EDG ENVIRONMENTAL DECISIONS GROUP

Marxan and relatives

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ARC ceed

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Target based SCP

C-Plan, Marxan, Zonae Cogito

Decision support systems and operations research tools for ecologists

- Multi use zoning
- Site destruction approach
- Species modelling approach
- Asymmetric connectivity
- High performance computing

Marxan

Worlds leading software for Spatial Conservation Prioritisation

Ball, I.R., H.P. Possingham, and M. Watts. 2009. Marxan and relatives: Software for spatial conservation prioritisation. Chapter 14: Pages 185-195 in Spatial conservation prioritisation: Quantitative methods and computational tools. Eds Moilanen, A., K.A. Wilson, and H.P. Possingham. Oxford University Press, Oxford, UK.

What does it do?

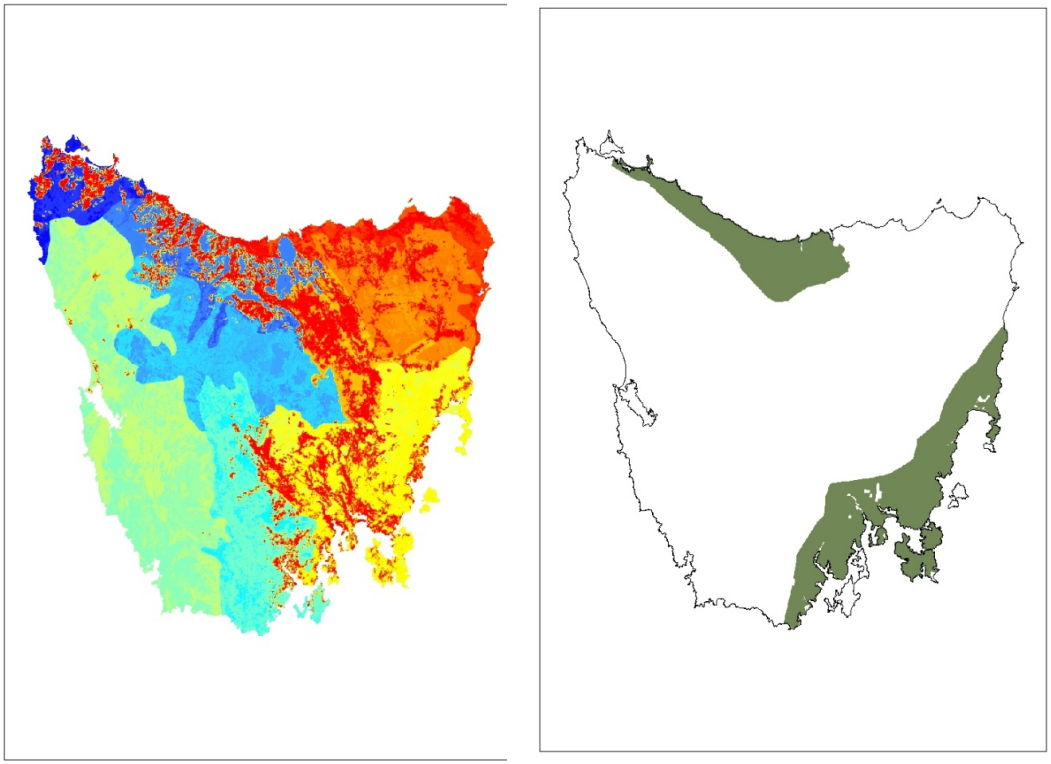
Protected area selection

Solves the “bin packing problem”: give me a little of everything at the least cost

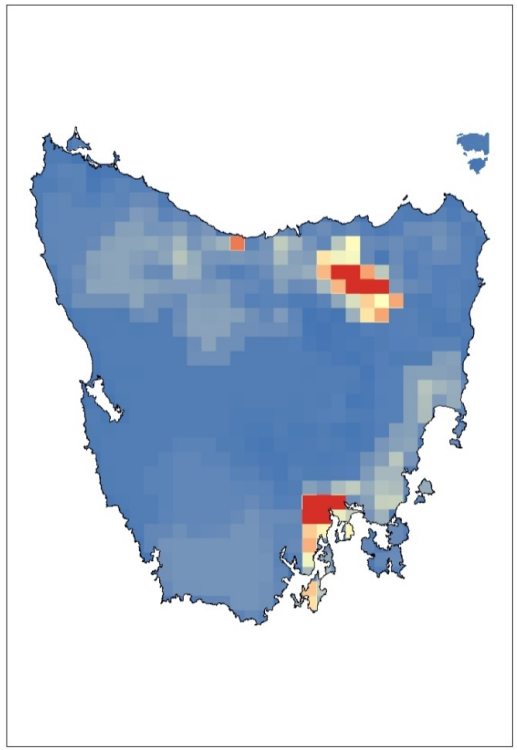
Simulated annealing algorithm

Marxan inputs

Conservation features



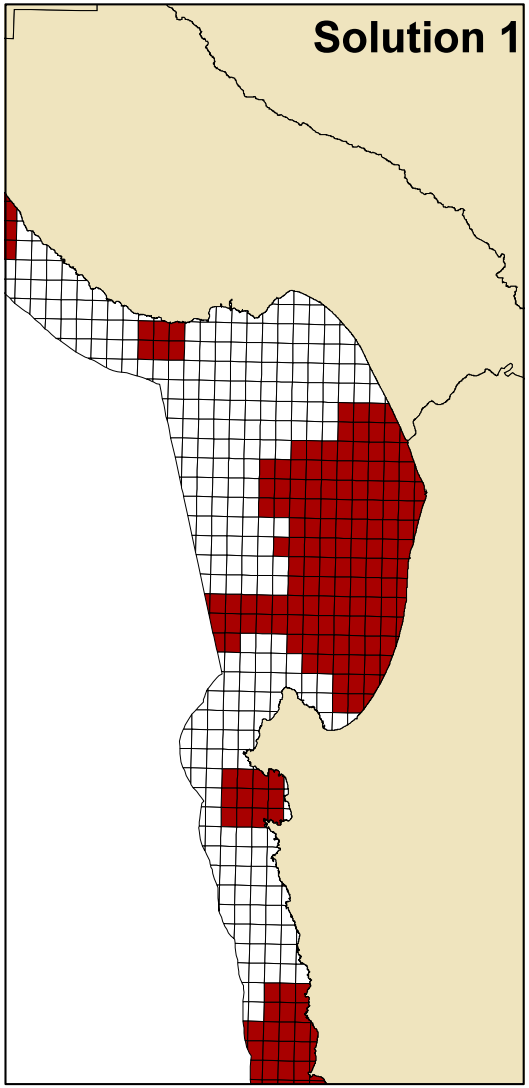
Cost surface



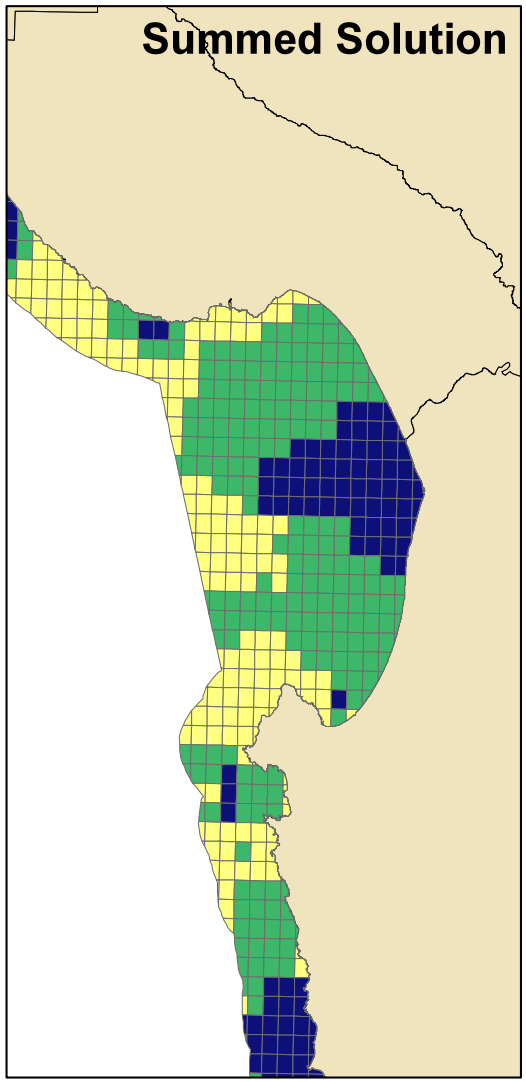
+ a clearly defined problem with objectives and constraints

Marxan outputs

Individual solutions

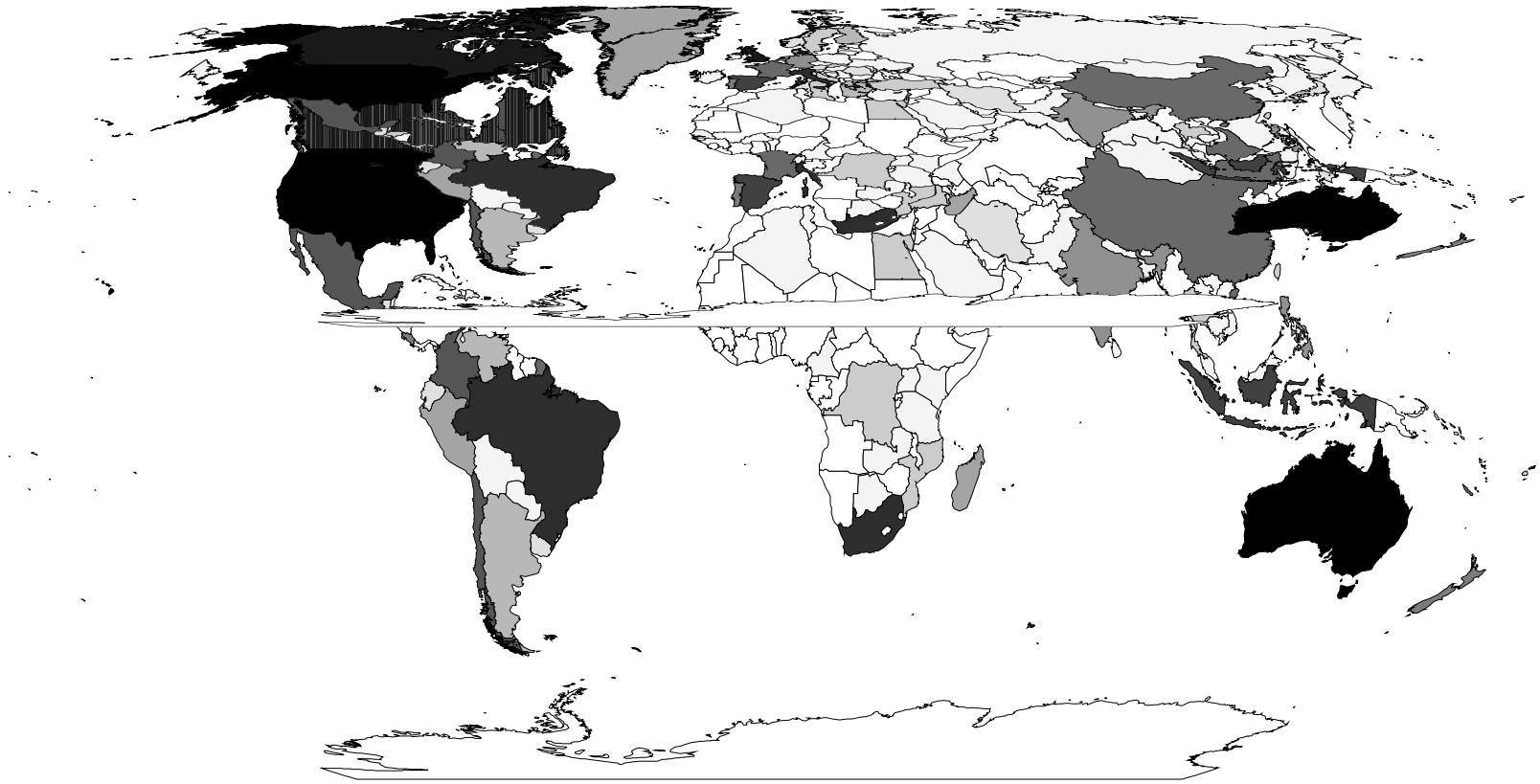


Selection frequency



Who uses Marxan?

Basically everyone who does **target-based** SCP: Over 10,000 downloads worldwide: > 100 countries, > 2,000 organisations, > 200 universities



Processing limits

Limited by the amount of time you can wait for the computer to run

Efficient use of computing resources means you can solve very large problems

Computational capacity and algorithms rarely limit conservation planning – lack of clear objectives do

Problem domain

Solves any **target-based** prioritisation problems

Many complexities can be added

- Complex spatial rules
- Zoning
- Risk
- Dynamics
- Interactive decision support

Multiple use zoning

Watts, M.E, I.R. Ball, R.R. Stewart, C.J. Klein, K. Wilson, C. Steinback, R. Lourival, L. Kircher, and H.P. Possingham. 2009. Marxan with Zones: software for optimal conservation based land- and sea-use zoning, Environmental Modelling & Software (2009), doi: 10.1016/j.envsoft.2009.06.005

Continental scale planning

Klein, C., K. A. Wilson, M. Watts, J. Stein, S. Berry, J. Carwardine, D. M. Stafford Smith, B. Mackey, and H. Possingham. 2008a. Incorporating ecological and evolutionary processes into continental-scale conservation planning. Ecological Applications 19: 206-217

Site destruction approach

Game E.T.,Watts M.E.,Wooldridge S.,Possingham H.P. 2008. Planning for Persistence in Marine Reserves: A Question of Catastrophic Importance. Ecological Applications: 18:3 670;680

Species modeling approach

Carvalho, S.B., Brito, J.C., Crespo, E.G., Watts, M.E., Possingham, H.P. (2011). Conservation planning under climate change: Toward accounting for uncertainty in predicted species distributions to increase confidence in conservation investments in space and time. Biological Conservation 144 (2011) 2020-2030

Asymmetric connectivity

Beger M, Linke S, Watts M, Game E, Treml E, Ball I, Possingham HP. 2010. Incorporating asymmetric connectivity into spatial decision making for conservation. Conservation Letters 3,5:359-368

Linke S, Watts M, Possingham HP. 2007. Muddy waters: Modifying reserve design algorithms for riverine landscapes. Proceedings of the International Congress on Modelling and Simulation Land, Water & Environmental Management, 2007 Volume 17 Pages 2216-2222

Decision support

Segan, D.B., E.T. Game, M.E. Watts, R.R. Stewart, H.P. Possingham. 2011. An interoperable decision support tool for conservation planning. Environmental Modelling & Software, doi:10.1016/j.envsoft.2011.08.002

Current developments

- Parallel processing,
- Improved platform independence,
- Better handling of uncertainty in data,
- Graph theoretic connectivity approach,
- Phase space visualisation,
- Improved optimisation algorithms,
- Continuous benefit functions.

Website

www.uq.edu.au/marxan

Papers

Courses

Manuals

Software

Questions?