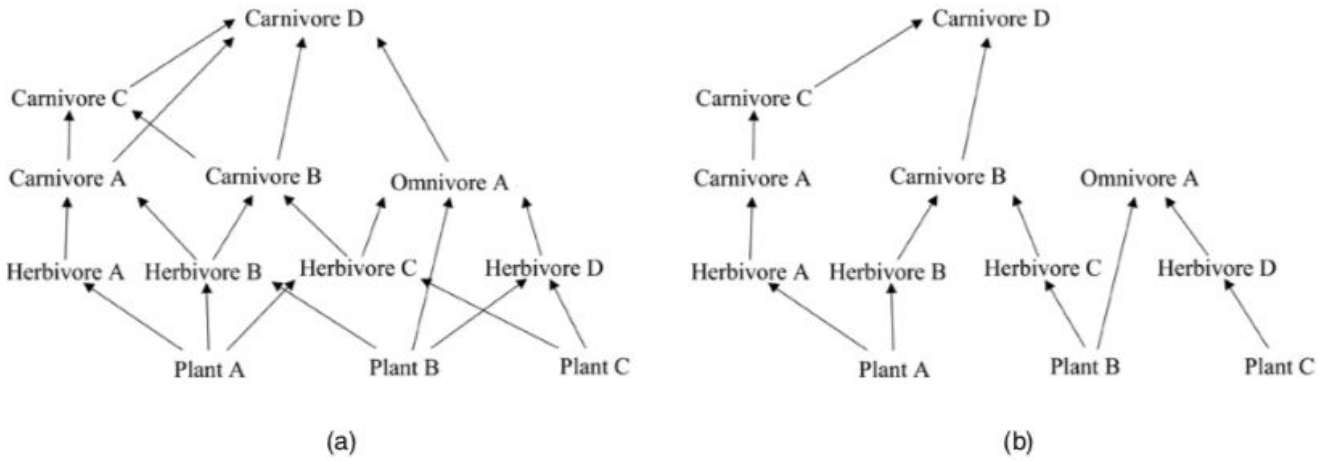
Lab 10: Food Webs and Biodiversity: How Does Food Web Complexity Affect Biodiversity?

Introduction

An ecosystem is a community of living organisms and the nonliving components of the environment. Energy flows in an ecosystem in one direction through food chains, and a food web is made up of all the food chains within a community of organisms. Food chains and food webs consist of the producers (the autotrophs of an ecosystem), the primary consumers (the herbivores and omnivores of the ecosystem), the secondary consumers (the carnivores and omnivores of the ecosystem), and the top predator. Some ecosystems have complex food webs and some do not. In ecosystems with a complex food web, herbivores and omnivores eat many different types of plants and the carnivores eat many different types of animals. The consumers in this type of ecosystem are described as generalists. Ecosystems that support consumers that rely on a single food source, in contrast, have simple food webs, because the consumers are specialists. An example of a complex food web is provided in panel (a) of the figure below, and an example of a simple food web is provided in panel (b) of that figure.

Example of (a) a complex food web and (b) a simple food web



Biodiversity refers to the variation in species found within an ecosystem, and it is measured in two ways: (1) species richness, which is the total number of different species in an ecosystem; and (2) relative abundance, which is a measure of how common each species is within the ecosystem. Regions that are home to many different species with a high relative abundance of those different species have high levels of biodiversity, whereas regions with only a few different types of species or that have moderate species richness but a low relative abundance of several species have a low level of biodiversity.

Notice that the food webs illustrated above have the same amount of species richness even though the feeding relationships are different. Some of the feeding relationships illustrated in these two ecosystems, however, may or may not be sustainable over time and may result in a net decrease in biodiversity. The relative abundance of each species, for example, may change if one or more of the populations within the ecosystem grows or declines over time. The species richness of the ecosystems could also change if some of the populations disappear because of too much predation or too little access to natural resources. Given the role that biodiversity plays in ecosystem health and tolerance to ecological disturbances, it is important to understand how food web complexity is related to the biodiversity of an ecosystem.

Your Task

Use the online simulation ***Ecology Lab*** to explore the relationship between food web complexity and biodiversity in an ecosystem.

The guiding question of this investigation is: ***How does food web complexity affect the biodiversity of an ecosystem?***

Materials

You will use an online simulation called ***Ecology Lab*** to conduct your investigation. You can access the simulation by going to the following website:

http://www.learner.org/courses/envsci/interactives/ecology/ecology.html

Getting Started

The ***Ecology Lab*** simulation allows you to create different food chains and webs within a model ecosystem. Once you establish the food chains and webs in the model ecosystem, you can run the simulation to determine the effect on the population of each organism.

To answer the guiding question, you will need to design and conduct several experiments using the online simulation. To accomplish this task, you must determine what type of data you will need to collect during each experiment, how you will collect it, and how you will analyze it.

To determine *what type of data you need to collect*, think about the following questions:

- What will serve as your dependent variable (population size, number of different populations,
- relative abundance, and so on)?
- What type of data will you need to keep a record of during your investigation?

To determine *how you will collect your data*, think about the following questions:

- What will serve as a control (or comparison) condition?
- What types of treatment conditions will you need to setup and how will you do it?
- What variables will you need to control during each experiment?
- How often will you collect data and when will you do it?
- How will you keep track of the data you collect and how will you organize the data?

To determine *how you will analyze your data*, think about the following questions:

- How will you determine if there is a difference between the conditions during each experiment?
- What type of calculations will you need to make?
- What type of graph could you create to help make sense of your data?

Report

Once you have completed your research, you will need to prepare an investigation report that consists of four sections (be sure to have section headings):

1. Introduction: Give some background information on the topic. Explain what question were you trying to answer and include a hypothesis. (Background info, research question and hypothesis)
2. Procedure: What did you do during your investigation and why did you conduct your investigation in this way? (How you collected and analyzed data)
3. Data: Include a data table and/or graph to show your results. Be sure to include a title for your table or graph with labels for the variables.
4. Conclusion: What is your argument? (Claim - Evidence - Reasoning)

Your report should answer these questions in two pages or less. The report must be typed, and any diagrams, figures, or tables should be embedded into the document. Type your report on Google Docs (12 point font, double-spaced) and share it with your teacher. Your report will be graded based on the rubric in the class syllabus.