Lab 5: Density Dependence

Basic instructions:

For today's lab, the 'density dependent growth' module will be used. To get to this module, click on 'single species dynamics' then on 'density dependent growth. For all questions, set 'Plot type' to N vs. t.

Mathematical background:

The mathematical background for today's lab was covered in the lecture 'density dependent population growth'. It would be very helpful to review that material and to bring a copy of it with you.

Questions:

1. Set 'Model type' to continuous logistic, 'run time' to 500, and K to 300.

   A. How does changing the intrinsic rate of increase, r, affect the time it takes the population to reach a size of 300?

   B. How does changing the initial population size, $N(0)$, affect the time it takes the population to reach a size of 300?

   C. Is there any value of $N(0)$, other than 0, that prevents the population from ultimately attaining its carrying capacity, K?

2. Set 'Model type' to lagged logistic, run time to 500, K to 300, and $N(0)$ to 10.

   A. Set the time lag, t, to 1. How do your plots change as you increase the intrinsic rate of increase from $r = .1$ to $r = 2.0$? Why?

   B. Given your result from A, would a population be more likely to go extinct with a growth rate of $r = .1$ or $r = 2.0$? Why?

   C. Set the intrinsic rate of increase, r, to 1. How do your plots change as you increase the time lag from $t = 1$ to $t = 3$? Why?

   D. Given your result from C, would a population be more likely to go extinct with a time lag of $t = .1$ or $t = 2.0$? Why?

3. Set ‘Model type’ to discrete logistic, run time to 50, K to 300, and $N(0)$ to 10.

A. Gradually increase the intrinsic rate of increase from $r = 0.5$ to $r = 3.0$. What happens to population dynamics? Why?

B. As you increase r you should be able to distinguish 3 distinct types of population cycles. What do each of these look like?

C. If the intrinsic rate of increase, r, exceeds a critical threshold (say $r = 2.9$), the population should begin to cycle in a “chaotic” fashion. Under these conditions does the population ever reach its carrying capacity?

D. Under the chaotic conditions described in C, try starting the population at initial sizes of $N(0) = 15$, $N(0) = 16$, $N(0) = 17$, $N(0) = 18$. How much difference does this slight change in initial population size make for the population size in generation 40?