Prioritising conservation actions for a multi-tenured grassland reserve system

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RMIT UNIVERSITY

Introduction

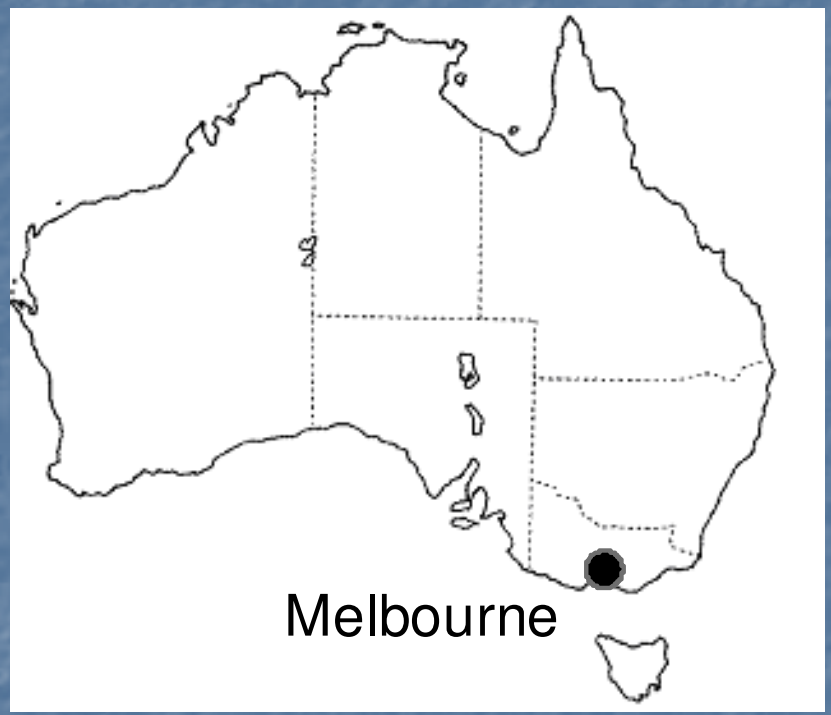
- Urgent need for efficient allocation of resources for conserving biodiversity
- Governments supplementing public conservation with market-based policies for conservation on private land
- What are advantages of private land conservation?
- How should resources be split between public and private conservation
- We're developing models to examine this question

Multi-tenured conservation reserves

- How to combine
  - purchasing land for *public* conservation reserves
  - *private* land conservation
- A trade-off:
  - public conservation: high price, high security
  - private conservation contracts: low price, low security
- How to split resources ?

Background

- Western (Basalt) Plains Natural Temperate Grassland
- One of Australia's most endangered ecosystems
  - < 0.5% of original extent remains
- Most remaining remnants on private land



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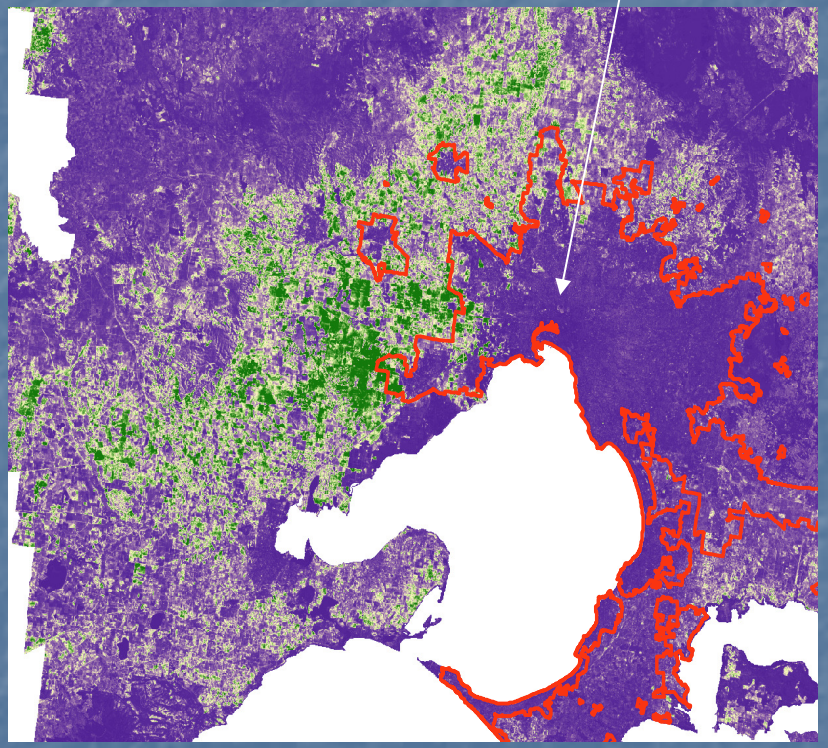
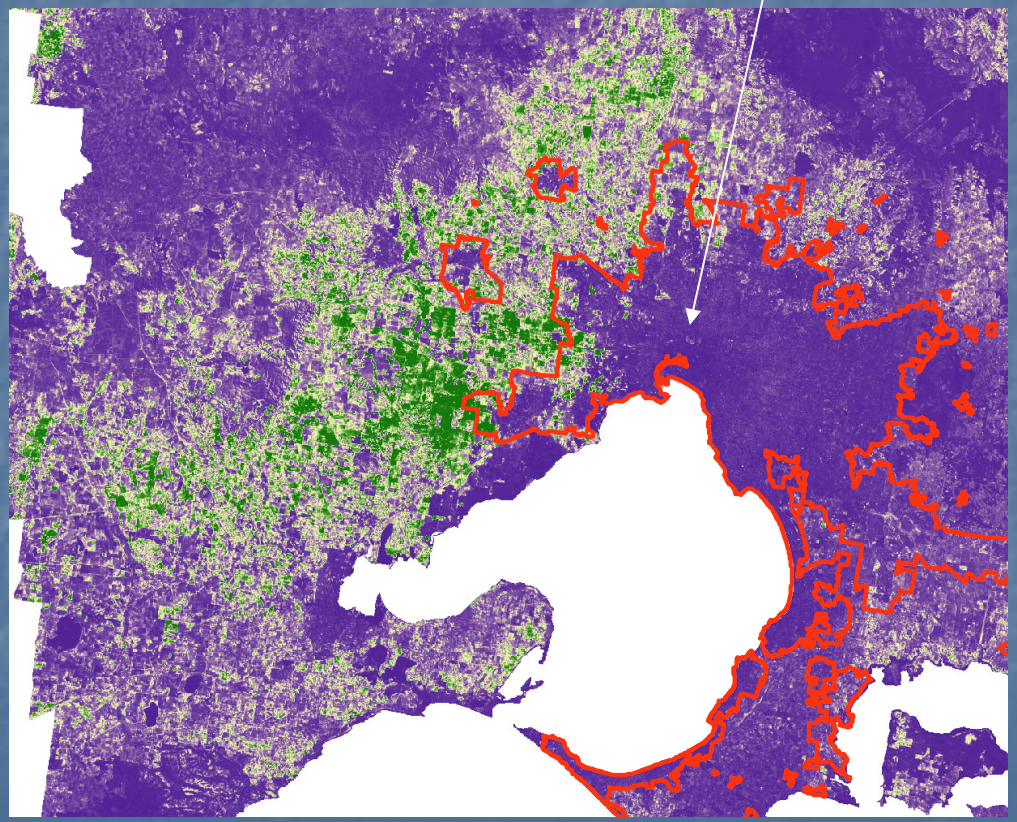


Evaluation Framework

- Define landscape
- Define spp distributions
- Define costs and PUs
- Undertake conservation actions
- Model system dynamics
- Collate Results



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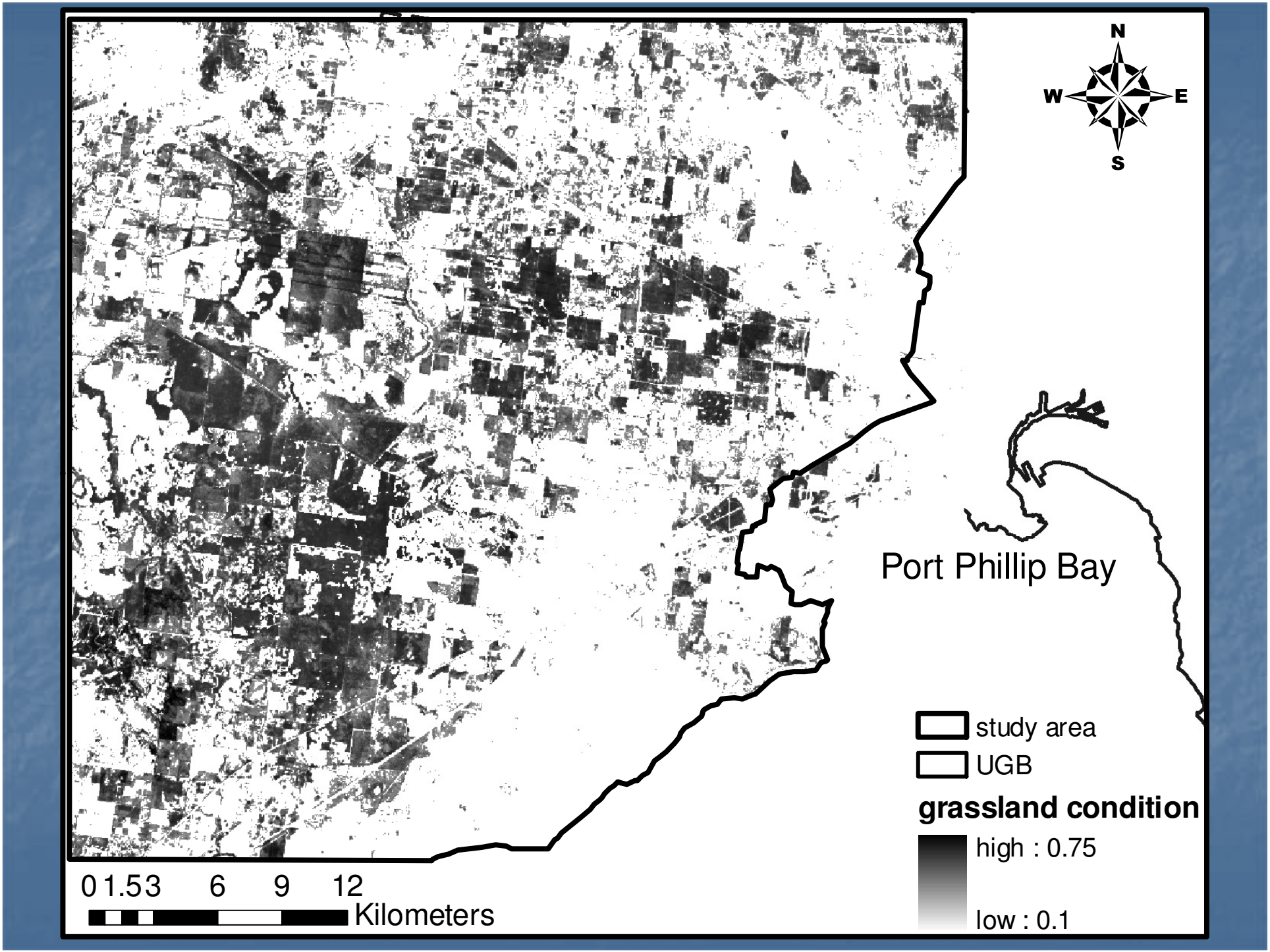
In this case only have 1 “species”


N
W
E
S
Port Phillip Bay
study area
UGB
grassland condition
high : 0.75
low : 0.1
0 1.5 3 6 9 12
Kilometers

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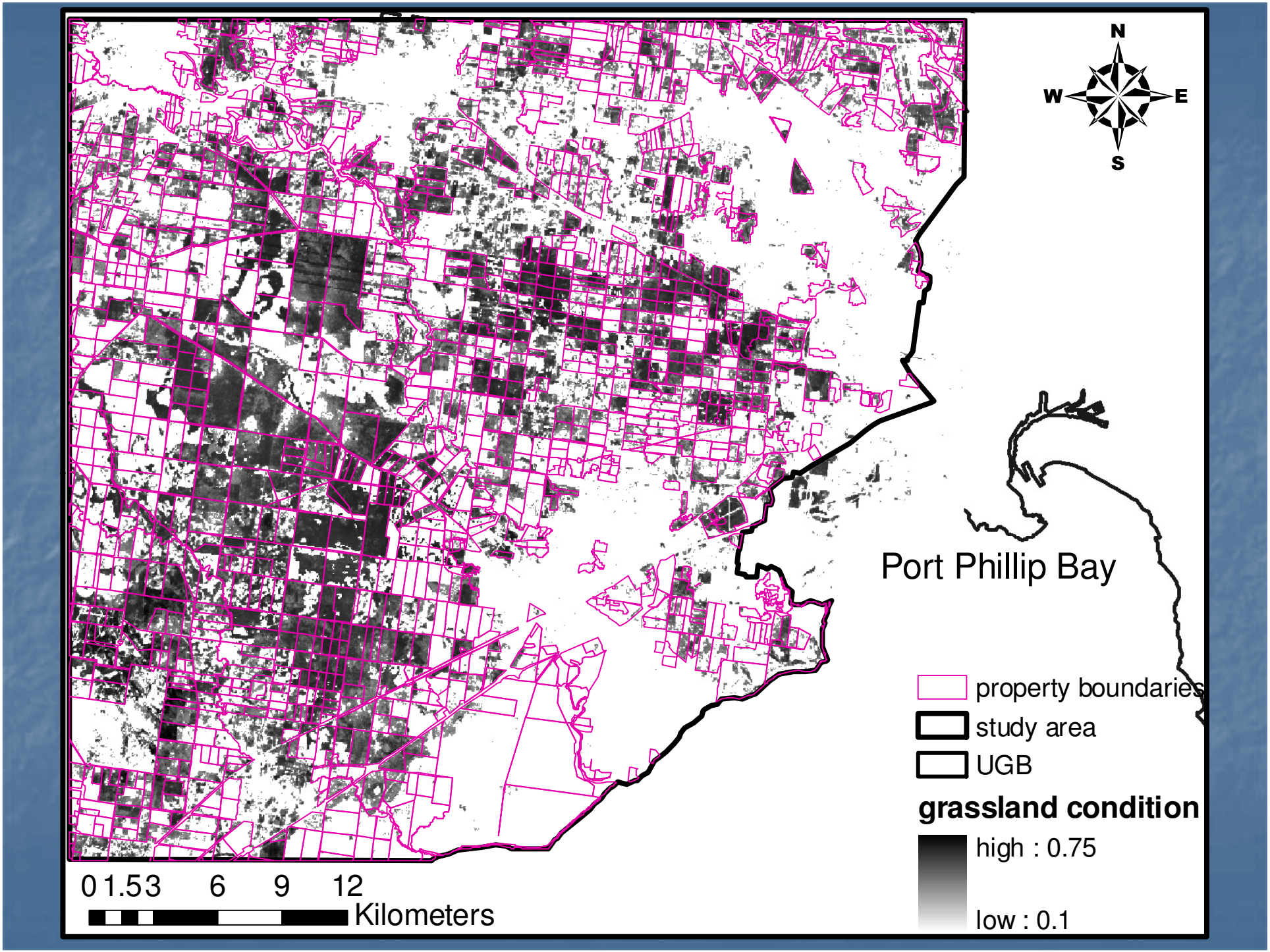
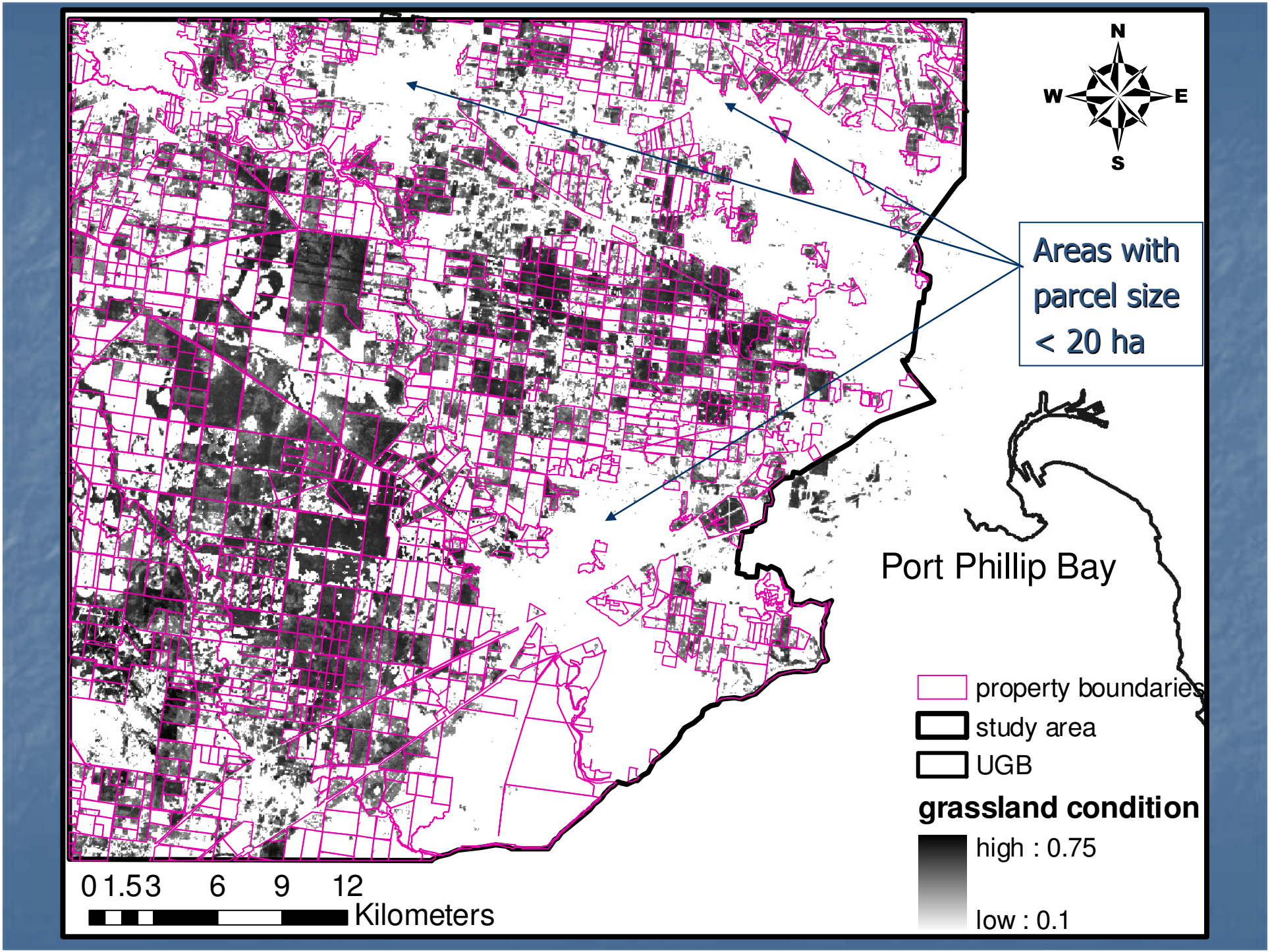

N
W
E
S
Port Phillip Bay
property boundaries
study area
UGB
grassland condition
high : 0.75
low : 0.1
0 1.5 3 6 9 12
Kilometers


N
W
E
S
Areas with parcel size < 20 ha
Port Phillip Bay
property boundaries
study area
UGB
grassland condition
high : 0.75
low : 0.1
0 1.5 3 6 9 12
Kilometers

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Used a range of values for the ratio

[management] : [purchase]

Show results for 1:10 and 1:20

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- Fixed budget each time step (~1% total cost)
- Each time step can spend entire budget on:
  - *public conservation*
  - *private conservation*
  - *split equally between both*

Evaluation Framework

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- Development
  - *randomly select parcels to be developed*
  - *assume all grassland on developed parcels removed*
- Grassland condition change

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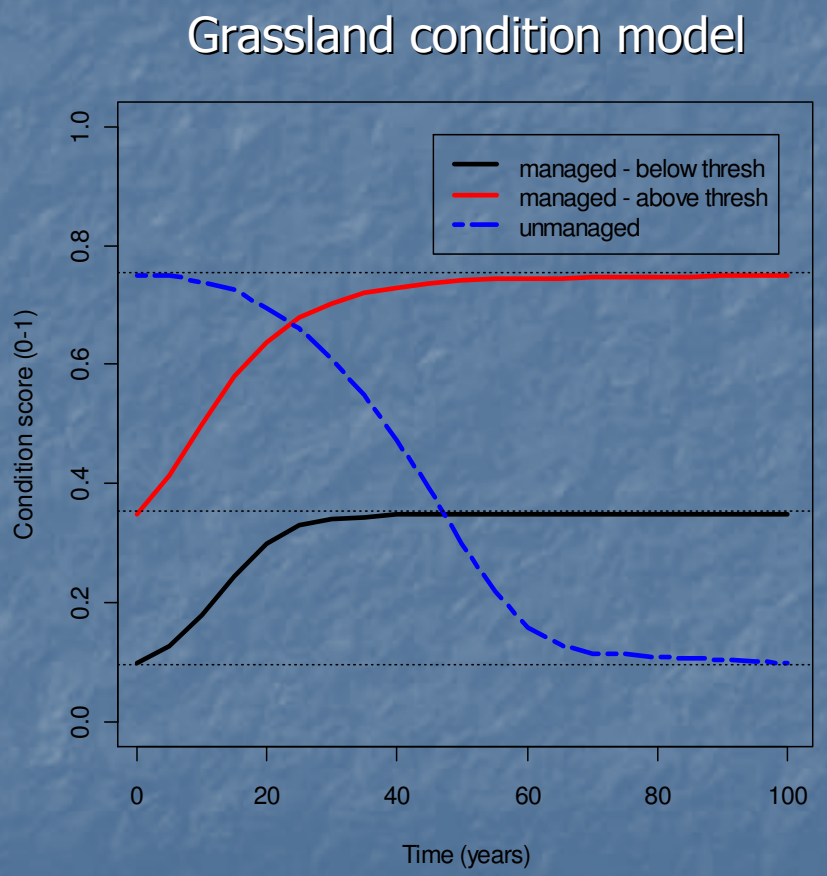
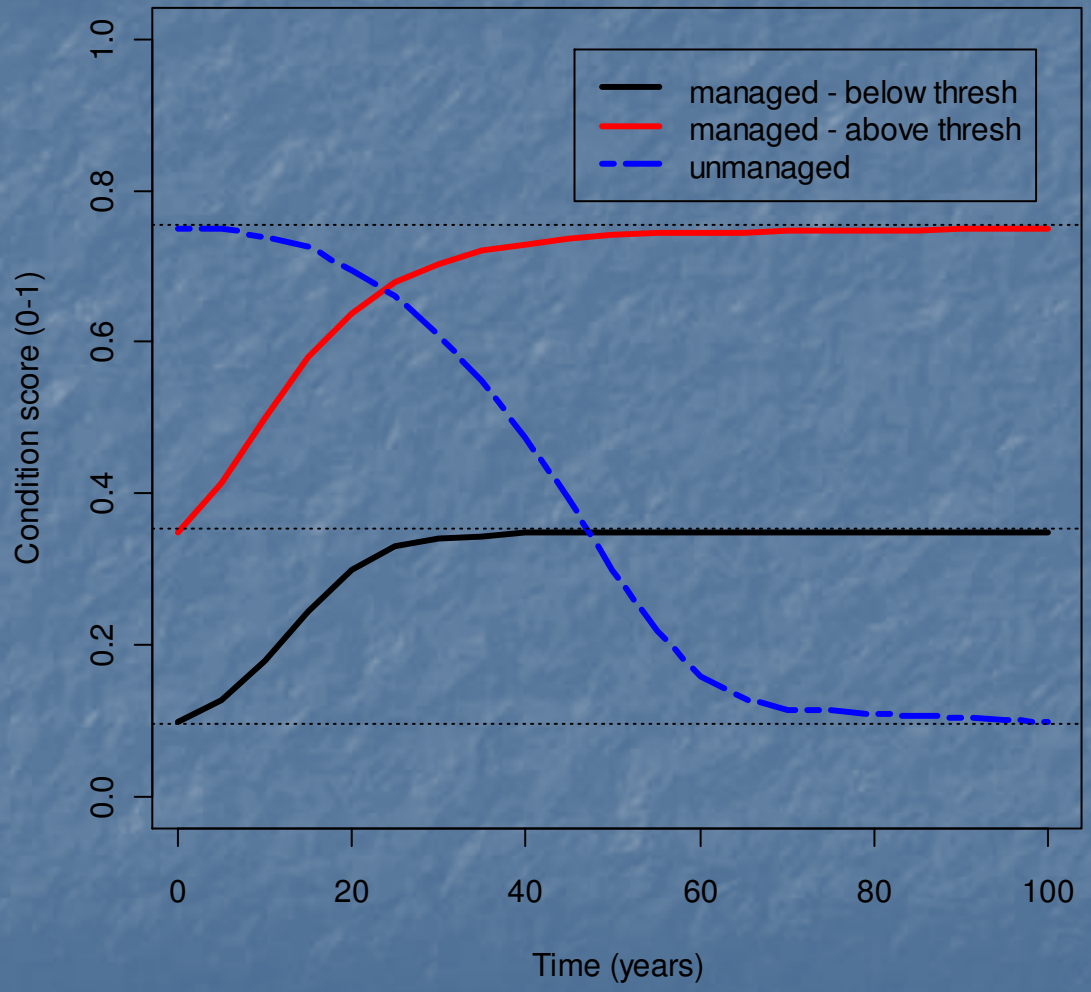
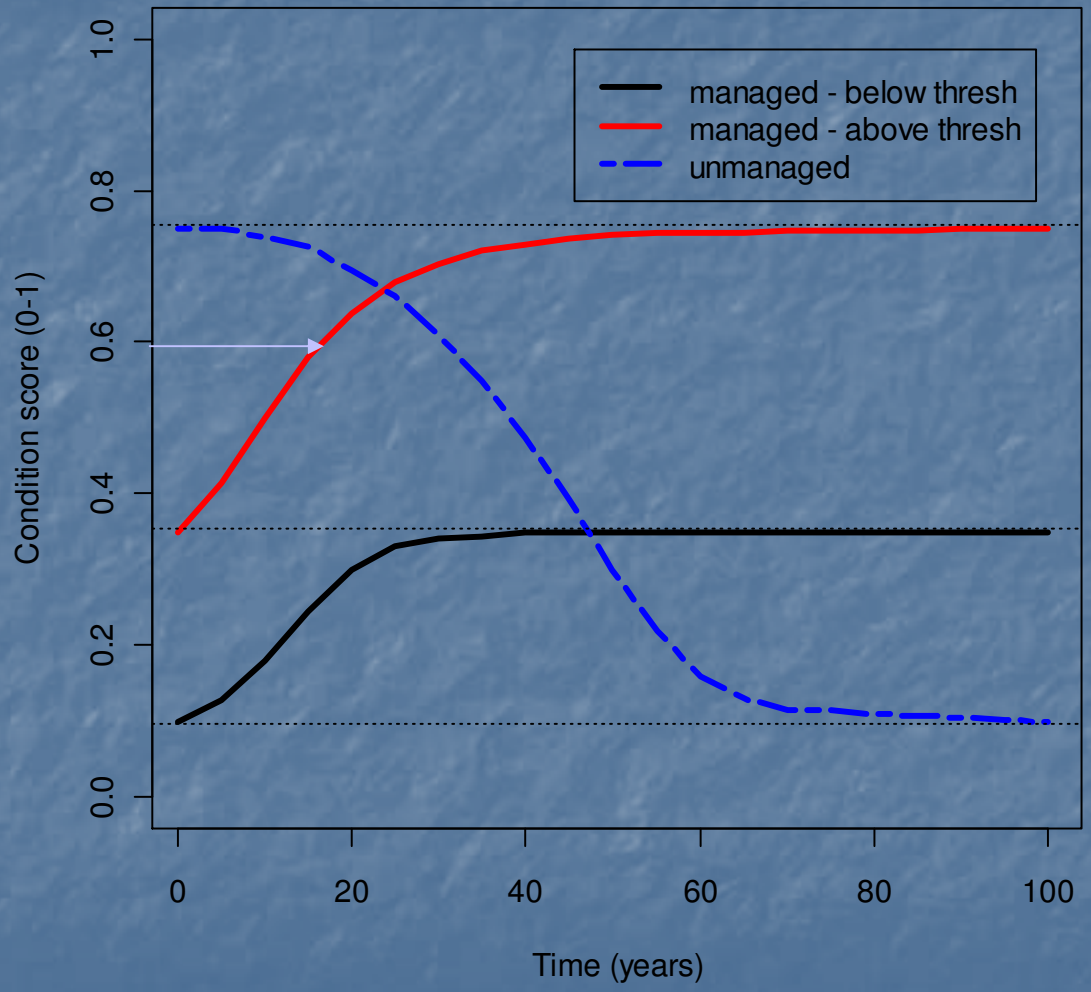


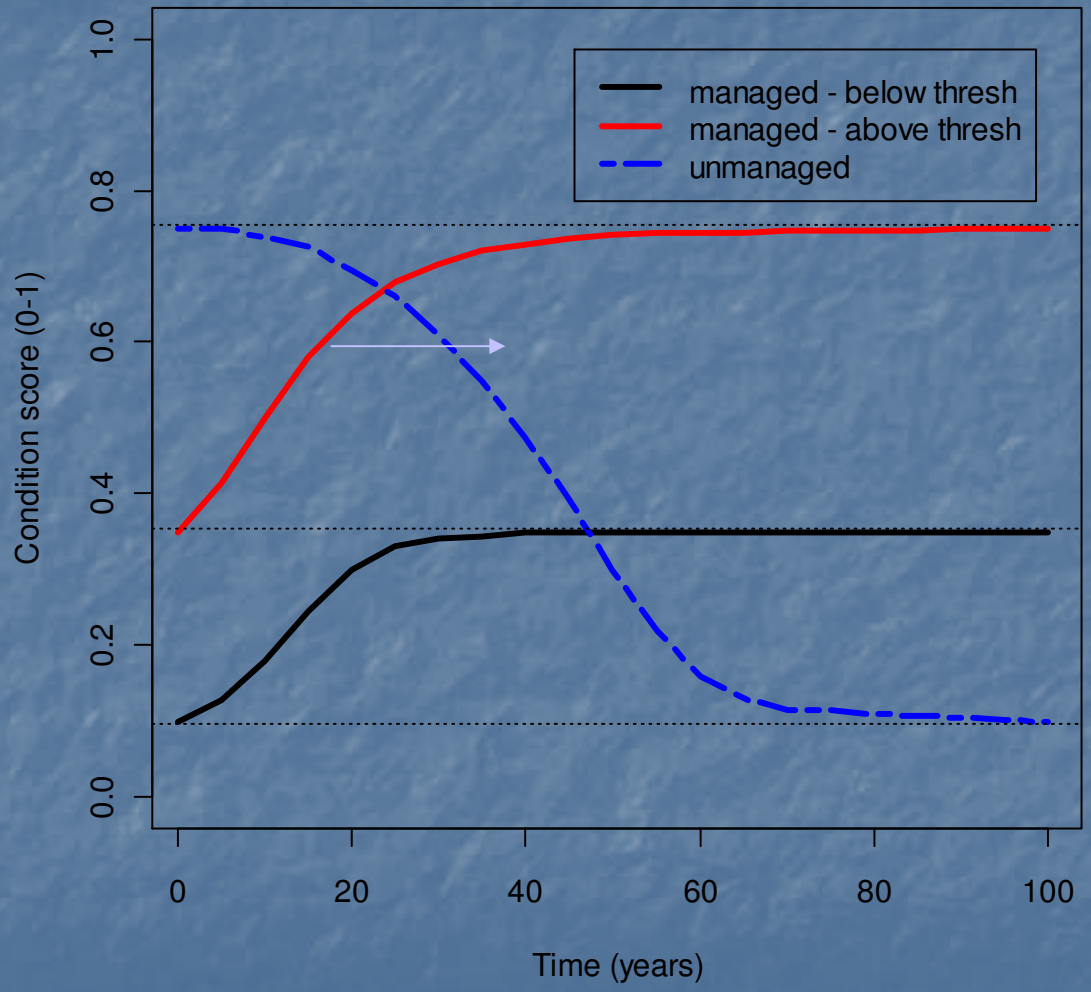
Grassland condition model



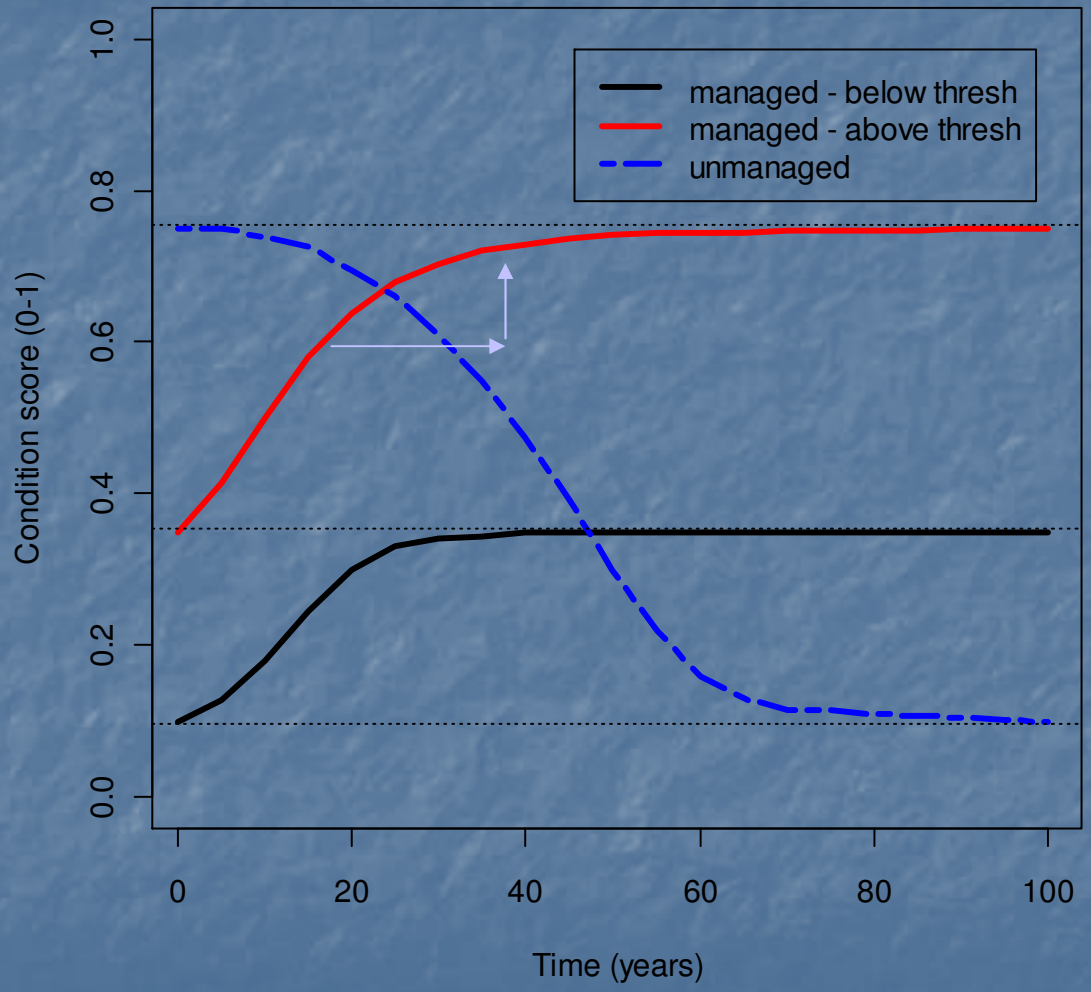
Grassland condition model



Grassland condition model



Grassland condition model



Evaluation Framework

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- Aggregate scores of grassland condition over time

Evaluation Framework

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- 5 year time steps
- Run model for 100 years

Evaluation Framework

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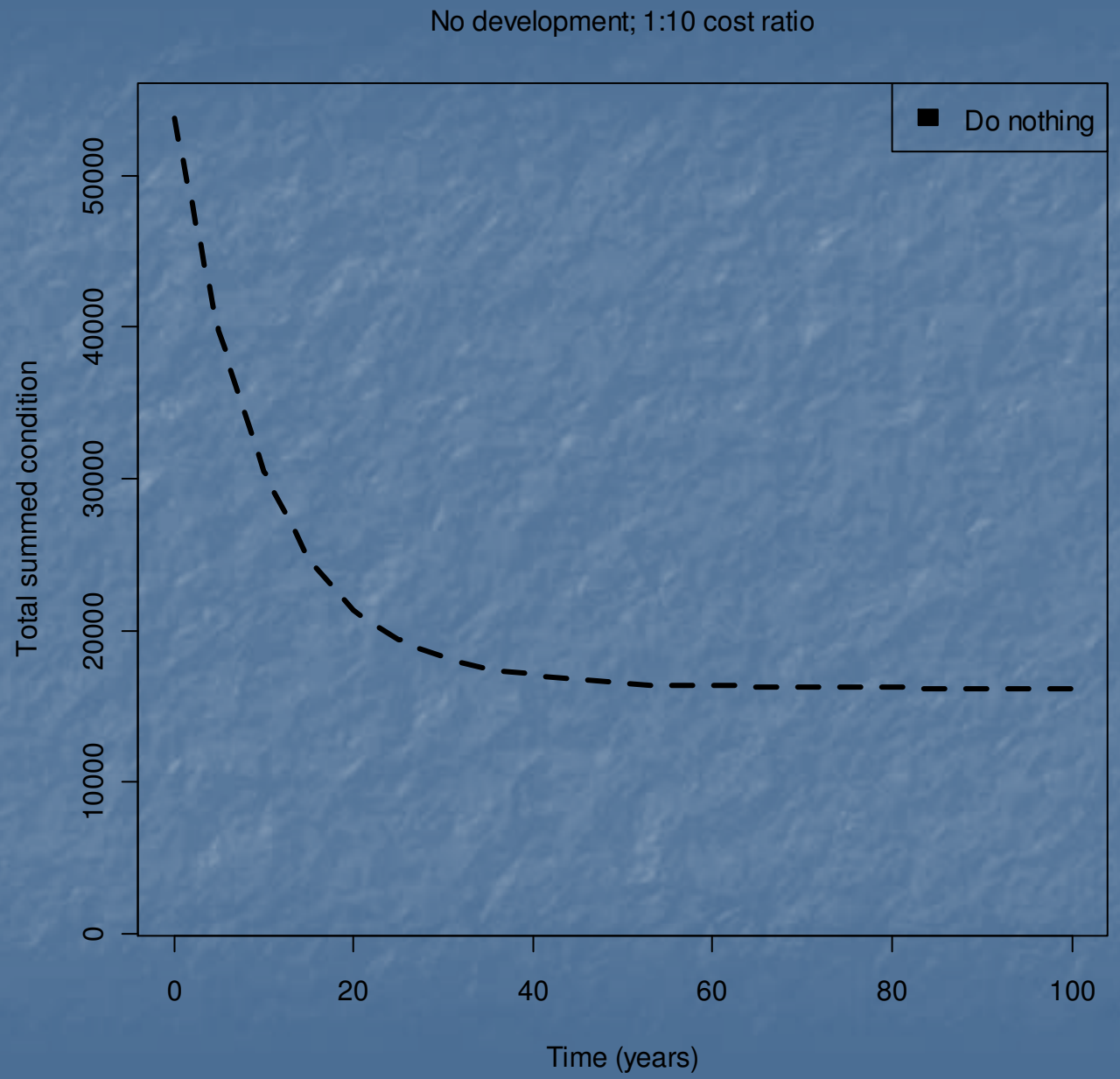
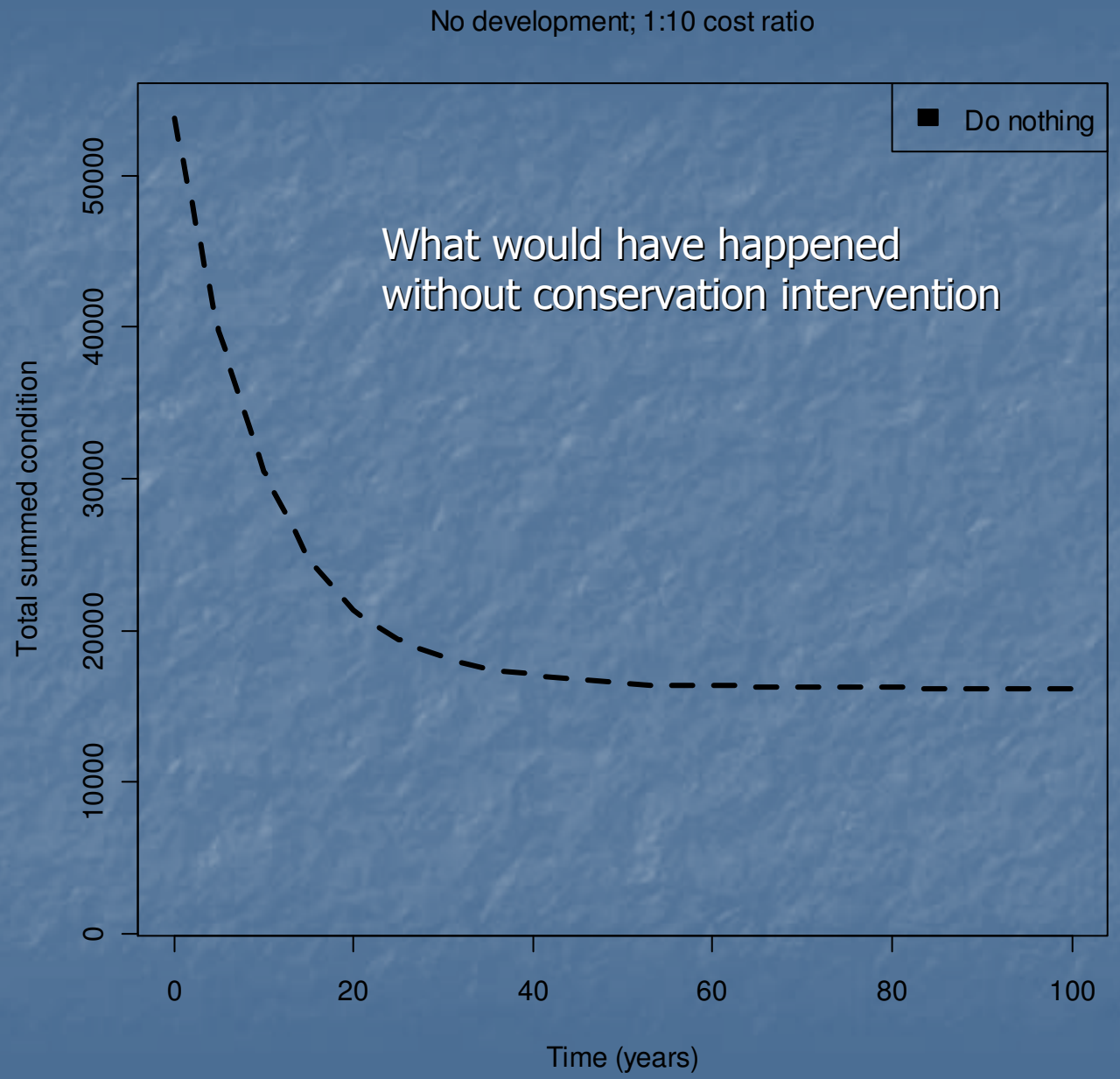
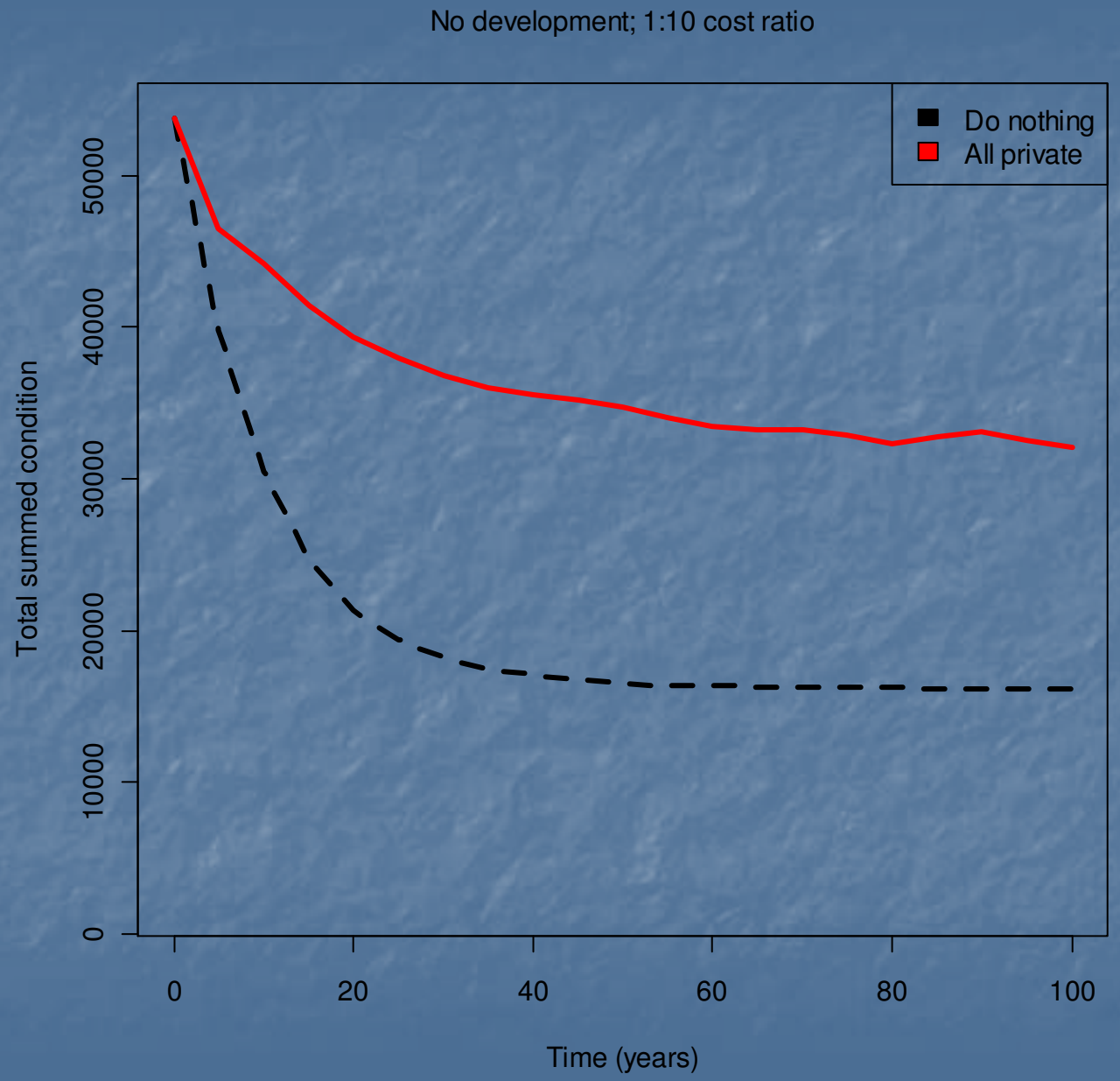
Langford WT, Gordon A, Bastin L (2009) When do conservation planning methods deliver? Quantifying the consequences of uncertainty. *Ecological Informatics*, 4, 123–135.

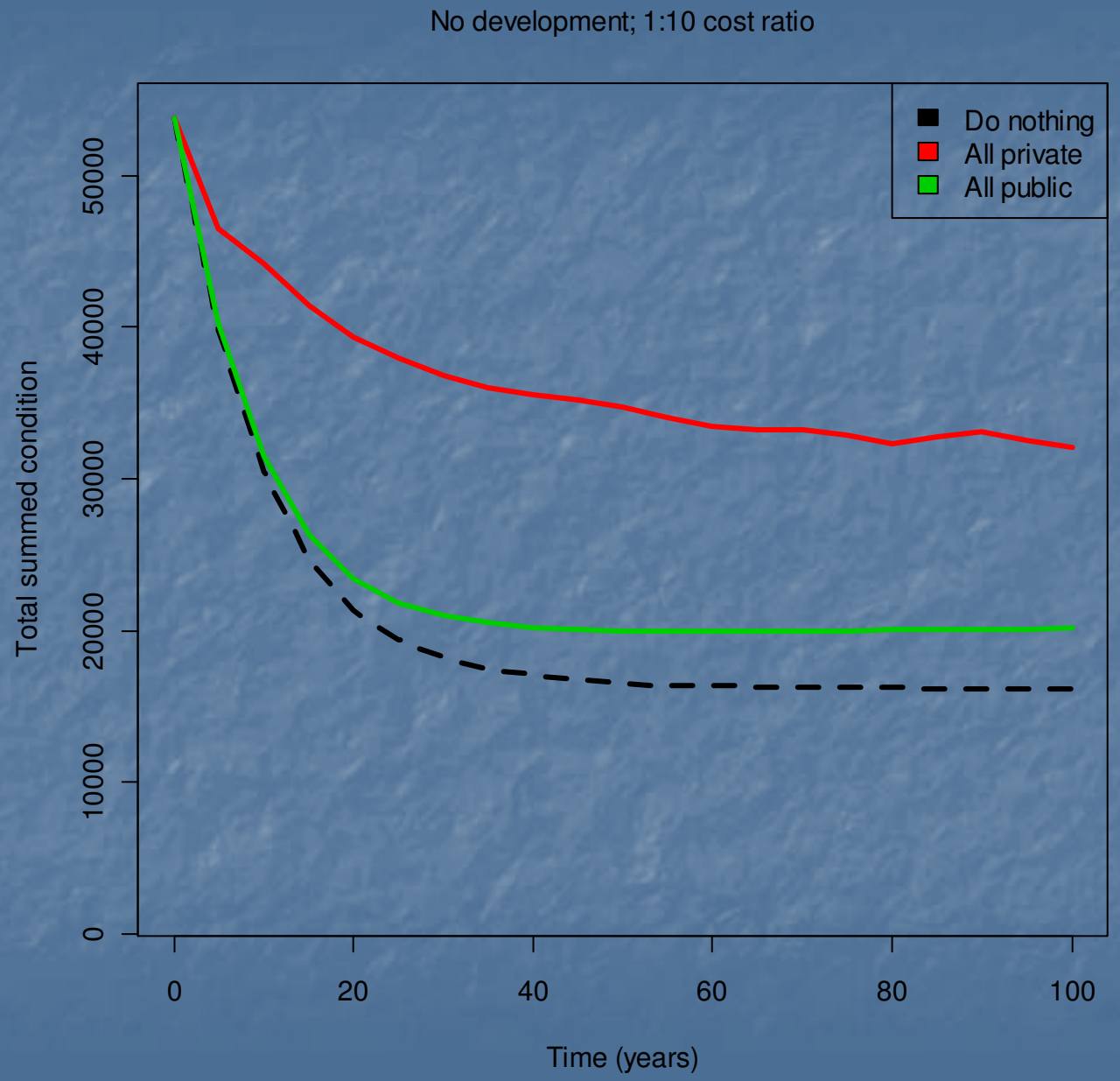
Animations of sequential model

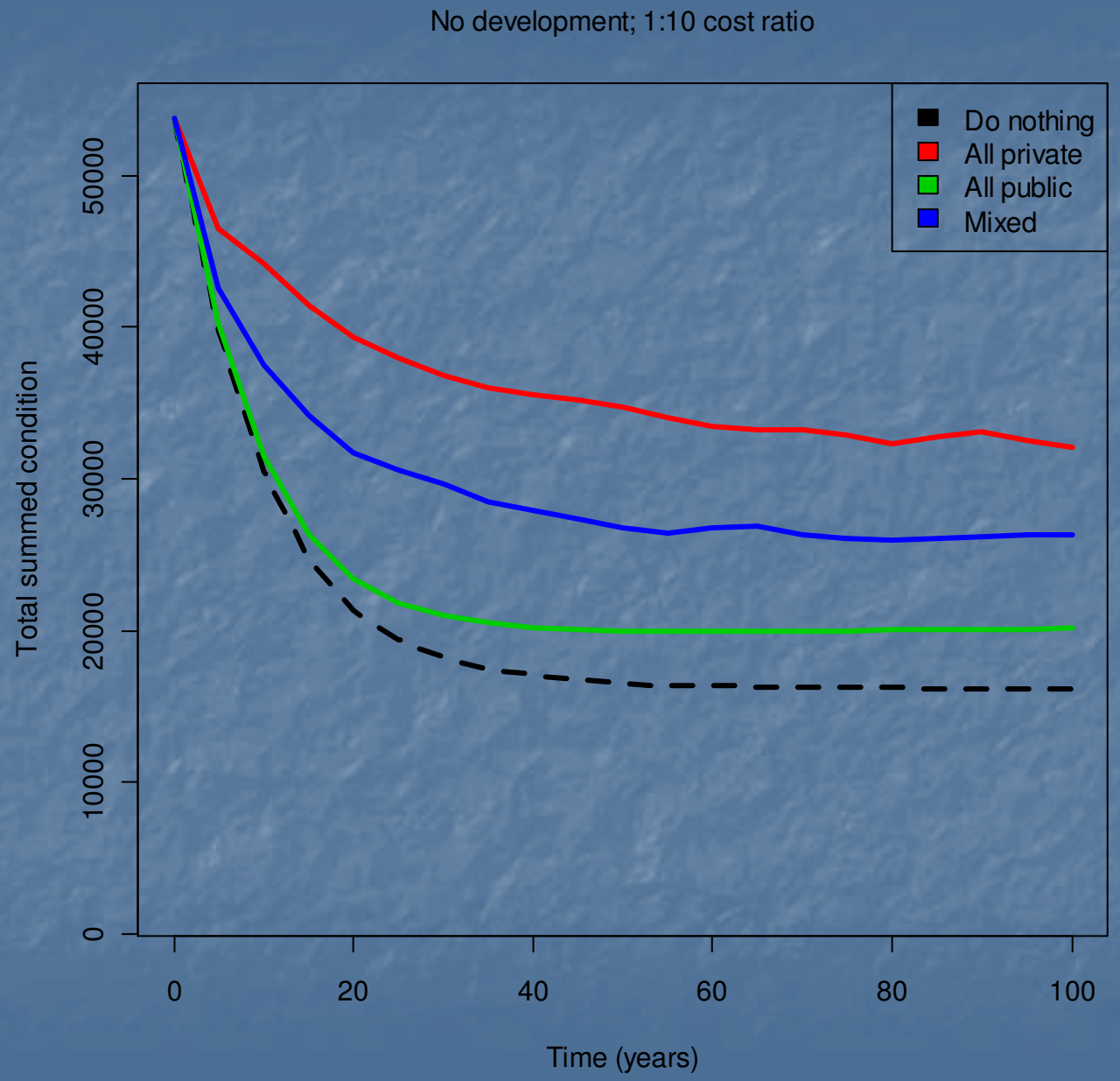
- All public conservation
- All private conservation

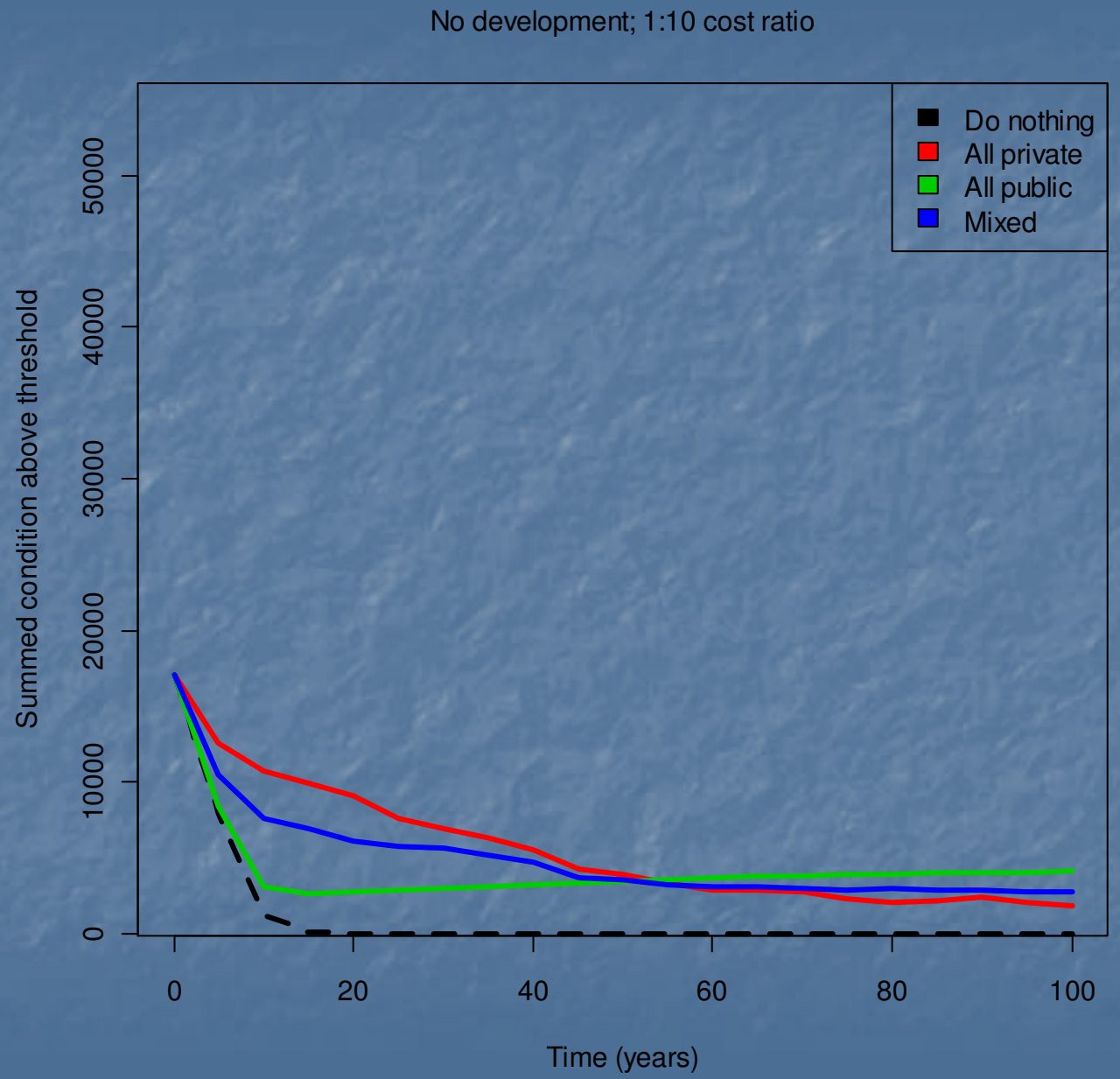

No development; 1:10 cost ratio
Do nothing
Total summed condition
0
10000
20000
30000
40000
50000
0
20
40
60
80
100
Time (years)

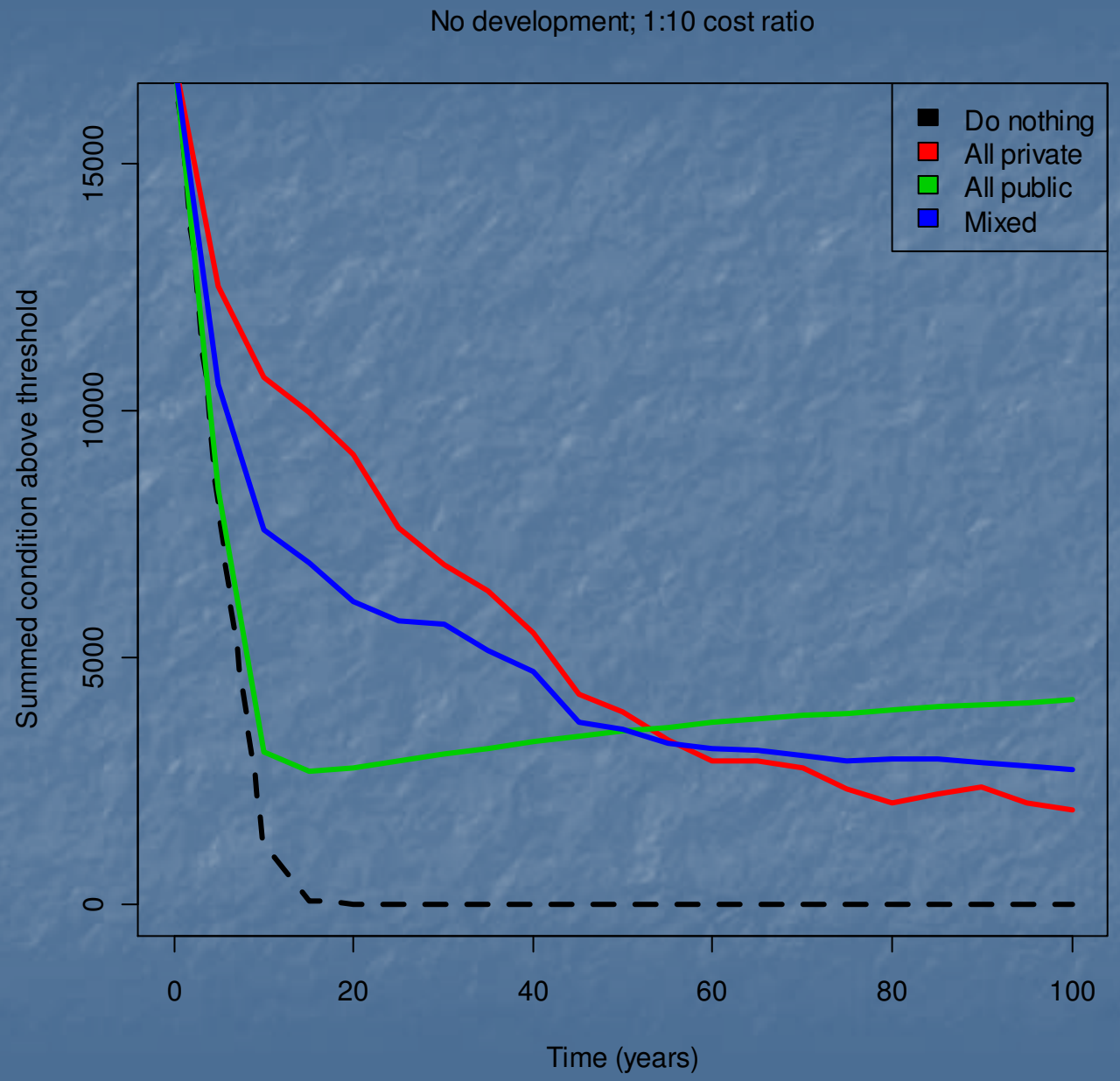

No development; 1:10 cost ratio
Do nothing
What would have happened
without conservation intervention
Total summed condition
0
10000
20000
30000
40000
50000
0
20
40
60
80
100
Time (years)

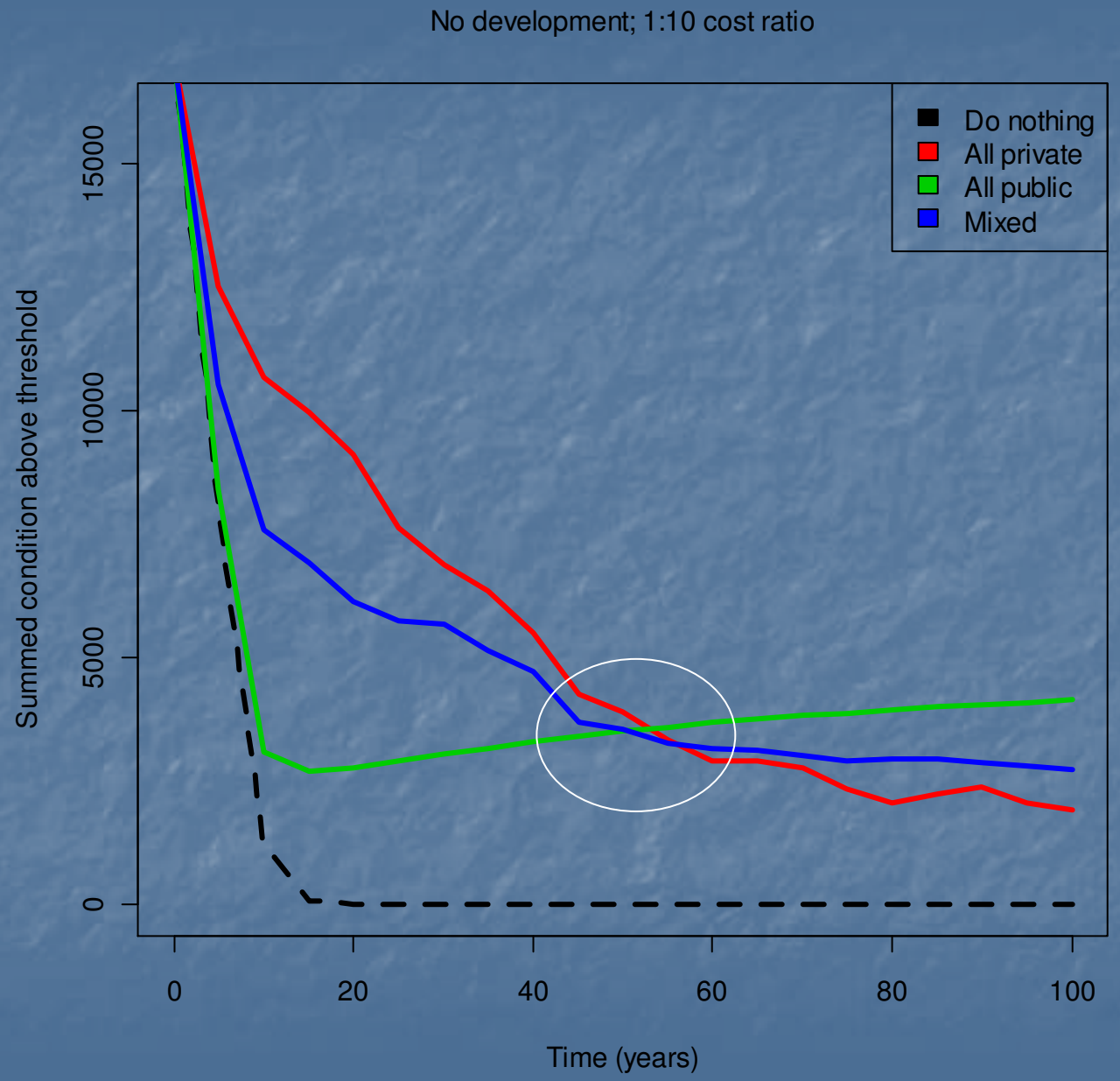

No development; 1:10 cost ratio
Do nothing
All private
Total summed condition
0
10000
20000
30000
40000
50000
0
20
40
60
80
100
Time (years)

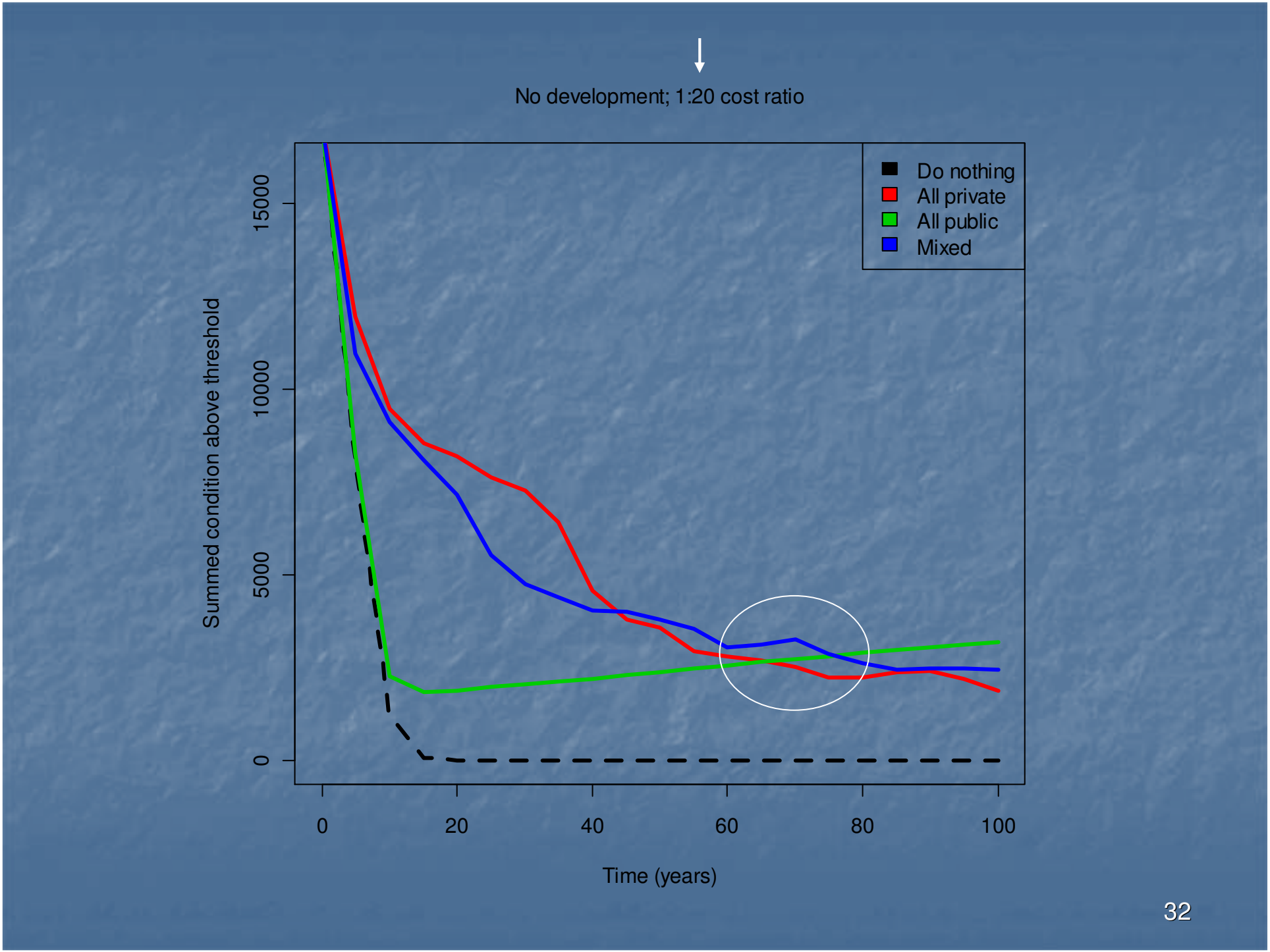

No development; 1:10 cost ratio
Do nothing
All private
All public
Total summed condition
0
10000
20000
30000
40000
50000
0
20
40
60
80
100
Time (years)

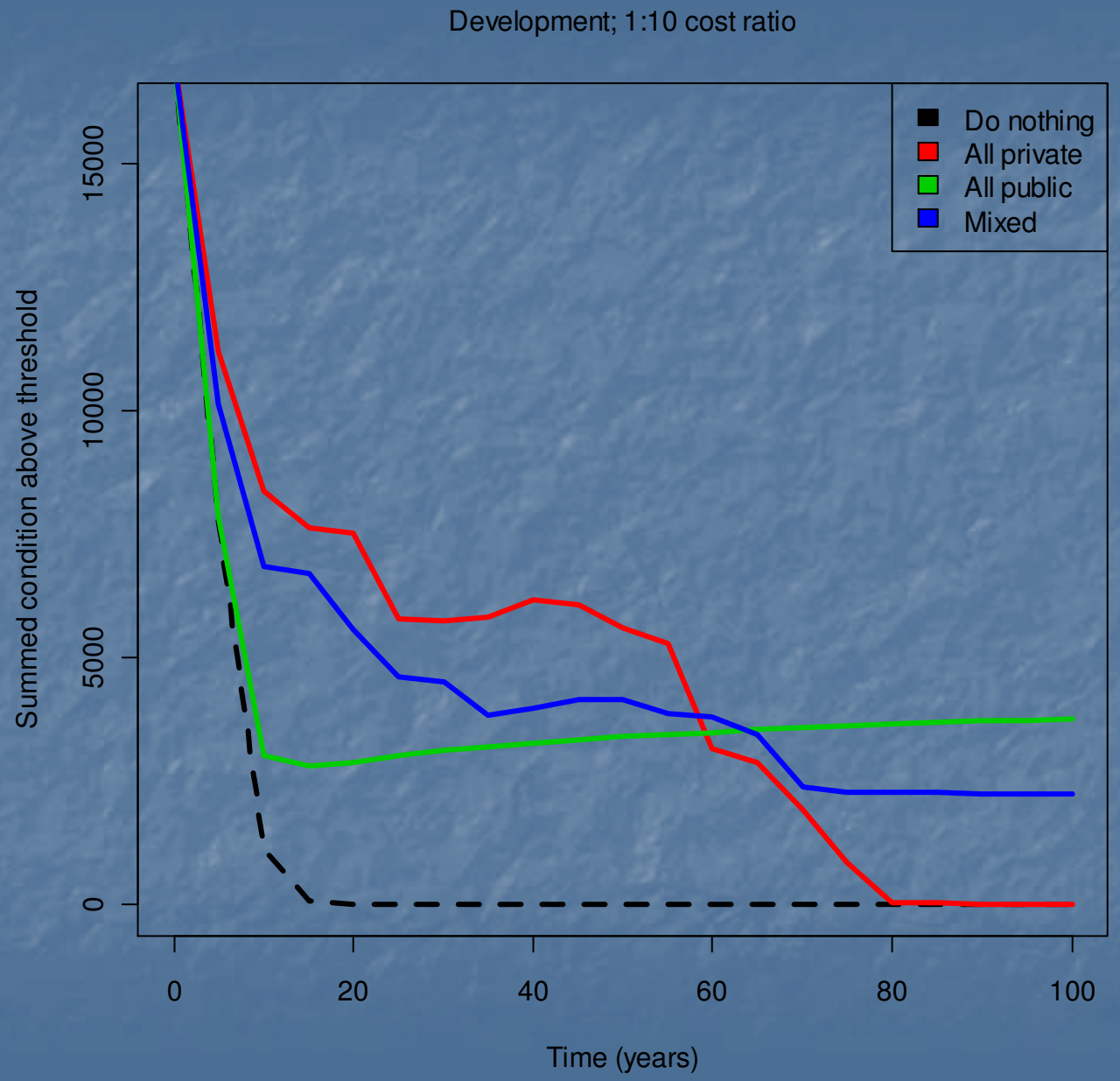

No development; 1:10 cost ratio
Do nothing
All private
All public
Mixed
Total summed condition
0
10000
20000
30000
40000
50000
0
20
40
60
80
100
Time (years)


No development; 1:10 cost ratio
Do nothing
All private
All public
Mixed
Summed condition above threshold
0
10000
20000
30000
40000
50000
0
20
40
60
80
100
Time (years)


No development; 1:10 cost ratio
Summed condition above threshold
0
5000
10000
15000
0
20
40
60
80
100
Time (years)
Do nothing
All private
All public
Mixed


No development; 1:10 cost ratio
Do nothing
All private
All public
Mixed
Summed condition above threshold
0
5000
10000
15000
0
20
40
60
80
100
Time (years)


No development; 1:20 cost ratio
Do nothing
All private
All public
Mixed
Summed condition above threshold
0
5000
10000
15000
0
20
40
60
80
100
Time (years)


Development; 1:10 cost ratio
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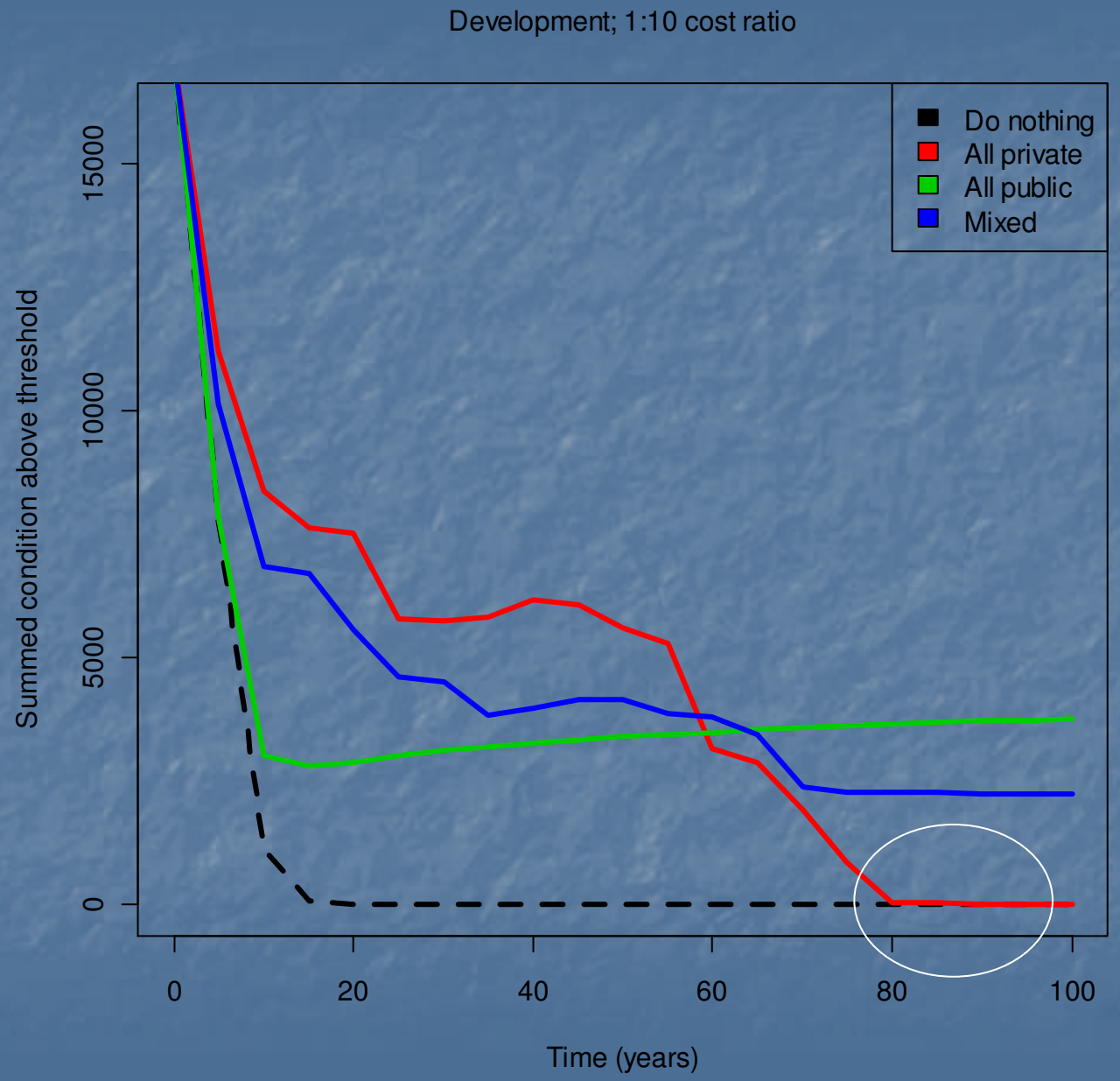
Time (years)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Summed condition above threshold
0
5000
10000
15000
0
20
40
60
80
100
Time (years)

Animations of sequential model

- All private conservation with loss

Ecological implications of the outcomes

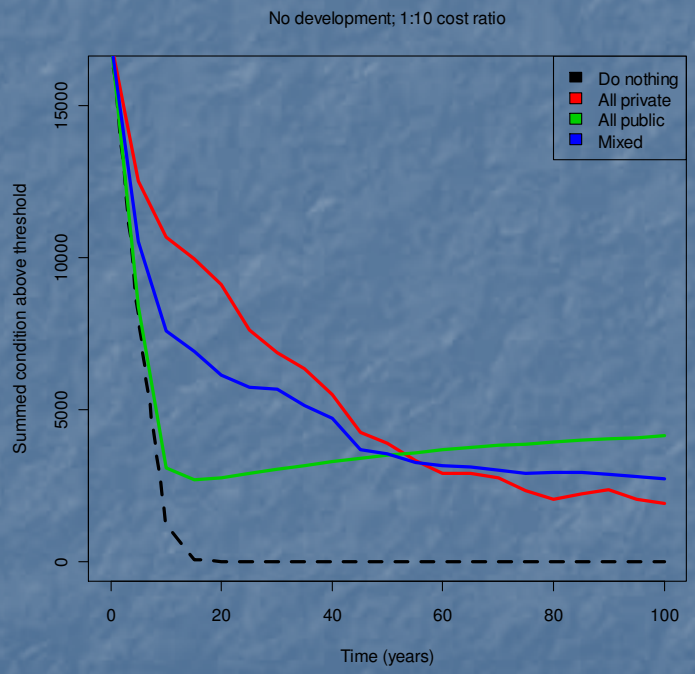
- Quality versus quantity

Ecological implications of the outcomes

- Quality versus quantity
- Species habitat requirements

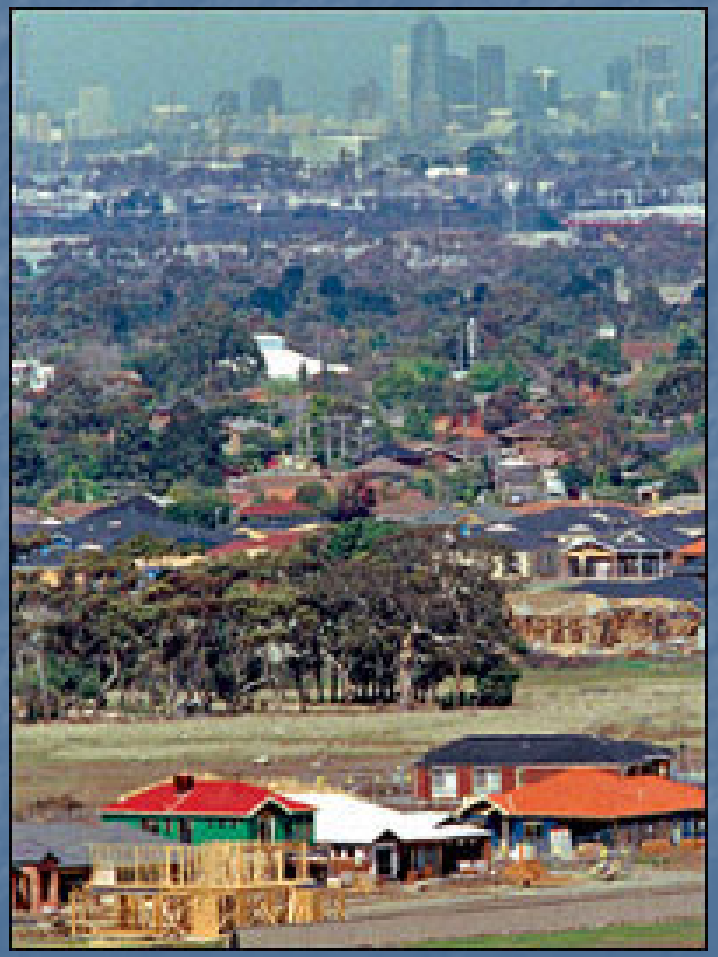
Ecological implications of the outcomes

- Quality versus quantity
- Species habitat requirements
- Time horizon of evaluation



Assumptions & Limitations

- Selection of landholders
- Economic models
- Effectiveness of management
- Uncertainties in:
  - vegetation condition model
  - grassland condition map



Conclusions

- A method for evaluating the consequences for conservation policies:
  - models *ecological* and *socio-economic* aspects
  - allows evaluation of different policy structures
  - the utility & visualisation of a complex sequential model
- (Currently) no generalisable answers to preferred policy structure
  - depends on assumptions and objectives
- Assess policy robustness to future adversities and catastrophes
- Robust prioritisations that deal with deep uncertainty: ensembles of system models, scenario modelling

Acknowledgements

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Industry Partners