Reading 3.1 – Competition for Limited Resources

In class today, you participated in a competition between classmates. You also saw how competition emerges in ecosystems when individuals interact with a set of limited resources. Understanding ways in which competition emerges between individuals in populations is necessary to understand how complex interactions with the ecosystem lead to changes in populations over time.

Question 1: Give some examples of where competition occurs in your life:

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Question 2: Give an example of where you may have unintentionally competed against another person:

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Competition occurs in human society in many forms. Some forms of human competition are intentional and others are unintentional. Some forms of human competition are for a set of limited resources, others are not.

Competition also occurs throughout the natural world between individuals in all ecosystems. When it occurs in ecosystems it is due to interactions related to the limited resources necessary for survival. Some forms of competition may be apparent when you study predator and prey relationships (such as interactions for food). The most obvious forms of competition are apparent when you consider only the direct and intentional competitive pressures that individuals exert on each other.

Example 1: A bird that sees a bug may change its flight to try to catch the bug.
Example 2: The bug (if it sees the bird) might try to fly away from its predator.

In both examples, the bird and bug are intentionally trying to outcompete each other in this interaction. Either individual might win this competition for survival (by either escaping its predator and living, or catching its prey and gaining more food to live longer). Though this example of competition is simple to explain, other forms of competition are more complex. Some forms of competition will require you to think about indirect and unintentional competitive pressures that individuals exert on each other. All forms of competition in nature will require you to think about what limited resources that are necessary for survival that are available in that ecosystem.

In 1798, Thomas Malthus published *An Essay on the Principles of Population*. In this essay, he calculated that human populations could, in theory, double every 25 years unless they are limited by food supply. He also noted that the human population could not keep growing indefinitely, since there was a limited food supply available on the planet.

Since then humans have found lots of ways to increase their food supply in order to support the size of the human population (over 7 billion). While the population of earth could continue to grow some more, the amount of food that humans can produce in a given year is not infinite. There is some limit to the number of humans that can be supported on Earth, simply due to the limited amount of food that the Earth can produce.

Other organisms have this same potential to exponentially increase their numbers (by reproduction) unless the resources they need to survive limit them. And of course, they too are limited by the amount of resources available on the planet.

Limited resources necessary for survival always generate competition in populations. Some individuals who are not as successful at getting those resources are more likely to die and less likely to have offspring and individuals who are more successful at getting those resources are less likely to die and more likely to have offspring. Therefore, competition between individuals arises any time the resources necessary for survival are limited and individuals interact with them.

Today, in your class activity, you used a computer model to simulate and visualize some of the interactions in an ecosystem. A scientific model is a representation of a system that helps you understand very complicated or difficult to observe processes. It is based upon a set of assumptions that are usually much simpler or more exaggerated than what may actually be taking place in the natural ecosystem. The computer models you will be using in class in the next couple of days are scientific models of simplified ecosystems.

Question #3 Which of these modeling assumptions contributed to creating a competitive environment for each bug to gather enough food (energy)? *Check all that apply*

_____ All bugs start with an equal amount of energy and move at the same speed

_____ All bugs lose energy as they move.

_____ When a bug moves over grass, it eats it and gains energy.

_____ When a computer-controlled bug gets enough energy, it has a single baby
(Transferring some its energy to the baby in the process)

_____ When bugs run out of energy they die.

_____ When grass is eaten, that spot of ground appears empty until the grass begins to grow back.

_____ Where grass grows (the grassland) is randomly assigned to only some spots, and
other spots that are not grassland will never grow grass.

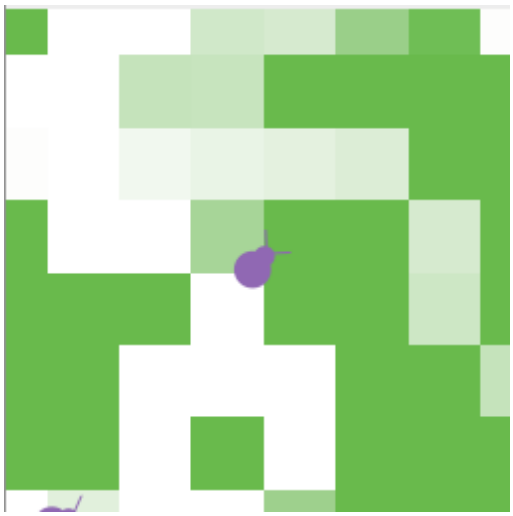
_____ When grass grows back, it does so with a fixed time delay and at a constant rate.

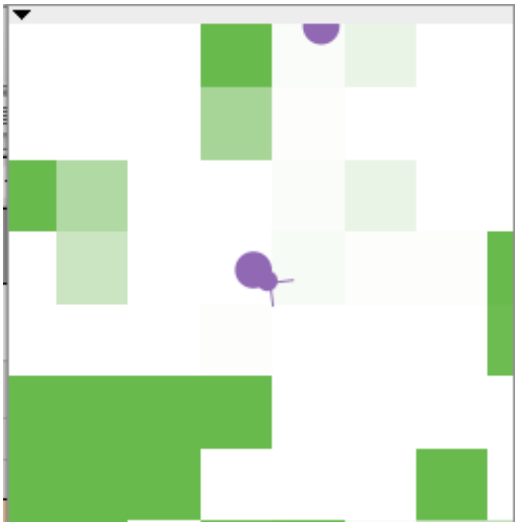
_____ There are predator birds that will eat bugs that are computer controlled.

Question #4 In the model you used in class, bugs competed for eating grass. What are other

resources necessary for survival that organisms might unintentionally compete for in an ecosystem?

In the computer model, different bugs might experience differences in how their food (grass) is distributed near them at different times. Here are pictures of two different bugs and the local environment around them from the same point in time during a model run:





Question #5 If the model had been running for a while, what are some of the interactions in it that may have caused this difference in food distribution to emerge?

Question #6 Complete the table below following these directions.

- Calculate the average amount of grass per bug for models A and B below.
- In model C, record an amount of bugs that gives you a larger average amount of grass per bug than in A or B.
- In model D, record an amount of bugs that gives the same average amount of grass per bug as in model A.
- In model E, record an amount of grass and bugs that gives a larger average amount of grass per bug than any model so far.
- In model F, record an amount of grass and bugs that gives a larger average amount of grass per bug than any model so far.
- In the columns for all the models (C-F), calculate the average amount of grass per bug.

	Model A	Model B	Model C	Model D	Model E	Model F
Amount of grass	300	300	300	100		
Number of bugs	30	60				
Average amount of grass per bug						

Question #7 In which of the model(s) would competition is more likely to lead to the death of some individuals? _____

Question #8 In which of the model(s) would bugs is more likely to reproduce faster? _____

Question #9 In any ecosystem, there is always some variation in the distribution of resources (such as food, water, shelter, and sunlight). Pick one of these resources to talk more about. What are some things that would lead to variation in the distribution of this resource?

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