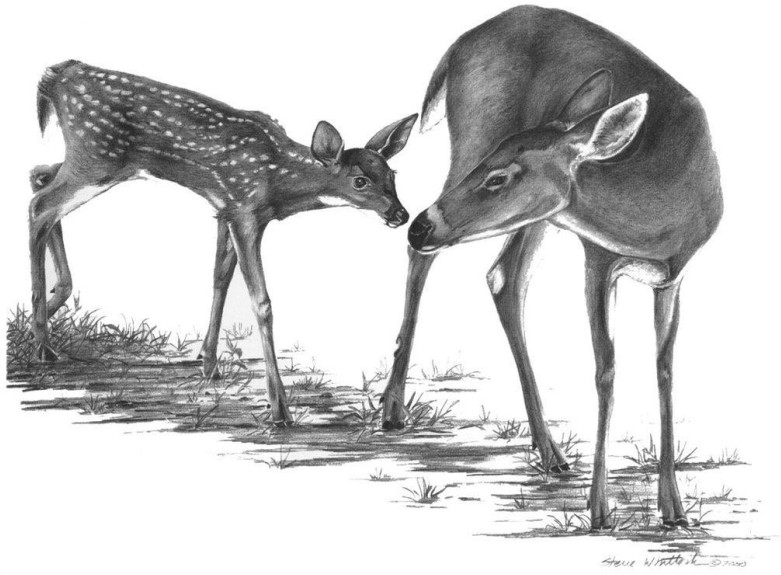
Case study: resource selection functions and “qualitative quandaries”



So far, we've primarily addressed quantitative and coding issues

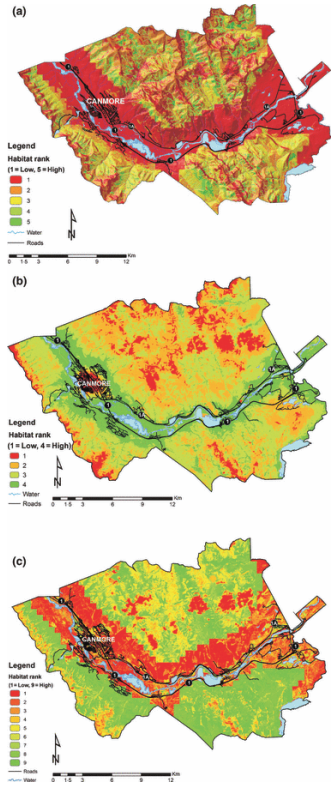
What kinda things do animals like?

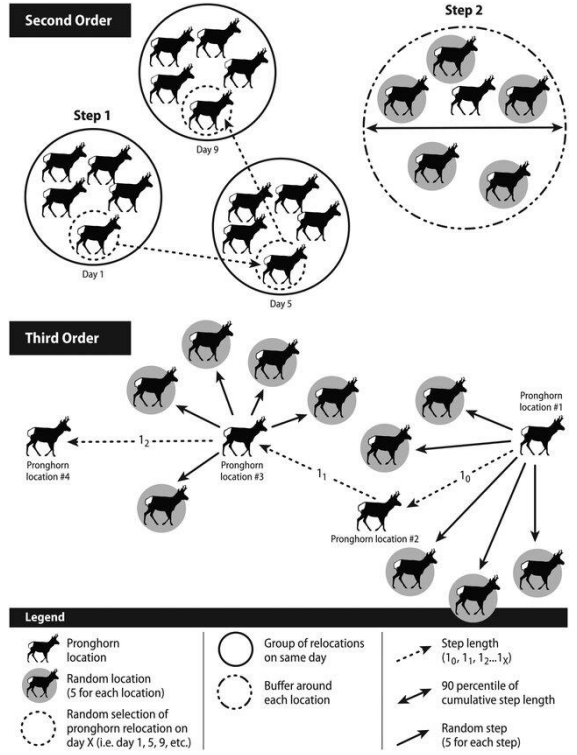
A NONMAPPING TECHNIQUE FOR STUDYING HABITAT PREFERENCES[1]

Analyses used to determine use of habitat require determining the available area of each habitat category. The method of mapping and using a planimeter to determine the area of well-defined plant communities was described by Neu et al. (1974). Other recent studies have used this or a similar technique (Nicholls and Warner 1972, Hirst 1975, Irwin 1975, Peek et al. 1976, Bloom 1978, Collins et al. 1978, Maxon 1978). Large diverse areas in rugged mountain terrain are difficult to map, and other habitat parameters, in addition to plant communities,

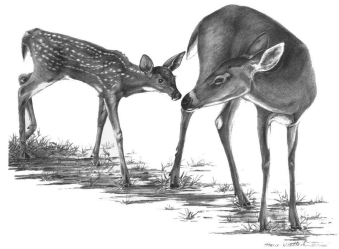
[1] Funding was provided by the McIntire-Stennis Federal Forestry Program administered through the School of Forestry, University of Montana; the USDA Forest Service Region 1 and Intermountain Forest and Range Experiment Station; and the Montana Department of Fish and Game, District 2.

J. Wildl. Manage. 44(4):1980



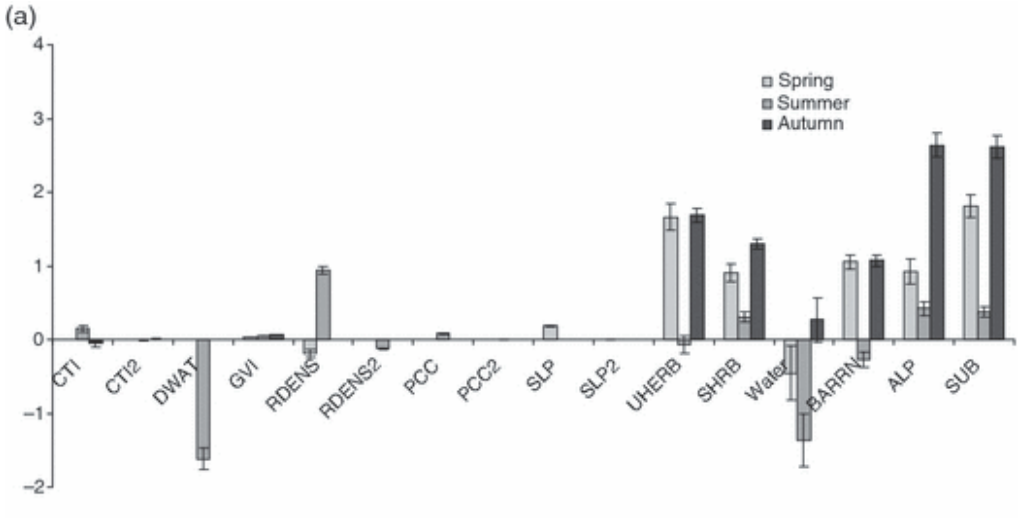


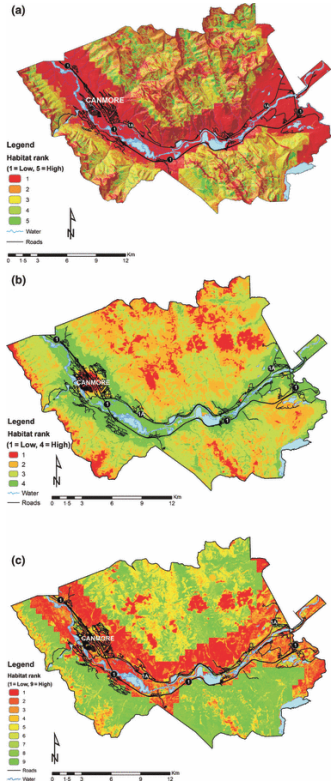
We need to understand use relative to availability

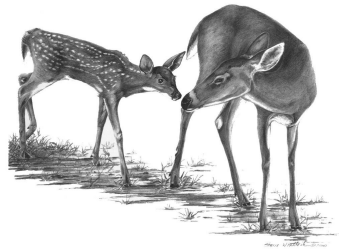


Resource selection functions

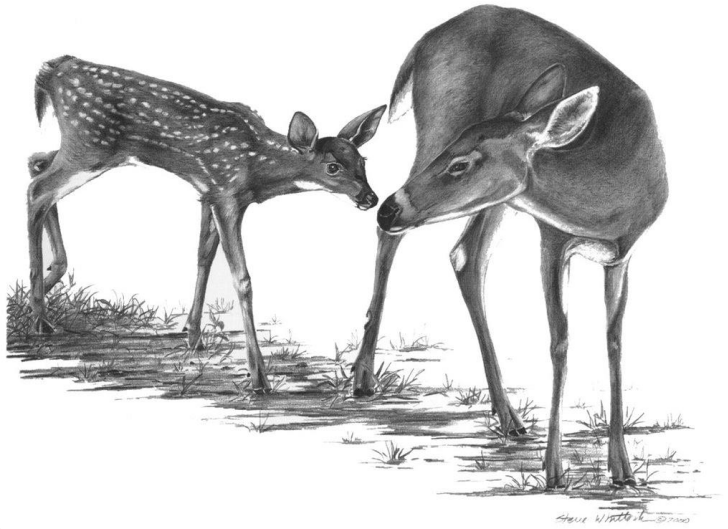
- **(Generally) logistic regression to understand relationships among covariates and probability of used (y = 1) v. random (y = 0) points**







We'll estimate selection for parturition sites for white-tailed deer breeding in a mosaic of 'natural' and human-impacted habitat types with recent substantial disturbance (i.e., heavily logged over the last decade)*

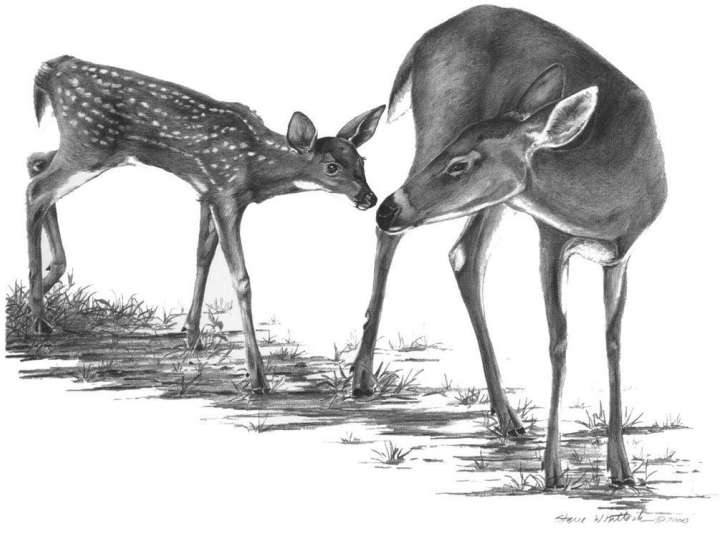


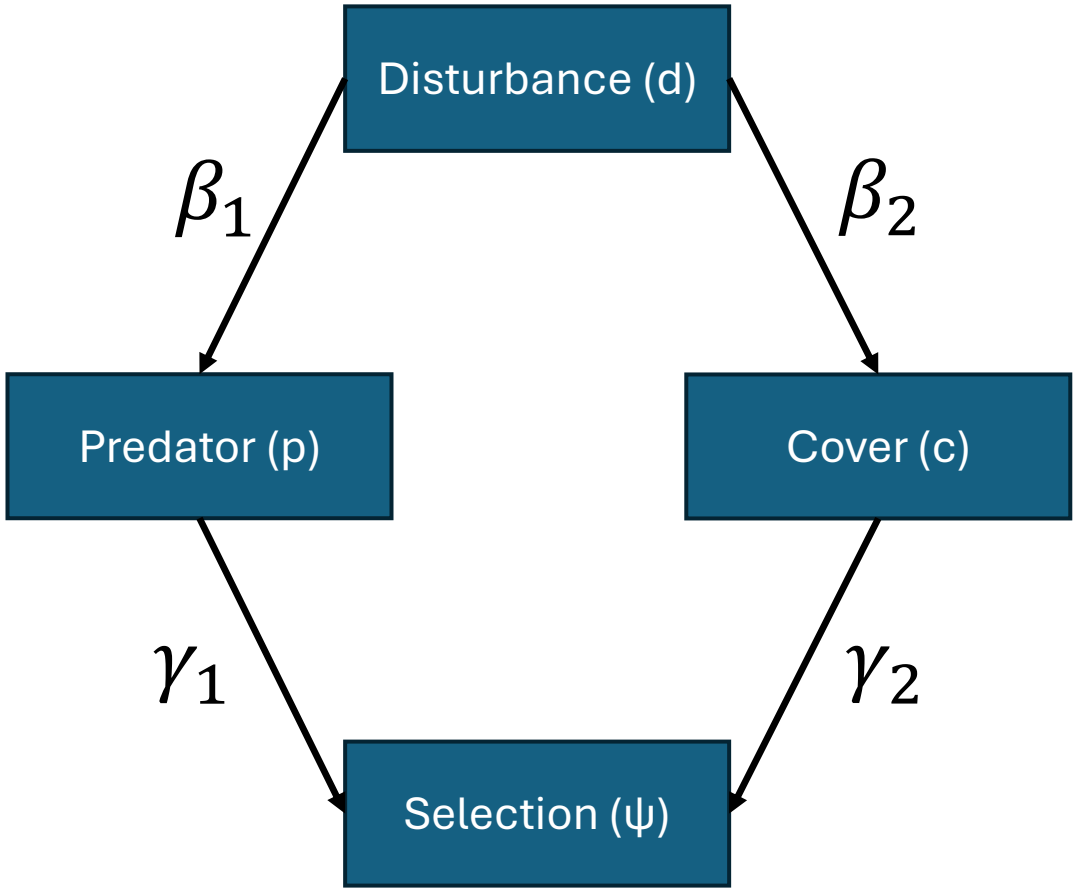
Joe Eisaguirre
Alaska Science Center

***DISCLAIMER: these are simulated data, not a perfect representation of reality**

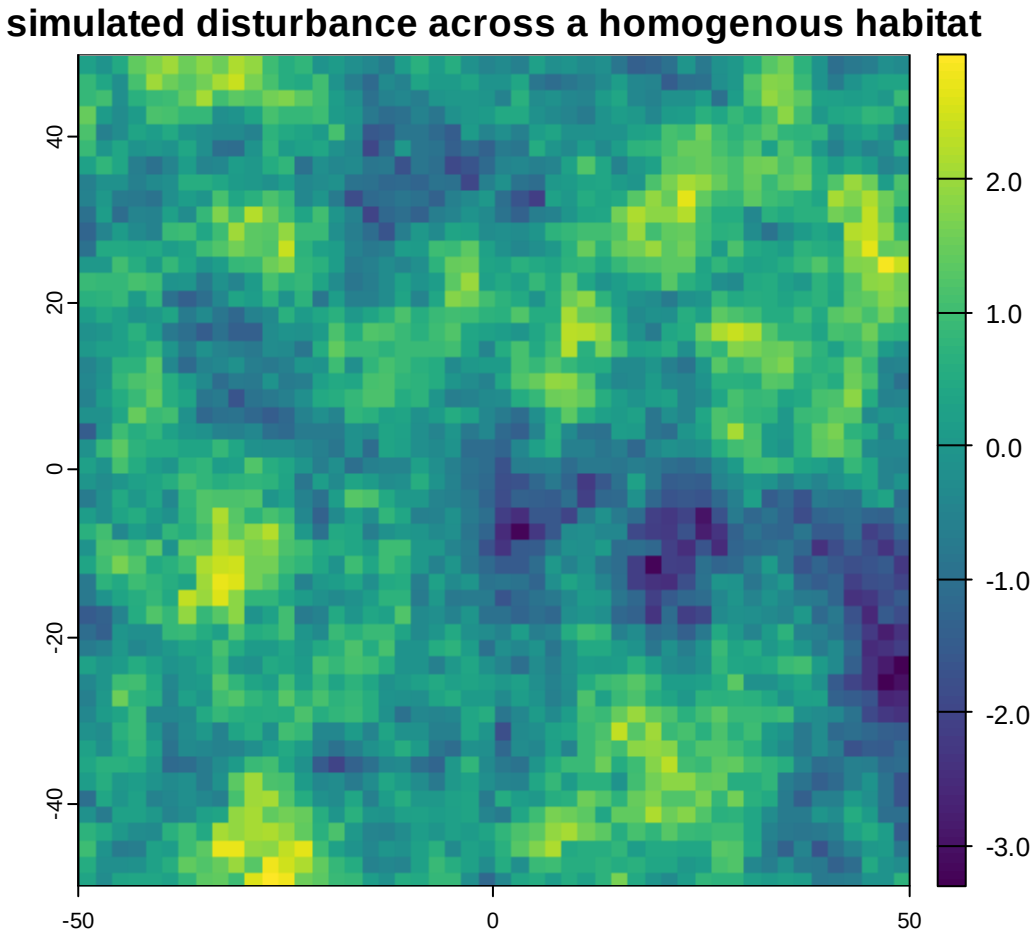
We'll measure three covariates

- Cover
- Predator activity
- Disturbance



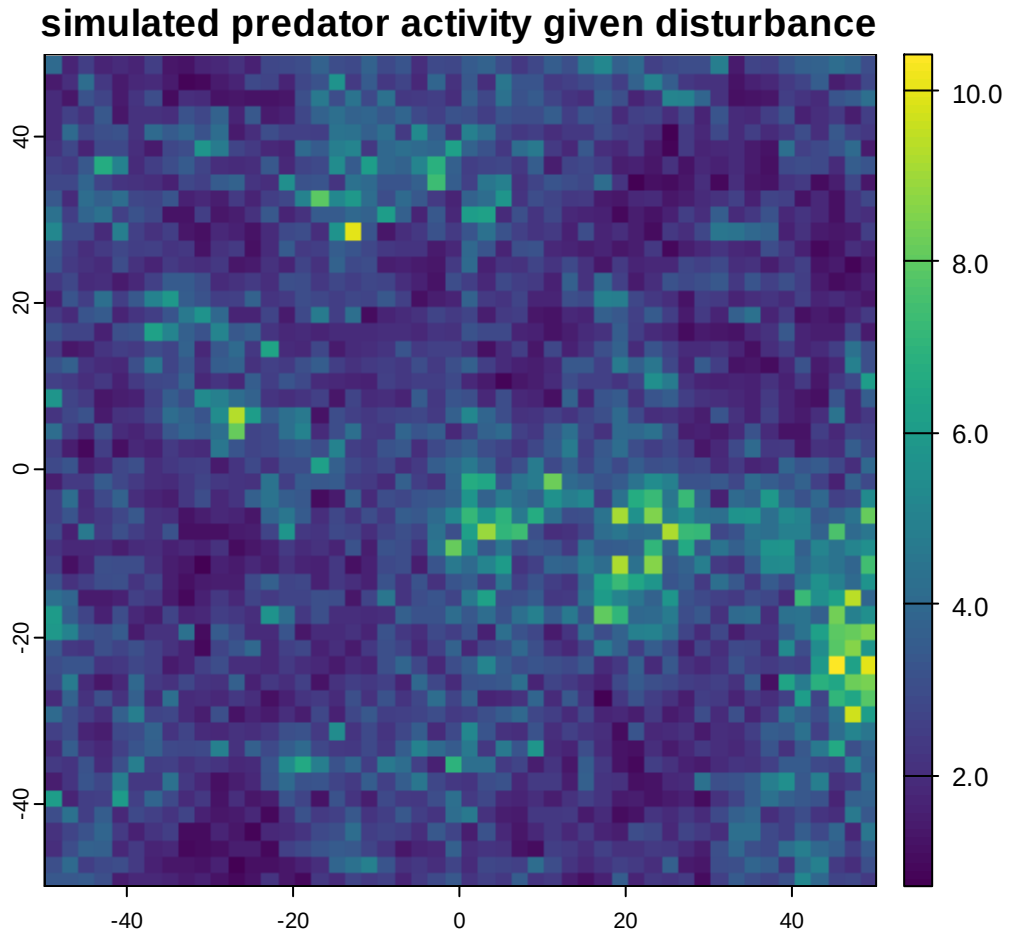


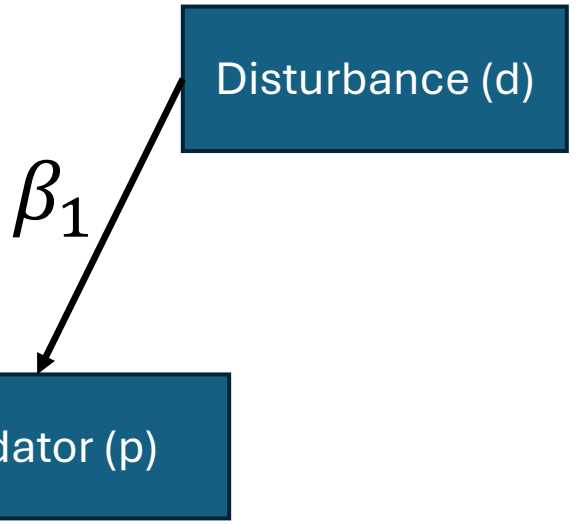
Simulating disturbance



Disturbance (d)

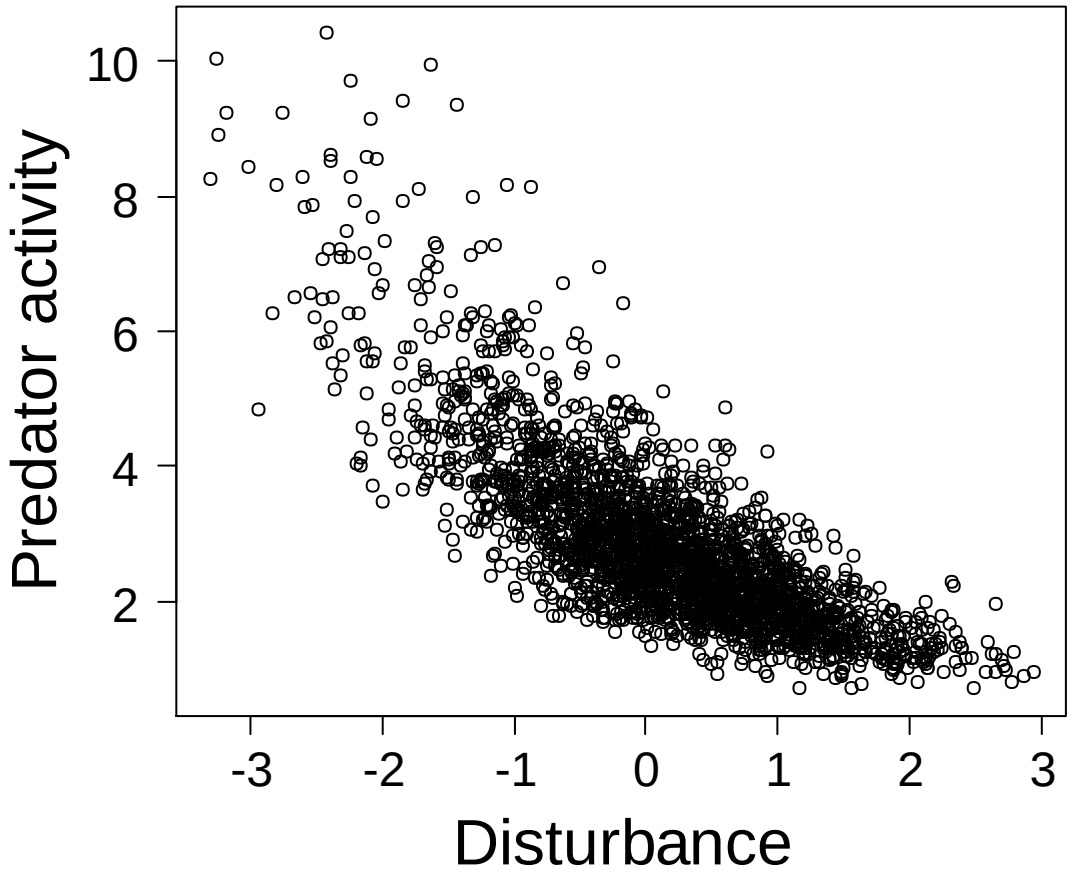
Simulating predator abundance as a function of ‘disturbance'

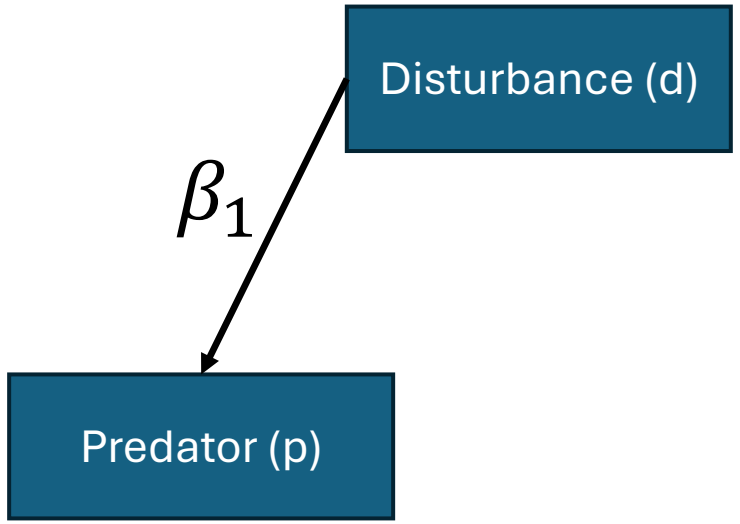




$$p_i \sim \text{lognormal}(\alpha_1 + \beta_1 d_i, \sigma_p^2)$$

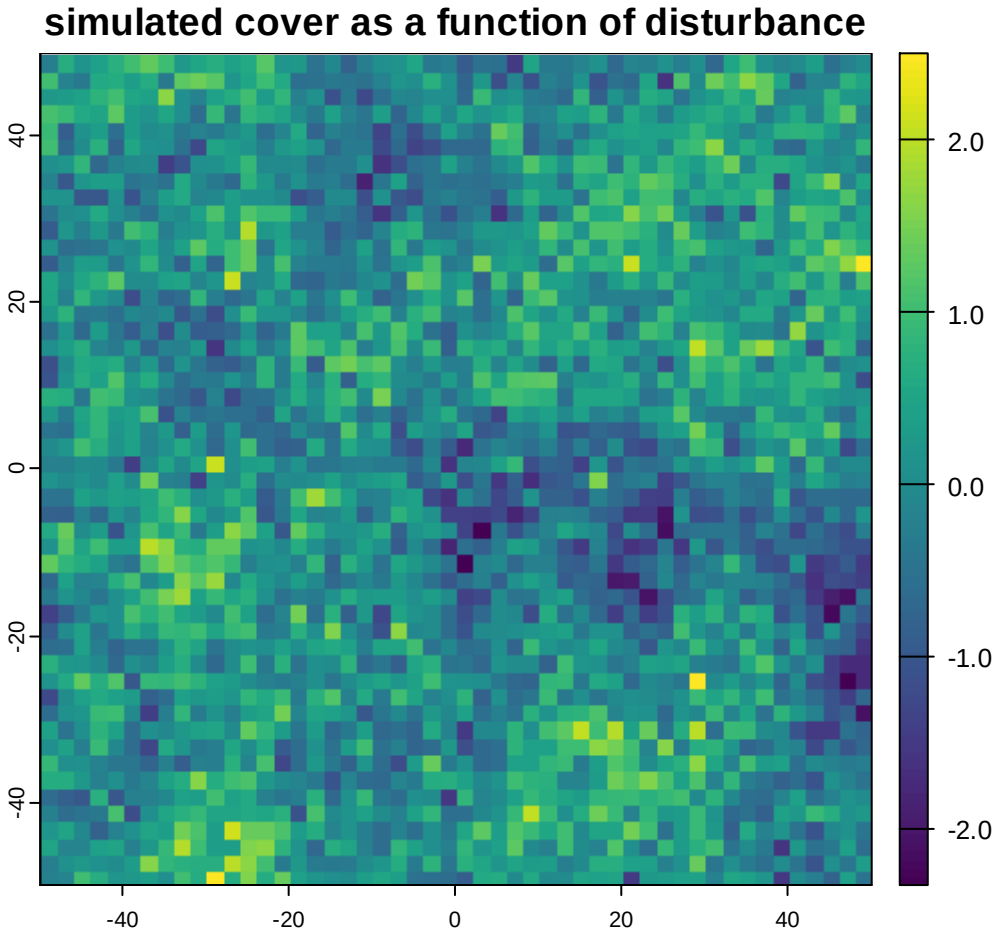
Simulating predator abundance as a function of ‘disturbance'

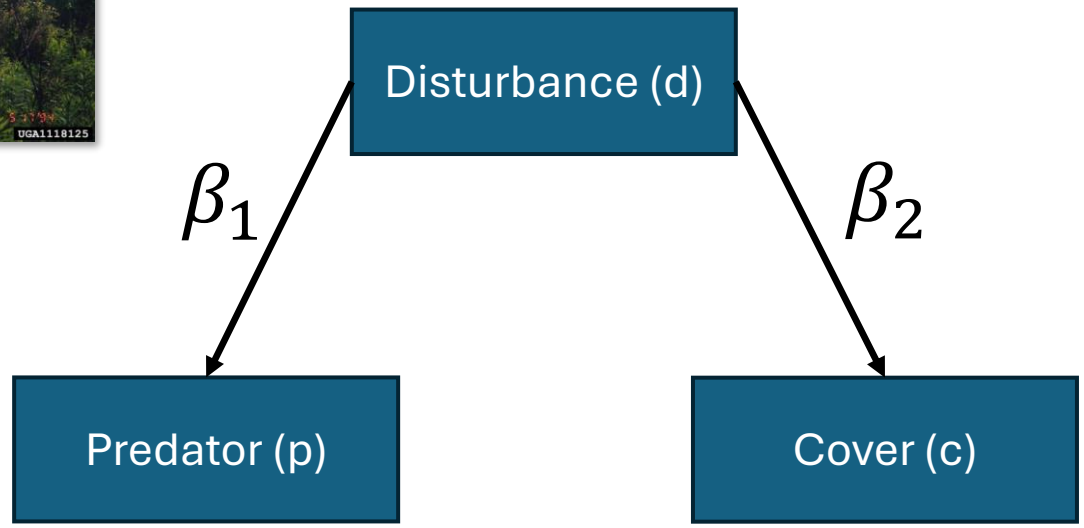




$$p_i \sim \text{lognormal}(\alpha_1 + \beta_1 d_i, \sigma_p^2)$$

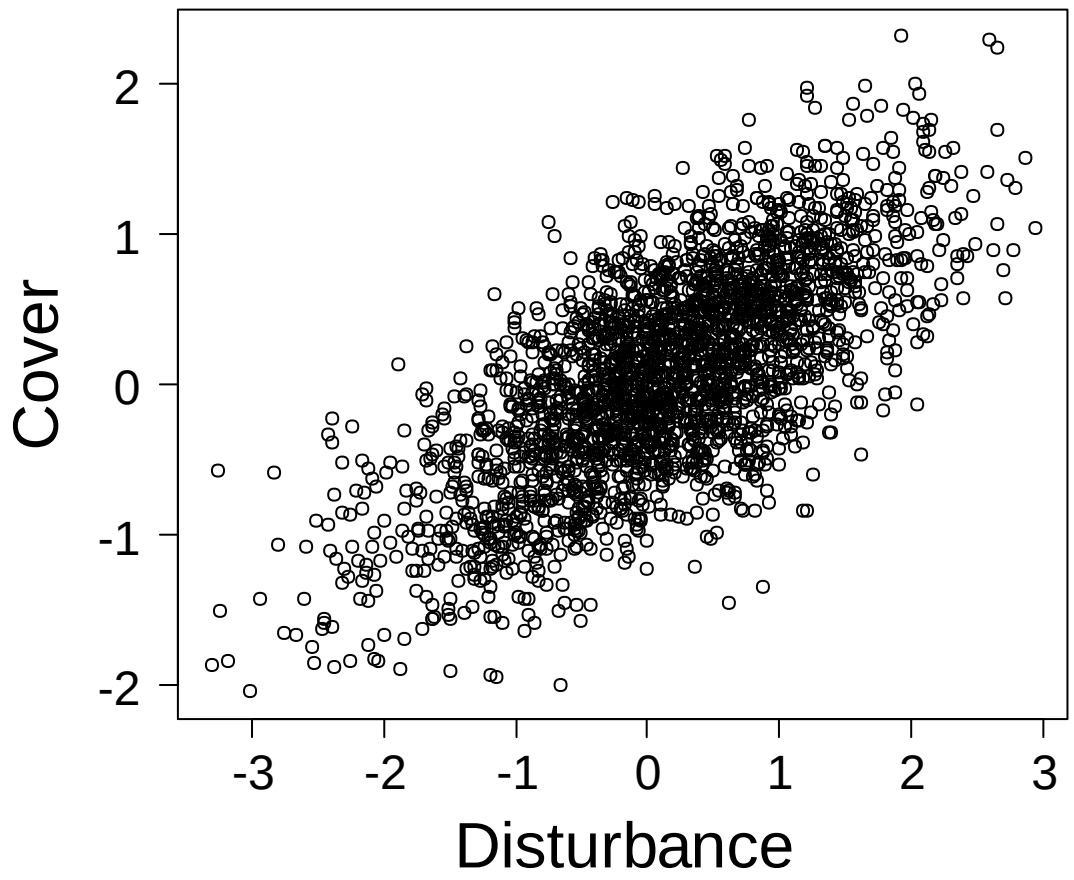
Simulating cover

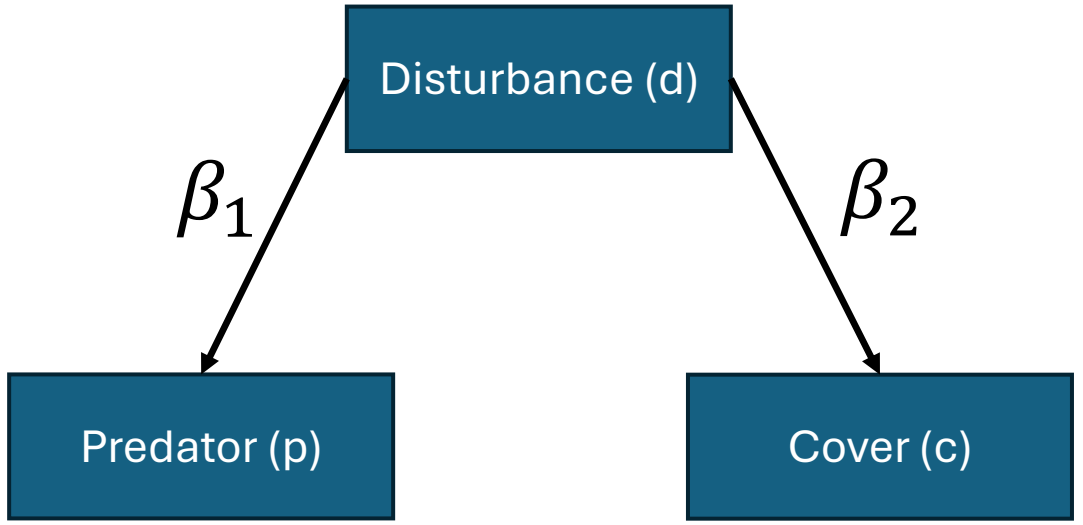




$$c_i \sim \text{normal}(\alpha_2 + \beta_2 d_i, \sigma_c^2)$$

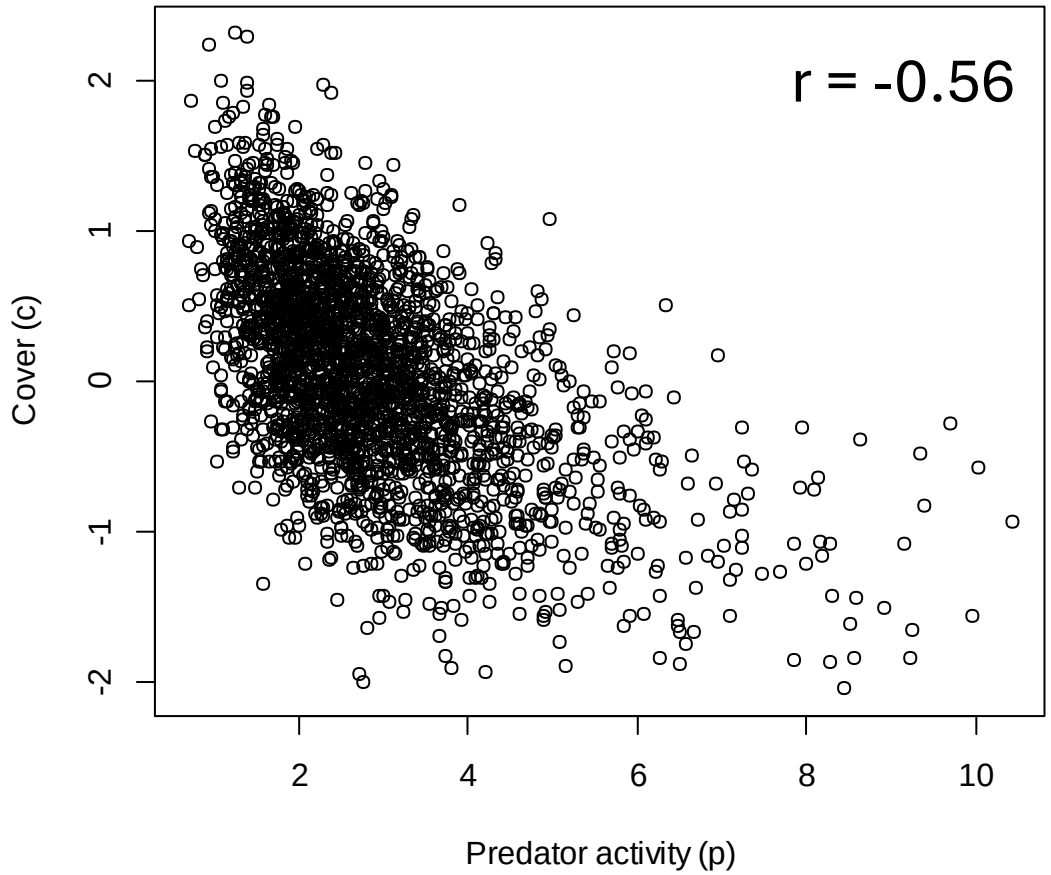
Simulating cover

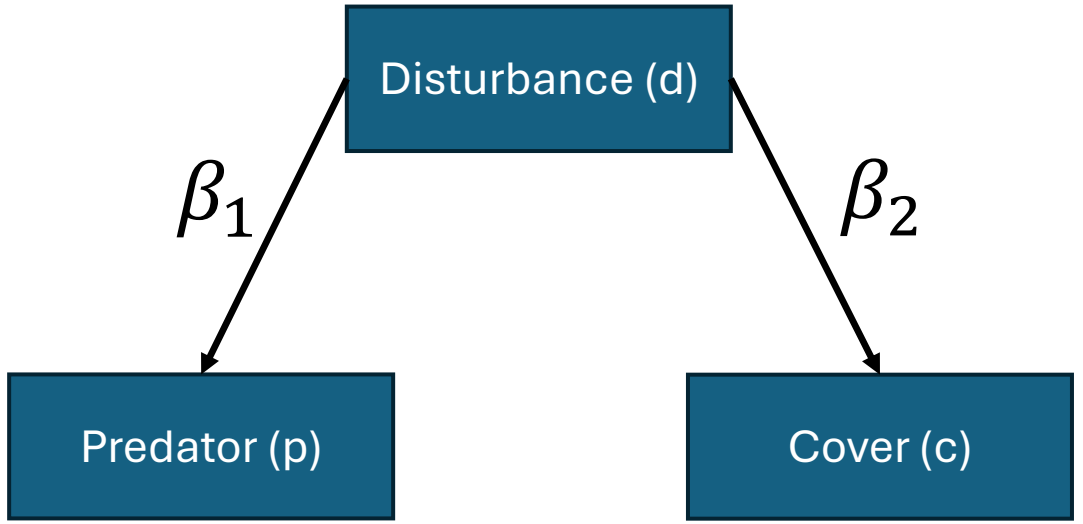




$$c_i \sim \text{normal}(\alpha_2 + \beta_2 d_i, \sigma_c^2)$$

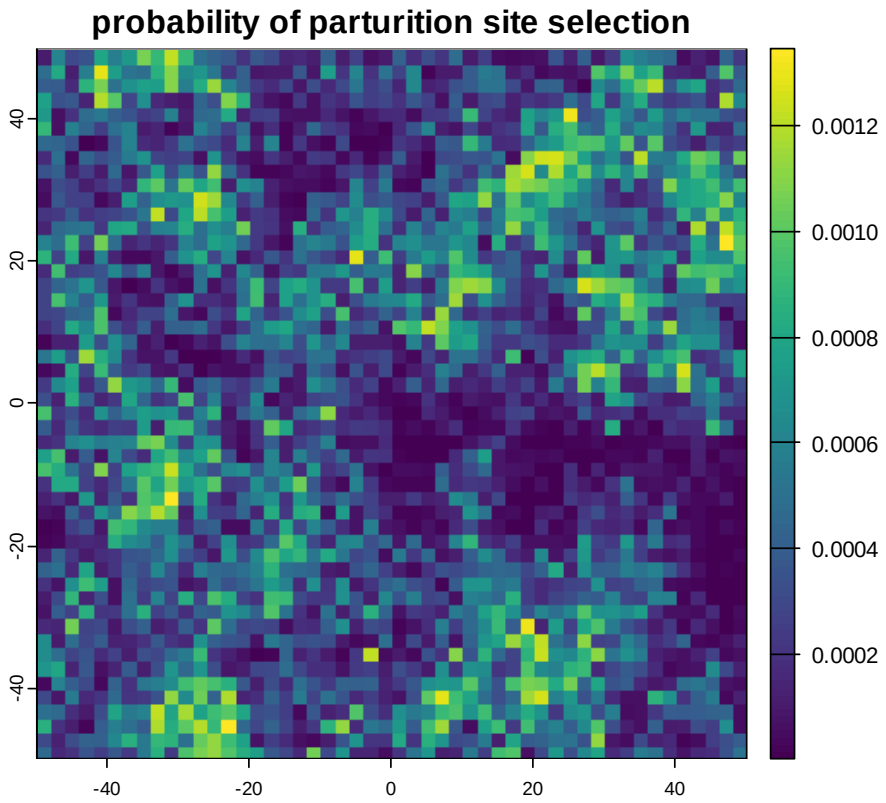
Multicollinearity

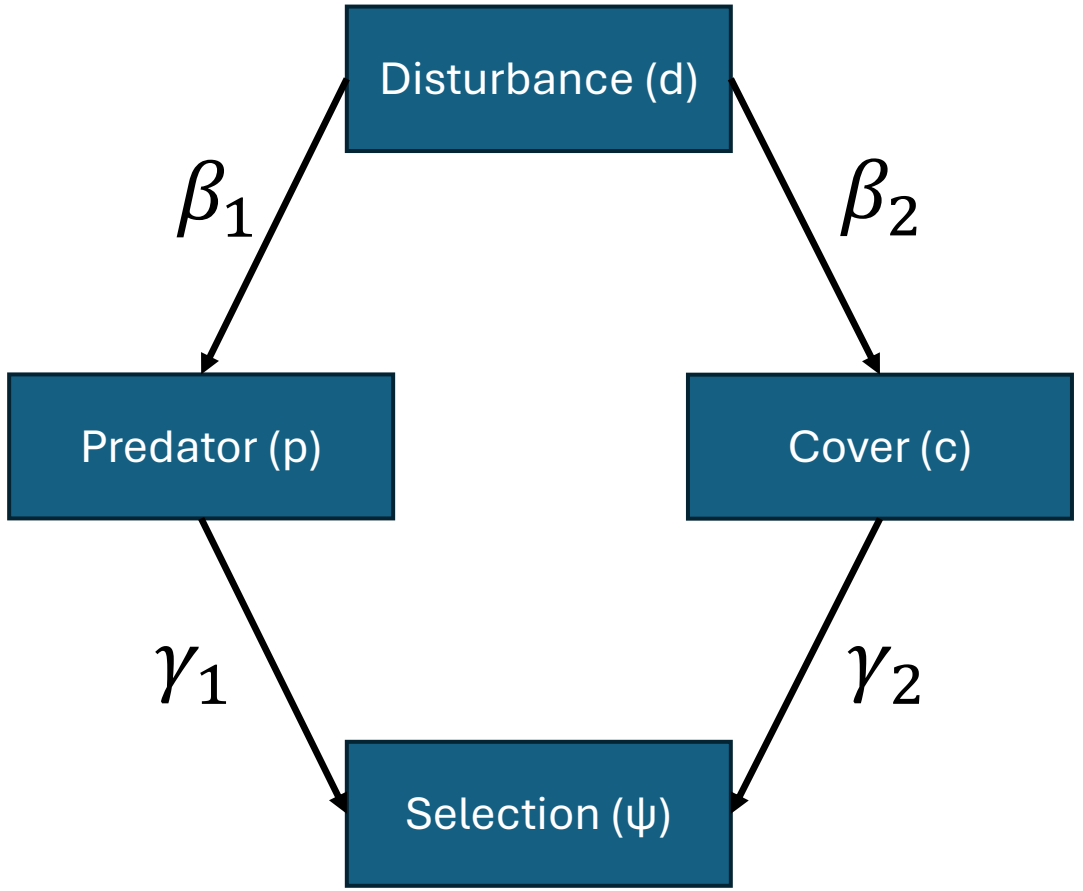




Simulating resource selection

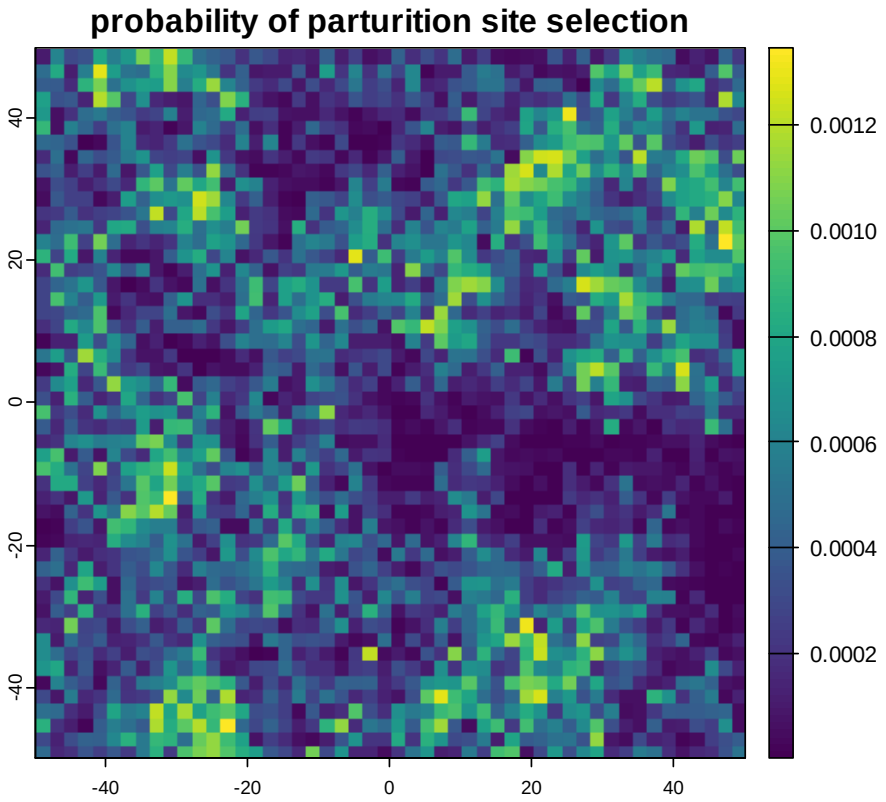
$$\text{logit}(\psi_i) = \alpha_3 + \gamma_1 p_i + \gamma_2 c_i$$

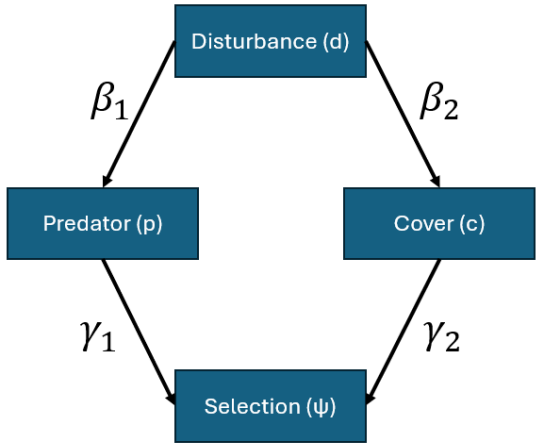


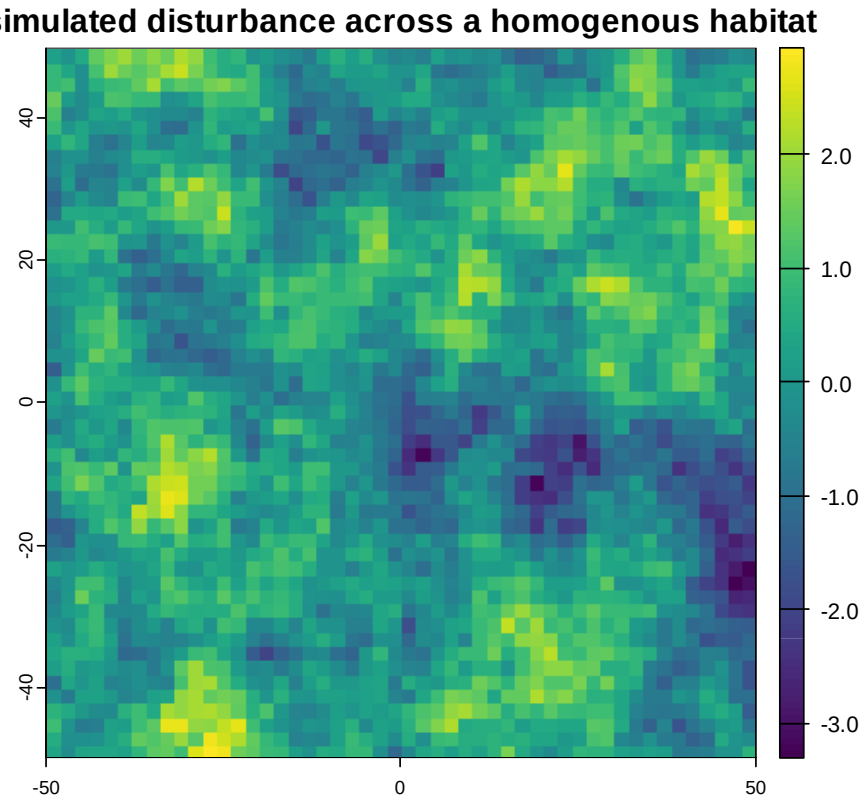


Areas with fewer predators and more cover are more likely parturition sites

Simulating resource selection





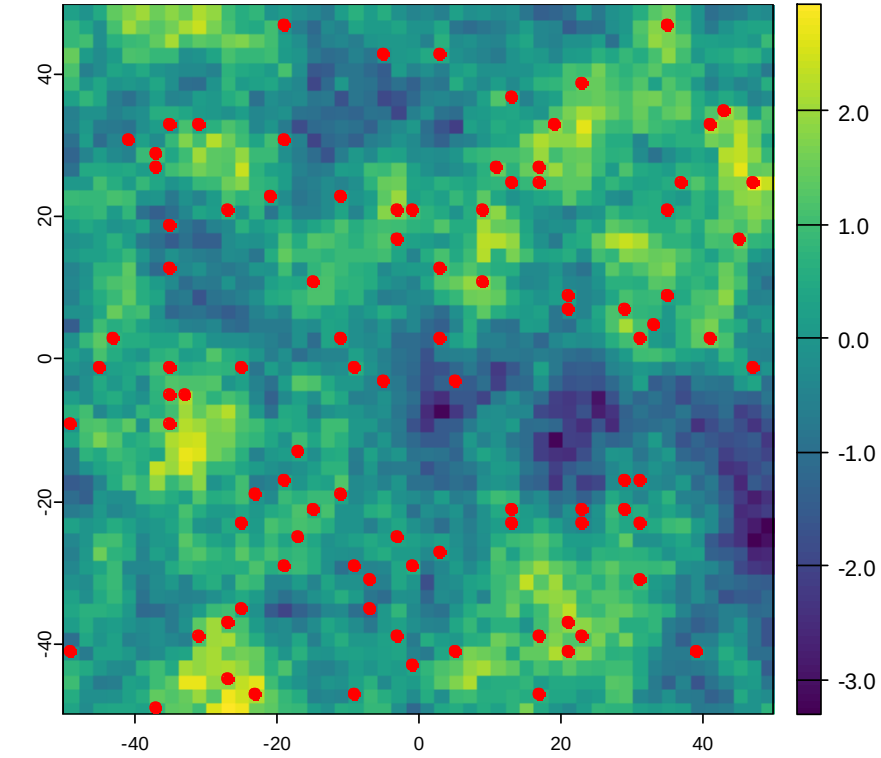


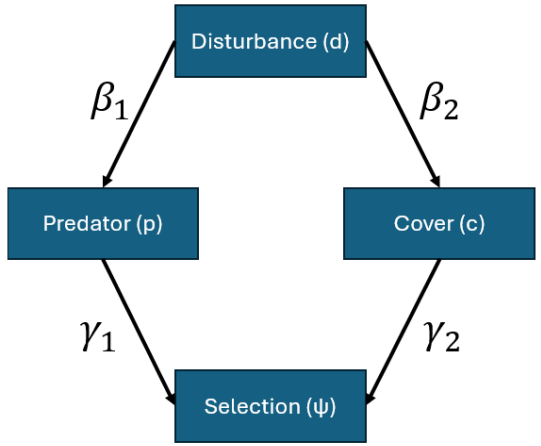
Areas with fewer predators and more cover are more likely parturition sites

Simulating data (y)

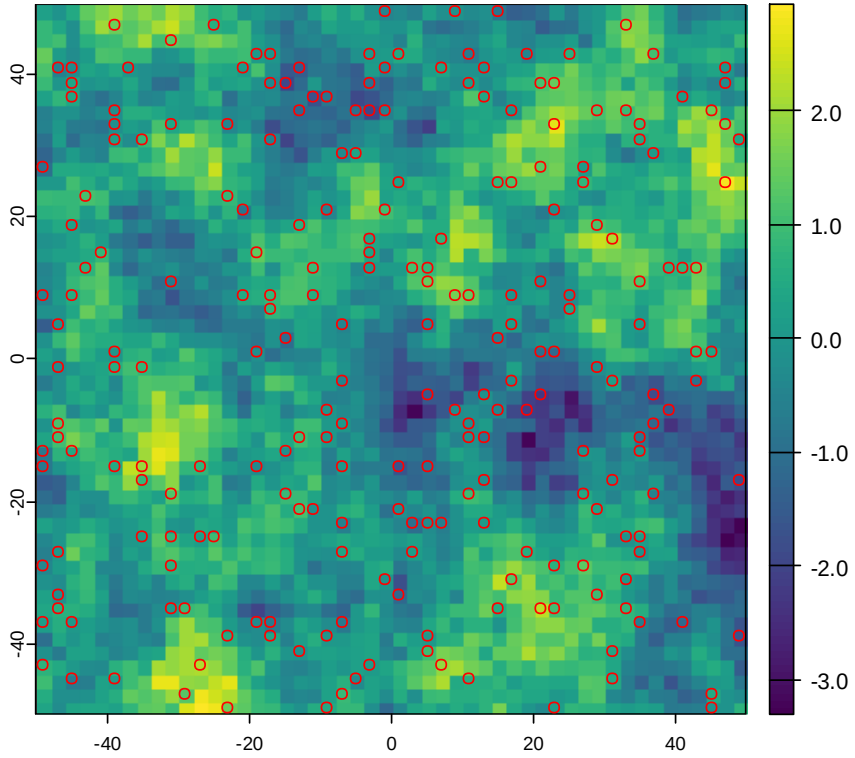
$$y_i \sim \text{Bernoulli}(\psi_i)$$

simulated disturbance across a homogenous habitat





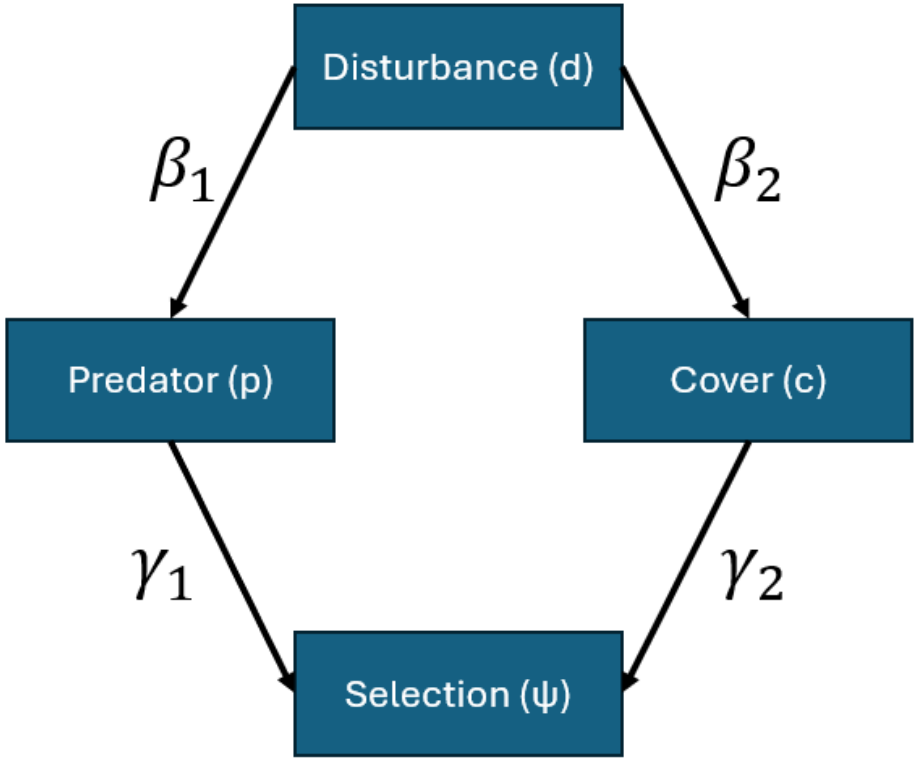
simulated disturbance across a homogenous habitat

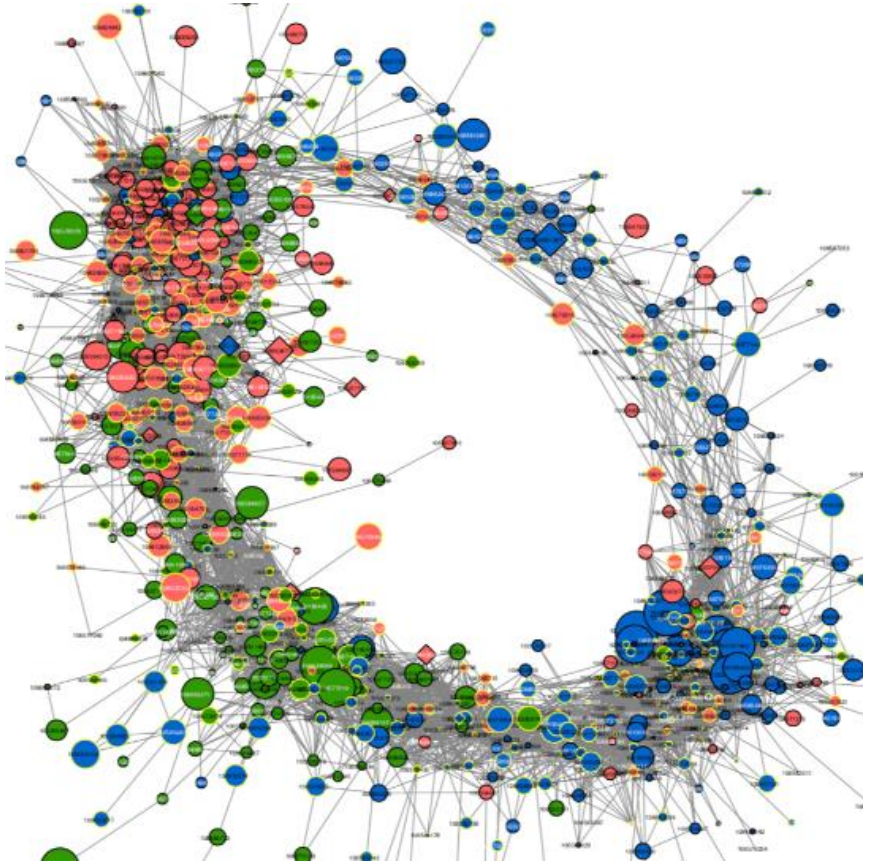


Used points (n = 100)

Random points (n = 250)

This (left) is the data-generating process…



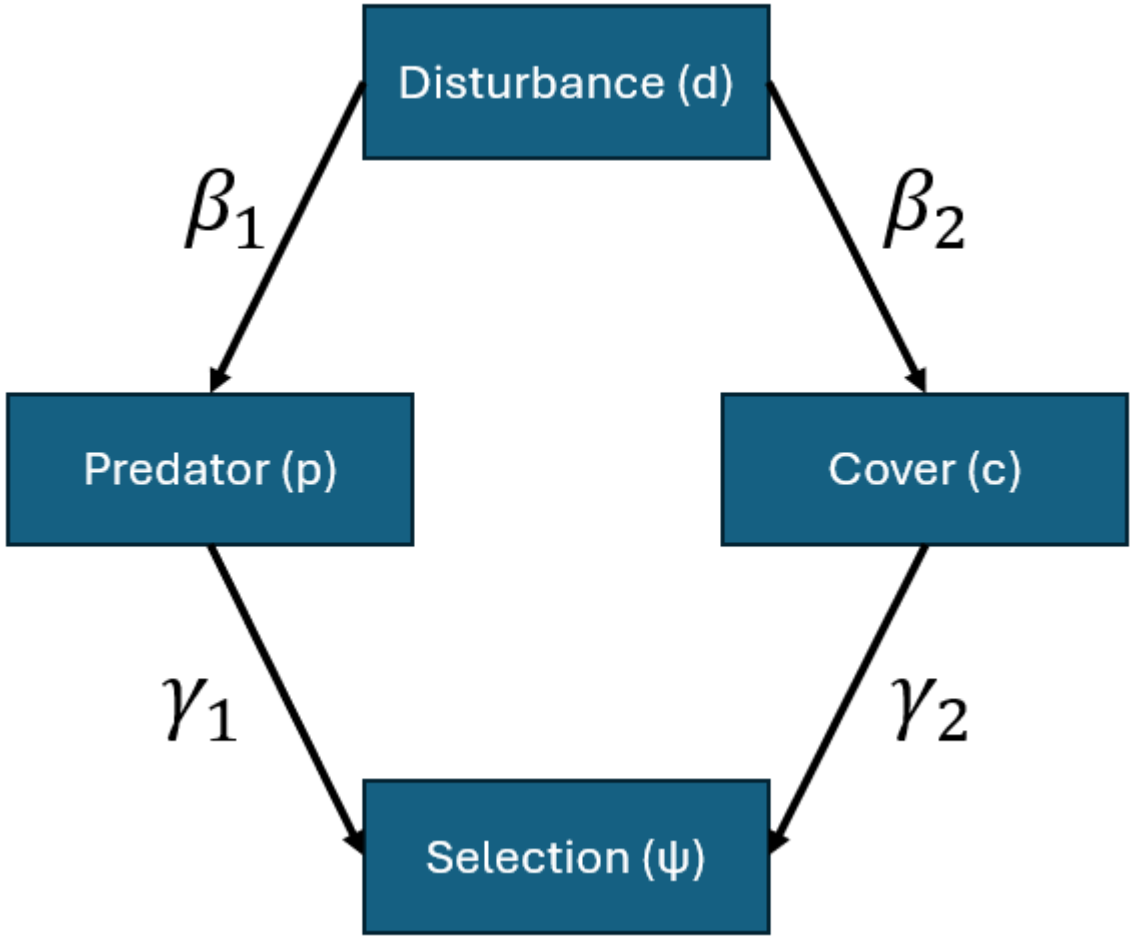


***DISCLAIMER: in reality, the data-generating process will be more complex!**

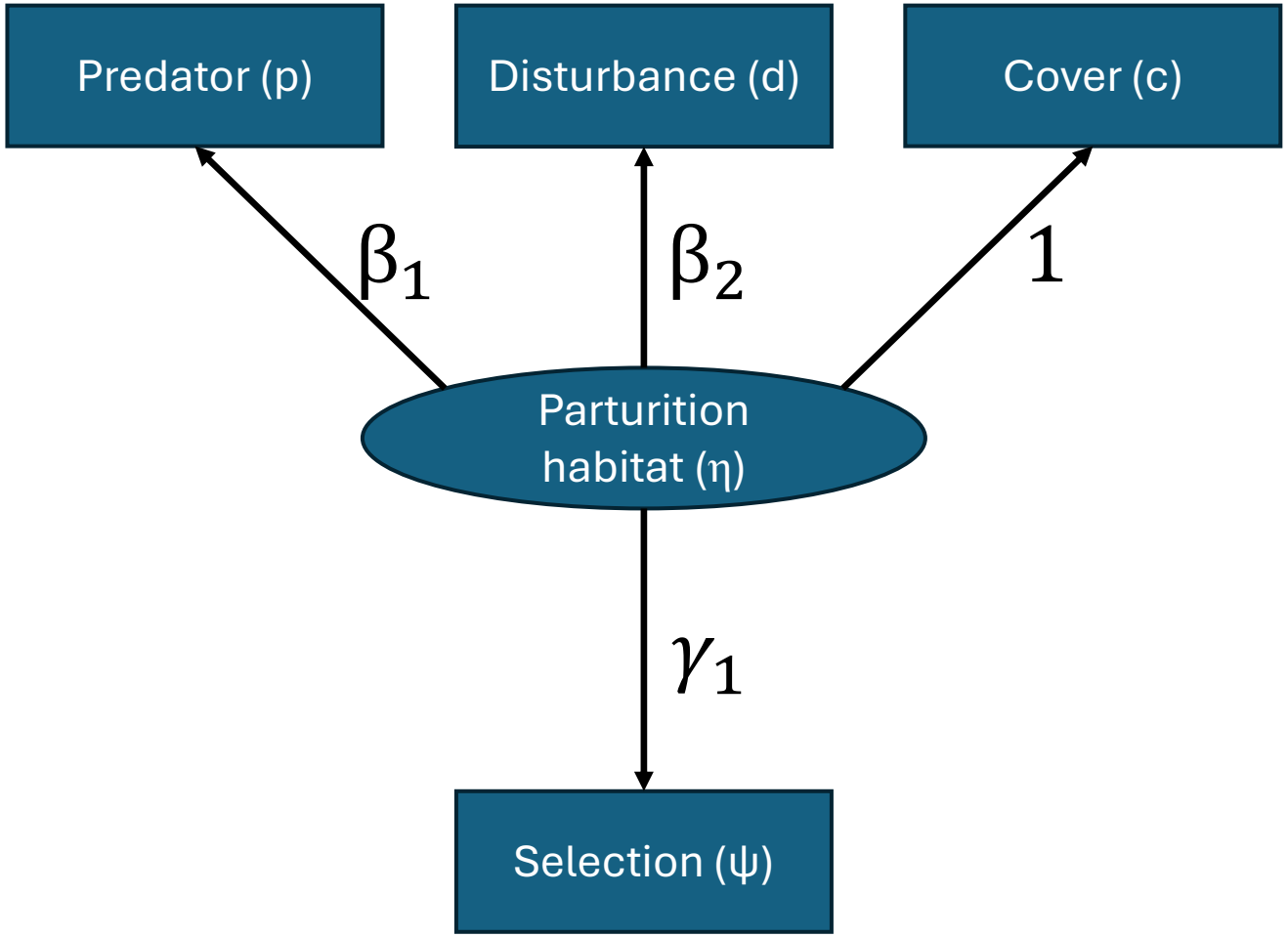
We’re going to fit two models to these data

- The data-generating model (path analysis)
- A SEM with a latent ‘parturition habitat’ variable

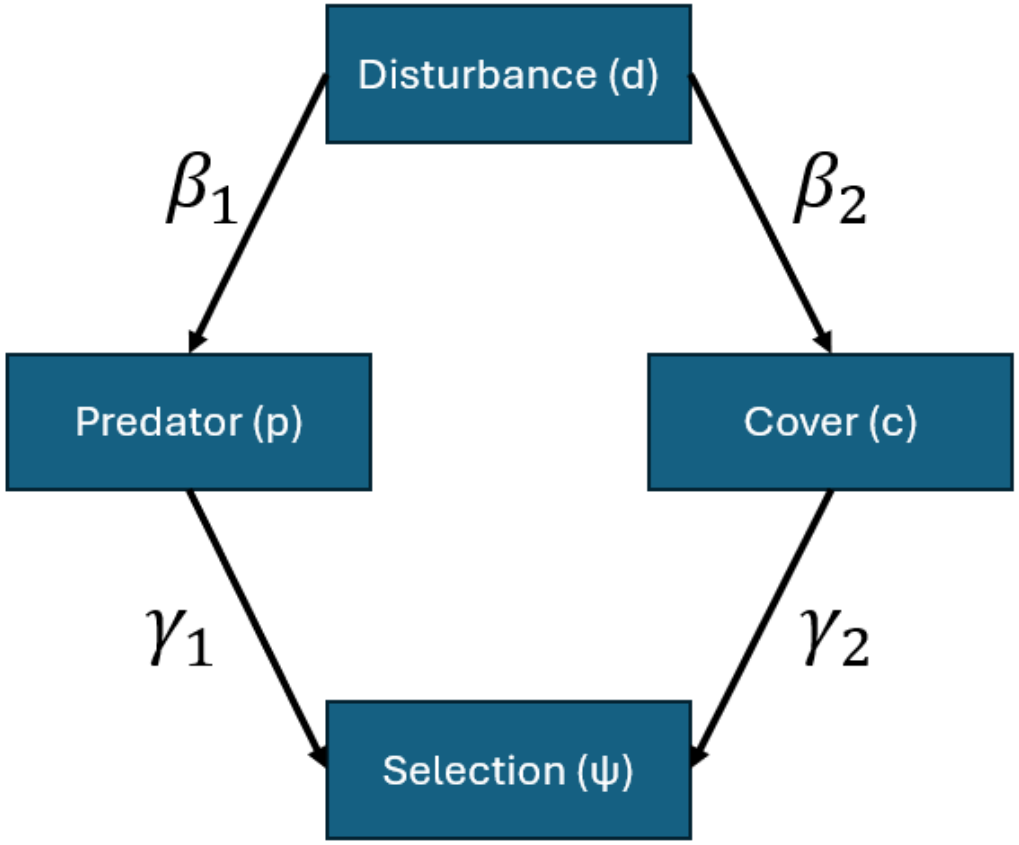
The data-generating model (m1)

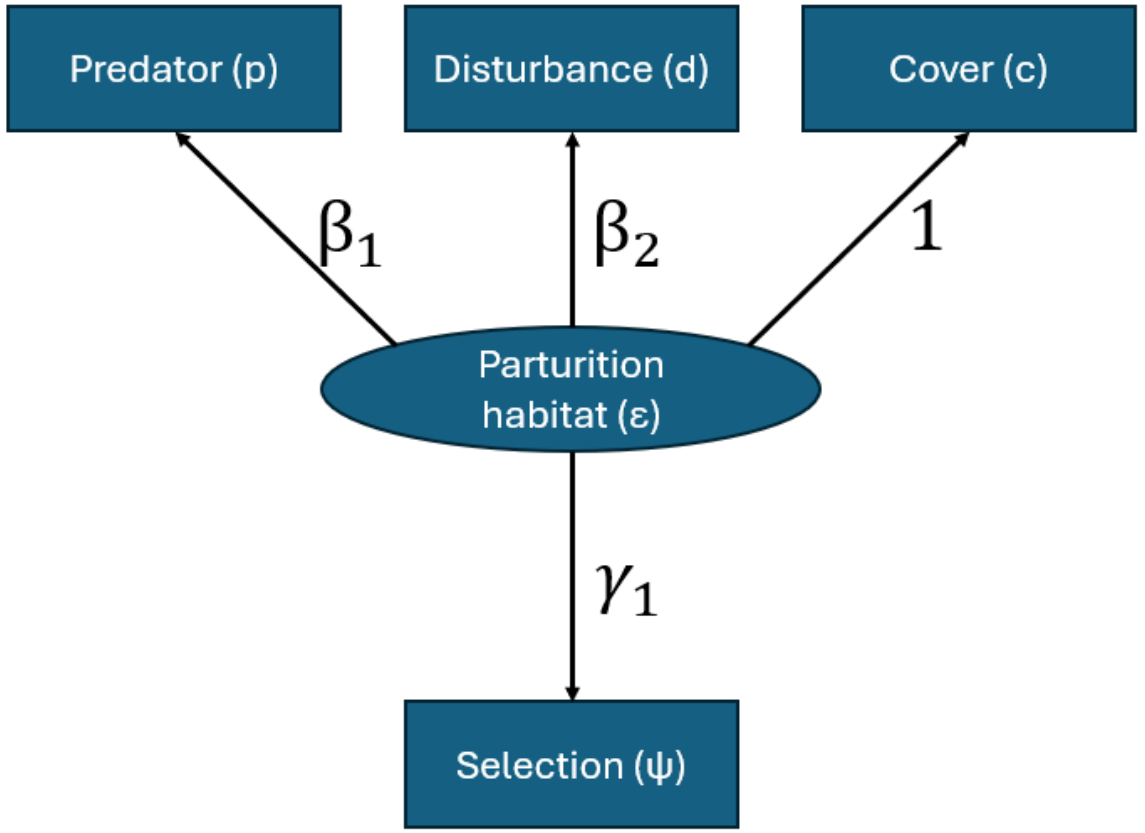


A latent variable approach (m2)



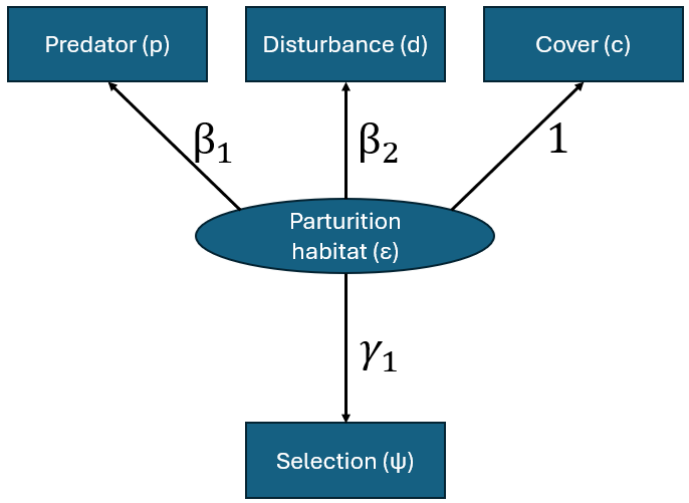
What are conceptual advantages/disadvantages of either approach?

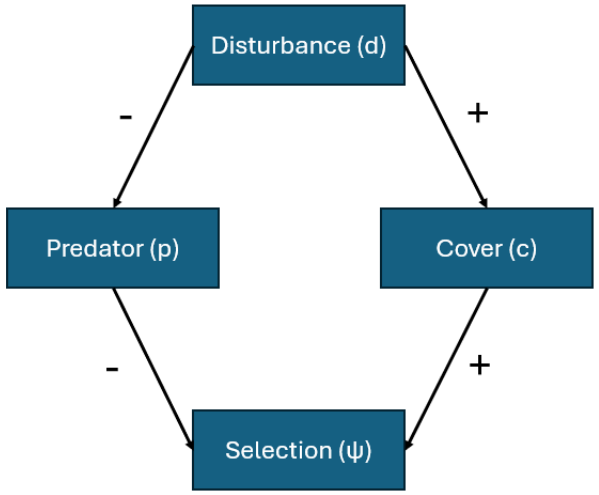




Imagine we wanted to predict the effect of increased disturbance on ψ

(Hard) Things to think about:





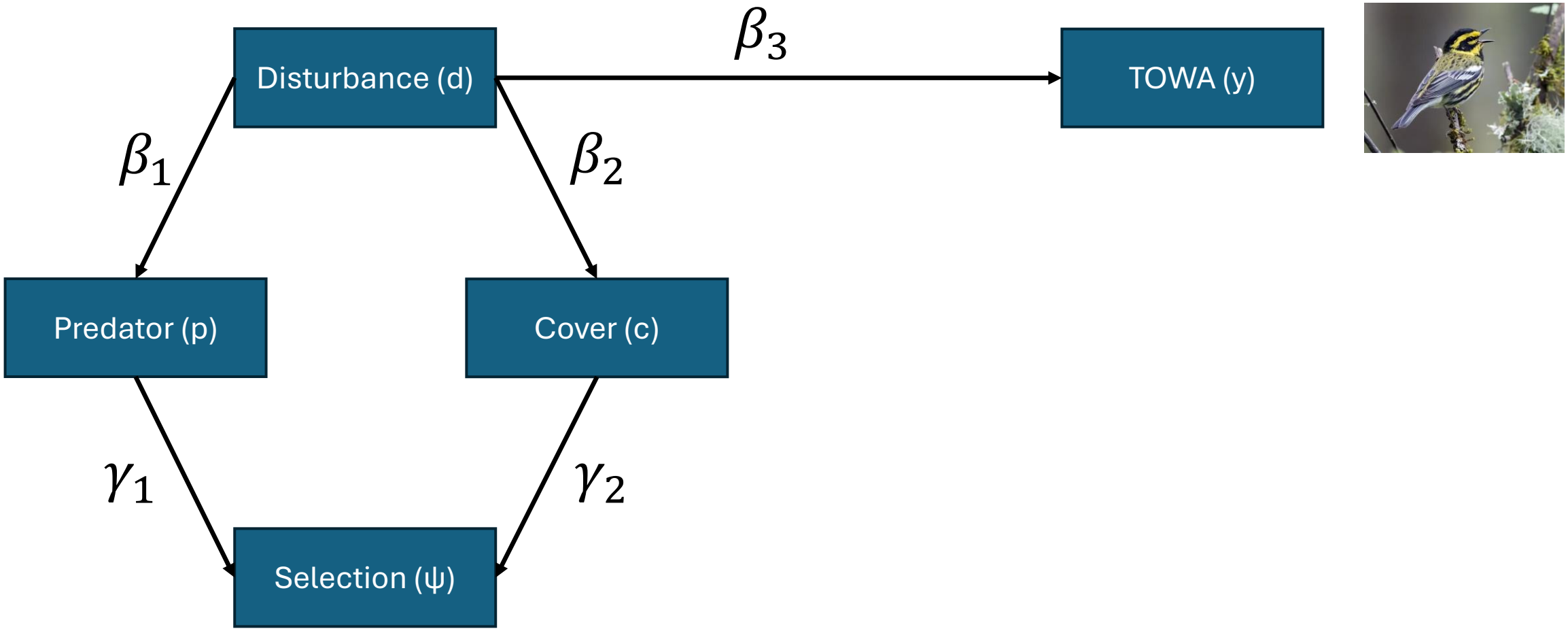
- Who is this for?!
- How will alternative parameterizations affect potential problems with parameter estimation (e.g., multicollinearity)?
- What are the questions I'm attempting to address, and is this parameterization sensical for addressing those questions?

(Exciting) Things to think about:

- This isn’t that much harder than coding up a ‘standard issue’ RSF!?
- Explicitly modeling hypotheses about relationships among covariates allows for improved inference!
- We can sidestep multicollinearity concerns without ‘throwing away’ information

(Really Exciting?) Things to think about:

- We could modify this model to include other species



(Really Exciting?) Things to think about: