

# Today

- Ants model
  - mapping to research questions
  - scope of inference
- Visualization: grammar of graphics
  - theory
  - application with any plotting code
  - application with ggplot

# Exponential model

$$y = ae^{bx}$$

$a$  is  $y$  intercept

expecting  $b$  negative for downward trend

$$\log(y) = \log(a) + bx$$

$\log(a)$  is  $y$  intercept

$y$  is richness

$x$  is latitude

# Exponential model

$$\log(y_i) \sim \text{Normal}(\mu_i, \sigma)$$

$$\mu_i = \log(a_b) + b_b x_i \quad : \text{bog}$$

$$\log(a_f) + b_f x_i \quad : \text{forest}$$

y is richness

x is latitude

# Map science questions to model

- What **model quantities** answer questions?
- Could be:
  - **parameters**
  - **derived quantities**
    - a function of the parameters
    - predictions of the model
- Plus associated **uncertainty**

# Map science questions to model

How does species richness vary with latitude?

Is this relationship different between habitats?

How different is species richness between habitats?

$$y_i \sim \text{Normal}(\mu_i, \sigma)$$

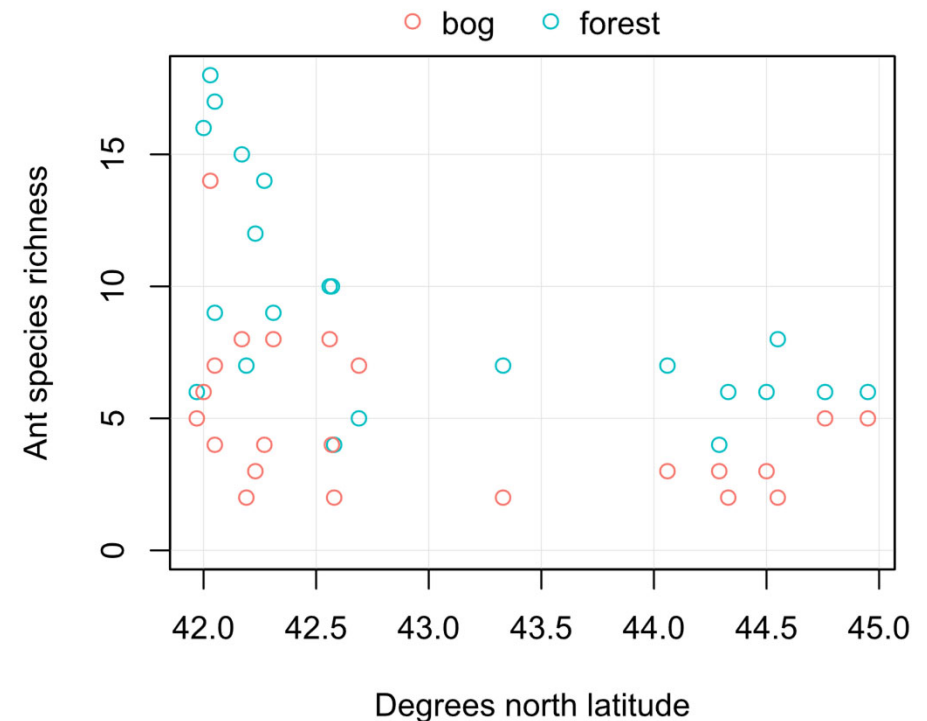
$$\mu_i = \beta_{0,b} + \beta_{1,b}x_i \quad : \text{bog}$$

$$\beta_{0,f} + \beta_{1,f}x_i \quad : \text{forest}$$

$$\log(y_i) \sim \text{Normal}(\mu_i, \sigma)$$

$$\mu_i = \log(a_b) + b_b x_i \quad : \text{bog}$$

$$\log(a_f) + b_f x_i \quad : \text{forest}$$



Identify model quantities that answer questions

Sketch how you would visualize answer with uncertainty

# Scope of inference

- Ants questions: **descriptive** inference
- What statistical **population** will this description **generalize** to?
- Generalization is determined by **study design** and assumptions we're willing to accept (wrt data → population)

“We sampled 22 high-grade, undisturbed bogs and their surrounding forests in Vermont, Massachusetts, and Connecticut”

**Make a statement about scope. Justify your statement**