

Opportunity cost, uncertainty, and biodiversity conservation planning

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Opportunity cost

- A well-recognized element in optimal biodiversity reserve site selection.
- Need good opportunity cost data to feed into planning models.
- One primary goal of this grant is to produce an Australia-wide, but fine-scaled, analysis of land value and its determinants.

Spatial approach

- Simplest approach is to spatially smooth land sales data, over latitude, longitude and height. Used thin-plate smoothing splines.
- Produces effectively a weighted average of local land values to predict as a predictor.
- Advantages: adapts to local conditions.
- Disadvantages:
 - unreliable if local sales data are sparse
 - not attribute based.

Attribute based analysis

- Traditional linear-regression style approach.
- Explain land values as a function of observed attributes (e.g. rainfall).
- Advantages:
 - allows out-of sample prediction,
 - allows analysis of impact of changes (e.g. new roads)
 - attributes may be biologically important
- Disadvantage: no adaptation for spatially-oriented omitted variables

Empirically important attributes

- Population density
- Distance to coast
- Distance to capital cities
- Distance to railways and major roads
- Native vegetation
- Rainfall (and irrigation)
- Temperature
- Elevation
- Topography
- Soil characteristics
- Predominant land use

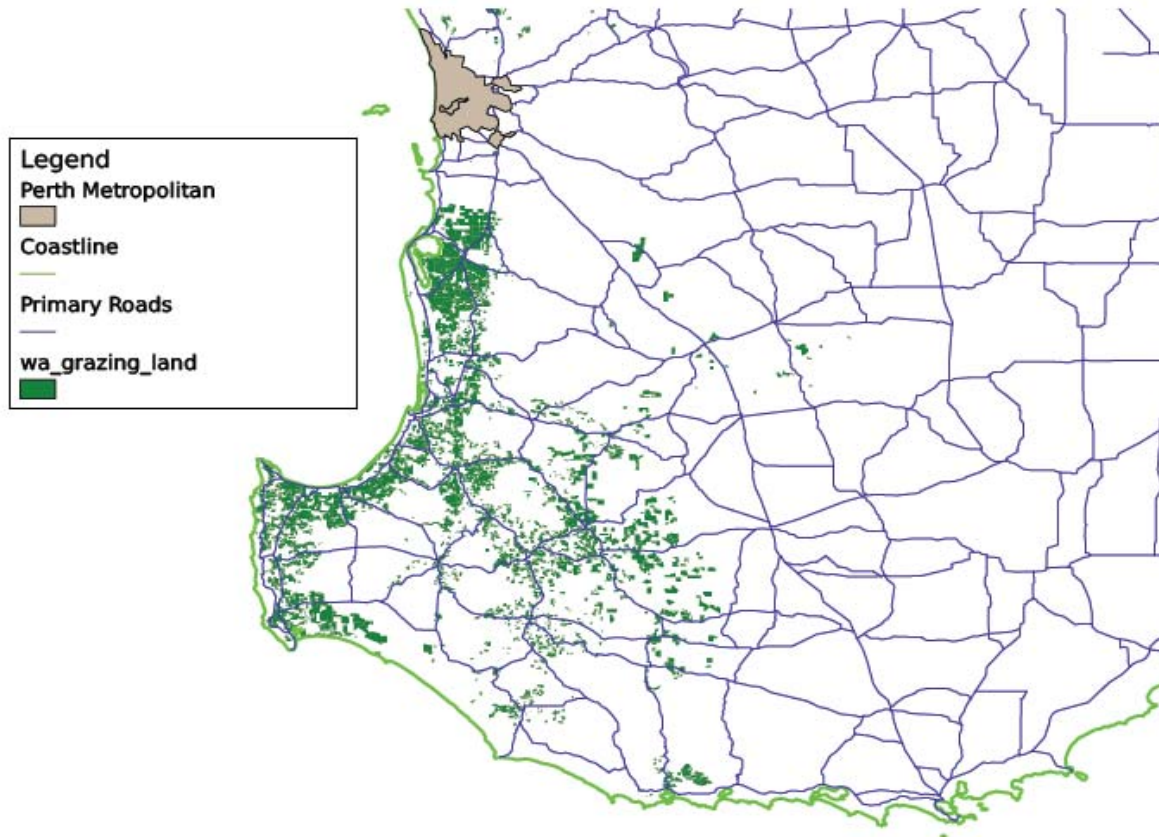
Data

- Acquired all land sales data from the various states for periods ranging from one to fifteen years (depending on price).
- Combined with data from other spatial databases (climate, land use, vegetation, etc)
- Using a combination of the spatial and attribute based approaches, based on Gaussian backfitting – combines merits of both and limits disadvantages of each.

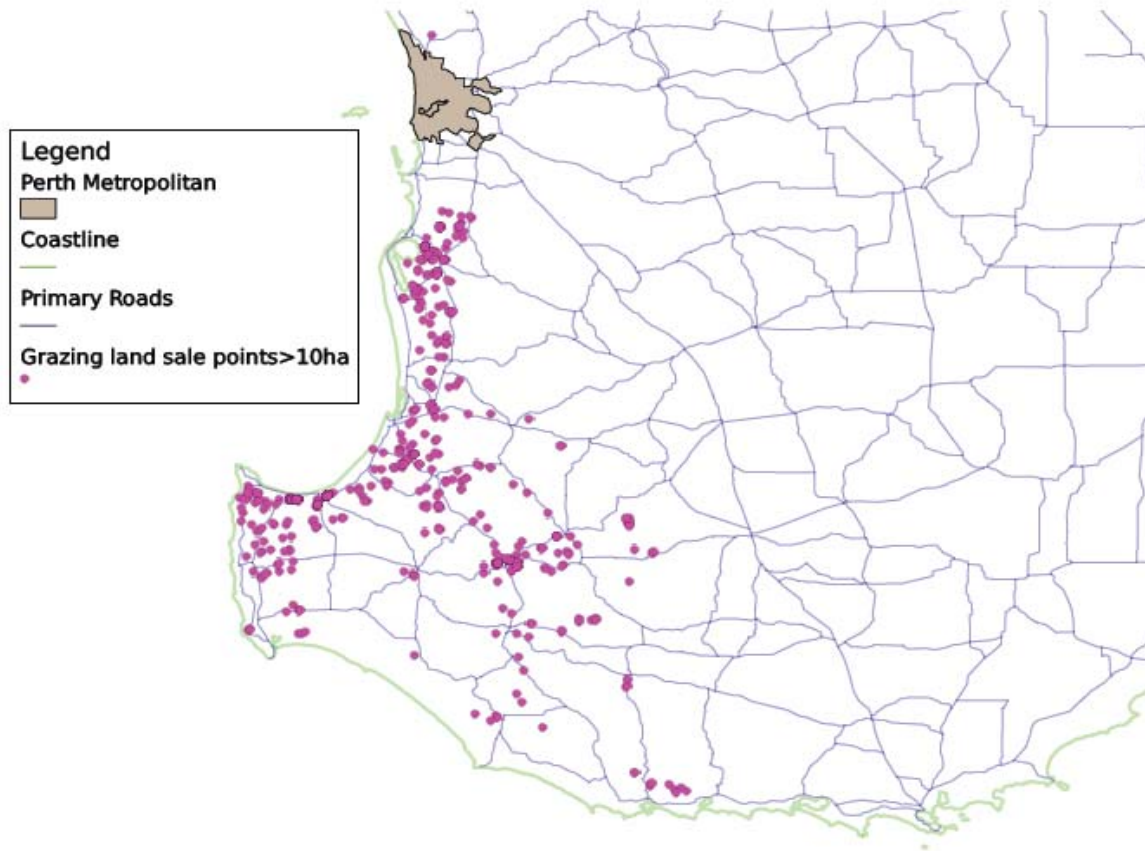
Wider application

- Immediate goal is to inform land-use planning. However, many other studies can benefit from this type of data.
- Climate change: combine the various climate attributes with climate projections to understand potential impacts on land values.
- Dryland Salinity: analyse the impact of increasing salinity on property values.
- Ecosystem Services: collaborating with E. Aisbett's hub project.

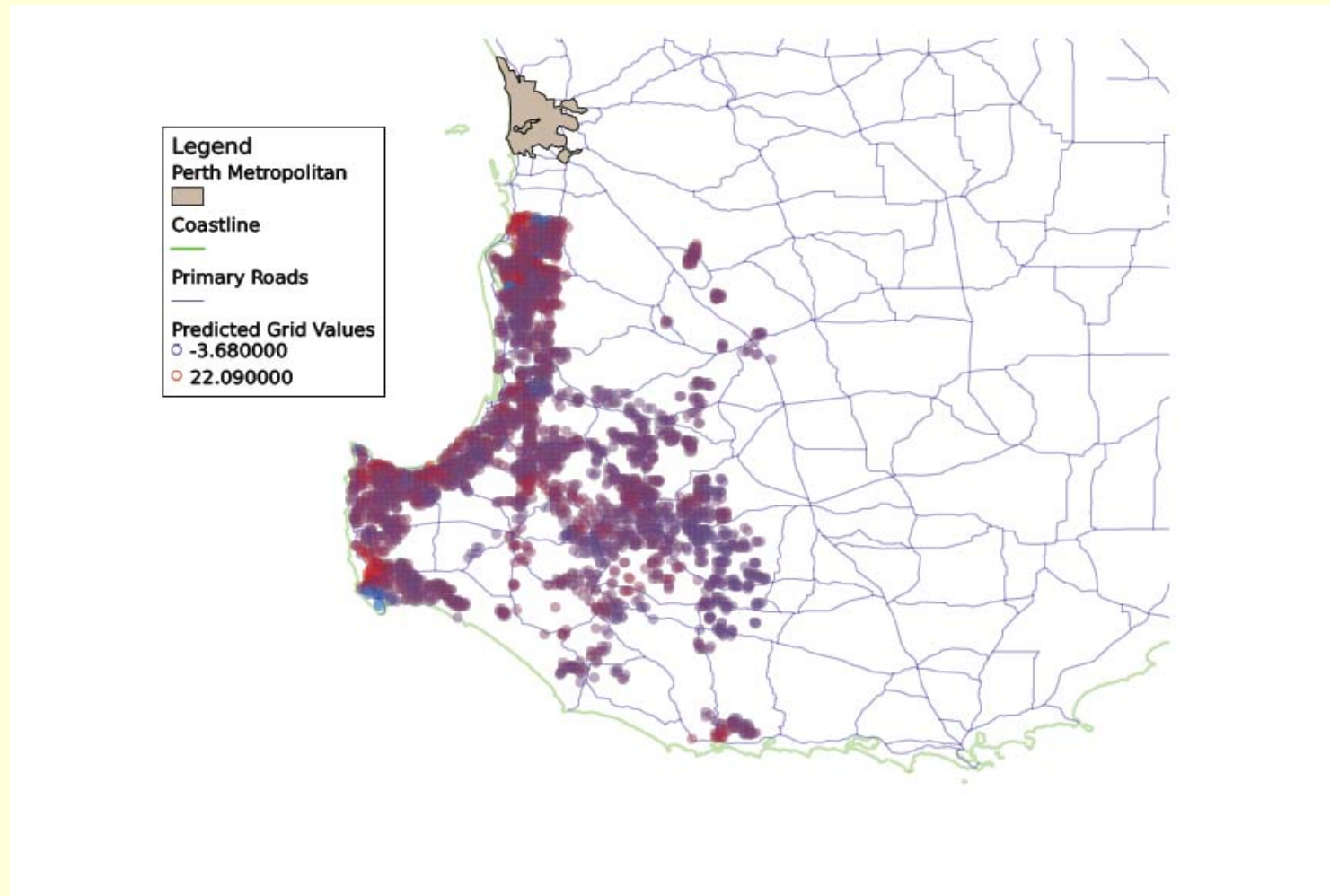
Fragmented grazing land near Perth



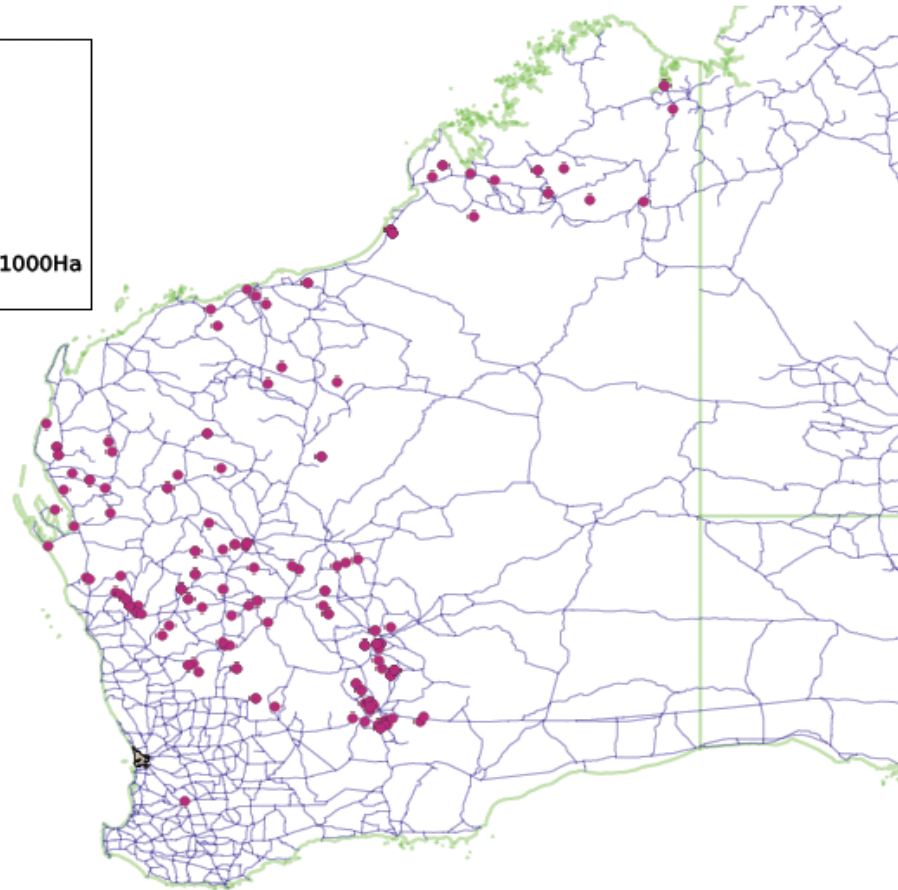
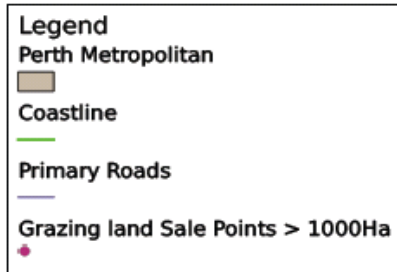
Observed grazing land sales



Predicted grazing land values



WA major grazing lands



Roles of Uncertainty

- Uncertainty plays a fundamental role in both good reserve selection and in broader incentive-based approaches.
- Second theme so far of project is theoretical analysis of information and uncertainty.
- Roles of scientific uncertainty, economic uncertainty, private land-holder information, etc.

Scientific uncertainty

- Often assumed that better information about biodiversity habitat will result in greater conservation. Not necessarily.
- Greater scientific uncertainty, combined with the prospect of scientific learning, often will result in greater immediate conservation through the option-value effect.
- Better information may also produce less conservation, if it identifies some land as of lesser habitat importance. There is a tension between opportunity cost and information that may shift the balance either way (joint w/ C. Costello).

Economic uncertainty

- Given a limited budget, should we conserve a smaller amount of highly threatened land, or a large amount of land with low current threat?
- Most existing reserves are examples of the second strategy.
- “Threat” is really economic uncertainty, but the analysis is quite different from the case of scientific uncertainty.
- Able to prove a neutrality result as a benchmark: under certain conditions in expectation it does not matter which strategy is followed.

Incentives and uncertainty

- Many incentive schemes recognize role of information and uncertainty.
- Bush-tenders, for example, are intended to address information asymmetry. However, in some circumstances, can be much less cost-effective than auctions for commercial purposes due to mismatch in source of value.
- Other preliminary work: input versus output compensation under asymmetric information and costly monitoring (w/ Quentin and Tom).