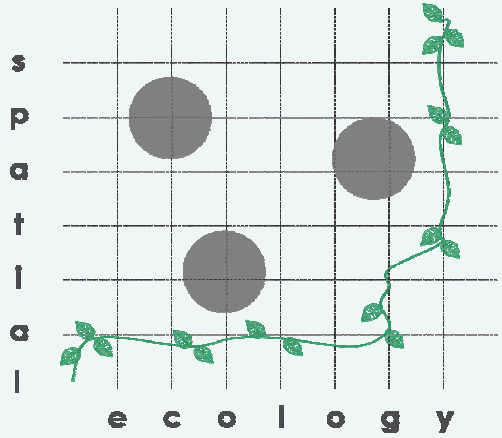
MarZone & other Marxan developments. How will they better help decision-making?

Matthew Watts



the ecology centre
university of queensland
australia
www.uq.edu.au/spatialecology
m.watts@uq.edu.au

The University Of Queensland
AUSTRALIA

Marxan Developments

- MarOpt, optimised Marxan
- MarZone, multiple zones and costs
- MarProb, probabilistic treatment of threats
- MarStat, cluster analysis of Marxan solutions
- Marxan courses

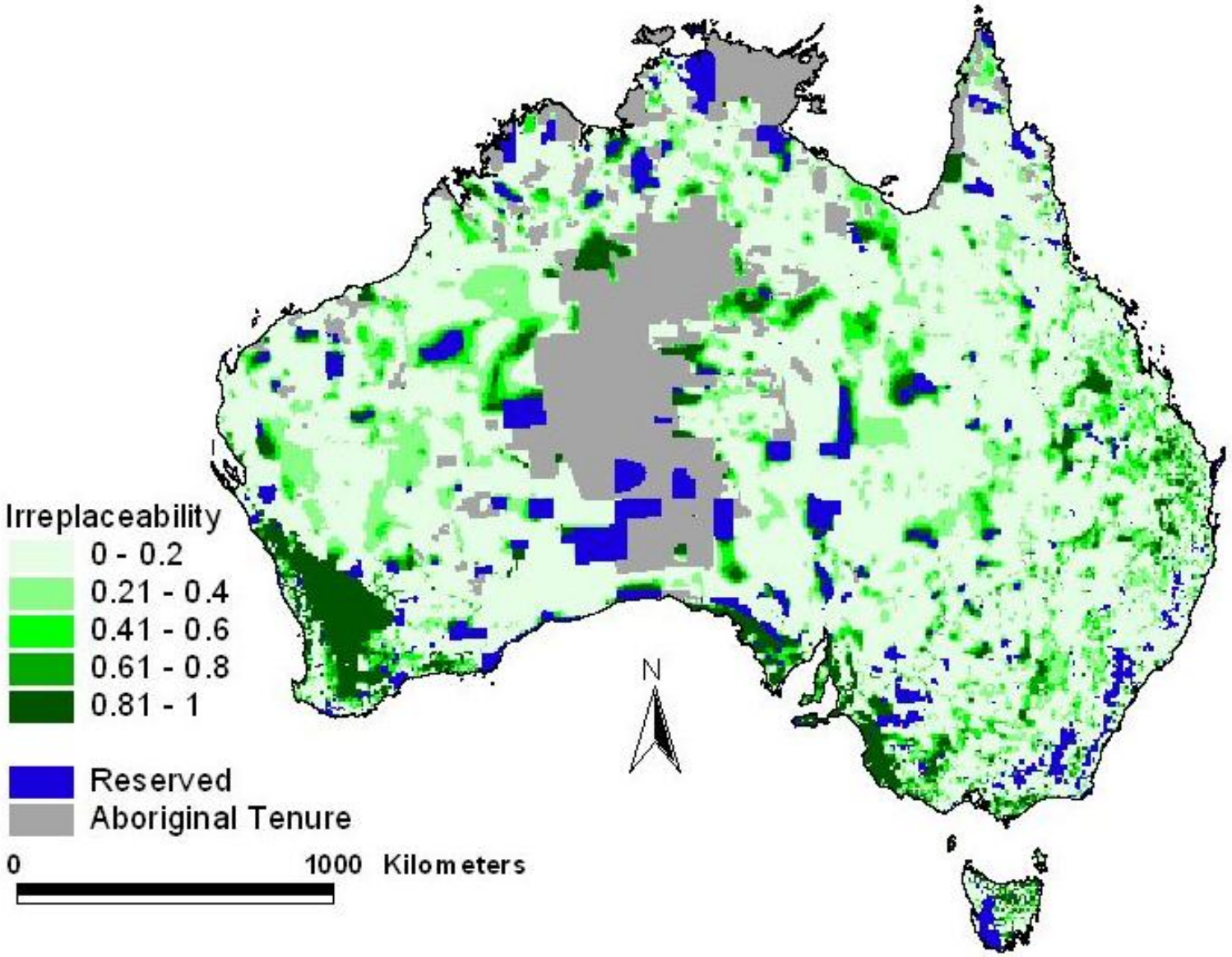
MarOpt, optimised Marxan

- Optimised for memory, between 500% and 3,000% more data
- Optimised for execution speed, up to 1200% more speed
- 20,000 planning unit limit removed
- 32 bit memory model, 2 gigabytes address space, only using 20% of available memory space so far

MarOpt, optimised Marxan

- More planning units and species
- More comprehensive datasets
- Fine scale datasets
- Large scale datasets
- National and global study regions
- More iterations, runs and scenarios
- More comprehensive data analysis

MarOpt, optimised Marxan



7.7 million square km

80 thousand planning units

6 thousand species

Fine scale data

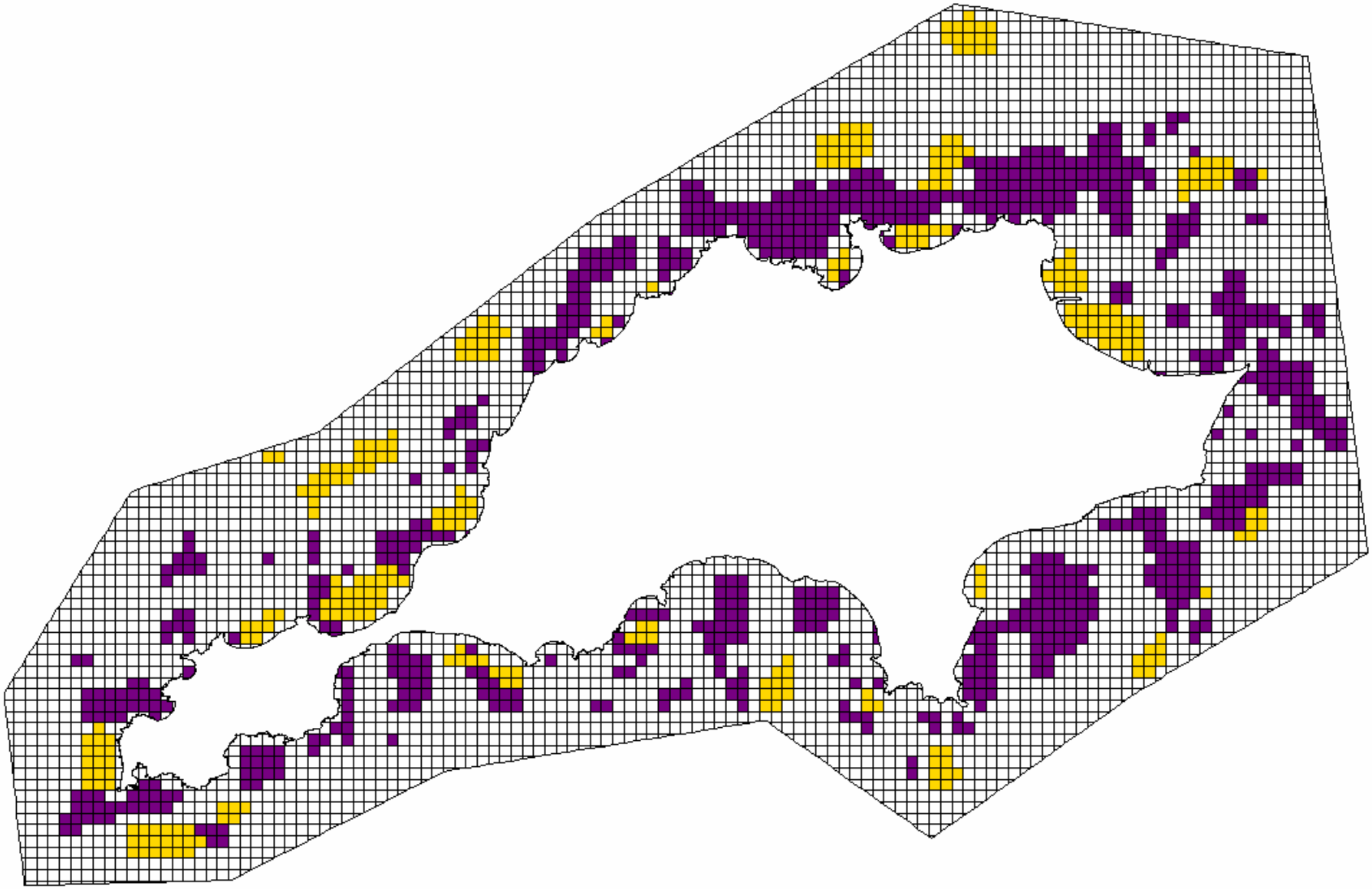
MarZone

- Expectations of MarZone
- Multiple zones
- Multiple costs
- New capabilities
- New data Requirements and complexities

MarZone

- Any stakeholder can have a constraint, features don’t have to be for biodiversity or protection
- Targets can be set for fishing
- For example, crab industry 90% of current take spatially must be in crab fishable zones (zone 3 or 4, where zone 1 & 2 can’t be fished)

MarZone



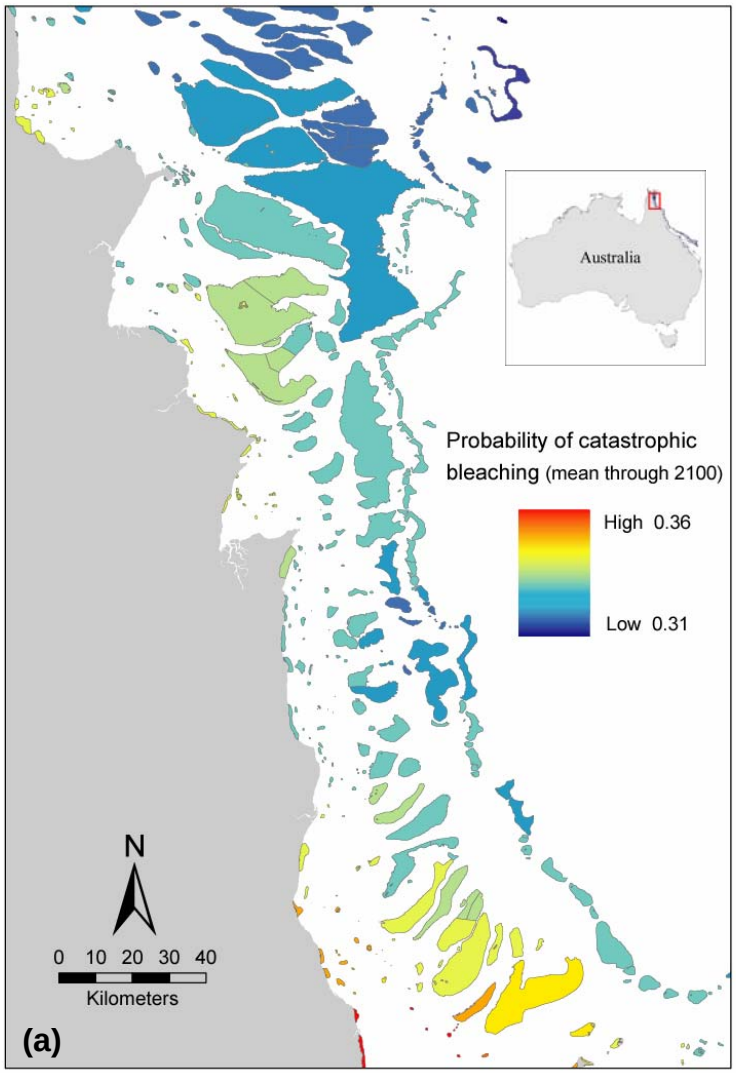
MarProb, probabilistic treatment of threats

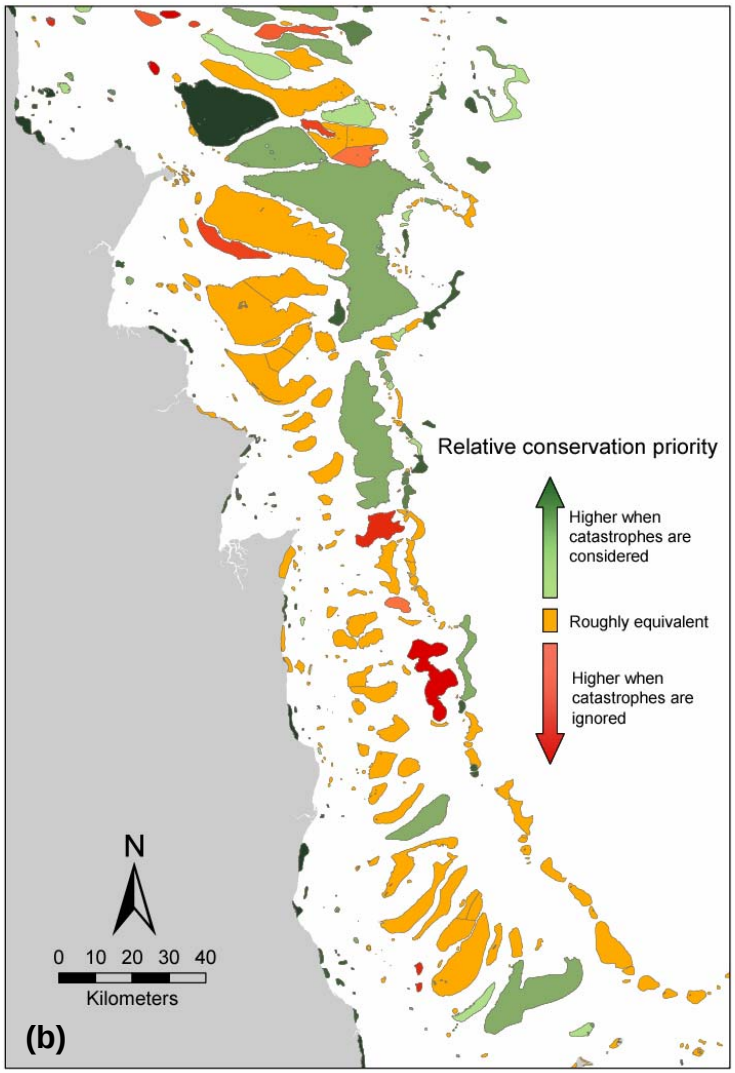
- Specify probability of a threat occurring at a planning unit
- Adding an extra term to the objective function
- Specify weighting to give to threats in the objective function

MarProb, probabilistic treatment of threats

- Reduce the likelihood of protected area networks being impacted by threatening processes
- For example, protected area networks in the Great Barrier Reef can be designed for the same cost while being significantly more resilient to coral bleaching. Over 100 years, the probability of species not meeting their targets due to coral bleaching can be reduced by 1/3 (Game et al 2006)

MarProb, probabilistic treatment of threats





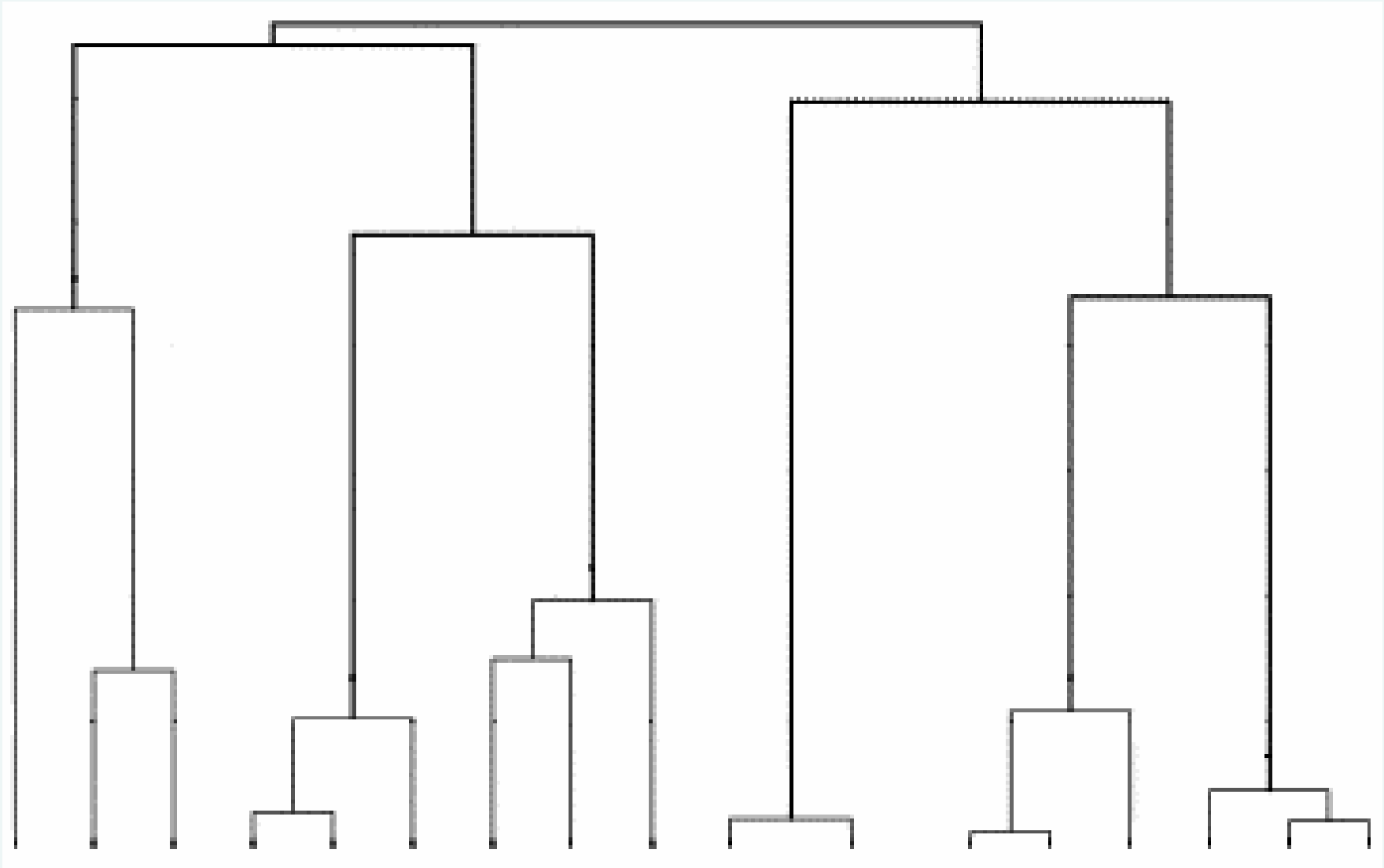
MarStat, cluster analysis of Marxan solutions

- Plug ins for R and PCOrd
- Computing similarity of Marxan solutions
- Identifying representative reserve configurations that are statistically different from each other to better examine the solution space

MarStat, cluster analysis of Marxan solutions

- An alternative to using Best Solution and Summed Solution
- Computing similarity of Marxan solutions
- Identify solutions that are statistically different from each other to better examine the solution space
- For example, choose 4 solutions that are the most different from each other out of a set of Marxan solutions

MarStat, cluster analysis of Marxan solutions



Dendogram with 17 solutions

Marxan courses

- Marxan 101 - Introduction to Marxan
- Marxan 201 - Advanced Marxan
- Marxan 301 – MarZone
- Courses in Australia, East and West coast
- North America and other locations ?

Marxan 101 – Introduction to Marxan

- Key concepts in systematic conservation planning
- History and overview of Marxan software
- Creating planning units
- Creating Marxan input files
- Parameter setting and setting up the file structure
- Running Marxan and understanding output files
- Viewing output files spatially in ArcGIS
- New developments with Marxan

Marxan 201 – Advanced Marxan

- Datastructures for Optimised Marxan
- Probabilistic treatment of threats
- Producing fixed cost solutions
- Cluster analysis of Marxan solutions

Marxan 301 - MarZone

- Modelling the Spectrum of Management Zones
- Multiple Zones
- Multiple Costs
- Spatial Configuration of Zones

Future Marxan developments

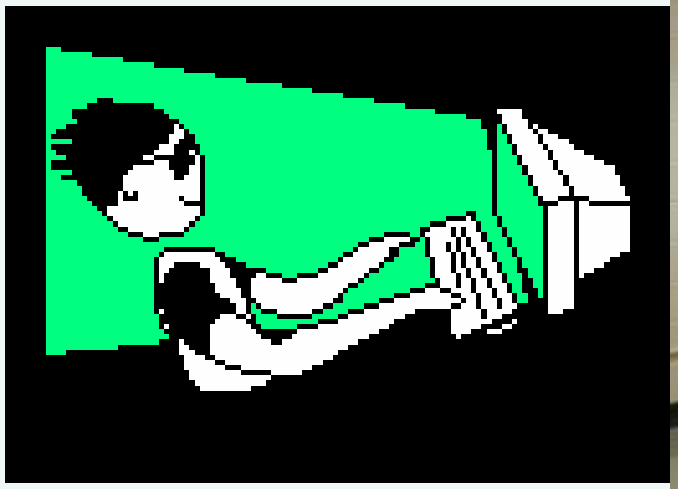
- Probabilistic treatments of species distributions
- PVM Marxan
- Marxan DBMS
- Interactive Decision Support System
- 64 bit Marxan
- Linux Marxan

Probabilistic treatment of species distributions

- Considers predicted distributions of species
- Specify a probability of a species occurring at a planning unit
- Improve the likelihood of protected areas containing species now and in the future
- Improve the likelihood of protected areas containing transition zones
- Managing the impact of climate change on protected areas by designing protected area networks that are resistant to climate change

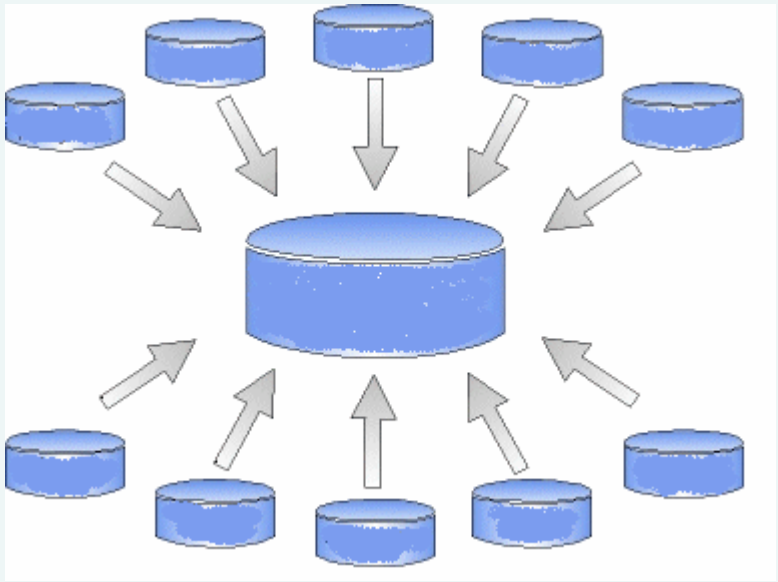
PVM Marxan

- Supercomputing with Marxan
- Parallel Virtual Machine and parallel processing
- Ever larger and more comprehensive datasets
- Real time analysis for stakeholder negotiations on large scale datasets



Marxan DBMS

- Database management system integrates with GIS and Marxan
- Build and maintain datasets easily
- Simplify dataset chores



Interactive Decision Support System

- Integration with GIS, DMBS and other software
- Automate mapping of Marxan results
- Open source and commercial GIS
- Advanced exploration of data and solution space
- Real time update of solutions and prioritys
- Support real time negotiation with stakeholders
- Advanced simulation and modelling tool

64 bit Marxan

- Allows datasets to be much larger than 2 gigabytes
- More speed
- Larger datasets

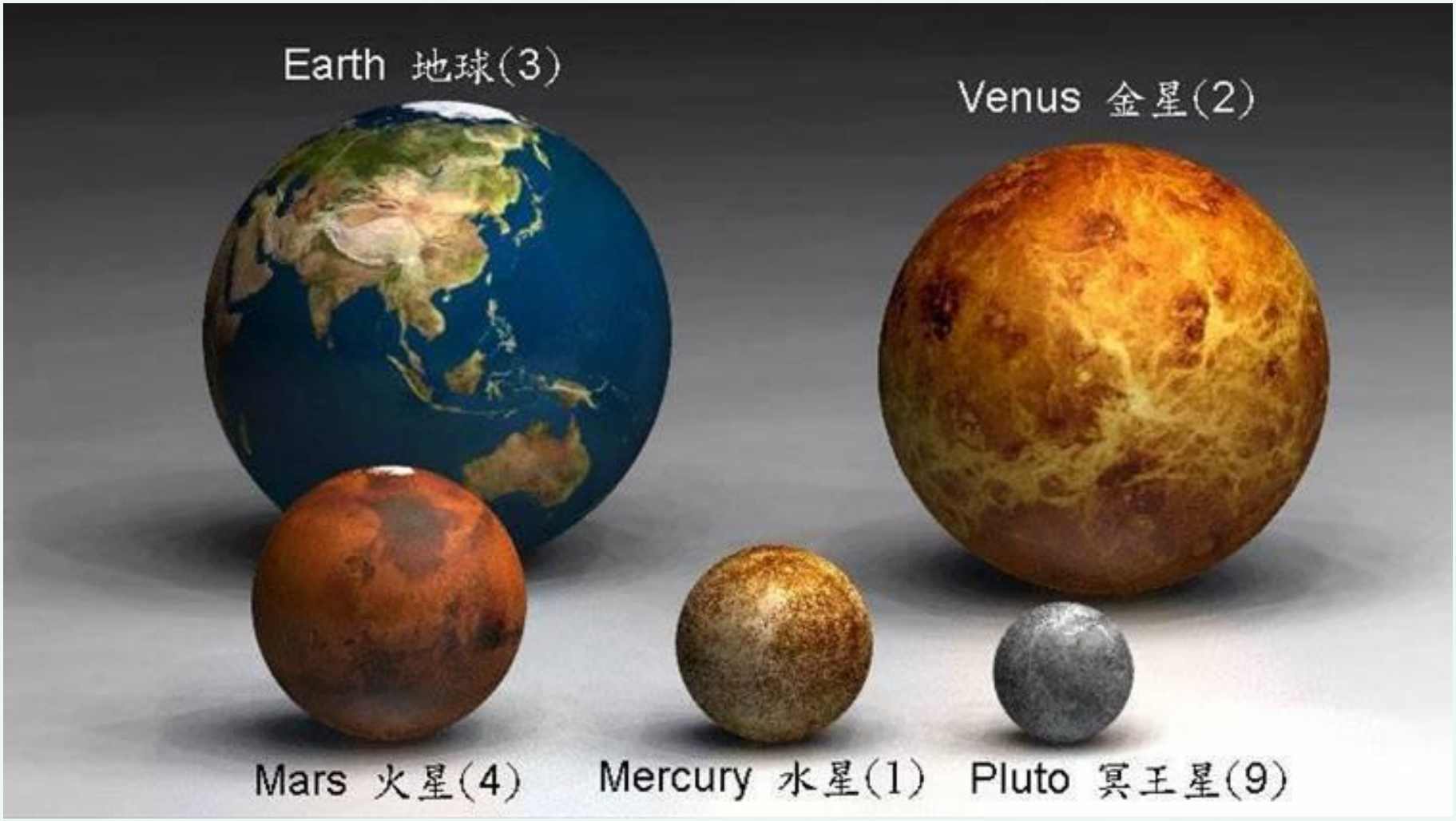
Linux Marxan

- Integration with open source operating system
- Free software is more available to 3rd world nations, developing nations, NGO's, stakeholders and students

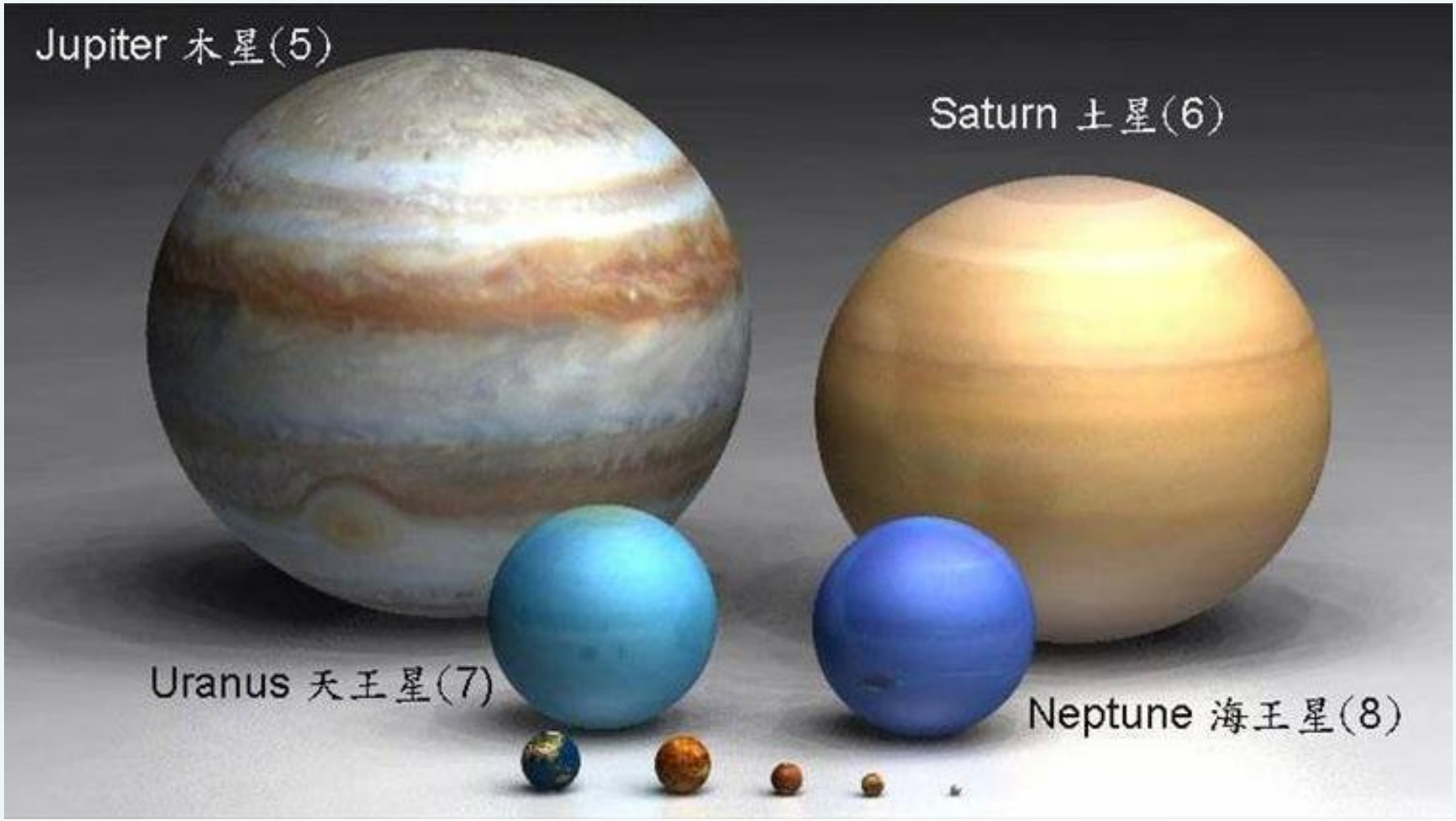
The Future of Marxan

- A vehicle for bringing new research and ideas to planners and decision makers
- ???

The Future of Marxan



The Future of Marxan



Marxan availability

- Downloading Optimised Marxan

www.ecology.uq.edu.au/marxan.htm

- Contacting Hugh Possingham

h.possingham@uq.edu.au

- Signing up for the Marxan email list

marxan-owner@sib.uq.edu.au

Acknowledgements

- Australian Department of Environment and Heritage
- Australian Natural Heritage Trust
- EcoTrust
- New Zealand Department of Conservation
- Ontario Ministry of Natural Resources
- The Nature Conservancy
- University of California
- University of Queensland

"Not everything that counts can be counted and not everything that can be counted counts.“

- sign in Einsteins office at Princeton

"The most incomprehensible thing about the world is that it is comprehensible.“

- Einstein quote from 1927