Analysis of Environmental Data
Week 4 Reading Questions
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(*I worked independently on this assignment)

Predictors

1. **For both models (abundance and presence/absence) identify:**
    a. **The predictor variable(s).**

        For the abundance model, the predictor variable would be the extent of late successional forest, because it is independent from the influence of brown creeper abundance, but abundance of brown creepers appears to increase linearly with an increased percentage of extent of late successional forest within the examined landscape.

        For the presence/absence model the predictor variable would be total basal area. Occurrence of brown creepers does not have a direct impact on total basal area. However, the proportion of brown creeper presence does appear to increase with an increase in total basal area.

    b. **The data type/scale used for the *predictor* variable.**

        For the predictor variable in the abundance model, extent of late successional forest is quantitative. The extent of late-successional forest is represented by the percentage of the landscape covered with late successional forest. Since landscape is a continuous surface that is measurable not counted, the data type is continuous. The data scale used would be ratio because you can't have a negative extent of landscape.

        For the predictor variable in the presence/absence model, the total basal area is also quantitative. While the units are not specified, the data type would be continuous as well with a ratio scale because you can not have a negative total basal area, there will always be a true zero.

Responses

2. **For both models (abundance and presence/absence) identify:**
    a. **The response variable.**

        For the abundance model, the response variable would be brown creeper abundance. For the presence/absence model the response variable would be brown creeper occurrence (presence/absence.)

b. The data type/scale used for the *response* variable.

For the response variable in the abundance model, brown creeper abundance is qualitative. Assumably measured from as the number of brown creepers found across the 30 subbasins observed in the Oregon Coast range, the data type would be discrete as each presence of brown creeper would be countable. The data scale would be ratio.

For the response variable in the presence/absence mode, brown creeper abundance is also qualitative and continuous. The data scale used would be ratio because the lowest occurrence value you could possibly have would be 0, representing absence, with the highest occurrence value being 1, representing presence.

Model Constraints

3. **For both models: How did the data type or scale influence or constrain the choice of model?**

The abundance model was an example of deterministic functions for which a simple linear model was used. The relationship between the Brown creeper abundance and extent of late successional forest has some notable variability and is not perfectly linear. While the linear model is desirable in its simplicity and ability to represent a small subset of predictor values, the relationship between Brown creeper abundance and extent of late successional forest clearly has variability which could be constrained by the choice of model.

The presence/absence model is also deterministic but uses a logistic model. The presence/absence data is binary, meaning the model must oblige the 0-1 value extent. The logistic model is commonly used for presence/absence data. In this case however, the type of relationship the predictor/response variable and total basal area have with one another is unclear in this scenario given the ubiquity that the function could either be phenomenological or mechanistic.

Predator-Prey Model

4. **What are the pros and cons of the Ricker model? What are the pros and cons of the quadratic model?**

The Ricker model is a mechanistic model that is commonly used for modeling density-dependent population growth. In the chapter 4 McGarigal reading, it is introduced in an example investigating striped bass-stock recruitment. Around the mean stock-recruitment relationship there is notable variability that appears to increase as the level of stock increases as well. The Ricker model does an adequate job at defining this observed variability using the assumption that "per capita fecundity decreases exponentially with density." (McGargial chapter 4.) However, the Ricker model requires a mechanistic explanation, while other models have the ability to describe and fit the data in a phenomenological manner.

The quadratic model is introduced in the McGarigal chapter 4 reading using a functional response experiment for which the initial larvae density and the number or larvae killed by aquatic predators is modeled. A quadratic model fit the data quite well in this scenario without the reliance on a mechanistic model. However, while the data is well fit through use of a quadratic function, there is no underlying environmental mechanism to describe what is going on pattern-wise within the model.