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CSE/ECE 6730 Project 1: Predator and Prey Populations With Variable Grass Species

Here I present the efficacy of my event-driven simulator for modeling the behavior of rabbit and wolf populations. First, it is important to note that my simulator requires several different model constants, and tuning these constants was crucial for meaningful model performance. For example, if I allow the rabbits to reproduce at too fast of a rate, something like this arises:

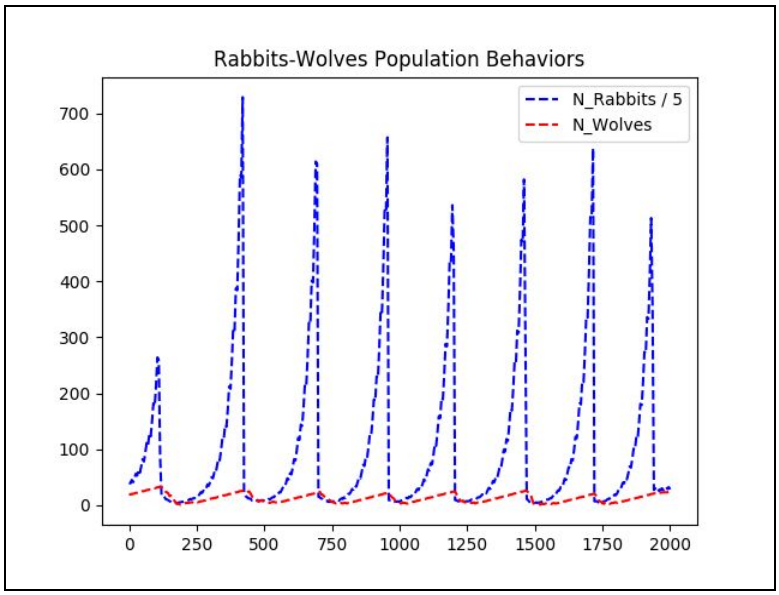

Figure 1: Model behavior when rabbits can reproduce too quickly.

While these behaviors might be realistic, I do not think it is a good idea to allow the rabbit population to spike this dramatically. Moreover, if the wolves are too good at hunting the rabbits (WolfCatchingRabbitRate), then the simulation will result in something like this:

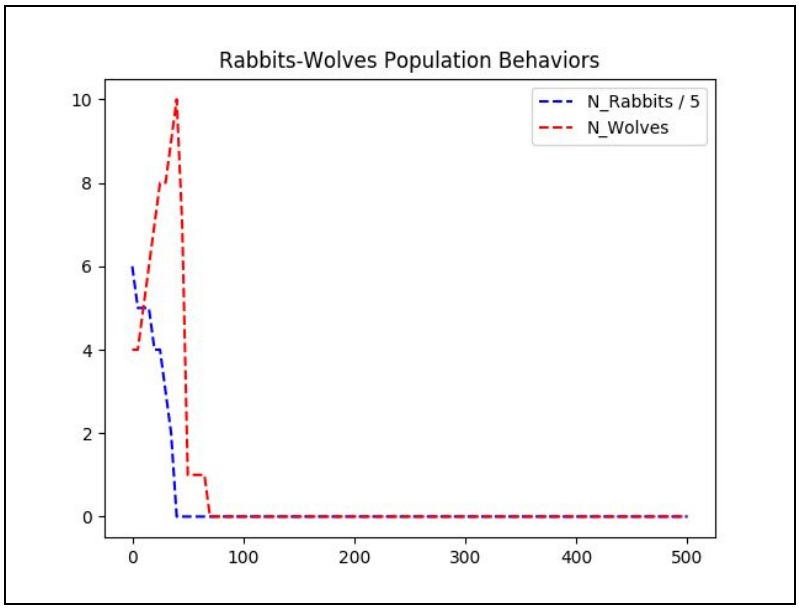

Figure 2: Model behavior when wolves can catch rabbits too efficiently.

Here, the wolves are too good of hunters, so the wolf population quickly spikes and overhunts the rabbit population. With that, here are the model constants that I found to be meaningful:

InitialRabbitCount	30
InitialWolfCount	4
R_Starvation	2
W_Starvation	6
RabbitBreedingRate	0.10
WolfBreedingRate	0.02
R_Repopulation	6
RabbitsToHunt	0.10
WolfCatchingRabbitRate	0.25
SimulationLength	2000
FieldSize	250

Moreover, I will use the following model parameters. The model parameters are tuples, were the first element dictates how many units the grass grows, and the second elements is how often the grass grows. Note that this applies to the entire field of grass, so that every G[1] days, N_Grass is incremented by G[0]*FieldSize.

Model Parameter, G
[1, 2]
[1, 4]
[1, 6]
[1, 8]

Here are the results:

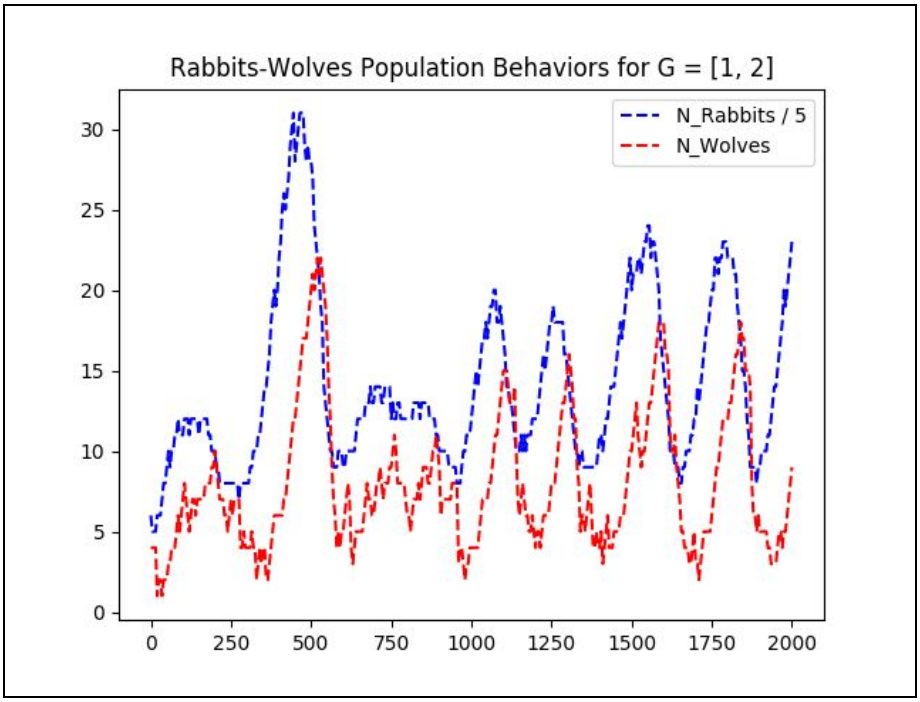

Figure 3: Model behavior when G = [1, 2].

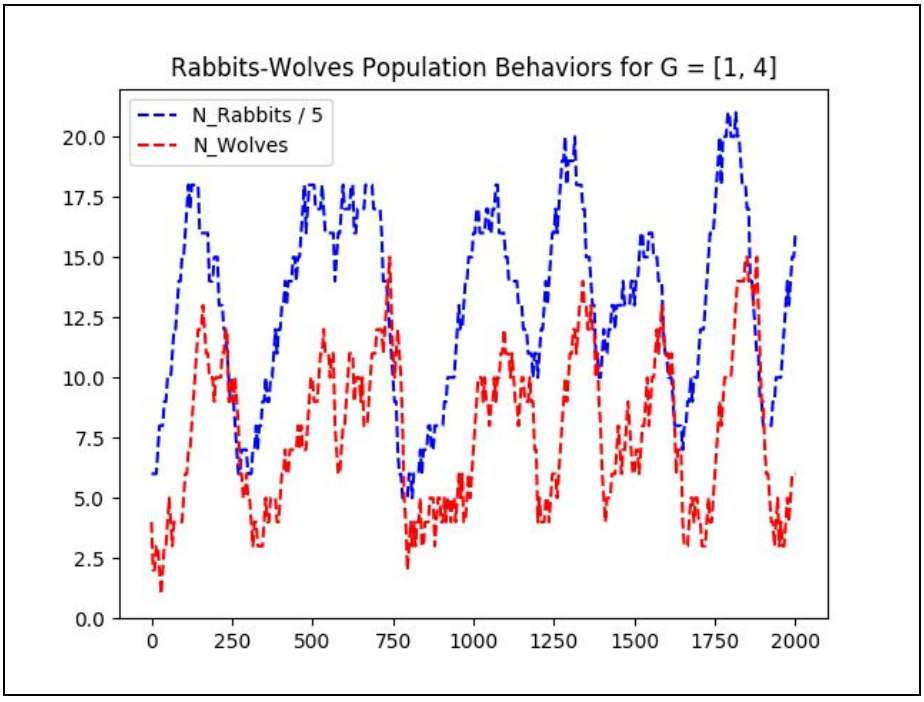

Figure 4: Model behavior when G = [1, 4].

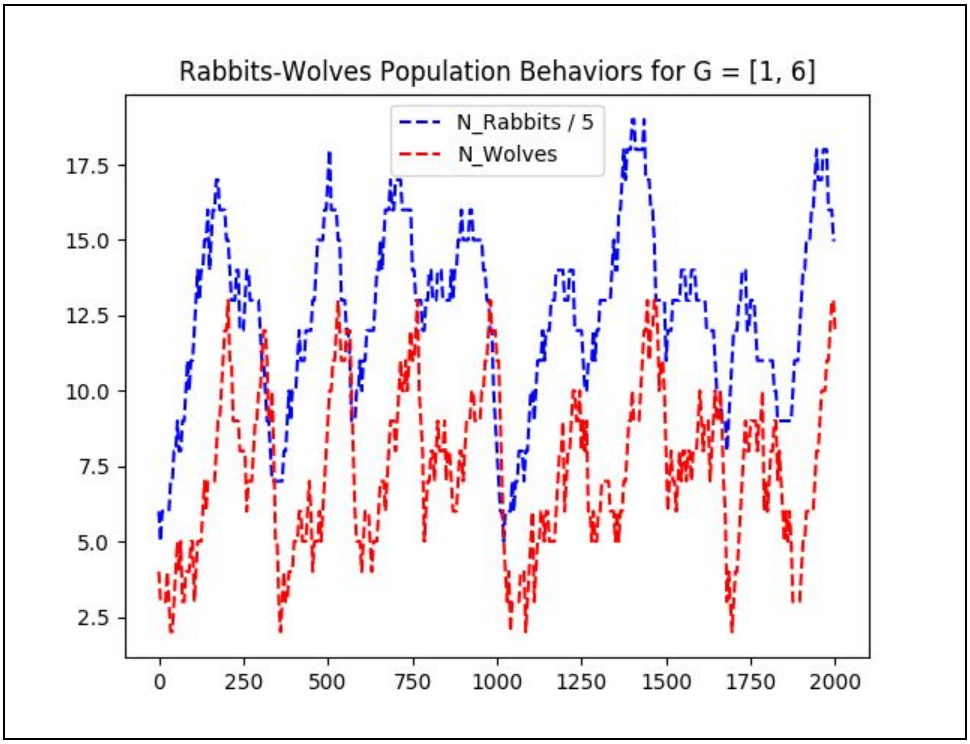

Figure 5: Model behavior when G = [1, 6].

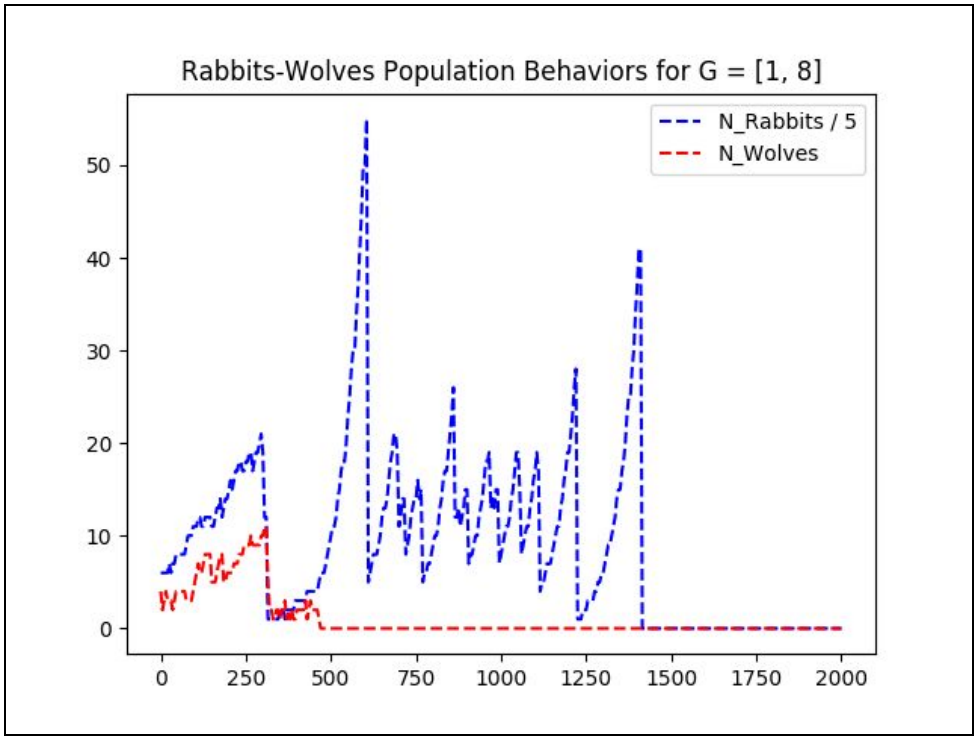

Figure 6: Model behavior when G = [1, 8].

Discussion:

These results validate the efficacy of my simulator. As the grass grows more and more slowly from G = [1, 2] to G = [1, 4] to G = [1, 6], one can see the population behaviors are similar, however, the average amount of organisms in the field systematically decreases. For the customer of this simulation, this means that purchasing grass seed that grows faster will allow them to sustain higher population numbers, on average. In the last case, G = [1, 10], the grass grows too slow, which results in both the rabbit and wolf populations going extinct. The customer of the simulation should be advised to not purchase this grass seed.