Beneath the Bog

Using clues from the lesson, students identify which soil core, from a set of models, represents a core from a cranberry bog.

How does the soil in a present day cranberry bog act like a code to tell us about the past?

Lesson Overview

In this lesson, students will examine models of core samples of soil. They go beneath the surface of the cranberry bog and find out about the various soil layers that support the cranberry vines. These models will help them learn about the unique geographical and historical conditions that led to the success of cranberry cultivation. They will explore how geology and human agricultural practices led to the present day cultivation of cranberries. In doing so, students learn the basics of a cranberry bog's structure. They also expand their appreciation that land, plants, and people interact in this system.

Although this lesson could easily be adapted as a hands-on experience for students, it is presented here as a demonstration, in order to simplify your implementation. You will present models of core samples from three different locations and introduce students to the main challenge of this lesson: to study the core samples and identify which core represents a sample from a cranberry bog. To support their work, students will view a movie presentation, which will provide them with information about the geological and social history of the bog land and construct a timeline to summarize this history. Because this history correlates to the events that led to the soil deposits in a bog, students will be able to use the timeline to meet the challenge. Comparing each model core sample, students will determine which one corresponds to the model of the bog.

Background

Visit a conventionally farmed summertime bog today, and you will see what's at its surface: cranberry vines (and perhaps some weeds). But if you were to dig down and pull up a plug of soil, or core, you would be able to the site's past. Each layer of soil contributes to the health of the cranberry vine. Each layer also points to a

specific event in geological or human history that in its own way helped create the right conditions for this useful fruit.

Close to the surface, you would see evidence of the recent past. You would see the current cranberry root zone (where the roots of the vine are) in the sand layers built up by farmers. (Within this layer, additional detail might evident. You might be possible able to distinguish between the layers of sand laid down every few winters and the organic matter that represents seasons of growth.)

Continuing your journey down through the core, beneath the sand, you would find peat, thousands of years old. Within this peat, there may even be chunks of old cedar, thousands of years dead, still slowly decomposing. Peat depth varies from bog to bog, and even from spot to spot, but can possibly be several feet deep or more.

Under the peat would be the glacial deposits: first the larger gravel particles, and finally the watertight clay layer lining the underside of the bog. While the gravel ensures good water drainage from the roots, the clay barrier seals in nutrients that leach from peat. This maintains a rich environment for growth. The diagram below illustrates what a core sample might look like.

In the lesson, students compare three different soil samples (which you will prepare; see Materials, below): Core Samples X, Y, and Z. The students' job will be to interpret the layers and identify the core that represents a core from a grower's cranberry bog (Core Sample Y).

- Core Sample X represents a sample that might be taken from the Holmhill Bog, located in the coastal county of Hampshire, England. It has similarities to a Southeastern Massachusetts cranberry bog core –but it has distinct differences. For example, it has *neither a top layer of sand nor a bottom clay layer.*

- Core Sample Y represents what you might see in a conventionally farmed, Southeastern Massachusetts cranberry bog. (This could also represent a cranberry marsh farmed in other cranberry growing regions.)

- Core Sample Z, by contrast, does not represent a known site, but instead is an "upside-down" Core Sample Y. This model is included so that you can determine whether students grasp the nature of geologic layering—with the rule of thumb being that more *recen*t soils and deposits are *nearer* the surface, while *older* deposits are *deeper*.

Materials

Samples of wet peat, sand, gravel, and wet clay for students to touch and examine (if possible)

Cranberry vines

- If you live in a cranberry growing region and wish to have cranberry vine samples for your classroom, try contacting a local grower. Otherwise, you can purchase cranberries from nurseries. While CCCGA does not endorse any particular supplier, national nurseries such as Johnny's Selected Seeds (http://johnnyseeds.com) sell individual plants for gardeners. You might check with a local nursery. If they carry the plant, they may offer some clippings

4 clear, 6-inch-long plastic tubes, such as containers in which beads or glitter might be sold (available at major chain craft stores).

- These tubes really work best. However, if they are not available, use 3 6-8-inch, clear containers as close to perfectly straight-sided as possible, such as water tumblers or tall salsa jars, and follow the alternate core sample procedure noted in the lesson plan, which eliminates the use of the fourth tube.

- 1 medium-sized container with straight, opaque sides. Examples: juice carton cut to about six inches in height, a small paint bucket, ***or*** a foil pan.

Materials for creating model soil layers, as follows or improvised as needed:

- Cranberry vines (a handful). (Possible replacements: a few sprigs of artificial plants; pipe cleaners; or (preferably green) twist ties
- Play or art sand (to represent the sand layer)
- Florist foam (to represent the peat layer). If you cannot get florist foam, you might use colored play dough or modeling clay.
- Natural-color aquarium gravel (to represent the gravel layer). If you do not need to be concerned about children's food allergies, or using food in your classroom, a possible replacement for gravel is Grape Nuts or similar cereal.
- Clay/playdough (to represent the clay layer)

Note: The amount of each material that you will depend upon the sizes you choose for the container in which you will build the model bog, as well as the core containers. The Preparation instructions below detail how thick each layer of material will need to be in each core model.

Index cards (10; or 10 per group)

Masking tape ***or*** rope

Cranberry Questions chart from Welcome to the Bog

1 ruler per student

1 pencil per student (or a set of colored pencils per student or student group)

Exploring Cranberries Web Resources:

Beneath the Bog Movie Presentation

Decoding the Core Student Worksheet (1 per student)

Preparation

1. To prepare **the model cranberry bog** in the opaque container, follow steps 1a-1e. See diagram of Core Sample Y, below, to guide you.

    a. Line the bottom of the container with about ¾- inch of clay/play dough.

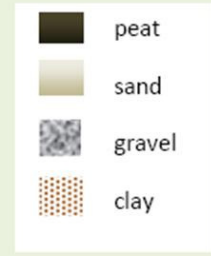
    b. Add a ¾-inch layer of aquarium gravel

    c. Add about 3 inches of florist foam or dark modeling clay.

    d. Top off with about ½ to ¾ inches of sand. You may wish to scatter pieces of cranberry vine roots in the deeper layer of sand.

    e. Set cranberry vine or substitute into the top sand layer.

2. Prepare **two core sample models for each "site"--X, Y and Z**--in the clear, plastic tubes, as follows. (This will provide six core samples, enough for six small groups in your classroom.) Also see diagram below. Cap and tape down or use strong tape to cover the top of each sample, and label each according to whether it is sample X, Y, or Z.



Key to Core Samples

Core Sample X:

- Pour about 2 inches of sand into the bottom of one of the clear, plastic tube.
- Cut a 4 inch layer of florist foam (or alternative peat model material) to fit into the tube and insert.

Core Sample Y:
This is the core that matches the cranberry bog, so it should be prepared to match the cranberry bog model you prepared in Preparation Step 1 (above):

- Line the bottom of the container with about ¾-inch of clay/play dough.
- Add a ¾-inch layer of aquarium gravel.
- Line the bottom of the container with about ¾-inch of clay/play dough.
- Add about 3 inches of florist foam or dark modeling clay.

Core Sample Z:

- Pour about ½ to ¾ inches of sand into the bottom of a clear tube.
- Add a 3-inch cylinder of florist foam (or alternate, representing peat) to fit the width of the tube.
- Add a ¾-inch layer of aquarium gravel.
- Top off with ¾ inch of clay (representing clay).

3. Post the Cranberry Questions chart from "Welcome to the Bog" lesson.
4. Clear a space on a wall and run masking tape across it to create a timeline. As an alternative, hang a rope or yarn across the front of the room to use as a timeline.

5. Prepare index cards by printing the following timeline "anchors," one on each card. Then mix the cards up.
    - Glacier covers parts of North America
    - Glacier retreats
    - Chunks of glacier take a while to melt
    - Kettle ponds form, with clay settling to the bottom, and gravel settling on the clay.
    - Peat builds up.
    - Wild cranberries grow in the rich, peaty soil.
    - Native Americans discover many uses for the cranberry.
    - The English value the cranberry and accept it as money.
    - Sea captains and sailors value the cranberry because it helps keep away scurvy during long voyages.
    - A sea captain realizes that wild cranberries thrive when they have sand blown on them from nearby dunes.
    - People begin farming the cranberry. Many bogs, once used for iron mining, turn out to be the perfect spot.
    - Today, cranberries grow in these areas (and newly developed ones, as well).

6. Prepare for students to access and use the Beneath the Bog MS PowerPoint presentation, either as small groups (2-3 students) at computer stations, or as a whole-group experience.

7. Make 1 copy of the Decoding the Core Study Student Worksheet for each student.

Lesson

1. Introduce this lesson by showing the model of the cranberry bog. Ask students to compare the model to what they would see if they visited a bog. Then raise these questions:

   "What do you think we might we see below the surface of the bog?"
   "How might we find out for sure what is under the bog's surface?"

   Students are likely to suggest digging into the soil.

2. Acknowledging that digging into the soil to see it is a reasonable idea, hold up a core sample (X or Z). Explain that one way scientists probe what is underneath the surface of the ground is to dig a core out of the soil. Point out that the model core sample has different layers. Each different soil is formed in a different way, so core samples are like secret geological codes that can help us understand what was going on in a given place when the soil was made and put down in that spot. (Different locations reveal unique patterns.)

   Let students know that in this lesson, they will learn what's beneath the bog—and how it got there. Introduce the challenge of this lesson: To examine three different model core samples and decide which one represents a cranberry bog core sample. Explain that to solve this challenge, students will need some information about what happens to create the layers underneath the bog. Tell students that you will show them a presentation of the bog's history to help them gather this information. (Also, if they have participated in the Exploring Cranberries lesson, Cranberry Connections, review what they recall about the bog history. Some information will be repeated in this presentation, but there will also be new information that students should listen and watch for.)

3. Explain to the students that following the slide show, the class will have enough information to create a bog history timeline. Randomly distribute the timeline index cards among the groups. Explain that each card captures a moment in the past of a cranberry bog, and that this past stretches back at least 10,000 years.

4. While introducing the Beneath the Bog movie presentation, instruct students to pay special attention to the part of the program that relates to the card(s) they have just received. Encourage students to notice what came before and after the moment in time that is summarized on their own timeline card. (To notice what comes *before* their assigned timeline moments, they'll have to pay attention carefully.) Let them know that after the presentation, each group will be responsible for suggesting where on a blank timeline the class should place the cards they have been given.

5. Have students watch the Beneath the Bog movie presentation in small groups at stations or as a whole class.

6. Conduct a class discussion to complete a timeline. As each group presents its card(s) to the whole class, let them suggest where they think the card should go—at the beginning of the 10,000 year timeline, at the end (present day), or somewhere in the middle? Attach the cards to the timeline. Give other groups opportunities to suggest changes or ask questions.

7. As different groups contribute their cards, rearrange the cards as necessary, referring back to the Beneath the Bog movie as needed to clarify points of confusion.

8. Once you have the timeline in place, play the slide show again to check the timeline for accuracy. Make corrections to the timeline as necessary.

9. Re-introduce the cores sample, pointing out that it is "a geologist's sort of timeline". You may find the following talking points helpful:

    a. A core sample helps us "see" into the past: It is a collection of soil and other material set down over a long period of time. The different materials and layers give clues to what was going on at different times.

    b. A helpful analogy might be the case of someone going on vacation for a whole summer. If the mail carrier makes a stack of the mail, adding to it with every delivery, eventually there would be a tower of catalogues, newspapers, and other material. Help students reason out that if the pile were kept in order, the mail that arrived first would be at the bottom of the pile. The closer to the top of the pile, the closer we get to today's mail. Similarly, the closer we are to the surface of the bog, the closer we are to the present.

10. Review the timeline cards for clues about what the different soil types indicate about what was happening at a given time. Which types of soils are mentioned in the timeline? (clay, gravel, sand, peat) Conduct a class discussion around the following questions:

    a. Which of these would be deep at the bottom of the bog core? Why do you think so?

b. Which would be in the middle? Why do you think so?

c. Which would be near to the surface? Why do you think so?

11. Again refer to the model core sample and collect students' observations of the core. At this time, hand out small samples of the actual soil materials (if available) so students can better understand the models.

12. Distribute the model core samples so that each group has one sample. On the board, provide a key to the different materials and the soil types they represent. Distribute one Decoding the Core Student Worksheet per student. Although each small group should work together to examine their core's layers, each student should individually record and label the layers in the core. Students can use the key on the sheet to determine what type of soil is in each layer.

13. After several minutes, have groups exchange their samples, so that each group can repeat the observation with a different core sample. Repeat again for the third sample.

14. Have small groups "decode" the information in the samples to determine which one--X, Y, or Z—they think most closely corresponds to the timeline of the bog's past. Discuss as a whole group, encouraging students to state the reasons for their conclusions.

15. Show students your model bog. Reinforce the idea that we can only see what's at the surface; no core is immediately available to us when we walk a bog. However, we can take a core sample. Demonstrate with your own fourth, empty plastic tube. You will need to twist the tube back and forth slightly to help ease its way through the layers. Be sure to go all the way through the clay at the bottom to ensure that the clay in the core sample can act as a plug to keep the gravel in.

    a. Note: If you were unable to acquire plastic tubes and are using the alternative set-up, settle for slicing the bog model like a piece of cake, trying to lift out the multi-layered piece intact. Even if this fails, you will have made a cut into the model and revealed the layers.

16. Pull out the core/expose the layers. Discuss student observations and establish which mystery sample matches the bog layers. Invite discussion and requests for clarification.

17. Wrap up with the following discussion points:
    - How does the core sample show the bog's past?
    - How has the past made the present cranberry bogs possible?
    - What questions from the Cranberry Questions Wall sheet have they addressed in this lesson?
    - What new questions would they like to add?