MODSIM workshop 16th December 2005

- Modelling of Land Use Impacts, Frameworks and Tools.

Spatial Risk Assessment Group www.gpa.uq.edu.au/CRSSIS/GIS/SRA.htm

Summary of workshop edited by David Pullar[1] and Carl Smith[2]

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Attendees:

Richard MacEwan (Primary Industries Research Victoria)
David Pullar (Uni Queensland)
Carl Smith (Uni Queensland)
Joanne McNeill (PIRVic)
Terry Walshe (Uni Melb)
Gemma Nichol (PIRVic)
Jean-Philippe Aurambout (PIRVic)
Alice Melland (PIRVic)
Graeme Newell (Dept. Sustainability and Environment, Authur Rylah Institute)
Rob Kingham (Bureau Rural Sciences, Canberra)
Harri Koivusalo (Helsinki University of Technology, Finland)
Ari Jolma (Helsinki University of Technology, Finland)
Mark Neal (Uni Queensland)
Jacqui Watt (CSU, Wagga)
Shahbaz Mustaf (CSIRO)
Zahra Paydar (CSIRO)
Errol McLean (VOW, Uni Wollongong)
Susan Cuddy (CSIRO Land & Water)
Felix Andrews (ANU, PhD)
Peter Griffioen (Acromap, consults to ARI?)
Joe Banks (Uni Melb, PhD)

Purpose

Frameworks for land use impact assessment increasingly make use of logic-based and numerical analysis tools. In particular, Bayesian networks are being used to model problems in environmental management.

The purpose of this workshop is to:
- Discuss frameworks for assessing environmental conditions, land resources and land use risk, and their linkages with mapping and analysis tools.
- Identify the 'next steps' for progressing this area of research
- Identify potential collaborations and networking opportunities

A summary of discussions on issues is given below. The three headings are: i) process (of undertaking an environmental risk assessment), ii) engagement (of stakeholders in the process), and iii) research needs (arising from gaps in modelling risk assessment).

Process	Engagement	Research Needs
Rapid assessment - use of widely available information - Automated data extraction from National databases (i.e. NLWRA) *Outcome: Communicate with agencies and support interoperable access to GIS databases.* Rules – ability to set conditional probability tables (CPT) from: - soft rules from expert elicitation - use probabilities generated from other models - training datasets and their currency *Outcome: This is supported in Bayesian networks and needs to be investigated with real studies.* Note: Issue at what level we can quantify nodes, i.e. nodes that use rules to define risk (susceptibility, management practice) versus nodes that have occurrence data (likelihood) Note: The value side of risk are difficult to quantify. Able to track or interpret uncertainty that comes from data (technical) versus uncertainty that comes from opinion (values). Asset value may be explored with determinants of land vales (hedonic models) or using contingent evaluation (willingness to spend). Difficulty with contingent value is separating $ spent on public .vs. private lands. Identifying incentives to address environmental issues. *Outcome: Can this be handled with scenarios where you change the assets are valued.* Assessments need to handle cumulative risk, i.e. aggregate diffuse upstream risks cause a high downstream risk. Issue is linking spatially and temporally the occurrence of degradation and its consequence. *Outcome: Support indirect linkages in causes and affects (see research*	Setting states – allowing for multiple opinions for the ratings and weights used in risk assessment rules, derive a consensus opinion. *Outcome: Investigate model averaging in Bayesian network to account for multiple opinions as uncertainty* Validity – using training data to validate model rather than rely on expert opinion - real occurrences, weight of evidence - sampling (how much and where) *Outcome: Support use of training data (case files) to populate CPT's* High risk and uncertainty – identify variables associated with highest risk/uncertainty to concentrate modelling effort on things that have big impact. *Outcome: Model development and sensitivity analysis* Availability of technology - free GIS is desirable for wide distribution of tools *Outcome: ?* Experience has shown the need to: - consistency of links - reduce complexity (simple but not too simple) - criteria to group things (remove redundancies) *Outcome: Explore sensitivity analysis as way to validate structure and sensitivity of nodes* Visual display of uncertainty – providing stakeholders a sense of what risk outcomes as based on. *Outcome: Exploring alternative ways of mapping risk probabilities (se research) and sensitivity analysis* Land use practices catalogue: - Are land use practices sufficiently consistent to publish and build knowledge base, can they be documented and peer reviewed - suite of practices and their costs	Uncertainty – ways to express different types of uncertainty (i.e. model uncertainty in rules, data uncertainty in input variables from hard data and soft opinions, spatial uncertainty in aggregate or mixed effects) incorporate into risk assessment and understand how the interact. Displaying uncertainty – Explore different ways of mapping and interpreting risk probability, i.e. probability of exceedence, different symbolisation of technical data uncertainty and expert opinion vagueness. Sampling strategy – Setting or advising the number of cases needed for reliably setting probabilities Ecosystem Functions and Values – can assets be related to ecosystem functions and values. Support Scenarios – ability for versioning to support optional input scenarios without replicating all of the data Disaggregate spatially – ability to cumulated effects by decoupling spatially likelihood and consequence (or generally any cause / effect). Also how to relate regional and local scales, i.e. similar to data drill down to drill down to a nested model, or just start new at a smaller scale.

needs) Scenarios – ability to set optional variables and compare risks for different scenarios in risk assessment. *Outcome: Ability to specify or draw alternative land use scenarios.*	- standard template for practices to address susceptibilities (has templates for different ecosystems / regions) - visit older database/reports (CMSS has catalogued practices for land uses, DLWC database) *Outcome: Investigate past studies, reports and databases to see if consistent general properties and management options exists.*	

In general there was strong interest in risk assessment methods and the need for further guidelines for practical applications and researching new methods. Risk assessment is a way to combine technical data derived assessments and value judgements in a way that is most informative for decision-makers.

Further development and educational seminars are planned. A web site has been established for keeping participants informed on activities. http://www.gpa.uq.edu.au/CRSSIS/GIS/SRA.htm

News and events will list previous and future events. Current research projects using LUIM to implement a risk assessment framework are described. A development is under way to link Bayesian Networks to GIS, this will be posted on this web site (expected May 2006).

Publications and links will be placed on web site in February 2006. Please contact me d.pullar@uq.edu.au if you would like to add links to this page.

Regards,

David Pullar