The SLIRPE model used in the final project is an epidemic model that represents the following system of equations…

𝑑𝑆/𝑑𝑡 = −𝛽𝑆𝐼 + (𝑑𝑃/𝑑𝑡)\*(1/𝐴p)  
𝑑𝐿/𝑑𝑡 = 𝛽𝑆𝐼 – (𝜇L)^(-1) \* 𝐿 + 𝑒  
𝑑𝐼/𝑑𝑡 = (𝜇L)^(-1) \* 𝐿 − (𝜇I)^(-1) \* 𝐼  
𝑑𝑅/𝑑𝑡 = (𝜇I)^(-1) \* 𝐼   
𝑑𝑃/𝑑𝑡 = 𝑑𝑃b/𝑑𝑡 + 𝑑𝑃l/𝑑𝑡  
𝑑𝑃b/𝑑𝑡 = (0.1724𝑃9 − 0.0000212(𝑃b )^2)𝑇E

dE/dt = e

dF/dt = 𝞒 \* exp(αIAp ) – FRf

which represent infection, colonization, condition and release, dispersion and decomposition as well as disease cycle. The variables denoted as S and R represent the amount of host population available for spread. Thus, the model enables us to have an accurate representation of how the plant disease will spread over a large plant field. The two main points of discussion are the time iteration method as well as the scouting method. For the time iteration method, we implemented a 4th order Runge-Kutta method because we came to the conclusion12 that it would be more accurate than a general Euler’s method which in turn would give the SLIRPE model better results in the end. (sacrificing computational time in turn). For our scouting function/ method we decided to use the random method which leads to a random “scout behavior”. This behavior mimics the disease because of how the disease acts randomly, also using a smaller number of scouts due to the random method would be a more optimal and effective solution. Our calculated cost from our code said it would be $160,500, but we suspect that our code must have ran too high of a cost number. We projected that a high cost would be somewhere around the range of $20,000 – $50,000. Provided below are images of the 5 runs of the plots of the average epidemic over the course of the forcing time period of 61 days, as well as the scouting code.

A screenshot of a computer

Description automatically generated

Forcing time period of 61 days

A graph of a number of infected patients

Description automatically generated

Example from assignment of average epidemic and what the plots should similarly look like( unfortunately while were able to get a successful cost price and run through the 61 day time period using the RK4 time period we were not able to get our plots to show up due to some technical small errors we were trying to debug) here is some code provided for the plots

A screenshot of a computer code

Description automatically generated

Lastly, a snippet of the scouting routine and cost-calc function.

A computer screen shot of a program

Description automatically generated

A screenshot of a computer program

Description automatically generated