

Improving Offset Policies Through Modeling As Sequential Reserve Selection

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Biodiversity Offsets

- **Biodiversity decreasing worldwide**
 - **loss of habitat to development**
- **Offsetting / mitigation**
 - **Develop => purchase / restore to offset loss**
- **Examples**
 - **Australia – Net Gain**
 - **US – Wetlands**
- **Not always said to be addressing biodiversity,**
 - **But has significant affects on biodiversity.**

Current policy example

- Look for listed species.
- Assess habitat quality (HH).
- Choose site to offset lost habitat .
- Do restoration hoping for original quality.
- Protect and maintain offset in the future.

Functional Structure of Policy

- **S**creen
- **O**ffset
 - **A**ssess
 - **C**hoose offset
- **R**estore
- **P**rotect

Amounts to Reserve Selection

- => can view as an optimization algorithm
- Developer is reserve selection mechanism
 - Would you purposely design a reserve selection alg that way?
- Developer criteria maximizing \$\$\$, not biodiv
- Suggests Trying to Improve Selector
 - Select from chosen set

But does it matter?

- *Are we worrying about the right things?*
- **Example: Do these have far more consequences than HH?**
 - Listing and detection levels
 - Restoration success rates
 - Permanence of protection
- *How should we determine what does matter?*

Many Uncertainties

- **Screen**
 - # spp vs. # known
 - % spp endangered
 - % listed
 - % detected on site
- **Offset**
 - Assess
 - Reflect pers. prob?
 - Choose offset
 - Reflect pers. prob?
 - Connectivity...
- **Protect**
 - Permanent or decays?
- **Restore**
 - Level of success

Credit Assignment

- To *pieces* of a system that is
 - *distributed,*
 - *sequential,*
 - *stochastic,*
 - *non-independent,*
 - *highly uncertain*
- Can we evaluate functional blocks, not implementations (HH)?
 - Screen Offset Restore Protect

Common Currency

- **One common intent to all actions**
 - Increase pers. prob.
 - May be other good currencies...
- **Example**
 - High HH as surrogate for increased pers. across many species
 - Uncertainty in assessment function
 - Express as measure of approx to pers prob (currency)

Functional Units of Policy

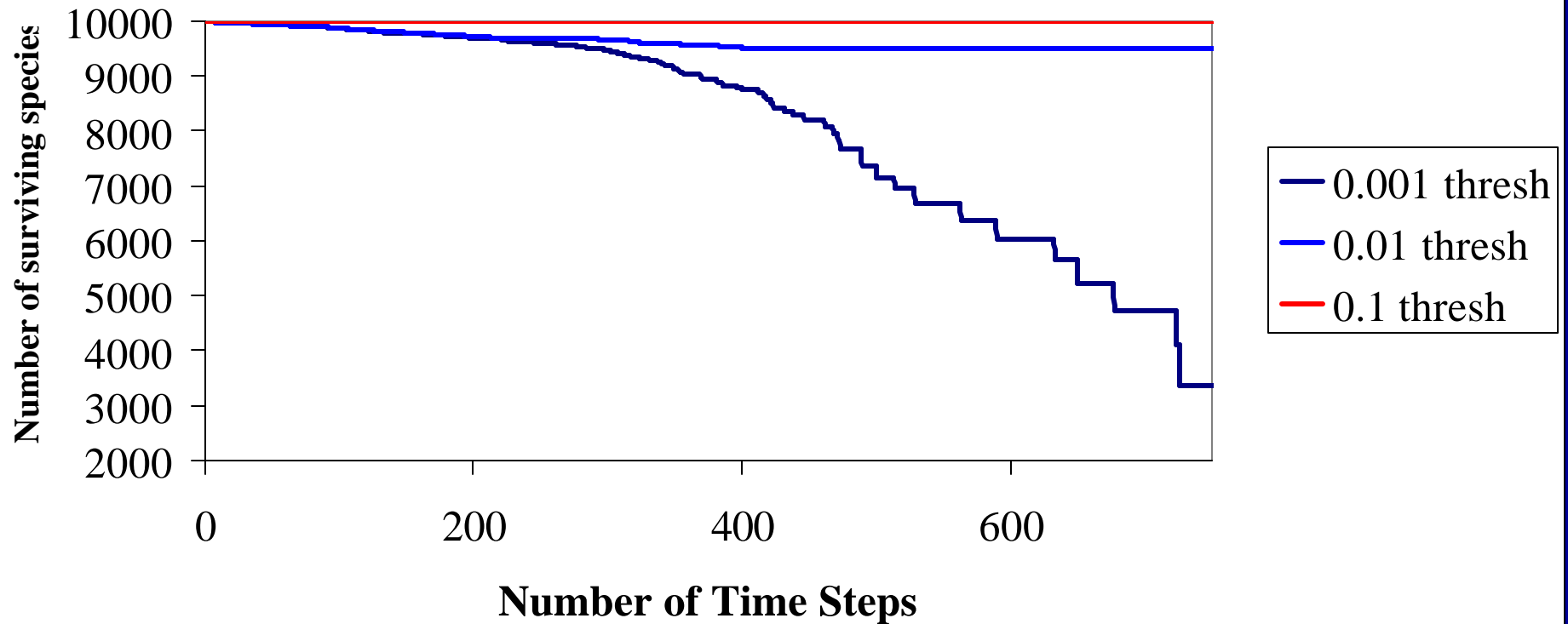
- **Screen, Offset, Restore, Protect**
 - at least 2^4 combined policies
- **Uncertainties in functional units**
 - **Screen**
 - Listing, detection, etc.
 - **Offset**
 - approximation to persistence prob
 - **Restore**
 - Actual change in persistence prob
 - **Protect**
 - Permanent vs. decay
- **Infogap style analysis of policy choice**

Policy simulation algorithm

- Choose uncertainties, etc.
- Draw set of patches & species
- Assign species to patches
- Simulate development
 - Draw a patch to develop
 - Screen
 - Offset
 - Restore
 - Protect
 - Update
 - Repeat

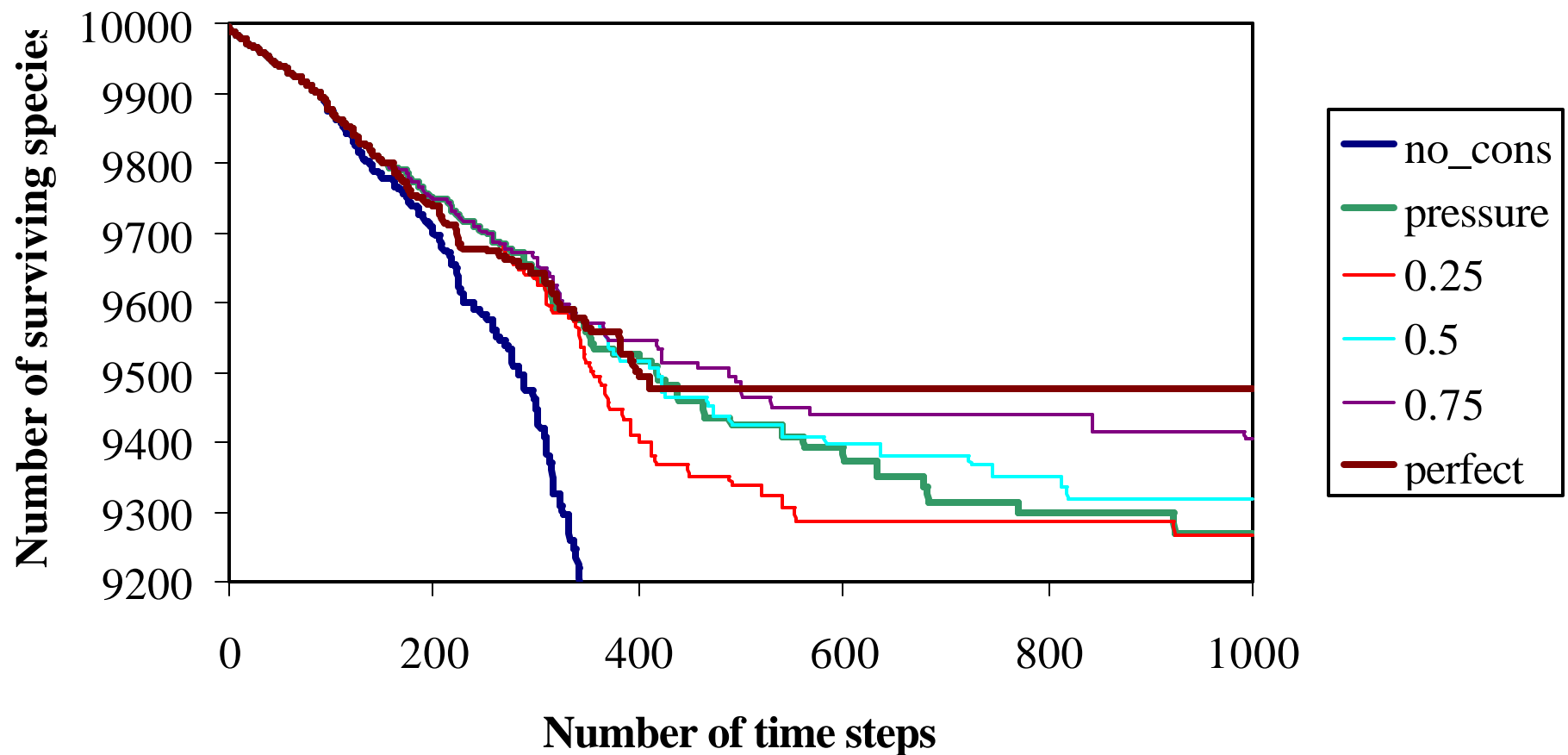
Effects of Defn of Listed Species (perfect prot, no offset)

Species Survival with Change in Listing Threshold



Effects of Decay in Protection

Trends in Number of Surviving Species



Conclusions

- **First thing: find out what matters**
- **Model functional units and outcomes**
 - **instead of implementations**
- **Do this using common currency (persistence)**
- **How much uncertainty before policy choice should change?**

Future Work

- **Improve model components**
- **Realistic model parameter choices**
- **Add costs**
- **How do things like trading ecosystems services and biodiversity fit into this kind of policy modeling?**
 - **Need a different model structure?**

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