

Zombie Model with Vital Dynamics

In this project, you will develop various models of the interaction between a human population that exhibits logistic growth and zombies. Under what conditions will a zombie outbreak occur and how does births/deaths affect the dynamics of the epidemic?

Background

We have studied the dynamics of a zombie outbreak in class. We made an implicit assumption that the birth/death rate of the population was small compared to the rate at which the infection spreads. Hence, we neglected births and deaths. If this assumption is not valid, one would need to incorporate the vital dynamics into the various models.

Some Model Requirements

- In the absence of zombies, the uninfected population behaves logistically.
- The population is divided into two groups: susceptible humans and zombies.
- When a zombie and a human interact, either the human is converted to a zombie yielding two zombies or the human kills the zombie leaving only the human.
- Zombies independently decay at a fixed rate.

Some Questions to Answer

- Under what conditions is there an outbreak when there are no births/deaths and the zombies do not decay? Can zombies be endemic in this case? If the zombie population goes to zero, how many humans are left?
- Under what conditions is there an outbreak when there are no births/deaths but the zombies decay? Can zombies be endemic in this case? If the zombie population goes to zero, how many humans are left?
- Under what conditions is there an outbreak when there are births/deaths in the human population but zombies do not decay? Can zombies be endemic in this case? What are the steady states and their stability?
- Under what conditions is there an outbreak when there are births/deaths in the human population and zombies decay? Can zombies be endemic in this case? What are the steady states and their stability?
- What predictions can you make concerning the prospects of the human race during a zombie outbreak? Do births/deaths and/or the decay of zombies improve the outlook for the human race?