

A Boreal Bog: An Example of Ecological Succession

Introduction

Ecological communities change in structure over time. This is known as **ecological succession**. Unfortunately, it usually happens too slowly for us to observe it. Life spans are too short (as well as funding periods). So, the best we can hope for is to find a site where the full range of successional stages is still visible. A **boreal bog** is such a site. In this lab, we will travel to the Tannersville Bog to study ecological succession. Bogs have very unique abiotic characteristics, specifically low pH, that some (non-ecologists) would consider “harsh.” Therefore, we will also sample the bog to measure pH (as well as temperature) to determine if there is an association between variation in conditions and the plant community. Recall the **law of tolerance and the concept of the niche**. But first, some background information.

Ecological Succession

There are two types of succession: **primary** and **secondary**. They are similar in that over time the structure of the ecological community changes. What differentiates the two is how they start. Primary succession starts when new habitat is produced. For secondary succession, a disturbance starts the process. Disturbances are any phenomena that remove members of a community. This opens up space in that community, which allows pioneer species to invade (*note*: invasion here simply means a new species arrives and takes hold. It can be a naturally occurring species or an alien species). An example of a disturbance is a forest fire. As the fire moves through the forest, fire intolerant species are killed off. This opens up area for new species to come in and become part of the community.

Succession follows a fairly typical sequence. The process starts either with a new habitat being produced (e.g., production of new land) for primary succession or a disturbance ceases for secondary succession. Vegetation then begins to colonize and become established in the following sequence:

Annual (pioneer) weeds → herbaceous perennials → early (pioneer) successional trees → late successional trees

As community structure changes, so do conditions and resources.

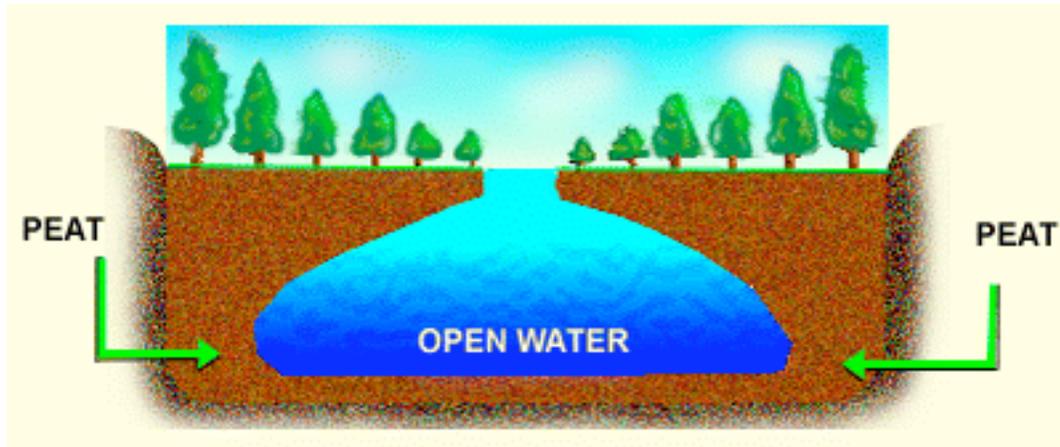
Boreal Bog

A boreal bog is a type of wetland. They are usually found in the boreal forest (i.e., taiga) biome. The Tannersville bog is a relict of the last ice age. We are lucky that we can see this habitat within a relatively short drive. Otherwise, it’s a road trip to Canada. In fact, Pennsylvania is the southernmost point where boreal bogs can be found.

Boreal, or true or quaking, bogs are formed by a very interesting process called “terrestrialization.” Basically, this is the filling in of a lake. The lake that used to occur

where the Tannersville Bog is now was a *kettle lake*. A kettle lake is formed when a large chunk of ice breaks off a glacier. Sediment collects around the chunk of ice, and when the ice melts, it leaves a large, sometimes deep, water-filled depression. Terrestrialization begins when a vegetation mat begins to grow from the shore towards the center of the lake. *Sphagnum* moss consolidates and stabilizes this mat. Eventually larger plants and trees are able to take hold. Over time, organic matter accumulates under this mat as **peat**. Eventually the mat may cover the lake surface. The lake may also become completely filled with organic matter. The opening in the center of the bog where you can still see water is called the bog's "eye."

Boreal bogs are characterized by (1) soil that is saturated, has low dissolved oxygen content, and very low nutrient concentrations, (2) low pH (3-5), and (3) low diversity of plants.



A cross section of a boreal bog showing the terrestrialization process (from www.aquatic.uoguelph.ca/wetlands/chapter2/bogs.htm).

The Tannersville bog began forming 10,000-15,000 years ago. The peat layer is approximately 12 m deep at its thickest point. The bog covers 715 acres.

Ecological Succession of Bogs

So how does one go about studying succession of a boreal bog. Well, in the absence of immortality or a time machine, one can simply walk from the edge of the bog towards the center. Why? Think about this. What's really cool is that as you walk towards the center of the bog, you are walking back in (successional) time. Be aware for changes in community structure (i.e., zones) as you walk.

Methods

We will be making three trips to the Tannersville Bog. During the **first trip**, you will be introduced to the plants of the bog. We will be looking for changes in communities/zones as we walk. The **second trip** will be used to map the changes in community structure. The boardwalk that goes through the bog is marked every 50 feet. Half of each lab

section (M vs. W) will sample the vegetation at every other mark. We will not do it in a formal way such as we did at the Acopian Center. We will not be using quadrats. We will merely determine what the major plant species are at each point (be sure to sample both sides of the board walk. The other half of each section will determine the pH and temperature of the soil/water every other point using pH strips.

Assignment

You will write a report following the format of the journal *Ecology*. The study has two objectives: (1) to describe the successional sequence of a boreal bog and (2) to determine whether there is a change in pH (remember pH is a condition) and temperature over the successional stages (i.e., if there is a correlation between these conditions and the structure of the floral community).