

Bayesian Hierarchical Model

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1 Generalized Linear Mixed Model

1.1 Fixed Effect Intercept and Random Slope (Version 1)

We fit a model to our data, where the occurrence of the species ($y_{i,j}$) for site i in projected area j is modeled as,

$$\begin{aligned}y_{i,j} &\sim \text{Bernoulli}(p_{i,j}) \\ \text{logit}(p_{i,j}) &= \alpha_0 + \beta_j \times \text{dist.human}_{i,j} \\ \beta_j &\sim \text{Normal}(\mu^\beta, \sigma^\beta)\end{aligned}$$

1.1.1 Priors

$$\begin{aligned}\alpha_0 &\sim \text{Logistic}(0, 1) \\ \mu^\beta &\sim \text{Normal}(0, 3) \\ \sigma^\beta &\sim \text{Uniform}(0, 5)\end{aligned}$$

1.2 Fixed Effect Intercept and Random Slope (Version 2)

$$\begin{aligned}y_{i,j} &\sim \text{Bernoulli}(p_{i,j}) \\ \text{logit}(p_{i,j}) &= \alpha_0 + (\beta_1 + \beta_{2,j}) \times \text{dist.human}_{i,j} \\ \beta_{2,j} &\sim \text{Normal}(0, \sigma^\beta)\end{aligned}$$

1.2.1 Priors

$$\begin{aligned}\alpha_0 &\sim \text{Logistic}(0, 1) \\ \beta_1 &\sim \text{Normal}(0, 3) \\ \sigma^\beta &\sim \text{Uniform}(0, 5)\end{aligned}$$