APPM 2360 Project 1: A Mathematical Investigation of Populations and Predator-Prey Dynamics

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# Introduction

During the 1980’s in the Sierra Nevada, researchers working for the National Forest Service conducted a study on the native mule deer population in the area. They noticed that the population of deer had decreased dramatically since the 1950 census on the population, which they attributed to over-population of the habitat. However, the population continued to fall even beyond a level which the researches deemed sustainable within the habitat. As the researches continued their study, they discovered that the population of the native mountain lion, a natural predator of mule deer, had steadily increased as the population of deer decreased. The interactions between these two species, deer and mountain lions, were studied by the researchers to deduce reasons why the deer population remained low even after its initial decline. In this project, we will use various models to mathematically analyze the interaction between predators and prey.

# Modeling Individual Populations Using the Logistic Equation

One way to analyze the population of deer and mountain lions is to model each population individually and see how they change over time.

If we assume the mountain lions are protected from hunting and have no natural predators, and assume the lions’ food source is