**Introduction**

Grassland wildfires define the vegetative identity of grasslands and the complex food webs that grasslands give rise to. These regularly occurring wildfires suppress populations of wooded vegetation that if unperturbed would convert a grassland into forest. While the direct cause of wildfire at any given time can be attributed to either humans or lightning strikes, the probability of a wildfire occurring at any given time is random; however, there is a non-random, predictable increase in the underbrush, or the dead and dried vegetation of a grassland, that will drive the increase in the probability of a wildfire occurring given a random chance of a direct cause. Because the grassland vegetation and their ecological webs represent a developmentally arrested landscape between that of a woodland and a desert due to wildfires, it is likely that the grassland biome and its ecosystems are generally sensitive to the frequency of wildfires and the factors that affect the probability of a wildfire occurring. While the contributions of humans to the frequency of wildfires is multifaceted, in the forms of climate change induced desertification, farming practices, etc., our model focuses on the management of underbrush.

At the most direct level, federal wildlife management regularly maintains underbrush levels using controlled burns, thereby controlling the probability of a wildfire occurring. In this model, we probe the behavior of a basic food chain in context of a grassland by modulating the rate at which the probability of a fire increases and the max probability of a fire occurring. We will assume the rate and degree to which underbrush predictably builds up to be the major factor that directly affects the probability of a wildfire in the grassland biome. By modulating the rate and degree to which underbrush builds up and increases the probability of a wildfire, we can abstract different fire probability regimes and track how these different fire probability regimes affect a basic forest ecosystem. Since the predators are key species in an ecosystem, the population size of apex predator is what we basically focused on. The primary focus is to investigate how undergrowth management will prevent the extinction of the apex predator species with the introduction of wildfires in a stochastic fashion into our mathematical model. The secondary focus will address the contrary question of what happens to the ecosystem should the apex predator species go to extinction from wildfires. Ultimately, the outcome of this model has broad impact on our understanding of the relationship between wildfires and grassland identity and could inform federal wildlife management policy and implementation for sustaining grassland biomes.