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THE EFFECT OF CONVERSION RATE ON PREY-PREDATOR MODEL WITH DISEASE IN PREY USING ONE- PARAMETER BIFURCATION ANALYSIS


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## ABSTRACT

This project offers a new method to investigate the effect of conversion rate on prey-predator models with disease in prey using one-parameter bifurcation analysis. As we all know, prey and predator have a symbiotic relationship. Thus, knowing the stability of their population is crucial when parasite infection in prey populations is a serious issue that must not be neglected. In this project, we examine the stability analysis of the prey-predator model with the presence of disease in the prey population and to analyze the effects of the conversion rate of the prey-predator population, by using one-parameter bifurcation analysis. A few graphs of bifurcation, phase plane, and time series are plotted using mathematical software such as XPPAUT, Maple, and MATLAB. As the parameter value of the steady states grows, the system's stability will change from stable to unstable or vice versa. According to our findings, the conversion rates effect can induce a switch in stability. As the conversion rate increases, the steady state of susceptible and infected prey are shifted from stable to unstable. We may conclude that the density of susceptible predator species reduces significantly, indicating that infected prey has a significant impact on the predator population.

# 1 INTRODUCTION

## 1.1 Prey Predator

The prey-predator relationship consists of interactions between two species and their consequent effects on one another. Prey and predator both engage in hunting and attacking activities. Predators hunt other animals, while the prey is those whom other animals attack. In an ecological system, prey and predator have a relationship. The prey is a part of the predator's environment, and the predator will die if it does not get its prey, as the predator is completely dependent on prey for survival.

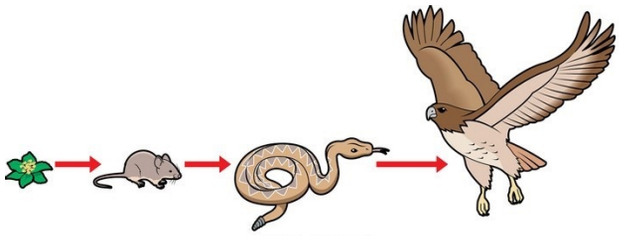

Figure 1.1: The example of food chain.

Figure 1.1 shows the example of food chain. A food chain is a series of organisms that pass nutrients and energy from one to the next as one eats another. In the food chain, prey species are closer to the producers as compared to predator species. Predators receive the least amount of energy because they are at the top of the food chain. Therefore, they play a crucial function in ecosystem by preserving the prey population and increasing biodiversity by preventing a single species from becoming dominant.

Since prey stores energy and is an important food source for predators, therefore, these species have higher populations than predators but lower populations than producers. They have great environmental adaptations that allow them to win battles against predators by hiding, escaping, and fighting. Sometimes they even use chemical weapons. Prey is an essential component of the ecosystem, particularly in facilitating the flow of energy to predators; if there were no preys, there would be no predators on this earth.

The prey-predator relationship maintains the earth's ecological balance because if preda-