1. One modeling dichotomy exists between theoretical models and applied models that collectively characterize scope and approach. Theoretical models aim to explain general ecological processes while applied models aim to explain and even predict the behavior of specific systems. Theoretical models are often mathematically complex and ecologically oversimplified. They are therefore largely used for qualitative predictions. Applied models are mathematically simpler and more ecologically complex. Applied models are therefore used to make more specific predictions compared to theoretical models.

My proposed research is a novel investigation of the influence of a dam on denudation patterns of the Western Massachusetts portion of the Connecticut watershed following periods of extreme precipitation. I hypothesize that Barre Falls Dam is inducing nonpoint source pollution through decreased downstream flushing from reduced water flow during floods, leading to increased loads of clay, silt, inorganic and organic matter. Furthermore, once the dam begins releasing flows, many of these contaminants are transported and deposited further downstream, reducing the water quality of several tributaries and lowland floodplains. My theoretical model of Barre Falls Dam causing increased turbidity following periods of extreme precipitation could be compared against my applied model that will use data to determine specific relationships between the dam, extreme precipitation, and turbidity.

1. The statement “Western science and our society requires that challenges to the status quo be empirically and rigorously demonstrated (analogy: “innocent until proven guilty“)” by McGarigal presents an assumption that both science and society effectively challenge the status quo through observation, experience, and implicit demonstration. However, challenges to western societal status quos often involve the subjectivity of morality and are legislated on the basis of citizens’ will. The first testimonial makes a similar assumption between science and society. It assumes that because climate change is accepted as a detriment to society by a segment of its members, a loose correlation between climate change and bird species nesting in higher elevation warrants financial investment in further research. Proper scientific communication would require more evidence than a loose connection to climate change, it would require a statistical model to investigate this possible linear trend, demonstration of the repeatability and scope of findings with replicated data, an investigation of competing hypotheses and reasoning and methodology to explore seemingly inconsequential aspects of findings demonstrated in the following three testimonies. If this scientific communication is lacking, bird management efforts would simply lack direction. They would therefore be unable to address any factors related to the observed increase in upper elevational limit of nesting along an elevational gradient.
2. The two primary components of a model constructed in the dual model paradigm are deterministic models and stochastic models such as probability distributions. Deterministic functions show expected behavior without random variation. Since they do not exactly match the data, they can only be used for qualitative comparisons with real systems. Stochastic models incorporate noise and random variation. As a result, they yield assumptions about the causes of random variability. Random variability can be measurement errors, demographic stochasticity which is the random variation in outcomes associated with identical samples and environmental stochasticity which is random variation imposed from external factors to the system under study.

In part of the system that I am interested in studying, I could make a deterministic model that might predict that there is a larger increase in turbidity in the upstream, downstream sections of Barre Falls Dam and the downstream section of the Ware River following extreme precipitation events than routine precipitation events. This prediction could be tested by a statistical model that estimates the magnitude of the average change in turbidity at these locations following extreme and routine precipitation events. It would distinguish between changes in turbidity due to precipitation and changes due to other factors such as measurement error.

1. A biological or ecological population is a species that resides in the same geographic area. A statistical population is the collection of all possible observations of interest. These observations are in spatial and temporal units relevant to the scientific question and can be used to measure characteristics of interest. The statistical population therefore may vary depending on the spatial or temporal scale of the research question.
2. In the model thinking in-class activity, my group chose the Cascades snowpack scenario. If I were to study which native conifer forests between hemlocks (*Tsuga spp.*), true firs (*Abies spp.*), and pines (*Pinus spp.*) retain the most snowpack throughout the spring, summer and fall seasons I could measure rate of snowmelt on a continuous/ratio scale because snow accumulation occurs throughout the winter and zero rate of snowmelt has value. If I were to study whether exposed slopes are susceptible to  erosion and flooding in the spring, summer or fall seasons I could count the months which contain snowmelt as a discrete variable because they are simply counts.