Optimally allocating resources for gathering evidence and managing biodiversity

Jeffrey Hanson

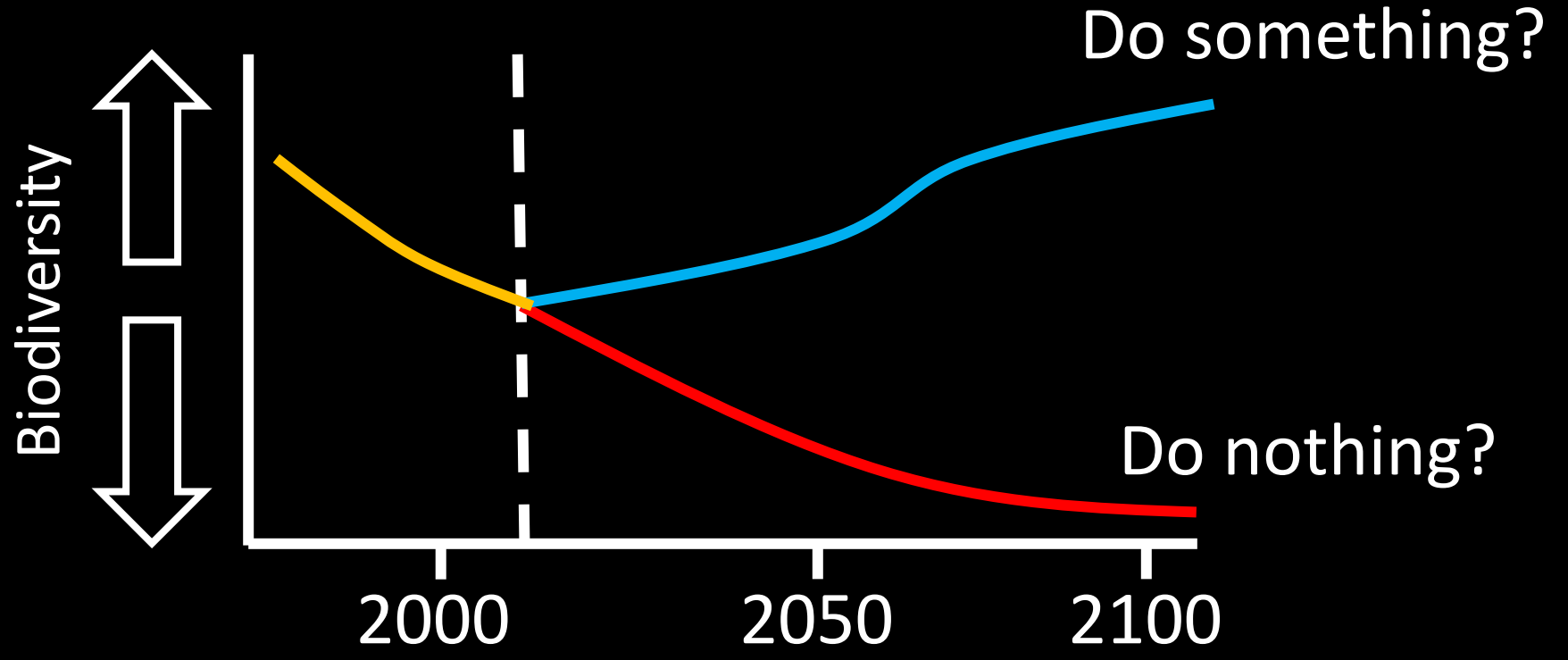
jeffrey.hanson@uqconnect.edu.au

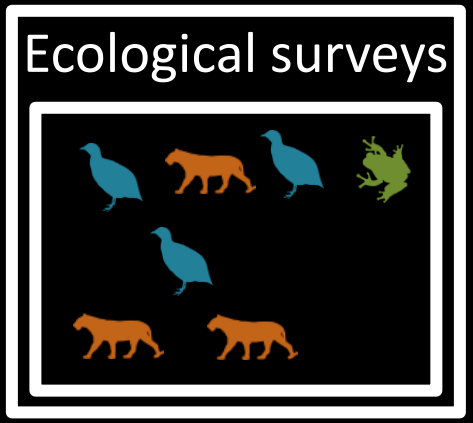
jeffrey-hanson.com

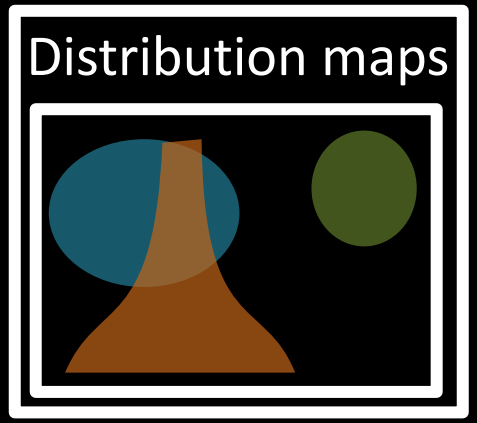
Acknowledgements

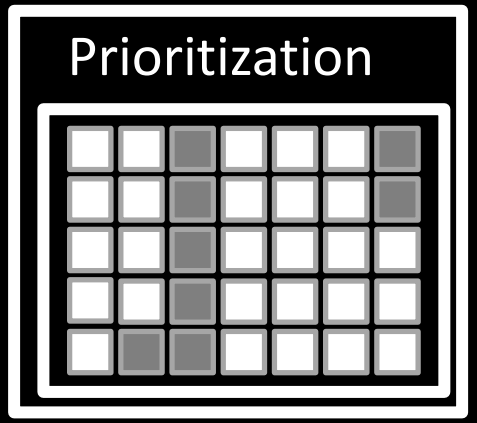
- Jenny McCune
- Iadine Chadès
- Caitlyn Proctor
- Joseph Bennett

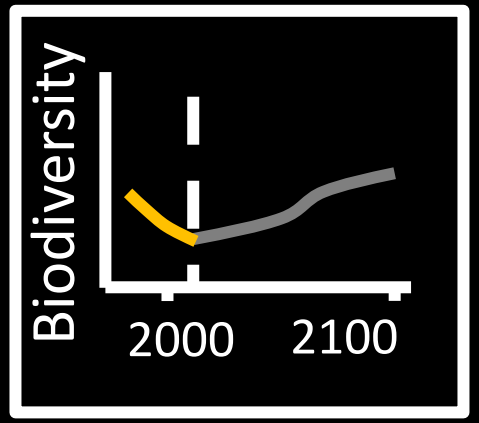
Carleton
UNIVERSITY


Biodiversity
Do something?
Do nothing?
2000
2050
2100



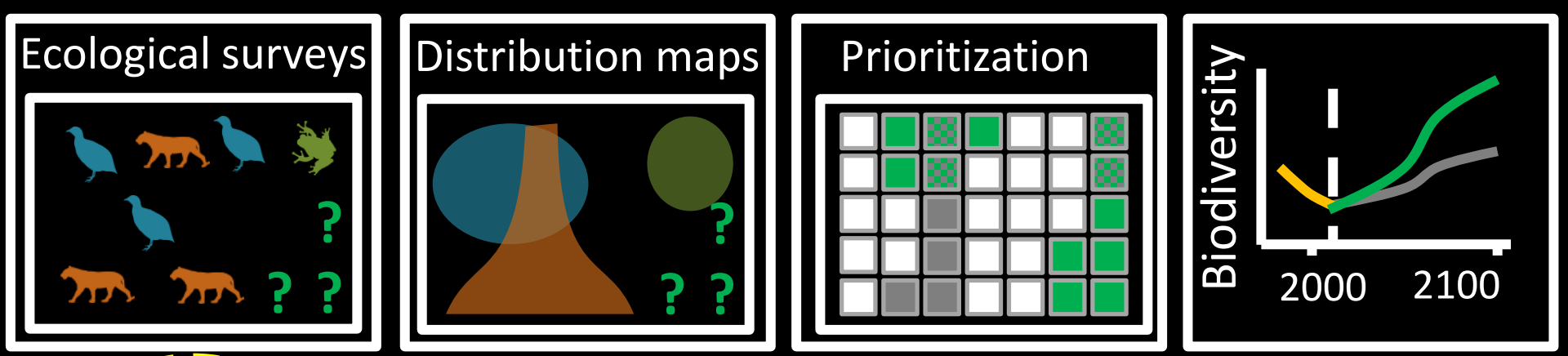






Data → Information → Action → Outcome

Objectives Constraints



Data → Information → Action → Outcome

More data

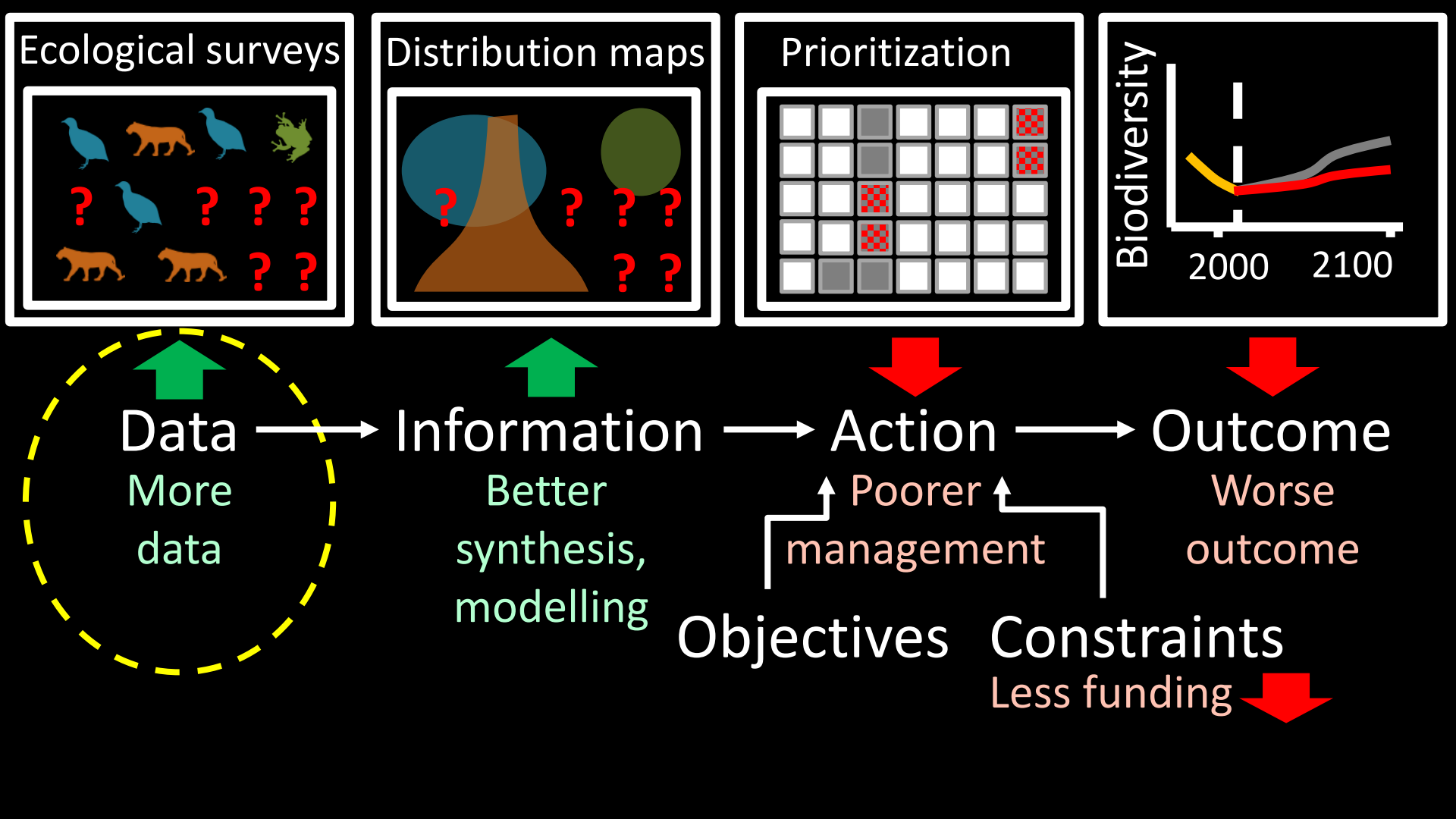
Better synthesis, modelling

Better management

Better outcome

Objectives

Constraints


Ecological surveys
Distribution maps
Prioritization
Biodiversity
2000
2100
Data
More data
Information
Better synthesis, modelling
Action
Poorer management
Outcome
Worse outcome
Objectives
Constraints
Less funding

How to design ecological surveys to gather more evidence?

Geographic Coverage?

Environmental conditions?

Cheapest places for conservation actions?

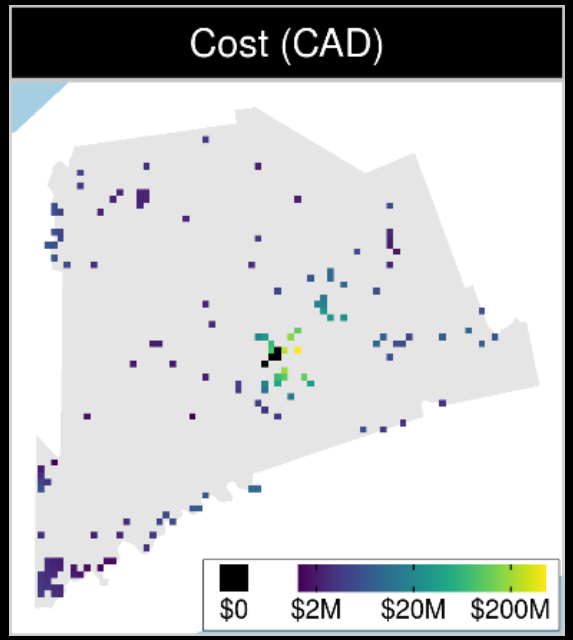
Places where we think threatened species might occur?

Places where we are uncertain if threatened species occur there?

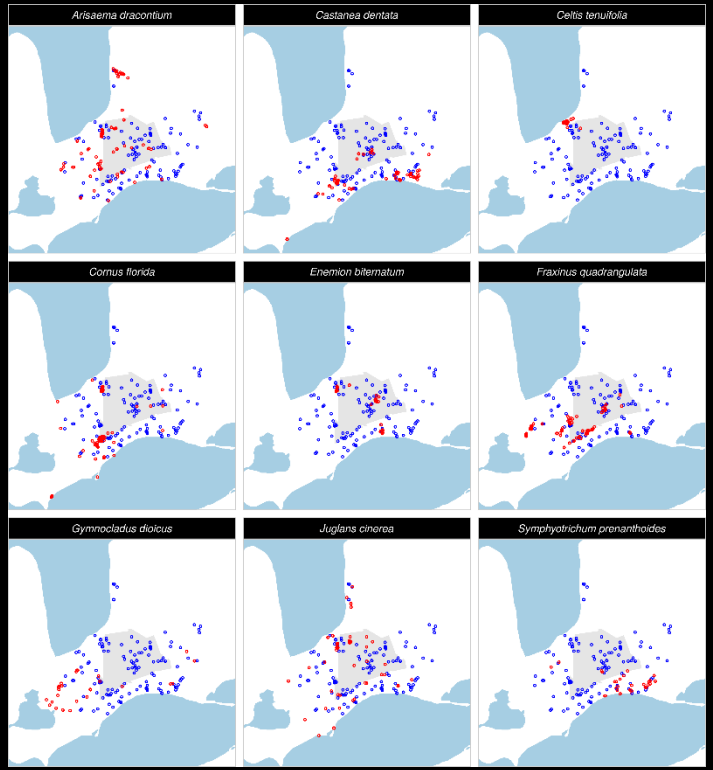
No where?
Just use existing data

Can’t we just maximize return on investment?

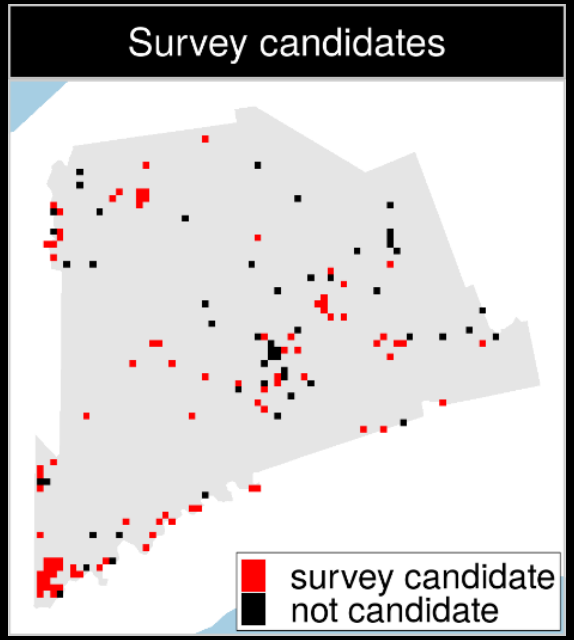
Case study: Middlesex county, Canada



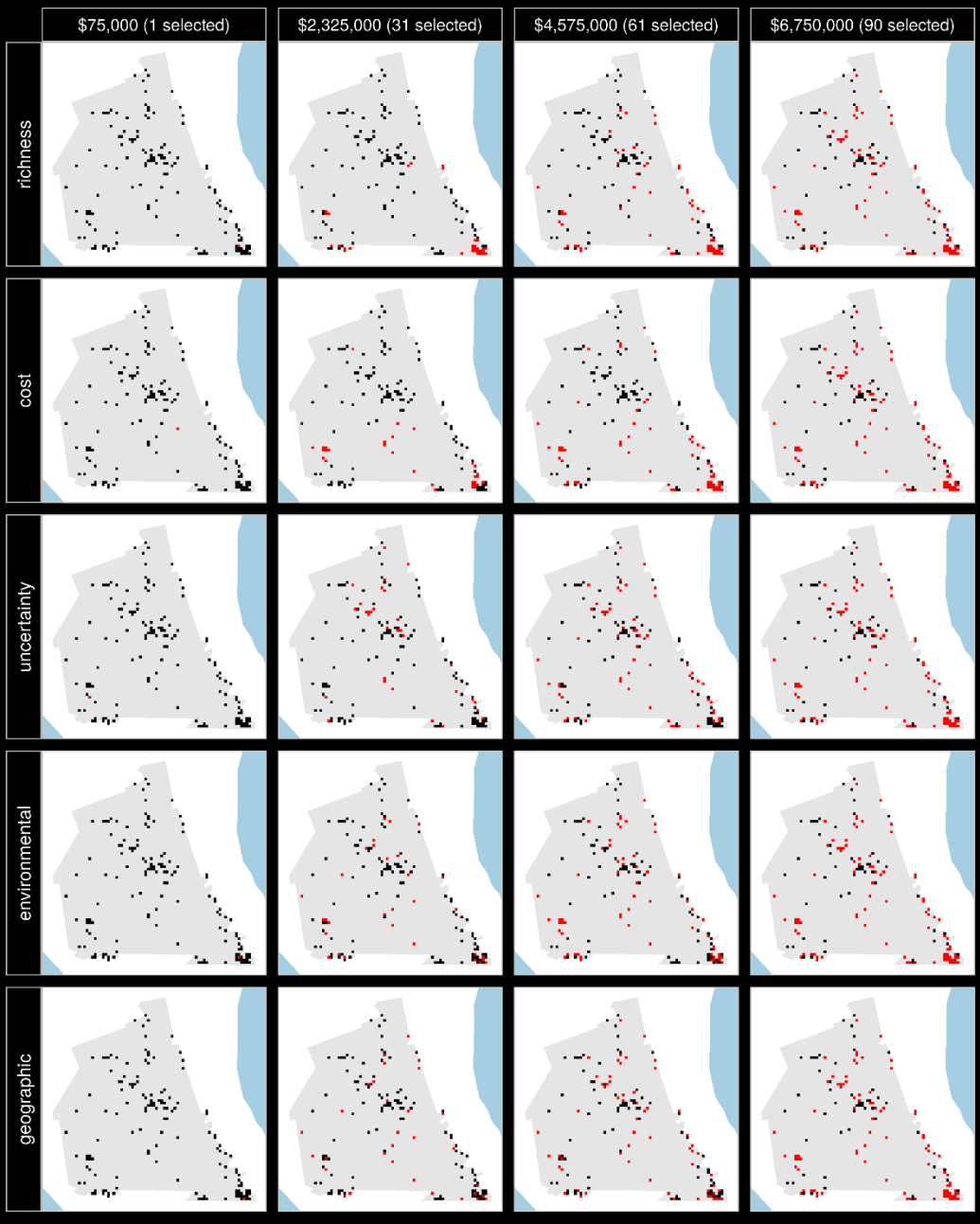
90 places that could potentially be acquired for protected area establishment



9 imperilled plant species

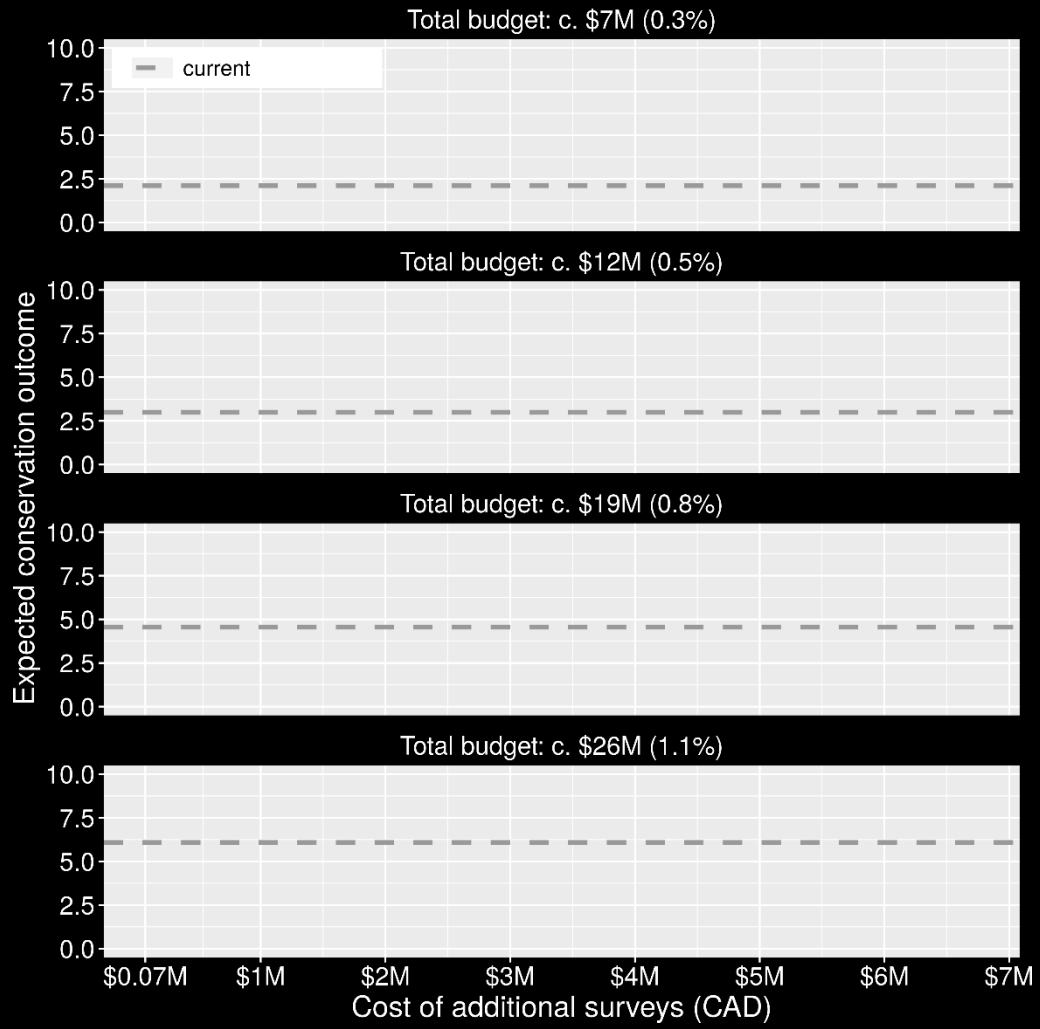


142 places that could potentially be surveyed to improve existing data


$75,000 (1 selected)
$2,325,000 (31 selected)
$4,575,000 (61 selected)
$6,750,000 (90 selected)
richness
cost
uncertainty
environmental
geographic

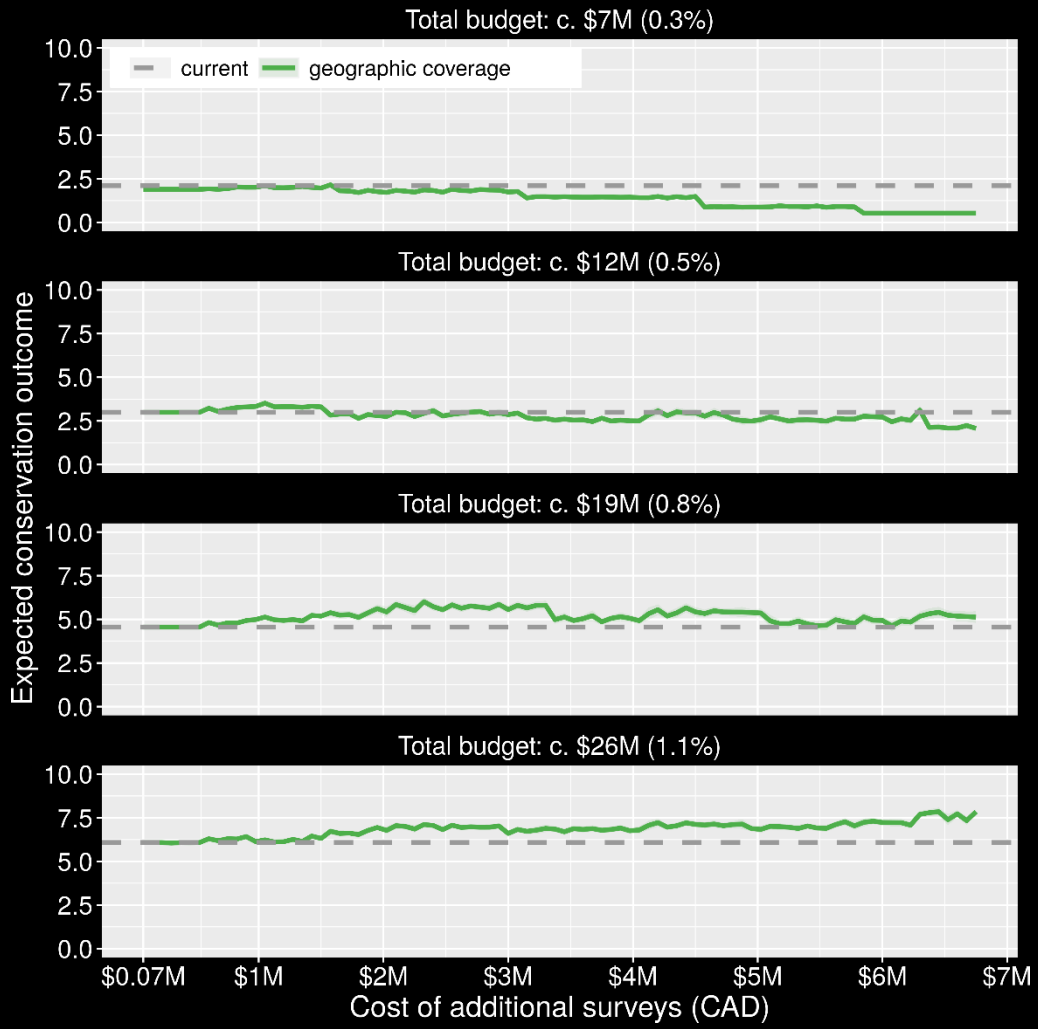
Value of information

- Existing evidence leads to positive outcomes
- More budget means better outcomes



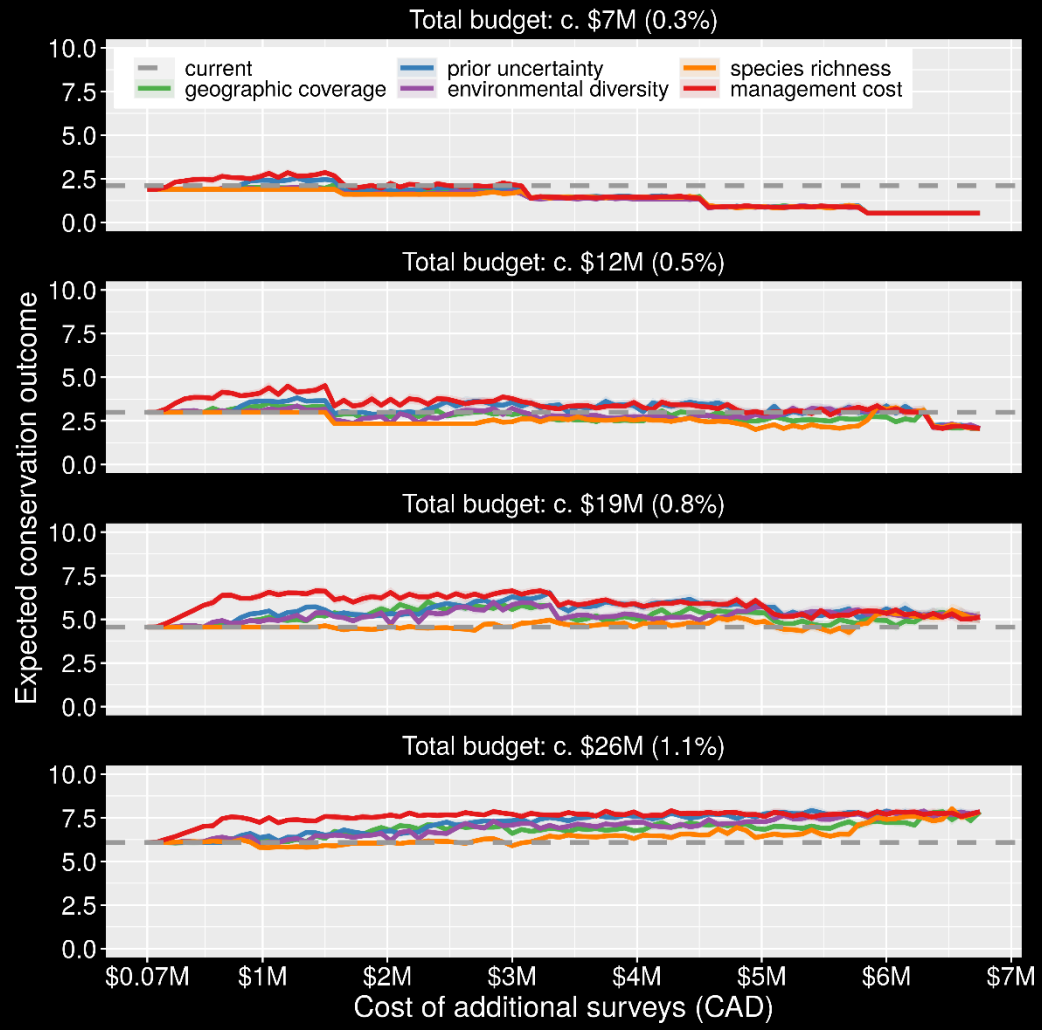
Value of information

- Spending funds on gathering additional evidence can mean worse outcomes
- Spending funds on gathering additional evidence can mean better outcomes too



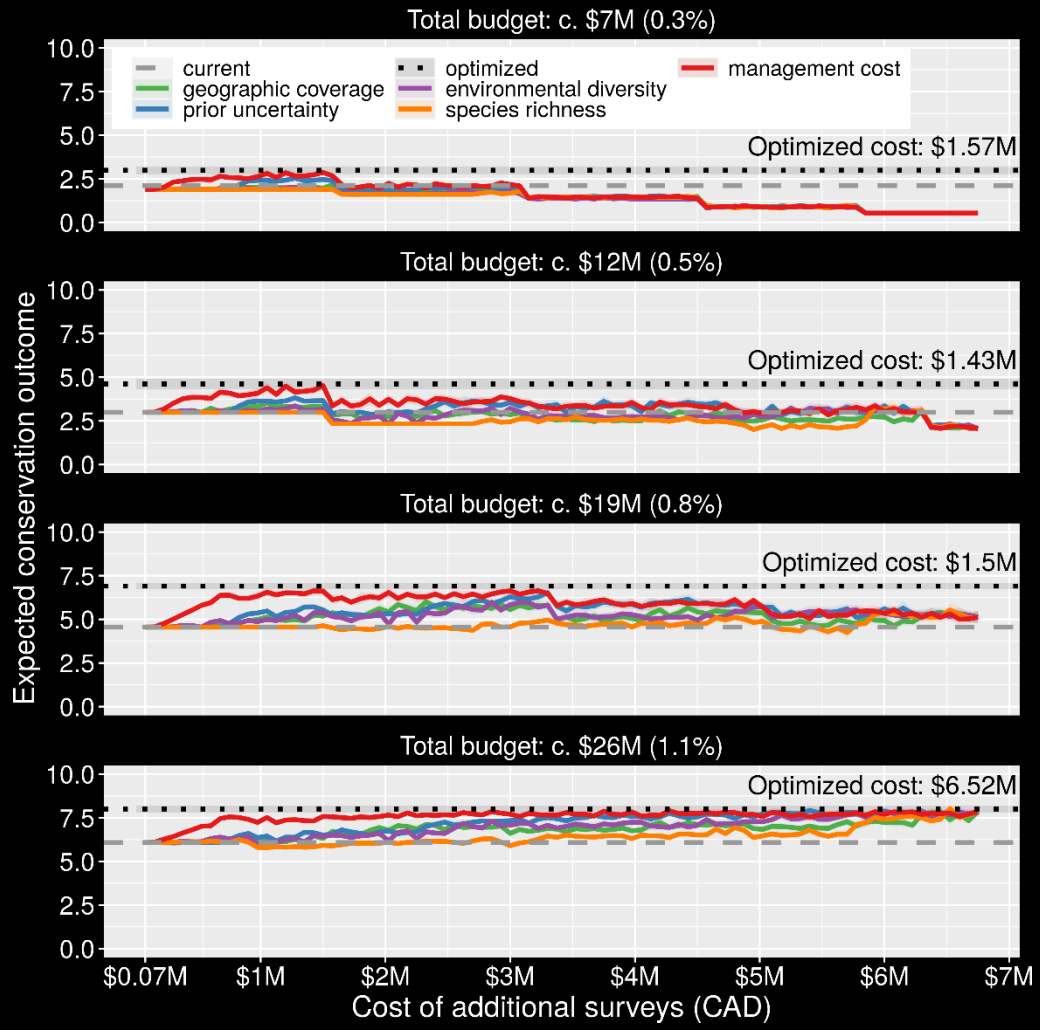
Value of information

- Conventional approaches for gathering additional evidence have different performance
- Performance of these approaches depends on available funds
- All of them could lead to lead to worse outcomes



Value of information

- Directly maximizing return on investment is best method for gathering evidence
- This considers objectives and constraints that underpin conservation plans and their success

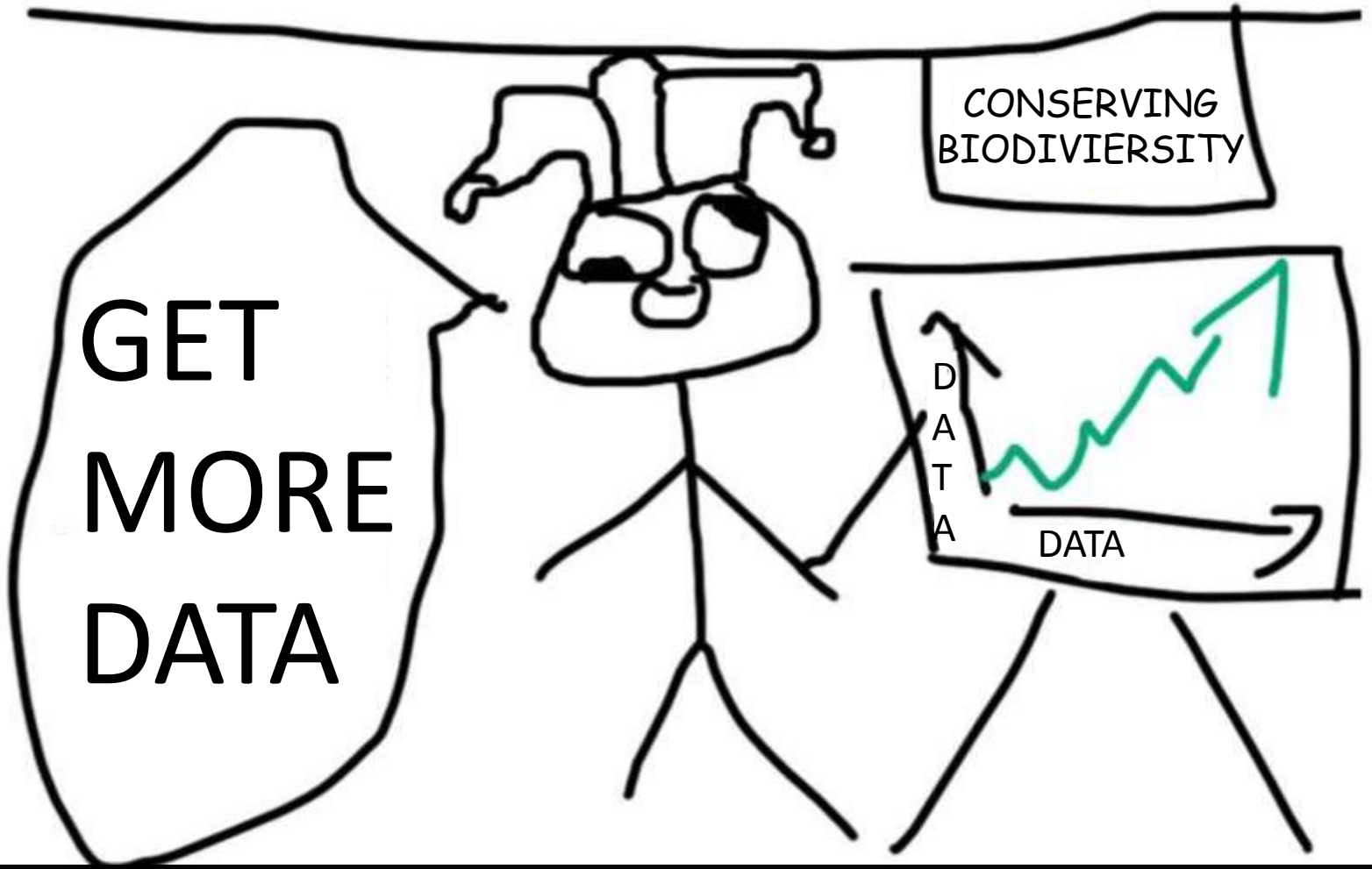


More evidence not always better

jeffrey.hanson@uqconnect.edu.au

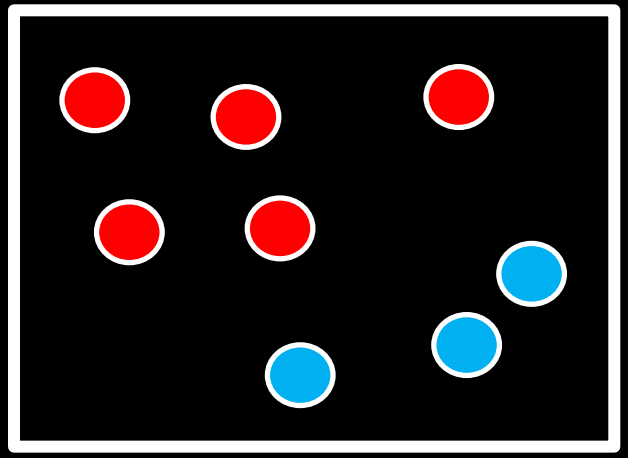
github.com/jeffreyhanson

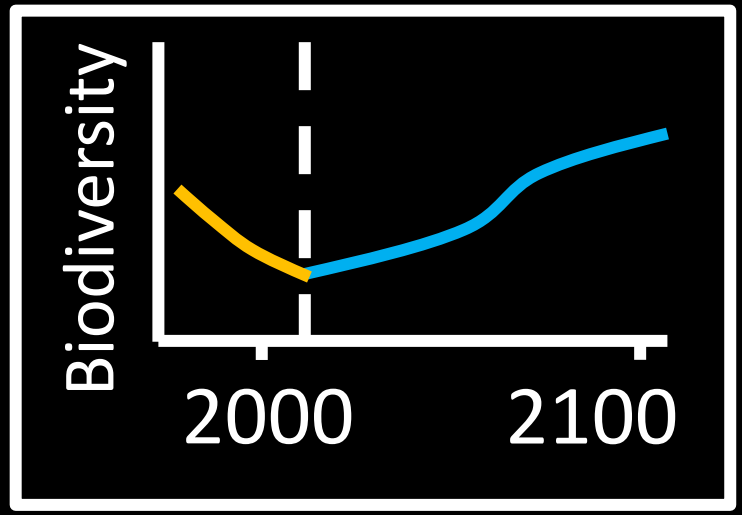
jeffrey-hanson.com


GET
MORE
DATA
CONSERVING
BIODIVIERSITY
DATA
DATA

Appendix

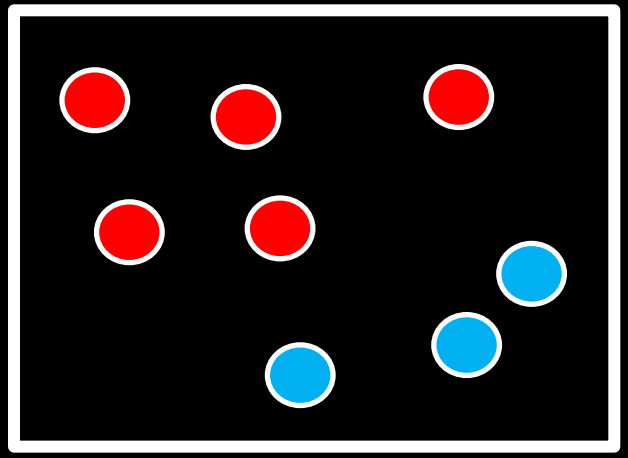
Ecological surveys for threatened spp.



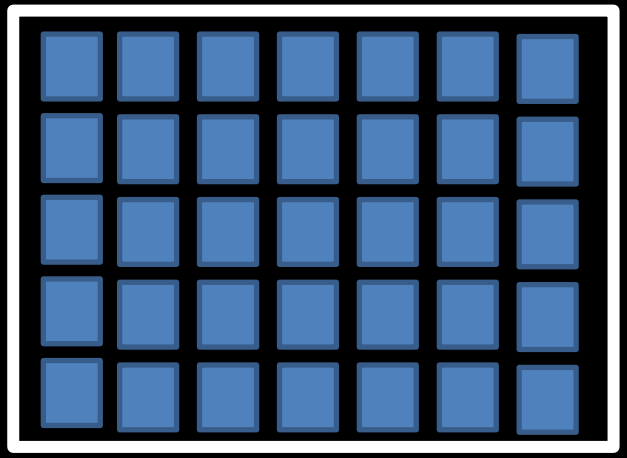


Data → ? → Outcome

Ecological surveys for threatened spp.



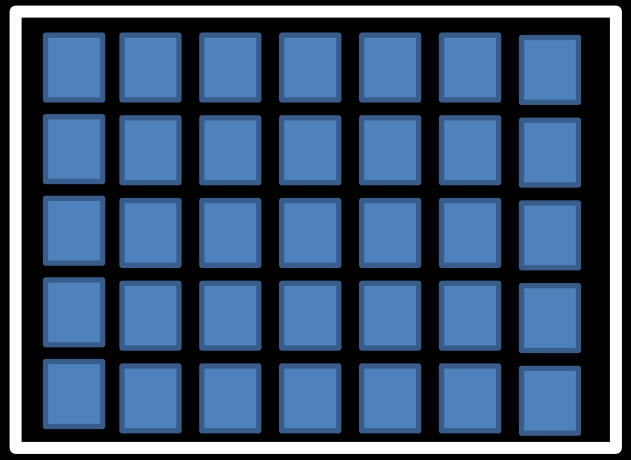
Spatial distribution of threatened spp.



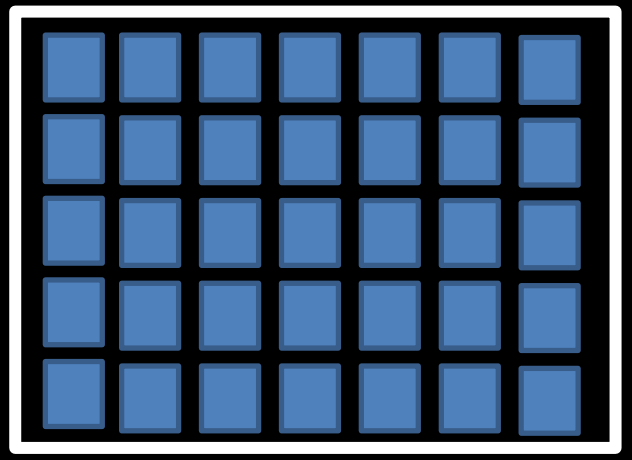
Data → Information

Outcome ← ? ←

Spatial distribution of threatened spp.

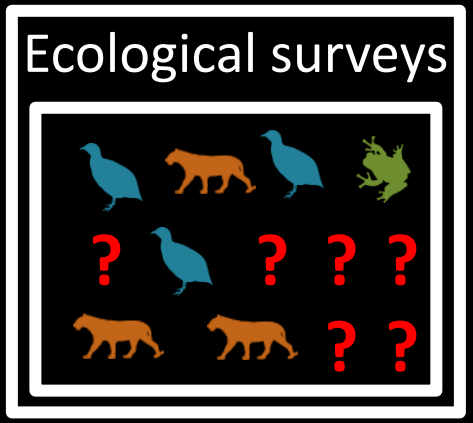


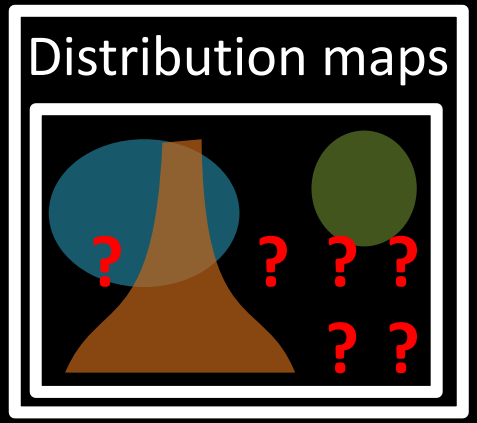
Priorities for protected areas

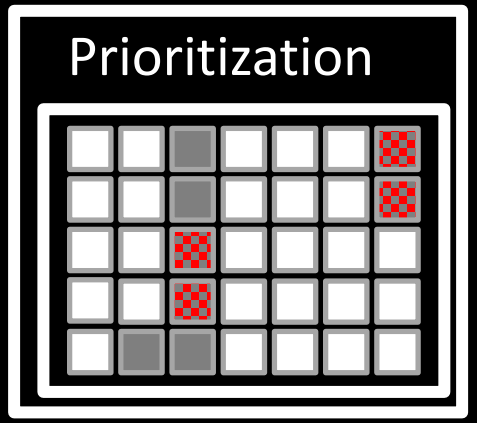


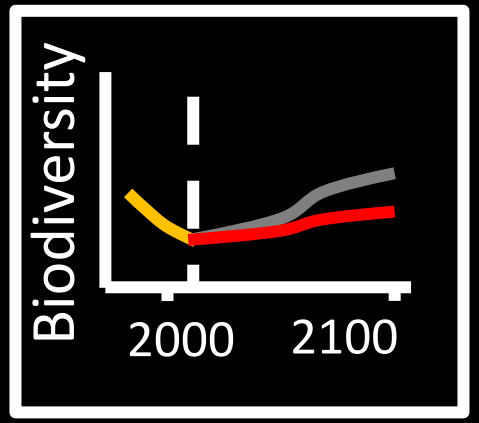
Information → Plan?

Plan? → Outcome ← ? ← Data ← Information









Objectives

Data → Information → Plan → Action → Outcome

More data

Better synthesis, modelling

Poorer management

Worse outcome

Constraints

Less funding