field of environmental studies (the latter involved being a member of the team which carried out the first Environmental Impact Study in Australia.) However, the main emphasis subsequently has been on the estimation of key climatic variables such as temperature, radiation, winds and evaporation rates, using the minimum of input data. Lack of direct measurements in practice means that such estimates are often needed in building computer models of climate change, air pollution patterns, agricultural productivity, past environments, and so on.

Selected Publications

Linacre, E. 2004. Evaporation trends. *Theor. Appl. Climatol.* 79: 11 – 22.

Linacre, E. and Geerts, B. 2002. Estimating the annual mean screen temperature empirically. *Theor. Appl. Climatol.* 71: 43-61.

Linacre, E. and. Geerts, B. 1997. *Climates* & *Weather Explained* (Routledge, London) 432pp.

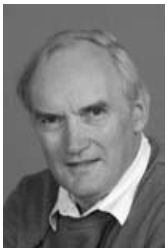
Linacre, E. 1994. Estimating US Class A pan evaporation from few climate data. *Water International* 19: 5-14.

Linacre, E. 1993. A three-resistance model of crop and forest evaporation. *Theor. Appl. Climatol.* 48: 41-8.

Linacre, E. 1992. Data-sparse estimation of lake evaporation using a simplified Penman equation. *Agriculture* & *Forestry Meteorology.* 64, 237-56.

Linacre, E. 1992. *Climate Data* & *Resources.* (Routledge, London) 366pp.

Dr Colin Matheson



Visiting Fellow
Quantitative, population and conservation genetics of forest trees, genetics of wood properties

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Career Brief

Colin Matheson was born in the UK and moved to Melbourne with his family to complete his time at school. He came to Canberra to undertake his first degree at the ANU in Botany and Zoology with Honours in Botany for a population genetics project on a small crucifer, after which he had a year working on eucalypts with Professor Lindsay Pryor at the Botany Department. He then returned to Melbourne for his PhD at La Trobe University on the genetics of the fruit fly *Drosophila melanogaster*. After that he came again to Canberra to take up a position with the then Department of National Development at the then Forest Research Institute in Yarralumla, Canberra, working on the genetics of trees. He then undertook a degree in Mathematics and Statistics at the ANU part time. In 1975, the Institute joined CSIRO and Colin has remained working at Yarralumla on breeding pines, eucalypts and acacias in collaboration with various industry bodies.

Colin has been Chair of Research Working Group No 1 of the Australian Forestry Council and Chair or Co-chair of two Working Parties of the International Union of Forestry Research Organizations. He has conducted a number of consultancies to Zimbabwe, China and Malaysia, was a Visiting Scientist at Oxford University and the University of Florida and was Co-Director of the Oxford Forestry Institute summer course on forest research. In addition, he has been an Invited Speaker at a number of international conferences in various countries.

Research, Teaching & Professional Activities

My current interests are in forest genetics with some emphasis on the genetics of wood properties, conservation and disease resistance in radiata pine as well as the strategy of breeding programs themselves. I am working on projects aimed at finding the best ways of improving the quality of juvenile wood and reducing its incidence as well as acoustic methods of measuring wood stiffness. Another of my projects aims to breed softwoods for planting on sites drier than those traditionally used for radiata pine. Because of the new pine pitch canker disease in California and Mexico, new collections from candidate species in these regions is not possible, so I am working to conserve ex situ genetic resources of these species as well as to find genetic resistance to pitch canker. Because of its applied focus, my work has been funded for many years partly by private companies and cooperatives both in Australia and New Zealand.

Although employed in a research position, I have supervised graduate and Honours students for many years, both through ANU and Melbourne University. I have designed and delivered courses on tree breeding and on design and analysis of experiments, one of which culminated in a collaborative book. In addition, I have contributed occasional lectures to the ANU Forest Genetics course; teaching most of the 'Production Genetics' part of the Conservation and Production Genetics course at SRES in 2003.

Selected Publications

Williams, E.R., Matheson, A.C. and Harwood, C.E. (2002) *Experimental Design and Analysis for Tree Improvement.* (2nd Ed, CSIRO: Melbourne).

Rogers, D.L., Matheson, A.C., Vargas-Hernández, J.J. and Guerra-Santos, J.J. (2004) Genetic Conservation of Insular Populations of Monterey Pine (*Pinus radiata* D. Don). *Biodiversity and Conservation* (In Press)

Wu, H.X. and Matheson, A.C. (2005). Genotype by environment interactions in an Australia-wide radiata pine diallel mating experiment: implications for regionalised breeding. *Forest Science* 51, 29-40.

Dickson, R.L., Matheson, A.C., Joe, B., Ilic, J. and Owen, J.V. (2004) Acoustic segregation of Pinus radiata logs for sawmilling. *NZ Jour. For. Sci.* 34(2), 175-189.

Wu, H.X. and Matheson, A.C. (2004) General and specific combining ability from partial diallels of radiata Pine: Implications for utility of SCA in breeding and deployment populations. *Theoretical and Applied Genetics* 108, 1503-1512.

Matheson, A.C., Wu, H.X., Spencer, D., Raymond, C.A. and Griffin, A.R. (2002). Inbreeding in radiata pine: III. Effect of inbreeding on age-age correlation and early selection efficiency. *Silvae Genetica* 51 (2-3), 115-122.

Wu, H. X., Matheson, A.C. and Abarquez, A..(2002). Inbreeding in radiata pine: IV. Inbreeding effect on wood density. *Annals of Forest Science* 59(5-6), 557-562

Matheson, A. C., Dickson, R. L., Spencer, D. J., Joe, B. and Ilic, J.(2002) Acoustic segregation of *Pinus radiata* logs according to stiffness. *Annals of Forest Science*, 59(5-6), 471-477.

Schimleck, L. R., Evans, R., Ilic, J., and Matheson, A. C. (2002) Estimation of wood stiffness of increment cores by near-infrared spectroscopy. *Canadian Journal of Forest Research*, 32, 129-135.

Yang, J.L., Fife, D. and Matheson, A.C. (2001) Growth strain in three provenances of plantation-grown *Eucalyptus globulus* Labill. *Australian Forestry* 64 (4), 248-256.

Wu, H. X. and Matheson, A. C. (2001a) Analyses of half-diallel mating design with missing crosses: theory and SAS program for testing and estimating GCA and SCA variance components. *Silvae Genetica*. 50, 265-271.

Wu, H.X. and Matheson, A.C. (2001). Reciprocal, maternal, non-maternal effects in radiata pine diallel mating experiment on four Australia sites. *Forest Genetics* 8, 205-212.

Nyakuengama, J.G., Matheson, A.C., Evans, R., Spencer, D.J. and Vinden, P. (2000) Genetics of heartwood formation and moisture status in *Pinus radiata*. *Appita J.* 53, 30-35.

Nyakuengama, J.G., Matheson, A.C., Evans, R., Spencer, D. and Vinden, P. (2000) Effect of Age on Genetic Control of *Pinus radiata* Earlywood and Latewood Properties. *Appita J.* 53(2), 103-107.

Wu, H.X. and Matheson, A.C. (2000). Analysis of half-diallel mating design with missing crosses: theory and SAS program for testing and estimating GCA and SCA fixed effects. *Silvae Genetica* 49, 130-137.

Matheson, A.C., Eldridge, K.G. and Spencer, D.J. (2000) A workshop on issues and strategies to conserve the genetic resources of *Pinus radiata* ex situ. *Forest Genetic Resources* 27, 75-78.

White, T.L., Matheson, A.C., Cotterill, P.P., Johnson, R.G, Rout, A.F. and Boomsma, D.B. (1999) A Nucleus Breeding Plan for Radiata Pine in Australia. *Silvae Genetica* 48(3-4), 122-133.

Nyakuengama, J.G., Matheson, A.C., Evans, R., Spencer, D.J. and Vinden, P. (1997) Wood quality and quantitative genetics of Pinus radiata IV. Time trends in the genetic control of density and pulp and paper-making traits and their interrelationships. *Appita J.* 50 (6), 486-494.

Wu, H.X., Matheson, A.C., and Spencer, D.J. (1997) Study of inbreeding in radiata pine I. The effect of inbreeding on growth, survival and variance. *Theoretical and Applied Genetics* 97, 1256-1268.

Wu, H.X., Matheson, A.C., and Spencer, D.J. (1997) II. Evolution of inbreeding depression and effect on growth curve. *NZ Jour. For. Sci.* 28(2), 123-139.

Butcher, P.A., Matheson, A.C. and Slee, M.U. (1996) Potential for genetic improvement of oil production in *Melaleuca alternifolia* and *M. linariifolia*. *New Forests* 11, 31-51.

Matheson, A.C., Spencer, D.J. and Kriedemann, P.E. (1995) Age-age correlations and early selection in radiata pine. 1. Family x environment interactions in plantation and greenhouse. *Australian Forestry* 58(2), 35-43.

Matheson, A.C., White, T.L. and Powell, G.L. (1995) Effects of inbreeding on growth, stem form and rust resistance in *Pinus elliottii*. *Silvae Genetica* 44(1), 37-46.

Matheson, A.C., Spencer, D.J. and Magnussen, D. (1994) Optimum age for selection in *Pinus radiata* using area under bark for age:age correlations. *Silvae Genetica* 43(5/6), 352-357.

Mr Bob Newman

Visiting Fellow
Forest history and forest policy

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Career Brief

Bob Newman who is a Registered Professional Forester, graduated in Forest Science at the Melbourne University following attendance at the Australian Forestry School, Canberra, the precursor to ANU Forestry.

He also graduated in Business Administration at the Hemingway Robertson Institute in Melbourne. After graduating he held forest management positions in private industry in Tasmania and Victoria. With his initial background at the CSIRO Division of Forest Products in South Melbourne, he then pursued a career for some 10 years in sawmilling, veneer production and timber presentation, and timber marketing.

Since the 1970's he has been consulting with a wide spectrum of forestry and forest products briefs, both domestically and internationally and continues to do so.

His contribution to date for organisations supporting the forestry profession has been wide and includes Vice-President, Chairman and Fellow of the Commonwealth Forestry Association, President of the Association of Consulting Foresters of Australia and he has had a 50 year membership in the Institute of Foresters of Australia. He has had a long interest in Australian Forest Growers Inc and was Hon National Secretary for some 7 years.

He comes to the ANU to carry out research in two fields of interest: forest history in Australia with emphasis on the private sector contribution during the past twenty years, and also with the hope of contributing to the development of useful forest policy to ensure sustainable forest management continues as a major factor in the Australian economy.

Dr Carolyn Raymond

Visiting Fellow

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Career Brief

Currently Senior Research Scientist, Forests NSW, Tumut NSW. Previously, 21 years with CSIRO Forestry & Forest Products.

Research, Teaching & Professional Activities

Silviculture Research Officer working on resource mapping for wood quality of *Pinus radiata* in NSW. Previous work on eucalyptus wood properties and quantitative genetics.

Selected Publications

Poke, F.S. and Raymond, C.A. 2006. Predicting extractives, lignin and cellulose contents using near infrared spectroscopy on solid wood in *Eucalyptus globulus*. *Journal of Wood Chemistry and Technology* 26:1-13.

Apiolaza, L.A., Raymond, C.A. and Yeo, B. 2005. Genetic variation of physical and chemical wood properties of *Eucalyptus globulus*. *Silvae Genetica* 54(4-5): 160-166.

Kube, P.D. and Raymond, C.A. 2005. Breeding to minimise the effects of collapse in *Eucalyptus nitens*. *Forest Genetics* 12:23-34.

Raymond, C.A and Anderson, D.W. 2005. Prior land use influences wood properties of *Pinus radiata* in New South Wales. *New Zealand Journal Forestry Science* 35(1):72-90.

Schimleck, L.R., Kube, P.D., Raymond, C.A., Michell, A.J. and French, J. 2005. Estimation of whole-tree kraft pulp yield of *Eucalyptus nitens* using near infrared spectra collected from increment cores. *Canadian Journal of Forest Research* 35:2797-2806.

Dr Gary Richards

Visiting Fellow
Greenhouse

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Career Brief

After completing his bachelor's degree in 1983 Gary was a founding partner in a small forest silvicultural business, later joining the ACT Parks and Conservation Service where he remained until 1991. Over this time he also completed both a Graduate Diploma in Outdoor Recreation and a Master of Applied Science in Resource Management at the University of Canberra. In 1990 Gary commenced his PhD in the then Forestry Department at ANU, while also joining the ACT Planning Authority to assist in developing the legislation and administration for environmental impact assessment.

On completing his PhD in 1993 Gary joined the National Capital Planning Authority and worked as a consultant to the Department of Housing and Regional Development in developing multi-disciplinary regional planning strategies. In his time with the Authority Gary co-authored the national evaluation of the Commonwealth Government's Better Cities Program. In 1996 Gary left the Commonwealth Government to join local government, taking charge of planning for a Southern Tablelands Council.

Since 1998 Gary has been the Director and Principal Scientist for the development of Australia's National Carbon Accounting System. Gary is also an active participant with the Intergovernmental Panel on Climate Change (IPCC), recently completing a role as Coordinating Lead Author on the development of definitions and methodologies for accounting of greenhouse gases from forest degradation and devegetation of other vegetation types. Gary is currently working on the IPCC revision to international accounting guidelines for Agriculture, Land Use and Forestry.

Gary has received achievement recognition awards including a Public Service Medal for contribution to greenhouse accounting and sustainable land management, and was a member of a team that won the 2004 CSIRO Chairman's Medal.

Research, Teaching & Professional Activities

My work has primarily been around multi-disciplinary planning and policy related issues, previously heavily oriented toward the human dimensions of natural resource management. Recent work has oriented toward applications of GIS systems and remote sensing techniques for land use modeling and decision making. Specific research interests focus on the development of GIS-based carbon budget models to assess the greenhouse gas emissions implications of land use and forest management activities.

Selected Publications

Lowell, K., Richards, G.P., Woodgate, P., Jones, S. and Buxton, L. 2005. Fuzzy Clasification for Assessing the Reliability of Multi-Period Landcover Change Maps.Photogrammetric *Engineering and Remote Sensing* 71 (8) 939-945.

Richards, G.P. and Brack, C. 2004. A Continental Biomass Stock and Stock Change Estimation Approach for Australia. *Australian Forestry* 67 (4) 284-288.

Richards, G.P., and Evans D.W. 2004. Development of the FullCAM Carbon Accounting Model, (FullCAM vers. 1.0) for the Australian Continent. *Australian Forestry* 67 (4) 277-283.

Richards, G.P., and Brack, C.L. 2004. A Modelled Carbon Account for Australia's Plantation Forests. *Australian Forestry* 67 (4) 289-300.

Richards G.P., J.O. Skjemstad, R.S. Swift and W. McDonald 2003. What are the Current Impediments and Research Needs to Improving Soil Carbon Measurement. *OECD Conference on Soil Carbon Indicators* (Ottawa, 2002).

Paul, K.I. Polglase and P.J. Richards G.P. 2003. Predicting Change in Soil Carbon following Afforestation or Reforestation. *Forestry Ecology and Management*:177 2003. 485-501

Paul, K.I. Polglase and P.J. Richards G.P. 2003.. Sensitivity Analysis of Predicted Change in Soil Carbon following Afforestation and analysis of controlling factors by linking a C accounting model (CAMFor) to models of forest growth (3PG), litter decomposition (GENDEC) and soil C turnover (Roth C). *Ecological Modelling*, 164 2003. 137-152

Cacetta, P.A., Bryant, G., Campbell, N.A., Chia, J.,Furby, S., Kiiven, H.J, Richards, G.R., Wallace, J. and Wu, X. 2003. Notes on Mapping and Monitoring Forest Change in AustraliaUsing Remote Sensing and Other Data. *30th International Symposium of Remote Sensing and the Environment*, Hawaii, October 2003.

Richards, G.P. The Expanding Role of Remote Sensing in Greenhouse Gas Accounting. *30th International Symposium of Remote Sensing and the Environment*, Hawaii, October 2003.

Karjalainen, T., Richards, G.P., et. al., 2003. *Definitions and Methodological Options to Inventory Emissions from Direct Human-Induced Degradation of Forests and Devegetation of Other Vegetation Types.* Intergovernmental Panel on Climate Change Report(IPCC). Published by the Institute for Global Environmental Strategies (IGES) for the IPCC, Japan 32pp.

Lowell, K, Woodgate, P., Jones, S., and Richards, G. 2003. Continuous Improvement of the National Carbon Accounting System Land Cover Change Mapping. *National Carbon Accounting System Technical Report No. 39*, Australian Greenhouse Office, Canberra, 28pp.

Brack, C.L., and Richards, G.P 2002. Carbon Accounting Model for Forests in Australia, *J. Environment and Pollution* 116:187-194.

Richards, G.P. (ed.) 2001. Biomass Estimation: Approaches for Assessment of Stocks and Stock Change. *National Carbon Accounting System Technical Report No. 27.* 160pp. Australian Greenhouse Office, Canberra.

Richards, G. P. 2001. The FullCAM Carbon Accounting Model: Development, Calibration and Implementation for the National Carbon Accounting System. *National Carbon Accounting System Technical Report No. 28* (50pp), Australian Greenhouse Office, Canberra.

Dr Robin Tennant-Wood

Visiting Fellow
Environmental politics and philosophy; waste management; sustainability; socio-political constructs of ecology; bioethics

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Career Brief

Coming from a professional background in education as a secondary teacher, and a long-time involvement in politics and environmentalism, Robin joined the ANU in 1999 – the year she also won a seat as a Councillor on the Snowy River Shire Council on a platform of issues relating to sustainable local development, including restoring environmental flows to the Snowy River. She was appointed Chair of the South East Waste Board at the end of 1999, a position she held until the end of 2001 and during that same period was a member of the NSW Waste Policy Body. Now resident in Canberra, Robin is currently a member of the ACT Chief Minister's Sustainability Expert Reference Group and, when not at the ANU, holds the position of Director of the Canberra and South East Region Environment Centre. She has been a Visiting Fellow in SRES since February 2003, during which time she also served a three month period as a Senior Policy Officer in the Department of Agriculture.

Research, Teaching & Professional Activities

My research work is largely influenced by my practical involvement in policy development at the local level, with a specific focus on waste management. This necessitates a strongly interdisciplinary approach, combining the social sciences with ecology in analysing specific aspects of eco-governance. My doctoral research examined the relationship between green politics and the environment movement, and the dynamics that drive paradigmatic change in eco-political thought using the case study of the campaign to save the Snowy River. Having held a seat in local government and chaired a statutory government authority, my working knowledge of environmental issues in the south-east region, and the socio-political and economic influences on the management of these issues, provides an added dimension to my academic work. As Director of an environmental NGO and having had a long involvement with Landcare, I am also a strong advocate of community-based natural resource management. I plan to foster links, formal and informal, between the ANU and the Environment Centre.

Selected Publications

Tennant-Wood, R. and J. Sullivan, 2006, Towards a best practice model of recycling in the tertiary sector, in Leal-Philo and Carpenter (eds), *Sustainability in the Australasian University Context*, Peter Lang, Frankfurt

Tennant-Wood, R. 2006. Silent Partners: the fluid relationship between women and dammed rivers. The case of the Snowy River, chapter in Lahiri-Dutt, K.(ed), *Fluid bonds: Views on gender and water*, Stree, Calcutta

Tennant-Wood, R. 2004. The role of the media in the public disclosure of electoral funding, *Democratic Audit of Australia*, http://democratic.audit.anu.edu.au

Tennant-Wood, R. 2004. From wasteland to wetland: creating a community ecological resource in regional NSW, *Local Environment*, Vol.9 No.6, pp.527-539

Tennant-Wood, R. 2003. Going for Zero: a comparative critical analysis of zero waste events in southern New South Wales, *Australasian Journal of Environmental Management* Vol.10 No.1

Tennant-Wood, R. 2002. Social sustainability through local environment policy, paper presented to Resource *NSW Soils and Sustainability Forum*, February 2002

Tennant-Wood, R. 2002. Local Green Governance: the value of community leadership and a sense of place *Ecopolitics Journal*, Vol.1, No.3

Beavis, S.G. & R. Tennant-Wood, 2001. Waste minimisation in schools: mapping successful pathways – paper presented to Waste Educate 2001 Conference, Brisbane, Nov.2001, *Waste Educate 2001: Maintaining the Momentum* pp 33-37

Beavis, S.G. & Tennant-Wood, R. 2001. *Waste minimisation in schools: a report on Mumbulla School, Rutherglen Primary School, Penola College and Cobden Technical School: a report to the South East Waste Board.* Research report, South East Waste Board, September 2001

Tennant-Wood, R. 2001, Taking out the garbage: waste as a social construct, paper presented to Wastebusters and Organics Conferences, Ashburton NZ, May 2001

Tennant-Wood, R. 2001. The sociology of waste, Keynote address to *mêtis Symposium*, Australian Academy of Science, Canberra, May 2001

Dr Chris Tidemann

Visiting Fellow
Wildlife ecology and conservation, conservation through sustainable use, management of feral species, animal welfare, community engagement

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Career Brief

Chris graduated from Adelaide University with a BSc in 1969 and a Diploma of Education in 1970 and from ANU with a PhD in Zoology in 1987. From 1971-1986 Chris was curator of the Zoology Museum at ANU and was on the academic staff of the School from 1987-2005.

Research, Teaching & Professional Activities

Chris has pursued a lifelong interest in wildlife biology and management in Indonesia, Papua New Guinea and many parts of Australia. His research in these areas has involved collaboration with rural communities; his most recent work has involved assisting communities and local governments to manage wildlife in urban areas. Chris teaches undergraduates and graduates in wildlife monitoring, conservation and management. Chris was a member of the ACT Flora and Fauna Committee from 1999-February 2004 and is a member of three of the World Conservation Union's Specialist Groups: Bats; Sustainable Use of Wildlife; Invasive Species.

Selected Publications

Tidemann, C.R. and Nelson, J.E. 2004. Long-distance movements of the grey-headed flying-fox (*Pteropus poliocephalus*). Journal of Zoology (London) 263: 1-6.

Tidemann, C. R. 2002. Sustainable management of the Grey-headed Flying-fox, *Pteropus poliocephalus*. Pp 122-127 In: Managing the Grey-headed Flying-fox as a Threatened Species in New South Wales. P. Eby and D. Lunney (eds). Royal Zoological Society of New South Wales: Mosman.

Tidemann, C. R., Vardon, M.J., Loughland, R.A. and Brocklehurst, P.J. 1999. Dry season camps of flying-foxes (*Pteropus* spp.) in Kakadu World Heritage Area, north Australia. Journal of Zoology 247, 155-163.

Pell, A.S. and Tidemann, C.R. 1997. The impact of two exotic hollow-nesting birds on two native parrots in savannah and woodland in eastern Australia. Biological Conservation 79: 145-153.

Webb, N.J. and C.R. Tidemann. 1996. Mobility of Australian flying-foxes, *Pteropus* spp. (Megachiroptera): evidence from genetic variation. Proceedings of the Royal Society of London B 263: 497-502.

Tidemann, C.R., Yorkston, H.D. and A.J. Russack. 1994. The diet of cats, *Felis* catus, on Christmas Island, Indian Ocean. Wildlife Research 21: 279-286.

Tidemann, C. R. (1993). Reproduction in the bats *Vespadelus vulturnus*, *V. regulus* and *V. darlingtoni* (Microchiroptera: Vespertilionidae) in coastal south-eastern Australia. Australian Journal of Zoology 41: 21-35.

Tidemann, C.R., Kitchener, D.J., Zann, R,B. and Thornton, I.W.B. 1990. Recolonisation of the Krakatau Islands and adjacent areas of West Java, Indonesia, by bats (Chiroptera) 1883-1986. Philosophical Transactions of the Royal Society of London B 328: 123-130.

Scheich, H., Langner, G., Tidemann, C., Coles, R. and Guppy, A. (1986). Electroreception and electrolocation in the platypus. Nature 319: 401-402.

Mr David Tongway

Visiting Fellow
Landscape ecology, soil science, restoration ecology, training

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Career Brief

David Tongway grew up in Bendigo, cental Victoria, obtaining a diploma of Applied Chemistry from the Bendigo Technical College, formerly the Bendigo School of Mines. He spent nearly 3 years as a Patent Examiner, specialising in polymers before taking a position with CSIRO in the Deniliquin Regional Laboratory. He initially ran the analytical services laboratory, but became interested in soil science. A range of CSIRO soil scientists in areas such as micro-morphology, chemistry, physics, pedology, land system mapping and biology mentored David. He put this knowledge to work in devising rapid assessment procedures for soil productive potential in rangelands. He acquired international status in this work and was promoted to Principal Research Scientist in 1994. He won the Chief's prize for Research Influence and Effect in 1997, the ACMER prize for contributions the environmental wing of the Minerals industry and the CSE prize for a lifetime contribution to science in 2003. He retired in 2003 after 38 years with CSIRO, but maintains professional contacts there as well as with Industry.

Research, Teaching & Professional Activities

David Tongway has presented guest lectures at Universities of Queensland, Western Australia, Murdoch, Canberra as well as the ANU. He is a consultant to the UN Security Council in regard to the ecological damages caused by the invasion of Kuwait by Iraq, and acts as a consultant to the rehabilitation industry.

Selected Publications

Tongway, David J., John A. Ludwig, and Walter G. Whitford. 1989. Mulga log mounds: fertile patches in the semi-arid woodlands of eastern Australia. Australian Journal of Ecology 14: 263-68.

Tongway, David J., and E. L. Smith. 1989. Soil surface features as indicators of rangeland site productivity. Australian Rangeland Journal 11, no. 1: 15-20.

Tongway, David J. 1990. Soil and landscape processes in the restoration of rangelands. Australian Rangeland Journal 12, no. 1: 54-7.

Tongway, David J., and John A. Ludwig. 1990. Vegetation and soil patterning in semi-arid mulga lands of Eastern Australia. Australian Journal of Ecology 15: 23-34.

Tongway, David J. 1995. Monitoring soil productive potential. Environmental Monitoring and Assessment 37: 303-18.

Tongway, David J., and Norman L. Hindley. 1995. Manual for Soil Condition Assessment of Tropical Grasslands . 60 p. Canberra: CSIRO Division of Wildlife and Ecology.

Tongway, David J., and John A. Ludwig. 1996. Rehabilitation of semiarid landscapes in Australia. I. Restoring productive soil patches. Restoration Ecology 4: 388-97.

Ludwig, J., Tongway, D., Freudenberger, D., Noble, J and Hodgkinson, K. (eds) (1997) Landscape Ecology Function and Management: Principles from Australia's Rangelands, CSIRO, Melbourne.

Tongway, David J., and Darren Murphy. 1999. Principles for designed landscapes and monitoring of ecosystem development in rangelands affected by mining. Proceedings of the International Rangeland Congress 6th v. 2: 945-49.

Ludwig, J.A , Wiens, J. A. and Tongway, David J. 2000. A Scaling Rule for Landscape Patches and how it applies to conserving Soil Resources in Savannas. Ecosystems. 3: 84-97.

Tongway, David J., Valentin, Christian and Seghieri, Josiane. 2001. Banded Vegetation Patterning in Arid and Semi-arid Environments: Ecological Processes and Consequences for Management. Ecological Studies No. 149, Springer Verlag, New York, 243pp.

Tongway, David J and Ludwig, John. A. 2002. Australian semi-arid lands and savannas. In Martin R Perrow and Anthony J Davy (Eds) Handbook of Ecological Restoration, Vol. 2 Cambridge University Press, Cambridge

Tongway, D.J.; Sparrow, A.D.; Friedel, M.H. 2003. Degradation and recovery processes in arid grazing lands of central Australia. Part 1: soil and land resources. J Arid Environ. 56; 301-326

Tongway, D J and Hindley, N L.(2004) Landscape Function Analysis: procedures for monitoring and assessing landscapes. CSIRO Sustainable Ecosystems, Brisbane.

Dr Brian J. Turner

Visiting Fellow
Native forest management,
Remote sensing

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Career Brief

Brian's career in forestry started with the NSW Forestry Commission on the North Coast and in Sydney. During that period, he went to Yale University in the USA to gain Master and Doctor of Forestry degrees. In 1969, he started teaching and research at the Pennsylvania State University, and returned to Australia in 1984 to take up the position of Reader in Forest Management at ANU. He retired at the end of 2002 but remains an active member of the staff, supervising honours and graduate students, and conducting research and consultancies.

Research, Teaching & Professional Activities

My interests range over the broad field of forest management planning, including models for prediction of future production of goods and services from managed native forests to techniques for collecting and analysing GIS and remotely sensed data.

I am currently involved in a RIRDC-funded project to determine the extent and condition of privately-owned dry sclerophyll forests on the tablelands of eastern Australia and develop a decision support system to help owners enhance their value.

Selected Publications

Mahiny, A.S. and Turner, B.J. 2005. Cumulative effects assessment as a framework for prioritizing mitigation measures in remnants of vegetation. *Environmental Informatics Archives* 3:418-426.

Huang, Z., Turner, B.J., Dury, S.J., Wallis, I.R. and Foley, W.J. 2004. Estimating foliage nitrogen concentration from HYMAP data using continuum removal analysis. *Remote Sensing of Environment* 93:18-29.

Turner, B.J. 2003. Why sustainable yield can be anything you want it to be (almost): good practice in its calculation. In: Mason, E.G. and Perley, C.J. (Eds.) *Joint Australia and New Zealand Institute of Forestry Conference Proceedings April-May 2003, Queenstown, NZ*. Ministry of Agriculture & Forestry, Wellington, NZ: 157-165.

Turner, B.J., Chikumbo, O., and Davey, S.M. 2002. Optimization modeling of sustainable forest management at the regional level: an Australian example. *Ecological Modelling* 153(1-2): 157-179.

Dury, S J, Turner, B. and Foley, W J. 2002. The use of high spectral resolution remote sensing to determine leaf palatability of eucalypt trees for arboreal marsupials. *International Journal of Applied Earth Observation and Geoinformation*. Vol 3 (4) 327-335.

Chikumbo, O., Spencer, R.D., Turner, B.J. and Davey, S. 2001. Planning and monitoring of forest sustainability: an Australian perspective. *Australian Forestry* 64(1): 1-7.

Chikumbo, O., Mareels, I. M. Y. and Turner, B.J. 2000. A stand optimization model developed from dynamical models for determining thinning strategies. In: Vasievich,, J.M., Fried, J.S., Leefers, L.A. (eds.) *Seventh Symposium on Systems Analysis in Forest Resources*; 1997; Traverse City, MI. USDA For. Serv. Gen. Tech. Rep. NC-205. Pp. 355-360.

Selected Student Theses

Chikumbo, O. 1997. Applicability of Dynamical Modelling and Theoretical Control Methods in Tree Growth Prediction and Planning. (PhD thesis)

Ingwesen, F. 2000. "Sundry Nameless Ranges": the Landscape Ecology of the Naas-Gudgenby Catchment. (PhD thesis)

Mahiny, A. 2004. A Modelling Approach to Cumulative Effects Assessment for Rehabilitation of Remnant Vegetation. (PhD thesis)

Kemmerer, E.P. 2005. Optimising Sawlog Production in Even-aged Eucalypt Stands. (PhD thesis)

Dr Rodney Weber

Visiting Fellow
Bushfire modelling, combustion phenomena

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Career Brief

Rod was born in Geelong and educated at North Geelong Primary School, North Geelong High School, The University of Melbourne and The University of Tasmania.

He did a short stint at University of New England as a Lecturer in Physics, then a Postdoc at UNSW at ADFA. He has been at UNSW at ADFA since 1987 and is now an Associate Professor there working on a range of problems related to the modelling of bushfires and other combustion phenomena.

Selected Publications

Weber, R.O., 2001: Wildland Fire Spread Models, In E.A. Johnson and K.Miyanishi (eds) *Forest Fires*, pp.151--169, Academic Press.

Mercer, G.N. and Weber, R.O., 2001: Fire Plumes, by. In E.A. Johnson and K.Miyanishi (eds) *Forest Fires*, pp. 225-255, Academic Press.

Watt, S.D., Mercer, G.N., Sidhu, H.S. and Weber, R.O., 2003: The Thermal Ignition Problem in a Cube, *ANZIAM Journal* 44:C820-C835..

Dold, J.W., Weber, R.O., Thatcher, R.W. and Shah, A.A., 2003: Flame Balls with Thermally Sensitive Intermediate Kinetics, *Combust. Theory Modelling* 7:175-203.

Gubernov, V., Mercer, G.N., Sidhu, H.S. and Weber, R.O., 2004: Evans function stability of non-adiabatic combustion waves, *Proceedings Royal Society London* A 460: 2415-2435.

Mr Piers Bairstow

Field Services Manager

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Career Brief

Piers joined the ANU in 1995 as a technical officer in the field services unit.

His main roles are to provide logistical and technical support for undergraduate fieldwork and laboratory based practical classes. Liaison and advice on methodology for project and postgraduate research is also part of his role. Maintenance and purchasing of field equipment, laboratory equipment and vehicle requirements is also included in Piers' duties. Piers is also the first aid officer for field services and the Geography Building.

Mr John Boland

SRES Information Services

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Career Brief

As a part of the SRES IT Team, John provides computing support and advice to the students, staff and visitors mainly in the Forestry building. John has been on campus off and on since 1982 and has spent the last 10 years providing IT services to SRES, RSBS and the Law Faculty.

His interests include Programming, Computer Games and Music. He has three young boys which fill the rest of his life.

Ms Tiffany Brown

Research Assistant
ANU *WildCountry* Research & Policy Hub

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Career Brief

After completing her Honours degree in Environmental Science at the University of Wollongong in 2003, Tiff began working as a Research Assistant at SRES in 2004. In this position, Tiff assists Prof Brendan Mackey in The ANU *WildCountry* Research and Policy Hub, an initiative aimed at facilitating research into systematic large-scale environmental conservation assessment and planning and related public policy. Tiff uses her knowledge of GIS applications and spatial data directories to compile and analyse the spatial data used for Hub research projects, particularly focussing on ecological connectivity in the Australian landscape.

Ms Debbie Claridge

Senior Technical Officer
Forest Ecology & Wildlife, GIS,
Web & Design

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Career Brief

Debbie supports teaching and research in a range of areas within the School. Debbie has a Bachelor's degree in Applied Science, majoring in Vegetation/Wildlife Management and Biometry (University of Canberra) and she also completed a course in Herpetology at the Sydney Technical College in order to further her interest in frogs. Part of her work has included research on bats and ecological surveys for ground-dwelling forest mammals and herpetofauna (reptiles and frogs). In addition, she has worked on the genetic improvement of forest products such as *Eucalyptus* and *Melaleuca* (tea-tree) oils, and has been involved in experimental design of glasshouse-based experiments.

Debbie's research skills were further enhanced, when she took a 12 month-posting to the United States (in the Pacific Northwest), where she participated in a study examining the distribution and abundance of frogs, newts and salamanders in Douglas Fir forests. She also had substantial involvement in research on the ecology of Douglas Fir Beetles. Her other research involvement included work on mycophagous (fungus-eating) Flying Squirrels, the primary prey of the Northern Spotted Owl. Since returning from the United States, and beyond her role at SRES, she continues to pursue diverse interests in the ecology/ diversity of Australian fauna and mycophagy and of hypogeous fungal species distribution.

Debbie provides teaching assistance to students in the course *Wildlife Research* including implementation of this course's on-line teaching. Debbie's other major contribution is to the School's Public Relations. Aside from being the School's principal photographer, she is involved in the design of scientific posters, pamphlets, brochures and displays, as well as the School's in-house Yearbook. She also takes part as support web master in the design and development of our on-line website, and design of many of our restricted on-line teaching sites.

Selected Publications

Jumponnen, A.M., Claridge, A.W., Trappe, J.M., Lebel, T. and Claridge, D.L. 2004. Ecological relationships among hypogeous fungi and trees: Inferences from associations analysis integrated with habitat modeling. *Mycologia* 96(3): 510-525.

Claridge, A.W., Trappe, J.M. and Claridge, D.L. 2001. Mycophagy by the swamp wallaby (*Wallabia bicolor*). *Wildlife Research* 28, 643-645.

Claridge, A.W., Trappe, J.M., Cork, S.J. and Claridge, D.L. 1999. Mycophagy by small mammals in the coniferous forests of North America: nutritional value of sporocarps of *Rhizopogon vinicolor*, a common hypogeous fungus. *Journal of Comparative Physiology B* 169, 172-178.

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Chick, R.R., Morris, B., Claridge, D.L. and Tidemann, C.R. 1997. *The Flora and Fauna of Big Bush Nature Reserve, Temora, NSW. A Biodiversity Survey Report to the NSW National Parks and Wildlife Service*. School of Resource Management and Environmental Science, Australian National University.

Mr Mauro Davanzo

Technical Officer
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Career Brief

Mauro joined the Department of Forestry in August 1991, after working for the Australian Defence Force Academy in supplies and transport. He has over 18 years' experience in vehicle management and supply related services.

He has also completed several courses that allow him to teach a number of selected training programs such as, the safe use of 4wds, chain saws and workshop safety. Mauro also maintains a senior first aid certificate.

Ms Cathy Gray

Administration Assistant

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Career Brief

Cathy previously worked in administration at the Research School of Chemistry between 1980 and 1996. From 1997 and 2004 she was Executive Assistant to the Executive Director of AARNet (Australia's Academic and Research Network) and joined the administration staff of SRES in October 2005. Cathy is first point of contact at the reception counter and assists the School Administrator, Student Programs Administrator and Finance Manager.

Ms Mayumi Hay

Student Programs Administrator

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Career Brief

Mayumi comes from Japan and her interest in different cultures and languages brought her to Australia in 1993.

She completed a Bachelor of Arts with Honours, majoring in political science and Asian studies at the Victorian University in Melbourne.

Mayumi has worked at the Australian National University since 1999. Before joining the School of Resources, Environment and Society as the Student Programs Administrator, she worked in the International Education Office and the College of Business and Economics.

Since settling in Australia, Mayumi has also worked as an interpreter and translator for various organisations including the ACT Government and universities in Australia and Japan.

Mr Clive Hilliker

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Career Brief

After 14 years' experience in the fields of botany, forestry, ceramics, microbiology, analytical chemistry, plant physiology, graphic design, instructional design, web design, and as a Technical Coordinator, Clive became Faculties Cartographer in August 1999.

Clive's qualifications include a Bachelor of Science (Botany) completed in 1984 and a Graduate Diploma (Management/Administration) completed in 1993. More recent courses include AutoCad, Graphic Design, University Teaching & Learning, 3D Studio Max, Multimedia Development and GIS/Environmental Modelling.

Prior to 1997 much of his time was spent demonstrating aspects of plant physiology and web design. Concurrently he was supporting research by developing and implementing protocols for the quantitative analysis of leaf oils using gas chromatography. Most effort during this period went into establishing methods of visual communication for use in teaching. This information proved popular within ANU and was presented to educators and others at the following seminars; ACTEIN, National Science & Technology Centre, Canberra, 1995 "Low Cost Animations for Graphically Illustrating Information"; Otago University, New Zealand, 1995, "Low Budget Multimedia in University Teaching".

His focus now is on visual communication in print media, primarily cartographic illustration as well as photography and the creation of graphics for publication. This also includes the design, layout and production of reports for publication, posters and promotional materials. Clive continues to find means to visually communicate scientific information in ways that both clarify and reinforce the messages and underpinning logic of the work.

Since 2002, Clive has also been responsible for the management and coordination of infrastructure change within the school.

Production and Layout

Mackey, B., Nix, H., Hitchcock, P. 2001. *The Natural Heritage Significance of Cape York Peninsula*, ANUTECH Pty Ltd, Commissioned by the Queensland Environmental Protection Agency.
Full Report ISBN 0-7315-3336-4
Executive Summary ISBN 0-7315-3338-0
Compact Disk (Executive Summary and Full report) ISBN 0-7315-3337-2

Maps and Illustrations

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Diamond, J. & Bellwood, P. 25 April 2003, *Farmers and their Languages: the First Expansions. SCIENCE*, pp. 587-603, Vol. 300. ISSN: 1095-9203

Dovers, S. & Wild River, S. (Eds), 2003. *Managing Australia's Environment*, The Federation Press, ISBN 1 86287 447 6

Kleinert, S. and Neale, M(Eds). 2001. *The Oxford Companion to Aboriginal Art and Culture*, Oxford University Press, ISBN: 0195506499

Lindenmayer, D., Claridge, A., Hazell, D., Michael, D., Crane, M., MacGregor, C., Cunningham, R. 2003, Wildlife *on Farms*, CSIRO Publishing, ISBN 0-643-06866-X.

Mackey, B., Lindenmayer, D., Gill, M., McCarthy, M. & Lindesay, J. 2002. *Wildlife, Fire and Future Climate: a Forest Ecosystem Analysis*, CSIRO Publishing, ISBN: 0643067566.

Campbell, J. 2002. Invisible Invaders: *Smallpox and Other Diseases in Aboriginal Australia* 1780-1880, Melbourne University Press, ISBN: 0-522-84939-3

Dr Susanne Holzknecht

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Graduate Students

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Career Brief

Sue studied Anthropology and Sociology (University of Qld), Linguistics and Teaching English as a Second Language (UPNG) and her PhD is in Linguistics (ANU). For 12 years Sue lectured at the Papua New Guinea University of Technology, Lae, in Language and Communication Studies, specialising in teaching English for Special Purposes and for Academic Purposes for Accountancy, Forestry, Land Management, Agriculture and Engineering. From 1993 to 1998, she worked in the National Centre for Development Studies, ANU, as lecturer in Academic and Research Skills in the EMD Program. Then she spent 3 years in the University's Study Skills Centre (now the Academic Skills and Learning Centre), and in 2001, began work in SRES as part-time Academic Skills Advisor to graduate students. Since mid-2003 Sue has been located in SRES, working 4 days per week.

Research, Teaching & Professional Activities

In SRES, I assist graduate students to develop their skills in academic reading, writing, doing research, and giving presentations at a graduate level. I hold weekly classes focusing on academic skills topics and workshops on language development, and am available for individual consultations with students about matters of concern to them, in relation to their academic work.

My research interests include communicating effectively in environment, development and natural resource areas, and discovering new and better ways of motivating students to express themselves more effectively, and take ownership of their own work. I am also involved in recording and publishing the stories of migrants and refugees now living in Australia, with the aim of helping to break down the barriers being set up between people of different cultures and backgrounds.

Selected Publications

Bourke, M., Holzknecht, S. and Bartlett, A. (eds). 2002. *Weaving a Double Cloth. Stories of Women from the Asia Pacific in Australia*, Pandanus Books, Canberra.

Bartlett, A., Holzknecht, S, and Cumming Thom, A., 1999. *To Hit the Ground Running. Preparing Students for Graduate Study*, Asia Pacific Press, Canberra (Teachers' Manual and Student Workbook).

Mr Steve Leahy

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SRES Information Services

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Career Brief

Steve is one of those scary computer-literate environmental scientists who would have taken over the world, if their energies hadn't been channelled into other areas such as IT support.

His only interest is improving the IT literacy of SRES staff and students (this seems to be working, because over the past year he found some time for other things like further improving the SRES IT infrastructure, and research-related computer programming). And making computers do what he expects...

Amongst his interests are ensuring people learn how to use their computers properly; forcing said computers into behaving themselves; making sensible use of multi-media systems; simplifying the administration of the SRES computer servers; occasionally making the acquaintance of a thesaurus; reading on the bus; paraphrasing Monty Python where-ever it seems appropriate; boldly splitting infinitives where no-one has split them before; recycling most of his previous yearbook entry; and writing about himself somewhat facetiously in the third-person.

Mr Karl Nissen

IT Support & Programmer

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Career Brief

GIS Consultant in CRES (Thursdays):
Karl has a Bachelor of Engineering Degree from the University of Auckland. He has worked at The Australian National University since 1996, with a two year absence in Japan. Prior to joining the University he worked at the Australian Centre for Remote Sensing at Fern Hill Park in Belconnen as both a production engineer and project engineer.

After graduating from University he was lucky enough to receive a two year scholarship at the University of Wisconsin Physical Sciences Laboratory, which is a research engineering laboratory. Work done there included the development of a long distance Ethernet bridge, digital frequency synthesiser design and the development of a programmable environmental chamber controller.

Current duties include the day to day operation of SRES PCs and servers, and the management of IT finances. He also looks after the undergraduate laboratories run by SRES and the management of SRES's GIS software.

He also provides GIS support to CRES.

http://cres.anu.edu.au/people/nissen.html

Ms Sarah O'Callaghan

Finance Officer

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Career Brief

Since completing a BSc(Hons)/LLB in 2002 Sarah has worked at the ANU as Technical Services Manager at Dept of Earth and Marine Sciences. More recently she has also worked as the SRES Finance Officer.

Ms Zosha Smith

School Administrator

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Career Brief

Zosha has a Bachelor of Arts (Modern Languages).

She has worked and lived in the Middle East, Africa and Europe. Zosha is the School Administrator.

Mr Toby Roscoe

Research Assistant

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Career Brief

After recently completing a Bachelor's degree in Resource and Environmental Management at SRES, Toby has been working as a research assistant in Dr. Chris Tidemann's laboratory, as operations manager of the Indian Myna Project. The main focus of Toby's role within this project is to collect environmental and ecological data that will create a knowledge base used to better understand the behavioural ecology of the Common Indian Myna (Acridotheres tristis). The project works closely with the Australian Rainforest Foundation. This research partnership allows us to collect data from Far North Queensland and Canberra in order to ensure that the conservation science behind is applicable to the entire East Coast. The aim of the Indian Myna Project is to create a safe, humane, species specific and socially acceptable solution to the significant negative impacts that these introduced birds are having on our native ecological system, human amenity and potential human health risks.

Dr Robyn Harris

Education Officer,
CRC for Greenhouse Accounting

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Career Brief

Robyn studied science and journalism at the University of Queensland, followed by the Postgraduate Diploma in Science Communication at the Australian National University and Questacon. After working on education programs within several international science and technology centres in Wales and New Zealand she returned to the Australian National University to complete a PhD in microbial biochemistry at the John Curtin School of Medical Research. Robyn has also managed the interactive science programs for visitors to Questacon.

In my role as Education Officer in the Cooperative Research Centre for Greenhouse Accounting I coordinate and assist with the development of postgraduate skills training programs and mentor postgraduates to ensure completion. I am also assisting with the development of an online Master of Contemporary Science in Greenhouse Science and Policy.

Selected Publications

Harris, R.M., Webb, D. C., Howitt, S. M. and Cox, G. B. (2001). *Characterisation of PitA and PitB from Escherichia coli*, Journal of Bacteriology 183:5008-5014.

Mr Eugene Wallensky

Executive Officer
Kioloa Coastal Campus

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Career Brief

Eugene is currently responsible for administrative oversight and day-to-day management of the ANU field station at Kioloa on the south coast of NSW.

His background is in Environmental Science and he completed his Masters Degree in *Coastal Geomorphology* at Kioloa in 1980. Subsequently he held positions as Head Technical Officer in Biogeography and Geomorphology in the Research School of Pacific and Asian Studies before taking over as Operations Manager in the Research School of Biological Sciences. His long-term association with the ANU provides him with a wide range of knowledge and contacts that enables him to carry out his present job effectively.

The focus for development of the Kioloa Coastal Campus is to provide all of the infrastructural requirements to establish the campus as a multi-faceted "learning centre". Construction of an auditorium/lecture theatre/performance space with additional meeting rooms and an IT commons is critical for the coastal campus to fulfil its potential.

SRES have provided a main campus base for Eugene and he is located in Room G225 of the Geography Building. Please feel free to visit him and to find out more about the Kioloa campus and the opportunities it can provide for you.

Selected Publications

Chappell, J.M., Rhodes, E.G., Thom, B.G., and Wallensky, E.P. (1982) Hydro-isostasy sea-level isobase for 5500 B.P. in North Queensland. *Marine Geology*, 49: 81-90.

Chappell, J.M., Chivas, A., Wallensky, E.P., Polach, H.A., and Aharon, P. (1983). Holocene palaeo-environmental changes, central to North Great Barrier Reef inner zone. *Journal of Australian Geology and Geophysics*, 8: 223-235.

Woodroffe, C.D., Chappell, J.M., Thom, B.G., and Wallensky, E.P. (1985). Geomorphology of the South Alligator tidal river and plains. In *Coastal and tidal wetlands of the Australian Monsoon region*. N.A.R.U. Mangrove Monograph No. 1, 3-15.

Woodroffe, C.D., Chappell, J.M., Thom, B.G., and Wallensky, E.P. (1985). Stratigraphy of the South Alligator River, Northern Territory. In *Coastal and tidal wetlands of the Australian Monsoon region*. N.A.R.U. Mangrove Monograph No. 1, 17-30.

Woodroffe, C.D., Chappell, J.M., Thom, B.G., and Wallensky, E.P. (1986). *Geomorphological dynamics and evolution of the South Alligator River and Plains, Northern Territory*. N.A.R.U. Monography No. 3.

Woodroffe, C.D., Thom, B.G., Chappell, J.M., Wallensky, E.P., Grindrod, J., and Head, J. (1987). Relative sea-level in the South Alligator River Region, North Australia, during the Holocene. *Search*, 18: 4, 198-200.

Woodroffe, C.D., Chappell, J.M., Thom, B.G., and Wallensky, E.P. (1989). Depositional model of a macro-tidal estuary ad floodplain, South Alligator River, Northern Australia. *Sedimentology*, 36: 737-756.

Woodroffe, C.D., McLean, R., Polach, H., and Wallensky, E.P. (1990). Sea-level and coral atolls: Late Holocene emergence in the Indian Ocean. *Geology*, 18: 1, 62-67.

Woodroffe, C.D., McLean, R., Polach, H., and Wallensky, E.P. (1990). Darwin's coral atoll: Geomorphology and recent development of the Cocos (Keeling) Islands, Indian Ocean. *National Geographic Research*, 6: 3, 262-275.

Woodroffe, C.D., Veeh, H., Falkland, A., McLean, R., and Wallensky, E.P. (1991). Last Interglacial reef and subsidence in the Cocos (Keeling) Islands, Indian Ocean. *Marine Geology*, 96: 137-143.

Smithers, S.G., Woodroffe, C.D., McLean, R.F. and Wallensky, E.P. (1993) Lagoonal sedimentation in the Cocos (Keeling) Islands, Indian Ocean. *Proceedings of the 7th International Coral Reef Symposium*, 1: 273-288.

Woodroffe, C.D., McLean, R., and Wallensky, E.P. (1994). Geomorphology of the Cocos (Keeling) Islands. Chapter 4: *Atoll. Research Bulletin*, No. 402. 33p.

Matsuda, S., Chappell, J.M., and Wallensky, E.P. (1995). Nonarticulated Coraline Algal Flora of present day coral reefs on Huon Peninsula. *Journal of Geography*, Tokyo, 104: 5, 719-724.

Nakomori, T., Chappell, J.M., and Wallensky, E.P. (1995). Living hermatypic coral assemblages at Huon peninsula, P.N.G. *Journal of Geography*, Tokyo, 104: 5, 743-754.

Croke, J.C., Magee, J.M., and Wallensky, E.P. (1999). The role of the Australian Monsoon in the western catchment of Lake Eyre, central Australia during the Last Interglacial. *Quaternary International*. 57/58, 71-80.

Panorama of Kioloa Coastal Campus. (http://kioloa-vfa.anu.edu.au/index.html)

iCAM Professor & Head

Professor Tony Jakeman

Director, Integrated Catchment Assessment and Management Centre

Professor, CRES
Integrated environmental assessment, hydrological and water quality modelling, and environmental education and training

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Career Brief

Tony Jakeman received his Bachelor of Science with first class honours in Pure and Applied Mathematics from the University of NSW in 1973. He was awarded the PhD in Applied Numerical Analysis from the ANU in 1976. After holding a short-term postdoctoral position in Statistics at the University of Florida, he returned to ANU in 1976 and joined the Centre for Resource and Environmental Studies. In 1997 he helped set up the Integrated Catchment Assessment and Management (iCAM) Centre, a continuing joint initiative of CRES and SRES, and now comprising 7 research staff, and 12 PhD students, supported by a small, dedicated group of technical and management staff.

Tony has been President of the Modelling and Simulation Society of Australia and New Zealand (www.mssanz.org.au) since 1987 and is Foundation President of the International Environmental Modelling and Software Society (www.iemss.org). He is on the Board of numerous academic journals and is Editor-in-Chief of Environmental Modelling and Software, an Elsevier journal. He has undertaken invited study leave at Stanford, Cambridge and Lancaster Universities, as well as at the University of Western Australia, CSIRO Land and Water and the UK Institute of Hydrology (Centre for Ecology and Hydrology).

Research, Teaching & Professional Activities

My research interests are hydrology, environmental systems modelling and integrated assessment of river basin issues to promote more sustainable outcomes. My work in iCAM focuses on developing the relevant disciplinary tools and their integration for this assessment. This problem-oriented work is facilitated by a project focus and networking with other research groups and industrial partners in Australia and internationally.

I have supervised over 30 postgraduate students, predominantly at the PhD level. I am also strongly involved in the supervision of Honours students. I am co-convenor of MATH 3133/3134H, a 3rd year course in Environmental Modelling usually offered in second semester.

Selected Publications

Jakeman, A.J., Letcher, R.A. and Norton, J.P. 2006. Ten iterative steps in development and evaluation of environmental models. *Environmental Modelling and Software*, 21: 602-614.

Giupponi, C., Jakeman, A.J., Karssenberg, G. and Hare, M.P. (eds) 2006. *Sustainable Management of Water Resources: an Integrated Approach*. Edward Elgar Publishing, Cheltenham, UK, 361pp.

Croke, B.F., Merritt, W.S. and Jakeman, A.J. 2005.. A dynamic model for predicting hydrological response to land cover changes in gauged and ungauged catchments. *J. Hydrology*, 291:115-131.

Letcher, R.A., Croke, B.F. and Jakeman, A.J. 2004. Model development for integrated assessment of water allocation options. *Water Resources Research* 40(5):W0552.

Merritt, W.S., Croke, B.F., Jakeman, A.J., Letcher, R.A. and Perez, P. 2004. A biophysical toolbox for assessment and management of land and water resources in rural catchments in Thailand. *Ecological Modelling*, 171: 279-300.

Jakeman, A.J. and Letcher, R.A. 2003. Integrated Assessment and Modelling: Features, Principles and Examples for Catchment Management. *Environmental Modelling and Software*, *18*: *491-501*.

Kokkonen, T.S., Jakeman, A.J. and Young, P.C. 2003. Predicting daily flows in ungauged catchments- model regionalization from catchment descriptors at Coweeta. *Hydrological Processes*, 17: 2219-2238.

Kokkonen, T.S. and Jakeman, A.J. 2002. Structural effects of landscape and land use on streamflow response. Chapter 14 In *Environmental Foresight and Models: A Manifesto*, M.B. Beck (ed.), Elsevier, Amsterdam, pp.303-321.

Letcher, R.A. and Jakeman, A.J. 2002. Catchment Hydrology, In *Encyclopaedia of Environmetrics*, Volume 1, A.H. El-Shaarawi and W.W. Piergorsch (eds), Vol. 1, pp 281-290, Wiley.

Parker, P., Letcher, R. A., Jakeman, A. J. *et al.* 2002. Progress in integrated assessment and modelling. *Environmental Modelling and Software*, 17: 209-217.

Croke, B.F.W. and Jakeman, A.J. 2001.. Predictions in catchment hydrology: an Australian perspective. *Mar. Freshwater Res*, 52: 65-79.

Kokkonen, T.S. and Jakeman, A.J. 2001. Comparing metric and conceptual approaches in rainfall-runoff modelling. *Water Resources Research*, 37: 2345-2352.

Mahendrarajah, S., Jakeman, A.J. and McAleer, M.J. (eds.) 1999. *Modelling Change in Economic-Environmental Systems* (Wiley).

Post, D.A. and Jakeman, A.J. 1999.. Predicting the daily streamflow of ungauged catchments in S.E. Australia by regionalising the parameters of a lumped conceptual rainfall-runoff model. *Ecological Modelling*, 123 91-104.

Ghassemi, F., Jakeman, A.J. and Nix, H.A. 1995. *Salinisation of Land and Water Resources: human causes, extent, management and case studies*, CAB International and UNSW Press, 540 pp.

Jakeman, A.J., Beck, M.B. and McAleer, M.J. (eds.) 1993. *Modelling Change in Environmental Systems*, Wiley Series on Principles and Techniques in the Environmental Sciences, 584pp. (Hardback). (Paperback version 1995).

Jakeman, A.J. and Hornberger, G.M. 1993. How much complexity is warranted in a rainfall-runoff model? *Water Resources Research*, 29(8): 2637-2649.

Dr Barry Croke

Research Fellow
(Joint appointment with iCAM and CRES)
Streamflow and water quality modelling, with particular emphasis on predicting flow in ungauged catchments

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Career Brief

Barry Croke has a BSc in Theoretical Physics and a PhD in Astrophysics from UNSW. He was a post-doctoral fellow in the Physics Department at the University of Crete between April 1994 and September 1996. From September 1996 to June 1999, he was a post-doctoral fellow in the Environmental Research Laboratory at the Foundation for Research and Technology – Hellas, working in the fields of hydrology and atmospheric research. In August 1999 he joined iCAM as a visiting fellow, and since October 1999 he has been a joint iCAM/CRES research fellow.

Research, Teaching & Professional Activities

My research interests include development of models for prediction of streamflow and water quality. This includes prediction of flow at ungauged sites, which requires techniques for predicting hydrologic response based on catchment attributes such as topography and land use. This involves development of models suitable for such work, as well as exploring the relationships between model parameters and key catchment attributes. In addition, research on modelling water quality is being undertaken including estimation of sediment, nutrient and pathogen exports. A key research component is investigating model response to uncertainty in parameter values and input data through sensitivity analysis. This is an important component of model development due to the sparse nature of environmental datasets. I am one of the co-founders of the Top-Down Modelling Working Group, and co-leader of one of the science themes within the Prediction in Ungauged Basins initiative of the International Association of Hydrological Sciences.

Selected Publications

Letcher, R.A., B.F.W. Croke and A.J. Jakeman, 2004. Model development for integrated assessment of water allocation options. Water Resources Research, 40, W05502, doi:10.1029/2003WR002933.

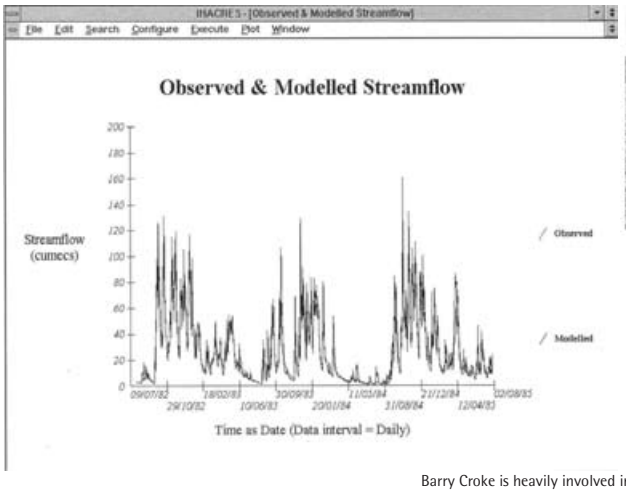
Croke, B.F.W., W.S. Merritt and A.J. Jakeman, 2004. A Dynamic Model for Predicting Hydrologic Response to Land Cover Changes in Gauged and Ungauged Catchments, Journal of Hydrology, 291, 115-131.

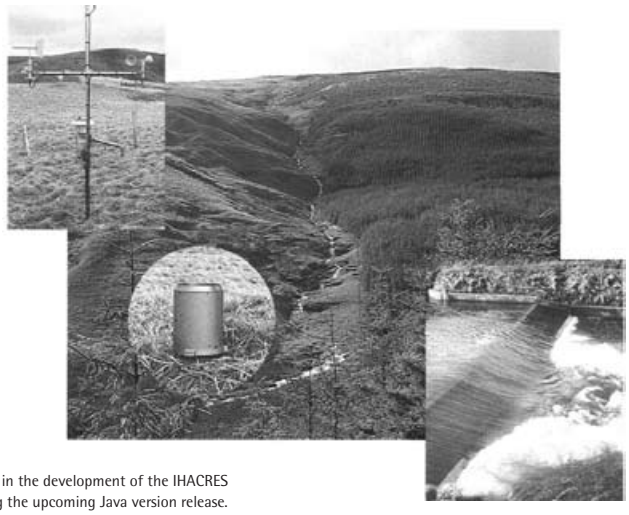
Croke, B.F.W. and A.J. Jakeman, 2004. A Catchment Moisture Deficit module for the IHACRES rainfall-runoff model, *Environmental Modelling and Software*. 19, 1-5.

Littlewood, I.G., B.F.W. Croke, A.J. Jakeman and M. Sivapalan, 2003. The role of top-down modelling for Prediction in Ungauged Basins (PUB), *Hydrological Processes*, 17, 1673-1679.

Littlewood, I.G., Jakeman, A.J., Croke, B.F.W., Kokkonen, T.S. and Post, D.A. 2002. Unit hydrograph characterisation of flow regimes leading to streamflow estimation in ungauged catchments (regionalisation). In: P. Hubert, D. Schertzer, T. Takeuchi and S. Koide (eds), PUB Communications. *Kick-off meeting for the IAHS Decade for Prediction in Ungauged Basins, Brasilia*, 20-22 November 2002. Also available at http://www.cig.ensamp.fr/~iahs/index.html .

Croke, B.F.W. and A.J. Jakeman, Predictions in Catchment Hydrology: an Australian Perspective, *Marine and Freshwater Research*, 52 (2001), 65-79.





Barry Croke is heavily involved in the development of the IHACRES rainfall-runoff model including the upcoming Java version release.

Dr Rebecca Letcher

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Integrated catchment assessment, modelling and decision support

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Career Brief

Rebecca completed undergraduate degrees in Science and Economics at the Australian National University (ANU) in 1998, majoring in economics, econometrics and mathematics. Her honours year in mathematics focused on assessing the impacts of farm dams on stream flow yields in several catchments in the Macquarie River basin, Australia. While completing her undergraduate degrees she also worked as a Research Economist at ACTEW, on water pricing, regulation and forecasting.

She then went on to complete her PhD at the Centre for Resource and Environmental Studies, also at the ANU. Her PhD thesis was entitled 'Issues in Integrated Catchment Assessment and Management'. This work involved the development of an integrated (economic, hydrological) model for assessing water allocation options in the Namoi River Basin, Australia. She has also worked on several other integrated assessment projects, including IWRAM, a water resources project in northern Thailand, and an Environmental Trust funded project in the Ben Chifley Dam Catchment focusing on management of sediments and nutrients to the dam. She is currently working on a three-year project in the Namoi and Gwydir catchments funded by the Cotton Research and Development Corporation. This project will deliver decision support tools for assessing alternative water allocation options for both catchments.

Research, Teaching & Professional Activities

Rebecca has substantial expertise in the field of model-based assessment of natural resource management issues and has developed innovative new methods for integrating economic and hydrological modelling approaches for considering water allocation management problems. This work has been the focus of co-authored keynote addresses and has been published in the top international water research journal, Water Resources Research. Her current and past collaborations on major international and Australian projects in the area include: Integrated Water Resources Assessment and Management (IWRAM) Project, Northern Thailand (Phases 1 and 2), funded by ACIAR; Management of Diffuse Pollutants in the Ben Chifley catchment, Australia, funded by NSW Environmental Trust; Development of a Decision Support System for the Gwydir and Namoi valleys, Australia funded by the Cotton Research and Development Corporation; Assessment of the Macroeconomic Impacts of Climate Variability in Mali, funded by the World Bank; National Pollutant Inventory projects funded by NSW EPA.

Rebecca has authored more than 40 refereed articles in the areas of integration of models, concepts and approaches from various disciplinary areas, particularly economics and hydrology, for considering management issues such as water allocation, salinity and other water quality (nutrients, sediments). She has developed novel approaches for integrating economic, hydrologic, water quality, agricultural and ecological modelling and assessment research and for considering long-run capital investment costs in water allocation decision-making. She has extensive experience in the use of various participatory methods in integrated assessment projects and in the use and development of economic models and assessment approaches. She also has substantial industry experience in the area of water pricing, regulation and methods for assessing marginal cost of service delivery and has maintained an active research interest in this area.

She is currently co-supervising several students at the ANU. She also helps organise an undergraduate course in environmental modelling which is run through the Mathematics Department at the ANU. She has given lectures in a water resources course run through SRES.

In addition to these activities she is the Secretary of the International Environmental Modelling and Software Society (iEMSs). As part of this commitment she co-organised a session on Integrated Assessment at the first Biennial conference of the Society which was held in Lugano, Switzerland in 2002. In the last few years she has edited Special Issues of the journals Integrated Assessment and Environmental Modelling and Software, featuring papers from this conference and from a separate workshop convened by a European Union research group called MULINO.

Selected Publications

Cuddy, S. M., Letcher, R. A., Chiew, F. H. S., Nancarrow, B., and Jakeman, A. J. (in press). "A role for streamflow forecasting in managing risk associated with drought and other water crises." *Drought and Water Crises: Science, Technology, and Management Issues*, D. A. Wilhite, ed., Marcel Dekker, Inc, New York.

Hare, M., Letcher, R., and Jakeman, A. J. (2003). "Participatory Modelling in Natural Resource Management: A Comparison of Four Case Studies." *Integrated Assessment*, 4(2): 62-72.

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Letcher, R. A., and Jakeman, A. J. (2002). "Catchment Hydrology, *Encyclopedia of Environmetrics*, (eds.) El-Shaarawi, A. and Piegorsch, W.W., Wiley.

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Letcher, R. A., Jakeman, A. J., and Croke, B. F. W. (2004). "Model development for integrated assessment of water allocation options." *Water Resources Research*, 40, W05502.

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Merritt, W. S., Croke, B. F., Jakeman, A. J., Letcher, R. A., and Perez, P. (2005). "A biophysical toolbox for assessment and management of land and water resources in rural catchments in Northern Thailand." *Ecological Modelling*, 171: 279-300.

Merritt, W. S., Letcher, R. A., and Jakeman, A. J. (2003). "A review of erosion and sediment transport models." *Environmental Modelling and Software*, 18: 761-799.

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Parker, P., Letcher, R., and Jakeman, A. J. (2002). "Progress in integrated assessment and modeling." Environmental Modelling and Software, 17(3): 209-217.

Sadoddin, A., Letcher, R. A., and Jakeman, A. J. "A Bayesian Decision Network Approach for Salinity Management in the Little River Catchment, NSW." Proceedings of the International Congress on Modelling and Simulation MODSIM2003, Townsville Australia, pp. 953-958.

Schreider, S. Y., Jakeman, A. J., Letcher, R. A., Nathan, R. J., Neal, B., and Beavis, S. G. (2002). "Detecting changes in streamflow response to changes in non-climatic catchment condition: farm dam development in the Murray-Darling Basin, Australia." *Journal of Hydrology*, 262(1-4): 84-98.

Dr Lachlan Newham

Post Doctoral Fellow
Water quality modelling and spatial data analysis, environmental management

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Career Brief

Lachlan Newham has been employed at iCAM since completing his a PhD at the Centre for Resource and Environmental Studies in 2002. Lachlan's PhD research was focused on developing and assessing modelling tools used to prioritise management for water quality improvement. Prior to undertaking his PhD studies Lachlan completed a BSc (Resource and Environmental Management) degree with Honours at the then School of Resources and Environmental Management.

Research, Teaching & Professional Activities

Lachlan's research interests are in the broad area of water quality assessment, modelling and management. His research is currently focused on a project titled 'Integrating Economic Valuation and Water Quality Modelling for Improving Management of Coastal Catchments'. This ARC Linkage project is being undertaken with partners the Eurobodalla Shire Council and NSW Department of Infrastructure, Planning and Natural Resources. It aims to develop and apply an integrated assessment and management tool for managing coastal catchments. The project consists of three core components: development of biophysical models to predict water quality impacts under a wide range of conditions; economic evaluation of those impacts; and the integration of water quality and economic modelling in order to influence policy development and investment in environmental conservation and remediation.

Lachlan is the Treasurer of the Modelling and Simulation Society of Australia and New Zealand.

Selected Publications

J.L. Ticehurst, L.T.H. Newham, D. Rissik, R.A. Letcher and A.J. Jakeman in-press. 'A Bayesian Network Approach to Assess the Sustainability of Coastal Lakes', *Environmental Modelling and Software*.

J. Drewry, L.T.H. Newham, R.S.B. Green, A.J. Jakeman and B.F.W. Croke submitted. 'A review of nitrogen and phosphorus export to waterways: context for catchment modelling', *Marine and Freshwater Research*.

A. Sadoddin, R.A. Letcher, A.J. Jakeman and L.T.H. Newham 2005. 'A Bayesian Decision Network Approach for Assessing the Ecological Impacts of Salinity Management', *Mathematics and Computers in Simulation, vol. 69, pp. 162-176.*

J.J. Drewry, L.T.H. Newham, R.S.B. Greene, A.J. Jakeman and B.F.W. Croke 2005. 'An approach to assess and manage nutrient loads in two coastal catchments of the Eurobodalla region, NSW, Australia', In A. Zerger and R.M. Argent (eds) MODSIM 2005 International Congress on Modelling and Simulation. Modelling and Simulation Society of Australia and New Zealand, December 2005, p. 2658-2664.

B. Fu, L.T.H. Newham and J.B. Field 2005. 'Integrating modelling and field-based analysis for improving catchment-scale pollutant management: an application of the CatchMODS model in the Moruya River Catchment', In A. Zerger and R.M. Argent (eds) MODSIM 2005 International Congress on Modelling and Simulation. Modelling and Simulation Society of Australia and New Zealand, December 2005, p. 2693-2699.

A.J. Jakeman, R.A. Letcher, L.T.H. Newham and J.P. Norton 2005. 'Integrated Catchment Modelling: Issues and Opportunities to Support Improved Sustainability Outcomes. In: Water Capital, 29th Hydrology and Water Resources Symposium, 20-23 February, Rydges, Lakeside, Canberra, pp. 1-15.

L.T.H. Newham, E. McLean, J.P. Norton and A.J. Jakeman 2005. 'An Independent Review of the Effectiveness of the Lake Macquarie Improvement Project', iCAM Client Report 2005/18 for the Office of the Lake Macquarie and Catchment Coordinator, Integrated Catchment Assessment and Management Centre, The Australian National University.

L.T.H. Newham, S.M. Cuddy, R.A. Vertessy and A.J. Jakeman 2005. 'Determining Future Directions in Contaminant Cycle Modelling Through an Evaluation of Existing modelling Systems' In Proceedings of the 2005 International Conference on Simulation and Modelling, V. Kachitvichyanukul, U. Purintrapiban and P. Utayopas (eds), 17-19 January, Bangkok, Thailand, pp. 426-433.

L.T.H. Newham, R.A. Letcher, A.J. Jakeman and T. Kobayashi 2004. 'A Framework for Integrated Hydrologic, Sediment and Nutrient Export Modelling for Catchment-Scale Management', *Environmental Modelling and Software*, vol. 19, pp.1029-1038.

L.T.H. Newham, J.L. Ticehurst, D. Rissik, R.A. Letcher, A.J. Jakeman and P. Nelson 2004. 'Assessing the Sustainability of NSW Coastal Lakes Using a Bayesian Decision Network Approach' In Conference Proceedings: NSW Coastal Conference 2004, 9-12 November, Lake Macquarie, pp. 63-69.

L.T.H. Newham, R.A. Letcher and A.J. Jakeman 2004. 'Integrated Assessment and Modelling for Catchment Management: An Australian Case Study in Participation ', Water Science and Technology, International Symposium: Uncertainty and Precaution in Environmental Management, Copenhagen, June 7-9.

L.T.H. Newham, S.M. Cuddy, R.A. Vertessy and A.J. Jakeman 2004. 'Informing the Design of Catchment Contaminant Cycle Modelling – a Survey of End-User Needs', CSIRO Technical Report 11/04, CSIRO Land and Water, Canberra.

J. Myiak, L.T.H. Newham and R.A. Letcher 2004. 'Integrated Modelling and Decision-Making Analysis for Water Quality Management: The Ben Chifley Dam Catchment Case Study' In Integrated Water Management of Transboundary Catchments: A Contribution from TRANSCAT, Venice, Italy, 24-26 March.

J.P. Norton, L.T.H. Newham and F.T. Andrews 2004. 'Sensitivity Analysis of a Network-Based, Catchment-Scale Water Quality Model' In iEMSs 2004 The International Environmental Modelling and Software Society Conference, Complexity and Integrated Resources Management, University of Osnabrück, Germany, 14-17 June 2004.

A. Sadoddin, R.A. Letcher and L.T.H. Newham 2004. 'Assessing the Ecological Impacts of Salinity Management Using a Bayesian Decision Network' In iEMSs 2004 The International Environmental Modelling and Software Society Conference, Complexity and Integrated Resources Management, University of Osnabrück, Germany, 14-17 June 2004.

L.T.H. Newham, J.P. Norton, I.P. Prosser, B.F.W Croke and A.J. Jakeman 2003. 'Sensitivity Analysis for Assessing the Behaviour of a Landscape-Based Sediment Source and Transport Model', *Environmental Modelling and Software*, vol. 18, pp. 741-752.

L.T.H. Newham I.P. Prosser and A.J. Jakeman 2003. 'Testing Output Quantities and Spatial Patterns of a Catchment-Scale Stream Pollutant Model Against Collateral Studies' In D.A. Post (ed.) MODSIM 2003 International Congress on Modelling and Simulation, vol. 1, pp. 314-319, Modelling and Simulation Society of Australia and New Zealand.

B.F.W. Croke, L.T.H. Newham and I.P. Prosser 2002. 'Improving Hydrologic Parameterisation of a Landscape-Based Sediment Source and Transport Model', Third International Conference on Water Resources and Environment Research, 22-25 July 2002, Dresden University of Technology, Germany, pp 242-246.

Selected Student Theses

S. Chen 2006. 'An investigation of the long-term viability of the oyster industry in the Eurobodalla Shire' (Honours thesis, SRES).

B. Fu 2005. 'Nutrient Sources and Transport under Different Land Uses: Case Study on the Upper Mogendoura Creek Subcatchment, Moruya River, NSW' (Masters thesis, SRES).

W.S. Ng 2004. 'Catchment-Scale Management of Pollutant Delivery to Coastal Lakes' (Honours thesis, SRES).

Professor John Norton

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Environmental modelling, uncertainty handling and assessment in complex models of dynamical systems, identification and state estimation, postgraduate training

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Career Brief

BA in Mechanical Sciences, Cambridge, 1962 (MA 1966); DIC, PhD in Electrical Engineering, Imperial College, London 1967. Research Engineer, English-Electric-Leo Computers, London 1962-63. Research Fellow, UK Civil Service 1967-71. Lecturer/Senior Lecturer, Dept. of Electrical Eng., University of Tasmania 1971-79. Lecturer/Senior Lecturer/Reader/ Professor, Dept. of Electronic, Electrical & Computer Eng., University of Birmingham 1979-2004. Dynamic Systems Modeller (Level E), ANU 2003.

Study leave Cambridge 1974, Warwick 1978, Newcastle NSW 1983, ANU 1992, 1997, 2000, 2002. Adjunct Professor, CRES, ANU 2002.

MIREE (Aust.) 1973-77, MIEAust. 1977-79, MIEE 1980, FIEE 1996, CEng.

Research, Teaching & Professional Activities

My research interests span identification of dynamical systems (particularly time-varying systems), state estimation; uncertainty handling, and their applications to environmental modelling, target tracking and guidance, gas-turbine modelling, process industries, automotive control and biomedicine. Current activity is concentrated on sensitivity assessment of simulation models for environmental applications and application of ideas from control engineering to environmental problems. I was head of the Estimation and Control Group at Birmingham from its inception in 1985 to its absorption into the Research Centre for Communications and Interactive Systems in 2000. I have supervised over 20 PhD students working on topics in power systems, electric traction, digital communication, identification, target tracking and missile guidance, gas turbine modelling, and a range of environmental modelling areas. My 150 or so publications include An Introduction to Identification, Academic Press, 1986. I have acted as consultant for Ferranti-Thompson Underwater Systems; British Gas; Defence Research Agency, Defford; Jaguar Cars Advanced Engineering; QinetiQ, Malvern and dstl, Farnborough.

I have been Editor for Adaptive Control of Int. J. of Adaptive Control & Signal Processing, and editorial board member of that journal, IMechE J. Systems & Control Eng. and Env. Modelling & Software. I am currently a member of the International Federation of Automatic Control Technical Committee on Modelling, Identification & Signal Processing, and of the Advisory Board of International Federation for Information Processing (IFIP) Working Group 5.11, Computers and Environment.

Selected Publications

Jakeman, A.J., Letcher, R.A. and Norton, J.P. 2006. Ten iterative steps in development and evaluation of environmental models. Environmental Modelling and Software, 21(5): 602-614.

J. P. Norton, J. D. Brown and J. Mysiak 2006., To what extent, and how, might uncertainty be defined?, Integrated Assessment Journal, 6(1), 83-88

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J. P. Norton and F. T. Andrews 2005., Sensitivity and structure assessment of a software tool to gauge the ecological impact of flow scenarios, J. of Hydrology, available online 13 December 2005, http://dx.doi.org/10.1016/j.jhydrol.2005.10.035.

J. P. Norton and J. G. Chanat 2005., Linear time-varying models to investigate complex distributed dynamics: a rainfall-runoff example, Maths. & Computers in Simulation 69, 1-2,123-134.

J. P. Norton 1999. Translation of bounds on time-domain behaviour of dynamical systems into parameter bounds for discrete-time rational transfer-function models, Maths. & Computers in Simulation 48, 4-6, 469-478.

P. F. Weston and J. P. Norton 1997. Detection and estimation of abrupt changes in input or state, Int. J. of Control 67, 5, 699-711.

D. Maksarov and J. P. Norton 1996. State bounding with ellipsoidal set description of the uncertainty, Int. J. of Control 65 5, 847-866.

J. P. Norton 1996. Roles for deterministic bounding in environmental modelling, Ecological Modelling 6,157-161.

J. P. Norton, T. Chen and A. J. Jakeman 1995. Estimation of unmodelled behaviour as time-varying model-input correction: application to rainfall evapotranspiration, Environment International 5 5,533-537.

S. M. Veres and J. P. Norton 1993. Predictive self-tuning control by parameter bounding and worst-case design, Automatica 29, 911-928.

S.M.Veres and J.P.Norton 1991. Structure selection for bounded-parameter models: consistency conditions and selection criterion, IEEE Trans. on Autom. Control AC-36, 474-481.

J.P.Norton and S. H. Mo 1990. Parameter bounding for time-varying systems, Maths. & Computers in Simulation 32, 527-534.

M.J.Chen and J.P.Norton 1987. Estimation technique for tracking rapid parameter changes, Int. J. of Control 45 4, 1387-1398.

J.P.Norton 1987. Identification and application of bounded-parameter models, Automatica 23 4, 497-507.

J.P.Norton 1980. Structural zeros in the modal matrix and its inverse, IEEE Trans. on Autom. Control AC-25 5, 980-981.

J.P.Norton 1980. Normal-mode identifiability analysis of linear compartmental systems in linear stages, Math.Biosci. 50, 95-115.

J.P.Norton 1975. Optimal smoothing in the identification of linear time-varying systems, Proc. IEE 122 6, 663-668.

Ms Jenifer Ticehurst

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Career Brief

After completing a BSc (Resource and Environmental Management) with Honours at the Australian National University in 1996 I worked as a technical officer with CSIRO (Division of Environmental Mechanics), NSW Agriculture and then CSIRO (Division of Plant Industry). My research experience varied from treating sewerage waste water through crop irrigation, to sustainable grazing systems, to wheat and rice crop breeding.

I completed my PhD in conjunction with CSIRO (Division of Land and Water) and CRES (Australian National University) in 2004. The project was an investigation of hillslope hydrology under various rainfall, topographic and soil conditions to increase the understanding of a hillslopes response to rainfall in southern New South Wales. The findings were used to assist in locating tree belt plantations to utilise excess water in our agricultural landscapes.

Research, Teaching & Professional Activities

Since completing my PhD I have been working at iCAM. My work has dominantly been in the development of decision support tools to assist in the sustainable management of coastal lakes in NSW. This project uses Bayesian decision networks to integrate and identify trade-offs between ecological, social and economic values. Other work includes groundwater modelling for Environment ACT, and I am about to begin modelling the surface water/groundwater interactions in the Namoi catchment, as part of a cotton CRC collaborative project.

Selected Publications

Ticehurst, J.L. H.P. Cresswell, N.J. McKenzie and M.R. Glover (submitted), Interpreting soil and topographic properties to conceptualise hillslope hydrology, *Geoderma*.

Ticehurst, J.L. L.H. T. Newham, D. Rissik, R.A. Letcher, and A.J. Jakeman (in press), A Bayesian network approach for assessing the sustainability of coastal lakes, *Environmental Modelling and Software*.

Ticehurst, J.L, B.F.W Croke and A.J. Jakeman 2005. Model design for hillslope hydrology with tree belts. *Mathematics and Computers in Simulation*, 69: 188-212.

Ellis, T., N. Potter, P. Hairsine, J. Brophy, J. Ticehurst, K. Hickel, D. Tongway, G. Caitcheon and R. Bartley 2003.. Banded Agricultural systems: A design framework for agricultural systems to meet surface water management and targets. Rural Industries Research and Development Corporation Publication. No 03/... November 2003.

Ticehurst, J.L., H.P. Cresswell, and A.J. Jakeman 2003., Using a physically based model to conduct sensitivity analysis of subsurface lateral flow in south-east Australia, *Environmental modeling and software*, 18: 729-740.

Professor Peter Cornish

Adjunct Professor

Agricultural systems design and management to improve productivity whilst reducing environmental impact

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Career Brief

Peter Cornish graduated in Agricultural Science (Honours) from the University of Sydney in 1968 and worked for CSIRO and NSW Agriculture for 25 years as a pasture ecologist then crop agronomist, with a break for his PhD at UNE (1976-9). In 1993 he joined UWS as the Foundation Professor of Agriculture (Farming Systems), a Chair endowed by the Vincent Fairfax Family Trust. His main interests have been in soil/plant water and phosphorus relations, in a broad farming systems context. This led him into the development of soil-conserving tillage systems in the 1980's, and subsequently into the integrated management of farms within catchments for improved environmental outcomes. He has been a member of several research advisory committees including the Wheat Research Council of Australia, Grains Research & Development Corporation, and Rural Industries R&t D Corporation. In 2003 he was the joint recipient with GRDC of the Prime Minister's Award for Excellence in Public Sector Administration, for a successful GRDC-funded national programme of farming systems research. At UWS, Peter leads a research group of 2 Postdoctoral Fellows and several PhD students and technical support, all funded by external sources. He is also a member of the CRC-Irrigation Futures.

Research, Teaching & Professional Activities

Main present research interests are in: (i) quantifying diffuse pollutant exports from major rural land uses, understanding the relevant processes, and developing management options for farmers; and (ii) developing less unsustainable farming systems for the rich farming areas of northwestern NSW, with a focus on understanding and managing subsoil constraints (apparently due to subsoil salinity) and optimising crop management strategies. He has supervised 14 research students (most PhD) and assisted with numerous others.

Selected Publications

Popov, VH, Cornish, PS and Sun, H 2006.. Vegetated biofilters: the relative importance of infiltration and adsorption in reducing loads of water-soluble herbicides in agricultural runoff. *Agriculture, Ecosystems and Environment* (In press)

Wangiyana, W, Cornish, PS and Morris, CA 2006.. Arbuscular Mycorrhizal Fungi (Amf) Dynamics In Contrasting Cropping Systems On Vertisol And

Regosol Soils of Lombok, Indonesia. *Experimental Agriculture* 42(4), October 2006. (In press)

Popov, VH and Cornish, PS 2006.. Atrazine tolerance of grass species with potential for use in vegetated filters in Australia. *Plant and Soil* 280: 115-126.

Sun, H and Cornish PS 2006.. A catchment-based approach to recharge estimation in the Liverpool Plains, NSW Australia. *Australian Journal of Agricultural Research* 57: 309-320.

Pedroli, Bas; Pinto Correia, Teresa and Cornish, Peter 2006.. Landscape – what's in it? Trends in European landscape science and priority themes for concerted research. *Landscape Ecology* (Special Issue) 21 (3): 421–430.

Madafiglio, G. P., Medd, R. W., Cornish, P. S. and van den Ven, R. 2006. Regulating seed production and yield loss of *Raphanus raphanistrum* with herbicides in wheat. *Weed Research* 45 (6) 50-60.

Sun, H and Cornish, P S 2005.. Estimating shallow groundwater recharge in the headwaters of the Liverpool plains using SWAT. *Hydrological Processes* 19: 795-807.

Cornish, PS and Burgin, S 2005... Residual Effects of Glyphosate Herbicide in Ecological Restoration. *J Restoration Ecology* 13 (4): 694-701.

Popov, VH, Cornish, PS, Sultana K and Morris EC 2005.. Atrazine degradation in soils: the role of microbial communities, atrazine application history and soil carbon. *Aust J Soil Res* 43 (7): 861–871.

Johnston WH and Cornish PS 2005... *Eragrostis curvula* (Schrad.) Nees. complex pastures in southern New South Wales, Australia: impact of *Eragrostis curvula*, *Medicago sativa* and *Phalaris aquatica* L. pastures on soil water. *Australian Journal of Experimental Agriculture* 45: 1267-1289.

Johnston WH, Cornish PS, Koen TB and Shoemark, VF2005... *Eragrostis curvula* (Schrad.) Nees. complex pastures in southern New South Wales, Australia: a comparison of *Eragrostis curvula* cv Consol and *Medicago sativa* cv Nova under intensive rotational management. *Australian Journal of Experimental Agriculture* 45: 1255-1266.

Johnston WH, Cornish PS and Shoemark VS 2005.. *Eragrostis curvula* (Schrad.) Nees. complex pastures in southern New South Wales, Australia: a comparison with *Medicago sativa* L. and *Phalaris aquatica* L. pastures under rotational grazing. *Australian Journal of Experimental Agriculture* 45: 401-420.

Cornish, PS 2005.. Case Study: Australian Approaches to Participatory Development and Adoption of More Sustainable Farming Systems. In 'Sustainable Resource Management in Intensive Agriculture Systems'. Ed. ERSEC/UNESCO (Tsinghua University Press and Springer). Pp 255-270.

Freebairn, DM, Cornish, PS, Anderson, WK, Walker, SR, Robinson, JB and Beswick, AR 2005.. Management Systems in Climate Regions of the World – Australia. In 'Dryland Agriculture', Chapter 20, Agronomy Monograph 23, 837-878.

McNamara, LA and Cornish, P 2004.. Participative Decision-Making to Identify Nutrient Pollution Sources and Potential Abatement Actions. *J River Basin Management* 2: 71-80.

Sun, H and Cornish, P S 2004.. Estimating shallow groundwater recharge in the headwaters of the Liverpool plains using SWAT. *Hydrological Processes* 19: 795-807.

Baginska , B, Milne-Home, W and Cornish, P S 2003.. Modelling Nutrient Transport in Currency Ck with AnnAGNPS and PEST. *Environmental Modelling and Software* 18: 801-808.

McCallum, R, Cornish, PS and Fettell, N 2003.. Model Applications in Farming Systems – the Condobolin Experience. Proc 1st Conf Aust Farming Systems Assoc, Toowoomba.

Cornish PS 2003. Prioritising locations, industries and abatement actions for environmental improvement in a heterogeneous catchment: the Sydney Basin Australia. Bruen, M. (Editor) Diffuse Pollution and Basin Management. Proc 7th International Specialised IWA Conference. Dublin, Ireland. ISBN 1902277767, I (2) 7-12.

Harhcegani, H B and Cornish, P S 2003.. A Catchment Approach to Understanding the Sources and Fate of Indicator Bacteria in an Intensive Agricultural Area. Bruen, M. (Editor) Diffuse Pollution and Basin Management. Proc 7th International Specialised IWA Conference. Dublin, Ireland. ISBN 1902277767, III (6): 59-64.

Cornish, P S; Hallissey, R and Hollinger, E 2002.. Is a rainfall simulator useful for estimating phosphorus runoff from dairy pasture? A question of scale-dependency. *Australian J Experimental Agriculture* 42: 953-59

Sun, H, Cornish, PS and Daniell, T M 2002. Contour-based digital elevation modelling of watershed erosion and sedimentation. *Water Resources Research* 38: 15-1 - 15-10.

Cornish, PS, Davey, P and Muston, R 2002. Landscape Management in this Millennium: securing enduring relationships between community and country. Proc Fenner Conf on the Environment: Agriculture for the Australian Environment. p 39.

Sun, H, Cornish, PS and Daniell, TM 2002.. Spatial variability in hydrologic modelling using a rainfall runoff model and digital elevation model. *J Hydrologic Engineering* 7: 404-412.

Hollinger, E, Cornish P S, Baginska, B, Mann, R and Kuczera, G 2001. Farm-scale stormwater losses of sediment and nutrients from a market garden near Sydney, Australia. *Agric. Water Management* 47: 227-241.

Selected Student Theses

Hollinger, E 1998. Links between management of a market garden and stormwater losses of sediment, nitrogen and phosphorus.

Harchegani, Habib 2002. A Catchment Approach to Understanding the Sources and Fate of Indicator Bacteria in an Intensive Agricultural Area.

Norrish, S 2003. Soil and water interactions controlling wheat crop response to phosphorus fertiliser in north-western NSW.

Popov, V 2005. A catchment approach to managing agricultural pesticides in the environment – a case study with the herbicide atrazine.

Professor Peter C. Young

Director, Centre for Research on Environmental Systems and Statistics

Emeritus Professor, University of Lancaster, U.K.

Adjunct Professor. Centre for Resource and Environmental Studies (CRES),The Australian National University

Data-Based Mechanistic (DBM) modelling; recursive methods of nonstationary and nonlinear time series analysis and forecasting with wide ranging applications in areas such as hydrology, climate modelling, volcanic science, engineering, business and economics; automatic control system design.

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Career Brief

Peter Young obtained B.Tech. and M.Sc. degrees at Loughborough University before moving to Cambridge University, where he obtained his Doctoral degree in 1970. He is a Whitworth Fellow (Whit.F.), a Chartered Engineer (C.Eng.) and the member of a number of Engineering Institutions. Following two years as a civilian scientist, working for the U.S. Navy in California, he was appointed University Lecturer in Engineering and a Fellow of Clare Hall, Cambridge University, in 1970. As a result of his novel research on environmental modelling, he was then invited to become Professorial Fellow and Head of the Systems Group in the new Centre for Resource and Environmental Studies (CRES) at the Australian National University in 1975. Finally, he moved back to U.K. in 1981, where he was Head of the Department of Environmental Science for seven years, during which time the Department grew from 17 to 25 members of staff and was graded at the highest level in the Earth Science Review. Subsequently, he became Associate Dean in the Institute of Environmental and Biological Sciences at Lancaster (now the Institute of Environmental and Natural Sciences) before becoming Director of the Centre for Research on Environmental Systems and Statistics. He is now Emeritus Professor at Lancaster but continues to work full-time on a number of research projects at The University, as well as on-going research projects with colleagues in Australia (CRES and RMIT, Melbourne), France (University of Nancy) and Italy (Joint Research Centre of the EEC, Ispra and Politecnico di Milano, Italy). Peter is Consultant Editor of the International Journal of Control; Departmental Editor of the Journal of Forecasting; and Associate Editor, Environmental Modelling and Software. He is on a number of Working Groups of the International Federation of Automatic Control (IFAC).

Research, Teaching & Professional Activities

Peter Young is well known for his work on recursive estimation and automatic control system design. His most recent research has been concerned with data-based modelling, forecasting, signal processing and control for nonstationary and nonlinear stochastic systems. The applications of this methodological research are wide ranging, from the environment, through ecology and engineering to business and macro-economics. He has specific interests in rainfall-flow modelling and flood

forecasting and is currently working on a project within the UK Flood Risk Management Research Consortium on real-time forecasting. Over his career, Peter Young has supervised a large number of successful Ph.D dissertations and he continues to advise research students at Lancaster, in association with colleagues there.

Selected Publications

Romanowicz, R. J., Young, P. C., and Beven, K. J. (2006). Data assimilation and adaptive forecasting of water levels in the River Severn catchment. *Water Resources Research*, 42(W06407):doi:10.1029/2005WR004373.

Young, P. C. (2006). Data-based mechanistic modelling and river flow forecasting. In *Proceedings 14th IFAC Symposium on System Identification*, pages 756–761, Newcastle, NSW.

Young, P. C., Garnier, H., and Gilson, M. (2006). An optimal instrumental variable approach for identifying hybrid Box-Jenkins models. In *Proceedings 14th IFAC Symposium on System Identification SYSID06, Newcastle, NSW, Australia*, pages 225–230.

Ratto, M., Young, P. C., Romanowicz, R., Pappenberger, F., A.Saltelli, and Pagano, A. (2006). Uncertainty, sensitivity analysis and the role of data based mechanistic modelling in hydrology. *Hydrology and Earth System Sciences* (*HESS*), *European Geophysical Union*: *in press*.

Young, P. C. (2005). Rainfall-runoff modeling: Transfer Function models. In Anderson, M. G., editor, *Encyclopedia of Hydrological Sciences*, volume 3, part II, pages 1985–2000, Hoboken, N. J. John Wiley.

Young, P. C. (2004). Identification and estimation of continuous-time hydrological models from discrete-time data. In Webb, B., Arnell, N., Onf, C., MacIntyre, N., Gurney, R., and Kirby, C., editors, Hydrology: Science and Practice for the 21st Century, Vol. 1, pages 406–413. British Hydrological Society: London.

Taylor, C. J., McKenna, P. G., Young, P. C., Chotai, A. and Mackinnon, M. 2004. Macroscopic traffic flow modelling and ramp metering control using Matlab/Simulink, *Environmental Modelling and Software*, 19, 975-988.

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Young, P.C. 2003. Top-down and data-based mechanistic modeling of rainfall-flow dynamics at the catchment scale. *Hydrological Processes*, 17, 2195-2217.

Romanowicz, R. and Young, P.C. 2003. Data assimilation and uncertainty analysis of environmental assessment problems – an application of stochastic transfer function and generalised uncertainty estimation techniques. *Reliability Engineering & System Safety*, 79, 161-174.

Young, P. C. 2002. Advances in real-time flood forecasting. *Philosophical Trans. Royal Society*, *Physical and Engineering Sciences*, 360, 1433-1450.

Young, P.C. and Parkinson, S.D. 2002. Simplicity out of complexity (Chapter 13 in M.B. Beck (ed.), *Environmental Foresight and Models: A Manifesto*, Elsevier: Oxford, 251-301) 2002.

Young, P. C., McKenna, P., Bruun, J, J. 2001.. Identification of nonlinear stochastic systems by state dependent parameter estimation. *International Journal of Control*, 74, 1837-1857..

Young, P. C., & Pedregal, D. J. 2002.. Statistical approaches to modelling and forecasting time series. In M. P. Clements & D. F. Hendry (Eds.), *Companion to Economic Forecasting*. Oxford: Blackwell.

Tych, W., Pedregal, D. J. , Young, P. C. and Davies, J. 2002. An unobserved component model for multi-rate forecasting of telephone call demand: the design of the forecasting support system, *Int. Journal of Forecasting*, 18, 673-695.

Young, P.C., Chotai, A., 2001. Data-based mechanistic modeling, forecasting and control, *IEEE Control Systems Magazine*, *Special Issue on Agriculture and the Environment*, 21, no.5, 14-27.

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Taylor, C.J., Chotai, A. and Young P.C., 2000., State space control system design based on non-minimal state-variable feedback: Further generalisation and unification results, *International Journal of Control*, 73, 1329-1345.

Young, P. C. 2000.. Stochastic, dynamic modelling and signal processing: Time variable and state dependent parameter estimation. In W. J. Fitzgerald, A. Walden, R. Smith, & P. C. Young (Eds.), *Nonstationary and Nonlinear Signal Processing*. Cambridge: Cambridge University Press, 74-114.

Young, P.C., Price, L. E., ., Berckmans, D., & Janssens, K. 2000. Recent developments in the modelling of imperfectly mixed airspaces, *Computers and Electronics in Agriculture*, 26, 239-254.

Mr Ray Evans

Visiting Fellow, ICAM
Groundwater, Dryland Salinity, Integrated Water Management, Catchment Management

E-mail: Ray.Evans@salientsolutions.com.au

Career Brief

Ray Evans has been prominent in the Australian groundwater and salinity management scene for over twenty years. His experience ranges broadly across groundwater systems, the hydrology of landscapes and their responses to land use change, and the nature of the interactions of groundwater and surface water systems.

He has provided high-level advice to Governments regarding salinity management, particularly in the Murray-Darling Basin, and has been a national figure in technical aspects of national groundwater management initiatives.

He was a key figure in the early description of the magnitude of the salinity problem in the Murray-Darling Basin, and the likely timeframe for responses to management options. He was a driving force behind the establishment of the National Groundwater Committee. He represented the Commonwealth Government as a technical expert on many groundwater issues.

Ray has over 28-years' experience in Australian hydrogeology and environmental geoscience. He has been heavily involved in groundwater and salinity issues in the Murray-Darling Basin for the past 20 years. This ranges across the hydrogeology of regional aquifer systems, fractured rock hydrogeology, hydrochemistry and isotope hydrology, dryland salinity, catchment management and landscape process studies. Ray specialises in broad regional solutions to natural resource problems. As well, he has extensive experience at the national groundwater policy level and with project and team management.

During his period of employment with BMR and AGSO, Ray was a Research Group Leader (at Senior Principal Research Scientist level) responsible for the strategic direction of the organisation's Groundwater Program. This involved a three-year period where Ray was Program Leader.

Ray was also a Senior Principal Research Scientist at the Bureau of Rural Sciences, in the Land and Water Sciences Division, responsible for the direction of the Groundwater Theme. He spent 11 months during this period as acting Chief of the Agriculture, Food and Social Sciences Division, a position that entailed his participation in the BRS Executive Board. As well, he was acting Chief of the Land and Water Sciences Division during other periods.

Ray is now director of a consulting company, Salient Solutions Australia Pty Ltd, which provides technical solutions for catchment-based groundwater and salinity problems. Salient Solutions works for a range of clients including: Government policy and regional operational groups, research agencies, semi-governmental and community-based catchment management organizations and Landcare groups.

The Federal Minister for the Environment and Heritage has appointed Ray to the Alligator Rivers Region Technical Committee, as part of the Government's response to a report from the World Heritage Committee. This committee is charged with reviewing the science related to the impacts of uranium mining on Kakadu National Park, and advising the Minister of its integrity and appropriateness.

During his commercial endeavour Ray has worked on a broad range of projects that range from high-level reviews of major State-based salinity programs, to national strategic programs aimed at achieving national consistency in approaches for dryland salinity, to projects aimed at defining sustainable yield approaches to groundwater management, and to more direct projects that work with local community groups and catchment managers aimed at influencing adoption of local scale natural resource management actions.

Selected Publications

Ray has produced/published over 80 refereed papers, conference papers, maps and unpublished reports (detailed list available). Ray has also produced many client reports as part of his commercial activities.

Dr Nigel Hall

Visiting Fellow iCAM
Integrated assessment, bioeconomic modelling, environmental economics and policy

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Career Brief

Dr Hall is a natural resource economist specialising in natural resource issues with 30 years' experience as a researcher and research manager, in ABARE, as a Consultant and at ANU. He has experience in research planning and management, policy analysis and in the modelling of bio-economic systems in collaboration with agronomists, hydrologists and other scientists.

Dr Hall grew up on a farm in Northumberland and studied agricultural science before specialising in economics at Newcastle University. He followed this with a postgraduate year at Oxford studying Agricultural Economics under Colin Clark. After working some years with the Bureau of Agricultural Economics, he was awarded a Public Service Board Scholarship to undertake a PhD at Newcastle University. On completion of the doctorate, he returned to Australia and the BAE. BAE and its successor ABARE have been key government research institutions influencing Australian Federal Government policies in agriculture and natural resources.

Research, Teaching & Professional Activities

Current research interests include modelling the economics of water and salt management in Australia and overseas and the economics of greenhouse gas abatement through agricultural change.

Recent work includes:
Providing the socio-economic modelling input to a study of catchment salinity and land use in NSW. Thailand and Laos with the University of Technology, Sydney funded by Australian Centre for International Agricultural Research (ACIAR). This study involves soil and water management in the Mekong and Murray-Darling basins.
Providing economic analysis for CRC for Water Quality and Treatment, Centre for Appropriate Technology Inc, to carry out on their Mabunji rainwater management project to provide drinking water for aboriginal housing in the Gulf of Carpentaria

Providing the socio-economic modelling for the National Centre for Development Studies (ANU) for a Fiji Sugar project funded by ACIAR

Managing the economic analysis and modelling for the iCAM TARGET project for control of salinity in New South Wales.

Selected Publications

Hall, N., Yongvanit, S., Lertsirivorakul, R., Last, R., Yuvaniyama, A., Anuluxtipun, Y., Milne-Home, W. and Greiner, R., (2004) 'Changing land use to manage salinity in northeast Thailand', 7th International Khon Kaen University-SEAGA Geography Conference, Khon Kaen, Thailand,

Hall, N., Oliver, M., Jakeman, T., Nicholson, A. and Watson. B. (2004). Land Use change for Salinity Management: A Participatory Model. In Proceedings of the International Environmental Modelling and Software Society Conference (iEMSs2004), Osnabrueck.

Hall, N., Lertsirivorakul, R., Greiner, R,. Yongvanit, S., Yuvaniyama, A,. Last, R. and Milne-Home, W. (2004). Land Use and Hydrological Management: ICHAM, an Integrated Model at a Regional Scale in Northeastern Thailand. In Proceedings of the International Environmental Modelling and Software Society Conference (iEMSs2004), Osnabrueck.

Hall, N., Greiner, R. and Yongvanit, S. (2004). Adapting modelling systems for salinity management of farms and catchments in Australia and Thailand. Mathematics and Computers in Simulation 64:319-327.

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Hall, N., Greiner, R. and Yongvanit, S. 2003. 'Adapting Modelling Systems for Salinity Management of Farms and Catchments in Australia and Thailand, ' *Mathematics and Computers in Simulation*, (forthcoming).

Hall, N. and Watson, W. 2001. 'A conceptual framework for integrated catchment management of salinity', *Proceedings of MODSIM2001*, Canberra, 10-13 December.

Hall, N.H., 2001. 'Linear and quadratic models of the southern Murray-Darling basin', *Environment International*, 27, 219-23.

Dunlop, M., Hall, N., Watson, W., Gordon, L. and Foran, B. 2001. Water use in Australia, CSIRO Sustainable Ecosystems, Canberra.

Barr, N., Ridges, S., Anderson, N., Gray, I., Crockett, J., Watson, W. and Hall, N. 2000. Adjusting for catchment management, Murray-Darling Basin Commission, Dryland Technical Report No.2, Canberra.

White, N., Sutherst, R., Hall, N. and Whish-Wilson, P. 2001. "The vulnerability of the Australian beef industry to impacts of the cattle tick (Boophilus microplus) under climate change." (Accepted for publication) Abdalla, A. and Hall, N. 1999. Using management practices to reduce greenhouse gas emissions from Australian agriculture, ABARE Report to the Rural Industries Research and Development Corporation, Canberra.

AATSE.1999. Water and the Australian Economy, Australian Academy of Technological Sciences and Engineering, Melbourne.

Watson, W., Hall, N. and Hamblin, A. 1999. The costs of soil acidity, sodicity and salinity for Australia: preliminary estimates, CRC for Soils and Land Management, CRCSLM/CTT2/6/99, Adelaide.

Hall, N., Poulter, D. and Curtotti, R. 1994. ABARE Model of Irrigation Farming in the Southern Murray-Darling Basin, ABARE Research Report 94.4, Canberra.

Forthcoming completed reports for the TARGET project

Oliver, M., Hall, N. and Watson, W. 2002, Farm Economic Analysis: Little River Catchment, Integrated Catchment Assessment and Management (iCAM) Centre report prepared for the TARGET project, Australian National University, Canberra.

Oliver, M., Hall, N. and Watson, W. 2002, Farm Economic Analysis: Mid-Macquarie Landcare, Consultancy report prepared for Mid-Macquarie Landcare, Watson Agriculture Resources & Environmental Consulting, Canberra.

Oliver, M., Hall, N. and Watson, W. 2002, Farm Economic Analysis: Mid-Talbragar Catchment, Integrated Catchment Assessment and Management (iCAM) Centre report prepared for the TARGET project, Australian National University, Canberra.

Oliver, M., Hall, N. and Watson, W. 2002, Farm Economic Analysis: Warrangong Catchment, Integrated Catchment Assessment and Management (iCAM) Centre report prepared for the TARGET project, Australian National University, Canberra.

Hall, N. (2002) Plantation Forestry Economics for the Lachlan and Macquarie Catchments, Integrated Catchment Assessment and Management (iCAM) Centre report prepared for the TARGET project, Australian National University, Canberra.

Hall, N., Oliver, M. (2001) Scoping Report, Integrated Catchment Assessment and Management (iCAM) Centre report prepared for the TARGET project, Australian National University, Canberra.

Dr David Post

Visiting Fellow, iCAM
Hydrology, water quality

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Career Brief

February 1999 – Present : Research scientist, CSIRO Land and Water, examining the relationships between landscape attributes (especially landuse), and hydrologic response (including water quality) in tropical catchments, particularly in North Queensland.

July 1996 – January 1999 : Post-doctoral research fellow, Oregon State University, carrying out research into the factors influencing hydrologic response for a range of sites within the United States long-term ecological research (LTER) network.

April 1992 - June 1996 : Ph.D, Centre for Resource and Environmental Studies, Australian National University, ACT. 1997. *Identification of relationships between catchment-scale hydrologic response and landscape attributes.*

April 1990 - April 1992 : Experimental Scientist, CSIRO Division of Atmospheric Research, carrying out research into the coupling of ocean and atmospheric general circulation models (GCM's).

December 1988 – December 1989 : B.Sc (Hons.), University of Newcastle, NSW. 1990. *A preliminary study of fog and rainwater quality in the Barrington Tops and New England regions of NSW.*

Research, Teaching & Professional Activities

Projects that I am currently involved in include:

Reducing Sediment and Nutrient Export from Grazed Lands in the Burdekin Catchment for Sustainable Beef Production - funded by Meat and Livestock Australia (MLA).

Ecological Monitoring of the Townsville Field Training Area (TFTA) - funded by the Department of Defence (DoD).

Increasing Sugarcane Productivity through Development of Integrated Surface Drainage Systems for low lying Canelands - funded by the Sugar Research Development Corporation (SRDC).

How do changing Agroforestry Landscape Mosaics in SE Asia Impact of Watershed Functions? - funded by the Australian Centre for International Agricultural Research (ACIAR).

Selected Publications

Post, D. A. 2005. A new method for estimating flow duration curves : an application to the Burdekin River Catchment, North Queensland, Australia. *IEMSs 2005 Proceedings of the International Environmental Modelling and Software Society*, Osnabruck, Germany, 14-17 June, 2005, International Environmental Modelling and Software Society.

Post, D. A., Kinsey-Henderson, A. E., Stewart, L. K., Roth, C. H. and Reghenzani, R. 2003. Optimising drainage from sugar cane fields using a one-dimensional flow routing model : A case study from Ripple Creek, North Queensland. *Environmental Modelling and Software* 18 : 713-720.

Post, D. A. and Croke, B. F. W. 2002. Predicting hydrologic response from physio-climatic attributes : an application to ungauged sub-catchments of the Burdekin River, North Queensland. *IEMSs 2002 Proceedings of the first biennial meeting of the International Environmental Modelling and Software Society*, Lugano, 24-27 June, 2002, International Environmental Modelling and Software Society, Volume 1, 334-339.

Post, D. A. and Jones, J. A. 2001. Hydrologic regimes of forested, mountainous, headwater basins in New Hampshire, North Carolina, Oregon, and Puerto Rico. *Advances in Water Resources* 24 : 1195-1210.

Post, D. A. and Jakeman, A. J. 1999. Predicting the daily streamflow of ungauged catchments in S. E. Australia by regionalising the parameters of a lumped conceptual rainfall-runoff model. *Ecological Modelling* 123 : 91-104.

Post, D. A.; Grant, G. E. and Jones, J. A. 1998. Ecological hydrology : expanding opportunities in hydrologic sciences. *Eos* 79 (43) : 517,526.

Post, D. A.; Jones, J. A. and Grant, G. E. 1998. An improved methodology for predicting the daily hydrologic response of ungauged catchments. *Environmental Modelling and Software* 13 : 395-403.

Post, D. A. and Jakeman, A. J. 1996. Relationships between physical descriptors and hydrologic response characteristics in small Australian mountain ash catchments. *Hydrological Processes* 10 : 877-892.

Post, D. A.; Jakeman, A. J.; Littlewood, I. G.; Whitehead, P. G. and Jayasuriya, M. D. A. 1996. Modelling land cover induced variations in hydrologic response : Picaninny Creek, Victoria. *Ecological Modelling* 86 : 177-182.

Selected Student Theses

2003 : Mirjam Alewijnse. Grazing and water infiltration in the savanna landscape. Honours, James Cook University, Townsville.

2002 : Anne-Katrin Heine. Characterisation of gully erosion by airphoto interpretation and GIS techniques of rangelands in semiarid north-eastern Australia. Graduate Diploma, University of Bochum, Germany.

2000 : Christine Jurgensen. Gully and sheet erosion in grazed areas in north-eastern Queensland, Australia. Graduate Diploma, University of Osnabruck, Germany.

iCAM Administrative Staff

Ms Susan Cuddy

iCAM Projects Manager

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Career Brief

Susan Cuddy is Projects Manager in iCAM. She has a Bachelor of Arts from Queensland University with majors in pure mathematics and German literature, and Graduate Diplomas in Secretarial Studies and Computing Studies from CCAE (now University of Canberra).

Susan has a background in project management, applications programming, GIS and database design. She has many years of experience in developing integrated modelling solutions for catchment land and water resource managers in Australia and near neighbours. Research interests/capabilities are in the meaningful translation of science and research results for managers and community groups via design of appropriate computer interfaces.

Selected Publications

http://www.clw.csiro.au/staff/CuddyS/publications.html

Ms Susan Kelo

iCAM Administrator

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Career Brief

I have been working for the Australian National University for 13 years. My current position is the administrative officer for the Integrated Catchment Assessment and Management Centre. I ensure the routine operation of the Centre, support the Projects Manager on budgetary matters and provide administrative assistance to the Director. My nominal position is with the Centre for Resource and Environmental Studies where my duties contribute to the public face of CRES including service to the Modelling and Simulation Society of Australia and New Zealand Inc., the International Environmental Modelling and Software Society and the Environmental Modelling and Software journal.

iCAM Research Assistant

Mr Ambrose Andrews

Research Assistant, iCAM

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Career Brief

Part-time research assistant at the Integrated Catchment Assessment and Management Centre. Mostly do software development and maintenance. Some server maintenance. Currently mostly developing decision support systems, especially ICMS plugin interfaces.

Philip Alcorn

PhD Scholar

Crown and canopy dynamics in subtropical eucalypt plantations

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Research Description

Growth and wood quality of forest stands are intimately linked to the development of the forest's canopy. The size and distribution of leaf area within crowns set limits to biomass production by defining light interception. While it may be desirable to grow trees with large crowns to facilitate rapid stem biomass accumulation, the enlarged branches to support high leaf areas are usually undesirable in the early growth phase until a sufficiently long branch-free section of the stem has formed. It is therefore standard practice in plantations grown for solid wood products to control branch development through stand density and/or pruning. Understanding the effect of these silvicultural treatments on the morphology and physiology of tree crowns can aid the development of models to explain and predict the growth of forest stands.

The aim of this project is to provide a mechanistic understanding of crown and canopy dynamics in a number of subtropical eucalypt species, to build the scientific foundations for stand manipulations to enhance wood quality and productivity. Field experiments will be employed to test the hypotheses that:

(1) The plasticity of green crowns (length, shape, number and size of branches) in response to stand density is greater in the more shade-tolerant eucalypts than in the intolerant eucalypts,

(2) The effect of green crown pruning on biomass production in eucalypts is related to the amount of foliage removed, the nutrient status of pruned foliage, the water status of pruned trees and the shade tolerance of the species.

Specifically, the study will examine crown dynamics in the early growth phase of three plantation eucalypts (*Eucalyptus pilularis* and *E. cloeziana*) with differing branch shedding habits. In addition, a detailed investigation of the physiological and morphological responses to differing green pruning severities will be conducted on two of these species exhibiting differing crown dynamics. Allometric relationships between stem, branch and crown components will be developed to aid the investigation. The outcomes from this project will aid the development of a stand management simulation model for the species in question.

Kerry Arabena

PhD Scholar

Mapping Indigenous Futures within an Indigenous Identity

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Research Description

Kerry Arabena is a descendant from the Merriam people in the Torres Strait and has been recognised both nationally and internationally for the contribution to the health of Indigenous Australians in particular, and for her commitment to health service development and delivery. In her professional career, she has been the Executive Director of health service and political agencies; and been a representative on a range of local, state and national Councils and Committees. During this time, she has also been contracted by the World Health Organisation and the World Bank to work with communities in Asia and the Pacific region. She is a Fellow of the Sir Gustav Nossal Leadership in Health Reform, having supervised the development and implementation of national strategies and engaged health systems in developmental issues; and was one of the top 10 finalists in the Health and Medical Research section for the Bulletin Magazine 'SMART 100' in 2004. She is currently is a Visiting Research Fellow, Social Health at the Australian Institute of Aboriginal and Torres Strait Islander Studies and an Adjunct Professional Associate, School of Education and Community Studies, Communication and Education; University of Canberra as well as a PhD at the Australian National University since March 2006. Her PhD thesis aims to develop 21st century conditions in which Indigenous people and societies can flourish and promote the capacities of Indigenous people to achieve 'health' and 'well being' within mainstream societies. She is investigating the fundamental building blocks for 'health' and 'well being' in the full exercise of Indigenous citizenship. Authentic Indigenous lives are lived in Australia. The questions to be answered are "Who decides?" and "How?"

Glen Bann

PhD Scholar

Dryland salinity, biodiversity and soil degradation in woodlands of eastern Australia: Quantification using biotic and abiotic indicators – with applications for NRM

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Research Description

Dryland salinity and the loss of biodiversity are among the most severe environmental challenges facing Australia. They are both high priorities on the political agenda. Yet there is surprisingly little research investigating the interaction of these two phenomena, particularly regarding terrestrial species.

My research will investigate the interaction between dryland salinity, regolith and terrestrial biodiversity in yellow box & red gum grassy woodlands. These woodlands are listed as a Threatened Ecological Community in both State and Federal Acts since clearing for agricultural practices has greatly reduced their extent. As the problem is multifaceted and complex, a holistic, multidisciplinary approach is required to identify important processes within the system. Survey methods including both biotic and abiotic indicators will be used to identify trends, thresholds and relationships. These include vertebrate, invertebrate and flora surveys, soil and plant analyses, 'Landscape Function Analysis', 'Habitat Hectares', piezometers and the use of EM38 and EM31 instruments. The methods will then be developed into an efficient survey and monitoring technique that can be applied to eastern Australian sites currently affected by salinisation. This information will be useful for targeting priority areas for mitigation, remediation and remnant retention activities, using perennial vegetation and farm forestry initiatives.

Results to date indicate that in these upland landscapes, dryland salinity;

1) is very localised and not expanding at a dramatic rate as currently promoted,

2) is caused by (surface) soil degradation processes subsequent to over-grazing, clearing and conventional cropping practices,

3) does not necessarily adversely affect terrestrial biodiversity in these woodlands as endemic fauna and flora species are relatively salt-tolerant.

4) can be mitigated and remediated with native species after appropriate soil treatment and stock management

Liliana Baskorowati

PhD Scholar

Reproductive Biology of *Melaleuca alternifolia* and Implications for Breeding

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Research Description

Melaleuca alternifolia (Maiden & Betche) Cheel is the principal commercial source of Australian tea tree oil. *M. alternifolia* occurs in three main chemical varieties (chemotypes); rich in either 1,8-cineole, terpinolene or terpinen-4-ol. The latter is the variety that has undergone most commercial development. Hence, the importance of breeding for increased yields and higher oil qualities to improve production efficiencies and marketability of the oil.

A breeding program to improve the yield and quantity of foliar oils from plantations of *Melaleuca alternifolia* in Australian commenced in 1993. The present study complements the Australian *M. alternifolia* breeding program implemented by NSW Agriculture and CSIRO (Doran *et al*., 2002). For any tree genetic improvement program, knowledge and manipulation of the reproductive biology of *M. alternifolia* are essential to the design and implementation of the genetic improvement program.

A more complete knowledge of the reproductive biology of this species will assist placement, design and management of seed orchards; allow controlled pollination techniques to be tailored for this species; lead to wider use of controlled pollination in breeding with potential to increase genetic gain and to facilitate breeding strategies.

The principal objectives of this study are to gain a better understanding of the reproductive biology of *M. alternifolia*, to inform and to draw implications for the breeding program.

Research will comprise:

a) Observation of floral morphology and development of *M. alternifolia* in individual level examining using scanning electron microscopy

b) Flowering phenology of *M. alternifolia* in population level, followed by experiment for inducing flowering using growth retardant in ANU glass houses

c) Observation the mating system by comparing the reproductive success of cross and self pollination in several families in two study sites and the compatibility mechanism in this species. Compatibility mechanisms on cross and self pollination will be observed using fluorescence electron microscopy

d) Producing hybrids of *M. alternifolia* with *M. linariifolia* and *M. dissitiflora*

This project is being supported by CSIRO Forestry and Forest Products and ANU.

This study is based on my previous work in CFBTI (Centre for Forest Biotechnology and Tree Improvement, Indonesia) breeding *Melaleuca cajuputi* subsp *cajuputi* in collaboration with ACIAR and CSIRO. The knowledge from breeding *M. alternifolia* can be used in breeding *M. cajuputi* subsp *cajuputi* in Indonesia.

Lara Boyd

PhD Scholar

Assessing the quality of remnant native vegetation on private land in north west Victoria

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Research Description

The importance of protecting and conserving biodiversity is reflected in legislation and policy at all levels of government. Implementing strategies to achieve biodiversity conservation requires effective, accurate and reliable tools, in particular a vegetation condition assessment tool. Such tools are being developed for identifying conservation priorities, monitoring rehabilitation programs, assessing development applications, managing conservation incentive programs, educating landholders, and state-of-the-environment reporting. In Victoria, government agencies currently use the Habitat Hectares method to evaluate vegetation condition, however the efficacy of this method for all vegetation types has not yet been established. The aim of this project was to refine an assessment tool for the Mallee-type vegetation of North West Victoria. Vegetation condition was determined using a range of assessment tools and basic ecological survey techniques at 32 sites across North West Victoria. Comparison of the data collected by different methods suggests that while the Habitat Hectares method was useful in indicating vegetation condition, other methods were more accurate. This project will construct a new method for measuring vegetation condition in the Mallee that was developed based on these analyses.

Matthew Brookhouse

PhD Scholar

Dendrochronological reconstruction of climate and streamflow in the Cotter River catchment

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Research Description

Eucalypt tree-rings are an immensely valuable natural repository of climatic data. However, the belief that the dendrochronological potential of eucalypts is limited by indistinct tree-ring boundaries, chronic suppression by folivorous insects and relatively short life-spans has stifled eucalypt tree-ring research. Recent advances in dendrochronological sub-fields of dendroecology and pyrochronology, debate over the intensity of folivorous insects throughout eucalypt forests and an emerging interest in local climate variability are progressively challenging such widely held assumptions. Moreover, the emerging body of dendrochronological research indicates that climatic data may be extracted from eucalypt tree-rings. This potential remains unrealised.

To date, most dendroclimatological research has focused upon one species, *Eucalyptus pauciflora*. Sampling strategies have ignored fundamental principles of limiting factors, ecological sensitivity and replication. Consequently, no literature exists to guide the selection of sites or species in eucalypt-based dendrochronological studies. In addition statistical aspects such as sample size requirements, intra/inter-sample correlation, spatial and temporal dependence of sample sensitivity, and serial correlation within individual tree-ring series have not been examined.

These fundamental sampling and analysis issues must be addressed before sampling targeted at eliciting climate signals from eucalypt tree-rings can be undertaken. The present study aims to resolve some of these

outstanding issues and investigate the potential of eucalypt tree-ring data for climatological analysis through investigation of statistical properties of eucalypt tree-ring data utilising established datasets collected by the Department of Sustainability and Environment, examination of the potential role of species and site selection on dendroclimatic signals preserved within eucalypts' tree-ring series and the derivation of tree-ring chronologies and reconstruction of pre-instrumental climate records from samples with high ecological sensitivity. The project is supported by the Cooperative Research Centre for Greenhouse Accounting.

Melissa Burgess

PhD Scholar

A spatio-temporal analysis of what makes people afraid of crime

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Research Description

Regardless of whether crime is present, people avoid areas where they feel afraid of becoming a victim of crime. With the widespread adoption of this behavioural response, fear of crime has emerged as a distinct phenomenon that can cause numerous problems for both the individual and community. Research into fear of crime, particularly the geography of people's avoidance patterns, has the potential to provide information that could be used to reduce the public's fear of crime and curb the negative consequences that result from this phenomenon. For example, it can allow police and government resources to be targeted at critical areas and toward those environmental cues that trigger people to feel afraid.

This research provides a spatio-temporal investigation into the avoidance patterns adopted by people who fear being robbed, beaten or attacked in Kings Cross, NSW.

GIS is used to produce a series of three-dimensional fear maps that represent the number and proportion of survey respondents avoiding areas, and how hard they try to avoid those areas. Specifically, the study will investigate the significant environmental cues that trigger people to feel afraid in certain fear hotspots (areas that a high proportion of respondents avoid). A number of social environmental cues will be mapped, including the presence of 'junkies', spruikers, homeless people, intoxicated persons, prostitutes, gangs, loitering people and the absence of pedestrians. Physical environmental cues will also be mapped, including the occurrence of poor street lighting and vandalism, the presence of rubbish or syringes, rundown or abandoned buildings, offensive or degraded shops, areas to hide, blocked escape and laneways. The patterns of avoidance adopted by different socio-demographic groups in response to these environmental cues will also be carried out. Through this study I hope to build upon the ties between geography and criminology and present my findings in a practical manner for use by the community, governments and the police.

Kylie Carman-Brown

PhD Scholar

Losing the Lakes: An Environmental History of the Gippsland Lakes, Victoria, Australia from 1838-2000

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Research Description

This thesis will examine the European settlement process in Gippsland with a particular emphasis on its impact on the health and integrity of the region's abundant wetlands. The major focus of analysis will be upon governance and regulation of wetlands over time.

Eras to be covered include, but are not limited to, the pastoral era, the role of gold and coal mining, land selection and closer settlement, the creation of a permanently open entrance, the establishment of transport corridors, and the gradual build up of different types of organisations, government and community based, whose sphere of influence impacted upon wetlands. For each era I will consider attitudes towards wetlands, what physical changes to wetlands occurred, and what sorts of conditions enabled those changes to occur.

By utilising the long view, and by laying out both the path of and the consequences of past decisions regarding wetlands, this thesis will provide a fuller source of information to guide decision making in the future about the Gippsland Lakes.

Peter Dostine

PhD Scholar

Ecology and management of the Flock Bronzewing *Phaps histrionica*

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Research Description

The Flock Bronzewing is a characteristic bird of the open black-soil plains of northern Australia. This species has suffered a substantial reduction in range and is now absent from large areas that were formerly occupied. However, it remains patchily and periodically common on the Barkly Tableland in the Northern Territory and parts of the Channel Country in south-west Queensland. Currently, the level of ecological understanding of this species is not sufficient to prescribe adequate conservation measures. Key data on resource use, movement patterns and interactions with the dominant land use on the black-soil plains (cattle production) are lacking. This project will redress this deficiency and provide data on distribution, diet, habitat requirements, and movement patterns in relation to variation in resource availability that will serve to derive conservation measures for this and other species with similar dispersal ecologies. The key component will be description of movement patterns at local- and broad-scales. Studies of local-scale movement will identify how they use landscapes currently dominated by the pastoral industry: studying the nature and extent of broad-scale movement will identify the sequence of habitats and resources that are required throughout the seasonal cycle, and the nature of linkages within the broad landscape that are required for maintenance of populations of this species.

Steve Douglas

PhD Scholar

Exploring the 'greening' of mainstream religion in Australia

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Research Description

The thesis explores the 'greening' of mainstream religion in Australia. An Internet-based search is being undertaken to document the ecological policies and related praxis of the Catholic, Anglican and Uniting Churches. This is supported by other forms of data gathering including conventional literature review, informal interviews, email networking, and participant observation. The ecological policies of the denominations are examined in the context of the much-discussed 'policy-praxis disjuncture'. Now that mainstream Christianity has adopted a 'green' theology, can it match this with ecological policy that goes beyond the symbolic and extends to meaningful organisational change?

A case study approach is used to test the willingness and ability of the denominations or parts thereof, to convert theology and policy into praxis in the context of land management. Are the Churches prepared to formally protect significant ecological assets on their estate? Are they prepared to do so even where such assets may not have 'sterilised' the land for the purposes of conventional economic 'development'? This is particularly important given the declining membership and funding base of the subject denominations and the associated tendency to sell surplus land, particularly in rural areas. The case study addresses key organisational issues within the denominations that affect their willingness and ability to implement substantial ecological reforms within their own institutions. Has ecotheological change led to progress beyond anthropocentrism? Are ecological assets still rated lower than financial gains that can be made through their direct or indirect destruction?

The research is situated in the international literature related to the 'greening' of religion, and an emergent literature that discusses the increasingly positive interaction of religious and nominally secular environmental interests.

For further information see http://www.users.bigpond.net.au/stevemd/phd_research.htm

John Drewry

PhD Scholar

Nutrient generation in Australian catchments: land use and management factors affecting water quality

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Research Description

Within catchments the loss of sediment and nutrients (phosphorus and nitrogen) is known to decrease the quality and recreational use of surface waters. There is a need to improve catchment scale model simulation of impacts of current and future land management changes and remediation options on water quality for stakeholder use. While working with Lachlan Newham, Richard Greene, Barry Croke and Tony Jakeman, my research is focusing on these catchment issues in the Moruya and Tuross coastal catchments in the Eurobodalla Shire, NSW. To assess nutrient and sediment loads and enable management of sustainable practices within these catchments, the integrated catchment model (CatchMODS) is linked with a field data program, designed to help assess loads on an event basis, as there is little information on the quality of storm water entering the catchment estuaries. The project also includes an approach to estimate nutrient loss risk at the catchment scale using an index risk-based and conceptual modelling approach to estimate areas of risk. Soil regolith and transport risk factors such as soil nutrient levels, soil and regolith chemical properties, soil map information, soil texture, land use, soil regolith erodability, and catchment-scale hydrology are being used within a conceptual catchment model framework.

Prior to joining the PhD program at ANU, I worked as a soil scientist with the Land and Environmental Management group at AgResearch Ltd in New Zealand. I have researched the effects of sheep, deer and dairy cattle treading on soil in terms of physical properties, pastoral responses to soil compaction, natural soil recovery, sustainable soil physical farm management practices, effects of wintering cattle on *Brassica* forage crops on soil physical properties and nitrous oxide emissions, and agricultural related environmental issues.

Selected Publications

Drewry, J. J. 2006: Natural recovery of soil physical properties from treading damage of pastoral soils in New Zealand and Australia: a review. *Agriculture, Ecosystems and Environment 114*: 159–169.

Drewry, J. J.; Paton, R. J. 2005: Soil physical quality under cattle grazing of a winter-fed brassica crop. *Australian Journal of Soil Research 43*: 525–531.

Drewry, J. J.; Newham, L. T. H.; Croke, B. F. W. 2005: Estimating nutrient and sediment loads in Eurobodalla catchments. Proceedings of the 14th NSW Coastal Conference, 9–11 November 2005, Narooma.

Drewry, J. J.; Newham, L. T. H.; Greene, R. S. B.; Jakeman, A. J.; Croke, B. F. W. 2005: An approach to assess and manage nutrient loads in coastal catchments of the Eurobodalla region, NSW, Australia. *In*: Zerger, A.; Argent, R. M. *Eds*. MODSIM 2005. International Congress on Modelling and Simulation. Melbourne. Pp. 2658–2664

Monaghan, R. M.; Paton, R. J.; Smith, L. C.; Drewry, J. J.; Littlejohn, R. P. 2005: The impacts of nitrogen fertilisation and increased stocking rate on pasture yield, soil physical condition and nutrient losses in drainage from a cattle-grazed pasture. *New Zealand Journal of Agricultural Research 48*: 227–240.

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Drewry, J. J.; Littlejohn, R. P.; Paton, R. J.; Singleton, P. L.; Monaghan, R. M., Smith, L. C. 2004: Dairy pasture responses to soil physical properties. *Australian Journal of Soil Research* 42: 99–105.

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Drewry, J. J; Cameron, K. C.; Buchan, G. D. 2001: Effects of simulated dairy cow treading on soil physical properties and ryegrass pasture yield. *New Zealand Journal of Agricultural Research 44*: 181–190.

Drewry, J. J; Littlejohn, R. P.; Paton, R. J. 2000: A survey of soil physical properties on sheep and dairy farms in southern New Zealand. *New Zealand Journal of Agricultural Research* 43: 251–258.

Rory Eames

PhD Scholar

Is working together enough? The role of 'community' in catchment and regional environmental management frameworks

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Research Description

'Community', 'stakeholder' and 'public participation' are often referred to as key aspects of integrated and collaborative frameworks used to address complex environmental degradation issues, especially at the catchment and regional scale. In Australia, Integrated Catchment Management and to some extent Landcare have predominantly provided the avenues for this to happen, and the case study of the Swan-Canning catchment in South West Western Australia is typical of this approach. However a combination of factors surrounding this case study suggests that the conceptualisations of the role of community in environmental management are increasingly inadequate. An understanding of these factors, combined with a synthesis of theories from a range of literature suggests a fruitful way to (re)conceptualise the role of community in collaborative environmental management at the catchment and regional scales.

David Eastburn

PhD Scholar

Realising rural community capacity to sustain strategic local landscapes on behalf of Australian Society

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Research Description

The basis of my research is the assumption that members of rural bioregional communities have a rich base for interpreting the past, are highly sensitive to current climatic, environmental, market and policy changes, and have a strong interest in a sustainable future for the landscapes in which they live and work. They should, therefore, have greater involvement in decision-making and management processes that relate to the sustainability of their 'places' so that they can respond with local knowledge, imagination and passion, rather than being forced to react to distant decisions or inappropriate prescriptions.

The research will examine the 'politics' of sustaining landscapes, and the values that different groups within society ascribe to different landscapes at different times (with special reference to wetlands). In particular, it will investigate current and historical policies relating to river regulation which impact/ed on the sustainability of landscapes. The research will identify attributes that rural communities, and natural resources management institutions, may benefit from in order to effectively contribute to ecologically and socio-culturally sustainable future landscapes. It will also explore the roles of community, intergenerational equity, and communication in sustaining landscapes.

Saan Ecker

PhD Scholar

Assessing socio-economic and cultural drivers advancing and impeding environmental certification in the Blackwood Basin, SW Australia

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Research Description

Australia is at an early stage in developing accredited Environmental Management Systems (EMS) and even earlier in developing certification processes for agricultural products. The principle objective of this study is to determine the role of attitudes, values and beliefs in driving environmental certification systems for agricultural products in Australia, focusing on the Blackwood Basin in the South West of WA. The study runs in tandem with an environmental certification process – "BestFarms" - in that catchment.

The study focuses on attitudinal influences on products, from production to consumption, considering attitudinal influences that occur throughout the cycle. The study explores five of the Blackwood Basin's major agricultural products - grains, milk, wool, wine and fruit using a conventional and a certified example for each product type. Assessment of the product's environmental 'career' will be developed through informal interviews with best practice case study farmers and other actors in the supply chain, including processors, distributors and consumers. An abbreviated life cycle assessment will also be undertaken to estimate each product's ecological footprint.

Potentially, this knowledge can be used by organisations promoting environmental certification to target and develop systems that recognise the role of attitudes, values and beliefs, thereby positively influencing rates of adoption.

Susan Emmett

PhD Scholar

The effects of soil properties and management disturbance on native earthworms in wet eucalypt forest ecosystems

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Research Description

Forest management practices such as clearcutting, burning and soil disturbance greatly impact on soil quality and soil fertility by the alteration of organic matter inputs, by changes to the soil physical structure and by changing the soil biological and chemical composition. Prescribed burning, thinning and clearcutting remove the forest understorey and energy rich forest floor and impact on soil biological communities, such as earthworms that are dependent on this food source.

This ARC funded project investigates the relationships between vegetation, soil properties (chemical, physical and biological) and native earthworms in several tall eucalypt sites in south-eastern Australia. In addition, the effects of disturbance from forest management operations on native earthworms are being examined. Preliminary findings from the *Eucalyptus regnans* site suggest that at ten years post-harvest, the probability of native earthworm occurrence is strongly related to soil organic carbon (SOC) content. Such a finding suggests that the proposed Montreal soil indicator, changes in SOC, is representative of important soil biological properties.

Sue Feary

PhD Scholar

The Role of Forestry in achieving Equality for Indigenous Australians

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Research Description

Key indicators of human well-being demonstrate that Indigenous Australians are the most economically and socially disadvantaged group in Australia. Over the last few decades successive State and Commonwealth governments have funded programmes to redress this situation but there has been little improvement in the statistics, particularly for rural communities. One possible reason for the lack of progress is that employment programmes aimed at creating economic wealth for individuals do not adequately acknowledge the inextricable links between economics, culture and customary values that exist in Indigenous communities.

A recent initiative of the Commonwealth government, to develop a national Indigenous Forestry Strategy (NIFS) is more cognisant of the need to identify programmes that have 'caring for country' components and are community, rather than individually based.

Aboriginal people across much of Australia have had an association with forests that goes back for millennia. Traditional use of forests was for food, raw materials for artefacts and shelter and for medicines. There is an extensive ethnographic literature pertaining to management of forests through periodic burning although the extent to which it occurred is contested. Contemporary communities retain links with forests through co-management arrangements with conservation agencies and involvement with state forestry departments in undertaking pre-logging surveys for cultural heritage. In some parts of Australia traditional knowledge of forest ecosystems and customary practices can complement western scientifically based land management techniques.

The focus of the strategy is to build on the desire of Aboriginal people to play a more active role in natural resource management, by facilitating partnerships between forestry industry enterprises and Indigenous communities. Opportunities for both wood eg plantations and non-wood e.g. bush tucker enterprises are examined.

The strategy is being undertaken by consultants funded through the Department of Agriculture, Fisheries and Forestry (DAFF) and the Aboriginal and Torres Strait Islander Commission (ATSIC) guided by a Steering Committee. The consultants completed an initial round of consultation with Indigenous communities and forest industry in 2003 and a draft strategy has been prepared based on the outcomes of the consultation process. In partnership with the ANU, DAFF and ATSIC are also funding the PhD research to critically evaluate the development and implementation of NIFS. This will be done through action research using several case studies where Indigenous communities and industry have established joint ventures that are or have the capacity to bring social, economic and environmental benefits to both communities and industry. Strategy implementation success will be measured through performance indicators developed in consultation with the joint partners.

Karen Fisher

PhD Scholar

Meeting urban water needs: exploring water governance and development in Tagbilaran, the Philippines

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Research Description

Water is subject to uncertainty of supply (quantity) and quality, which affects decisions determining allocation, use and management for human and environmental functions. Tensions concerning water and its allocation reflect conflicting ideologies influencing development; therefore, focusing on water governance enables the allocation and management of environmental resources and tensions in development to be explored. I argue, however, that water governance is conceptualised differently at different scales and as discourses become localised, hybrid forms emerge. The aim of this research is to uncover local perspectives and knowledge about water governance systems in urban environments which can be used to shape and influence urban water management. I explore the hybridisation of water governance by considering the problem of ensuring urban water supply in a developing country context. In particular, I am concerned with exploring the problems faced by groundwater-dependent small cities in securing municipal water for drinking and other basic needs. My decision to focus on urban water in a small city is based on the increasing significance of urbanisation in developing regions, including Southeast Asia, and the implications that rapid urbanisation has for people's ability to satisfy their water needs.

The field research was conducted in Tagbilaran City, Bohol, in which water and sanitation services are shared amongst various public and private sector agents. This dissertation contributes to the growing body of knowledge concerned with the hybridisation of water governance and the experiences of small cities confronted by water problems manifesting as problems of development and environmental management.

Baihua Fu

PhD Scholar

Using fingerprints to trace the sources of suspended sediments in coastal catchments

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Research Description

It is increasingly recognised that information on the provenance of fluvial suspended sediment is essential to assist the design and implementation of catchment management strategies. Sediment fingerprinting technique is one approach to assembling such information, given that 1) potential sources can be distinguished by different geochemistry properties and 2) by comparing the properties in source and mixed samples, the importance of potential sources can be determined. This technique is appropriate for tracing sources of sediment over a range of spatio-temporal scales, while avoiding many constraints associated with direct field surveying. Despite the advantages of sediment fingerprinting, there are several uncertainties and problems associated with fingerprinting: generic guidelines are not available to predict the most suitable fingerprints under different environments; some assumptions need to be further tested; the transformation of tracer properties during sediment delivery may be a potential problem; the uncertainty of mixing models needs to be examined.

This research aims at improving sediment fingerprinting technique, and thus developing further understanding of sediment provenance under different geomorphic environments in Australia (e.g. Moruya and Burdekin catchments), by testing a number of sediment fingerprints and mixing models. Fingerprint properties such as geochemistry, mineralogy, mineral magnetism and environmental radionuclides may be used in the project. The project also aims at linking the fingerprinting approach to numerous catchment management scenarios. The results of the project can also be used to test sediment models such as CatchMODS and SedNet.

Nicholas Gellie

MPhil Scholar

Landscape Susceptibility to Severe Drought, Fire, and Storm

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Research Description

Historical susceptibility of landscapes to drought, fire, and storm, has not been studied extensively in Australia. We need to learn more about the incidence and severity of droughts, severe fire weather, and storm patterns of fire-prone landscapes and their potential coincidence in the last 100 years. Is there a regular or irregular pattern to the occurrence of these factors? Also little is known about the likely relationships between these factors in exposing landscapes to severe fires and storms and their post-fire impact on soil erosion, water quality, and post-fire recovery of vegetation. Hence what is the probability of a forested landscape being exposed to one or more of these factors over time?

The aim of my thesis is investigate the patterns of seasonal weather, using a drought index, and daily records of weather, to estimate the potential frequencies and durations of historically severe landscape events in the last 100 years. The seasonal component of landscape susceptibility will be estimated using a soil dryness index model to monitor the daily dryness of soils over a 100 year period. I intend to use time series analysis of soil dryness in catchments with different cover types, such as dry sclerophyll forest, wet sclerophyll forest, plantation, and grassland. The catchments lie within part of the central and northern parts of the Snowy Mountains and Brindabella ranges.

The soil dryness index is embedded within a water balance model of each catchment. Therefore the individual components of the water balance model will be validated using weather and stream flow records. The components of the water balance model to be validated are precipitation, canopy Interception, run-off, and evapo-transpiration.

After completion of the validation work of the soil dryness index in each of the catchments, data of daily fire weather, storm events, and rainfall intensity, will be superimposed on the soil dryness data to build a picture a picture of coincidence of droughts, lightning storms, severe fire weather, and post-fire storms in the Snowy Mountains. Historical research of weather patterns in particular years and months may reveal the incidence of events that have occurred historically, records of which have been buried through time.

A broad picture in spatial and temporal terms will be built of landscape susceptibility to severe events, using the likely coincidence of these factors in my study areas. This interpretation should provide land managers with a historical perspective as a well as a projective view of an impending risk period. In simple terms, what warning signs can be read from the seasonal and daily patterns of weather before a severe landscape event happens.

Martin Golman

PhD Scholar

Determining the optimum land-use options in the context of the April Salumei forest area, Papua New Guinea

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Research Description

In Papua New Guinea (PNG), the rich forest resource is managed on behalf of the landowners by the Government, though the resource is communally owned by the local tribes and clans. Management of these forests by the Government does at times lack the capacity for proper planning, strategically, tactically and operationally. In addition, planning to integrate resource owners' social and environmental values of their forests is done poorly. As PNGs' forest assets are presently managed mostly for timber production, the future of these resources will be at stake under the current pressure on them to generate revenue. Managers of the forests will be forced to adopt alternative, multiple-use strategies in the face of not only economic aspirations, but environmental as well as social pressures to meet sustainable forest management (SFM) requirements.

This research project has been developed to address the above issues and therefore will investigate the nature of the surrounding social, environmental and management aspects in the April Salumei forest context. At the same time, tools available for multiple use planning such as Geographical Information Systems (GIS), as a spatial analytical tool and multiple use planning models will be reviewed. Information will be gathered on biophysical, social and cultural impacts, biodiversity and forest growth and will become the basis for determination of an optimum land-use option.

This research will provide a holistic systems-management philosophy that is more vigorous and compelling in PNG Forest Management than the narrow orientations of the past.

This doctoral research is supported by the John Allwright Fellowship of the Australian Centre for International Agricultural Research (ACIAR).

Simon Gordon

PhD Scholar

Deliberating With Leviathan: Addressing Complex Ecological Problems in the Administrative State

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Research Description

Deliberative democracy is at a crossroads. Heralded for its theoretical potential to both enhance democratic legitimacy and lead to more 'ecologically rational' policy processes, deliberative democracy has yet to consistently deliver on these claims in practice. In this study, I argue that this is largely due to a failure to reconcile tensions between the conditions required for deliberative democracy and the competing practices and imperatives of the administrative state.

As the ability of deliberative procedures to enhance both democratic legitimacy and the 'ecological rationality' of the policy process is contingent upon them being able to influence policy outcomes, it would seem that addressing their failure to do so would stand as an urgent project. Yet, to date, efforts to address the issue of impact have been inadequate. The empirical literature, while full of instances where

deliberative procedures have failed to have a significant influence on policy outcomes, has generally ignored this crucial issue. The theoretical literature is equally culpable.

In this study, a possible path to reconciliation between the aforementioned tensions is suggested. In particular, a deliberative procedure, based loosely on the inter-departmental committee model, but with the inclusion of representatives from the public and technical spheres is developed. The practical potential for this type of model to improve both the democratic legitimacy and efficacy of policy decisions is examined in the context of a real-world case study. The case in question is a joint government-citizen working group, the Swan-Canning Cleanup Program Taskforce which, was established to address the highly complex ecological problem of algal blooms in the Swan-Canning river system in Perth, Western Australia.

Sue Gould

PhD scholar

How do vegetation, birds and landscape function in post bauxite mining rehabilitating lands compare with remnant tall Eucalyptus tetradonta woodlands of the bauxite plateau?

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Research Description

A unique regional ecosystem of tall *Eucalyptus tetradonta* woodlands on Cape York Peninsula is confined to one of the world's largest bauxite deposits. The bauxite ore body extends along the west coast of Cape York Peninsula for 275 kilometers north to south and 75 kilometers east to west. The combined bauxite mine leases along the west coast of Cape York Peninsula cover an area of 585,526 hectares.

The bauxite mining process results in altered landscape and soil profiles in which the post-mining land surface is lowered by a few metres. There are potentially significant changes in the infiltration and water holding characteristics in the post-mining landscape.

Current bauxite mining and rehabilitation practices have the potential to alter a high percentage of the tall *Eucalyptus tetradonta* woodlands from the regional landscape. The question arises as to the long term impact of mining and associated landscape rehabilitation on the flora and fauna of the Weipa region that are dependent on the tall *Eucalyptus tetradonta* woodlands.

The primary objective of this research project is to understand the short to medium term ecological impacts of bauxite mining in the Weipa plateau on the role of the tall *Eucalyptus tetradonta* woodlands as bird habitat.

Key research questions are:-

1) How are vegetation, birds and landscape function characterised in (a) remnant *Eucalyptus tetradonta* woodlands of the bauxite plateau, (b) analogue ecosystems to the post-mining landscape and (c) post-mining rehabilitating lands?

2) To what extent has the post-mining rehabilitation process been able to restore bird communities, habitat and landscape functions that are similar to remnant *Eucalyptus tetradonta* woodlands or post-mining analogue ecosystems to date?

3) To what extent is the rehabilitation process likely to restore bird communities, habitat and landscape functions that are similar to those of remnant *Eucalyptus tetradonta* woodlands, given the ecological trajectory of rehabilitation to date?

4) How do birds respond to vegetation and landscape function in the post-mining environment?

5) What theoretical models of ecosystem development best fit the observed development in post bauxite mining rehabilitation sites?

Quintin Gravatt

PhD Scholar

Phosphorus management in Oxisols using cover crops and organic acids

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Research Description

The aim of this project is to develop cover crop practices for the heavily fertilised potato cropping soils of the Robertson district that will minimise erosion and runoff of water, potentially rich in phosphorus (P), thereby resulting in significant improvements in the environmental management of this sensitive catchment area. The cover crops will improve infiltration, decrease erosion, and off-site transport of P and increase access to accumulated soil P, making it available to a subsequent potato crop, thus decreasing the P loading of the soil.

Catherine Gross

PhD Scholar

Applying justice frameworks to environmental decision-making

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Research Description

Decisions concerning the use of natural resources have the potential to damage a community's social organisation—or social capital—if the outcomes are perceived to be unfair. Fairness, or justice, is accepted as central to the well functioning of society and fairness is an expectation in day-to-day interactions. Outcomes that are perceived to be unfair can result in protests, damaged relationships and divided communities, particularly when decisions are made which benefit some sections of the community at the perceived expense of other sections. For example, people have expressed dissatisfaction in such areas as water allocation, forestry operations and the siting of wind farms. This loss of social capital can have a snowball effect on local and national natural resource management issues where whole-of-community responses are required, such as invasive weed control and water catchment management.

The aim of my PhD is to find out how people interpret and react to perceived fairness—or the lack of fairness—in environmental decision-making. This research extends empirical research which I completed for my Masters degree. The central argument there was that justice theory can be practically applied to environmental decision-making. The theory includes distributive justice, concerned with outcomes, and procedural justice, concerned with the fairness of the decision-making process. From this empirical research a community fairness framework was developed. The community fairness framework will be further developed to serve three purposes: first, to predict community reactions to natural resource management policies and decisions; second, to be a proactive planning tool for community consultation; and third, for use as a social learning tool. An important objective will be to create practical tools and guidelines for use by natural resource management practitioners. The research is primarily concerned with environmental decision-making with respect to water allocation and use.

I am on the Board of the international Society for Human Ecology. I am also a committee member of the Nature and Society Forum. In February, 2006, I presented a paper "Community perspectives of wind energy in Australia: the application of a justice and community fairness framework to increase social acceptance" at a University of St. Gallen research conference "Social Acceptance of Renewable Energy Innovation" in Tramelan, Switzerland. This paper has been accepted for publication in the journal *Energy Policy*.

Sarah Hemmingsen

PhD Scholar

Indigenous traditional resource management: An Australia and New Zealand Comparison

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Research Description

Over the past few decades, ex-settler countries have begun to create an identity for themselves not granted in terms of the colonial power. This has eventually led to the recognition of issues important to Indigenous peoples within these ex-settler countries and has thrown open many complex issues. The most significant issues are resource sovereignty and the impact of colonisation on indigenous relationships with the environment. However, while non-Indigenous populations are beginning to realise the value of Indigenous resource management, the ability of Indigenous peoples to carry out appropriate management methods is often restricted or not recognised. In coastal areas, colonisation was a major obstacle for Indigenous ownership, use and management, as coastal areas in all colonies were viewed as *mare nullius*, a homogeneous water column to be managed as public 'commons'. This framework poses many difficult dilemmas for Indigenous peoples as they face insecurity in their aspirations to control their marine territories and associated resources using traditional management methods and as a result of the general public's perception of their right to access coastal environments.

This research aims to undertake a comparative study between Australia and New Zealand, to investigate the continuing impact of colonisation on Indigenous management of coastal environments. In spite of the different experiences of colonialism in both countries, with Australian colonists declaring the land *terra nullius*, while in New Zealand, the Treaty of Waitangi was signed with the British Crown renouncing elements of Maori sovereignty, alienation from land and resources was experienced by both Aboriginal and Maori communities. Understanding how colonialism has impacted on environmental relationships in the past and continues to influence the ability of Aboriginal and Maori communities to participate in coastal management today is an important part of redress.

Cameron Holley

PhD Scholar

Governance, the environment and mobilizing local knowledge and capacity

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Research Description

In the last three decades the regulation of environmental and natural resource problems (ENRPs) has shifted from a top-down state-delivered activity to one involving 'webs', 'networks' and 'collaborations'. These collaborations are variously constituted by multiple private, government and non governmental stakeholders, who seek to govern ENRPs by pooling their knowledge and abilities, making joint decisions and taking on-ground action.

Both internationally and nationally, governments have been actively experimenting with this new way of governing ENRPs and have implemented a variety of on ground experiments that differ institutionally and spatially. But will these experiments "work", and if so how? What representation processes and decision rules are used in these collaborative institutions, and what impact do these have on the larger collaborative enterprise and its regulatory outputs? How can accountability and democratic legitimacy be effectively maintained in processes where local and regulated interests are often the main decision makers and implementers?

The answers to such questions remain uncertain, not least because existing regulatory and governance theory has yet to come to terms with these collaborative experiments. Accordingly, this project seeks to (i) advance our understanding of what this new form of collaborative governance involves; and (ii) provide insights for theory and practice regarding the above questions so as to guide the development of future collaborative initiatives.

To achieve these goals this project seeks to examine and draw critical distinctions and comparative lessons between three Australian experiments in collaborative governance. Specifically, it explores: (i) under what conditions does collaborative environmental regulation take place; and (ii) what factors determine the nature of the relationships between the various stakeholders and how they regulate the environment. The three empirical foci of the project were selected to maximise variance in *institutional*, *stakeholder* and *environmental* contexts and include:

- Environmental Improvement Programs: a regulatory initiative that focuses on local point source pollution and involves a collaborative governing endeavour between a single large industry, members of a community and governmental representatives;
- Neighbourhood Environmental Improvement Programs: a regulatory instrument that relies on an array of government and community stakeholders to govern multiple, diffuse environmental problems in a defined geographical area (normally comparative to a local government boundary);
- Regional governance initiative: a broader regulatory program that focus on multiple, diffuse ENRPs in mostly rural settings that cover the large geographical area of a catchment and involve multiple stakeholders such as farmers, townspeople and business.

Kevin Jeanes

Ph.D Scholar

Natural Forest Loss, Land Use and Climate Change Impact upon River Flow Regimes & Limnology of the Singkarak - Ombilin River Basin, West Sumatra, Indonesia

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Research Description

It is evident throughout Indonesia, SE Asia and the tropics world-wide that natural tropical forests are disappearing and that water resources are widely degrading in quantity or quality, or reaching their limits of supply versus increasing water use demand. Yet, there is an on-going global scientific debate in the field of tropical forest hydrology and varying opinions as to the likely impacts of forest loss upon water resources. In light of this scientific debate the current research seeks to explore and review the current 'new hydrology philosophy' where recent findings of some leading tropical hydrologists suggest that the maintenance or loss of natural forest (i.e. cover of trees) may not be the most crucial factor for the preservation of all catchment functions. However others warn that the linkage between forest and water is more complicated.

With a case study focus upon the Singkarak lake and upper Ombilin river basins of West Sumatra province, the research focuses upon a systematic exploration of the bio-physical factors that lie behind, or are acting in conjunction with, the impact of forest loss, land use and climate change upon watershed functions within the forested uplands of West Sumatra. The study aims firstly to explore the impacts upon river basin and catchment capacity to buffer peak rain events and release water gradually (i.e. the elements of seasonal river flow stability). Secondly it will explore the impact upon the river basin and catchment capacity to transmit water in the form of total annual yield and maintain water quality (in form of reduced sediment and pollution transport). Thirdly, it will explore the impact of these changes on the limnology of a receiving freshwater lake (Lake Singkarak).

The doctoral research is currently carried out under guidance of the Integrated Catchment Assessment and Management Centre, ANU, with a collaborative linkage to, and advisory support from, the World Agro-Forestry Centre (ICRAF), South East Asian Regional Office, Bogor, Indonesia. Financial assistance, in the form of a Miscellaneous Scholarship award by SRES, has supported the research since Year 2 of the program.

Stuart Johnston

PhD Scholar

Soil characteristics and processes critical to the sustainability of alpine grasslands

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Research Description

Mhe tall alpine herb field community in the alpine area of Kosciuszko National Park NSW, is a limited and biologically significant climatic climax ecosystem. However, past grazing practices and the current impacts of tourism, exacerbated by the harsh climate, have resulted in extensive vegetation degradation and subsequent soil erosion of the alpine humus soils. These phenomena have occurred over large areas of the tall alpine herb fields. These disturbances have also produced ecosystem states different from that of the natural climax state. The objective of this study is to provide a framework for determining the soil and vegetation characteristics and processes, which determine the inherent ecological stability of alpine herb fields. From this, a state transition model for alpine herb field ecosystems is to be developed to help in the understanding of ecosystem function and help management.

Stefan Kaufman

PhD Scholar

The roles of reflexivity in managed social change for sustainability

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Supervisors and advisors : Valerie Brown (SRES-ANU), Rob Dyball (SRES-ANU) Larry Saha (SoSS-ANU) and Steve Cork (CSIRO/LWA).

Research Description

This research investigates the roles of reflexivity in managed social change for sustainability. Reflexive is the effect of action back on the actor, reflexivity is the *experience* of that feedback. In the context of knowledge and action, the term refers to the links between the knower, and the known. The concept comes to the fore when we wonder 'do I have knowledge worth acting upon?'

In investigating reflexivity, the research aims to gain insight into a broader question: 'How can people embedded in complex systems arrive at the capacity to intentionally change them?'

Various debates around the framing and answering of this question have existed for as long as humanity has tried to direct our own future. However, getting it right has become particularly pressing with an increasing awareness of humanity's dependence and impact upon complex, interdependent and constantly changing social, economic and biophysical systems. Existing answers can be usefully grouped in two categories. Defining the system to be understood and changed from the 'outside in' has been typical of both dominant mainstream and critical/ marginal analyses in western civilisation. Arguably, this understanding has driven much of the development and change of our civilisation in the last two to three hundred years, with mixed results. More recently, attempting to explore and change a system from the 'inside out' has become a more acceptable, if far from the dominant approach.

It is the contention of this thesis that 'outside in' approaches are only tenable when no one cares enough about the knowledge and action in question enough to contest it, OR when the proponents are powerful enough to exclude fatal criticisms, contrary evidence and alternative interpretations. On this basis, it is predicted that change agents working in contested areas and without a great deal of power will be forced to enact their knowledge and action from the 'inside out'. In particular, the research aims to identify critical moments when change agents are forced to confront the explicit and implicit ways they have decided that they have 'knowledge worth acting on', and the roles reflexivity plays at these times.

The primary research contributing towards this thesis investigates case studies of managed social change: a public interest think tank focusing on influencing decision makers, a program fostering future environmental change agents, and a environmental product certification and labelling organisation. Interviews, participant observation, focus groups and archival research are used to establish the roles that reflexivity, and understanding of it, plays in attempting to understand and change complex situations which we are embedded in.

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Carola Kuramotto de Bednarik

PhD Scholar

Relative importance of fire regimes, environmental gradients and climate change for rainforest distribution in the Sydney region.

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Research Description

The distribution of vegetation communities across landscapes is determined by a range of environmental factors including historical fire regimes, climatic variation, soil fertility and characteristics; topography, water availability and plant vital attributes. Various theories have been proposed to explain current distributions of plant communities, and many have identified fire as an important component. These theories demonstrate that the probability of plant species remaining in particular localities following fire is a function of the fire regime (in particular fire frequencies and intensities), and the species' post-fire regeneration attributes.

The distribution of rainforests is of particular interest. Although some rainforest species are able to resprout after a fire, there is evidence suggesting that frequent and severe fires can eliminate these species from the landscape. To study the influence of fire regimes and other environmental variables on rainforest distribution, I am using information from the Sydney region. This area provides an ideal study site as the relatively high incidence of both natural and anthropogenic fires appears to be in direct conflict with rainforest persistence. Currently, fire management practices in the Sydney region aim to protect people and property, while simultaneously maintaining biodiversity values. However, these objectives are often in conflict as hazard reduction prescribed burning can eliminate species that require long periods to reach maturity. Further, the occurrence of severe fires affecting large areas, such as those observed during the 2003 fire season, is expected to be detrimental for certain species. As many rainforest species require fire-free periods of at least one hundred years to reach maturity, shorter fire intervals would eliminate them from the landscape. This problem is likely to be exacerbated under climate change conditions, which fire frequency and severity have been forecast to increase. This project is investigating the key factors contributing to the persistence of rainforest in the Sydney region, and how incompatible fire regimes may alter rainforest distribution. Such information is vital for developing optimal management strategies for this significant component of the landscape under present and changed conditions.

Adam Leavesley

PhD Scholar

The response of birds to the fire regimes of central Australian mulga woodlands

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Research Description

Within the arid zone, mulga (*Acacia aneura*) supports a rich bird fauna. Mulga grows in large continuous stands and in patches that are interspersed with other plant communities in an intergrove pattern. Fire-prone spinifex (*Triodia* spp.) hummock grasslands are thought to influence the distribution of mulga which can be killed by fires which scorch the canopy – i.e. of moderate intensity or greater. Little is known about the way birds respond to the spatial distribution of mulga in the landscape, or the fire regimes associated with mulga.

Unreplicated evidence from a study of the birds of Uluru - Kata Tjuta N.P. suggests that fire influences the species composition, richness and abundance of birds in mulga. I intend to formally demonstrate how the common mulga species respond to the fire regimes of mulga woodland.

Alex Lee

PhD Scholar

Utilising airborne scanning laser (LiDAR) to improve the estimation of Australian forest structure & biomass.

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Research Description

As a party to the Kyoto Protocol negotiations under the 1994 UN Framework Convention on Climate Change, Australia has a strong interest in calculating greenhouse gas emissions associated with land use change and forestry. As a result, information on biomass and how this changes through time, particularly in response to different land management practices is required to support regional calculation of carbon budgets. However, due to the inherent high variability found in natural and managed natural forest and woodland systems, and the diversity of land management practices employed, there is an ongoing need for improved methods of biomass estimation at a range of spatial and temporal scales, for practical and cost effective carbon accounting. The primary aim of the research is to develop algorithms to accurately quantify forest structure and above ground biomass using airborne scanning lasers (LiDAR), to assist regional and national vegetation monitoring initiatives. The utility of LiDAR is being examined across a range of scales; from within plot structural variability to broad structural types across environmental gradients. LiDAR has advantages over traditional optical data because it can sample both the canopy (upper and lower strata) and ground, however the representativeness depends on vegetation density and LiDAR collection parameters (e.g. beam size, scanning rate). The research used LiDAR (1,125 ha in central Queensland, and 60,000ha in Broken and Ovens catchments of North East Victoria) with field and other data. North East Victoria is where a National Forest Inventory pilot project, undertaken in mid-2003, is evaluating the possible implementation of a Continental Forest Monitoring Framework (BRS, 2006). Three dimensional

tree modelling combined with empirical relationships from tree and plot data are used to measure forest structure and above-ground biomass. In Queensland, multiple regression analyses utilised six canopy heights from overstorey and understorey with percentage crown cover to produce plot biomass estimates equivalent to field measurements (r2 = 0.92, SE = 12 Mg ha-1). Regional modification of the biomass function was required after testing at the Victorian site, where foliage cover, elevation, and five canopy heights were found to be optimal for biomass estimation in the taller, multi-layered higher elevation forests. Investigations of LiDAR apparent vertical foliage profiles show promise for the assessment of stand growth stage and understorey recovery since disturbance (Parker & Russ 2004). As these are useful for forest condition assessment they have been initially assessed both in Queensland (Lee *et al.* 2004) and Victoria. Here three relatively mature peppermint forest (*Eucalyptus radiata* Sieber ex DC) plots indicated a progression of understorey top height since last recorded fire, from no understorey after recent fire, to 10m understorey after 12 years, to multiple strata (at 10m and 20m) after 64 years without fire.

The research has concluded that LiDAR data can provide information just as detailed and possibly more accurately than field measurements for many required forest attributes. When utilised within sampling schemes much larger areas can be accurately reported on (Tickle *et al.* 2006). Information obtained from 3D tree and stand modelling using LiDAR data can be used to train satellite sensor (optical or radar) data to better report forest information at regional and national scales (Lucas *et al.* 2006). While current LiDAR use in Australia has primarily focused on research into accurately retrieving basic inventory attributes (Lovell *et al.*2003), its wider adoption has been limited due to cost (data supply for this research was $53 ha-1 (Queensland) and $1.50 ha-1 (Victoria)), and issues with processing large volumes of data (many millions of points).

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Lynette Liddle

PhD Scholar

A study of the conservation values of Aboriginal people and their linkages to the environment.

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Research Description

Conservation values are strongly linked to what people derive, understand and know about, and how they manage, country. Conservation in many parts of Arid Australia is reflected in the landscape values of the people. Conservation and its values are an inherent way in which Aboriginal people are motivated to conserve the animals, plants and land units on country.

The aim of this research is to analyse and investigate the values behind Aboriginal conservation and how this is underpinned by linkages between ecology of the land and culture.

David Little

PhD Scholar

Biologically mediated weathering in the rhizosphere of Australian forest soils

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Research Description

Soils and regolith are particularly interesting because of commonly observed emergent patterns that develop over time in response to climate, geology, topography and biological activity. Traditionally, biota-soil interrelationships have been ignored or over-simplified, and few studies have examined the impact of trees on soils in the rhizosphere. Recognition of the importance of rhizosphere processes and recent rapid technological advancement have opened up many avenues for biogeochemical investigation in the rhizosphere.

My research examines roles of low molecular weight organic acid root exudates in providing an essential component of microbial habitat, as well as in mobilising soil metals by such processes as ligand exchange and adsorption to soil minerals. Detailed chemical, mineralogical and microbiological investigations were undertaken using rhizosphere and non-rhizosphere soils under co-occurring Eucalyptus mannifera and Acacia falciformis in a dry sclerophyll forest at Mulloon Creek, Bungendore (NSW).

This research contributes to the scientific understanding of organic acid – mineral and organic acid – soil microbial community interactions in a forest soil rhizosphere, and has specific implications for understanding:

- biogeochemical cycling and biological weathering in Australian forest soils,
- landscape function, aiding vegetation rehabilitation and bioremediation strategies on degraded or contaminated lands, and
- and geochemical exploration, by providing information on how metals move through the rhizosphere to the root, and then how these elements are expressed in the above ground biomass.

Kirsten Maclean

PhD Scholar

Creating Spaces to Negotiate Environmental Knowledges at the Environment and Development Interface in Australia

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Research Description

There are ongoing debates in the contemporary environment and development literature regarding the role of both scientific and Indigenous participation in sustainable development initiatives. These debates have been critical of the supremacy of western scientific knowledge in such initiatives, with some academics asserting that science can be imperialistic, and its application can sometimes lead to social inequity and exclusion. In response, local and Indigenous knowledges have often been offered as providing a panacea for all environment and development problems.

Other scholars have argued that we need to move beyond this dichotomy. Before this can be done we need to understand the commensurability of these knowledge groups. In particular, how do the different interest groups construct notions of 'the environment'? What are these constructions and how can they be allianced? How do different administrative regions affect and manage these alliances and networks? To what extent is this equitable and how can this be improved? Finally, what role is there for local knowledge and, in particular, Indigenous ecological knowledge in these networks?

I propose to engage with these debates by conducting an investigation into the knowledge synergy that is (or indeed is not), occurring between local and more 'global' knowledge bases in Australia. The empirical focus is upon knowledge interfacing between government organisations, non-government organisations, 'communities' and individuals involved in environmental management in Australia. I use two case studies - one in central Victoria and the other in central Australia as a basis for this investigation. The case studies act as points of access into the localised knowledge networks surrounding environmental management in Australia.

The research methodology takes a 'participatory learning and action' approach. This involves compiling ethnographies of the projects, conducting semi-structured interviews with interested participants, and doing transect walks. The emphasis is upon open, flexible, interactive research relationships between all stakeholders who choose to be involved. This will help get at the perceptions, opinions and relationship dynamics of and between different interest groups, as well as set the foundations to devise appropriate strategies for greater interfacing between these groups.

Kate Park

PhD Scholar

The influence of land management factors on bird assemblages using riparian land in an agricultural system: a scale analysis

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Research Description

Increasingly within Australian agricultural landscapes, the important role of streamside vegetation as habitat for terrestrial wildlife is being recognised. However, maintenance of riparian habitat has focused on land management at the local scale, with little attention being paid to the influence of management practices within adjacent upland ecosystems. This research aims to investigate the influence on bird assemblages of land management factors across multiple spatial scales. Bird species utilising riparian land within farmland on the Southern Tablelands of NSW will be investigated. The influence of a variety of land management practices operating at scales ranging from the riparian vegetation itself, to the entire catchment will be explored. It is anticipated that these results will provide a greater understanding of the relationship between riparian and terrestrial ecosystems, and thus allow recommendations to be made regarding the conservation of riparian habitat for birds within agricultural systems.

Sue Powell

PhD Scholar

Modelling flood dynamics and vegetation response in a regulated floodplain wetland

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Research Description

Ecological processes in floodplain wetland systems are largely driven by the wetting and drying cycles (flood dynamics) provided from periodic or episodic flooding. The diversity of vegetation communities of floodplains is a product of the variability of the flood dynamics. Regulation of river systems and the associated extraction and diversion of water may alter the flood dynamics of these systems, impacting on the vegetation community structure. Environmental flow allocations and current water management policies are trying to balance the water needs of the environment with those of human enterprises such as agricultural production, basic water rights or urban needs. For water allocations and policies to be successful the flood dynamics required to maintain floodplain and wetland vegetation need to be clearly understood.

This study will investigate the flood dynamics operating in a regulated floodplain wetlands system and how these flood dynamics influence the vegetation in relation to taxonomic composition, productivity, structure or spatial distribution. Using this knowledge, modelling approaches will be explored to provide this information in a form that can be used to inform decision making in water allocation and policy development. The Gwydir wetlands, an internationally recognised inland terminal floodplain system of the regulated Gwydir River, will be used as a case study to undertake this research.

Ida Aju (Daju) Resosudarmo

PhD Scholar

Between Development, People, and Forests: Local Government Decision Making under Decentralization. Case Study of Two Districts in Kalimantan, Indonesia.

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Research Description

Many countries around the world are devolving political, fiscal, and administrative powers to sub-national governments; at least sixty countries have embarked on some kind of decentralized control over a natural resource or forest. However, so far, there is limited evidence that decentralization has benefited forests and the people who depend on them.

This research examines the outcomes of Indonesia's recent decentralization process in the context of forest use and management. It will observe the dynamics of forestry and forestry-related decision making processes and their implementation. It will explore elements such as the actors and their roles, locus and distribution of power, and accountability mechanisms. Research will involve investigation at the national, sub-national, and local levels.

Birte Schöttker

PhD Scholar

Remote Sensing in Coastal Catchments to Support Water Quality Modelling

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Research Description

Water is a vital resource critical to Australia's future and it plays a major role in sustainability and economic prosperity and requires smart use and management. Assessing and managing catchments as integrated systems will increasingly be a key for sustaining economic, social, cultural and environmental assets on all scales. This requires understanding of the processes operating within a catchment and the drivers of change – whether natural or human-induced. Especially in the changing nature of coasts the global and regional drivers are pressuring the system and operating at different spatial and temporal scales. Linking information on the land and ocean interface is a current challenge facing environmental research.

After having conducted a preliminary study on a NSW catchment, my research is now focussing on the Burdekin River Catchment in Australia, with 130,000km^2 the second largest catchment, draining into the unique ecosystem of the Great Barrier Reef – an area of high iconic, ecological and economical value. The Burdekin River catchment is highly variable and the sediments and nutrients delivered to the marine environment become mobilised predominantly during cyclonic and monsoonal events. The sediment delivery is suggested to have increased fourfold since European settlement and can exceed 10 Million tonnes.

Remote sensing techniques offer extraordinary potential to address the lack of some spatial and temporal information needed to support the development of tools to assess the impacts of changes in land use and land management on water quality, especially, given the major developments in Earth observation during the last decade. Remote sensing has evolved to represent a true multi-scale sampling tool, in both spatial and temporal domains. I am highly interested in contributing to the development and improvement of the understanding, sustainable use and preservation of complex ecosystems with the use of remotely-sensed data.

The proposed study aims at the improvement of the temporal and spatial resolution of existent sediment erosion models through the integration and assimilation of multisensoral, multitemporal remotely sensed information and ancillary data from various sources. Information on certain catchment characteristics is used to model event based sediment erosion. Furthermore, the results will be combined with ocean colour satellite sensor applications and modelling of the adjacent coastal waters quality in cooperation with the Remote Sensing Research Group at CSIRO. Idealistically, the findings of this bigger regional study could be transferred to other areas in the land ocean interface.

The experiences I documented prior to joining the PhD-program at the ANU should be of appreciable use. I finished my studies with the Diploma (Master) in Geography, supplementary subjects Communicational Science and Soil Science, at the University of Bonn, Germany in the Remote Sensing Research Group on "Recording Land Cover and Derivation of Vegetation Changes Using Multi-temporal LANDSAT Data in West Africa (Benin)". Afterwards I enjoyed working at the Centre of Remote Sensing on Land Applications (ZFL), Bonn, Germany on mapping land use changes in the state of North-Rhine-Westphalia with satellite images. When I arrived in Australia at the end of 2003 there was the great opportunity to work as Technical Officer at the Earth Observation Centre (EOC), CSIRO Atmospheric Research and to be involved in the Great Barrier Reef Program node in the Water for Healthy Country Flagship Program.

Catherine Simpson

PhD Scholar

Predictive modelling of stand structural complexity of dry sclerophyll forests on the Southern Tablelands, NSW using remotely sensed and GIS data

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Research Description

Whilst extensive in eastern Australia, native dry sclerophyll forests (DSF) on the Tablelands largely occur as patches of remnant regrowth that emerged following the abandonment of unproductive agriculture on private lands. These forests have generally been overlooked by systematic assessments in favour of the taller, wet sclerophyll public forests. As a result, conservation priorities and management strategies on a landscape scale are poorly developed. However, a number of organisations and researchers have recognized the potential biodiversity conservation and economic values of DSF.

Methods previously investigated for estimating the structural complexity of native vegetation are unsuitable for operational monitoring because the techniques are costly where repeated measurements across large extents are required; and limited where vegetation occurs on lands with restricted access.

Remote sensing technologies have the potential to characterise relevant spatial patterning and structural attributes at scales sufficient for DSF conservation priorities and management strategy development. However, a pilot study highlighted the limitations of using spectral analysis alone for mapping DSF condition where structural differences are subtle. Researchers investigating the predictive modelling of structural complexity in other vegetation communities found that the spatial information content of remotely sensed imagery assisted in the differentiation of stands with different structures but common spectral response in remotely sensed imagery.

This research explored the value of spatial information derived form satellite imagery for improving predictions of within-stand variations in structural complexity for a representative sample of dry sclerophyll forests on the Southern Tablelands of New South Wales, Australia. Relationships between spectral and spatial information from satellite imagery, along with abiotic environmental variables, were compared to field measurements of a structural complexity index and biophysical parameters using regression analysis. Despite the moderate accuracy of predictions, the results obtained have been consistent with other attempts to estimate structural attributes of open eucalypt vegetation.

The estimates of forest stand structural complexity provide natural resource managers with information on the relative structural complexity of native vegetation stands within the landscape to underpin management strategies that enhance the biodiversity conservation and economic values of DSF. The utility of spatial information from finer spatial resolution imagery for predictive modelling of vegetation structure is a key research priority since the moderate resolution of Landsat imagery limited the sensitivity of its spatial derivatives in the current study.

The research is partially supported by the Rural Industries Research and Development Corporation (RIRDC) and CSIRO Sustainable Ecosystems.

Geraldine Teakle

PhD Scholar

Past, Present and Future: Processes of Human Adaptation to Risk in Complex Adaptive Systems

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Research Description

Rapid and exponential population growth, unhalting development in vulnerable disaster prone regions and anthropogenic climate change are contributing to unprecedented disasters from known natural phenomena across the globe. Despite extensive government planning, preparation, risk management and mitigation programs to deal with the potential effects of such phenomena, some human groups and individuals are overwhelmed when an extreme event strikes resulting in chronic losses. Other groups, however, respond proactively, dramatically reducing losses in their community. The latter seem to have adapted or learnt from their own, or others', past risk experience more successfully than the former. If we could better understand this inconsistency in human behaviour then many lives can be saved and future losses can be reduced if not avoided completely. Furthermore, learning from past risk experience can help policy makers design better policies that contribute to more resilient and sustainable communities.

The thesis adopts critical realist philosophy and applies soft systems thinking and theories from cognitive science and risk research to gain a better understanding of individual and social processes of adaptation to risk—or learning from risk experience. To investigate the problem in-depth, a case study community prone to tropical cyclone risk in the city of Darwin in the Northern Territory (NT) of Australia is investigated. The case study community is viewed as a complex adaptive system: a socio-environmental system in which humans learn and human behaviour changes in response to its surrounding environment and one that is characterized by self organization and emergence. Primary data in the form of in-depth interviews and secondary data in the form of historical documents, laws, media and so on are used to investigate human adaptation to risk at individual and social system scales. The study reveals that a number of beliefs, perceptions, traditions, myths and urban legends emerge from the complex adaptive system and contribute to both past and present adaptive and maladaptive practices. The study concludes by presenting a number of possible approaches or interventions that would better enable individuals and society to adapt to risk especially in the context of a changing world with an uncertain future.

Kylie Theakston

PhD Scholar

Environmental Regulation for Small and Medium-Sized Enterprises (SMEs): An investigation into the determinants of SME environmental behaviour and the suitability of various regulatory approaches.

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Research Description

During the 1970s and 1980s, environmental regulation was primarily focused on the environmental behaviour of large corporations. More recently, however, small and medium-sized enterprises (SMEs) – business enterprises with fewer than 200 employees – have been increasingly identified for their contribution to key environmental problems such as resource use, pollution and waste generation. While the impact of individual larger companies was clearly seen to outweigh the environmental impact of individual smaller companies, it is now argued that the aggregate environmental impact of SMEs is not only great, but may in fact outweigh the combined environmental impact of large business. Thus there is a need to address the issue of environmental behaviour within the SME sector.

The SME sector, however, poses particular challenges for environmental regulators. Not least, the capacity of government agencies to monitor and enforce environmental standards is severely limited by the sheer size of the sector, as well as the wide dispersal and diversity of the business enterprises involved. In addition, characteristics that appear to be unique to firms within the SME sector – such as a lack of resources, low environmental awareness, lack of public exposure and a lack of receptivity to environmental issues– can inhibit the effectiveness of conventional regulatory strategies. So there is a need to address the issue of regulating SME environmental behaviour.

Yet little is known about what influences SME environmental behaviour or which environmental regulatory approaches are most suited to the SME sector, particularly within the Australian context. These deficiencies in our understanding represent substantial gaps in the environmental regulatory literature, and the research aims to address these gaps in the following ways:

(i) The research will investigate determinants of SME environmental behaviour. What influences the environmental behaviour of SMEs? Is this behaviour any different to the environmental behaviour of larger enterprises? How can we begin to understand variation in environmental behaviour within the SME sector?

(ii) The research will explore the suitability of various regulatory approaches to SME environmental behaviour. What regulatory approaches are currently used to address the environmental behaviour of SMEs? What are the strengths and weaknesses of each of these approaches? Why are some regulatory approaches more or less suited to the regulation of SME environmental behaviour?

Drawing on perspectives from individual SMEs and environmental regulatory stakeholders, the research aims to provide insight into the suitable means for regulating the environmental behaviour of SMEs.

Philip Townsend

PhD Scholar

Economic mechanisms to promote plantation establishment in Australia

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Research Description

In response to the national industry-government strategy *Plantations for Australia*: *the 2020 Vision*, released in 1997, Australia's plantation estate has expanded to approximately 1.8 million hectares. However, several changes to the taxation arrangements applying to plantation expenditure have lead to significant changes in the level of investment each year and the subsequent area planted. A long-term and committed effort, within a stable investment environment, will be required to complete the Vision target of establishing 3 million hectares of plantations by 2020.

The aim of the project is to investigate the economic mechanisms and associated policy approaches that could be used to support the long-term growth of Australia's plantation resources. In particular, there is a requirement to overcome the impediments to investment in long-rotation plantations. Economic models of plantation forestry will be used to investigate the options for increasing the liquidity of plantation investments, by assessing changes to the current tax rules or the use of futures contracts, and providing the means for plantation growers to receive payments for the environmental services provided by their plantations.

Two important policy areas that will be given detailed consideration, due to their potential impacts on the profitability of forestry projects, are the water entitlement and allocation processes for plantations and the public infrastructure funding models that could be applied in forestry regions. Both of these policy areas require a mechanism for valuing plantation projects across time, where the processes of valuation can incorporate the economic, social and environmental impacts.

Ha Thi Thu Tran

PhD Scholar

The impacts of the renovation policies on communities and forest land management in the northern mountainous region of Vietnam

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Research Description

In the late 1980s and early 1990s, the Vietnamese Government shifted from a subsidised central economy to a market economy, and transferred land use rights from the state to users through implementing "Renovation Policies" (Doi moi). The government expected that by increasing local income based on forestry activities, deforestation would be stopped and forest and forest land would be managed sustainably. My research asks the question: "How have Renovation Policies affected sustainable forest and forest land management in the northern mountainous region of Vietnam?" The research was carried out using six case studies following a transect representative of the physical geography of the northern upland region, in three different provinces (Cao Bang, Bac Kan and Thai Nguyen) each with a different forest type. The research explores how forest cover and quality have changed and investigates relationships among key socio-economic indicators such as income, food security and measure of equity (between family, households, genders) since the 1990s in each case study.

A methodology to assess sustainable forest and forest land management in northern Vietnam was developed for answering the research questions. The methodology was drawn from three approaches: 1) SFM local concepts; 2) Developing criteria & indicators of SFM (ITTO); 3) Landscape scale approach (WWF/IUCN and CIFOR). The research also used two secondary data sources: 1) my own data from my MSc research thesis in 1999-2001 & field samples established since 1992; 2) economic and social statistics, satellite imagery from GOs and NGOs. The research was based on an interdisciplinary approach; the major disciplines are forestry, human geography, ecology, economics, environmental science, and social anthropology.

The research shows that the renovation policies have not been as successful as expected, in terms of objectives, local livelihood quality and forest land management. First, the livelihood quality of most better-off villagers improved based on agricultural and forestry activities, but not the livelihood of poor people. Inequity in land use rights and public goods access has led to a big gap between the better-off and the poor. Second, forests have not been managed in a sustainable way. Although forest cover has increased compared to the 1990s by natural regeneration, the quality of forests was very low. In particularly, since 2000 many good natural forests have been replaced by poor plantations under the 5 million ha rehabilitation program and cash crop plantation. Illegal logging is still happening in protected and special use forest types. Shifting cultivation is also still happening as a result of food insecurity and the poverty of forest dependant people.

Renee Visser

PhD Scholar

Temporal and spatial interactions of foxes, cats and dingoes in arid Australia

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Research Description

On mainland Australia the dingo (*Canis lupus dingo*) has been the apex predator since the extinction of the thylacine (*Thylacinus cynocephalus*) 4000 years ago. There has been little research, but much speculation, on the role the dingo may play in trophic regulation in Australian ecosystems. This research aims to investigate the role of dingoes in structuring ecological communities through regulation of two smaller introduced predators, the feral cat (*Felis catus*) and the red fox (*Vulpes vulpes*). Previous studies have shown an increase in the number of smaller predators (cats and foxes) when dingoes are controlled and a decrease in small to medium-sized mammalian prey species. However, this relationship or the mechanisms behind it are not clear. There is some anecdotal evidence that the behaviour of dingo populations, rather than their density or abundance, may be a determining factor. Current management strategies that target dingoes as a pest species may have a direct impact on their ability to limit cat and fox numbers. The long-term implications of this for native species are yet to be determined.

The project will explore the potential conservation value of the dingo through their ability to facilitate behavioural change in cats and foxes. It will examine the role dingo behaviour may play in limiting assess to resources in a resource poor environment. It aims to investigate behavioural interaction as a mechanism behind predator-predator and predator-prey interactions and if so, whether some current management/ control measures may promote or hinder this role.

Lyndsey Vivian

PhD Scholar

Patterns and variations in plant responses to fire

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Research Description

Fire is a major recurring disturbance event in many Australian ecosystems and influences the evolution and dynamics of vegetation communities. The response of plant species to fire is variable and complex, however plant species can be divided into two general groups: those that are killed by fire (obligate seeders), and those that are able to survive fire by resprouting (facultative or obligate resprouters). Variations in plant responses to fire occur with many different factors, and across different scales. For instance, an individual plant may vary in its sprouting ability according to its age or size. Variations in plant responses to fire can also occur within a species in relation to factors such as fire intensity or severity, previous fire history, competition, climate and site productivity. At a landscape scale, the proportion of seeders to sprouters also can vary across different habitats. My research proposes to investigate the extent of variations in plant responses to fire at these different scales, and to explore the factors which are influencing this variation. For instance, at the landscape scale, the abundance of seeders and sprouters is thought to be influenced by site productivity and past fire frequency, however the relative influence of each is uncertain, and these two factors are also to some degree interrelated. Greater understanding of the variations that can occur in plant response to fire, and the driving factors behind this variation, will be invaluable to fire and land management.

Robert Waterworth

PhD Scholar

Stem profile development in *Pinus radiata (D. Don.)* under differing environmental conditions

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Research Description

The way trees grow, and in the process distribute and store carbon in the stemwood, is related to site and climatic conditions. This research aims to determine how the stem profile of *Pinus radiata* varies with differences in growing conditions. This will provide a better understanding of the relationships between stem development, stem volume increment and environment.

The research is based on historical data and recently collected samples from CSIRO's Biology of Forest Growth experiment, a long-term research trial terminated by the 2003 Canberra bushfires. The trial consisted of combinations of irrigated and fertilised treatments, representing a diverse range of growing conditions. The main phase of the research involves full stem analysis of sample trees to determine the stem volumes and changes in stem form between the treatments.

The research is being carried out with assistance from CSIRO Forestry and Forest Products. Funding from the CRC for Greenhouse Accounting is gratefully acknowledged.

Eddie Webber

PhD Scholar

Coarse Woody Debris Decomposition, Carbon Sequestration, and Management, in Eastern Australian Forests

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Research Description

This study is concerned with the decomposition dynamics of decomposing logs lying on the forest floor (known as coarse woody debris; CWD), and the impact this has on carbon sequestration and CWD management. Wet eucalypt forest (New South Wales and Tasmania), eucalypt woodland (central Queensland), and tropical rainforest (far north Queensland) were studied.

The eucalypts from the wet forests exhibited the slowest decomposition rates known for flowering trees. The CWD of both New South Wales and Tasmania had comparable decomposition rates (the slight difference between the areas was not significant). In the relatively undisturbed forests of southern Tasmania, this resulted in the highest accumulation of dead wood for any forest ecosystem reported anywhere. The tropical rainforest CWD decomposed the fastest, and decays at a rate comparable to other tropical rainforest ecosystems elsewhere in the world. The fast decomposition results in much less wood lying of the forest floor, in undisturbed sites, compared to the undisturbed sites in the eucalypt forests. The rainforest CWD loading is about one-fifteenth that of the relatively-undisturbed southern Tasmanian eucalypt forests. The woodland CWD (central Queensland) decomposition was so slow, that most loss to the surrounding environment was due to fragmentation and incorporation into the soil; this is undoubtedly due to the prevailing harsh-climate of the region (high temperatures and low moisture availability). Consequently, due to the extremely slow decomposition of the woodland CWD, and the unavailability of old samples, a decomposition rate could not be established.

Modelling of the Tasmanian eucalypt tree-growth and CWD-decay, shows that including CWD in carbon accounting can provide an increase of up to 40% of the long-term carbon that is stored in living trees. If change can be made to the current practice of excluding CWD from carbon trading, then managers of nature parks and reserves, where wood clearing has occurred in the past, may be able to increase their potential income by including CWD-carbon in their tradable-carbon stocks.

The slow decomposition of the eucalypts poses several management problems. Generally, it has been found that the most decayed wood contains the highest number of different species of resident organisms. However, due to wood removal in several areas of Australia, it will take a long time for forest regeneration, tree death, and decomposition to the most decayed stage to occur. This means that the organisms that rely on the most-decayed logs may become locally extinct if a region has had extensive wood-removal in the past. This may require that some select-trees be felled periodically within nature parks, in order to generate CWD earlier than would occur naturally in regenerating forests. This is especially relevant for the larger trees, which are also favoured by many of the organisms found in rotting logs. The felling of trees in nature parks is a contentious issue within the community, but may be necessary as the 'lesser of two evils'.

Besides being important as a habitat for many forest organisms, CWD performs other important functions. The logs act as slow-release fertilisers, continually releasing nutrients back to the forest environment as they continue through the slow decomposition process. The logs also act as obstacles to water flowing over the soil, reducing the speed of the water, which in turn reduces erosion, albeit to a small extent. Any reduction in erosion will help, to some extent, reduce the soil and nutrients from being transported into creeks and other water bodies, which, in turn, helps to reduce turbidity and nutrient loading of the aquatic environment. Turbidity of the aquatic environment reduces the light received by aquatic plants, reducing their ability to photosynthesise, and produce their own food. Increased nutrient loading of aquatic environments leads to increased intensity of algal blooms, which reduces the drinking-quality of the water. (Increased algal blooms can also lead to a dramatic increase in the zooplankton which prey on the algae, which can, in turn, lead to a depletion of the oxygen content of the water, subsequently resulting in the death of aquatic animals that require oxygen; the so-called 'fish kills'.)

Coarse woody debris is an extremely important element in the terrestrial environment, which has generally been ignored by environmental managers in the past. The impact of the slow decay of the eucalypts requires that environmental managers need to take CWD seriously, and formulate extensive management strategies to overcome the effect of environmental degradation caused by extensive log removal in the past, especially in nature parks and reserves, and water catchment areas.

This work is supported by The Australian National University, the Cooperative Research Centre for Greenhouse Accounting, and Forestry Tasmania.

Wendy Welsh

PhD Scholar

Groundwater balance modelling with Darcy's Law

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Research Description

Groundwater is an important resource in many parts of Australia. Unfortunately it is hidden from view and therefore difficult to quantify. Quantification and understanding of the resource and its interactions with surface water are essential to the effective management of groundwater.

A GIS-based method of estimating the magnitude of the water balance components and their interaction with surface water was developed and trialled near Bowen, a Queensland coastal irrigation area. Here rainfall is seasonal and high-value horticulture depends on groundwater. Over-extraction of the groundwater causes seawater intrusion, which leads to long-term aquifer contamination. Historical data were combined with formulae based on Darcy's Law of groundwater flow to produce spatial and temporal water balance estimates.

Although model development using the GIS-based method is faster than the more traditional numerical groundwater flow modelling, the latter method allows for the prediction of future water levels and water balances.

Steady state and transient MODFLOW-based groundwater models have been created for the Great Artesian Basin. This is the most important source of water in western Queensland and parts of regional NSW, SA and NT. The aquifers are laterally continuous across the Basin and extend to 3000 m below the ground in the central depocentres. The groundwater is potable for stock, and in most areas is under sufficient pressure to flow freely when tapped. However, many bores flow uncontrolled into open bore drains, wasting water and reducing groundwater pressures.

Springs, which are the Basin's natural groundwater discharge zones, have also declined due to over-extraction of groundwater. In 2001 the native ecosystems dependent on the Basin springs were listed as *endangered* under the Commonwealth Environment Protection and Biodiversity Conservation Act.

The groundwater models, which use data collected since the late 1800s, increase understanding of Basin hydrology and enable spatial and temporal predictions of groundwater recoveries due to on-ground work, such as rehabilitating uncontrolled bores and replacing open bore drains with pipes, tanks and troughs.

This work is supported by the Bureau of Rural Sciences. Data are provided by the Queensland Department of Natural Resources, Mines and Water, the NSW Department of Natural Resources, the SA Department of Water, Land and Biodiversity Conservation and the NT Department of Natural Resources, Environment and the Arts.

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Vanessa Wong

PhD Scholar

The effect of salinity and sodicity on soil carbon stocks and fluxes

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Research Description

This project aims to determine how increasing salinity and sodicity affects soil carbon stocks and fluxes, and the extent of hysteresis these systems exhibit upon rehabilitation. The soil organic carbon pool is the world's largest terrestrial carbon sink, with interest rising in the effects of land use practices in mitigating carbon dioxide emissions. Saline soils were estimated to cover over 5.5 million ha within Australia in 2000, while sodic soils were estimated to cover 74 million ha, both of which are predicted to increase in the future. Increases in both salinity and sodicity can lead to a decline in vegetation health and plant biomass production, and in extreme cases, result in the complete loss of vegetation and the development of salt scalds, which become increasingly susceptible to soil erosion. Because the amount of carbon present in the soil is dependent on inputs and losses, increasing salinity and sodicity levels have the potential to decrease carbon inputs into the soil from declining vegetation health and increasing erosion, in addition to altering soil physical and chemical properties which would subsequently impact upon nutrient cycling and biotic activity. Therefore any change in management regime, both in the degradation and rehabilitation processes, has the potential to affect the carbon flux in the landscape.

Results have shown increased losses of native soil organic matter when salinity and sodicity levels are increased due to increased rates of decomposition. Where scalding occurs as a result of high levels of salinity and/or sodicity, those degraded soils indicated that very little biological activity was occurring in profiles with low soil organic carbon stocks. However, the addition of organic material and gypsum into these degraded soils not only improved soil chemical and physical properties, but also re-established soil ecosystem function. Similarly, soil organic carbon stocks have been shown to increase to levels approaching that of a soil under native pasture following revegetation, while in scalded areas, soil carbon stocks were up to five times less than that of a non-degraded soil.

Therefore, as salinity and sodicity increase, losses of soil carbon also increase due to declining plant health resulting in decreased biomass inputs, with soil organic matter rapidly lost due to increased rates of microbial decomposition processes. Where scalding occurs, low levels of soil organic carbon and hostile soil environmental conditions result in minimal biological activity. However, where rehabilitation is successful, biological activity and soil organic carbon levels can be restored, particularly if rehabilitation efforts can successfully re-introduce plant production into these degraded landscapes.. This project will undoubtedly provide a broader understanding of issues associated with salinity, sodicity and carbon, and have the potential to be applied towards changing land management practices to reduce carbon loss and enhance carbon sequestration.

This project is being supported by the CRC for Greenhouse Accounting and CRC for Landscape Environments and Mineral Exploration.

Sarah Goldin

Master of Environmental Science Scholar

Restoration Ecology

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Research Description

I am currently studying part-time towards a Masters of Environmental Science. My primary interests are in restoration ecology and conservation of biodiversity. I intend to focus my sub-thesis on restoration of Australian temperate woodlands. These woodlands have been cleared extensively since European settlement resulting in the widespread loss of biodiversity and land degradation. I am principally interested in large-scale restoration efforts, the effectiveness of current restoration treatments and methods to improve management of remnant woodlands.

Prior to joining SRES, I worked in environmental consulting after completing a Masters in Environmental Management from UNSW. At present I am working part-time as an Environmental Officer with the Australian Fisheries Management Authority.

Kim Marchiori

Master of Environmental Science Scholar

Characterising the functionality of Spring Creek and its catchment prior to the implementation of Natural Sequence Farming techniques, Lake Cowal, New South Wales.

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Research Description

Lake Cowal is the largest inland lake in NSW. As part of the mining licence to mine on Lake Cowal, the Lake Cowal Foundation was set up to enhance and protect Lake Cowal and its environs. The Lake Cowal Foundation has received Federal funding to implement Natural Sequence Farming techniques to rehabilitate Spring Creek, a 10km long ephemeral creek that drains into Lake Cowal.

Natural Sequence Farming is an agriculture-based holistic approach to land and water management and rehabilitation. Through reconnecting the natural sequences it aims to reinstate the chain-of-ponds system that existed prior to European settlement. This reconnects the stream and the floodplain, slows water flow and retains scarce resources within the catchment.

The aim of this project is to characterise Spring Creek prior to implementation of Natural Sequence Farming techniques. Landscape Function Analysis will be used to assess the functionality of the existing landscape and the Landloch Gully Assessment method will be used to assess the state of the gullies. The major influences on water flow will be established and proposals to lower the run-off energy flows will be reviewed. A set of protocol and analysis techniques based on Landscape Function Analysis and Landloch Gully Assessment will be formulated to be used in future years. These procedures will be used to monitor changes compared to the baseline data collected in this study.

Jennifer McMillin

Master of Resources, Environment and Society Scholar

Education for Sustainability

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Research Description

The concept of sustainability is gaining acceptance as humans recognize that the earth's resources are finite and must be conserved for current and future prosperity. In order to reverse the trends of environmental degradation, a major shift in paradigm is required to reorient the relationship of humans and the environment from the current industrial model of control to an understanding of ecological limits. This necessitates educational innovation toward a more holistic view of the world. Higher education institutions prepare future leaders and are uniquely poised to take on the challenge of educating students to integrate the concepts of sustainability into their chosen fields. My research examines Education for Sustainability and its role in institutions of higher education. I am organizing and researching a new initiative at ANU called the Sustainability Learning Community, which aims to bring together students and staff from diverse disciplines to link theory to real life problems in sustainability-related issues on campus. Linking greening of campus initiatives to the curriculum provides an important experiential learning component for students, offering practical skills in campus sustainability projects.

Luke Pinner

Master of Environmental Science Scholar

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Research Description

I am currently studying part-time for a Master of Environmental Science. Previously, I completed a BAppSc Resource and Environmental Science (UC 1997) majoring in ecology and statistics and a GCert Applied Science (CSU 2001), majoring in spatial analysis and modelling. My interests are spatial analysis, landscape and fire ecology. In addition, I work full time for the Department of Environment and Heritage as a GIS analyst.

Indra B. Prachhai

Master of Forestry Scholar

Implication of forest policy on biodiversity conservation in Nepal

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Research Description

Nepal is rich in biodiversity, offering a natural home to a significant number of flora and fauna relative to its geographical area. However, this resource has been under tremendous pressure from humans and their activities. Nepal has shown its full commitment for biodiversity conservation by adopting all international treaties and conventions. At the local level, forest policy has been instrumental for ensuring biodiversity conservation along with the management and development of forest resources. There has been limited research, in particular, on the implications of this policy on biodiversity conservation in Nepal. Therefore, the main goal my research is to assess the role of forest policy on biodiversity conservation in different jurisdictions, including national parks, conservation areas, national forests and community forests, based on the available and relevant literatures and personal observation/experience.

Enesh Seitmuradova

Master of Environmental Science Scholar

Destruction of the Aral Sea: Causes, consequences and lessons to be learned

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Research Description

Having come from Turkmenistan in Central Asia I am naturally interested in environmental topics related to that region. In particular, water management issues are my area of interest. My research project is on the world's biggest environmental disaster – the destruction of the Aral Sea.

This project discusses the environmental, social and economic aspects of the Aral Sea crisis. The previous Soviet environmental practices and the current practices are analysed so that the key contributors to this disaster are identified. The majority of these problems are related to the unsustainable use of resources, in particular water, in the region. Potential solutions that can overcome the problem of unsustainable resource use in the region are then presented. These potential solutions are analysed, in respect to the local conditions, to see how they could benefit the Aral Sea Basin. Following this a series of recommendations to improve the situation are given.

Arief Setiyo Utomo

Master of Forestry Scholar

Forest Conservation

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Research Description

Indonesia has experienced a high rate of deforestation in the last two decades. Social and technical factors of forest management should be improved. Some main issues that need to be addressed soon are conflicts between government agencies and local communities, rehabilitation and conservation of the remaining forests.

I hold a Bachelor degree from Department of Forestry, Gadjah Mada University Indonesia, focusing on forest management. By undertaking a Master of Forestry program in SRES ANU, I want to develop my knowledge especially in forest conservation and social forestry. Since I have been working in the Ministry of Forestry of Indonesia for five years, I hope in the future I will be able to apply my knowledge to decision making in forest policy in Indonesia.

Muhammad Arshard

Graduate Diploma in Environmental Science Scholar

Water resources Management, Environmental Economics, Climate Science and Resources Environment and Society

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Research Description

I am presently enrolled in SRES doing a Graduate Diploma in Environmental Science. At present I am working with the Taraqee Foundation a National NGO in Pakistan. The focus of my work is to improve the living standard of marginalized communities in rural areas of Pakistan. I completed my Bachelor's degree in Civil Engineering from the Balochistan University of Engineering and Technology (Pakistan) in 1993. After graduation I worked with various humanitarian and development organizations in the field of rural infrastructure management.

My major interests are Water Resources Management and Economics of Natural Resources. I intend to seek a Master degree in Environmental Science in the year 2007 from ANU after completion of my Graduate Diploma.

Israel Bewang

Graduate Diploma in Forestry Scholar

Community Forest Management in Papua New Guinea

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Research Description

During my 2 years in SRES, I plan to analyse the experiences from my four years of Community Forest Management in Papua New Guinea. I hope to find out how to approach and organise communities to manage their forests themselves more sustainably to improve their living standards and alleviate poverty. The fact that 97% of PNG's land and forest resources is owned and controlled by the customary resource owners has been overlooked and forest management rights taken away from them through forest rights being taken away by the government and given to foreign companies to manage has been responsible for the destruction of most of Papua New Guineas pristine forests. I will research how the forest resource owners can be empowered through capacity building in forestry-related training. This must be accompanied by enabling conditions including policy and regulation support, technical institutional support of the resource owners themselves to manage the forest so that they can improve their living standards. I will also document what NGOs are doing in the area of building the capacity of the communities through donor support in eco-forestry activities and recommend ways for forestry management independence by the forest resource owners of Papua New Guinea. As a member of such a Community Organization called Madang Forest Resource Owners Organization (MFROA), I will try to use the group's experiences in helping communities manage their forests.

Ravindra Birua

Graduate Diploma in Environmental Science Scholar

Acid Mine Drainage in abandoned coal mines and its impacts on stream water and ecosystem health

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Research Description

Coal is one of the most plentiful energy resources, and its use is likely to quadruple by 2020 but coal mining produces a large amount of wastes which causes a large amount of wastes. These wastes have been associated with environmental damage due to the formation of Acid Mine Drainage (AMD). AMD poses potential environmental hazards, in particular stream water and ecosystem health.

I am interested in this subject because I have worked in mine rehabilitation projects in India for more than three years. My work was related to social aspects of people near a uranium mine, Jadugoda, India. So I want enhance my knowledge and develop skills dealing with those problems with more scientific knowledge.

Therefore, I have focused on coal mines, since India has a huge amount of coal which is increasing the danger of AMD. I am looking at case studies of different coal mines and associated AMD problems and solutions. Also, I am analysing the solutions using the case studies success and failure factors.

Gemma McBride

Graduate Diploma in Environmental Science Scholar

Climatology and factors affecting animal distribution

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Research Description

For my undergraduate degree I studied Asian Studies at the University of Qld and University of Hong Kong. Since then I have been working as an outdoor guide and tour guide in various locations around the world. I came to ANU to study Environmental Science in order to gain more knowledge to pass on in my outdoor guiding. For the first semester I studied climatology including a research project on rainfall patterns in Singapore, looking at spatial and temporal distribution. I am now looking forward to research on the factors affecting animal population distribution.

Elizabeth Noble

Graduate Diploma in Resources, Environment and Society Scholar

Organisational Learning for Environmental Management

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Research Description

I completed a Bachelor of Visual Arts at the University of Sydney before moving to Melbourne and becoming involved with community gardening and coordinating an organic garden at the Centre for Education and Research in Environmental Strategies (CERES). I continued this kind of work whilst living in Bristol, UK, until 2005, before returning to Australia and study.

I am currently involved in designing an Environmental Management System (EMS) for the new prison being built in Canberra. My interest lies in the integration of different disciplines for the creation of better approaches to environmental management. This involves focusing on how systems of learning, education and knowledge can be transferred and how different interests can be best engaged in the development of these approaches.

Deazy Rachmi Trisatya

Graduate Diploma in Environmental Science Scholar

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Research Description

I received my bachelor degree of Forestry from the University of Lampung, Indonesia in 2003 and then worked at the Ministry of Forestry. I am currently doing the Graduate Diploma in Environmental Science, hoping to continue to the Master of Environmental Science program in 2007.

My main interests are carbon trading and forest inventory in the context of forest management in Indonesia. I hope to get the most out of the program to upgrade my knowledge and skills to be implemented in Indonesia.

John Bennett

Honours Scholar

Interactions between Chemical Ameliorants and Vegetation in a Sodic Red - Brown Earth, Upper Bogan Region, NSW

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Research Description

Sodicity is recognised as having a negative impact on the physical behaviour and structural stability in a vast majority of Australian soils. It affects the ability of crops and pastures to develop, ultimately causing a decrease in their potential yield. Chemical amelioration using gypsum and lime is one method of rehabilitation for these degraded soils. This has resulted in a focus on interactions between chemical ameliorants and the soil profile, with a secondary consideration for plant establishment and growth. Die to this, plant interactions with chemical ameliorants and soil physio-chemical properties have only been allowed cursory consideration. Therefore the primary aim of this research is to investigate the processes and interactions involved with and between chemical ameliorants and plants, with a view to identifying a possible synergistic process between chemical ameliorants and plants.

Rachel Bessell

Honours Scholar

Predicting fire season severity using atmospheric circulation indices

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Research Description

Fire is one of the most important elements in the Australian landscape. Many Australian plants have evolved with fire as a necessary part of their life cycles. However, bushfire damage costs Australia millions of dollars every year, not to mention the invaluable loss of lives. As fire is intrinsically linked to the Australian landscape, there is little that can be done to prevent fire events, so the best form of protection is preparedness. There are already indices in place to predict daily fire danger, such as McArthur's forest fire danger index (FFDI) or Canada's fire weather index (FWI); however these indices are based on short term weather conditions to predict individual events. An advance warning of fire season severity of up to 3 months could help provide an indication of the resources that need to be invested seasonally. For example, if a fire season were predicted to be severe, than taking advantage of optimal days for hazard reduction burns in the month/s prior to that season would be very beneficial.

This research investigates whether fire season severity in southern Australia can be predicted using atmospheric circulation indices. The approach is to identify signature monthly and seasonal synoptic conditions preceding severe fire weather seasons in southern Australia; develop and use pressure based indices to capture the key synoptic procedures; and develop a predictive model using decision-tree cluster analysis. The research will provide a rigorous evaluation of the potential for fire season severity prediction from meteorological parameters. It has the potential to increase the effectiveness of medium to long term planning for fire seasons in southern Australia. The index could help alert professionals, landholders and the general public to the potential severity of each coming fire season to aid in preparation.

Paul Cheeseman

Honours Scholar

Changes in soil properties resulting from Biodynamic Agriculture: Southern Tablelands, NSW

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Research Description

The sustainability of global agriculture is a growing concern with increasing demand for food, fibre and fuel and the need to maintain ecosystem services which provide benefits such as biodiversity, climate regulation and fresh water. An avenue for greater sustainability is the continued incorporation of ecological concepts into systems of agriculture. There is a long history of such innovation within Australia, e.g. minimum tillage regimes to preserve soil structure, and rotational grazing to better emulate natural animal and pasture interactions.

Biodynamic agriculture, like organic agriculture, is a system that aims to be sustainable through the use of natural fertilisers, soil conditioners and pest control. It has an additional overlay, in that it is designed to promote and enhance natural forces and energies through specific material inputs and the timing of activities.

The management of soil fertility is a key indicator of sustainability. Fertility comprises all of the soil properties that encourage plant growth. The effect of biodynamic agriculture on soil properties has been studied, but not exhaustively; studies indicate some improvements in soil structure and ecology, but there are some questions over nutrient balances.

This study compared soil chemical, biological and physical properties on paired biodynamic and conventional grazing paddocks at two locations on the Southern Tablelands of NSW. Grazing systems generally create a reasonable level of soil organic matter through minimal tillage. This results in good physical and biological soil properties. In this situation, a discernible biodynamic effect would need to exceed these benchmark conditions.

Overall, land use and the application of ameliorants as part of normal farming operations produced strong effects on physical and chemical properties that may have overwhelmed any treatment effect. The study could not support hypotheses of the maintenance of soil nutrient status and the improvement of soil structure; however, the hypothesis of improved biological activity was supported. Further such studies need to reduce the effects of recent and historical farm management.

Serena Chen

Honours Scholar

Assessing industry viability: an investigation of the Eurobodalla Shire oyster industry

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Research Description

The oyster industry in the Eurobodalla Shire is of high economic and social importance to the local community, however its viability is potentially threatened by a range of factors. This research explores the environmental, social and economic factors affecting the industry in the Shire. It focuses on the three major oyster-producing estuaries: the Clyde River, Wagonga Inlet and Tuross Lake.

Three approaches to assessing the viability of primary industries were identified: (i) literature review and expert consultation, (ii) data modelling, and (iii) surveying. I adopted elements of each of these approaches, so that the limitations of one approach can be offset by the advantages of another. Firstly, research on the NSW oyster industry was undertaken through examination of literature to identify and understand the various factors that affect production. Production in the three Eurobodalla Shire estuaries was then modelled using three environmental indicators identified in the literature review: rainfall, streamflow and tidal data. The third approach involved interviewing a cross-section of local farmers to gain their perspectives of factors affecting their industry and its future. The findings of the three approaches were drawn together to identify possible means of improving the productivity and profitability of the local oyster industry.

Correlations between the environmental factors and oyster production were found to differ for each estuary. The main environmental factors affecting oyster productivity are weather, hydrological regime, water quality and disease. Changes in farming practices can help overcome some of these environmental factors. However, a farmer's ability or decision to adopt new technology may be hindered by access to finance or their sense of long-term security in the industry. Farmers have experienced an overall trend of decreasing profitability since the 1980s, which must be overcome for the industry to remain viable in the long term. The absence of QX disease and acid sulphate soils in the Eurobodalla Shire, as well as the lower development pressure compared to northern NSW, has allowed the local oyster industry to maintain relatively good oyster growing conditions. The long-term viability of the local industry can be improved through better farming practices, advances in technology, expansion of the Sydney rock oyster market and protection of water quality. The triple-approach method developed in this research demonstrates the importance of gaining a multifaceted understanding of an industry to assess its viability.

Amy Davidson

Honours Scholar

Key determinants of fire frequency in the Sydney Basin region

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Research Description

Fire frequency is a key component of the fire regime. It directly impacts on flora and fauna diversity as well as having implications for fire risk in terms of people and property protection. This project aims to identify the relative importance of a number of contributing variables to the spatial variation in fire frequency in the Central Branch of the Department of Environment and Conservation (NSW) Parks and Wildlife Division. Although there have been several studies focussing on individual elements affecting fire frequency, including many within south-eastern Australia, there have been surprisingly few studies examining the interactions between these components at a landscape level. This study aims to statistically model the relationships between the calculated number of fires at any given point in the landscape with important climatic, topological and access characteristics of that point using GIS and statistical software.

Outcomes from the project will aid in improving the understanding of the relative contributions of a number of variables in determining the distribution of fire frequency in the landscape. This knowledge can directly influence future fire and land management decisions directed at reducing fire risk.

Graham Fifield

Honours Scholar

Acacia browse as seasonal forage for fine wool Merino sheep: Southern Tablelands and Southwest Slopes of NSW

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Research Description

The loss of agricultural production to dryland salinity is becoming increasingly pertinent across large areas of southern Australia. While tree planting is recognised as an effective solution, deriving benefits from the presence of trees in the landscape is considered necessary to make the process of planting more attractive and economically viable. From the small number of land managers that have previously planted native trees and shrubs, anecdotal evidence has emerged of the value of *Acacia* (*spp.*) browse for improving the otherwise poor growth of fine wool Merino sheep consuming pasture diets during the summer and autumn months. This research investigates these claims by determining the carrying capacity of acacia dominated agroforestry paddocks relative to pasture paddocks, and changes in sheep weight associated with the provision of supplementary acacia browse (foliage and/or seed pods). Three distinctly different trials were undertaken, two of which were conducted on commercial farms on the Southern Tablelands and Southwest Slopes of NSW, and a third at the CSIRO Ginninderra Experiment Station.

The results of this research indicate that previously saline degraded land, rehabilitated through the direct seeding of native trees and shrubs, is equally as productive as non-degraded pasture land during an above-average rainfall spring, and summer period. This research supports the conclusion that browse from the acacia species commonly used for revegetation in the study area is palatable, sought after and not toxic to Merino sheep. There appears to be great potential to use acacia seed pods as an additional fodder source for Merino sheep as they are seasonally abundant, relatively high in protein and do not require additional management or harvesting to be accessible to stock.

Adam Flanagan

Honours Scholar

Stream-aquifer interactions in the Namoi Basin, northern New South Wales

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Research Description

In recent years increasing public awareness of the degraded state of many of Australia's freshwater resources has placed significant pressures on managers and policy makers to ensure a more sustainable and equitable use of the resource. Groundwater and surface water resources have traditionally been managed in New South Wales as isolated components of the hydrological budget. This policy direction is somewhat contradictory to the current state of scientific awareness in stream-aquifer inter-connectivity. It has been well established that in numerous ways, the two resources interact as part of the greater hydrological continuum. Where these interactions are present, it seems logical that surface and groundwater should be managed as a single resource. In order to allow the more effective management of the resource as a single inter-connected system, the complexities and quantitative effects of the interaction processes need to be better understood. In previous studies, where interactions between groundwater and surface water existed in combination with irrigation based groundwater abstractions, the processes which control both the sustainable supply of the resource and the ecologically significant baseflow contributions to streams have been found to be detrimentally influenced.

In an alluvial aquifer, such as the Namoi, the mechanism by which surface water flows may be reduced (either by induced recharge or decreased discharge) as a result of groundwater abstractions relates specifically to the cone of depression that surrounds a bore during extraction. When water is pumped from a bore, a radial cone of depression forms around the bore and localised flow may be concentrated toward the bore itself. As extraction continues the periphery of the cone may move to a point where it reaches a surface water system. At such a point, the quantity of water extracted from aquifer storage will decrease as water is increasingly drawn from the surface water system. Current water allocation policy in New South Wales stipulates that in periods of drought or low flow, surface water extraction is generally not permitted. This allocation policy does not currently prevent groundwater extraction where the mined water is primarily sourced from a surface water system.

In order to determine the quantitative effects of these groundwater extractions on surface water systems in the Namoi catchment, stream-aquifer interactions are being modelled for the Cox's Creek sub-catchment using a spatially-lumped conceptual rainfall-runoff model incorporating a groundwater loss module (IHACRES_GW). By simulating variance in the intensity of groundwater extractions, modelled stream flow reductions can be determined. This project aims to use these modelled flow reductions to better inform policy makers and managers of sound allocation options to protect all users of the resource.

Waverney Ford

Honours Scholar

Wilderness: The End Of An Era

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Hannah Hueneke

Honours Scholar

To climb or not to climb: the nature & historical origins of a contemporary dilemma at Uluru

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Research Description

Uluru-Kata Tjuta National Park is World Heritage listed for its cultural and natural values. It is also a sacred landscape to the local Pitjantjatjara and Yankunytjatjara people. It is jointly managed by traditional owners, who obtained title to the land in 1985, and Parks Australia, who leased it back at the same time. Uluru is a very popular tourist destination, receiving more than 400 000 visitors annually. Traditional owners ask that visitors respect their law and culture, and their concern for visitors' safety, by not climbing Uluru. This request is communicated within the park on signs, brochures, and at the park's cultural centre. However, many visitors continue to climb.

This thesis aims to improve understanding of visitors' response to the Anangu request, and knowledge of visitor motivations for climbing or not climbing. The research outcomes could include strategies for improved management of the cultural values of the national park, and a better understanding of cultural conflicts in site management more generally. The research involves an analysis of how climbing Uluru has been represented over time (encompassing travel literature, print media, and online travel blogs), and a survey of visitors to the national park.

Place-based natural and cultural values are some of desert Australia's most significant assets, and their protection and sustainable management is vital to providing a strong foundation for desert livelihoods. The research provides a case study of a key conflict over cultural resource management in desert Australia.

Emma Jacobs

Honours Scholar

Knowledge and Gardens: factors that stimulate the adoption of water efficient gardening practices in Canberra

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Research Description

The security of Canberra's water supply is increasingly threatened by a growing population and continuing uncertainty about future climatic conditions. With over 30% of all of Canberra's potable water being used on domestic gardens and lawns, it is critical that we increase our understanding of how and why people reduce their garden water use.

The purpose of the project is to look at the various sources of information available to domestic gardeners on changes in gardening water use; and to examine the degree to which this information is understood and applied by individuals in a Canberra suburb.

The project examines the changes that have occurred over the past 30 years in Canberra domestic gardens using several different methods: a photographic essay including aerial photographs over time; a field survey of front gardens, looking at maintenance, greenness and water use patterns; and in-depth interviews with domestic gardeners and garden experts in a range of fields.

Juliana Lazzari

Honours Scholar

A vegetation classification framework to inform NRM policy in the Australian rangelands

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Research Description

Human induced changes to native vegetation in the Australian rangelands have been ongoing since Indigenous and European settlement. Since the late eighteenth century Europeans introduced exotic species, cattle and sheep, for grazing production purposes into arid and semi-arid rangeland areas. Two hundred years of almost continuous grazing have had ecological impacts on these lands. Current significant investments in natural resource management (NRM) through government natural resource and environment programmes seek to reverse, maintain and improve these ecological impacts. However, measuring and reporting on the effectiveness of these investments has been lacking. A range of assessment tools have been developed to assist decision makers at the policy and landholder level to track changes and target investments.

The aim of this project is to investigate one of these tools which is a conceptual vegetation assessment framework called VAST – Vegetation Assets, States and Transitions. VAST has been developed to assess the condition of native vegetation. It has been designed to accommodate a range of scientifically based survey data and values that can then be presented in a form which is simple, useful and practical for decision makers. VAST can be applied at continental, regional and finer (landholder) scales to investigate vegetation condition as a source of information for NRM policy. The Mitchell Grass Downs (MGD) bioregion is the case study area.

Heather Mason

Honours Scholar

The effect of management on the phosphorus status and pathways of phosphorus transport in agricultural soils

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Research Description

Research exploring the phosphorus status and pathways of phosphorus transport in agricultural soils is of vital importance when assessing potential risk of phosphorus runoff entering waterways. Ferrosol soils at Robertson have a high phosphorus fixing capacity; to overcome this farmers apply up to 200kg/ha of fertiliser per crop. Such high application of phosphorus fertilisers enhances the level of soluble phosphorus in soil pore water and may have adverse effects in terms of potentially increasing the amount of phosphorus leaving the soil as runoff and drainage through the soil profile.

Research in Robertson is aimed at quantifying the amount of soluble P in soil pore water under different agronomic management practises, comparing soluble P movement in the soil profile down slope, assessing levels of soluble P in runoff in a simulated rainfall event, and finally, determining which agronomic management practise leads to the greatest potential for P loss to waterways.

Emily May

Honours Scholar

Use and value of private native forests: a study of landholders with dry sclerophyll forests on the Southern Tablelands of NSW

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Research Description

The research asks landholders questions on how they use and value their dry sclerophyll forests on the Southern Tablelands to inform their future management.

Understanding how landholders value and manage their DSF will assist in the development of policies that can address the management issues identified by landholders, and will identify how management affects the different values landholders have for their forests. The research includes the use of quantitative and qualitative methodologies. It will be conducted through a series of semi-structured informal interviews, followed by a posted questionnaire.

Melinda Mylek

Honours Scholar

Landholder perceptions of impediments to the adoption of farm forestry in the Southern Tablelands

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Research Description

This project examines the factors affecting landholder decisions to adopt or not adopt farm forestry in the Southern Tablelands of NSW. Demographic characteristics are compared with responses to perceptions of impediments to identify if different kinds of landholders are more likely or less likely to adopt farm forestry.

The results of this research will be used to inform groups such as the Southern Tablelands Farm Forestry Network about how to better assist landholders who are interested in adopting farm forestry, and will contribute to an understanding of impediments to the uptake of farm forestry in the Southern Tablelands region of NSW. The information can be used to help inform development of policies and strategies for increasing adoption of farm forestry.

Nilmini Ponamperuma

Honours Scholar

Environmentally and socially sustainable systems: Case study of the Mahaweli Development Scheme (Sri Lanka)

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Research Description

This thesis aimed to examine the influence of cultural identity on the development process. The outcomes of development would also be examined with an eye to the long-term environmental, economic and social viability of the AMDP (Accelerated Mahaweli Development Program). to do this a review of existing studies and data was undertaken. This process was hampered by the difficulty of assessing information from authorities in Sri Lanka. However, a study of available sources was conducted and a critical argment built.

It was found that the long-term viability of irrigated development is threatened by the failure to create resilient and reliable social institutions. Management is centralised and top-down. This has hampered agriculture and contributed to impoverishing the settlers. Also, management of the Upper Mahaweli Catchment has been poor. In order to ensure the long-term viability of the AMDP policy makers need to learn from the country's hidtory of stable, participatory, irrigated society.

Jason Raappana

Honours Scholar

The use of *Macrozamia communis* (L. Johnson) as a biogeochemical indicator of underlying mineralisation

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Research Description

Many known mineral reserves in Australia are reaching the end of their productive lives. Dependence on minerals for earning export dollars requires continued growth in this sector. The majority of new deposits will be found in areas where conventional methods failed to find them in the past. The aim of the project is to identify and provide a biogeochemical tool for use in the exploration of difficult terrain in the under-explored South Coast Region of eastern Australia. The target species for the study is *Macrozania communis* (L. Johnson).

Millie Rooney

Honours Scholar

'Oh you're just up the street!' - Discovering Community as an Agent of Change

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Research Description

Community is considered a key to bringing about desired social and environmental changes. It is therefore important that the concept of community and the way in which it influences behaviour is understood. My work is an exploration of the relationship between people's perceptions of community and their willingness to engage in activities requiring changes to existing patterns of behaviour. The Walking School Bus is used as a case study for exploring these relationships.

An emerging conceptual framework orders the data and highlights the importance of notions of *empowerment*, *rationality* and *belonging*. These three concepts are central to the discussion of people's perceptions of community and their willingness to engage in an activity such as the Walking School Bus.

Robyn Sakkara

Honours Scholar

The potential of forest certification to address illegal logging: an analysis based on four case study countries

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Research Description

Illegal logging is a significant problem in economic, environmental and social contexts through many regions of the world. Developing countries in tropical areas are particularly vulnerable, and forest management practices in the Asia- Pacific region heavily impact Australian and world markets. Timber production figures in the Asia-Pacific region are either unavailable or inaccurate, but indicate that roughly 8-10% of global annual wood production is illegal.

This thesis aims to determine the potential of forest certification to address illegal logging. While each of these areas has been individually highlighted within forest research, there is limited knowledge about how they relate on a real level, and the extent to which forest certification could be useful in affecting forest management practices.

Methodological approaches involve the development of an appropriate analytical framework and application of this framework to four case study countries. Analysis is based on assessing key relationships between illegal logging and certification, and determining which aspects of one are directly affected by the other. The framework is applied to case studies to cross check its potential practical applications. Results will give an indication of whether certification can be a valid tool in increasing the legality of products produced in the Asia- Pacific region. It is hoped that the research will have a practical application throughout the region to understand key areas where certification can affect forest management standards.

Eleanor Sobey

Honours Scholar

The influence of vegetation structural attributes on bird species richness and abundance

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Research Description

Rehabilitation of landscapes, and retention of avifauna richness within these landscapes, requires an understanding of the ecological processes underpinning both biotic and abiotic variables. In order to minimise the decline in native bird numbers we must understand resource needs for each species and the scale at which these needs operate. This necessitates understanding not only how birds relate to individual variables, but also how these variables interact with each other, and their combined effect on species richness and composition.

The primary aim of this study is to identify the patch-scale vegetation structural attributes that are significant predictors of bird species richness in the Southern Tablelands region of NSW. The relative importance of landscape and patch scale variables for avifauna occurrence is analysed, comparing the association of structural attributes with different measures of avifauna richness, and deriving management options from the outcomes.

Vegetation structural variables that have been previously shown to be significantly correlated with bird diversity will guide the quantification of vegetation attributes in the 42 survey sites in the Southern Tablelands region. Landscape variables at each site, categorized using GIS software and aerial photography, were combined with vegetation structural attribute measurements and bird survey data. Results will be analysed using generalised linear mixed models to determine the most important variables at both patch and landscape scale. The results will allow a rapid assessment of the conservation value for birds of an individual patch, and help prioritise management designs for vegetation remnants in an agricultural or suburban matrix.

Daisy Summerfield

Honours Scholar

The effectiveness of mulch and cover crops in stabilising sloping rehabilitation areas at the Cowal Gold Project, West Wyalong, NSW

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Research Description

Mine site rehabilitation is now one of the most important components of any mining operation in Australia. A sound rehabilitation plan must be developed, detailing the rehabilitation objectives before, during and after the mining operations. The Cowal Gold Project Environmental Impact Statement Report states the company's commitment to the environment through its sound rehabilitation plan during and post mining operations. Appropriate infrastructure design and construction is strongly reflected in the plan, as are the prevention of erosion and the establishment of native vegetation communities on mine disturbed areas. In order to establish vegetation, and in the long term a native plant community, a suitable landform with appropriate soil materials must first be constructed. Rapid revegetation is then required to facilitate the establishment of ground cover. The ground cover will assist in retaining soil moisture, increasing soil nutrients and reducing soil erosion.

The Cowal Gold Project is at its early stage of operation. Revegetation is required in several areas. Those of interest to this project include the walls of the permanent lake protection bund and northern tailings storage facility. Some revegetation and mulching treatments have already been undertaken on these areas. This includes the establishment of a vegetative cover of rye-corn along the exposed face of the lake protection bund, and the use of straw mulches on the walls of the tailings storage facility. Both these measures are in an early stage and are intended to protect the structures and stabilise them against erosion. This study investigates the effectiveness of cover crops and mulch in stabilising sloping rehabilitation areas at the Cowal Gold Project mine site. This study also uses Landscape Functional Analysis to define adequate plant or mulch densities to control erosion at acceptable levels. This not only provides context for the soil analysis compnent of this study, but also provides the mine with baseline monitoring data.

Ben Weilinga

Honours Scholar

The timber stiffness of radiata pine at paired breeding trials in southern NSW

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Research Description

I evaluated the potential use of an acoustic tool for wood quality selection in tree breeding. The lack of wood quality screening has been partly due to the cost of assessment. The TreeTap was developed for use on live trees, which prevents the need for destructive testing. As with similar tools, the velocity of sound transmissions is used to calculate the dynamic modulus of elasticity (~ timber stiffness). Acoustic methods have received a great deal of interest in recent times, but there is little evidence of their success in breeding.

To address this need, acoustic measurements were taken at two breeding trials in the Tumut plantation region. Cores were also extracted from the trees to determine if differences in water content influence measurements. This work was done in collaboration with Forests NSW, Tree Improvement.

The results were very promising. Wood-water relationships partly distorted acoustic measurements on trees, but not sufficiently to negate the benefits of this method. Timber stiffness was highly heritable and variable, giving a large response to selection. 10-15 trees per seedlot yielded reliable family mean estimates. Over 70 trees per day can be assessed by a single operator. The practical implications of these findings are discussed in detail in the thesis.

Kangane Mudiyanselage Ariyaratna Bandara

PhD

Genetic improvement of solid product value in subtropical eucalypts: a case study of Eucalyptus grandis and *E. dunnii*

Subtropical eucalypts are widely planted throughout the world, primarily for pulpwood. Although subtropical eucalypts from native forests have long been used for solid wood products, the use of younger plantation-grown wood of these species for these products has often been limited by wood quality problems, particularly growth stress- and drying- related defects. Successful genetic improvement of tree species for solid wood products depends on the genetic control of and relationships between economically important traits, the potential for early and inexpensive assessment of those traits, and clear definition of breeding objectives. This thesis addresses these issues, and develops a breeding objective and associated selection criteria for a flooring production system, using data from genetic trials of two important subtropical eucalypt species, Eucalyptus grandis and E. dunnii.

Genetic parameters of growth traits, of wood density and its component traits, and of wood shrinkage properties and end-splitting, were estimated in provenance-family trials of E. grandis in Sri Lanka and northern Queensland, Australia, in of E. dunnii in northeastern NSW, Australia. Generally, both provenances and families differed significantly in growth traits, wood density and wood collapse. Heritability estimates were moderate for growth traits, moderate to high for wood density and shrinkage properties, and low for end-splitting. High genetic correlations were evident between ages for growth and wood density. Genetic correlations between growth traits and between wood density at different ages were high. Genetic correlation between growth traits and wood density varied from slightly positive to slightly negative, and that between growth and wood collapse was unfavourable.

The relationships between economically important wood shrinkage properties assessed on sawn boards and micro-structural wood properties assessed on increment cores were investigated. Multiple regression models using increment core properties typically explained only small proportions of the observed variation in sawn board properties, although a model including shrinkage and microfibril angle showed promise for predicting board spring. However, the phenotypic correlations between sawn board shrinkage and wood cupping, and between wood density and wood hardness, were high, as was the genetic correlation between hardness and pilodyn penetration.

A breeding objective was defined and selection criteria were identified for a vertically integrated grower-processor enterprise producing flooring timber from E. dunnii. Profitability-based economic analysis indicated that sawn board cupping, mean annual increment, wood hardness and sawn board spring are the most economically important breeding objective traits. Mean annual increment, pilodyn penetration and shrinkage were identified as the most appropriate selection criteria to maximise progress in the breeding objective. Selection indices were developed using data from this and other relevant studies. The predicted economic gains from selection based on these indices were very high at around 30 cents per dollar investment, due mainly to the severe impact of the board defects on profitability, their strong inheritance and correlation with heritable selection criteria, and strong impact of volume improvement on profitability in young aged trees.

Sensitivity analyses indicated that genetic correlations, especially those between mean annual increment and wood traits, are the most influential of the genetic and economic parameters used to predict genetic gain in this breeding objective. Therefore, future breeding objective studies for eucalypt solid wood products should focus on verifying the genetic correlations between breeding objective traits, and between breeding objective traits and selection criteria traits. The results of the study also illustrate the importance of taking an approach integrating genetic improvement, silviculture, and processing methods, to improve solid wood product value from subtropical eucalypt plantations.

Paul Carlile

PhD

A Semi-Distributed Catchment Hydrology Model for Simulation of Landuse Change, Streamflow and Groundwater Recharge

Improvements in understanding of catchment hydrology will come from an ability to accurately disaggregate and connect surface and sub-surface hydrological components. This PhD thesis research has developed and investigated the ability of a rainfall-runoff, recharge-discharge model to simulate the hydrological fluxes in a catchment at various scales. The model has been developed to be a management tool for examining the affect of landuse change on stream flow and recharge within data poor catchments. Therefore the Little River Catchment located in central western New South Wales was used as a case study to test the approach. A successful conceptual rainfall-runoff model with relatively few parameters is used as a starting point for model development. This takes the form of a top-down modelling approach. The model was further developed so that it could integrate physical characteristics of the catchment while maintaining a simple model structure.

The aim is the development of a semi-distributed catchment hydrology model which can be used as an investigative tool for the effects of landuse change on the flux of water at the surface and sub-surface. The model has been designed so as not to require calibration prior to simulation of stream flow, as many real catchments are ungauged for stream flow. The model aims to utilize datasets typically available for catchments throughout Australia. The use of vegetation and soil types in directly estimating transpiration and deep drainage within the model allows the effects of various land-use scenarios to be tested. The approach has been designed to be augmented with contaminant mobilisation and transport schemes, in particular to assist prediction of salt loads and concentrations throughout the catchment.

The results presented show that the final distributed model is able to give reasonable estimates of stream flow, transpiration and recharge over time, while being sensitive to land-use change such as increases or decreases in forest cover. This research presents a meta-modelling approach to determine transpiration and recharge of shallow aquifers. This unique approach first uses a complex plot scale soil-water infiltration model to identify relationships for transpiration and recharge that can be used at the field scale in the distributed model. This meta-modelling approach, coupled with the spatial disaggregation of the catchment into management units based on soils, vegetation, topography and groundwater flow systems allows the model to be sensitive to land-use change while avoiding the complexity of other physical-based distributed models. Future research should examine the accuracy of model components in other more intensively studied catchments.

David Carpenter

PhD

An agroecological analysis of the adaptations of resource poor rice farmers from a Philippine barangay

The search for more sustainable modes of agricultural production is one of the greatest challenges facing the modern world. Agroecologists suggest that sustainable modes of production must adopt ecological principles and restore and reinvigorate agricultural communities. Using an agroecological framework, this thesis explores the possibilities for sustainable adaptations amongst resource poor rice farmers from the Philippine barangay (village) of Campagao. The thesis explores the adaptations of Campagao's rice farmers over the last thirty years, a period which saw substantial changes in agricultural practice within the barangay. Using a reinvented agroecological approach that emphasises the importance of linking ecological and social systems, and dealing directly with the political, social and epistemological barriers to sustainable agricultural production, this thesis reviews the possibilities open to resource poor rice farmers in the Philippines. The thesis suggests that the agroecological approach needs to focus more on the development of persistent, enabling social mechanisms that support ecologically-informed practices, and that encourage new, locally renewable practices. The thesis suggests how this may occur within the context of the Philippines.

Houshang Farabi Khanghahi

PhD

A risk-based approach to control of water quality impacts caused by forest road systems

Most forestry systems use extensive unsealed road networks for timber harvesting and other forest management activities. These road networks are significant sources of runoff and sediment delivery to streams, causing impacts on the quality of stream water. Thus roads that are built close to streams and road-stream crossings have enormous potential for erosion resulting in stream deterioration. The potential and extent of impacts depends not only on road-derived runoff and erosion, but also the degree of connectivity between roads (the main source of sediment) and streams. Stream water is impacted when road-derived runoff and sediment are delivered to adjacent watercourses. Several methods have been developed for identifying this connection and protecting stream water by managing the hydrological proximity between roads and streams.

In Australian forest management systems, the legacy of old, poorly designed and constructed roads are now causing water quality problems. Many existing forest roads are not well designed and pose a high risk for soil erosion and water quality. New remedial techniques are required to fix the problems.

Minimizing stream deterioration through managing the road-to-stream connectivity is a significant objective in achieving an environmentally appropriate forest road management system. Areas vulnerable to erosion can be identified using the Revised Universal Soil Loss Equation (RUSLE), combined with new approaches such as terrain analysis, Digital Terrain Modelling (DTM), Geographical Information System (GIS) based modelling and statistical analysis. It is also necessary to relate sediment production from first road surfaces, and second, outlets of the road drainage systems to the watercourses where it will be delivered by road-derived runoff flow pathways. Identification is done by assessing the road's surface, topographic and terrain factors, road-stream interactions, road contributing length and area and identifying road segments which have a high potential risk of sediment delivery to streams.

Risk assessment has become a useful tool in research and management activity in natural phenomena and environmental systems. In this research, it is argued that both the likelihood and the location of soil erosion and water quality impacts caused by forest road systems can be identified by a specific risk assessment method using GIS-based application and terrain analysis. The study was carried out in Stromlo Forest, Australian Capital Territory (ACT), located on the western edge of Canberra within the Murrumbidgee River Catchment. A specific risk assessment process is developed for surveying, assessing and gathering data related to the elements at risk (soil erosion and water quality) from road prisms. In addition, various methods of assessing the risk arising from different segments of forest roads with regard to their impacts on soil and water are developed.

This research evaluates the possibility of implementing GIS-based modelling and using the risk approach for cumulative impact assessment of forest roads. This approach provides a simple and practical method for assessing the risks arising from different segments of roads on soil and water. GIS and DTM are used with risk assessment to set up and draw risk maps. These maps identify the segments of the roads at risk. The risk map is a simple and practical tool for identifying the segments of the roads highlighted as critical areas for risk mitigation management.

The research also introduces a new method called Forest Road Impact Assessment (FRIA), an integration of the different processes and procedures of the risk evaluation approaches presented here. One of the benefits of this method for unsealed forest road management is that the time and cost of fieldwork can be dramatically reduced using GIS techniques for risk assessment and evaluation. The innovative achievements of the study, benefits of the method are highlighted and future directions for making this procedure a routine practice for road impact assessment are also suggested.

Gae Yansom Gowae

PhD

A Cohort Model for Pometia genus in the Lowland Tropical Rainforests of Papua New Guinea

Modelling growth of individual tree species of commercial importance in the mixed tropical rainforest of PNG has been hindered by lack of individual species data as well as the general assumption that individual species growth cannot be reliable estimated in such forest conditions. The genus of Pometia is of great interest, both commercially and ecologically, that has lacked information on growth and yield for planning and management purposes.

Data collected from the PNG/ITTO PSPs on the growth and yield study were used to develop a cohort model for predicting future growth of Pometia genus for stand management. Linear least-squares methodology was used intensively for parameter estimation.

A cohort model was developed, by incorporating a simple competition index based on stand variables, to estimate the potential growth of Pometia genus. Growth is defined as the mean periodic annual increment of basal area increment at stand level. Individual tree, distance-independent model was developed for comparative purposes.

The analysis indicated that growth model of Pometia genus is different from the rest of the species, and that individual species growth models can be derived from the combined species data. This suggested that any management decision based on the overall growth pattern would significantly undermine the potential of Pometia genus as an important commercial species.

Model evaluation based on the sensitivity analysis for model assumptions, and the prediction reliability of the model indicated that the model is adequate for planning purpose. The variables for parameter estimation conform to biological principles of tree growth and any bias in growth prediction would be of limited consequence.

Diana Margaret James

PhD

KINSHIP WITH COUNTRY: Acts of Translation in the Cross-Cultural Performance Space. A case study on the Anangu Pitjantjatjara Lands of Central Australia

Two maps of country represent the one continent: Australia, its lands and its peoples. One is an Indigenous map of a continent linked by the Songlines of the Western Desert Peoples' Creation Ancestors under Anangu Law. The other is a Western map of a continent divided by the state borders of colonial ancestors under British Law. This research project was generated from the philosophical statement of Nganyinytja, a senior Pitjantjatjara elder of Anangu Law, who said:

Reconciliation means bringing two cultures together, maru munu piranpa tjunguringanyi, black and white coming together. The two laws need to become one to care for the land. (Nganyinytja 1993:23)

This thesis explores the difficulties and possibilities inherent in attempts to reconcile these two cultures of knowledge and their relationship to land in Australia today. The study examines in some detail the potential for the convergence of Western and Indigenous perceptions and values of cultural and natural resource management (CNRM) in the practice of tourism on Anangu Pitjantjatjara (AP) Lands of Central Australia. The central question for the thesis is whether Indigenous knowledge of the complex interrelationships of kinship between nature and culture can be translated across the borders of languages, cultures and disciplines so as to be understood in the Western knowledge culture.

The methodology is derived from a bi-cultural research model, developed by the Ngaanyatjarra, Yankunytjatjara and Pitjantjatjara Women's Council, that integrates Anangu method into the framework of Western action research. The field research conforms to the protocols and accountability requirements set for Western researchers by Indigenous academics and traditional elders. In the results section the evidence analysed is my own and others' records of the Indigenous and Western cross-cultural exchange in the context of Desert Tracks tours on the AP Lands from 1988 to 2005. These records include diaries, visitor book entries, letters and email correspondence, tour brochures, research field notes and interviews with Anangu and visitors recorded in print, on audiocassette and film over these years. The research has also been guided by the formal ethics requirements of the Australian National University.

The findings are that, while recognition of Indigenous cultural landscapes in Australian land management is not new, the integration of this holistic conceptual approach into Western knowledge is proving problematic in both theoretical and practical arenas. This can be partly attributed to the ontological divide of culture and nature, spirit and matter in the Western intellectual tradition and partly to the problems of conceptual translation of knowledge across the gaps of language and cultural difference. Within the performance space of Desert Tracks on the Pitjantjatjara Lands this gap of understanding had to be bridged to develop a successful Indigenous and Western co-management of an ecologically and culturally appropriate tourism business. Building on these findings, a schema is proposed whereby mainstream natural resource management (NRM) is able to expand into a holistic conception and practice of cultural natural resource management (CNRM), thereby joining together Indigenous and Western knowledge. The schema provides translation between the two conceptualisations of ontology, ecology, culture and economics, and the spirituality of shared tangible and intangible landscapes, providing a performance space in which knowledge translation between peoples of different cultures can occur.

Ernst Paul Kemmerer

PhD

Optimising sawlog production in even-aged eucalypt stands

On a global scale the demand for solidwood products is rising and increasingly eucalypt plantations are becoming an important source of solidwood, instead of just a source of pulpwood. Of continued importance is the development of thinning schedules (both in timing and intensity) to produce a higher proportion of larger diameter logs (or sawlogs).

Stand optimisation (or the steps taken to recover the maximum potential value from a standing forest resource) can be formulated as a multi-stage decision making process which has traditionally been solved in forestry using the dynamic programming formulation, or via Pontryagin's Maximum Principle which is embedded in optimal control theory. In a control system it is typical to use a state-space representation with the assumption of Markov independence, where the current state is independent of the previous state(s).

Eucalypts are generally very intolerant to competition within the stand and any past growth restriction can affect future growth. In this case the assumption of Markov independence is likely to be violated because the future stand performance is dependent on previous states (or past silvicultural treatments). This thesis presents an alternative approach to forest stand optimisation so that the future stand performance is independent of past decisions or states.

The economic concept of a production possibility frontier was used to build a stand based growth model indicating the basal area production possibilities as a function of stocking and age. The principle of optimality is maintained by finding the optimal stocking level at each time-stage and constructing a model of the production limits over time, thereby ensuring Markovian independence. A suitable proxy for sawlog value was found which was correlated (R^2=0.86) with standing timber value and was insensitive to changes in the log-size price structure.

Based on the results of thinning trials for Eucalyptus pilularis, the optimal range for sawlog production was found to be between an upper and lower stocking level (in stems per hectare, or sph) given by the equations $S_{ub} = 144.1 + 2.2617 \times 10^{-3} A^{-1.9719}$, and $S_{lb} = 41.8 + 3.9092 \times 10^{-3} A^{-1.9296}$ where S_{ub} is the upper bound (in sph) prior to thinning and S_{lb} is the lower bound after thinning (in sph), and A is age in years. These limits correspond to the silvicultural requirement for early and intensive thinning of E. pilularis stands and were found to vary with site quality. The upper limit was found to be similar to a light thinning regime recommended by Horne (1981) for ages less than 30, but thereafter the upper limit was found to be less intensive than recommended by Horne (1981), however remaining consistent with the silvicultural recommendations by Curtin (1971) and Florence (1996).

Typically, sawlog production could be achieved by a moderate initial stocking of between 800 and 1200 sph, a first thinning at age 15 down to 300 sph, a second thinning at age 35 down to 100 sph, and clearfall at age 65. This regime would ensure a final average stand diameter of 80 cm dbh. Where smaller diameter logs are required a shorter rotation may be chosen, and modifications can be made for clearwood production using the given equations in a simple spreadsheet application.

The results were the same from dynamic optimisation routines using MATLAB®, and since the PPF model has the properties of convexity, it quickly converges to a solution. The use of more sophisticated software would allow for improved formulation of model constraints (such as number of thinning events, minimum harvestable volumes, financial considerations) and faster solutions.

The PPF model can be applied to any species where thinning trial data are available. Since age is an independent variable in the model, the timing and intensity of thinning can be organised without having to know the state or condition of the stand.

Chris McElhinny

PhD

Quantifying stand structural complexity in woodland and dry sclerophyll forest, south-eastern Australia

In this thesis I present and test a methodology for developing a stand scale index of structural complexity. If properly designed such an index can act as a summary variable for a larger set of stand structural attributes, providing a means of ranking stands in terms of their structural complexity, and by association, their biodiversity and vegetation condition. This type of index can also facilitate the use of alternative policy instruments for biodiversity conservation, such as mitigation banking, auctions and offsets, that rely on a common currency – the index value – that can be compared or traded between sites. My intention was to establish a clear and documentable methodology for developing a stand scale index of structural complexity, and to test this methodology using data from real stands.

As a starting point, I reviewed the literature concerning forest and woodland structure and found there was no clear definition of stand structural complexity, or definitive suite of structural attributes for characterising it. To address this issue, I defined stand structural complexity as a combined measure of the number of different structural attributes present in a stand, and the relative abundance of each of these attributes. This was analogous to approaches that have quantified diversity in terms of the abundance and richness of elements. It was also concluded from the review, that stand structural complexity should be viewed as a relative, rather than absolute concept, because the potential levels of different structural attributes are bound within certain limits determined by the inherent characteristics of the site in question, and the biota of the particular community will have evolved to reflect this range of variation. This implied that vegetation communities with naturally simple structures should have the potential to achieve high scores on an index of structural complexity.

I proposed the following five-stage methodology for developing an index of stand structural complexity:

1. Establish a comprehensive suite of stand structural attributes as a starting point for developing the index, by reviewing studies in which there is an established relationship between elements of biodiversity and structural attributes.

2. Develop a measurement system for quantifying the different attributes included in the comprehensive suite.

3. Use this measurement system to collect data from a representative set of stands across the range of vegetation condition (highly modified to unmodified) and developmental stages (regrowth to oldgrowth) occurring in the vegetation communities in which the index is intended to operate.

4. Identify a core set of structural attributes from an analysis of these data.

5. Combine the core attributes in a simple additive index, in which attributes are scored relative to their observed levels in each vegetation community.

Stage one of this methodology was addressed by reviewing a representative sample of the literature concerning fauna-habitat relationships in temperate Australian forests and woodlands. This review identified fifty-five studies in south-east and south-west Australia, in which the presence or abundance of different fauna were significantly ($p<0.05$) associated with vegetation structural attributes. The majority of these studies concerned bird, arboreal mammal, and ground mammal habitat requirements, with relatively fewer studies addressing the habitat requirements of reptiles, invertebrates, bats or amphibians. Thirty-four key structural attributes were identified from these fifty-five studies, by grouping similar attributes, and then representing each group with a single generic attribute. This set, in combination with structural attributes identified in the earlier review, provided the basis for developing an operational set of stand level attributes for the collection of data from study sites.

To address stages two and three of the methodology, data was collected from one woodland community –Yellow Box-Red Gum (E. melliodora-E. Blakelyi) – and two dry sclerophyll forest communities – Broadleaved Peppermint-Brittle Gum (E. dives-E. mannifera), Scribbly Gum-Red Stringybark (E. rossii-E. macrorhyncha) – in a 15,000 km^2 study area in the South-eastern Highlands Bioregion of Australia. A representative set of 48 sites was established within this study area, by identifying 24 strata, on the basis of the three vegetation communities, two catchments, two levels of rainfall and two levels of condition, and then locating two sites (replicates) within each stratum. At each site, three plots were systematically established, to provide an unbiased estimate of stand level means for 75 different structural attributes.

I applied a three-stage analysis to identify a core set of attributes from these data. The first stage – a preliminary analysis – indicated that the 48 study sites represented a broad range of condition, and that the two dry sclerophyll communities could be treated as a single community, which was structurally distinct from the woodland community. In the second stage of the analysis, thirteen core attributes were identified using the criteria that a core attribute should:

Be either, evenly or approximately normally distributed amongst study sites;

Distinguish between woodland and dry sclerophyll communities;

Function as a surrogate for other attributes;

Be efficient to measure in the field.

The core attributes were: Vegetation cover <0.5m; Vegetation cover 0.5-6.0m; Perennial species richness; Lifeform richness; Stand basal area of live trees; Quadratic mean diameter of live stems; ln(number of regenerating stems ha^{-1}+1); ln(number of hollow bearing trees ha^{-1}+1); ln(number of dead trees ha^{-1}+1); √(number of live stems ha^{-1} > 40cm dbh); √(total log length ha^{-1}); √(total large log length ha^{-1}); Litter dry weight ha^{-1}. This analysis also demonstrated that the thirteen core attributes could be modelled as continuous variables, and that these variables were indicative of the scale at which the different attributes operated.

In the third and final stage of the analysis, Principal Components Analysis was used to test for redundancy amongst the core attributes. Although this analysis highlighted six groupings, within which attributes were correlated to some degree, these relationships were not considered sufficiently robust to justify reducing the number of core attributes.

The thirteen core attributes were combined in a simple additive index, in which, each attribute accounted for 10 points in a total index value of 130. Attributes were rescaled as a score from 0-10, using equations that modelled attribute score as a function of the raw attribute data. This maintained a high correlation ($r > 0.97$, $p < 0.0001$) between attribute scores and the original attribute data. Sensitivity analysis indicated that the index was not sensitive to attribute weightings, and on this basis attributes carried equal weight. In this form my index was straightforward to apply, and approximately normally distributed amongst study sites.

I demonstrated the practical application of the index in a user-friendly spreadsheet, designed to allow landowners and managers to assess the condition of their vegetation, and to identify management options. This spreadsheet calculated an index score from field data, and then used this score to rank the site relative to a set of reference sites. This added a regional context to the operation of the index, and is a potentially useful tool for identifying sites of high conservation value, or for identifying sites where management actions have maintained vegetation quality. The spreadsheet also incorporated the option of calculating an index score using a subset of attributes, and provided a measure of the uncertainty associated with this score.

I compared the proposed index with five prominent indices used to quantify vegetation condition or habitat value in temperate Australian ecosystems. These were: Newsome and Catling's (1979) Habitat Complexity Score, Watson et al.'s (2001) Habitat Complexity Score, the Site Condition Score component of the Habitat Hectares Index of Parkes et al. (2003), the Vegetation Condition Score component of the Biodiversity Benefits Index of Oliver and Parkes (2003), and the Vegetation Condition Score component of the BioMetric Assessment Tool of Gibbons et al. (2004). I found that my index differentiated between study sites better than each of these indices. However, resource and time constraints precluded the use of a new and independent data set for this testing, so that the superior performance of my index must be interpreted cautiously.

As a group, the five indices I tested contained attributes describing compositional diversity, coarse woody debris, regeneration, large trees and hollow trees – these were attributes that I also identified as core ones. However, unlike these indices, I quantified weeds indirectly through their effect on indigenous plant diversity, I included the contribution of non-indigenous species to vegetation cover and did not apply a discount to this contribution, I limited the direct assessment of regeneration to long-lived overstorey species, I used stand basal area as a surrogate for canopy cover, I quantified litter in terms of biomass (dry weight) rather than cover, and I included the additional attributes of quadratic mean diameter and the number of dead trees.

I also concluded that Parkes et al. (2003), Oliver and Parkes (2003), and Gibbons et al. (2004), misapplied the concept of benchmarking, by characterising attributes in terms of a benchmark range or average level. This ignored processes that underpin variation at the stand level, such as the increased development of some attributes at particular successional stages, and the fact that attributes can respond differently to disturbance agents. It also produced indices that were not particularly sensitive to the differences in attribute levels occurring between stands. I suggested that a more appropriate application of benchmarking would be at the overarching level of stand structural complexity, using a metric such as the index developed in this thesis. These benchmarks could reflect observed levels of structural complexity in unmodified natural stands at different successional stages, or thresholds for structural complexity at which a wide range of biota are present, and would define useful goals for

Angela Newey

PhD

Decomposition of plant litter and carbon turnover as a function of soil depth

Soils contain twice as much carbon (C) as the atmosphere and have the potential to act as a net source or sink of C, depending on a range of factors that are still poorly understood. Our ability to manipulate C sequestration and retain greater amounts of C in the soil is dependent upon an understanding of the processes controlling decomposition throughout the profile. Current understanding of decomposition has largely been focussed on the 0-30 cm layer.

This study investigated the processes controlling litter decomposition within the profile, to a depth of one meter. Its aims were to (i) determine whether decomposition was slower in deep soil relative to surface soil, and (ii) identify the mechanisms responsible. A field based litter-bag study and a laboratory incubation experiment were conducted to measure litter decomposition rates directly. A range of different types of litter from surface leaf litter to plant roots were investigated. These studies were carried out using two important soil types that are widely distributed in Australia, i.e. a red chromosol and an alluvial soil. A decomposition model was developed to help interpret experimental results.

Litter decomposition was found to be slower at depth in the profile by a factor of 3.3 – 6.3, depending on plant species from which the litter was derived. The mechanisms causing this effect were found to include litter quality variation with depth and soil edaphic constraints to decomposition at depth. Variation in litter quality caused decomposition rates to decline by a factor of 2.2 – 4.2 between leaf litter and root materials. Thus litter inputs to surface soils were higher in quality than those to deep soil layers. Soil edaphic constraints to decomposition caused decomposition rates to vary by a factor of 1.5 between 0 – 10cm and 50 – 100cm. This was attributed primarily to nitrogen deficiency at depth, and was largely ameliorated in the laboratory when soluble N was added to decomposing litter in surface and deep soil samples. However N was unable to account for all of the differences between surface and deep soil decomposition characteristics and some other factor appeared to be involved. Indirect evidence suggested that high bulk density and possibly oxygen deficiency may impede decomposition at depth. It is also postulated that soil biological differences between surface and deep soils were part of the deep soil constraint.

The empirical data derived from this study will improve model predictions of C fluxes between soils and the atmosphere. These models are critical for the identification of management and policy options for responding to the challenges of climate change.

Jacqueline Yvette Russell

PhD

Human ecology: A proposal for a critical systems approach to a conceptual framework

This thesis develops an argument that conventional, or traditional, accounts of science are not only untenable and impracticable, but that they are also unable to support the transdisciplinary and ethically driven work of human ecologists concerned with ecological sustainability and social justice. A course is purposefully charted that both directs attention towards and invites critical discursive engagement with those ideas and writings in the literature which are considered to have important bearing upon a reconceptualisation of science that has the capacity to support the aims, values, assumptions and practices of human ecologists. In particular, the thesis draws upon the philosophy of science, and the history and sociology of science along with critical theory and critical systems thinking to develop the proposed conceptual framework for human ecology.

Karim Saberaftar

PhD

The Hydrological Flux of Organic Carbon at the Catchment Scale: a Case Study in the Cotter River Catchment, Australia

Existing terrestrial carbon accounting models have mainly investigated atmosphere-vegetation- soil stocks and fluxes but have largely ignored the hydrological flux of organic carbon. It is generally assumed that biomass and soil carbon are the only relevant pools in a landscape ecosystem. However, recent findings have suggested that significant amounts of organic carbon can dissolve (dissolved organic carbon or DOC) or particulate (particulate organic carbon or POC) in water and enter the hydrological flux at the catchment scale. Subsequently, because of this potentially important but as yet poorly accounted-for component of the terrestrial carbon cycle, it is possible that landscape ecosystems may effectively continue to function as carbon sinks even when biomass and soil carbon fluxes reach equilibrium. A significant quantity of total organic carbon (TOC) sequestered through photosynthesis may be exported from the landscape through the hydrological flux and stored in downstream stocks.

This thesis presents a catchment-scale case study investigation into the export of organic carbon through a river system in comparison with carbon that is produced by vegetation through photosynthesis. The Cotter River Catchment was selected as the case study. It is a forested catchment that experienced a major wildfire event in January 2003. The approach is based on an integration of a number of models. The main input data were time series of in-stream carbon measurements and remotely sensed vegetation greenness. The application of models to investigate diffuse chemical substances has dramatically increased in the past few years because of the significant role of hydrology in controlling ecosystem exchange. The research firstly discusses the use of a hydrological simulation model (IHACRES) to analyse organic carbon samples from stream and tributaries in the Cotter River Catchment case study. The IHACRES rainfall-runoff model and a regionalization method are used to estimate stream-flow for the 75 sub-catchments. The simulated streamflow data were used to calculate organic carbon loads from concentrations sampled at five locations in the catchment.

The gross primary productivity (GPP) of the vegetation cover in the catchment was estimated using a radiation use efficiency (RUE) model driven by MODIS TERRA data on vegetation greenness and modeled surface irradiance (RS). The relationship between total organic carbon discharged in-stream and total carbon uptake by plants was assessed using a cross-correlation analysis.

The IHACRES rainfall-runoff model was successfully calibrated at three gauged sites and performed well. The results of the calibration procedure were used in the regionalization method that enabled streamflow to be estimated at ungauged locations including the seven sampling sites and the 75 sub-catchment areas. The IHACRES modelling approach was found appropriate for investigating a wide range of issues related to the hydrological export of organic carbon at the catchment scale. A weekly sampling program was implemented to provide estimates of TOC, DOC and POC concentrations in the Cotter River Catchment between July 2003 and June 2004. The organic carbon load was estimated using an averaging method.

The rate of photosynthesis by vegetation (GPP) was successfully estimated using the radiation use efficiency model to discern general patterns of vegetation productivity at sub-catchment scales. This analysis required detailed spatial resolution of the GPP across the entire catchment area (comprising 75 sub-catchment areas) in addition to the sampling locations. Important factors that varied at the catchment scale during the sampling period July 2003 – June 2004, particularly the wildfire impacts, were also considered in this assessment.

The results of the hydrologic modelling approach and terrestrial GPP outcome were compared using cross correlation and regression analysis. This comparison revealed the likely proportion of catchment GPP that contributes to in-stream hydrological flux of organic carbon. TOC Load was 0.45% of GPP and 22.5 - 25% of litter layer. As a result of this investigation and giving due consideration to the uncertainties in the approach, it can be concluded that the hydrological flux of organic carbon in a forested catchment is a function of gross primary productivity.

Sunil Sharma

PhD

A comparison of combinatory methods and GIS based MOLA (IDRISI®) for solving Multi-Objective Land use Assessment and Allocation Problems

The aim of this study was to provide an informed choice among two combinatory methods and GIS based MOLA module in IDRISI® by comparing their performance in solving a hypothetical Multi-Objective Land use Assessment and Allocation (MOLAA) problem. Among the combinatory methods, Simulated Annealing and Tabu Search algorithms were chosen for study. The application of Simulated Annealing had already been demonstrated in solving a MOLAA problem but Tabu Search had not been applied to a MOLAA problem before. A compactness function was also incorporated in these algorithms in order to enhance spatial compactness in land use allocation.

The Kioloa Region of New South Wales, Australia was chosen for designing a hypothetical MOLAA problem because of availability and also because of being able to access to the digital datasets at the Australian National University. The MOLAA problem was formulated for accomplishing six land use objectives by allocating the area to four land use types, that is, conservation, agriculture, forestry and development, using altogether 17 criteria, including 16 factors and one constraint. The criteria maps were classified in ordinal, continuous and fuzzy scale and combined by using Weighted Linear Combination for producing land use suitability models for each land use type. The ordinal and continuous land use suitability models were used in solving the problem by applying the MOLA module. In order to apply the combinatory methods, all three land use suitability models, that is, ordinal, continuous and fuzzy, were transferred to cost suitability models where the lowest cost value represented the best suitability and the highest cost value represented the lowest suitability in the interval data set. Three initial input solutions generated by the random, cheapest and greatest difference methods were used for optimising by applying both algorithms.

Both combinatory methods maximized overall land use suitability with better spatial compactness by allocating each land unit with the most suitable land use with the lowest cost. At the land use level, MOLA exhibits a bias towards land uses with lower area requirement and allocates more suitable land units to them. Though the MOLA module is highly efficient in solving large grid MOLAA problem, the combinatory methods deliver a solution close to the near-optimal solution with better compactness in an acceptable time frame. Hence, the combinatory methods have been shown to be appropriate choice to solve MOLAA problems.

The solutions were not significantly different at their mean cost functions between Simulated Annealing and Tabu Search at the appropriate parameters (C_R, T_I, S_R) = (0.2, high, 100*V_C) and (T_L, S_R) = (10, 50*V_C), respectively. Among the cost suitability models, both algorithms performed better in the fuzzy models in the large MOLAA problem. The initial input solution influenced the performance of the algorithms. The algorithms produced better results in the cheapest and greatest difference initial input solution in the medium grid MOLAA problem whereas the cost function was more improved using the random initial input solution in the large grid.

Although there is no significant difference in the mean cost functions between Simulated Annealing and Tabu Search, Simulated Annealing is found more efficient than Tabu Search in solving large grid MOLAA problem. For the same values of compactness factors, Simulated Annealing also produced more spatially compact land use allocation than Tabu Search. Thus decision makers/land use planners or consultants could obtain a better decision alternative to a land use allocation problem by applying Simulated Annealing with the recommended appropriate annealing schedule, using the random initial input solution of a fuzzy cost suitability model.

This study recommends further research in Tabu Search to find an effective attribute for a Tabu list, to be applied to a MOLAA problem.

Sanjeev Kumar Srivastava

PhD

Predicting Freshwater Fish Distribution in the Murray-Darling Basin

The natural history collections (NHC) of the world hold a huge repository of species occurrence information that can be used for predicting species' distribution. With the setting up of the Global Biodiversity Information Facility (GBIF) by the Working Group on Biological Informatics of the Organisation for Economic Cooperation and Development, increasingly more NHC data have become digitised and available online. Another important objective of GBIF is to set up a web site with a home page for all the species known to science having information on their life history traits. This study was conducted to examine the prediction of species' distribution using such occurrence and life history trait datasets.

For predicting species distribution in multi-dimensional environmental space using NHC data, several niche-based statistical models are used. The NHC data are considered as presence-only data because they are random collections over time. Prediction from presence-only data is often erroneous when subjected to conventional statistical modelling. The modelling of such data is best done by niche-based techniques that use presence-only data and enable modelling of species distributions in geo-space, based on the environmental characteristics of known occurrence sites. These techniques can provide accurate and informative synoptic maps for all species with sufficient occurrence records from NHC at regional and national scale.

One of the main constraints to predict freshwater fish distribution is the availability of base maps on which predictions are to be made. Another constraint is the collection and derivation of different spatial layers that can be related to the occurrence and abundance of fish species. River systems, being linear habitat features on the landscape, are inherently difficult to model particularly when distribution is to be predicted using spatially distributed parameters. However, drainage networks drain catchments, and this provides a convenient geographic unit for monitoring and managing the impacts of land-use activities on fish habitat and populations. With the advances in geographical information science and the availability of drainage enforced Digital Elevation Models and flowdirection grid, it is possible to derive drainage networks, and catchment boundaries. The catchment boundaries and the drainage network of the Murray-Darling Basin (MDB), the study area, were derived and the whole MDB was divided into 463 sub-catchments. This enabled collection and derivation of over eighty spatial variables using catchment as a unit.

Two niche-based techniques, Genetic Algorithm for Rule-set Production (GARP) and Ecological Niche Factor Analysis (ENFA) were applied in predicting species' distribution using NHC data while Generalised Additive Models (GAM), and Classification and Regression Trees (CART) were used for existing survey data. The predicted maps were evaluated with training, testing, and existing survey data. The results were statistically significant for most of the fish and were in accordance with the existing maps and expert opinion. The NHC data provided better prediction when compared with the survey data. The evaluation of NHC-based model with the recent existing survey data provided insight into recent declines of some fish.

For some species, particularly rare and endangered ones, sufficient occurrence and abundance records were absent. This is also the case when the potential distribution of exotic invasive species is to be studied. For such circumstances use of life history traits to explain species' distribution can be the only way. The conventional way of linking traits to environmental variables has been to group the species based on their traits and then to relate these groups to environmental variables. However, single species possess multiple traits and often such guilds have fuzzy boundaries resulting in ambiguous grouping. To relate species traits rather than species themselves, the RLQ technique was used. This is a three-matrix ordination technique available in the R-statistics software. Three data sets were used for the study: life history information on MDB fish, site occupancy data from the New South Wales River Survey on twenty-five fish species at fifty-one locations across the MDB, and spatial information on these locations. The RLQ analysis enabled comparison of sites, species, environmental variables, and life history traits on a common axis. The analysis showed a significant relationship between life history traits and environmental variables. Using this distribution of fish with few or no occurrence and abundance records was explained and the relationships between species, species' traits, and environmental variables were explained.

The study has demonstrated the importance of existing survey and occurrence information when it is combined with spatial information from spatial data infrastructures and subjected to recently evolve knowledge-based models.

Peter Mason Deane

MPhil

A failing science: Understanding private landowners in the forestry milieu

This thesis contributes towards science studies in the forestry milieu, a topic little investigated. In particular, it directs attention to the paucity of theoretical and critical discourse amongst the private landowner research community. While conducting research into private forest landowners, significant difficulties were noted within the forestry milieu over understanding complex socio-material systems. Consequently, an assertion was made that there exists a single research rationality that has epistemic (knowledge) and normative (belief) characteristics which restrict how landowners can be known.

To assess the assertion, thirty-two research reports were analysed from within the landowner literature using insights from epistemology (theory of knowledge) and critical realism (philosophy on the nature of reality). The analysis was conducted through a general assessment of core epistemic and normative criteria across all cases, as well as of a single case showing how the normative and epistemic inter-relate.

It was found that one knowledge framework dominates. As a generalisation, it lacks conceptual sophistication and is largely a-theoretical, emphasising data collection by questionnaire and data analysis by statistics. The dominant knowledge framework proves to be objectivist, determinist, dualist, positivist and foundationalist. It is being informed by a normative approach that promotes managerialism to the exclusion of any other relational system regarding people and forests. Although the knowledge framework appears rational, the lack of critique and diversity in ways of building knowledge both internal to it and external to it across the research community, suggests the science produced in the research community that studies landowners is irrational.

This thesis may encourage critical dialogue alongside growing the potential for diverse theorisations and methodological care in research.

Sunit Adhikari

Master of Forestry

Incomplete Contracts and Principal-Agent Problems in State - Forest User Group Relationships: A Case Study of Community Forestry Program in Nepal

Community forestry has been promoted in Nepal as a mechanism for attaining sustainable forest management of the state-owned forests. The main features of Nepal's community forestry program are making the users the custodians and giving to user groups common property rights over the forests. However, in the two and half decades since its inception, and in spite of spending a huge amount of resources in this sector, the experience of the implementation of community forestry in Nepal has shown mixed results, and has raised problems and issues that could hinder the sustainability of the program. The poor and the marginalized groups in most community forest user groups are still deprived of the benefits of the community forestry activities. Several studies have been conducted to demonstrate the success of the community forestry program in sustaining livelihoods of its users, but very few studies challenge whether sustainability can be achieved through the community forestry program.

Community forestry could be an important step towards sustainable forest management as it involves sustainable management of the resource as well as sustainable livelihood of users, and considers both the institutional and ecological aspects. Formulation and implementation of supportive forest policy, conservation through prohibition of particular activities, a vision for poverty alleviation, and management by locals based on a comprehensive forest management plan are the salient features of the program.

However, this study argues that the community forestry contract between a user group and the State is incomplete and the principal-agent relationship between the State and District Forest Officer does not always work well for the general good of the forests because of the possible high rewards from corruption. Hence the goal of sustainable forest management as pursued through the community forestry program in Nepal cannot be achieved under the existing practices and arrangements. This paper identifies incomplete custodianship, asymmetric and imperfect information, inadequate incentive mechanisms, improper institutional arrangements, and missing markets as the major hindrances to achieve contractual completeness of the community forestry program in Nepal. The State holds key decision-making powers, sanctions and ownership of the forests, and the limited use rights assigned to the user groups can easily be further limited due to the absence of influence over constitutional legal rights. A critical imbalance in power relations between the State and user groups has arisen due to the monopoly of government staff in service provision. The policy processes are still controlled by forest bureaucracy and political interests. In addition, bureaucratic inefficiency has resulted in the forging of alliances between forest officials and the local elites, encouraging rent seeking and corruption. Similarly, regular auditing and effective monitoring mechanisms are absent, which have promoted moral hazard problems. Adverse selection is another important issue in principal-agent relationships. All this has resulted in several institutional deficiencies.

However, enabling legislation, and corrections and improvements to the existing arrangements could lead to contractual completeness and better principal-agent relationships, thus ensuring the sustainability of forest management. Abolishing restrictive and/or conflicting provisions in the legislation, and assigning full property rights vested in groups over the resources with adequate support to interpret and enforce the rights could ensure better custodianship. Moreover, creating alternative livelihood opportunities for those who suffer perverse impacts from the forest handover, and creating an effective market for biodiversity and other environmental values by encouraging private sector investment, and exploring the application of private provision of public goods could provide incentives for sustainability. Wider application of market mechanism with minimum government intervention could improve the principal-agent relationships. Above all, formulation and implementation of effective monitoring mechanisms to minimise bureaucratic inefficiency, rent seeking and corruption, by strong supported political commitment, is an urgent need. Strengthening local institutions as lobby groups to minimise the monopoly of the government staff in service provision could be the best option at present. Maintaining good governance is also important for continued international donor support, without which the future of the community forestry program is uncertain.

Ari Arifah

Master of Environmental Science

Traditional Knowledge and Sustainability: The Case of the Dayak People in Kalimantan, Indonesia

This essay investigates an integrated system of human-environment relationships among he Dayak people, indigenous groups who maintain their customary laws and land use systems. Their settlement and cultivation history has created a mosaic of forest and land use system practicing swidden agriculture, mixed forest gardens, rattan gardens and small scale rubber gardens. Because the Dayak people are subsistence farmers, small land parcels are used to cultivate a high variety of resources. Multiple cropping and swidden agricultural cycle systems, provide both a high degree of subsistence as well as substantial financial income.

The study identifies and examines the situation of Dayak forest dwelling people in Kalimantan regarding their land management and resource utilization. They have developed a complex cultural system in relation to the forest that they depend on for survival. It is argued that the customary laws, culture and traditional life styles have shaped the methods of the Dayak people in managing their resources in a sustainable way. Through the literature review, the sustainability efforts of the Dayak people in resource use and economic utility of the various land use types are identified.

The local resource management methods show that the indigenous Dayak people in Kalimantan have managed their resources in a sustainable way. Indigenous resource management strategies of the shifting cultivation system which has being practiced by the Dayak people demonstrates that traditional environmental knowledge can be used to overcome local environmental problems. Therefore, these traditional shifting cultivators have clearly devised an original and efficient pathway for intensification which should be taken more seriously into consideration by development planners. The Dayak people have secured their food availability and generated income activities as well, through the practices of traditional mixed cropping. Hence, the mixed cropping that characterizes traditional Dayak agroforestry patterns is much more likely to achieve greater overall productivity, stability and sustainability.

Despite its adaptable and flexible structure, the Dayak resource systems will most probably face a difficult future due to the drastic changes caused by interactions with outsiders, the existence of timber and mining companies and the ignorance of traditional land tenure by the Indonesian government, particularly in policy making.

Recommendations are made at the end regarding the acknowledgement of local people's claims to their land, incorporation of traditional knowledge into agroforestry development efforts and integrating indigenous land use strategies into future development projects.

Gerard Crutch

Master of Geographical Sciences

Exploring a modelling approach to identify climate change impacts on biodiversity. A case study of the Musky Rat-Kangaroo

The research essay outlines an attempt (through a case study) to identify climate refugia for the Musky Rat-kangaroo (Hypsiprymndon moschatus). The essay explores whether recent innovations in regional-scale climate models together with developments in ecosystem modelling will provide a practical capacity to manage climate change impacts on biodiversity. The task highlighted the research challenges of linking climate change to ecological processes.

The methodology chosen for the essay includes an extensive literature review and a modelling case study. This methodology was chosen because of the conceptual nature of the project objectives, the time constraints and the resources available. The modelling techniques used in the case study include bioclimatic analysis and habitat modelling.

The essay argues that attempts to model interactions between species (ecosystems) and a future climate create conceptual and practical difficulties. It is suggested that the geographic distribution of biodiversity is influenced as much by biotic interaction between biodiversity components as by climate. For example it is contended that climate change will unbalance the complex set of interactions between ecosystems and climate, which through evolutionary processes have reached a short term (geological scale) equilibrium. It is suggested that potential changes in climate on top of human induced threats (such as land clearing) will affect the equilibrium that exists between climate and the habitat of the H. Moschatus making the future distribution of the species very difficult to model.

The essay concludes that the project approach and modelling techniques whilst a useful first step involves many simplistic assumptions and excludes a number of important variables. The development of an approach that includes vegetation modelling, uses multi criteria evaluation and includes a capacity to address uncertainty would provide a more useful approach to modelling the impacts of climate change on biodiversity.

Jhuma Dewan

Master of Environmental Science

A Social and Economic Analysis of the Catastrophic Situation of Groundwater Arsenic Contamination in Bangladesh

Arsenic is a metaloid element of the earth's crust present in some areas around the world especially in floodplains. Groundwater which moves through arsenic rich rocks is at risk of arsenic contamination. Over the last few decades arsenic contamination in groundwater has become a worldwide problem because naturally-occurring arsenic causes large-scale health problem around the world. The groundwater arsenic contamination in Bangladesh is reported to be the biggest arsenic calamity in the world in terms of the size of its affected population and the many health resulting problems, which are collectively referred as arsenicosis. Being situated in one of the largest deltas formed by the Ganges, the Brahmaputra and the Meghna rivers the country is flat, low-lying, and subject to annual flooding. As a result, much fertile and alluvial soil is regularly deposited by floodwater. The population of Bangladesh is in serious danger as the groundwater in the Gangetic Delta lands has been found to be contaminated with high levels of arsenic. While, there is no doubt that the major cause of arsenic is geological, however, it is the unplanned sinking of shallow tube wells by different organizations and over-exploitation of groundwater for reaching agricultural prosperity that has accelerated the overall problem. Besides its toxic nature arsenic creates widespread socioeconomic problems such as divorce, dowry problems, ostracism and economic burdens especially for the rural livelihoods. Pollution of groundwater due to over-exploitation of groundwater for irrigation purposes is generating negative externalities as the generators (mainly organizations responsible for sinking shallow tube wells) are not paying compensation to the arsenicosis affected patients. Moreover, the cost externality appears because the pumping cost increases with pumping lift; groundwater withdrawal by one farmer lowers the water table, which eventually increases the pumping costs for other farmers operating over the same aquifer and as well as for future generations. The enhancement and implementation of appropriate economic policy and implementation strategies would help to ensure internalisation of the cost to the externality, which would reflect the actual cost of society of the production process and to make the producers of the externality to bear the cost. The Integrated Water Resource Management (IWRM) approach, which explains the rationale for effective community participation, is one possible solution to the current problem.

Catherine Gross

Master of Environmental Science

Blowing in the wind: Community consultation and procedural justice

Justice, or fairness, is accepted as central to the well functioning of society. Theories of justice are still evolving, and include distributive justice, concerned with outcomes, and procedural justice which is concerned with the fairness of the decision-making process. While Australians understand the term a "fair go", and use it as a core value, justice theories are not generally discussed or broadly understood in practice. Yet fairness is an expectation in day-to-day interactions and protests arise when outcomes or decision-making processes are perceived to be unfair. This cross-disciplinary research investigates how justice theory can be applied in practice. Through empirical research in a wind farm case study, community perceptions of the consultation process are explored using procedural justice principles to evaluate fairness. The paper argues that procedural justice principles applied to community consultation can increase acceptance of the outcome and improve the outcome through dialogue and debate.

Findings from the case study indicate that perceptions of fairness do influence how people perceive the legitimacy of the outcome, and that a fairer process will increase acceptance of the outcome. Findings also show that a lack of procedural justice can lead to social conflict and the loss of social capital. A key research finding was that both procedural and distributive justice are important and that different sections of a community are likely to be influenced by different aspects of justice, namely by outcome fairness, outcome favourability and process fairness. Based on this finding, a community fairness framework was developed to match each section of the community with the type of justice most likely to influence it. This analytical tool can be used in three contexts: to analyse a community in conflict; as a proactive planning tool in community consultation; and as a social learning tool to strengthen social capital.

The research found that the principles of justice are a vital ingredient for successful environmental decision-making, particularly because they enable full public participation—in the real sense of the term—to take place. The challenge is for communities to hold governments accountable to ensure that social justice is done.

Hung Dong Khanh

Master of Forestry

Monitoring the rehabilitation process using landscape function analysis. A study of cleared power-line easements in a montane ecosystem, Tumut Sub-Region, NSW

The montane ecosystems of the Tumut sub-region of NSW are a significant part of the Australian continent, linking the largest alpine and sub-alpine ecosystems of Australia with the surrounding lowland areas. As such they provide continuity for the protection of catchments, for landscape diversity and ecological values over a large area. Despite their widespread importance, these landscapes have been threatened by many human disturbances such as grazing, building infrastructure, tourism and most recently by over-clearing associated with the construction of high voltage power-line easements.

The over-clearing occurred in April 2001, causing the ecosystems to suffer from significant degradation, thus, necessitating rehabilitation. In June 2001, rehabilitation action consisting of log mounds, mulch and seeding was applied. This rehabilitation quickly arrested any major potential erosion. However, in January 2003 severe wild-fire at two sites badly damaged the rehabilitation, so additional rehabilitation work was done. Therefore, on-going monitoring to reconfirm the success of rehabilitation and the effect of the fire is critical.

The aim of this study is to evaluate the effectiveness of the rehabilitation of the over-cleared easements using Landscape Function Analysis (LFA) method. Three objectives accompany the aim: (i) to assess changes in the landscape functional status between 2001 and 2005 in rehabilitated areas on four power-line easement sites (ii) to carry out a subsequent evaluation of the effects of wild fire on the rehabilitation process; and (iii) to examine the efficiency and suitability of LFA as a monitoring procedure.

Rehabilitation work has achieved its objectives in terms of ecological management and safety requirements for high voltage power-lines. Ecologically, the newly restored ecosystem has been fully covered by vegetation in the un-burnt sites, and nearly fully covered in the burnt sites. Even though the fire has seriously affected the rehabilitated areas, the LFA indices also show that the burnt sites have achieved a functional state that can be self-sustaining without needing any further help. In terms of safety, the height of vegetative cover is less than the safety limit, that is under 2 meters.

LFA appeared to be the most appropriate monitoring procedure for on-going monitoring. LFA meets the three requirements of land managers of power-line easements. It provides a rapid assessment procedure for rehabilitation processes and is inexpensive; (ii) it is highly inclusive, not omitting any useful indicators; and (iii) it provides objective information about the current status and longer term, trends of the landscape being monitored, including the response to new disturbances.

James Gray

Master of Forestry

A qualitative interview study – partnership development with the Southern Tablelands Farm Forestry Network and four catchment management authoriities in South East NSW

The Southern Tablelands Farm Forestry Network (STFFN) is a regional, not for profit organisation that assists rural landholders in private forestry development activities in the Southern Tablelands region of NSW. STFFN is presently supported through State and Federal Government funding, being one of 18 Private Forestry Development Committees that exist in Australia's commercial timber growing regions.

In 2004 Catchment Management Authorities (CMAs) emerged in NSW to address natural resource management issues within regional areas based on major catchment boundaries. It has now become recognised that a significant portion of future government grants for addressing NRM issues on the NSW rural landscape could chiefly by accessible through CMAs. STFFN is therefore acutely aware of the importance of forming partnerships with the four CMAs in STFFNs operational region, being the Lachlan, Murrumbidgee, Hawkesbury-Nepean and Southern Rivers.

There is basically no known protocol yet available that details methods to which organisations like STFFN can effectively engage CMAs with a goal to developing financial and mutually beneficial partnerships. In light of this, this major research essay was based on conducting a qualitative interview study of identified stakeholders from the four CMAs in STFFNs region of operation and others closely associated with those CMAs. The purpose of the study group was to generate an understanding of the potential actions and procedures STFFN could take to attract financial assistance from CMAs, as well as to gauge the opinions of the study group participants as to the worth of farm forestry in addressing catchment natural resource management issues.

The qualitative interview process revealed a range of recommendations for STFFN to consider relating specifically to the formulation of mutually beneficial partnerships with CMAs. All study group participants made partnership development suggestions, as well as mentioning the STFFN

would be one organisation, where by CMAs would consider proposals to conduct relevant catchment related NRM projects. Recommended mechanisms, actions and practices suggested by study group participants for STFFN to consider include:

- Review CMA investment strategies to gather more insight into the most appropriate areas within CMA programs for STFFN to target farm forestry project proposals.
- Contact CMA Boards in writing to build capacity and to offer STFFN services.
- Build new CMA network contacts, especially those individuals mentioned by interviewees.
- Consider the development of memorandums of understanding with CMA Boards specifying STFFNs role in catchment NRM.
- Explore potential partnership development options with other like organisations for the development of joint project proposals to CMAs, thus exploiting the collective expertise and making proposals more appealing to CMAs.
- Provide CMA offices with STFFN farm forestry information sheets and static displays.
- Explore options for training courses and the like, relevant to STFFN, CMAs and the multiple use of vegetation on the rural landscape.
- Increase capacity building with CMAs through regular engagement, such as preparing farm forestry written articles for CMA newsletters and the like.

Kirsty MacPherson

Master of Environmental Science

The role of legume fallows in contributing nitrogen to sugarcane cropping systems

In the last twenty years, two factors have had a negative impact on the sugarcane industry in Australia. The first is declining productivity in sugarcane soils and the second is the link between inappropriate fertiliser use and nutrient pollution of local waterways and the Great Barrier Reef. In response to yield decline and nutrient pollution issues several management practices are currently being recommended to sugar producers, one of which is the inclusion of a legume fallow crop in their management strategy. A legume fallow breaks the monoculture and adds nitrogen (N) to the soil reducing the need for N fertiliser.

The focus of studies so far into legume fallows has been to assess the amount of N they are contributing to the following sugarcane crop. Total nitrogen has been used as the measure of nitrogen added to the soil when a fallow crop is returned to the soil. This, however, overlooks the source of N within the soybean plant. Soybeans are able to extract nitrogen from the soil as well as fix it from the atmosphere. The N extracted from the soil is therefore not added to soil but rather temporarily held by the soybean before being returned to the soil. The N 'added' to the soil comes from the atmosphere through fixation. The percentage of N added to the soil through fixation has not been assessed in the reported studies to date. Also missing from the literature is how N content and nitrogen (N_2) fixation vary across sugarcane growing areas. Sugarcane is grown from subtropical northern New South Wales (NSW) to the wet tropics of northern Queensland (Qld), however to date most studies have been in the wet tropics.

This study addresses some of the current knowledge gaps in this area, including how much N_2 is fixed by legume fallows, and what factors affect N_2 fixation rates in sugarcane systems. The first two objectives of this study were to investigate N_2 fixation in a range of legume fallow crops at a range of locations within sugarcane growing systems and to investigate whether location and environment affect fixation.

This study has shown that N delivered by legume fallows is extremely varied across sugarcane growing areas and legume types. It also appears from this study, that in the wet tropics, cowpeas are slightly better than soybeans as a fallow crop in terms of total N content, soybean crops contain between 87-323 kg N/ha (n=4), and cowpeas contain between 211-381 kg N/ha (n=2). In terms of biomass (DM), cowpeas also have the advantage, with 5.3-9.9 t/ha and soybeans 2.8-9.9 t/ha, however fewer crops of cowpeas were studied. For N_2 fixation cowpeas and soybeans were found to be equally suited (both 100%). However, it should be noted that this study was conducted in a dry year where no water logging was observed, which is where water tolerant soybeans have an advantage over cowpeas. In southern sugarcane growing regions soybeans produced varying N_2 fixation rates (50-100%) and total N content (102-344 kg N/ha) (n=7), as did lablab (44-89% N_2 fixation, 97-248 kg N/ha total N content) (n=3).

In cases where soybean crops are harvested instead of fallowed the data collected in this study suggests that an approximate fixation rate of >65% for a small to medium (>3.3 t/ha DM biomass) crop and >75% for a medium to large (>7.6 t/ha) crop is required to avoid soil N losses.

The third objective was to identify key factors that influence N_2 fixation. These factors may then have the potential to act as predictors of N_2 fixation. This study has shown that the N added to the system through N_2 fixation is closely correlated with water availability, and manganese availability/toxicity in the soil. Manganese availability is in turn mediated by iron (Fe:Mn ratio) and pH. It is possible with further work these factors could be used to predict fixation rates in soybean fallow crops.

Most of the recommendations regarding the use of legume fallows in sugarcane farming systems have come from the sugarcane yield decline joint venture (SYDJV) and are based on many years of research. The results of this study are an important addition to this research.

Ahmad Maryudi

Master of Forestry

Politics within markets: Convergence and divergence in Indonesian and Malaysian forest certification governance

In response to the perceived ineffectiveness of the government approaches to forest conservation and the sustainable management of forests, some environmental non-government organizations (ENGOs) created a certification body, the Forest Stewardship Council (FSC) with a mission to ensure that forest management processes comply with certain pre-defined standards. Concerned about the FSC's prescriptive standards, Indonesia and Malaysia established their own certification programs, the Indonesian Ecolabelling Institute (LEI) and the Malaysian Timber Certification Council (MTCC), with more flexible standards, to compete with the FSC. However, the LEI and the MTCC have pursued different paths: the former has converged with the FSC, while the latter still maintains its opposition to the FSC. This research, hence, asks why the LEI has converged with the FSC, while the MTCC has continued to oppose the FSC.

This paper uses the Governing through Markets (GTM) model of Cashore et al. (2004) to examine the factors contributing to those policy dynamics. Having identified three structural factors with seven hypotheses that would facilitate FSC certification, the GTM model focuses on the support that particular certification programs can gain from forest companies. In this paper, the dependent variable is not the support from forest companies per se; rather, it is the relationship among certification programs, and the research focuses on why some have "conformed" and thereby become similar, and why others have not conformed and have instead maintained their quite distinct status.

The paper concludes that the GTM model provides a useful framework for understanding the policy dynamics of certification programs. However, uses of the model need to be made aware of some other considerations to explain the story of forest certification in the selected cases because some hypotheses cannot explain the policy "choices" of the competing programs. Hence, the hypotheses need additional assumptions to work in the case study countries. This paper identifies that, to suit the cases, H1 and H3 need be to be refined as follows:

H1 (1): Forest companies in a country or a region that sells a high proportion of its forest products to foreign markets are likely to support the FSC to the extent that FSC standards are attainable by them and that the markets differentiate forest products according to how they were manufactured.

H3 (1): Large and concentrated industrial forest companies are likely to be convinced to support the FSC only if they are committed to staying in the forestry business.

This paper also identifies the importance of "regimes changes" in understanding policy evolution of the competing certification programs in Indonesia and Malaysia. The presence or absence of the factors in terms of H5, H6 and H7 in these countries has been determined by domestic political circumstances, whether or not a regime change toward an open political space for multi-stakeholder forest policy dialogues has been created. Thus, the GTM model needs to be expanded to accommodate the importance of regime changes, as the factors of H5, H6, and H7 are to some extent dependent on such changes; and this paper suggests another hypothesis (H8) as follows.

H8: Forest companies in a country or region with regime changes that result in more open domestic politics are likely to support the FSC, because such changes will create a favorable environment for FSC certification.

The future interactions of the programs depend on the extent to which they have achieved their objectives. While acceptance by Indonesian forest companies of the programs would influence the future of the FSC-LEI collaboration, the outcome in Malaysia depends on the success of either the FSC or the MTCC to gain support from its targets.

Some ENGOs have expected that forest certification will promote SFM through market pressure. While SFM issues have been raised among forest managers and are on the wider forestry agenda, the implications of forest certification for the promotion of SFM in both Indonesia and Malaysia are still uncertain. Forest certification might help to some extent, but the Indonesian and Malaysian cases show the limitations of the roles of certification.

Aru Joel Mathias

Master of Science

Improving forest policy in Vanuatu

Forests in Vanuatu have important economic, social, and cultural significance. Ni-Vanuatu people have strong customary and spiritual linkages to forests and land, which they regard as their identity. Forest-based industries generate important direct and indirect economic benefits; they provide a substantial proportion of government revenue (e.g. 18% of export earnings of in 1995), and job opportunities and income for landowners; they also provide important indirect benefits in the form of rural infrastructure such as road networks. The major actors in the Vanuatu forestry sector are landowners, who own the land and forests, the national Government, which develop policies for the forests and forest-based industries, and the forest-based industries, who invest in the forestry sector through forest harvesting and the manufacture of forest products, and through plantation development.

Since independence in 1980, Vanuatu's forest-based industries have grown substantially. There are now three principal elements of the Vanuatu forest industry: large-scale logging and processing operations, small-scale mobile sawmills, and sandalwood round-wood exports. Each is important, and has contributed in its own way to the economy and to communities. This thesis focuses on the maintenance and development of the large-scale industry, which is limited principally by longer-term forest resource availability and aspects of customary land tenure. Both these constraints need to be addressed by development of appropriate forest sector policies, to stimulate and promote sustainable forest-based development. In particular, the policy framework for accessing forest resources, and for providing resource security over the longer term, is currently inadequate.

This research suggests a number of key issues that Government, as a whole, should address to advance sustainable forest-based development. These are:

- the processes by which Government and industry interact with landowners to access land;
- the legislative framework for access to customary land for forest-based development;
- policies to promote investment in the forestry sector and its long-term development.

The research suggests that the Government must play a more active and defined role in accessing and securing customary land for forestry purposes. The principal role would be to act as a facilitator during negotiations between the landowner and industry about access to land bank for forestry purposes, and acquisition of forest resources. For forest plantation development, two types of lease arrangement are identified as appropriate mechanisms to access land:

Government sub-lease, where the Government leases land from landowners and sub-leases it to industry; here the Government takes out the lease, and manages the lease under specific conditions to promote forestry development purposes. The arrangement minimises developer involvement with landowners, which comprises land access negotiations, particularly coming into agreement with groups of landowners.

private lease, i.e. a direct lease agreement between developer and landowner. Although this is a private agreement, Government involvement as a facilitator in organising consultations between the parties (including Provincial Governments) to interact in accessing land is very helpful.

Currently, Government involvement in the negotiations towards accessing land is not well defined, often leading to fruitless negotiations and wastage of wastage of time and other resources. Key areas which need to be addressed and are proposed in this thesis to better manage the current situation to achieve sustainable forestry development in Vanuatu, are:

- enhancing the institutional capacity of Government agencies in the policy area to promote sustainable management of Vanuatu's forest resources;
- application and adoption of appropriate land use policies and planning methodologies;
- replacement and expansion of the existing forest resources; and
- equal distribution of costs and benefits associated with forest development.

These measures could be introduced within the framework of a Provincial Forestry Agreement process, which this thesis describes.

Muhammad Zahrul Muttaqin

Master of Forestry

Resource Rent Capture in the Management of Indonesia's Natural Production Forests

In developing countries like Indonesia, forest concession arrangements have been an important part of forest management. Since most forests are owned by the government, ensuring that appropriate level of revenue from forests is returned to the state is important. Several systems have been implemented to capture timber rent from natural production forests in Indonesia. Yet there has been inefficiency and parts of timber rent have been dissipated. This study's purpose is to compare the Resource Rent Tax (RRT) mechanism with current approaches implemented in natural production forests in Indonesia. The RRT has been successfully implemented in the mining industry, but there is a lack of information about the implementation of this scheme in forest harvesting. Other objectives of the study include: (1) examining the efficiency and effectiveness of the resource rent tax instrument in terms of revenue maximisation and sustainability outcomes; and (2) observing implications of the RRT implementation for forests in Indonesia.

The study reveals that the current forest revenue system in Indonesia has failed to capture timber rent optimally. In order to improve the rent capture, a RRT could be employed. The benefit of the RRT is to avoid under-reporting of log production as well as distorting effect on investment. The introduction of a RRT would require some adjustments of current rent capture mechanisms as well as reforms of current forestry policies. Under Indonesia's newly decentralised forest governance arrangements, local governments could be responsible for implementation of RRT as it may avoid generalisation of cost estimation, and give incentives to local governments to manage their forest resources properly.

Kala Perkins

Master of Environmental Science

Buddhist and modern cosmology in dialogue: Calculating the incalculable

All that contributes toward accomplishment of the task of humanity's advancement in the chain of evolution coordinates its earthly direction with Infinity. The task suggests that creative thoughts be applied toward discoveries in the realm of Space. Great is the loss when designs force the closing of that which induces the perfecting of all forms. Only when the evidence of all spatial riches will be realized will it be possible to give perfection to our earthly forms. Be-ness was affirmed before its full realization by humanity, and all forms of life were then in varying stages. There are as many stages in Infinity as there are steps of consciousness. All things are interrelated. All things are mutually attracted and everything is reflected in the depthless ocean of creativeness.

The spirit able to assimilate the highest on the planet and cognizant of the incompleteness of one life is an eagle spirit, soaring unfettered in life, in the sun of knowledge above the desert. It is given to the spirit to know the cosmic fires! (Maitreya, 1930:26)

The following essay is a comparative dialogue between Buddhist cosmology and modern Western astrophysics and cosmology. It focuses on ideas of the infinite, and the nature and fabric of space-time and reality from both perspectives. From Buddhist philosophy the Avatamsaka Sutra (Sanskrit: Flower Ornament Scripture) provides the basis for the cosmological insights. Ideas unique to each system as well as their commonalities are investigated. The essay is to contribute toward bridging diverse knowledge systems by exploring the hypothesis that a single Reality may underlie diverse approaches to truth and reality. It is concluded that both Eastern and Western systems present the picture of an over -riding wholeness and integrity to the entire cosmos, with all dynamics being interdependent and interrelated, stemming from a single baseless source of origination. The methodology employed is that of the traditional science – theology interface applied to the cosmological context. The essay arises as part of an inquiry into the fabric and dynamism of our cosmic environment, ecology[1] and evolution. The conclusion explores dynamics at the cosmic-human nexus. It is proposed that awareness of nature's integrity and the actual fabric of space-time reality transcend the classical mind-matter dichotomies. It is anticipated that such insights may in some measure lead humanity toward transcendence of conflict and a more sustainable way of living in the global bio-sphere, co-creatively with cosmic intention and process.

The word ecology as it appears in this essay is used in terms of its Greek entomology, i.e.: eco - referring to home, ology - as in logic or logos. Thus it is used referring to an exploration of the logical workings of our universal home.

Julia Pickworth

Master of Environmental Science

Community perceptions of pine plantations: A report based on a sample survey of residents in the Bombala region of NSW

Pine plantations are expanding in Australia, with this expansion often surrounded by controversy within the community. Understanding people's responses to pine plantations is the focus of this research, which explores the community's perceptions of plantations in the Bombala region of NSW through a survey of a random sample of 261 residents.

This research reveals that most respondents (42.5%) see the disadvantages of plantations as outweighing the benefits of plantations for their region. However, the results also show that the majority of respondents see both positive and negative impacts from plantations. Plantations are seen by the majority of respondents to have positive economic impacts particularly related to employment; predominantly negative environmental and social impacts; and as having mixed impacts on the region's population. The current governance of plantations is viewed poorly with most respondents believing that current government management and community participation in plantation planning is inadequate. The central role of governance in people's views of plantations is reflected by the majority of respondents believing that with appropriate planning, plantations are a positive industry for their area.

Perceptions of plantations varied significantly (χ^2 tests with significance level of $p<0.05$ in this study) by whether respondents lived in a town or a rural area, and by whether they lived in the Bombala locality or in a surrounding locality. This spatial unevenness is apparent in the perceptions of the risk of negative impacts from plantations in the future; the probability of positive impacts in the future; plantation impacts on respondent's quality of life; and most statements on economic, social, environmental and population impacts. This indicates that perceived plantation impacts are strongly spatially uneven, suggesting actual impacts may also be spatially uneven.

The perceptions of plantations varied in other ways across the community, with perceptions of the relative benefits or disadvantages of plantations being significantly related to gender, education level, occupation groups and whether the respondent adjoins a plantation. Contrary to common conceptions, views of the relative benefits or disadvantages of plantation are not significantly related to years or generations lived in the area; reported levels of plantation knowledge; or age.

The research shows a high level of support for community participation in plantation planning, with face-to-face meetings involving information exchange being reported as the most useful and most attended participation activities. Results also show that reported plantation knowledge is concentrated in the areas of forestry practices and economic and environmental impacts, with a low level of reported knowledge about government policies and management practices. This research highlights several issues for further research, as well as implications for governments and industry arising from the results of this research.

Susan Jennifer Powell

Master of Environmental Science

Modelling flood dynamics in a regulated floodplain wetland

Floodplain wetlands rely on catchment flows to maintain the flooding cycles critical to their ecological integrity. In inland Australia, these wetland systems can be permanent, semi-permanent or ephemeral and may link to downstream river systems or become terminal inland deltas. Many of these wetlands have national and international significance to a range of vegetation and bird communities. As these systems are so reliant on water from upstream catchment areas, they can be significantly impacted by water management activities in the catchment. Water storages, weirs, channel alteration and water extraction can alter flow patterns to the detriment of the downstream floodplains and wetlands. Community and government pressure has seen a change in water management practices towards more equitable and sustainable sharing of water resources between the environment and water users. In order for this change to be effective the water requirements of the environment need to be understood.

Current approaches to water resource planning include the use of decision support systems, with an emphasis on testing water management scenarios. A range of river flow tools have been developed to test these scenarios and can provide a daily flow into a floodplain or wetland system. To subsequently test these scenarios against a range of ecological benefit or response over large scale floodplain wetland systems is more difficult. Recent research into water requirements for wetland systems shows that duration and frequency of flooding are the most important influences on vegetation communities. The water depth, timing of flows and extent of flooding influence the numbers of colonial waterbirds nesting. The available models and decision support systems developed for floodplains or wetlands often give a total inundated area from a specified inflow volume, or are used to determine the impacts of floodplain development in design floods. These types of outputs cannot be used to assess measures of ecological response over a range of water management scenarios. A model that simulates the impact of inflows on the frequency and duration of flooding as well as the depth and area inundated is required.

An assessment of data availability in the Gwydir floodplain wetlands of north-western New South Wales, Australia, showed a paucity of information on flood dynamics. The application of remote sensing, using AVHRR satellite data, was shown to be an effective option for data acquisition in the context of development of a flood dynamics model. This thesis proposes an approach applicable to archived AVHRR satellite data to provide calibration data for a range of historic floods.

Vegetation communities and flood patterns of the Gwydir floodplain are analysed to provide a conceptual basis for the development of a model structure based on channel, flowpath and habitat components. The temporal and spatial behaviour of each component is described using water balance principles. The model was calibrated and tested using a range of climatic conditions. The results demonstrate that the model can simulate ecologically-significant flood dynamics of the floodplain wetland. This type of model is not intended to replace floodplain modelling designed to assess physical changes to the system like levee banks and other floodplain developments. However it provides much more useful information than these types of models for designing water release programs and for water management.

Of particular interest are habitat areas that are used as colonial nesting sites, where water level is critical to the success of bird breeding events. The model simulated daily water height within centimetres and duration of flooding within days of the observed data at a nesting site. Broader floodplain and flowpath flood dynamics are also simulated well. The model is capable of simulating wetland behaviour with reference to defined sets of habitat requirements, such as a minimum number of days a specific area is flooded to a particular depth. This provides an objective basis for assessing a range of water management scenarios.

Future model development is required to address a number of identified limitations including spatial representation, flow travel times and attenuation patterns and soil moisture accounting algorithms. The model would also benefit from its structure and parameterisation being informed by enhanced data analysis.

This thesis demonstrates that a conceptually-based, water balance approach can provide the basis for an effective decision support system for water management. The thesis also shows that, for this purpose, archived, low resolution, satellite data can be used to calibrate a conceptual model of a large floodplain wetland system.

Liping Rao

Master of Forestry

Spatial Distribution of Soil Hydrophobicity under Dry Sclerophyll Forests: a case study in Mulloon Creek Natural Farms, NSW, Australia

Hydrophobic (water repellent) soils are widespread in Australia. In the research conducted so far, key factors effecting the formation of these soils are generally summarised as vegetation and fire. Dry sclerophyll eucalypt forests (DSF) are widely distributed in eastern Australian water catchments and are strongly associated with severe water repellence in soil. In order to achieve a comprehensive understanding of the hydrology of these catchments, information on the hydrophobic properties of the soils under this forest type is critical. An understanding of the spatial variation in hydrophobicity is particularly important to its hydrological and erosional consequences.

This research project studied the spatial distribution of soil hydrophobicity around tree boles, as well as the effects of different silvicultural regimes in the forest on its severity and variation. The major findings of this study are that:

1. There is a strong spatial variation between the hydrophobicity in the dry sclerophyll eucalypt forest and the distribution and development of fungal mats in the current study.

2. The spatial distribution of soil hydrophobicity around tree boles is highly variable for individual trees. However, some trends are discernible. In terms of lateral distribution, the lowest hydrophobicity occurs near the bole while the highest occurs at about 0.5 to 1 m away from the bole. There is a gradual decrease at distances further than 1m. Litter fragments and surface layers have a relatively lower hydrophobic level, while layers between 2 and 5 cm depth have the highest hydrophobicity.

3. Amongst four silvicultural treatments, the Burnt-thinned treatment showed the lowest hydrophobic level, while the Control (un-thinned and un-burnt regrowth DSF) has the highest. The Thinned treatment had a higher hydrophobicity than the Burnt. Thus the combined silviculture of burning and thinning may ease the severity of water repellence of the soil under dry sclerophyll eucalypt forest.

4. Micro-topography and landscape also strongly affect the severity and distribution of hydrophobic soils through changes in the amount and distribution of litter, stemflow and throughfall, and consequent nutrient and chemical alterations. These balances in the soil in turn, modify the distribution of fungal mats, and concomitant water repellent soil within this forest system. Temporally, the antecedent moisture conditions, water content of the soil surface and infiltration into the lower layer also alter the distribution of soil hydrophobicity.

5. Results from the two common methods for testing soil hydrophobicity, water droplet penetration time (WDPT) and molarity ethanol drop (MED), do not show a simple linear relationship to the hydrophobic severity of the results. However, there is a positive and linear relationship between MED values derived from in situ and ex situ testing of the same soil.

6. There is a strong relationship between surface soil hydrophobicity and soil infiltration rates. Soil hydrophobicity also affects the redistribution of precipitation from vertical to lateral movement in the upper soil and surface layer.

7. Soil biopores such as root channels under Poa sieberana (native tussock), accessing pores in ant nests and termite mounds all strongly affect infiltration rates.

Given these findings, further study of some aspects should be undertaken to achieve a better understanding of the system. More measurements are needed on first, the relationship between soil hydrophobicity and fungal mats in DSF; and second, the effects of stemflow on the severity of soil water repellency. Further investigation is needed on the consequences of silvicultural regimes on the level and spatial distribution of soil hydrophobicity on a larger scale. Also requiring further study are the effects of surface soil hydrophobicity on infiltration affected by biopores. These require detailed measurements in order to promote a larger body of data at a larger scale to understand the hydrological and erosional consequences of hydrophobicity in Australian DSF soils.

Ray Rahayu

Master of Environmental Science

A framework for evaluating success for national parks management with local people

The emergence of local people's engagement in national park management was encouraged by dissatisfaction expressed in both national and international fora, over the effectiveness of approaches to conserving biodiversity through national parks. The establishment of national park was seen as the most desirable way of achieving biodiversity conservation goals. Local people inhabiting national parks or adjacent areas were seen as threats to biodiversity conservation, and were often removed from their land following declaration of a park. However, there is a growing realisation that national parks are not successful in conserving biodiversity. Instead, advocates of biodiversity conservation are seeking ways to manage national parks with local people, to achieve both conservation and development objectives. Driven by international institutions, the relationship between conservation and development has been explored through integrated conservation and development projects. However, projects have been constrained by stakeholders' conflicts of interest, funding shortages, dilemmas between conservation and economic development, and pressures of population growth.

Therefore, managing the balance between ecological conservation and economic development, managing the differences between stakeholders with vastly differing power and economic status, and improving the livelihoods of local people, are still challenges that must be addressed for successful management of national parks with local people. Each park is unique: there is no blueprint for its effective management. However, success can be achieved so long as park management is responsive to the needs and aspirations of all stakeholders, especially those who live within or on the borders of parks. This essay focuses on what determines success, its major elements, and the means to measure success in managing national parks with local people.

Assessment frameworks built around the concepts of principles, criteria and indicators have been developed for both sustainable forest management and for national park management in other contexts. In this work, an assessment framework of 6 principles, 18 criteria and 53 indicators was developed and tested. The 6 principles were: good governance; effective partnerships; economic development to accommodate local needs; adequate human & financial resources; clearly defined and respected property rights over resources, and; respect and recognition of indigenous peoples' issue.

This framework was applied to Rawa Aopa Watumohai National Park in Sulawesi, Indonesia. The analysis drew on official data and published literature, supplemented by personal communications with relevant individuals. The essay concludes that this type of framework is useful and informative for evaluating success of national park management with local people. Within the case study, the framework highlighted mostly the "negatives", but this has the advantage of showing where improvements must be made in the short-term and long-term. The analysis also identified ways in which management of the park was succeeding for conservation and local people. The general applicability of the approach needs to be tested more widely, especially in a well managed national park.

Laxman Shrestha

Master of Forestry

Capacity building of Forest user groups for enhancing equity in community forestry in Nepal

Forests play a significant role in the Nepalese economy, particularly in supporting rural people's livelihoods. The majority of rural people remain highly dependent on forest resources. Realising this fact, the Government of Nepal formally introduced the Community Forestry Program in 1978. This policy gradually devolves control of forests to local communities which were required to form forests users groups. So far, the community forestry model has successfully protected the forest resources, and enhanced biodiversity and environmental services in rural areas. The success so far achieved in the community forestry program and its potential prospects in community development are laudable but there are still urgent social issues that need to be addressed for it to realise it goals.

This paper recognises that equity is still a genuine problem in the implementation and outcomes of community forestry. The power structures of Nepalese societies and socio-cultural mores have limited the extent to which community Forest can realize its goals of benefit-sharing from forests. This paper identifies the negotiation between rich and poor, in terms of decision making and benefit sharing, as central to promotion of equity. Enhancing equity in community forestry requires that the capacity of poor, marginalised people and women's should be built up, so that these marginalised voices which are now at the periphery come to the core of community forestry decision making.

This paper shows that there is a linkage between capacity buildings and enhancing equity in Community forestry. In many cases, the existing situation is counter-productive for enhancing equity because the devolved authority is captured by the elite and the rich members of forest users groups. Because of the inter-linkages between equity and capacity building, this paper emphasises the following interventions to make enhance equity in community forestry: implementation of pro-poor policies, good forestry governance, leadership development, forest user groups networking and income generation activities, and non-formal education for the poor, marginalised people and women.

Policy development is both challenging and important for developing community forestry in Nepal. A policy environment should be created such that the poor people have enough space for raising their voices and increasing their bargaining power. The paper proposes a modified form of general assembly of FUGs, to provide greater space for hearing the voices of poor, marginalised people and women, as one solution to this issue. Similarly, leadership development, user group networking and income generation activities are also important interventions for CB of FUGs in CF. However, these are short term solutions because social needs are changing all the time. These sorts of interventions are needed to build capacity for FUGs to adapt to the ongoing social changes in rural communities. Good forestry governance is also very important to ensure decision making processes are transparent; otherwise the poor, disadvantaged and women will remain disadvantaged while the elite will continue their monopoly over the decision making process.

Therefore, CB of FUGs is a fundamental solution. However it is not an overnight process, nor is there a particular recipe. It needs continuing effort and iterative adaptation in a supportive policy environment to make desired difference in CF.

Niranjan Shrestha

Master of Forestry

Community Forestry and its implications on Rural Livelihoods in Nepal

Forests play crucial roles in the socio-economic life of the Nepalese people and in the protection of the country's fragile mountain environment. In Nepal, the majority of the population lives in rural areas and derives its livelihoods from subsistence farming which is directly or indirectly dependent upon forest resources to maintain farm productivity. Most importantly, poor people, particularly women, lower castes and indigenous people, are entirely dependent upon forest resources for their daily livelihoods. In terms of the sustainable livelihood framework, forests are important sources of natural capital, which can generate financial and physical capital as well as social and human capital. However, the management approach to forest resources determines the status of the resources, their availability, access and thus the quality of people's livelihoods.

After failing in the management and conservation of forest resources through centralized bureaucratic mechanisms, the government of Nepal for three decades, has promoted a participatory forest management approach, i.e. community forestry (CF). In this approach, an area of national forests, its management and use rights are handed over and transferred to local forest users. These users are organized into Community Forest User Groups (CFUGs), recognized as autonomous and independent grassroots institutions to manage and utilize forest resources. Nepal's community forestry approach has been successful in improving the quality and quantity of the forest resources, and has generated other resources such as financial, physical infrastructure, social and human.

Despite these successes, the existing CF paradigm has had negative effects on poor people's livelihoods, restricting their access to forest resources and other development outputs generated through CF. The elite hijack the decision-making forums of CFUGs, and exclude and discriminate against the poor people in decision-making processes and benefit sharing. This study proposes a new paradigm for CF which can address existing problems in CF as well as supporting poor people's livelihoods. The new paradigm involves inclusion and representation of the poor people in CFUGs and their executive committees through a social mobilization process, and would ensure equity in benefit sharing through analysing the real needs of users. Pro-poor strategies such as land allocation and skill development, developing CFUGs as a common grassroots institution, improving planning processes, innovative forest management and compatible government policies are also included in the new paradigm for CF.

Ramkaji Shrestha

Master of Forestry

Linkages between aid and community forestry: Impacts of donor's interventions on community forestry in Nepal

Community forestry practice [CF] of Nepal has been in a mature stage now for some time and received worldwide approval. However, behind the successes of CF there are the significant roles played by aid-support for community forestry projects. Major international donors have helped launched many community forestry projects in the development of the forestry sector over more than two decades. Some of these donors have now ceased their activities and some of them will be terminating their activities quite soon. This study investigates how far these project interventions have been successful in terms of sustainability, and examines the sustainability of these aid-supported project interventions and the sustainability of some of the projects where aid has already been terminated.

The analysis shows that aid-supported community forestry projects have had many positive impacts across Nepal. Importantly, capital formation – natural capital, social capital, financial capital, human capital, and physical capital - in CF is the most important asset for the Community Forest User Groups (CFUGs), since these are the bases for the sustainability of community forestry in the future. Capacity building of community forestry institutions, the Department of Forest and the establishment of related community-based organisation can help to sustain the practice of community forestry in the future.

The study identifies a number of impediments for the sustainability of CF including limited capacity of the Department of Forest, attitudes of government staff, unstable government policy, and increased lack of transparency in CFUGs. Recent project initiatives should address these issues for sustainable community forestry.

This study concludes that the sustainability of community forestry will depend on the policy and commitment of government, donors, and CFUGs themselves. Ultimately, CFUGs, which practice their activities using their own local resources, will sustain in the future. The Government should prioritize the program to seek donor assistance only for the intervention of new techniques or infrastructure. Most importantly, government should devolve more responsibilities to appropriate local institutions for effective service delivery. Similarly, donors also should be required to hand over their running programmes to concerned institutions before the termination of their projects.

Jodi Smith

Master of Resources, Environment and Society

Post-conflict environmental rehabilitation in Vietnam: Socio-economic factors and constraints to environmental remediation

Vietnam's environment was severely compromised by the tactics employed during the Second Indochina War. Since the end of the war the Government of Vietnam has implemented many programmes aimed at addressing the degradation. After 1993, many international organisations assisted the Government's efforts. However, ongoing social and economic issues have complicated this rehabilitation.

This essay explores the integration of social and economic issues in the environmental rehabilitation that has occurred on areas damaged in the Second Indochina War. Through three case studies, environmental and social rehabilitation is explored. Recommendations based on the outcomes are made for future work in environmental rehabilitation in Vietnam.

Atsuko Tanaka

Master of Environmental Science

Human wellbeing, ecosystem services and agriculture: Rice farming in Bohol, the Philippines

Extreme poverty is a serious and persistent problem. In order to improve the lives of marginalized people, agriculture is of vital importance as agriculture is the source of livelihood for most of marginalized people.

Given the fact that past agricultural development policies and programs had their limitations for improving lives of resource poor farmers, this research aims to explore interrelations between human values, what farmers are trying to achieve through farming, and the farming systems that they operate. By taking case study approach in Bohol, the Philippines, this research project investigated farmers' objectives in carrying out farming, their concerns about their current farming practices, their views on agroecological farming and their desired farming system properties. Collected qualitative data was analysed applying the hierarchy of agroecosystem model and the livelihood approach.

The research results indicated the complexity and dynamics of the human values that the marginalized farmers were aiming to realize through farming. Human values covered from biophysical needs, through economic well-being to subjective well-being (satisfaction and happiness). These human values affected strongly the farming system properties desired by the farmers. For the farmers whose biophysical needs and subjective well-being were important, maintaining production had its priority. Hence, farming system properties such as stability, resilience and efficiency were essential rather than productivity, which has been the main focus of agricultural development programs. Farmers recognized the benefits of agroecological farming in satisfying these desired properties. However, its adoption was limited due by many barriers such as limited information on techniques, social constraints and risk associated with adopting agroecological farming.

The findings of this research indicate that for current agricultural development efforts to be effective in assisting marginalized farmers, it needs to incorporate farming system properties that are considered important by these farmers.

Alberto Valerio

Master of Environmental Science

Future Roles of NGOs in Natural Resource Management in Mindanao, The Philippines

This paper examines the possible roles of NGOs in the conflict-prone, underdeveloped but resource-rich southern Mindanao, Philippines, which has been the locus of intermittent secessionist conflicts between the Philippine government and the different secessionist Bangsamoro groups, which has lasted for more than 30 years now. The internal conflict has cost 120,000 lives, considerable damage to property and displaced hundreds of thousands of families.

Through the years, the Philippine government and the secessionist groups have attempted many times to end the open hostilities and conflict and in 1996 a peace agreement was signed between the main group, the Moro National Liberation Front (MNLF), and the Philippine government paving the way for foreign development assistance to pour into the region. International and local NGOs also extended their support in the area to support for a lasting post-conflict rehabilitation and development.

However, change and socio-economic development can not happen overnight. Southern Mindanao has retrogressed through those years, became impoverished, and politically undeveloped, with aged-old prejudices persisting between the Christian majority and the Muslim minority. The Moros, who are mainly southern ethnic Muslims, continued on the struggle for separate a Islamic state. Consequently, human lives and damage to property continued to be wasted and the development of the whole region of Mindanao and the country in general has been affected. This internecine war has impeded natural resource management and development in the region even while the remaining natural resources are being hijacked to support either of the two sides in conflict. The current international campaign against terror has further incensed Muslim radicals and militants in southern Mindanao resulting in a vigorous campaign against the American `war on terror'. This has unnecessarily placed the region's natural resources and peoples' lives in the path of danger and destruction.

The paper concludes that unless government institutions seriously consider suggestions from Mindanao's different sectors, including the NGO/ civil society's peace initiatives, the search for security, lasting peace and economic stability will remain a mere dream for all people in the region. For NGOs, a balanced way of dealing with these socio-cultural, political and external geopolitical realities becomes a necessity when pursuing natural resource management and development projects in the region.

Stephanie Weidemann

Master of Environmental Science

Spatial and temporal variability of transpiration in the Gwydir and Namoi catchments from 2000-2004

Vegetation links the atmosphere and the hydrologic cycle. Rapid advances in satellite technology have allowed scientists to monitor changes in vegetation productivity through time which is useful in global change studies. This project utilises band 1 satellite imagery from the moderate resolution imaging spectrometer (MODIS) for the years 2000-2004 in the Gwydir and Namoi catchments, New South Wales, Australia. The MODIS imagery was used to compare the differences in gross primary productivity (GPP) and transpiration fluxes between croplands and non croplands. Two solar radiation parameters were estimated; daily solar irradiance (R_s).and the global solar irradiance (R_g). These outputs were then used to estimate the diffuse fraction of radiation (R_d/R_s) reaching the canopy. The fraction of photosynthetic radiation (fPAR) was estimated from the MODIS NDVI images. Then the diffuse fraction of radiation was then used to estimate canopy efficiency (e) (mol CO_2 mol^{-1} PAR). Canopy efficiency and the diffuse fraction of radiation were used in a radiation use efficiency approach to estimate GPP and transpiration fluxes. Annual GPP and transpiration fluxes were then estimated. Differences in annual transpiration fluxes were compared between croplands and non croplands. Non cropland pixels had higher annual transpiration fluxes than pixels containing cropland. Non cropland pixels transpire more water over longer time periods. Cropland pixels had higher variance in fPAR values compared to evergreen vegetation pixels. Croplands experience shorter growing seasons than non-cropland pixels. Croplands and vegetation both experience high inter-annual variability in NDVI. These results have important implications for catchment management. Remotely sensed data is a useful way to track land use change. Land use change alters these cycles which in turn affect vegetation productivity. Remotely sensed data provides an efficient way of monitoring catchment scale transpiration fluxes.

Andrew Beard

Adaptive community-based environmental management

Improving environmental management requires a better understanding of both ecological systems and the social structures and processes underlying their management. Social and ecological systems are, however, both complex and typically characterised by change and uncertainty. Despite these difficulties management must continue. Therefore the only hope to improve management is to also improve learning and adaptation. Adaptive management (AM), which is a cyclic approach to managing complex social-ecological systems that accelerates learning by adjusting practices based on what is learned, explicitly targets this issue.

This thesis investigates the use of AM within community-based environmental management groups so as to identify capacity constraints they face when learning and adapting. The goal is to assist in the development of the notion of adaptive community-based environmental management. The research is grounded on a synthesis of the literature on AM and community-based environmental management. It identifies that the technocratic aspects of AM need to be adapted to suit a community setting. It is suggested that five core adaptive principles could provide a simple adaptive framework upon which to base management: 1) Flexibility, 2) Inclusiveness, 3) Persistence, 4) Purposefulness, and 5) Information-Richness and -Sensitivity. The capacity of community groups to implement AM is also demonstrated to be dependent upon a number of enabling and constraining factors, which influence AM at different times and in different places.

The use of AM is then examined further through case studies of two community-based wetland management groups. Core findings include: learning and adaptation is likely to informally occur in community groups; a general lack of awareness and understanding of AM within community groups, particularly those without institutional support; accelerated learning and adaptation within a community setting would appear to be highly dependent upon structures that formally promote AM; community groups face a range of constraints in implicitly and explicitly learning and adapting; the additional burdens that AM places on community groups must be minimised, in recognition of their existing capacity constraints; community adaptive capacity constraints highlights the role that external, primarily government, support plays in promoting an understanding and explicit use of AM within community groups.

Understanding the reality of AM within community-groups enables the development of strategies to build community adaptive capacity and foster an environment that facilitates the use of AM. Overall, learning and adapting at an individual, group or organisational level is fundamental to improving the sustainable management of our environment.

Naomi Brydon

Production and product, values and visions: Drivers of the Australian native food industry, Prom Country, Victoria

This thesis seeks to understand how the production and product of the Australian native food industry might be driven by the values and visions of the industry actors. The research and development conducted on the native food industry tends to focus on issues of production or product, with little mention of the perspectives of the producers. To investigate the producer perspectives, this research focuses on a regional association of native food producers; the interpretations of the industry presented within a regional context. The Prom Country Bushfoods Association (PCBA) is an ideal case study in which to develop these understandings.

The Hermeneutics and Interpretivist traditions have applicability, and I chose to collect primary qualitative data in the form of semi-structured interviews. Nine interviewees were conducted with 14 PCBA members over a period of 10 days in June and July, 2005. Observation at a PCBA Field Day and local farmers markets also proved valuable data. Using Glaser-style Grounded Theory methods, I analysed my interviews for emergent values and visions.

Three main groupings emerged: selection according to values; sharing in Association workings; and cooperation in envisaging the future. In the PCBA, values of ethical land use and lifestyle preferences contribute to an individual,s selection of native food production. These values are fostered through the workings of a regional association and collectively present a shared vision of cooperation for the future. For the nation-wide native food industry, it can be concluded that industry development needs to be regional, with an understanding and appreciation for the regional context and the interpretations of its industry actors. The thesis resolves that the values and visions of industry actors are crucial in driving the development of production and products in the Australian native food industry.

Emma Clifton

Exclusion of stock from flood plain wetlands: changes in soil and vegetation characteristics, mid-Murrumbidgee region, NSW

Floodplain wetlands are an important ecological and agricultural resource. However, because of their intensive use, wetlands within agricultural systems have become severely degraded. This has been recognised, and as a consequence measures have been taken to start their rehabilitation in the form of fencing to control stock. Yet, little work has been done to show how these areas recover once stocking rates are controlled.

This study aimed to determine how soil and vegetation properties changed in floodplain wetlands fenced for regeneration under different grazing regimes. Three study sites were located on the Mid-Murrumbidgee River Region of NSW, between Gundagai and Hay on private property and public land. Soil and vegetation properties were compared across fencelines dividing two contrasting grazing regimes. Soil physical properties measured included bulk density, steady state infiltration and sorptivity. Soil chemical properties (0-5 cm) studied included soil pH, electrical conductivity and soil organic carbon. Vegetation properties measured included live and dead biomass, species diversity, Eucalyptus camaldulensis density and groundcover.

The results demonstrated that sites excluded from stock for extended periods of time experienced significant improvements in soil physical properties such as bulk density and steady state infiltration, compared to adjacent grazed areas. However, although there was prolific regeneration of E. camaldulensis in the ungrazed treatments studied, other vegetation measures such as live biomass and species diversity were significantly lower in the ungrazed treatments compared to adjacent grazed treatments. These decreases are primarily attributed to the suppressing effects of E. camaldulensis on understorey growth.

The results from a site where very high intensity stocking rates had been used to control E. camaldulensis regrowth showed a significant decline in steady state infiltration rates compared to adjacent less grazed treatments. Live and dead biomass also showed significant decreases in the heavily grazed treatment; however the amounts of soil organic carbon and EC increased significantly, probably as a result of urine and faeces addition to the soil.

Overall results from this study show that long term complete exclusion of stock from floodplain wetlands improves soil properties; however vegetation properties are not improved. This study has also shown that in the short term very high stocking rates used to control E. camaldulensis regrowth have negative effects on other vegetation characteristics as well as soil properties. It is suggested that management practices for floodplain wetlands find a balance between complete exclusion of stock and very high stocking rates; such a balance needs to include moderate intensity, short term grazing, backed up by monitoring of soil and vegetation properties.

Robert De Ligt

Probability of burning with time-since-fire in the Sydney region

Fire is a natural and significant environmental variable over most of the Australian continent. The frequency of fire is considered to be one of the most important aspects of fire that influences both the natural and human environment. The frequency and variability of fire occurrence is one of the major components responsible for plant community diversity, and also indicates the frequency at which lives and property may be exposed to risk by fire. This point is particularly important for the greater Sydney region, a highly populated region with important reserves for the conservation of biodiversity.

Of particular interest to fire managers is the extent to which the pattern of fire frequency is determined by fuel accumulation, and the extent to which fire frequency is determined by fire weather. Probability distributions can be used to describe the pattern of fire frequency, which include: the age-specific probability of burning at a point, which describes the pattern of probability of burning with time-since-fire; and the probability distribution of intervals between fires, which describes the distribution of intervals between fires.

Using mapped fire history data for the Department of Environment and Conservation (DEC) National Parks Division Central Directorate, this thesis analysed recent historical patterns of fire frequency for a study area in the greater Sydney region. This was undertaken by defining a landscape scale study area considered to be approximately homogeneous in regard to fire frequency. The hypothesis that the probability of burning at a point distribution would mimic the asymptotic Olson fuel accumulation curves in the study area was constructed.

The probability of burning was found to increase with time-since-unplanned-fire, however, it did not mimic fuel accumulation curves in the study area, increasing in a more linear manner. The probability of burning increased more rapidly for time-since-planned-fire compared to time-since-unplanned-fire. Possible explanations for the observed relationships are presented.

Fire intervals between unplanned and unplanned fires were found to be appropriate for the survival of fire sensitive plant species in the region, while fire intervals between planned and unplanned fires were less compatible for the maintenance of fire sensitive species populations, however, the area represented by these intervals was relatively small.

These findings indicate that the probability of burning was related to fuel accumulation, but, was not directly proportional to it. The probability of burning in the Central Directorate, therefore, is not random with respect to time-since-fire, but increases with time-since-fire.

Adrian M. Hathorn

Inheritance of spiral grain in *Pinus Radiata* D. Don

Spiral grain, the deviation of wood angle from the longitudinal axis of a tree, has important implications for wood quality and value. Spiral grain was evaluated in samples collected from a control-pollinated progeny trial of ***Pinus radiata*** D. Don. established at two sites - Flynn, Victoria, and Kromelite, South Australia – in southern Australia. At the time of sampling, the trees were aged 8 and 9 years, respectively, from seed. In total, 530 trees were sampled from 150 half-sib families. Spiral grain angles were measured in each annual growth ring, from disc samples or increment cores.

The data were used to estimate time trends in additive genetic variances and age-age genetic co-variances of spiral grain angle. These variances were used to estimate the extent of genetic control of selected spiral grain traits, their genetic interrelationships, and the correlated genetic gain in mean corewood spiral grain from indirect selection on single-ring spiral grain measurements. The latter was of particular interest because single-ring assessments of spiral grain on standing trees can be performed for approximately one tenth the cost of multiple ring measurements.

Individual ring spiral grain angles followed a similar trend from pith to bark at both sites, with the highest mean angle at age 4 (ring 2 from the pith). Around 27% of individual-tree mean spiral grain values in the corewood exceeded 5º, the point above which grain angle can cause downgrade of dried timber due to twist. The individual tree narrow-sense heritability in mean spiral grain was high at both sites (0.76±0.23 and 0.97±0.33, respectively). The genetic correlations of individual ring values with mean spiral grain were close to 1 in most rings, but showed a tendency to decrease at age 7 or 8. Maximum correlated genetic gain per breeding cycle in mean spiral grain was achieved by individual-ring selection at age 5 at Kromelite, and age 6 at Flynn. Maximum genetic gain per year was achieved by selecting at age 3 at both sites. There was little additional genetic gain from selecting on the mean of multiple rings compared to selecting on individual-ring values in the rings formed at ages 3-5 (rings 1-3 from the pith)

Due to the practical difficulty of measuring spiral grain on standing trees at very young ages, the results suggest that there is a narrow window of time during which selection for spiral grain should take place – after the bole becomes accessible, but before the age-age genetic correlation, and hence the efficiency of early selection, declines. Although selection for growth and form traits in ***P radiata*** is typically conducted between ages 7 and 9 from seed, the results suggest that selection for spiral grain should be undertaken no later than age 5.

Bradley Jackson

The variable nature of rainfall in the Murray-Darling Basin

Between 1997 and 2003, the rainfall in Australia was above the 1961-1990 and long-term means for five out of the six years. Yet, in 2002, Australia experienced its second lowest year of rainfall since 1901, which caused water stress similar to that of regular drought conditions experienced in Australia since 1864. This was especially the case in the Murray-Darling Basin (MDB), Australia's primary production region, which received only 45% of the average rainfall over the nine months from March to November in 2002. But was it really a drought, especially as five of the six years of rainfall were above average? Or was it a variation in rainfall when it is needed that created water stress, such as that of variable seasonality?

This study answers these questions by examining rainfall records from 44 sites in the MDB from as early as 1872 through to 2003 to see whether rainfall varied in its seasonality, intra- annually and over the longer term. This analysis also answers the over-arching question, whether there was drought in Australia and the MDB or whether a variation in rainfall was responsible for water stress in Australia and the MDB by 2003.

The research proves the hypothesis that rainfall in the MDB has changed seasonally, intra- annually and over the longer term since 1872. Specifically rainfall varied seasonally in the MDB between 1872 and 2003, with a decline in autumn at some sites, but with corresponding increases in other seasons. Intra-annually rainfall varied between months, with up a 100% variation at some sites whilst over the longer term, rainfall had generally increased between 1950-2003 when compared to 1901-1950. The study also identifies the cause of the variation in rainfall in the MDB by correlating rainfall with the El Niño Southern Oscillation (ENSO) phenomenon and a new pressure index for the Southern Ocean, to assist in the measurement of the location and intensity of the subtropical ridge (STR). It was found that although ENSO and the STR are related, rainfall anomalies were more closely correlated with monthly pressure anomalies over the Southern Ocean than with ENSO. This was due to an intensification of mean sea level pressure in the Southern Ocean in 1984-2003 compared to 1954-1973.

To determine Australia's and the MDB's drought status by the end of 2003, this study defines a new, simpler way of measuring drought in light of the pressures experienced in climatic and anthropogenic terms. The new method focuses on 'water stress' instead of 'drought' and found that Australia and the MDB were in meteorological drought by the end of 2003, and the increasing population and agricultural pressures were at a point where only a small decline in rainfall would see an increase in the level of water stress experienced.

Carola Kuramotto de Bednarik

Determinants of fire severity in the Cotter River catchment

Using geographical information systems datasets and generalised linear models, this study identified and quantified the relative importance of various environmental variables for determining fire severity (damage to vegetation canopies) in the Cotter River catchment after the 2003 Canberra bushfires.

Fire severity is ecologically and socially significant. Severe fires have numerous effects on the environment including destruction of the canopy and removal of understorey vegetation; changes in soil properties, water quality and paths of vegetation succession; as well as directly affecting faunal communities. In addition, severe fires are difficult to control and pose a substantial risk to property and fire fighter safety. Therefore, identification and quantification of the determinants of fire severity at large spatial scales is required to aid management decisions, and as input for models to forecast fire outcomes.

Fire severity was determined by a range of environmental variables, and the importance of these variables varies according to the complexity of the landscape being investigated. Weather was found to be the primary determinant of fire severity. Vegetation type was found to be second in importance when the environment is topographically similar, however in topographically complex areas, slope was found to be more important than vegetation type. Post-hoc analyses suggest that vegetation height may be an important variable determining fire severity, but further studies are required to confirm this relationship. This study highlighted the need to quantify the relative influence of fine fuel accumulation, vegetation height and small scale weather variation on fire severity, and provided new evidence relevant for the prescribed burning debate.

Michael Neimanis

Analysis of regolith materials for rehabilitation of the Mount Boppy minesite, near Cobar, NSW

Effective minesite rehabilitation to acceptable community standards is an integral component in the implementation of sustainable development for the minerals industry in Australia today. Site-specific effects of mining are far from benign; extractive operations and infrastructure can have a profound and lasting impact on the landscape.

The Mt. Boppy gold mine, situated adjacent to Canbelego, near Cobar, NSW is an ongoing mineral enterprise on a site with in excess of one hundred years of mining history and disturbance. However, like all mines, the inevitability of closure is important to manage for, in which case effective site rehabilitation will be required.

This project investigates the chemical and physical properties of a range of regolith materials that will be involved in the rehabilitation process of the Mt Boppy gold mine. These materials came from a range of different sites, including the existing minesite and the surrounding landscape. The methods used for analysis included the determination of pH, EC, CEC, mineralogy, geochemistry and aggregate stability; saturated infiltration rates were determined in situ.

A regolith-landform map encompassing the Canbelego region was also compiled, which provided a regional context for understanding the properties and behaviour of materials and the distribution of vegetation across the landscape. The regolith-landform map was used to provide a basis for detailed rehabilitation planning on the mine site.

A suggested rehabilitation plan was drawn up, involving recommendations for site management. Locations on the mine to be rehabilitated were delineated into three main categories; areas requiring immediate rehabilitation in situ, i.e. tailings dam, mullock heap and open void; areas requiring less urgent rehabilitation, i.e. other infrastructure; and areas that require no further rehabilitation, i.e. revegetated rock dump. Another relatively undisturbed site was used for comparison and was found to be an excellent source of materials for rehabilitation. Surface soil in nearby remnant woodland was considered suitable for use in capping the tailings dam and mullock heap. Long term monitoring using a system such as Landscape Function Analysis is also recommended.

Anna van Dugteren

Phytoplankton dynamics in the Clyde, Georges and Tuross estuaries NSW, 2002-2004

An understanding of the aquatic ecology of estuaries is critical in determining their future viability. A key determinant of estuarine health is the phytoplankton populations that inhabit these environments. At the base of aquatic food webs, phytoplankton populations are important in influencing fish, crustaceans and bivalve production and overall ecosystem health.

This study looks at the abundance, diversity, distribution and population dynamics of phytoplankton populations in three NSW estuaries using data provided by the NSW Food Authority. The phytoplankton populations in the Clyde, Georges and Tuross estuaries (at six sites in total) were analysed in the period 2002 to 2004.

The dynamics of phytoplankton populations are determined by numerous factors including nutrients, salinity, water temperature, catchment and oceanic inputs. However, nutrient data was not available for this study, so two surrogates which are major influences on the nutrients delivered to estuaries, were used in this analysis: rainfall in the estuarine catchments and stream flow.

The aims and objectives of this study are to describe and analyse phytoplankton population dynamics in the Clyde, Georges, and Tuross estuaries over the study period and to explain the reasons for these dynamics. This is intended characterise these estuaries and provide a baseline understanding of their phytoplankton ecology to assist in their management for aquaculture, recreation and conservation. Total phytoplankton dynamics; diatom, flagellate and dinoflagellate dynamics; and phytoplankton genus and species dynamics were compared and contrasted. Data on salinity, temperature, rainfall and stream flow were used to explain these dynamics.

Climate and catchment conditions were considered important in determining total phytoplankton abundance in this study. Total phytoplankton and proportions of diatoms, dinoflagellates and flagellates were different at each site and between estuaries. Salinity, rainfall, stream flow and catchment and oceanic sources of nutrients were identified as the most influential parameters in determining phytoplankton dynamics while water temperature and season did not influence the variability observed in this study. The two most oceanic sites, in the Georges and Clyde estuaries, had the highest total phytoplankton abundance, the greatest variability in phytoplankton abundance, the most distinct genus assemblages and the highest diatom numbers over the sampling period. This was attributed to the importance of oceanic and coastal-sourced nutrients replenishing these more oceanic sites. The more estuarine sites in the upper Clyde estuary and the Tuross estuary had lower total phytoplankton counts, probably due to the reliance of these upstream sites on catchment runoff and stream flow, during a sustained dry period. Flagellate numbers were particularly high at two estuarine sites, while the proportions of dinoflagellates was relatively low at all sites.

While nutrient data would have assisted in explaining some of the variability in phytoplankton dynamics, this study provides a baseline for understanding the phytoplankton biodiversity in the Clyde, Georges and Tuross estuaries under particular climatic conditions. The results from this study also emphasises the significance of catchment inputs, particularly in the most estuarine sites in determining phytoplankton abundance and diversity. Research in Australia and overseas has identified how sustained shifts in phytoplankton biodiversity can indicate major ecosystem disruptions. Long-term monitoring of phytoplankton populations in these estuaries will assist in providing an early warning of any changes to the ecology and thus the productivity of these estuaries due to the effects of human development.

Colin Wilshire

A Chinese worker made my shirt: Mapping demand from the global market to the factory floor

Branded clothing sold in the Australian retail market can often be traced to factories in China. Demand for branded garments necessitates high quality, timely production and competitive costs, and influences marketing and production in commodity chains. This thesis is focused on a case study of a branded shirt designed and marketed in Australia, and manufactured in China.

A market-driven commodity chain analysis is used to map demand for the shirt in the Australian retail market through to the factory floor where it was made. The thesis relies on the perspectives of management, as interpreters of marketing and manufacturing conditions in the global garment industry. Qualitative data was collected through semi-structured interviews with managers at each stage of the commodity chain. Interviews were first conducted in Australia, with the branded clothing company (UA) that acts as a lead firm and dictates policies for the production of the shirt. In July, further interviews were conducted in Shanghai, China, with management of trading companies and factories. Observations and quantitative data in the form of factory regulations, conditions and payrolls were also collected and analysed.

This thesis finds that the market-driven commodity chain for branded garments is influenced by the changing international and domestic context of China and its garment industry. There has been an increase in manufacturing for garment cluster towns in the Shanghai region and more recently through the removal of the multi-fibre agreement. However, domestic labour conditions pose difficulties for factory management who seek to produce high-quality and timely branded garments. The increase in demand for garments and consequent competition for skilled labour are forcing factory managers to increase wages and improve working conditions to recruit and maintain the best workers. The commodity chain for the shirt demonstrates how demand in the Australian retail market influences policies and day-to-day management through to the factory floor.

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