

# Thesis proposal

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The proposal for my thesis, *Simulation models for predictive ecology*

1 Forecasting in ecology. Forecasting in weather, introduce computers.  
2 Future is uncertain, how do we best act given a forecast?  
3 We have some goal state for the future, and some estimate of what the state of the world will be given a set  
4 of actions.  
5 Brief summary of decision theory.  
6 Transition to theme of optimization given unknown information. In face of uncertainty, decision making  
7 is an optimization problem. Frame optimization problem mathematically an introduce concept of  
8 solution-space and constraint.  
9 Transition to how this is applied in ecology. Introduce idea of monitoring network. Transition to specifics  
10 of this thesis.

11 [Figure 1 about here.]

## 12 **CH1 optimizing sampling of species distributions**

### 13 **Methods**

- 14 • simulate species distribution and efficacy of detection given a set of observation points where the  
15 dist from observation site decays.
- 16 • optimize set of repeated sampling locations  $L$  for a *known* distribution  $D$ .
- 17 • address SDM not being the territory

## 18 **CH2 optimizing sampling of interactions**

### 19 **Methods**

- 20 • the missing link paper, turn this into optimizing with two different SDMs

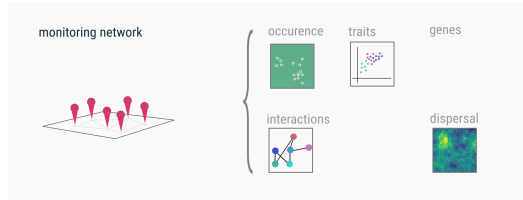
## 21 **CH3 optimizing corridor placement**

- 22 • land cover -> resistance -> extinction time
- 23 • simulated annealing to optimize landscape optimization

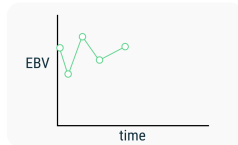
## 24 **CH4 a software note on the resulting packages.**

- 25 • `Observatories.jl`, `Corridors.jl`, `MCD.jl`

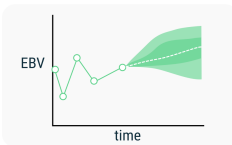
data



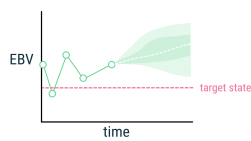
Essential Biodiversity Variable



Forecast



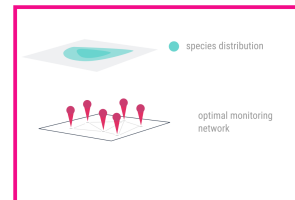
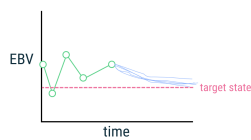
optimizing action to get target state



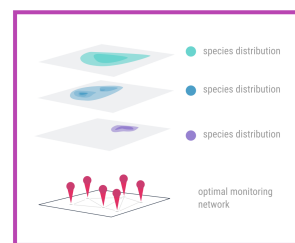
all actions -> constraints -> possible actions

optimal action

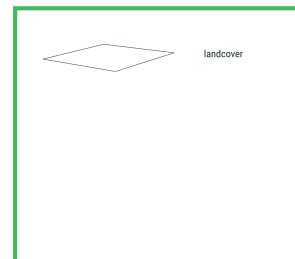
goal to minimize distance actual outcome (unknowable until the future)



chapter one  
optimizing sampling  
of species distributions



chapter two  
optimizing sampling  
of interactions



chapter three  
optimizing corridor  
placement against  
ecological dynamics



chapter four  
MetacommunityDynamics.jl:  
a virtual laboratory for  
community ecology

Figure 1: thesis concept