Analysis of Environmental Data

Week 2 Reading Questions

1: Dichotomies (draws from the Bolker reading: Chapter 1, sections 1.1-1.3. and the ideas in the Model thinking lecture and notes)

**Choose one of the modeling dichotomies that Bolker writes about in sections 1.1 - 1.3 (summarized in table 1.1 on page 6).**

**In 1 - 2 short paragraphs, explain the dichotomy in your own words and briefly describe how you might approach one of your research interests from each of the dichotomy endpoints.**

Analytical-computational models are presented within the “technical details” dichotomies set that are summarized in table 1.1, for which they are characterized by Bolker in accordance with the methods that are used to analyze them. Analytical models utilize equations to predict and analyze observed components of the of the studied environment. Computational models use a computer program/system to analyze the behavior of the parameters of the observed components run.

In my past research of urban heat island effect and street tree planting, I could apply an analytical model to calculate NDVI, Proportion Vegetation Index, Emissivity and LST using spectral bands derived from landsat OLI imagery. A computational model could be then used to apply the calculations to the imagery to analyze how high/low land surface temperatures correlate with densely urbanized/areas with high impervious surface.

2. Assumptions and Biases (McGarigal chapter 1 slides, concepts in the Bang et al. paper may also provide insight)

In McGarigal’s quote in regard to status quo in Chapter 1, McGarigal is offering cultural assumption in

3. Dual Model Paradigm (McGarigal Chapter 1, Bolker Chapter 1)

**In 1 - 2 short paragraphs, describe the following:**

* **Identify and briefly define the two primary components of a model constructed in the dual model paradigm.**
* **Give an example of the two components in the context of a system you are interested in studying.**

Frequentist modeling implements the dual model paradigm. The two primary components of a model constructed in the dual model paradigm are a deterministic and a stochastic model. Essentially the dual model paradigm attempts to fit these two primary components to the data. A deterministic model assumes zero random variation meaning only the average rate of change of an examined system or population is represented and the rate of change is assumed to be constant. The output of a deterministic model is therefore fixed. A stochastic model, on the other hand, considers random variation by estimating the model parameters, causing varying outputs for each model run.

Hypothetically if you were to model the population a rare salamander species over time, the deterministic model and the stochastic model would look very different. By using a deterministic model to predict the future populations of the salamander species, you would assume the breeding, birth/death and extinction rate to be constant. If the purpose of the study is to model/predict species population assuming the current behavior of their ecosystem to remain the same, the deterministic model would likely achieve this. By using a stochastic model in this scenario, variability would be assumed on account of environmental factors such as habitat fragmentation, predation, alle effects etc. In the context of modeling salamander populations, the dual model paradigm would attempt to fit the present salamander population data to both deterministic and stochastic models in order to strengthen the inferences made about the data.

4. Populations (McGarigal Chapter 2)

**In 1 - 2 short paragraphs, describe the difference between a statistical and biological or ecological population.**

* **Which of these populations may vary depending on the spatial or temporal scale of the research question?**

Biological/ecological populations encompass all the individuals coexisting in the same place. The size of the ecological population usually remains constant across the different extents the research question may reach. A statistical population is oftentimes a subset of an ecological population, and its meaning is conclusive to the extent of the research question. While the biological/ecological populations represent all of the species within the population for a given area, the statistical population represents the observations of the species within the examined study area. For example, if you were to study moose in New Hampshire, the ecological population would be the entire species range while the statistical population would be all moose in New Hampshire. The statistical population may vary depending on the spatial or temporal scale of the research question.

5. Model Thinking (McGarigal Chapter 2 slides and the in class group model thinking activity)