
Math 347
Tuesday, November 6, 2007
Harvesting Strategies

Reconsider the following harvesting problem from Discrete Dynamical Systems Homework 2:

In this problem, we will consider two different harvesting strategies. Assume that we are modeling a population of deer, and that in the absence of harvesting, the deer population follows logistic growth as in the previous problem. Assume that the size of the units are chosen so that one unit equals the carrying capacity of the population ($L = 1$). Let's say that one unit is equal to 10,000 deer (so the carrying capacity for deer is 10,000). Assume that the unrestricted growth rate of the deer population is $r = 0.8$.

1. Consider a harvesting strategy in which hunters are allowed to kill b units of deer per season. Construct the dynamical system that models the growth of the deer population. Find the equilibrium points of the system, and use derivative and/or graphical techniques to discuss stability. What is the maximum sustainable harvest level for this population (i.e. the maximum harvest level such that the deer population does not die out).
2. Next, consider a harvesting strategy in which hunters are allowed to hunt a fixed proportion of the population per season. Let b represent the proportion of the population that is allowed to be hunted, and construct the dynamical system that models the growth of the deer population in this case. Find the equilibrium points of this system, and use derivative and/or graphical techniques to discuss stability. What is the maximum sustainable harvest level?
3. Compare (in a written discussion) the two harvesting strategies.