MODULE 1: What is Biodiversity?

Course 1
Practicum 1 and 2: Species Interactions, Trophic Levels, and Energy Flow

Introduction

In an ecosystem, different kinds of species interactions can occur, including competition, parasitism, predation, mutualism, and commensalism.

Energy can flow from one trophic level (type of feeder—producesr, consumers, decomposers) to another level through predation or parasitism. These are in turn aided or hindered by other species interactions.

Objective

To learn about different kinds of species interactions through observation and analysis.

Procedures

Take a walk to the FTI arboretum and observe what species interactions you can see. Take notes on the kinds of interactions (mutualism, competition, commensalism, etc.).

Course 2
Practicum 1: A Comparison of Spider Communities

Introduction

Spiders are a species-rich group of invertebrates that exploit a wide variety of niches in virtually all of the Earth's biomes. Some species of spiders build elaborate webs that trap their prey whereas others are active predators that ambush or pursue their prey. Spiders represent useful indicators of environmental change and community-level diversity because they are taxonomically diverse, with species inhabiting a variety of ecological niches, and they are easy to catch.

Objective

This practicum helps you to learn how life forms are classified and how biological diversity varies at different taxonomic levels. This exercise focuses on classifying and analyzing spider communities to explore the concept of biological diversity and experience its application to decision-making in biological conservation. You will gain experience in classifying organisms by sorting a hypothetical collection of spiders from a forest patch and determining if the spider collection accurately represents the overall diversity of spiders present in the forest patch.

Procedures

The families of spiders named in this exercise are real, and the illustrations are of real species that occur in central Africa. However, the combination of species and families collected at the different sites, as well as the geographic arrangement of the sites, is entirely hypothetical and does not represent the species assemblages one would find in the wild.

MODULE 1: What is Biodiversity?

1) Each group will be given a handout with images of spiders collected from "Forest Patch 1." The spiders were captured by a biologist traveling along a transect through the patch, stroking a random series of 100 tree branches. All spiders that were dislodged and fell onto an outstretched sheet were collected and preserved in alcohol. The illustrations of the spiders are aligned in rows and columns so that it is easy to cut them out with scissors, for subsequent examination and identification.

2) The next task is for you to sort and identify the spiders. To classify the spiders, look for external characteristics that all the members of a particular group of spiders have in common but that are not shared by other groups of spiders. For example, look for characteristics such as **leg length, hairiness, relative size of body segments, or abdomen patterning and abdomen shape.**

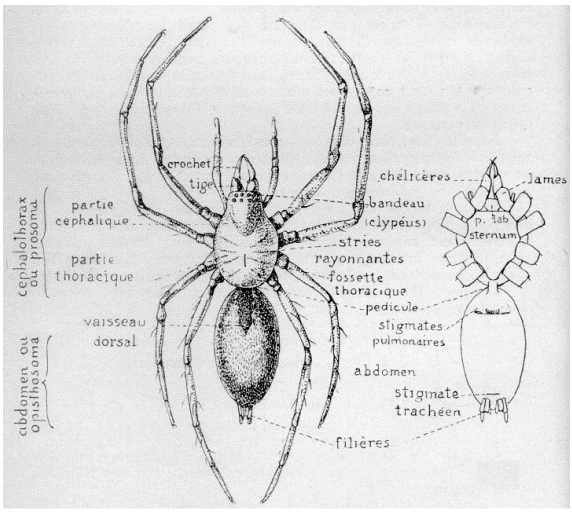


Figure 1. Basic external characteristics of spiders useful for identifying individuals to species.

3) Assign each species a working name, preferably something descriptive. For example, you might call a particular species "spotted abdomen, very hairy" or "short legs, spiky abdomen." Just remember that the more useful names will be those that signify to you something unique about the species. Construct a table listing each species, its distinguishing characteristics, the name you have applied to it, and the number of occurrences of the species in the collection.

4) Last, ask whether this collection adequately represents the true diversity of spiders in the forest patch at the time of collection. Were most of the species present sampled or were many likely missed? This is always an important question to ask to ensure that the sample was adequate, for example, to assign areas as "low" versus "high diversity" sites.

To do this you will perform a simple but informative analysis that is standard practice for conservation biologists who do biodiversity surveys. This analysis involves constructing a so-

called “collector’s curve”. These plot the cumulative number of species observed (y-axis) against the cumulative number of individuals classified (x-axis). The collector’s curve is an increasing function with a slope that will decrease as more individuals are classified and as fewer species remain to be identified (Fig. 2). If sampling stops while the collector’s curve is still rapidly increasing, sampling is incomplete and many species likely remain undetected. Alternatively, if the slope of the collector’s curve reaches zero (flattens out), sampling is likely more than adequate as few to no new species remain undetected.

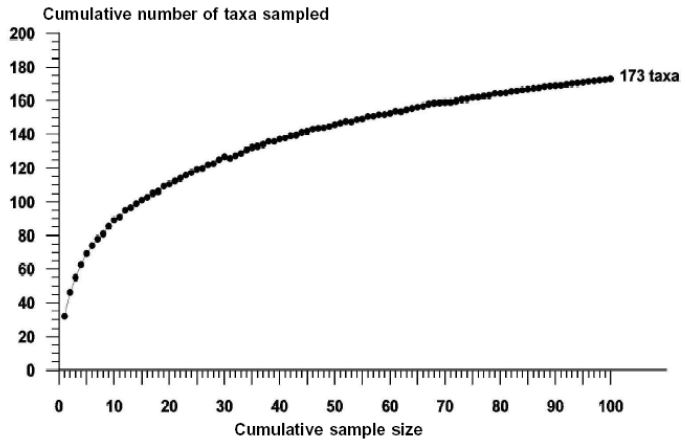
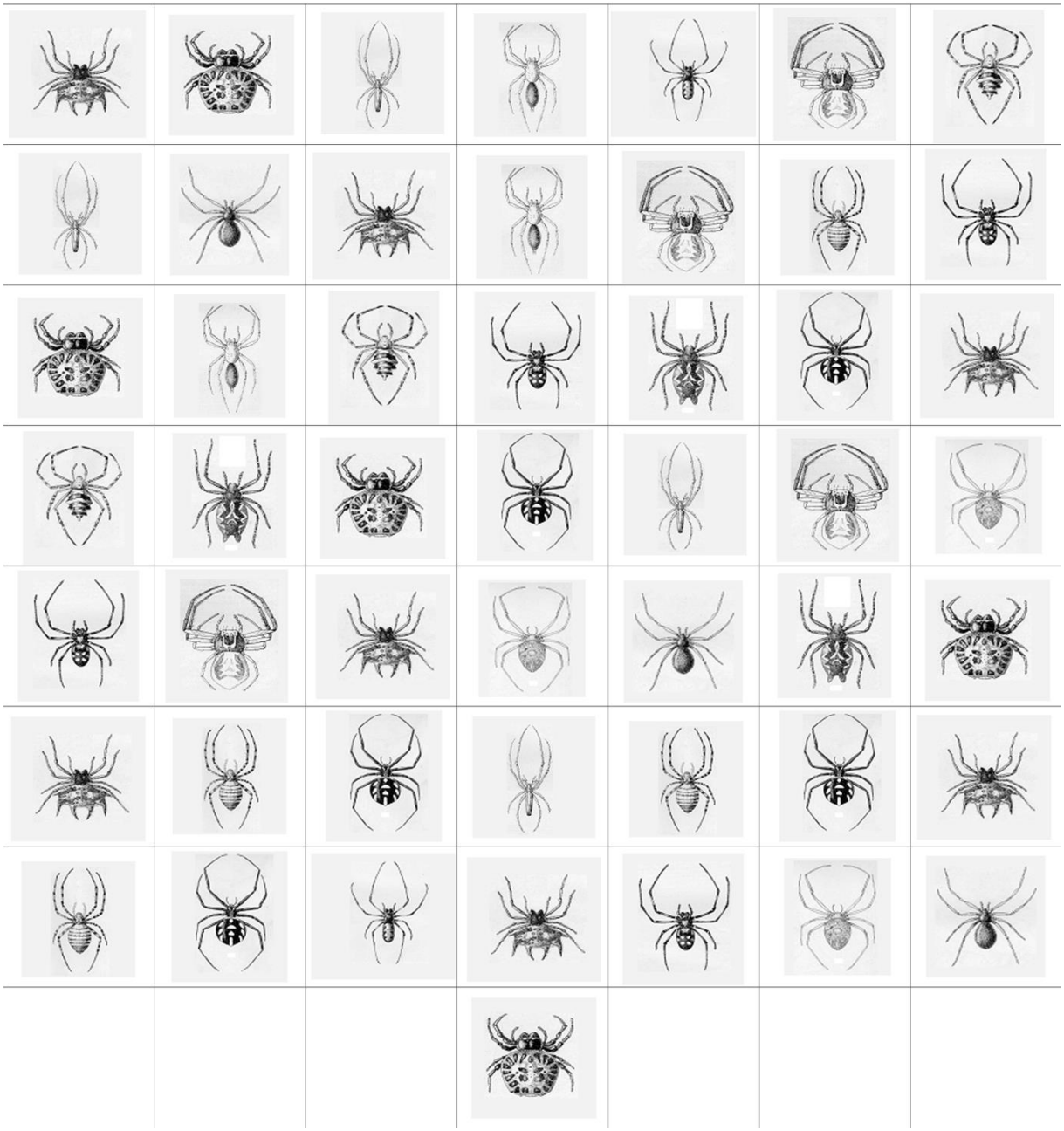


Figure 2. An example of a collector’s curve. Cumulative sample size represents the number of individuals classified. The cumulative number of taxa sampled refers to the number of new species detected.

To construct the collector’s curve for this spider collection, choose a specimen within the collection at random. This will be your first data point, such that X = 1 and Y = 1, because after examining the first individual you have also identified one new species! Next move consistently in any direction to a new specimen and record whether it is a member of a new species. In this next step, X = 2, but Y may remain as 1 if the next individual is not of a new species or it may change to 2 if the individual represents a new species different from individual 1. Repeat this process until you have proceeded through all 50 specimens and construct the collector’s curve from the data obtained (just plot Y versus X). Does the curve flatten out? If so, after how many individual spiders have been collected? If not, is the curve still increasing? What can you conclude from the shape of your collector’s curve as to whether the sample of spiders is an adequate characterization of spider diversity at the site?

MODULE 1: What is Biodiversity?

Forest Patch 1 Spider Images



Practicum 2: Africa's Biodiversity Hotspots

Introduction

Conservation biologists are particularly interested in areas that have high **species diversity** or **species richness**. Conservationists are also often interested in areas with high levels of **endemism**. **Endemic** species are *those species whose distributions are naturally restricted to the defined region*. Areas of high endemism often also have high species richness. Conservation biologists have focused their attention on areas that not only have high levels of endemism but which are also experiencing a high rate of habitat loss: these regions are **biodiversity hotspots.** More precisely, a terrestrial biodiversity hotspot is defined as an area that has at least 0.5%, or 1,500 of the world's approximately 300,000 species of plants, and that has lost at least 70% of its primary vegetation.

Objective

You will design a poster that describes the important features of a biodiversity hotspot in Africa.

Procedures

You will be assigned to groups of 4 people to develop a poster representing the characteristics of a particular African biodiversity hotspot. Your poster should provide the following specific information:

1. A presentation of the basic physical/geographical and socioeconomic characteristics of the country (countries) where the hotspot is located.
2. A description of the major ecosystems of your hotspot, including information on endemic species and communities found in the hotspot.
3. A description of the principal threats faced by the hotspot.
4. A description of the current conservation actions and programs taking place in the hotspot.

The African hotspots to be represented are the following:

- Cape Floristic Region
- Guinean Forests of West Africa
- Cameroon Highlands
- Congo Basin

Practicum 3: Exploring biodiversity in Bomi County

Introduction

If you wish to follow the adage, "Think globally, act locally," you need to begin with an understanding of your local species and ecosystems.

Objective

This practicum is designed to help you to become familiar with local ecosystems and species

diversity in your region and the threats that they may face.

Procedures

1. Define study area (geographical region, county, park boundaries, etc.)
2. Classification
    a. physical environment
    b. vegetation
    c. species composition
3. Assess Ecosystem Types
    a. representation on landscape (widespread vs. localized)
4. Assess Ecosystem Diversity
    a. Literature reviews
5. Identify the conservation status and major threats to local ecosystems