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Week 2 Reading Questions

Q1 (2 pts.): 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.

The dichotomy is a spectral comparison of the two sides to model thinking. Models can be stochastic or deterministic. They can be phenomenological or mechanistic. They can be Lagrangian or Eulerian. This isn't to say that the models have to be completely one or the other, just that they can be. As a comparison along a spectrum, models can be somewhere in between the two ends of the spectrum, and indeed, you may find yourself starting your modeling at one end of the spectrum and wind up somewhere in the middle as you adjust your model to fit the data.

If I was going to approach one of my research interests, say salt marsh response to climate change, since that's what I work on in my lab, I could approach it from either end of the spectrum, but I would probably want to approach it from multiple angles, develop multiple models. I could start with a model at one end of the spectrum that shows what would be expected behavior of the salt marsh system in a given year, in the absence of any variables. Here is how it should be growing, receding, what species are present. Then I could create a model at the other end of the spectrum that focuses on how the salt marsh is reacting to a number of variables that may or may not be preventing it from aligning with the expected patterns, whether that be human interference such as pollution, recreational use or development, invasive species, disease, sea-level rise.

- **Q2 (2 pts.):** 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)

One source of bias or assumption may be an implicit bias that favors scientists with a lot of funding or equipment. If collection of your data calls for very rigorous sampling with expensive equipment, it can preclude scientists from poorer communities or poorer countries, or even from wealthy areas but who don't get a lot of funding for their research from contributing to it. They would be unable, due to the high costs associated, of replicating your research, which results in less data for making models, less data for analysis, and ultimately, a less complete picture of what you're trying to accomplish.

For example, if you're trying to survey bird nesting sites, but your research calls for the use of a very expensive drone and multispectral imagery hardware, while scientists in Europe may be able to replicate this experimental design, it is unlikely that many scientists in Africa or South America would be able to do so just by the limitation of being unable to get their hands on the drones and cameras. This would prevent them from contributing to the conversation, and ultimately, it would

hurt management efforts because you could be preventing any management strategies that could otherwise come out of those other research groups from being realized.

- **Q3 (2 pts.):** 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.

The two primary components for a model constructed in the dual model paradigm are the deterministic model, which is the expected, without any noise or random variability, and the stochastic model, which is the probability distribution, showing the variation from the expected (deterministic) model, which is important to show what is considered the standard errors for the deterministic model so it can easily be determined what data is falling outside the expected values under the dual model.

Going back to the salt marsh example from an earlier response, the deterministic model would be the expected observations of say, the amount of marsh grass present (by acreage) in a particular marsh each year. The stochastic model would show the random variation due to things like weather events such as flooding or drought, or the consumption of grasses by marsh-dwellers. This is useful because if you're looking to model this through the dual model paradigm, and you get a bunch of values far lower than the expected, and far outside the stochastic model, you can infer that there is something causing this drastic change, perhaps overharvesting of the grasses by an invasive species such as the purple marsh crab.

- **Q4 (2 pts.):** 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?

The statistical population is usually a subset of the ecological population (unless the statistical population *is* the ecological population). The ecological population is typically the entirety of a species or group everywhere. For instance, all mangrove trees across their entire range. Whereas the statistical population is a smaller subset that you are interested in inferring information about the parameters of. The statistical population of the mangroves could be all the mangroves in a particular county in Florida, or all the mangroves on a particular island in the Florida Keys. The ecological population doesn't change, it's still all the mangroves everywhere, but the statistical population changes to match your study area or the time scale for your study.

- **Q5 (2 pts.):** For each of your two chosen variables: Describe your proposed entity or variable and explain why your chosen data type/scale is appropriate.

White Pine blister rust

Numerical variable on interval scale

Categorical, nominal variable

For the numerical variable on interval scale, I would measure the percentages of *Ribes* species in areas exhibiting blister rust infection to model the impact of *Ribes* that can carry the blister rust without suffering from it. This would work as a numerical variable on an interval scale because the exact percentage of afflicted gooseberry species is not necessary to model whether an increase in their infection would increase the infection rate of pines.

For the categorical, nominal variable, I can model all the susceptible species to the blister rust to measure the susceptibility of an area not currently afflicted based just off what species are present that could suffer from an infection.