



Beware of mathematicians bearing gifts

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**Offsetting
in the urban fringe**

How to tell when/if it works?

- Academic results often results often real-world complexities and uncertainties
- How do we predict real-world performance?
 - Sherwood Forest, “get new consultant”
- Which steps are responsible for outcomes?
 - **Sets** of actions
 - **Sequential** dependence
 - **Uncertainty** in all steps
 - **Embedded** in local contexts



Generic structure of offset policies

- Restore in exchange for what you destroy
- Sequential process
 - Screen
 - Assess
 - Choose
 - Restore/Manage
 - Protect
- Lots of uncertainty

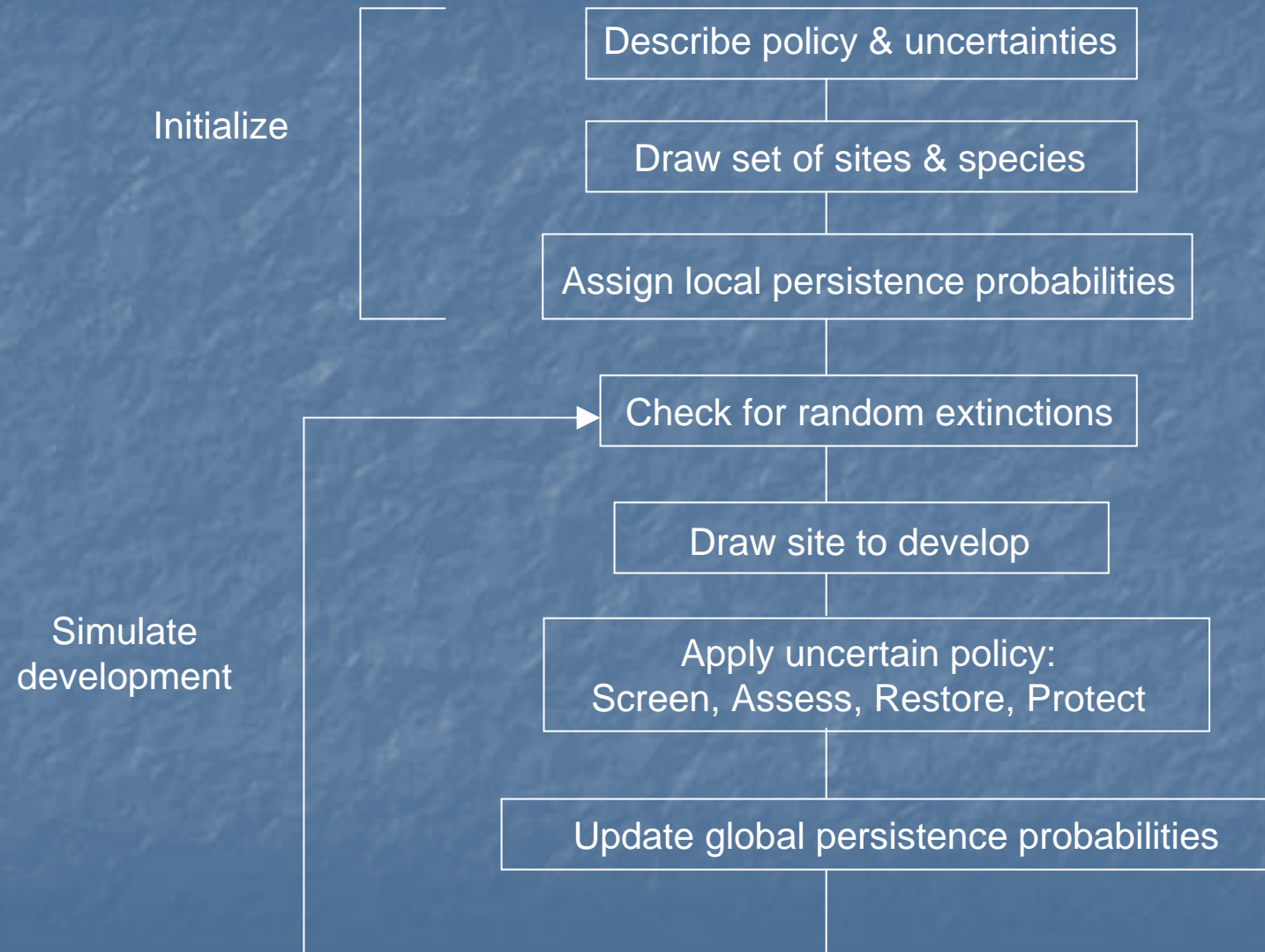


Model outcome sensitivity to each action

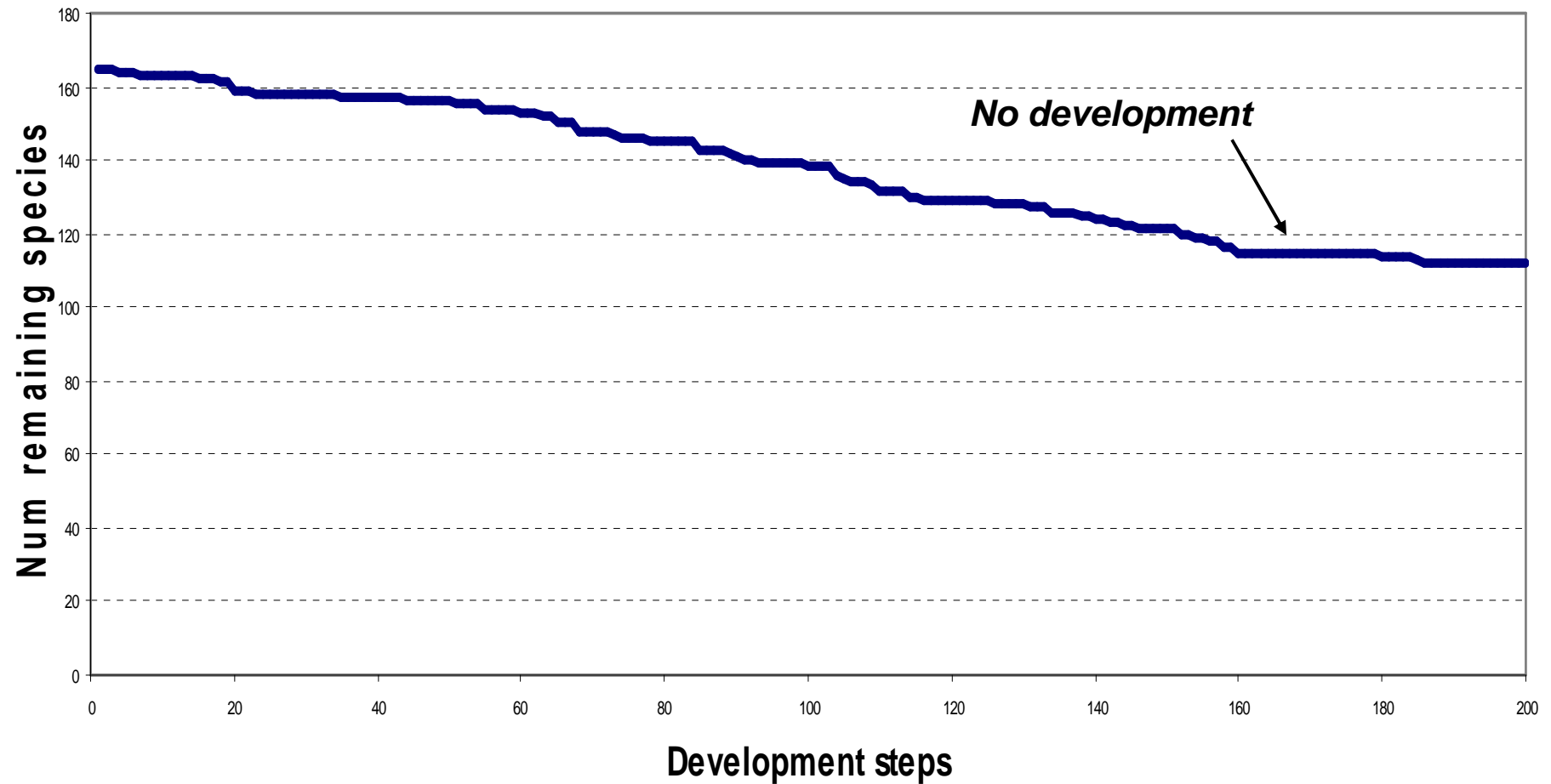


- Separating value question from mechanism questions
 - Like for like, instantaneous vs. Time integration, discounts, etc.
- Simplest possible model
 - Only actions raising & lowering outcomes
 - Not mechanistic
 - Not *why* they have gone up or down
- Uncertainties in each step's consequence

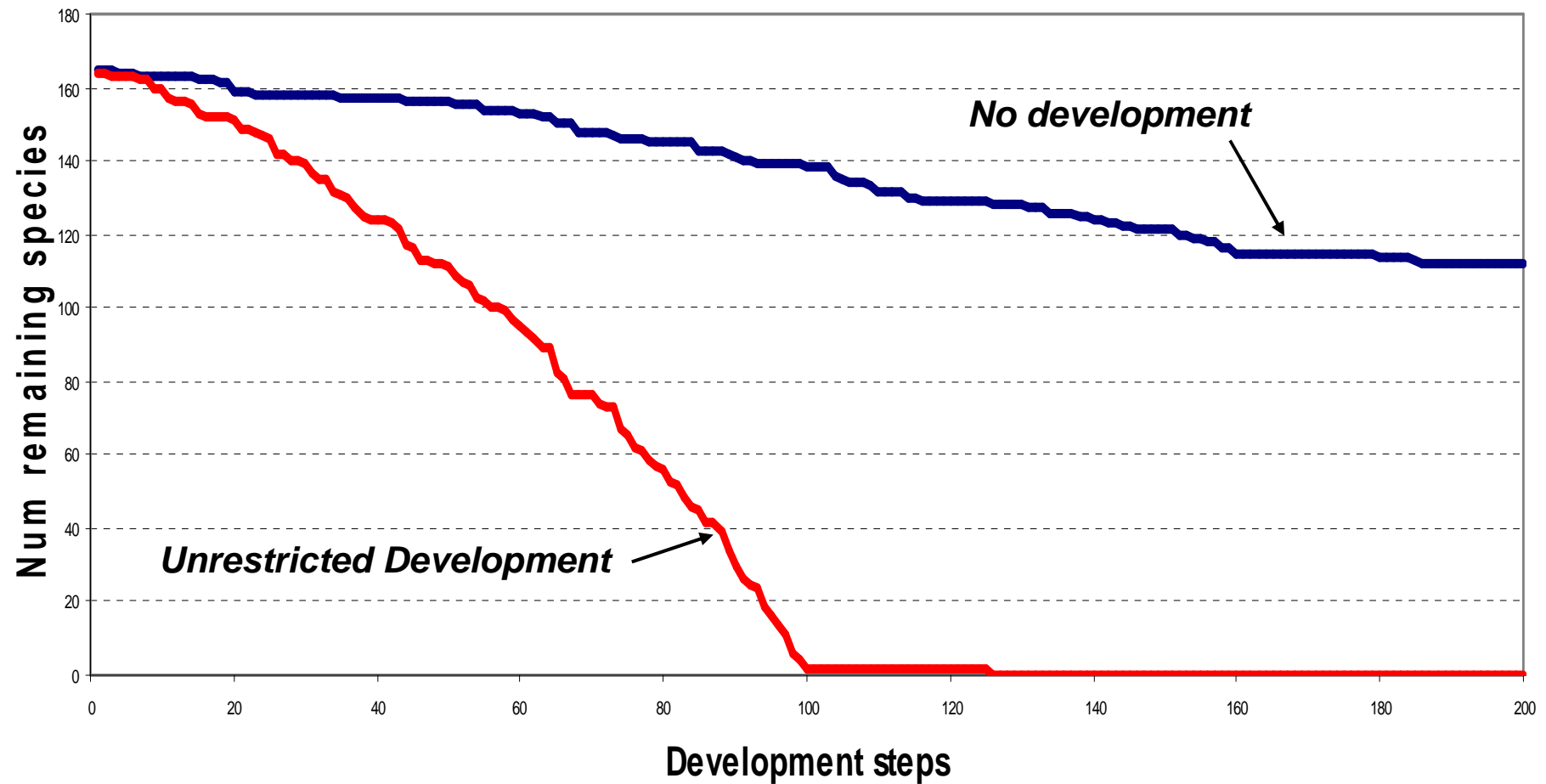
Policy Simulation Algorithm



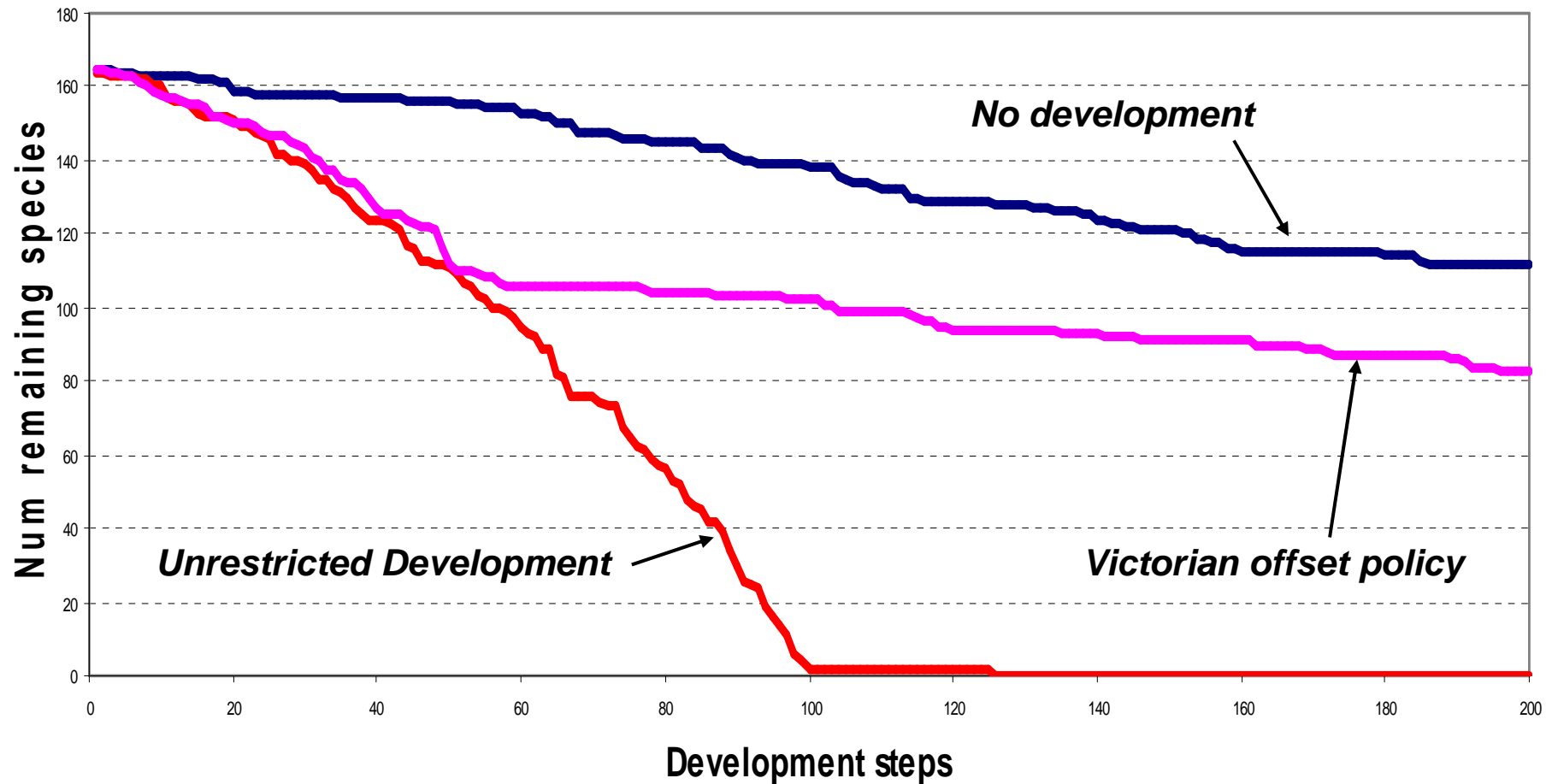
Effects of Policy *without Uncertainty*



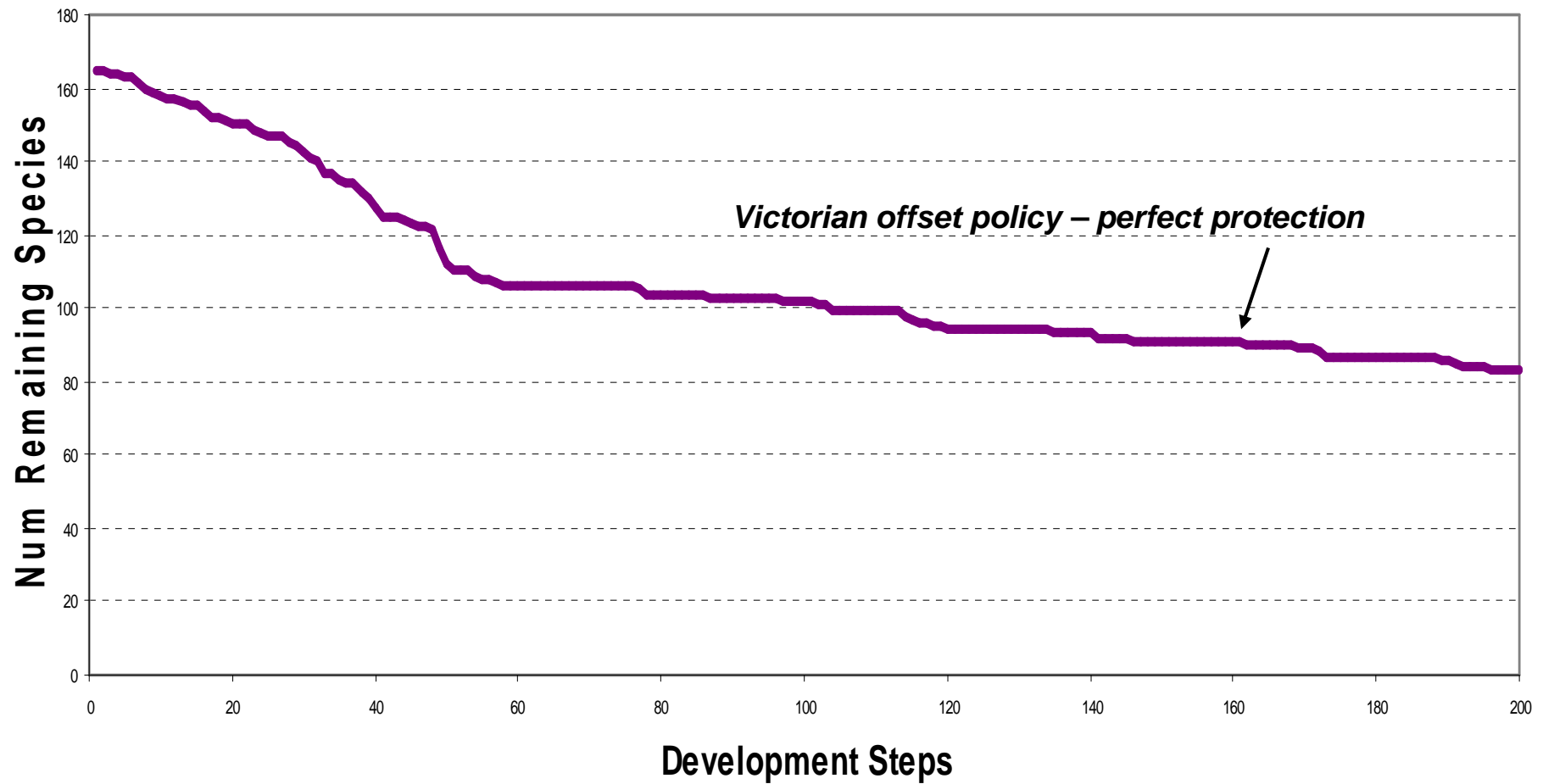
Effects of Policy *without Uncertainty*



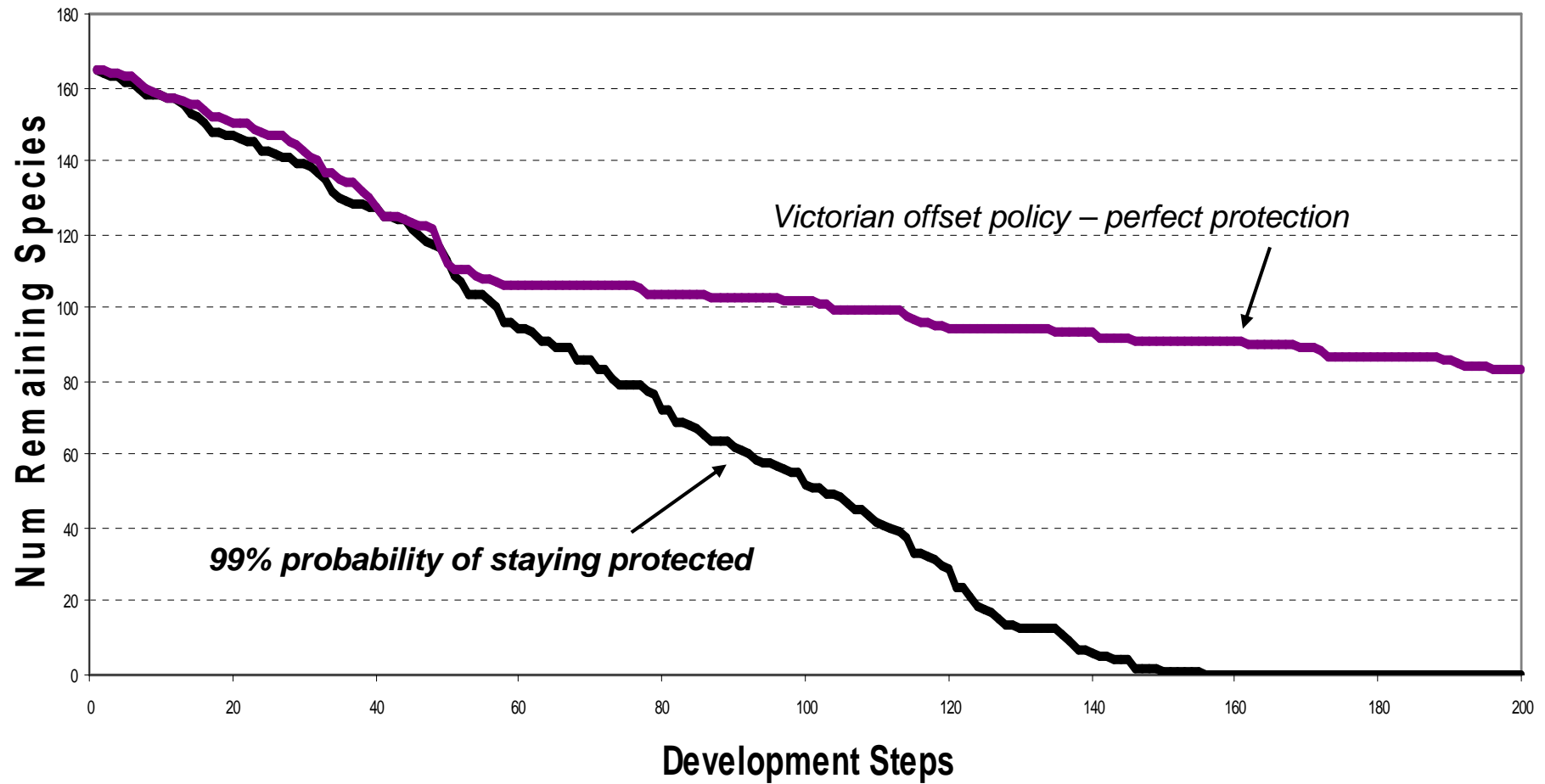
Effects of Policy *without Uncertainty*



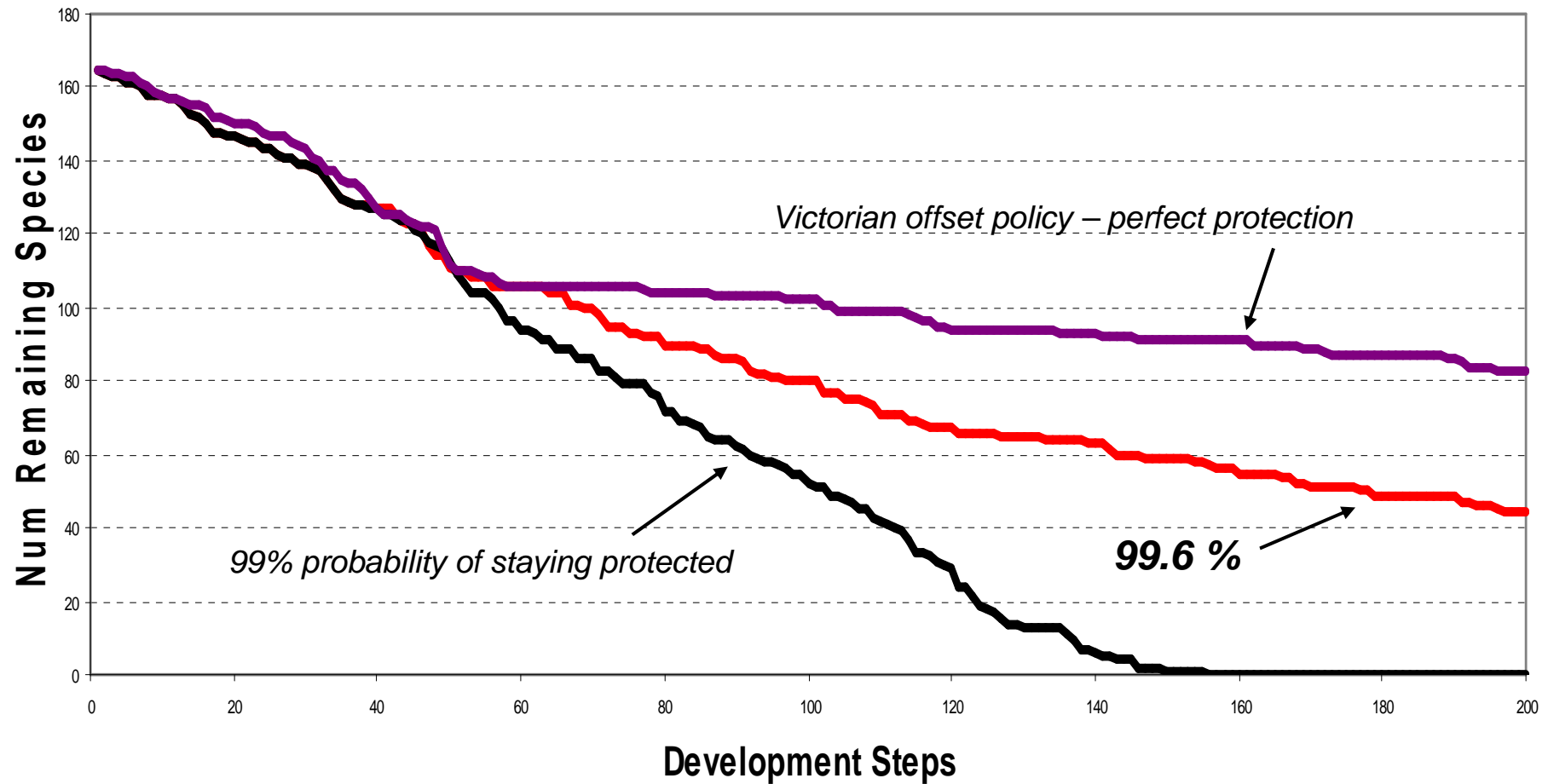
Effects of Uncertainty in *Protection*



Effects of Uncertainty in *Protection*

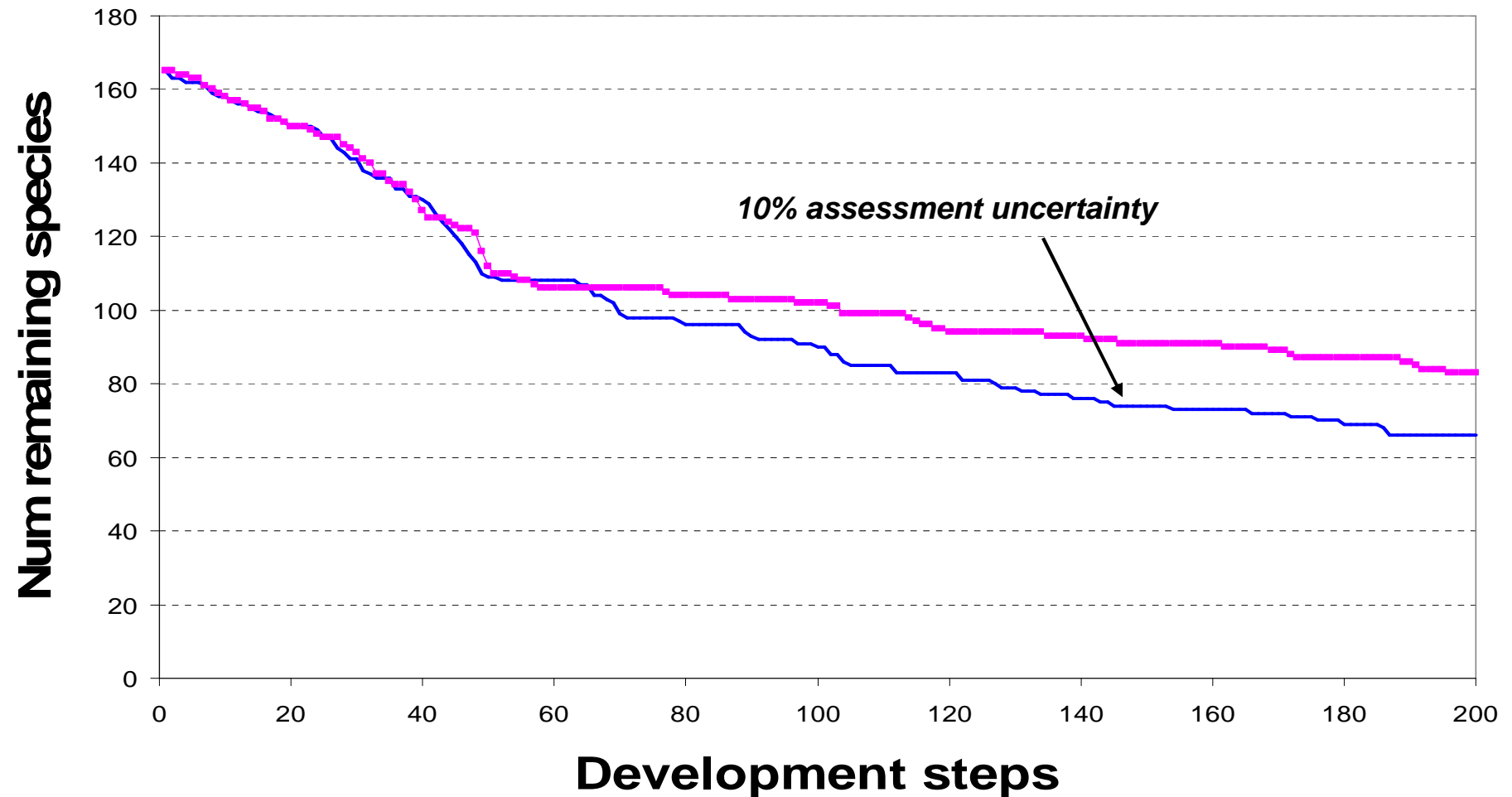


Effects of Uncertainty in *Protection*



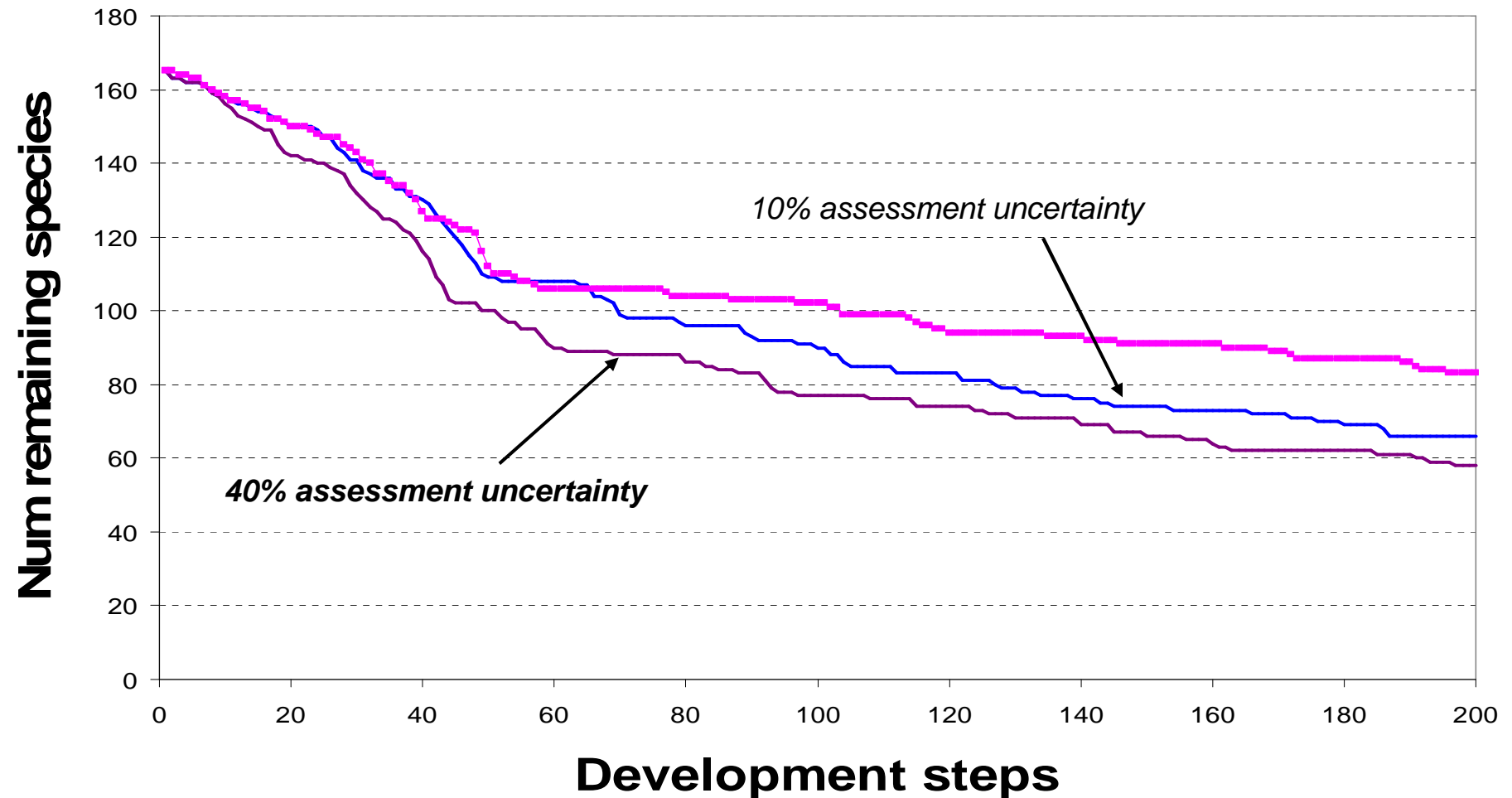
Need virtually perfect protection to avoid *complete* extinction...

Effects of Uncertainty in *Assessment*



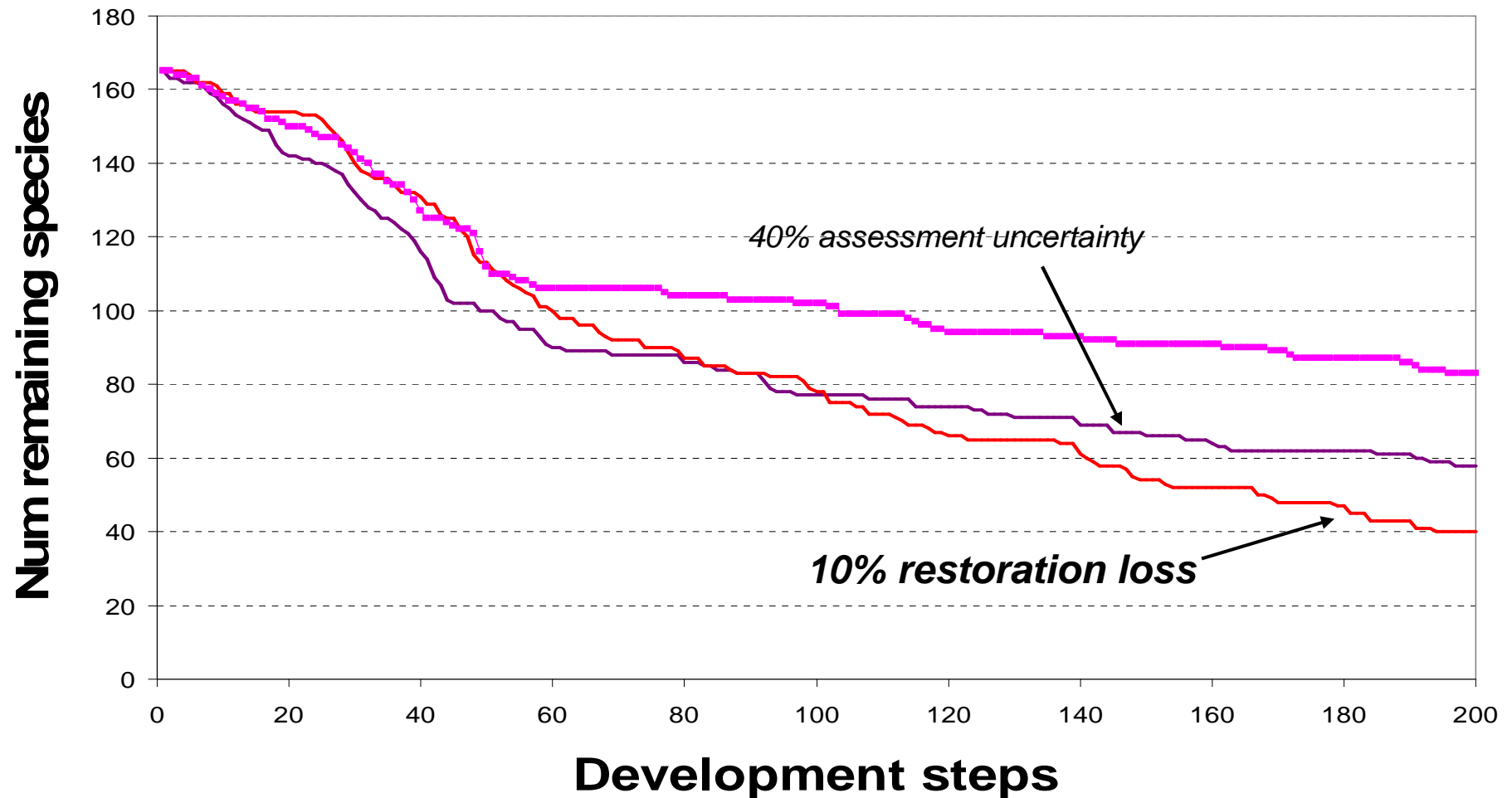
Little difference between 10% and 40% assessment error...

Effects of Uncertainty in *Assessment*



Little difference between 10% and 40% assessment error...

Effects of Uncertainty in *Restoration*



10% restoration loss matters more than even 40% assessment error...

Policy implications

- Sensitivities vs. misconceptions
 - Habitat hectares arguments
- Under *this* species distribution :
 - *Protection* is what really matters.
 - *Detection & assessment* not worth refining.
 - *Restoration* much more important than assessment & screening.



Melbourne grasslands

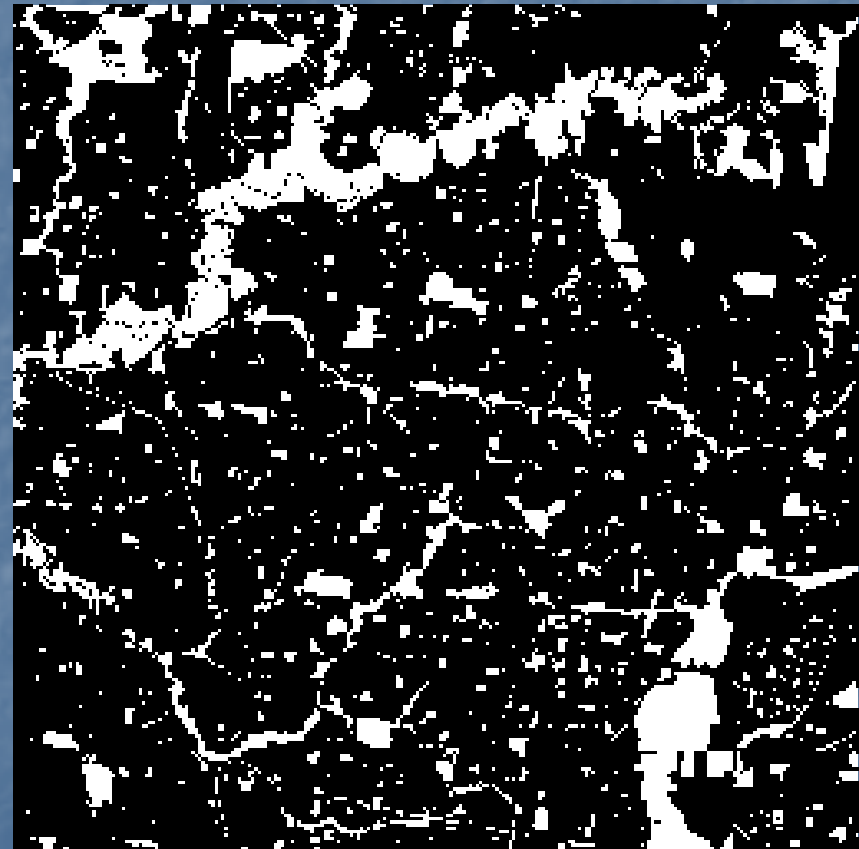
Offsetting is random reserve selection

- Mathematically sophisticated, needed
- But
 - High precision, low accuracy?
 - Huge approximations to govt process
 - Many, large uncertainties
- Not addressed in algorithms/policies
- Does it matter?



Evaluation Framework

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



Reserve selection framework

General settings | Species Distribution | **Reserve Selection** | Loss Model

Reserve selection methods

Random ☐ Richness ☐ Reverse richness ☐ Unprotected richness ☐
Reverse unprotected richness ☐ ZONATION ☐ MARXAN ☐ User-specified ☐

Subset of species for reserve selector: Full set ▼

No. to choose: 200

Parameters for Random & Richness options

Fraction of patches to reserve: 0.5 Redraw patch indices for every run? ☐

Species representation goals for unprotected richness

Use default value? ☒ Enter R expr... `rep(1,200)`

Parameters for ZONATION

Fraction of patches to reserve: 0.7 Only call ZONATION on first run? ☒ Select partial patches? ☐
Proportion of patch overlap: 0.3 Use cost in Zonation? ☐

Parameters for MARXAN

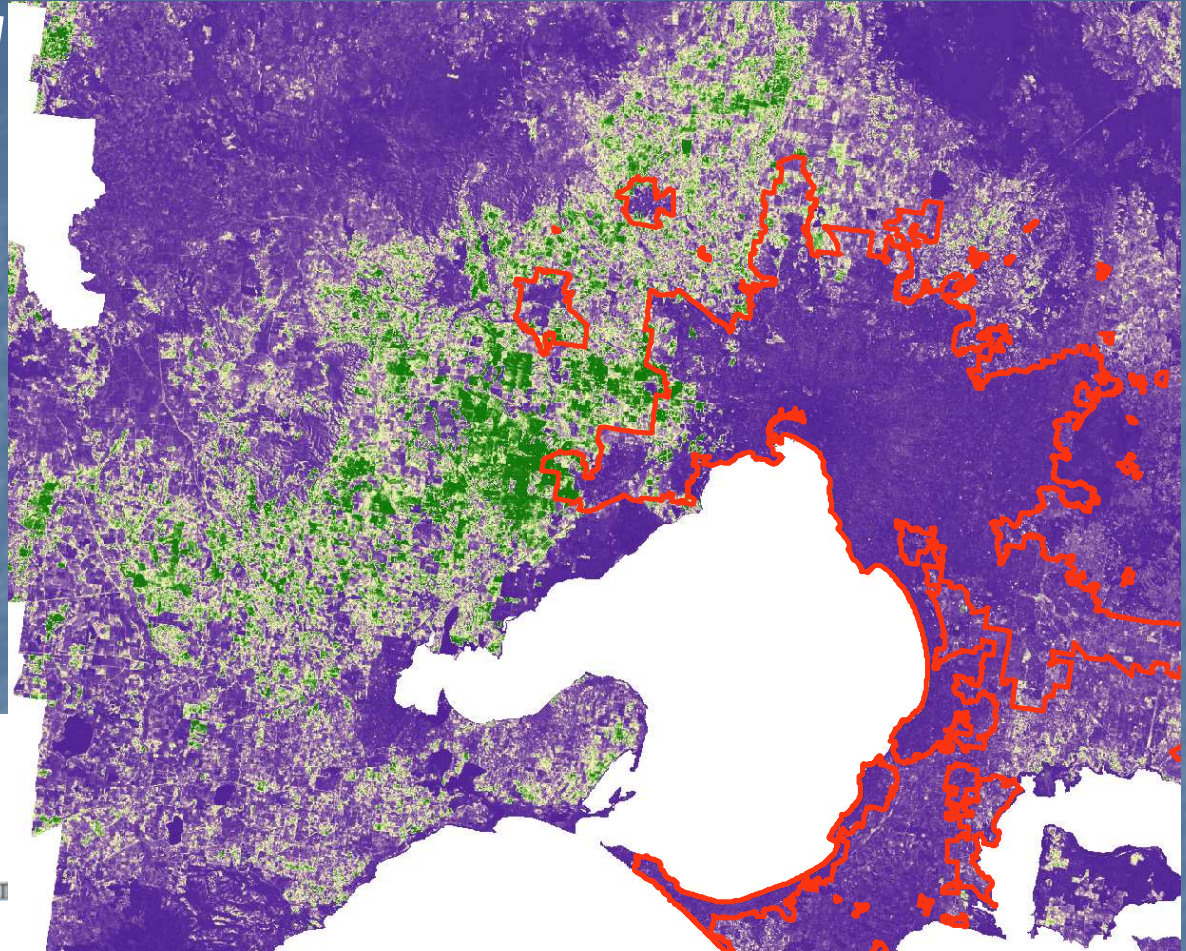
Goal Scale Factor: 0.9 Species Penalty Factor: 2

Generate puvspr.dat file? ☐ Read representation goals from file? ☐

File containin... Rep. goals - ... `c(rep(0.2, 24))`

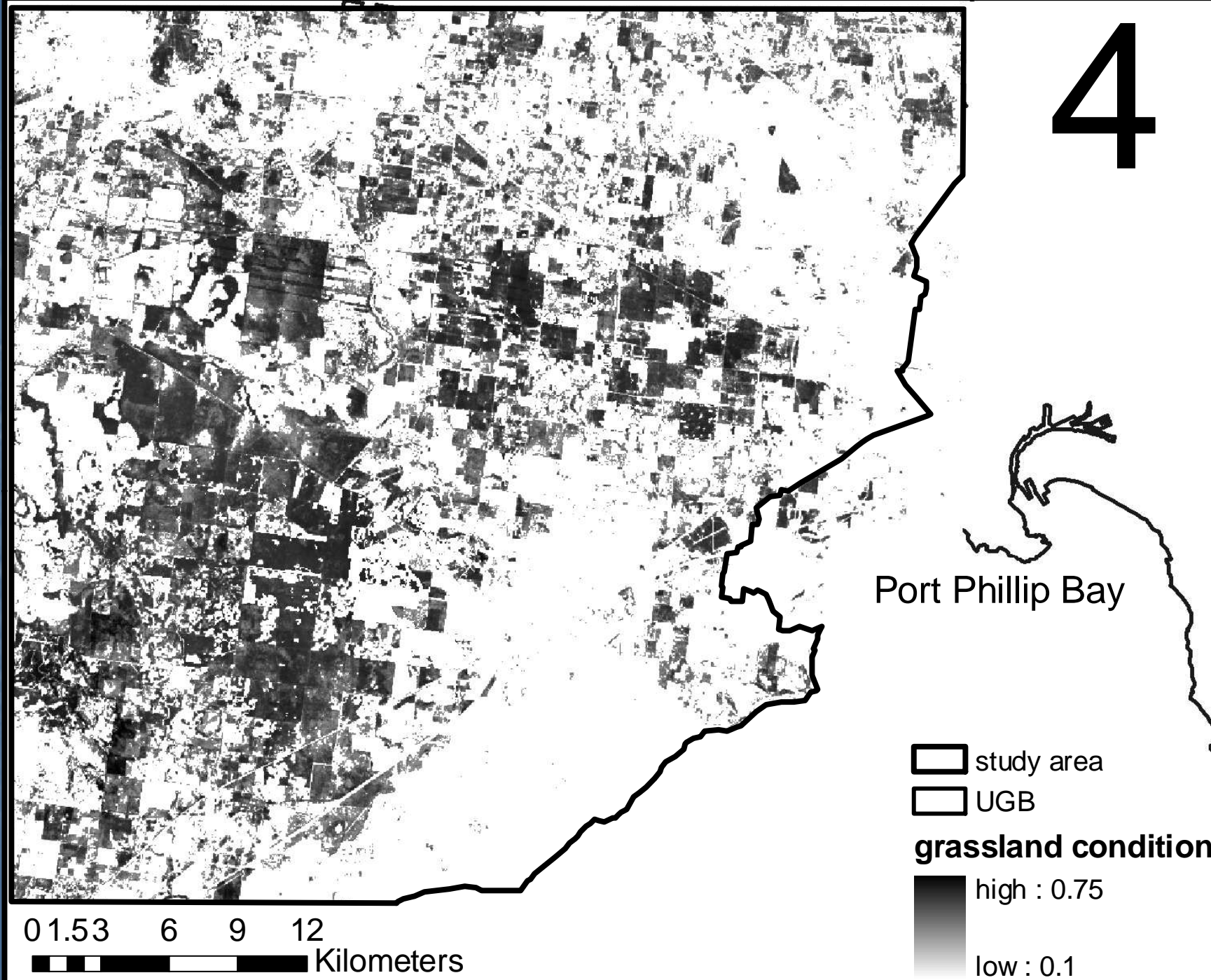
Use patches in representation? ☐ Use cost in MARXAN? ☐
Use proportions in representation goal ▼ Select partial patches? ☐
Proportion of patch overlap: 0.3

Offsetting Policy Model Example



0 3.5 7 14 21 28 Kilometers

4



4

Areas with
parcel size
< 20 ha

Port Phillip Bay

property boundaries

study area

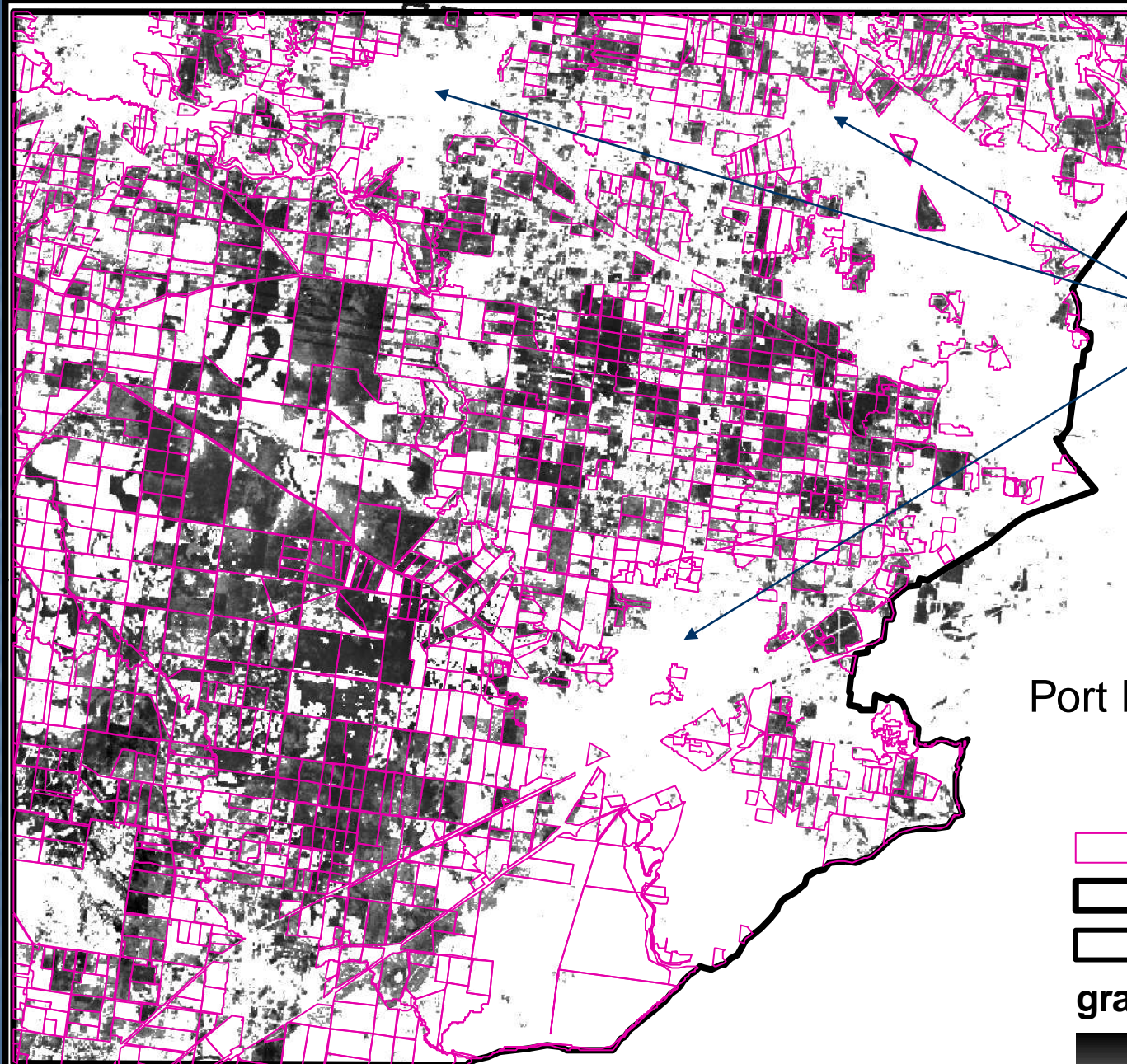
UGB

grassland condition

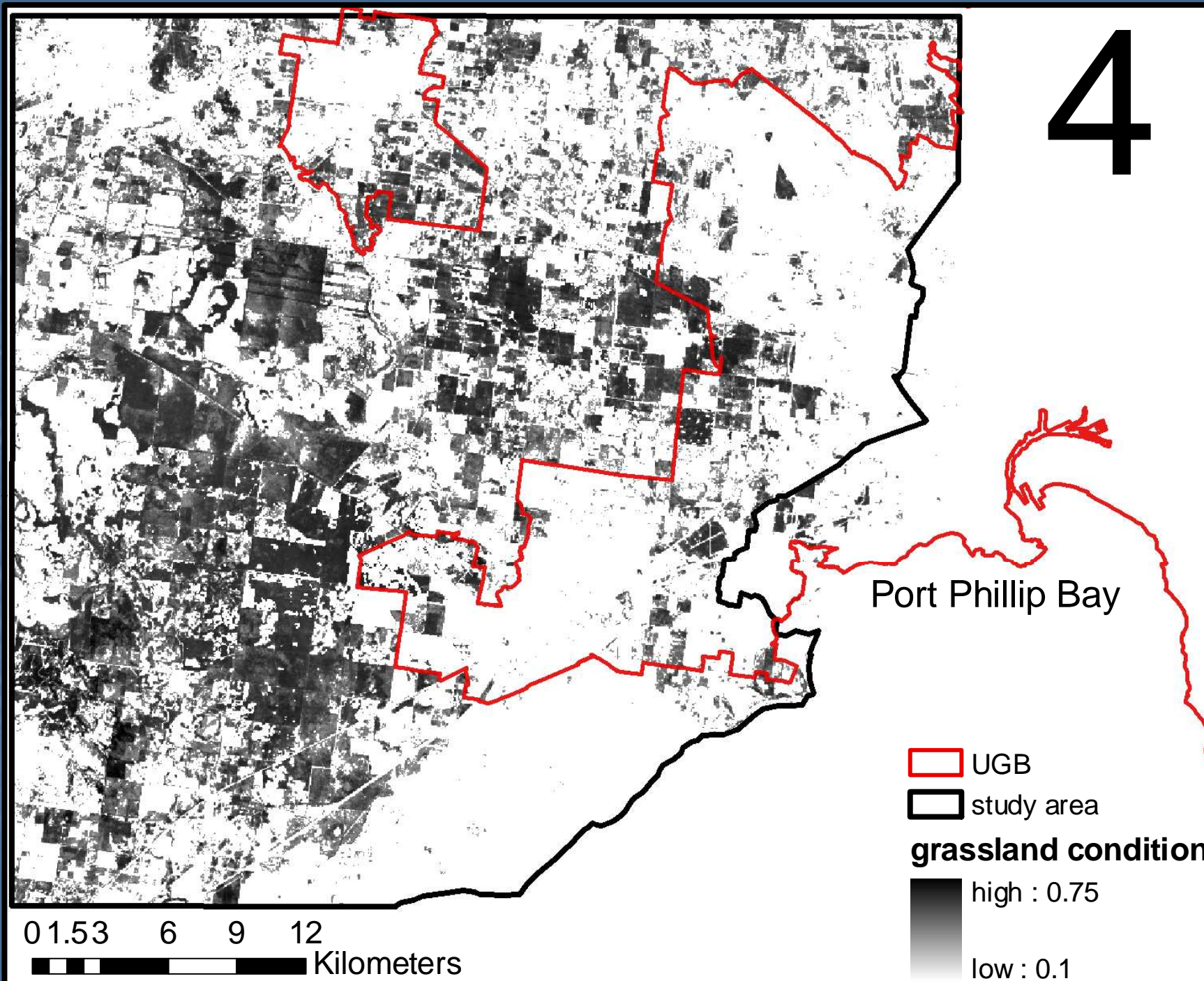
high : 0.75

low : 0.1

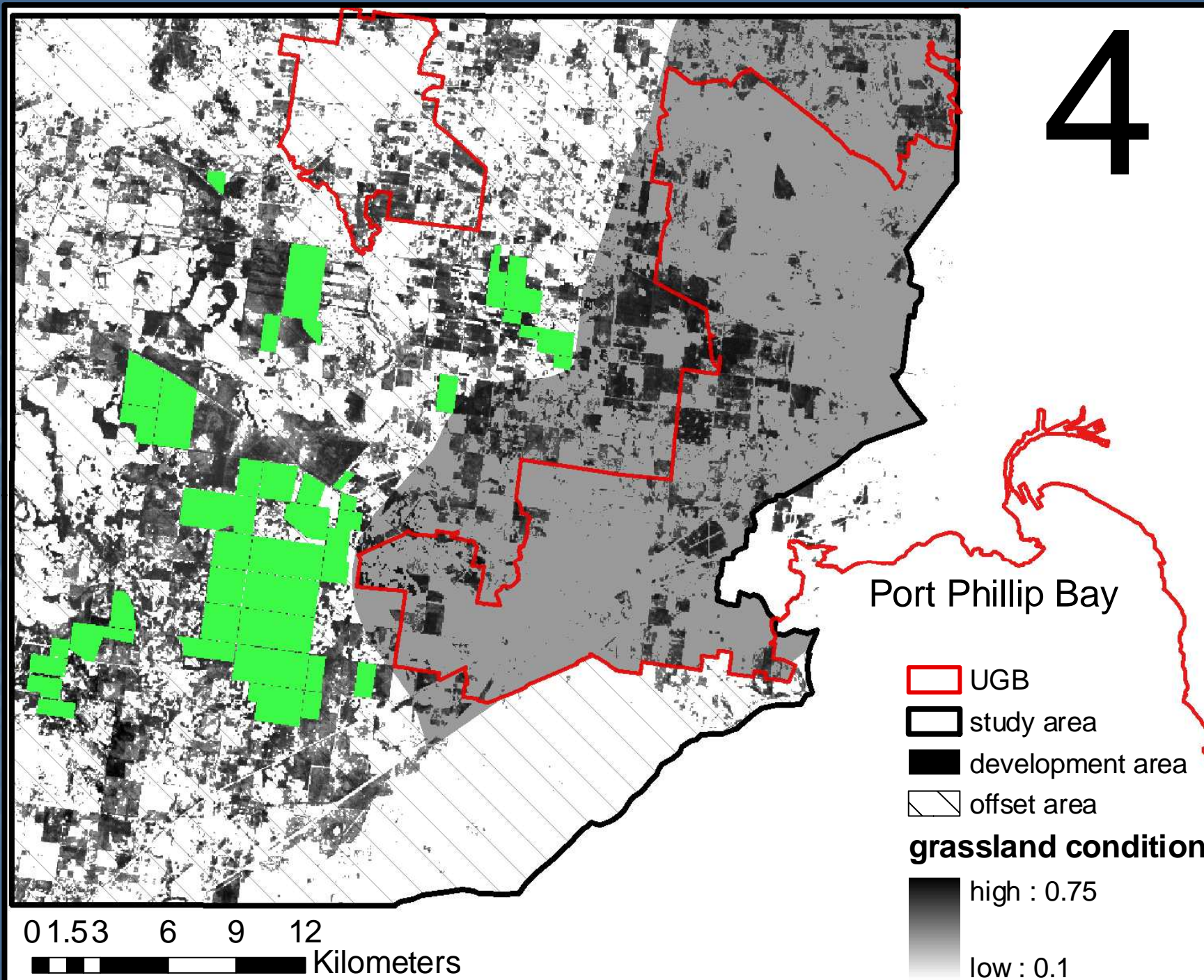
0 1.53 6 9 12
Kilometers



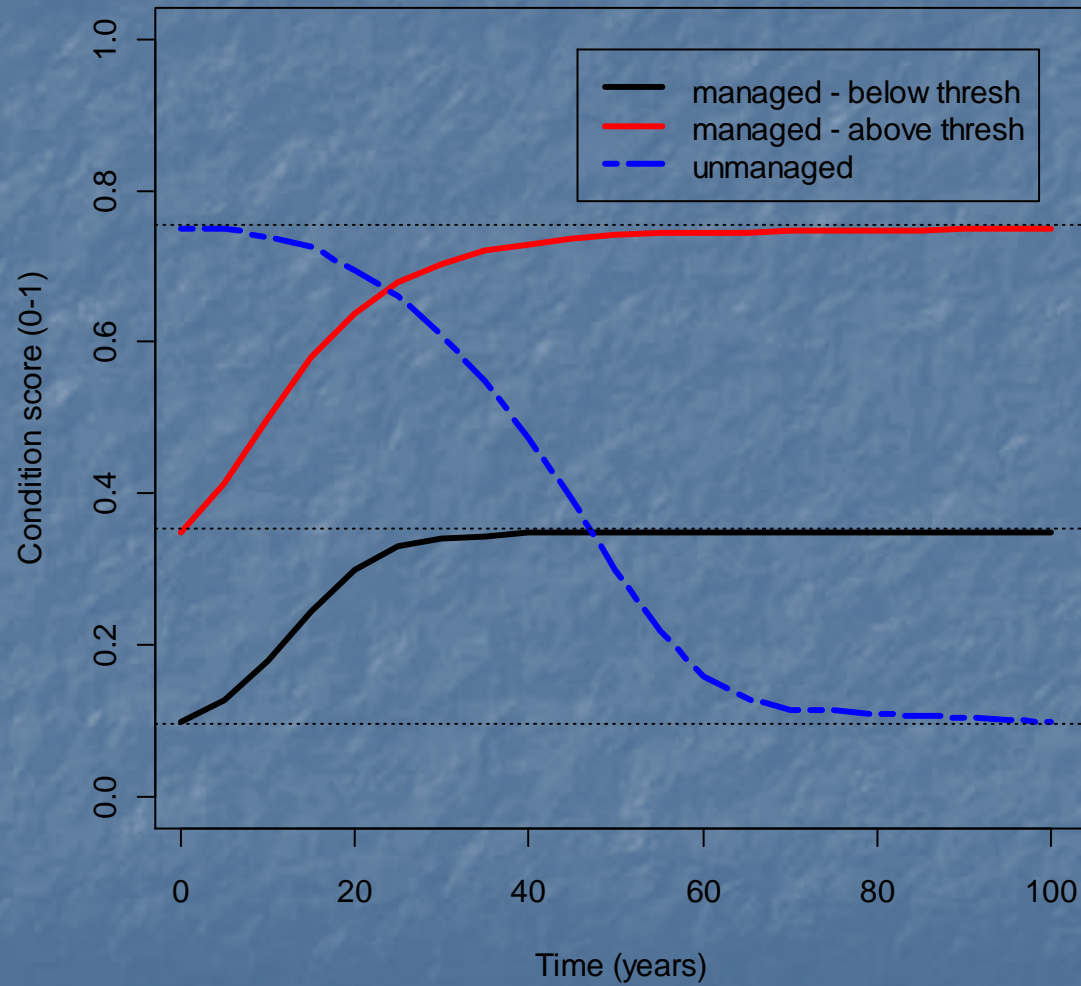
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4



Grassland condition model



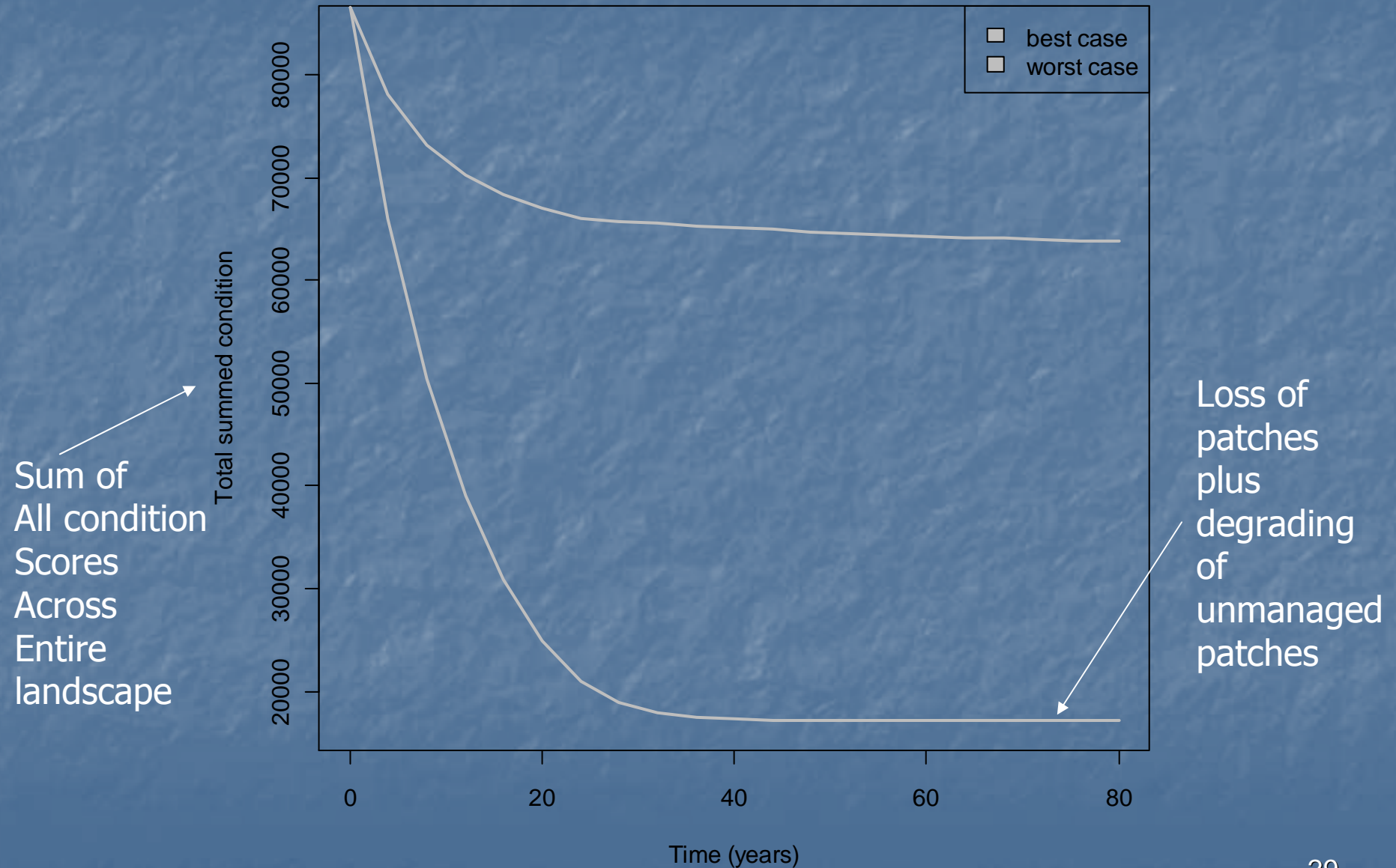
Model conservation actions

- Develop inside Urban Growth Boundary (UGB)
- Offset each development
 - Random
 - Strategic
 - Strategic implemented immediately

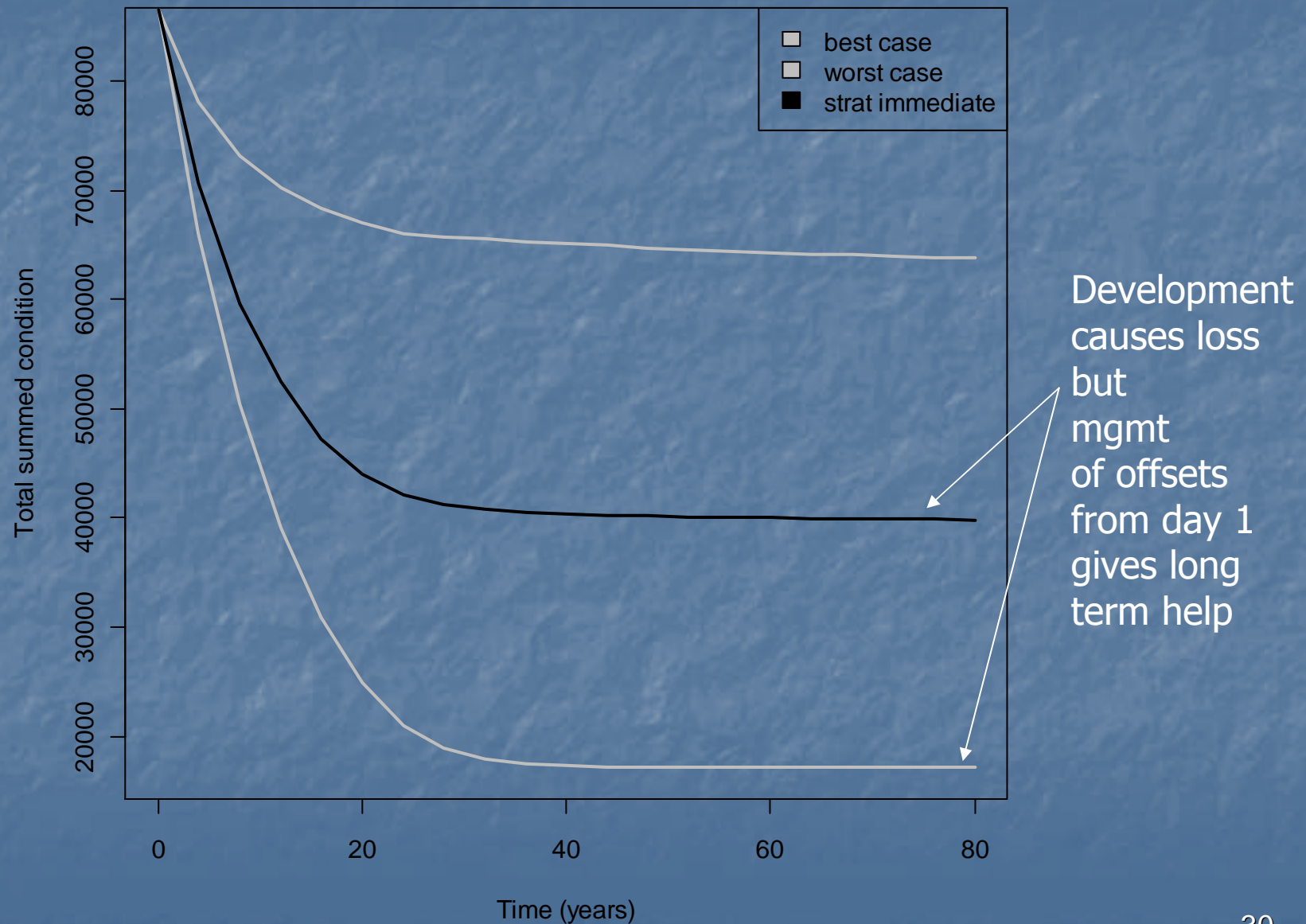
Animations of sequential model

- Development
- Random
- Strategic
- Strategic implemented immediately

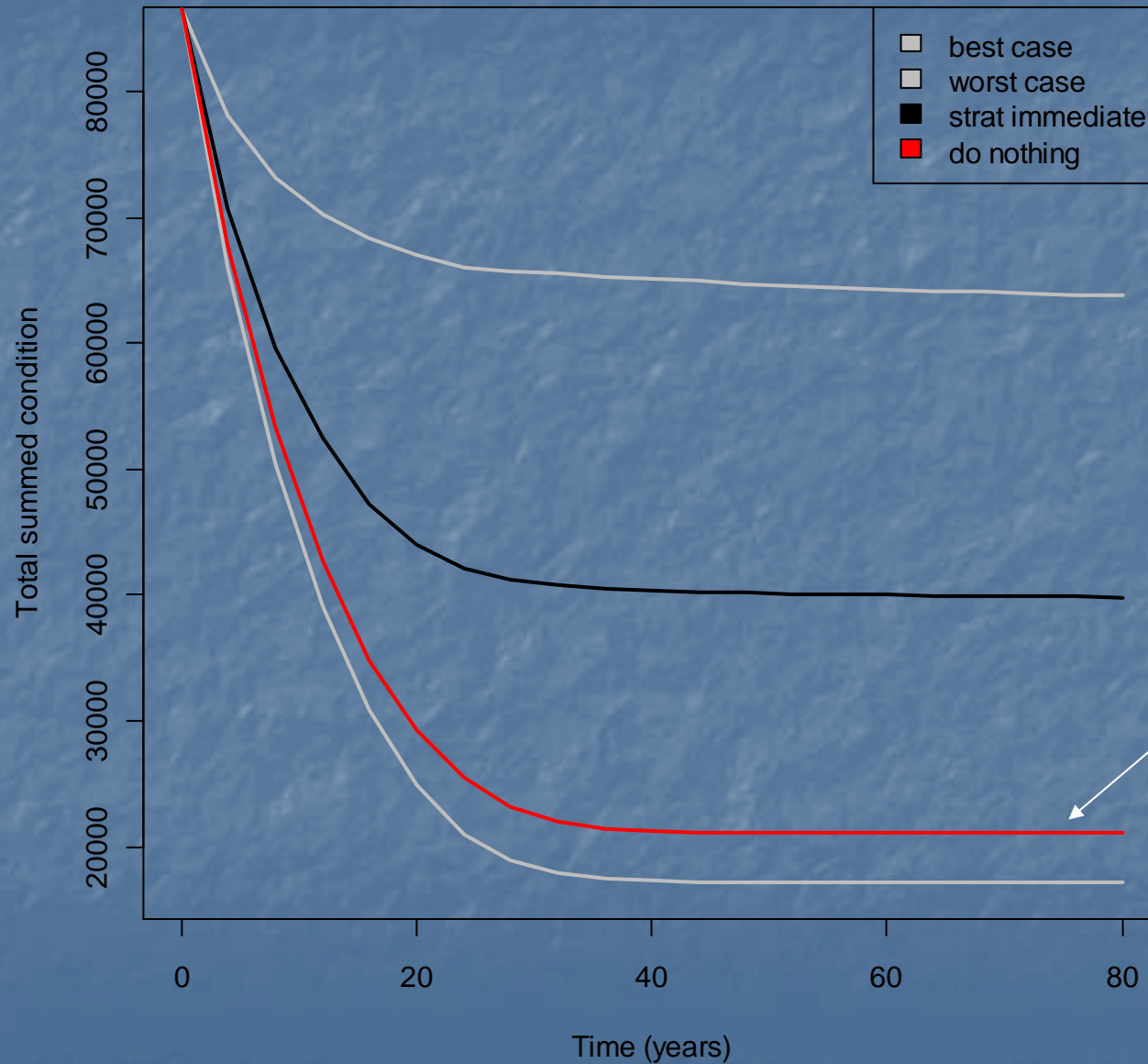
Worst case – No management, Full Development



Strategic Immediate – Offsets from Immediately Managed Pool

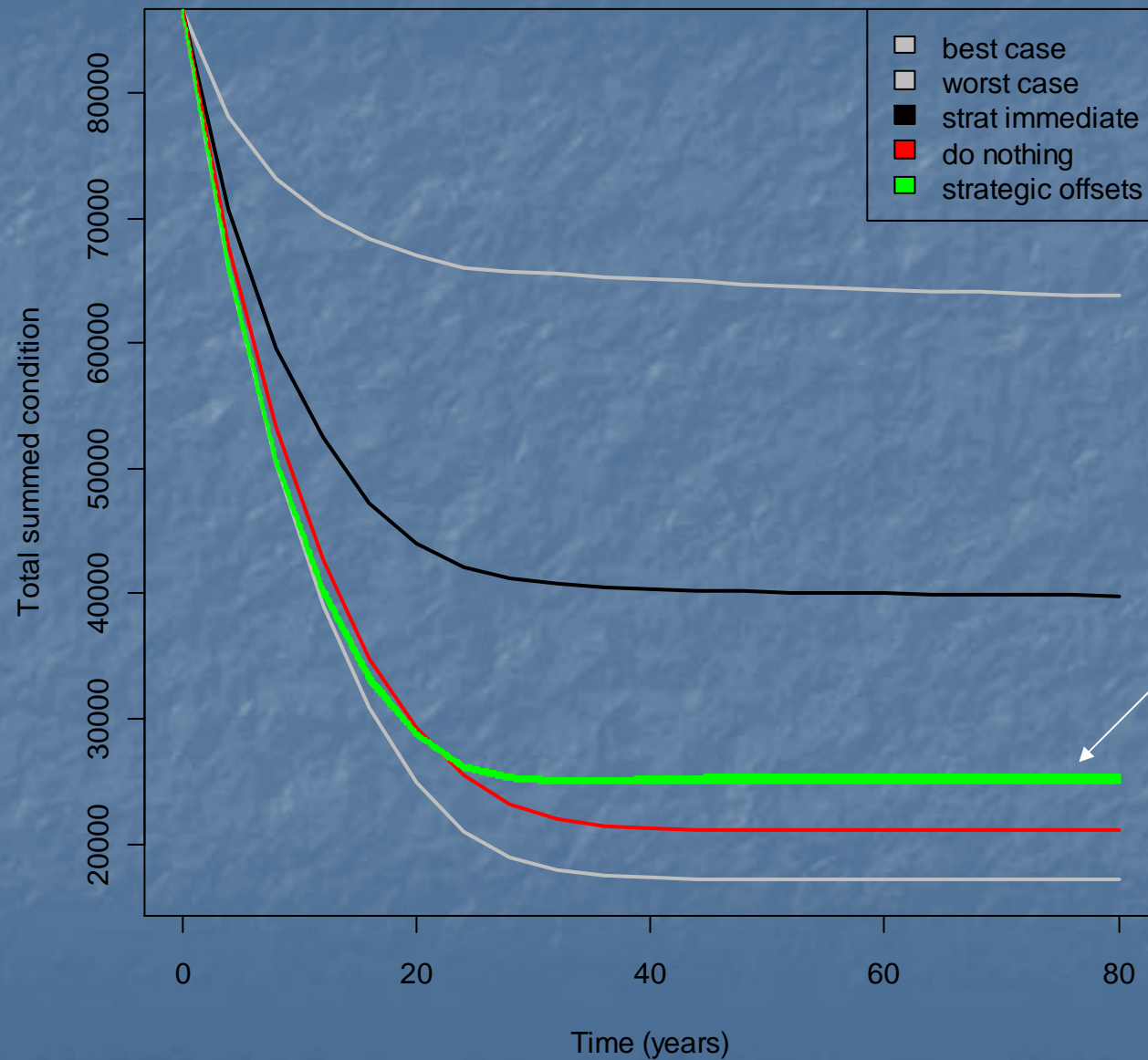


Do nothing – No development, No management



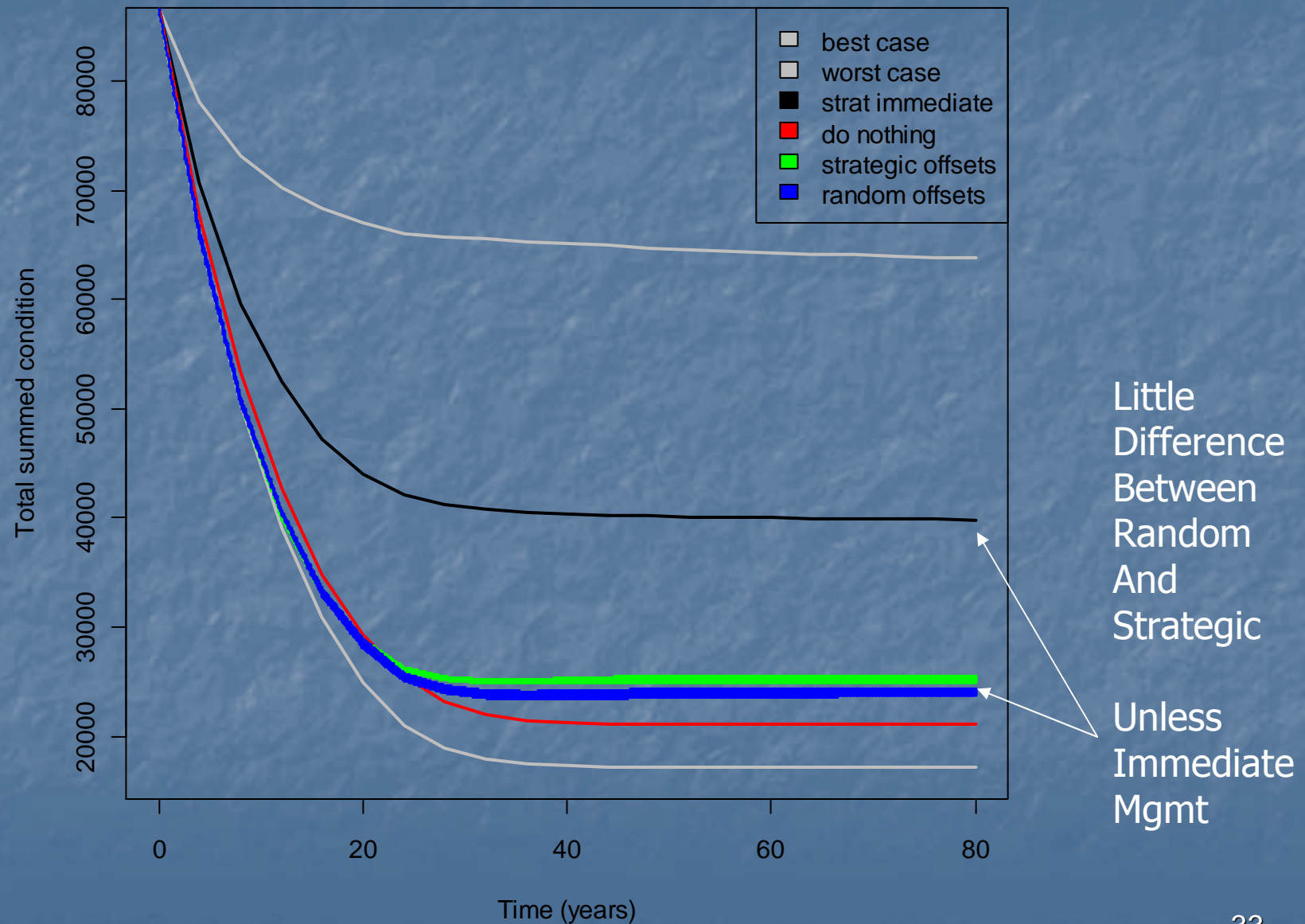
Doing nothing,
Grassland
degrades
even w/o
development

Strategic offsets – as development occurs

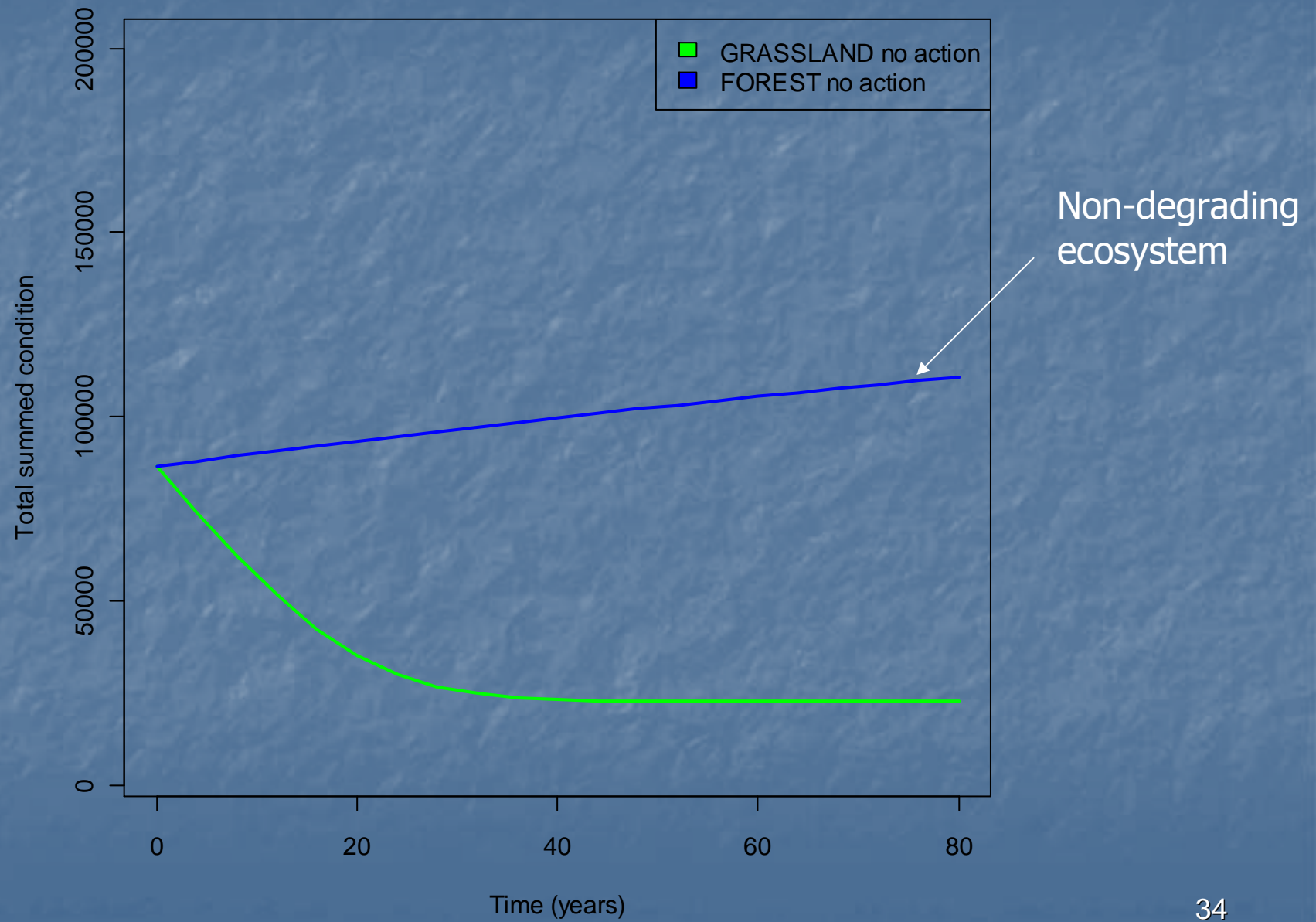


Strategic
Better than
Do nothing
But
Degradation
Before
Offset
Mgmt
Starts

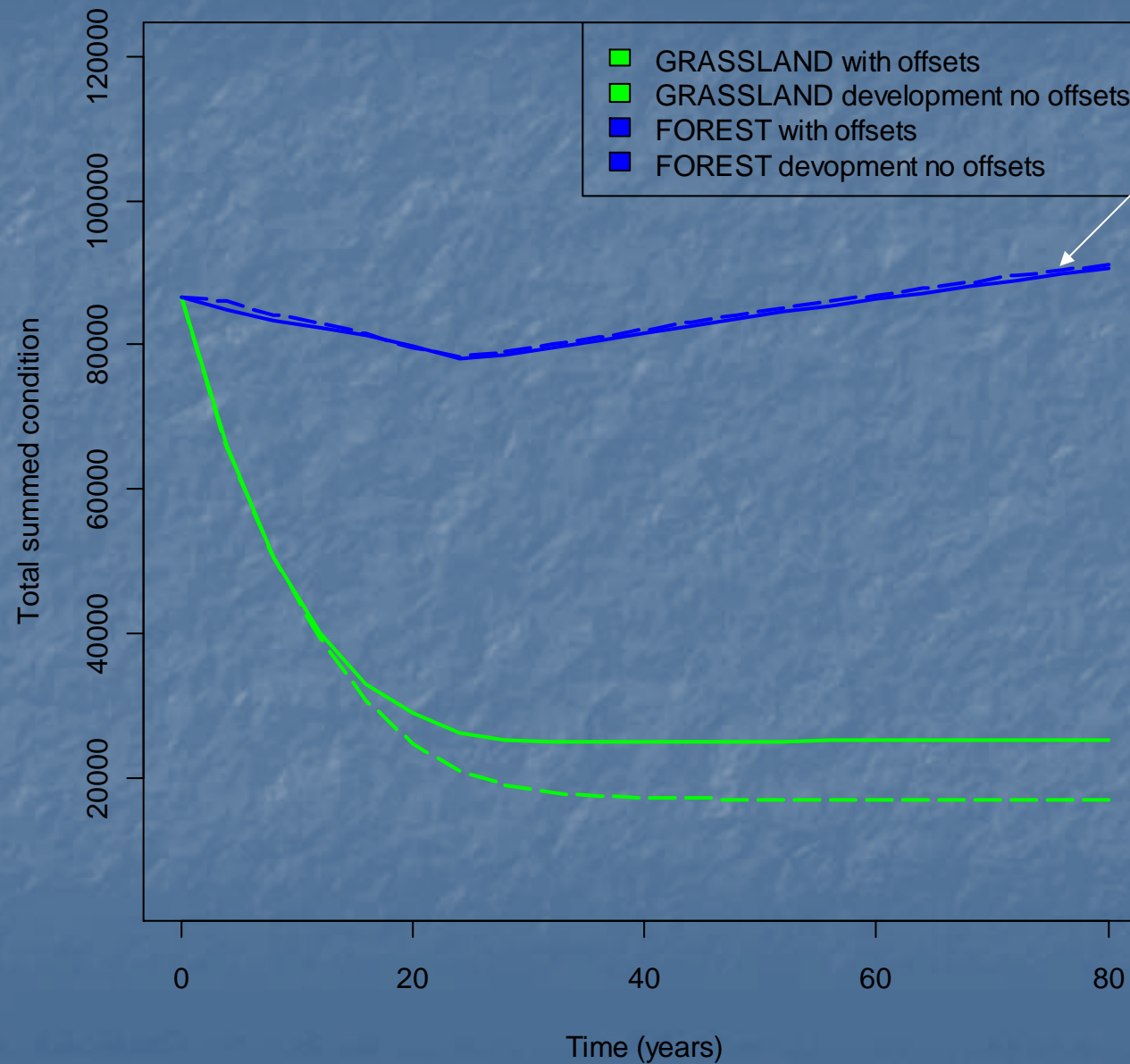
Strategic offsets – as development occurs



Habitat condition in Grassland and Forest ecosystems



Habitat condition in Grassland and Forest ecosystems



Offsetting
has no
effect on
total
condition

since no
loss is
avoided

Policy Model Summary

- Simulate sensitivities & uncertainties in policy
 - Find out *what actions matter*
- Honest about consequences of ignoring uncertainty
- Approach can be used to model sequential policies in general (Water? Carbon? Ecosystem services?)

What can you do to improve outcomes?

- *Test under local constraints and uncertainties*
- Immediate mgmt bank followed by buy back
 - In threatened environment
- Selection quality rule
 - Requiring offsets to be as good as lost patch
- Avoided loss
 - Choose offsets from pool where losses *do* occur
- Enforce protection (10 year expiration problem)
- Offset multipliers

Everything comes down to manipulating these terms

Net “gain” =

(created value + *avoided* loss) – loss

Current work

- Updating model framework to handle more situations
- Generalizing - marine ideas of interest

Langford, William T, Gordon, Ascelin, Bastin, Lucy, 2009.
“When do conservation planning methods deliver? Quantifying the consequences of uncertainty”, Ecological Informatics (4), pp. 123-135.