

## Week 2 Reading Questions

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1. 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.*

Mechanistic and phenomenological models are contrasted as the process-based model vs. the pattern-based model, respectively. The mechanistic model specifically looks at underlying components and their parameters based on theoretical expectations that then explain the processes in nature. A mechanistic model proceeds analyzing data collected from a specific sample. The phenomenological models are created by understanding patterns observed in data collected. In a phenomenological model there is a function that is fit to the data to describe the processes. Phenomenological models have predictive power within the limits of the parameters estimated by the model based on the data collected, whereas a mechanistic model has predictive power if there are already existing parameters for the system. (White & Marshall 2019)\*

I am much more comfortable with thinking in terms of phenomenological models because I am less familiar with what existing information or theoretical models that are used in my system. I will be exploring how floral attributes effect pathogen dynamics in wild bee species in natural habitats. I suppose that a mechanistic approach would be to look at models that describe horizontal pathogen transfer at certain “hub” points and try and apply it to the plant – bee system. For a phenomenological model I would go out to the field and collect data about which flowers the bees land, the identity of the bee and whether there are infected. This data would then be analyzed, and certain patterns could be described and modeled.

2. Identify at least one source of bias or assumption (cultural, scientific, other). Hypothesize a practical impact these biases or assumptions might have on scientific communication and the effectiveness of management efforts? (1 - 3 paragraphs)

What I may identify as biased in the “innocent until proven guilty” framing of the Western scientific community and more broadly the Western society is that the individuals who are given the tools and the platform to challenge status quo are typically from a specific intersection of privileged identities and experienced. This means that their shared cultural and scientific education is exclusive and narrowly focused due to the lack of a diversity of philosophical input and experiences from others who are outside of this group. One main bias would be that most people do not have access to these types of tools to present “true challenges” to the status quo. Even if a challenge to the status quo is valid and true, it will not be taken seriously until it is accompanied with data and significant evidence that statistically proves it to be true. The practical impacts are that there is greater separation between the scientific community and everyone else. This creates mistrust towards the scientific community and a serious disconnection from what type of information is produced and communicated from the actual interests and needs of the larger society.

The assumption that I can see in the from the four testimonials regarding climate change and bird nesting habitat that there are climatic factors associated to climate change that is making the birds move up in elevation over time. I do not see explicitly here that there was a measurement of temperature or precipitation during the sampling periods. Additionally, there was no historical report of how climatic variables have changed due to climate warming. This is not great for management purposes because the actual underlying conditions are not described so the specific factors to manage or monitor are unknown.

3. Identify and briefly 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.*

There was no explicit mention of a “dual model paradigm”, but I am assuming that the question is referring to deterministic vs. stochastic modeling which involves the probability distributions. A deterministic model only looks at the expected behavior of the system without considering random variation. These models are used to make comparisons to real systems but do not incorporate how other factors might also influences the variation of the response. These variables are defined as being random and represent the uncertainty associated with the data collection or natural system, i.e., measurement error, seasonal variation, weather, population cycles, etc. A stochastic model considers the likelihood that the variation in the data has some sort of error and a probability distribution associated to it. These dual models also can have interchangeable factors, for instance, there may be some random factors in the stochastic model that would be used as a deterministic function.

In my system a deterministic function might be more effective in a lab setting where many things are being controlled. I may test the pathogen load of a bee according to bee species and type of treatment diet. In a stochastic model I might include the individual bee identity as generating some sort of random variation, or the colony from which I collected the bee from as being a cause for variation of the responses from all the bees from that colony.

On the other hand, stochastic models,

4. 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?

A statistical population is a collection of the observations of interest. A biological or ecological population could be a statistical population if the entire population is encompassed in the study. A statistical population is denoted as ‘N’ from which one subsets a sample and denoted as ‘n’. The sample ‘n’ from the statistical population ‘N’ will vary depending on the spatial or temporal scale of the research question.

5. Consider the scenario your group chose to use in the model thinking in-class activity:

Cascades snowpack

The data types I would like to analyze are proportion of trees cut down in relation to a given area which would be considered as the continuous variable on a ratio scale. Additionally, I would like to look at the level of water turbidity, as a categorical variable, in neighboring streams.

\*I looked at another resource for a deeper understanding of phenomenological vs. mechanistic models:

*Should We Care If Models Are Phenomenological or Mechanistic?*

White C.R., Marshall D.J.

(2019) *Trends in Ecology and Evolution*, 34 (4) , pp. 276-278.