Dr Mick McCarthy

mamcca@unimelb.edu.au

University of Melbourne

Day 1, 3.05pm

Area of work: population ecology, decision-making and risk analysis

Specialty: I examine factors that contribute to the risk of extinction, and ways to manage this risk.

Take-home messages:

The value of active actively learning about environmental management problems depends on how:

- the future is valued;
- broadly knowledge is applied; and
- success is measured.

Is it really worth learning about the benefits of management?

Adaptive management is learning by doing; management strategies are implemented, their effectiveness is monitored, and then the mix of management strategies is adjusted depending on the outcomes of the monitoring. The number of examples of adaptive management is increasing, with researchers determining the best way to conduct management and monitor outcomes to achieve particular objectives. But in most of these examples, the benefits of adaptive management are predicted to be small, even when monitoring is inexpensive.

This is a surprising result. It suggests that knowledge and learning are not as beneficial as scientists might like to think and that managers should mostly implement management strategies using the best available information, rather than planning on obtaining more information.

Are these suggestions reasonable and why does adaptive management often predict modest improvements in management? The answers to these questions depend on:

1) the way in which knowledge is updated in adaptive management problems;

2) how broadly the results of monitoring are applied; and

3) the degree by which the value of future returns are discounted.

The usual way of updating knowledge in adaptive management studies is to use Bayes' rule, which limits the range of outcomes to a pre-conceived set of options; complete changes in paradigm are precluded, limiting the perceived value of new information. The value of information is limited when adaptive management results are only applied within a particular case study. Standard discounting of future returns also limits the value of information.

Adaptive management is most beneficial when changes in paradigm are considered, the results of monitoring are applied beyond the case study and the future is not heavily discounted. These ideas are illustrated using a number of case studies with a particular focus on learning about re-vegetation strategies.

Relevant publications

McCarthy MA and Parris KM (2008). Optimal marking of threatened species to balance benefits of information with impacts of marking. *Conservation Biology,* 10.1111/j.15231739.2008.00999.x

Chadès I, McDonald-Madden E, McCarthy MA, Wintle B, Linkie M and Possingham HP (2008) When to stop managing or monitoring cryptic threatened species. *Proceedings of the National Academy of Sciences* 105: 13936–13940.

McCarthy MA, Thompson CJ and Garnett ST (2008). Optimal investment in conservation of species. *Journal of Applied Ecology* 45: 1428–1435.

Moore AL, Hauser CE and McCarthy MA (2008). How we value the future affects our desire to learn. *Ecological Applications* 18: 1061–1069.

McCarthy MA and Possingham HP (2007). Active adaptive management for conservation. *Conservation*.

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Is it really worth learning about the benefits of management?

Alana Moore

Michael McCarthy, Cindy Hauser &
Hugh Possingham

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Merri Creek revegetation

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Economics

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budget & costs

- 5 areas of high density planting per 5 years (~4,000 / ha)
- 10 areas of low density planting per 5 years (~2,000 / ha)

success

>1,500 surviving plants per ha after 5 years

objective

- maximise successful area of revegetation over next 20 years

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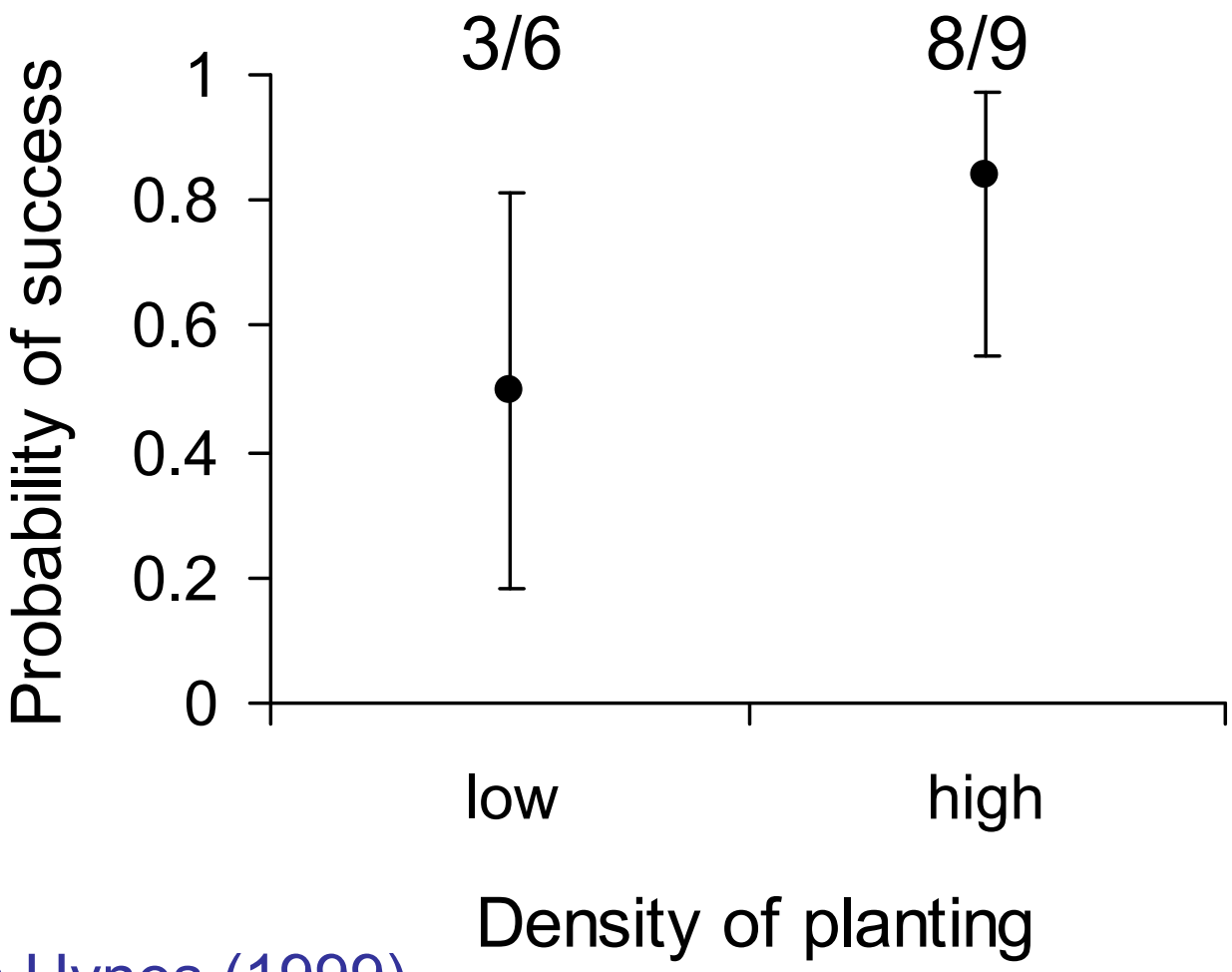
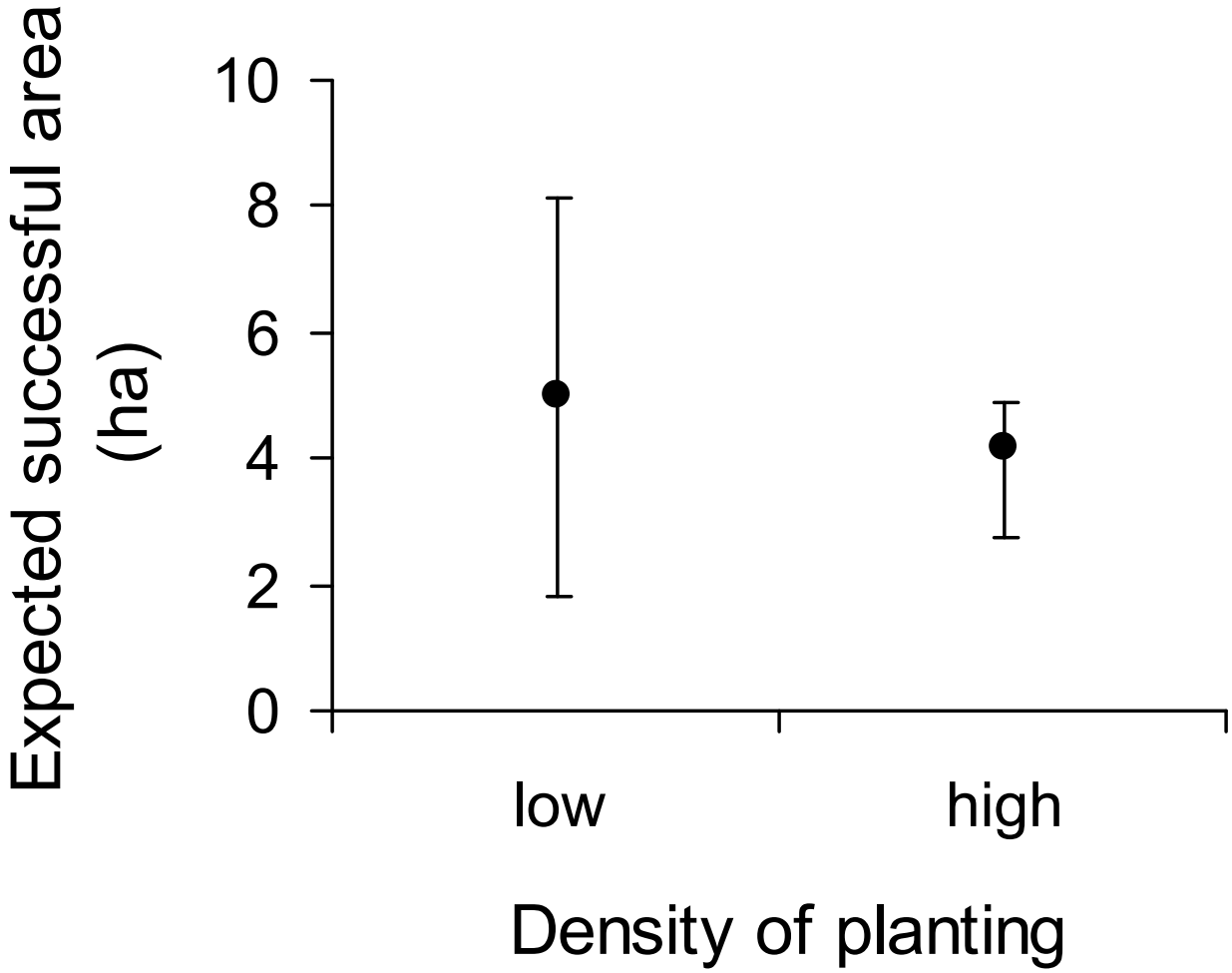
Uncertain success



data from Hynes (1999)

Uncertain outcome



Optimal learning

- maximise outcome (not statistical power)
- trade-off between learning and doing
- Bayesian estimation
- stochastic dynamic programming

McCarthy and Possingham (2007) *Conserv. Biol.*

Proportion to high density planting

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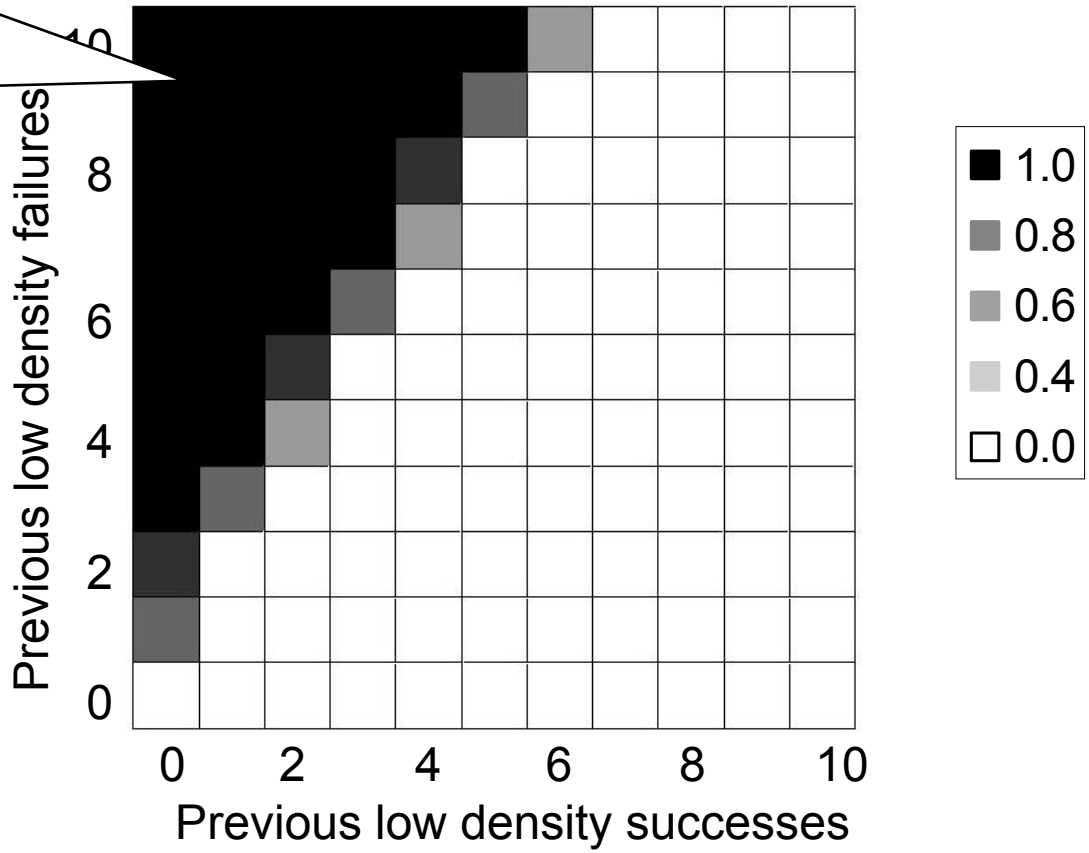
Many low density failures, use high density planting

given we've had 8/9 previous successes of high density planting



McCarthy and Possingham (2007) *Conserv. Biol.*

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Proportion to high density planting

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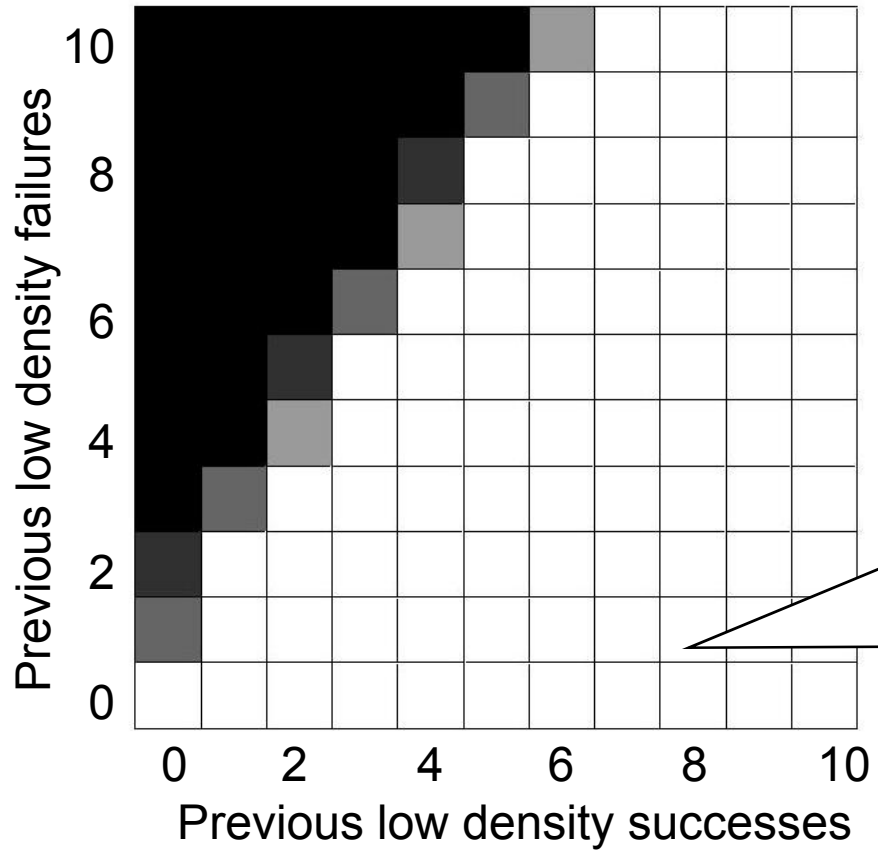

Many low density successes, use low density planting

McCarthy and Possingham (2007) *Conserv. Biol.*

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Proportion to high density planting

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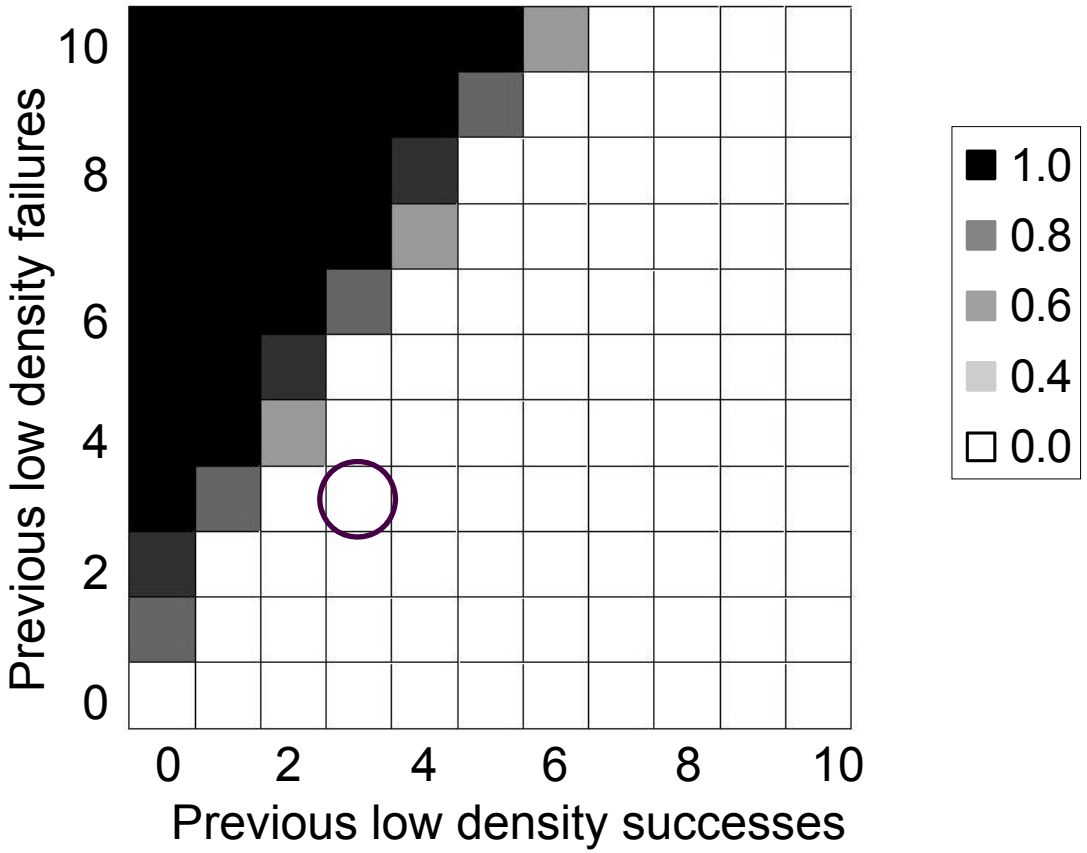

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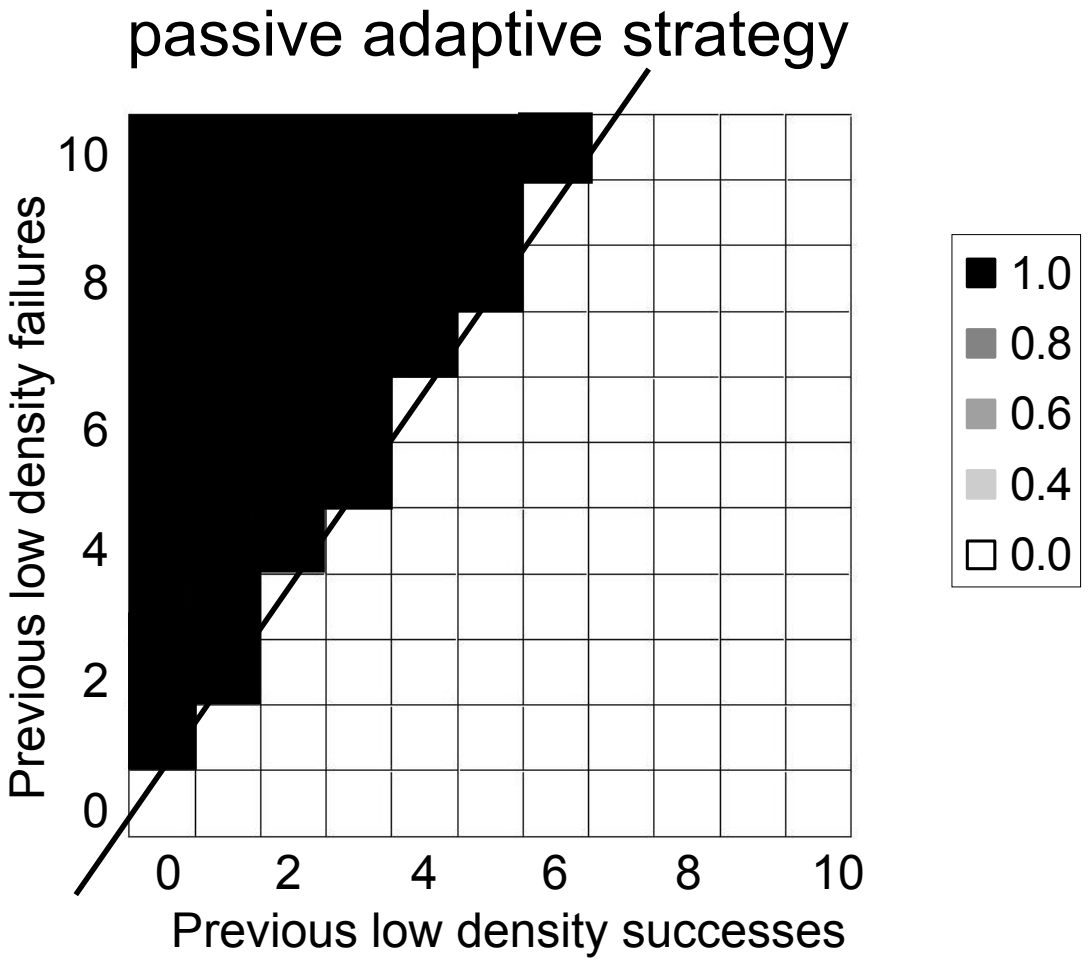

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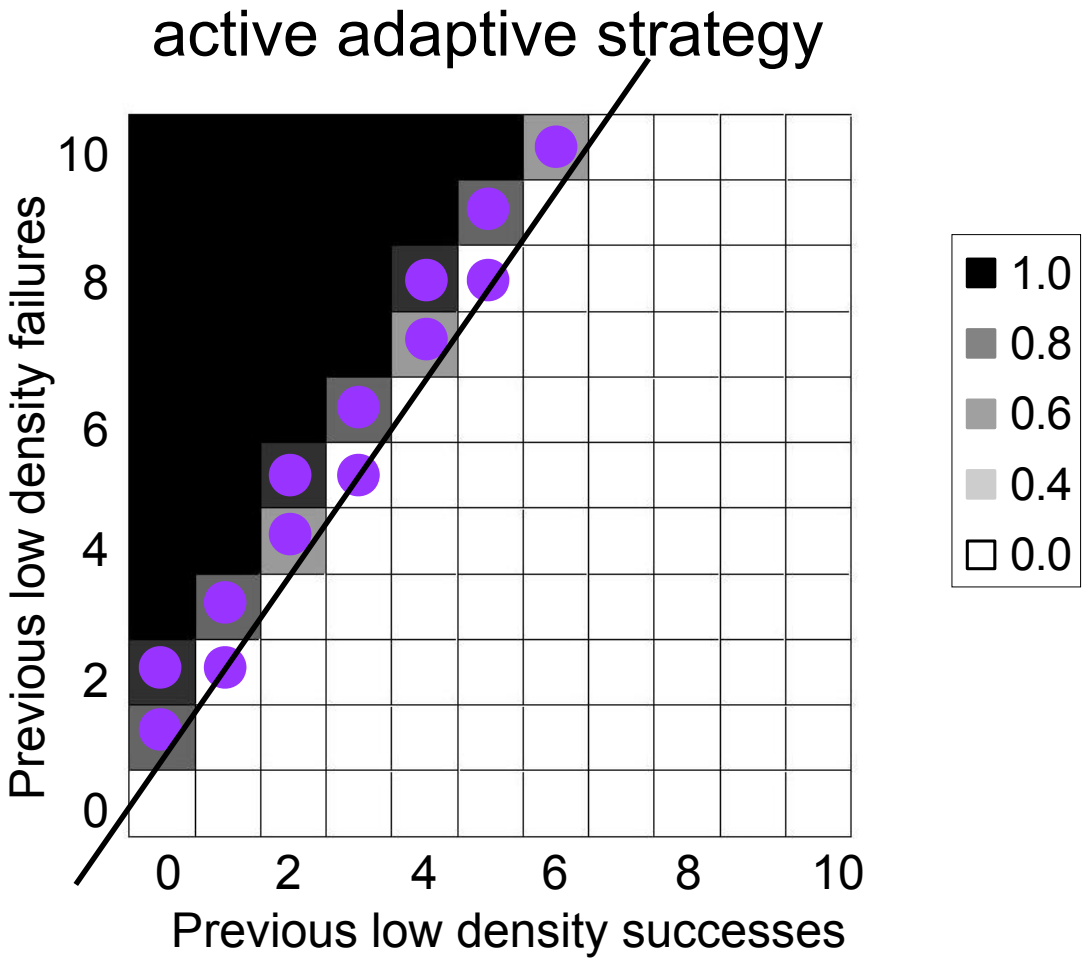

McCarthy and Possingham (2007) *Conserv. Biol.*

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When would we want to learn?

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discount the future less?

greater applicability of results?

a reward that depends on variance?

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Discounting the future

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Ecological Applications, 18(4), 2008, pp. 1061–1069

HOW WE VALUE THE FUTURE AFFECTS OUR DESIRE TO LEARN

ALANA L. MOORE,[1,4] CINDY E. HAUSER,[2] AND MICHAEL A. MCCARTHY[3]

[1]*Department of Mathematics and Statistics, University of Melbourne, Parkville, Victoria 3010 Australia*
[2]*Australian Centre of Excellence for Risk Analysis, School of Botany, University of Melbourne, Parkville, Victoria 3010 Australia*
[3]*School of Botany, University of Melbourne, Parkville, Victoria 3010 Australia*

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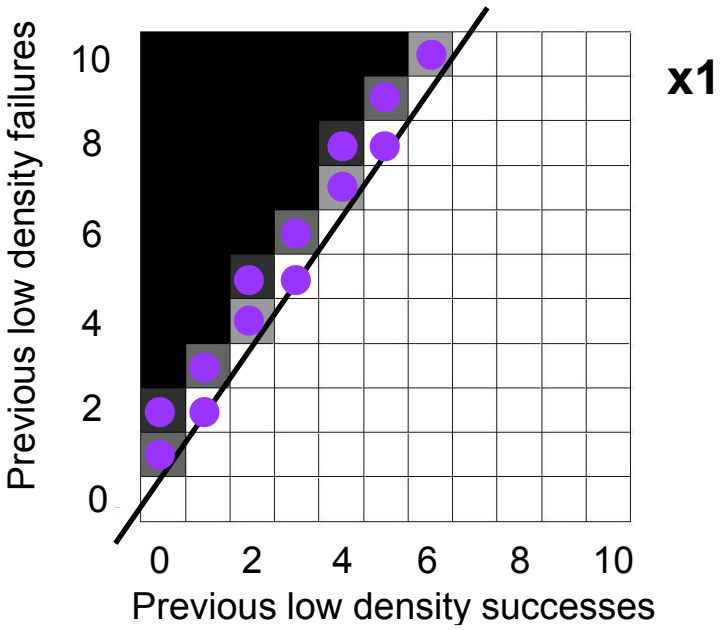
Moore and McCarthy (in prep.)



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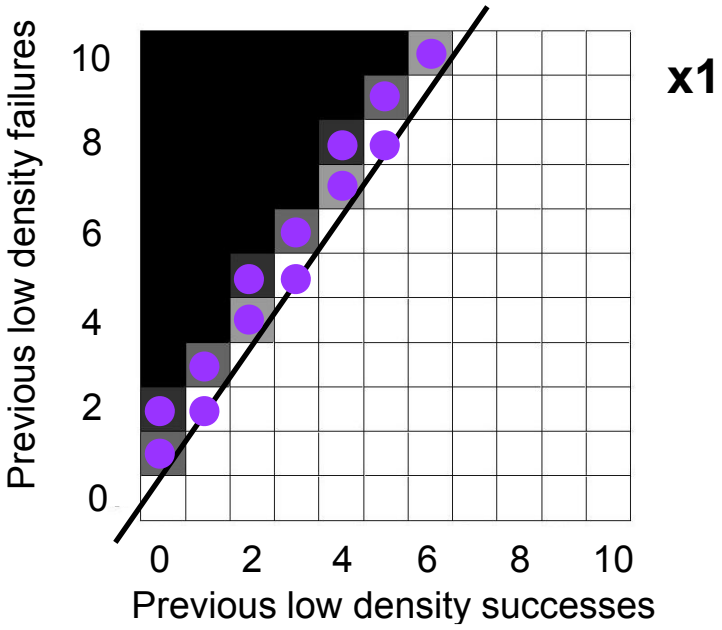

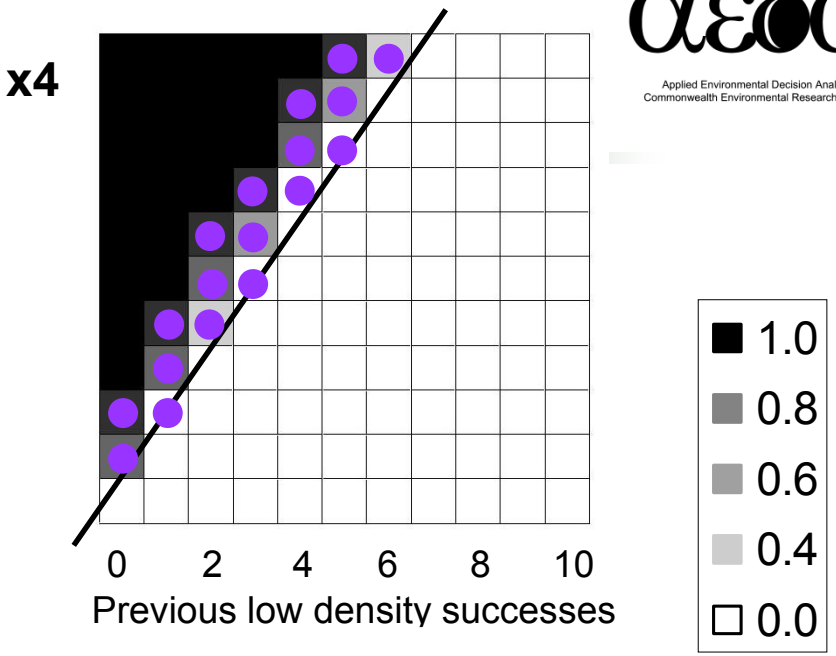

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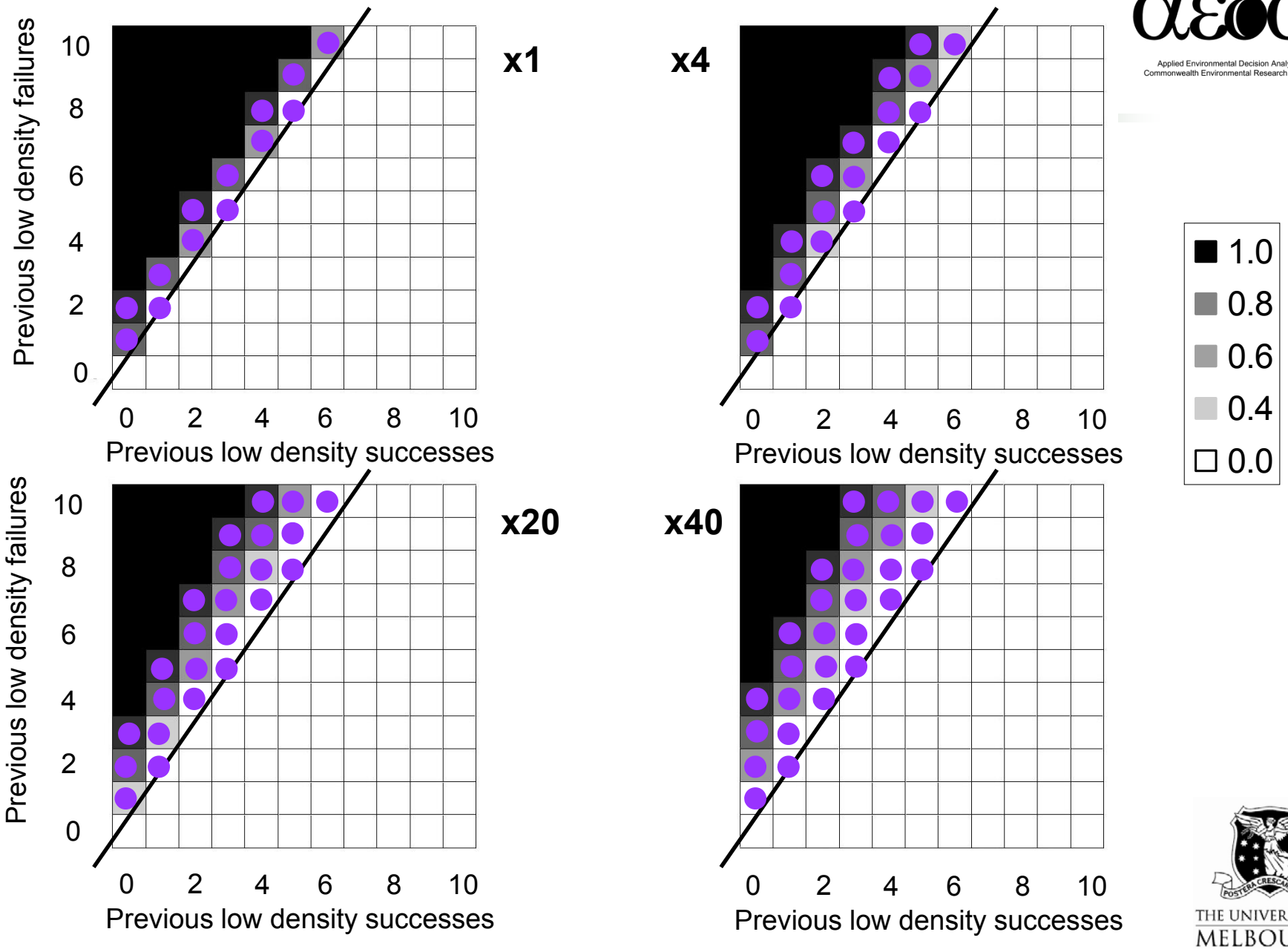

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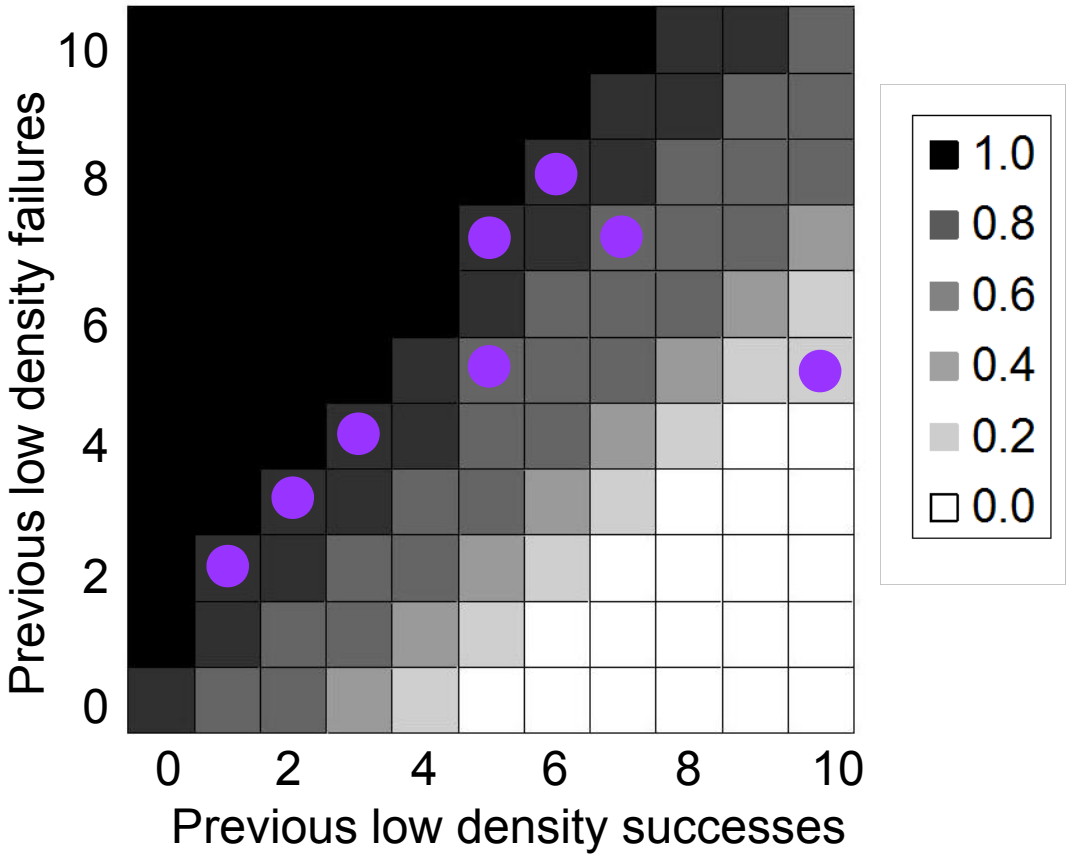
Minimising large failures (at least 3 areas successful per period)



McCarthy and Possingham (2007) *Conserv. Biol.*

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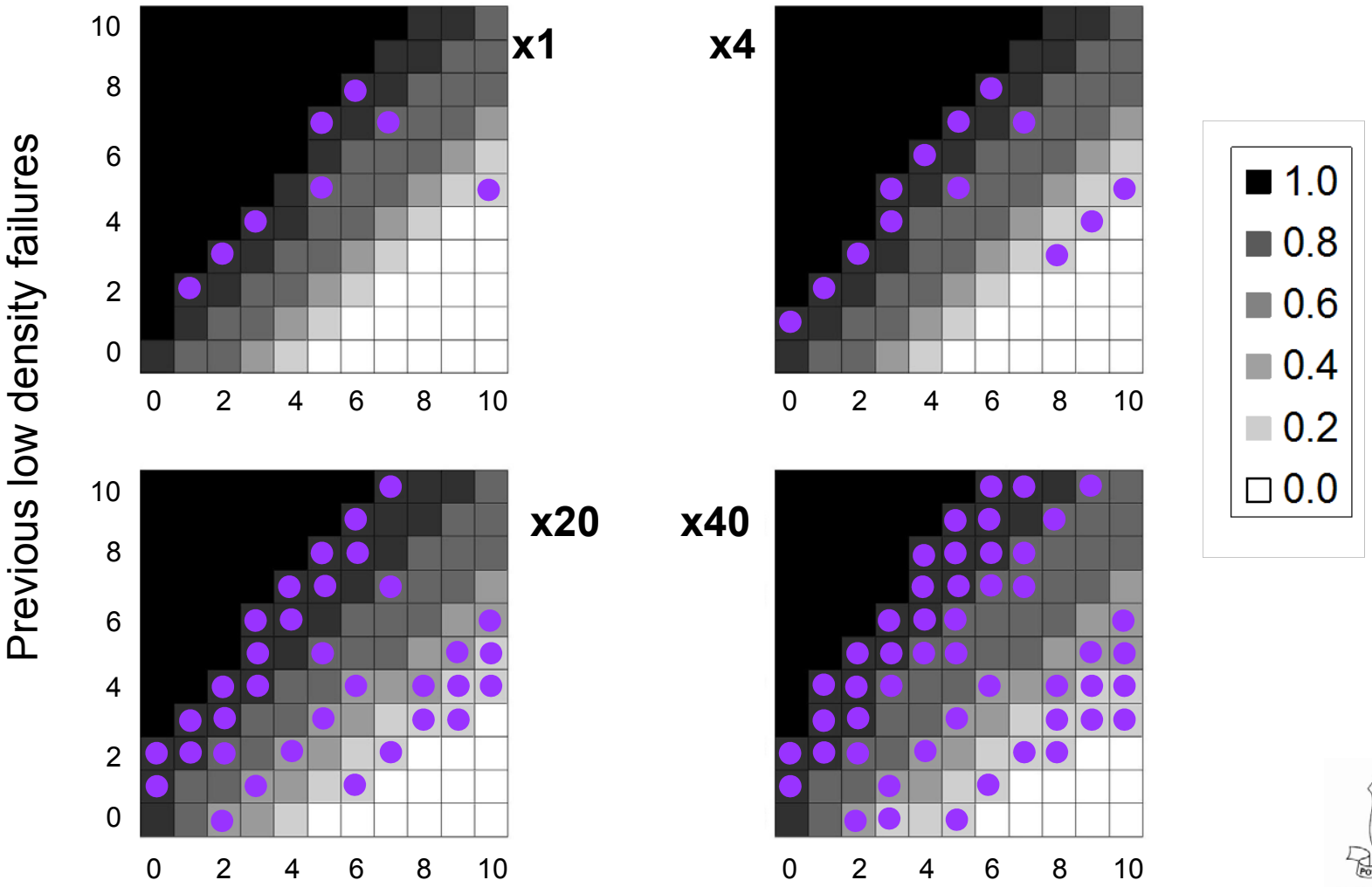

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Moore and McCarthy (in prep.)

When to spend money on learning?

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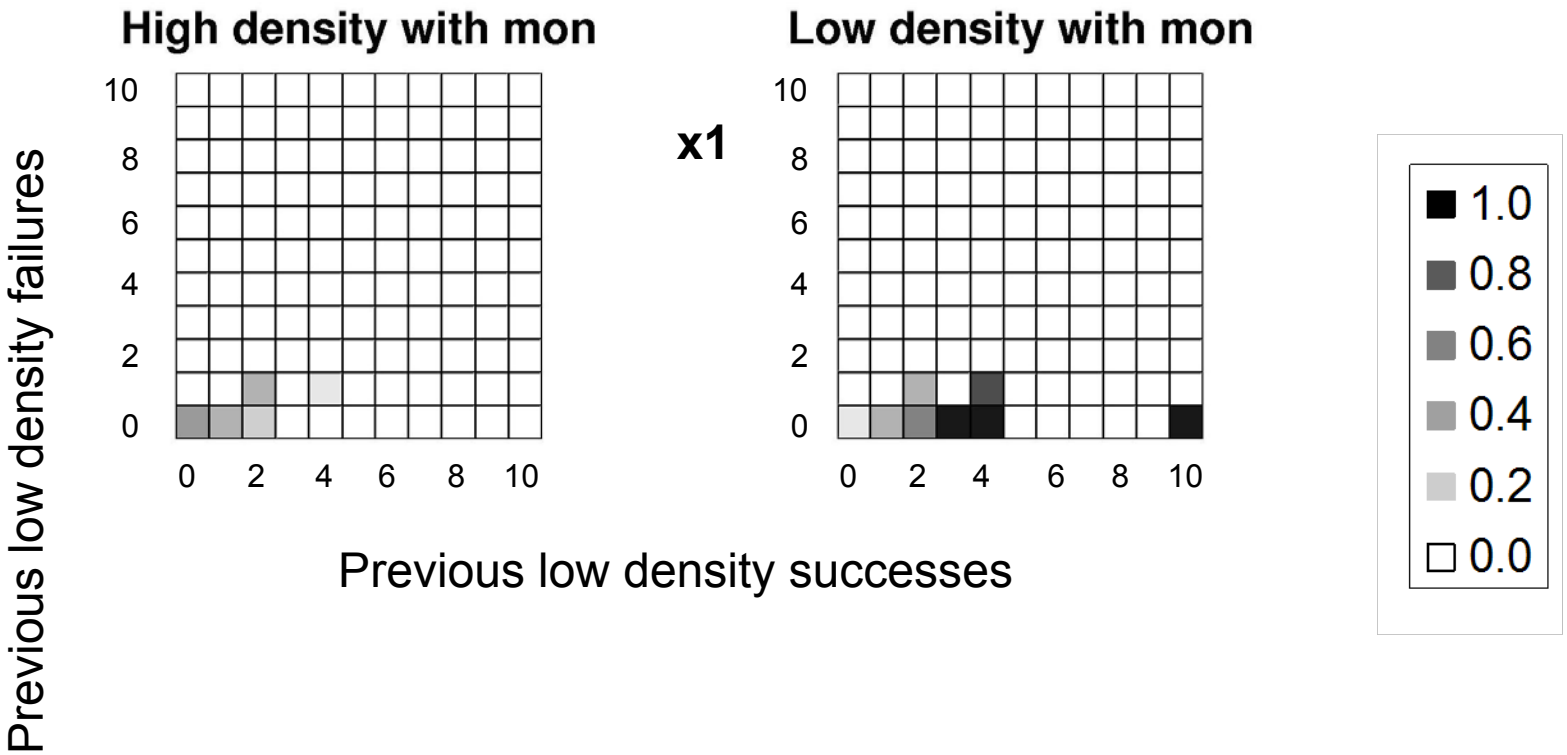

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Moore and McCarthy (in prep.)

When to spend money on learning?

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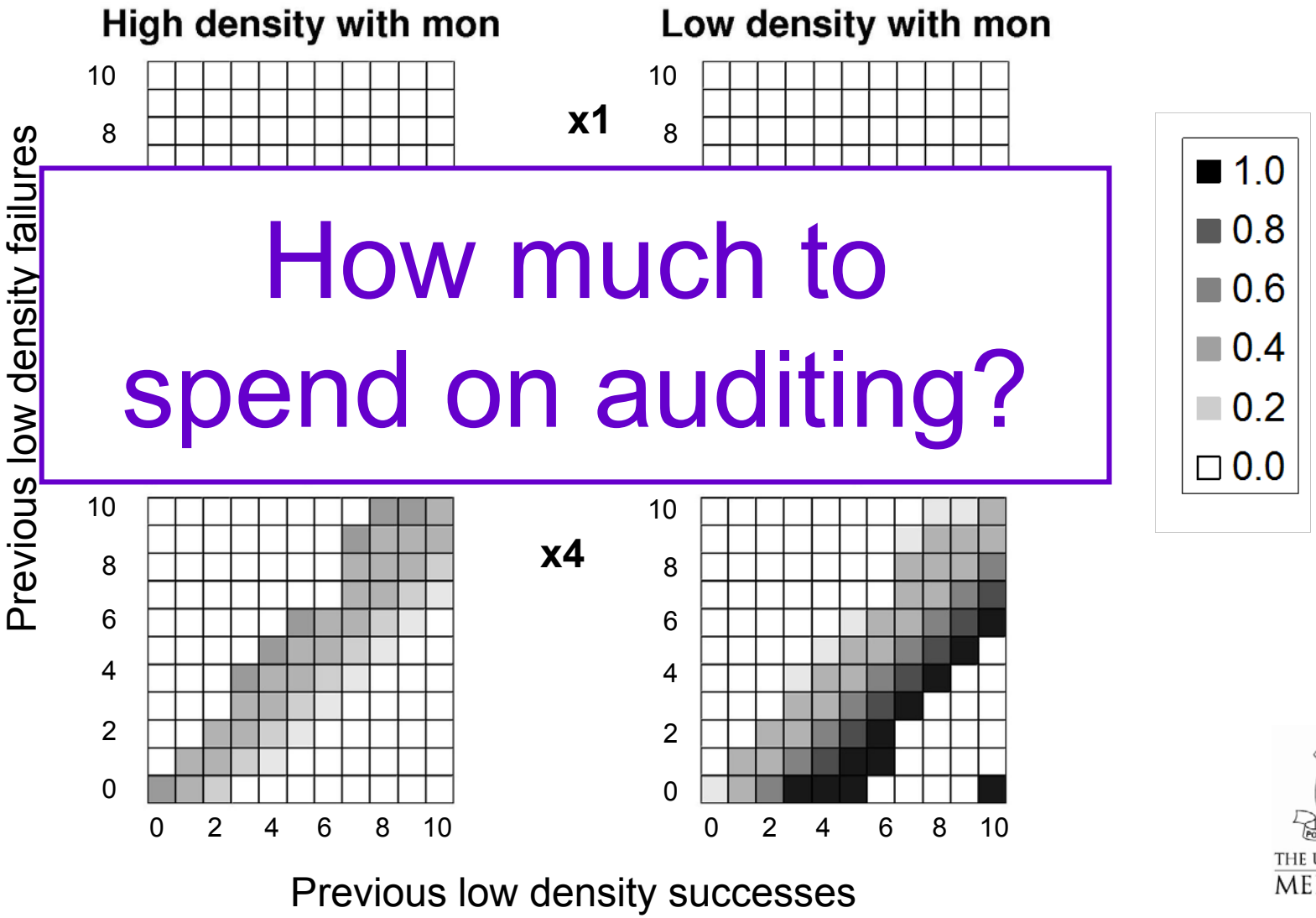

How much to spend on auditing?

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Factors that influence learning

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discount the future less

greater applicability of results

a reward that depends on variance

moa@unimelb.edu.au

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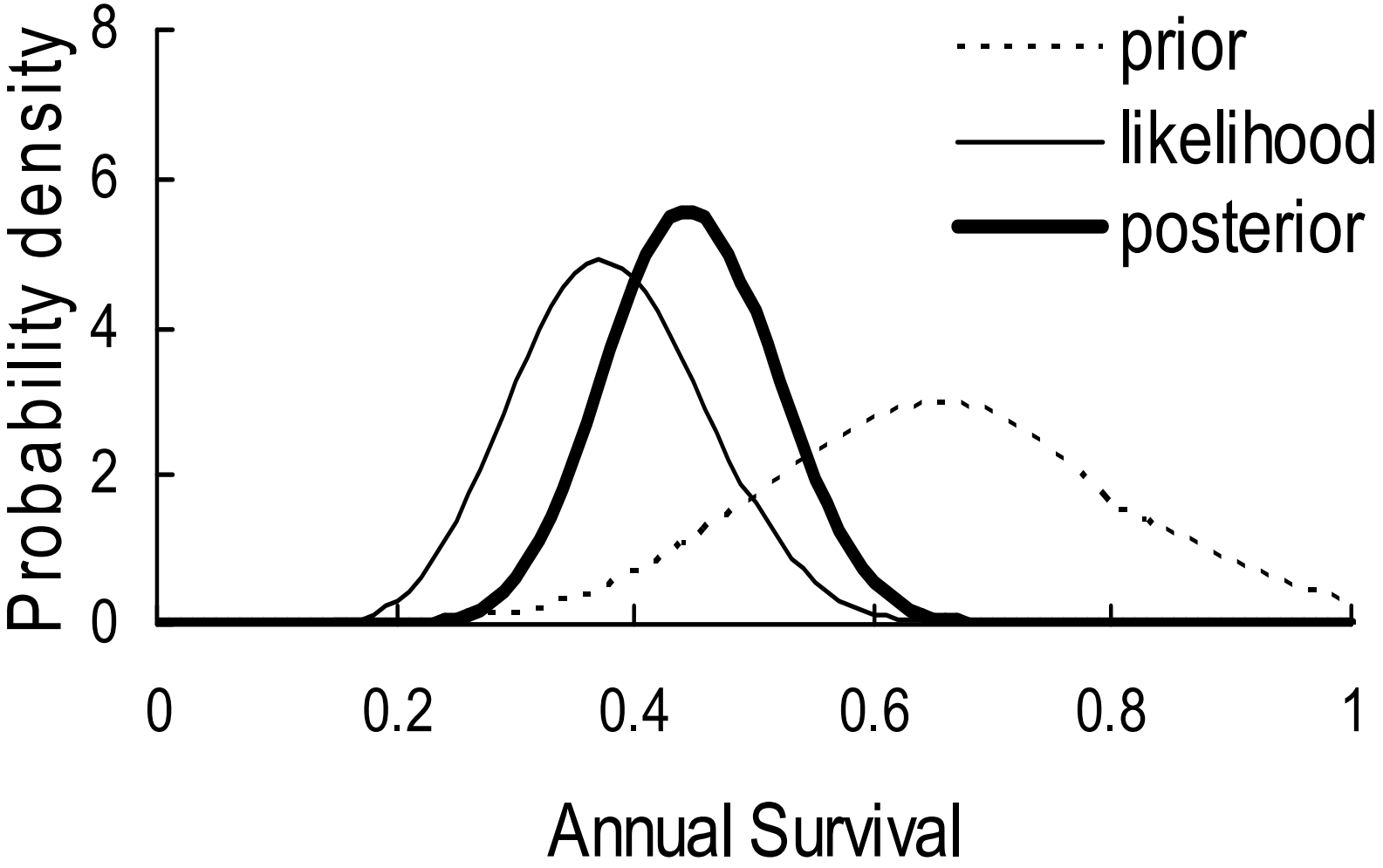
Bayesian updating



McCarthy et al. (2008) *Am. Nat.*

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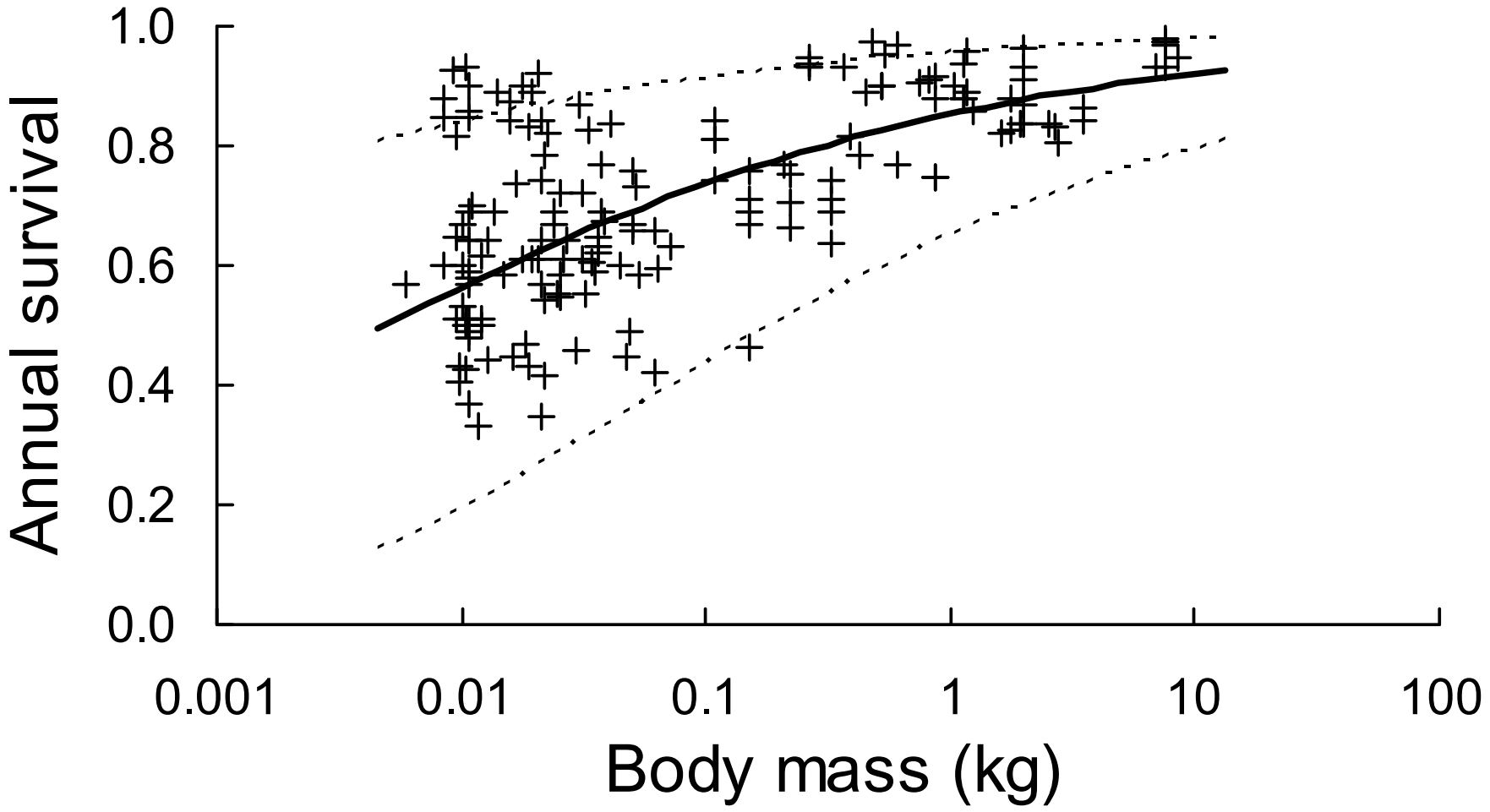
Annual survival of birds



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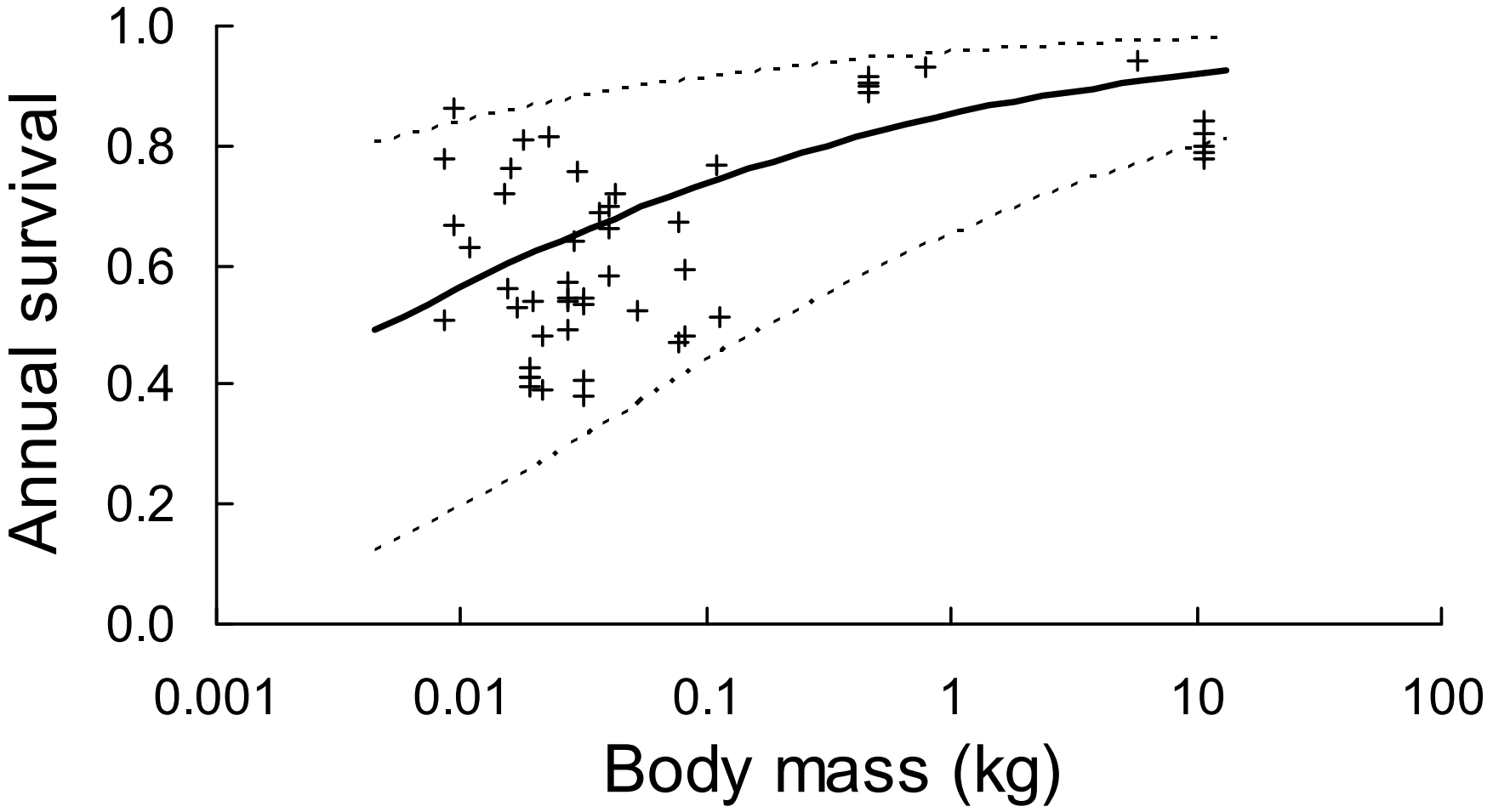

Proportion to high density planting

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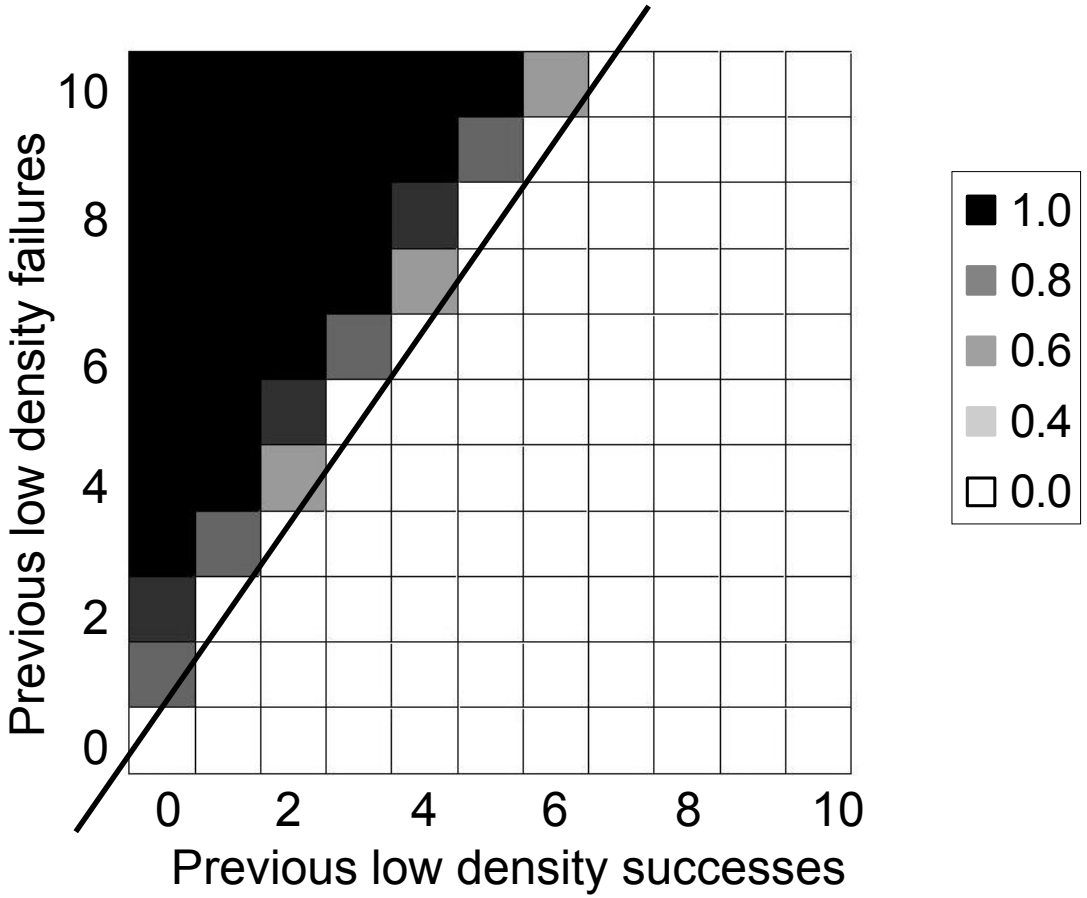

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