What Can We Learn About Our Seasons?

Purpose

Students develop a qualitative understanding of the characteristics and patterns of seasons and highlight the relationship of seasons to physical, biological and cultural markers.

Overview

Students observe and record seasonal changes in their local study site. They establish that these phenomena follow annual cycles and conclude the activity by creating displays that illustrate the repeating pattern associated with the appearance and disappearance of seasonal markers.

Student Outcomes

Students will be able to,

- recognize aspects of seasonal change;
- explore relationships among seasonal changes;
- relate local seasonal changes to conventional equinox and solstice dates; and
- create a profile of local seasonal variation.

Science Concepts

Earth and Space Sciences

Weather changes from day to day and over the seasons.

Seasons result from variations in solar insolation resulting from the tilt of the Earth's rotation axis.

The sun is the major source of energy at Earth's surface.

Solar insolation drives atmospheric and ocean circulation.

Physical Sciences

Sun is a major source of energy for changes on the Earth's surface.

Life Sciences

Organisms' functions relate to their environment.

Organisms change the environment in which they live.

Plants and animals have life cycles.

All organisms must be able to obtain and use resources while living in a constantly changing environment.

Sunlight is the major source of energy for ecosystems.

Energy for life derives mainly from the sun.

Living systems require a continuous input of energy to maintain their chemical and physical organizations.

Scientific Inquiry Abilities

Observing seasonal changes

Recording observations in GLOBE Science Logs

Organizing observations in tables and graphs

Representing information with pictures, numbers, and photographs

Use appropriate tools and techniques.

Develop explanations and predictions using evidence.

Use appropriate mathematics to analyze data.

Communicate results and explanations.

Time

On-going

One class period per month to visit the GLOBE study site; one or two additional class periods per month to record, graph, and discuss observations

Note: There is some advantage in designing a schedule for Study Site visits which corresponds to the data collection visits used in the protocols.

Level

All

Adapting the Activity to Different Levels:

Beginning: as described here

Intermediate: Discuss the strengths and weaknesses of qualitative data.

Advanced: Require more detailed observations of seasonal transitions. Also, discuss whether it is a coincidence that many cultural celebrations correlate with the solstices and equinoxes.

Materials and Tools

Large sheets of paper
Colored markers
Glue
GLOBE Science Logs

Preparation

Select and examine GLOBE Study Site.

Prerequisites

None

Background

The purpose of this activity is to engage your students in careful observations of the seasonal changes that occur in their GLOBE study site. Because we want them to be active participants in planning what they will observe, we ask them to predict which things they think will change in the study site. We then ask them to make careful observations and to compare these with their predictions. When they have collected observations over an extended period of time we ask them to identify trends in the phenomena and to predict "what will happen next" and why. In Step 6 we ask them to think about how the changes they observe are interrelated and in Step 7 to relate the observations to the conventional astronomical markers of seasons (solstices and equinoxes). The activity concludes by asking students to create a profile of each local season using their own observations and, if they wish, to share this with GLOBE school they are collaborating with.

We envision this as an activity that continues throughout the school year, with students adding observations on a periodic basis. As the teacher, you will need to decide how often students will visit the study site to make observations. If your site is readily accessible, you may be able to visit as often as once a week, especially during times of the year when many things are changing. But if this is not feasible, try to visit the site monthly. These visits can be supplemented by asking students to make observations near the school, looking out the window, at home, and as they travel to and from the school. If you keep separate records of changes observed at different local sites, you can discuss how the different sites compare.

Understanding what causes seasons is not the primary goal of this activity. Rather, it should be viewed as an introductory activity that focuses students on making careful observations, recording their observations in a systematic way, and noticing the annual cycles that their observations reveal. Remember that GLOBE is an international program and that seasonal changes are quite different in different parts of the world where GLOBE schools are located. This is a wonderful asset of The GLOBE Program! We suggest that you contact a GLOBE school in another part of the world and share information with them on your seasonal observations. This could then launch further collaborations.

Procedure

1. **Ask students to think about the seasons that occur in their GLOBE study site.**
   How would they characterize the local seasons? How many seasons are there? What are they called? When do they begin and end? Compose a description of local seasons that the class can agree on.
2. **Brainstorm about change.**
   Ask students to think about things that are likely to change in their GLOBE study site during the course of the year as the seasons change. Organize them in small groups and ask each group to make a list of all the changes they think might take place. One way to do this is to think about how the study site will change during each month of the year. Guide them to think about changes such as:

- changes in plant life and vegetation, e.g. blossoming of trees and flowers, leaves dropping, grass turning brown, the appearance of certain fruits
- changes in animal behavior, e.g. birth of babies, hibernation, migration
- changes in personal behavior and societal behavior
- changes in the physical environment, e.g. getting warmer or colder, rainier or drier, freezing or thawing of bodies of water.

Have a whole-class discussion of all the changes that the small groups have recorded. Create a composite list for the entire class of changes that you think will occur in the study site during the course of a year.

3. **Record actual observations.**
   The point now is to begin to observe systematically the kinds of changes that students listed in the preceding step. Help students develop an organized system of recording changes that they observe in the study site. If they have GLOBE Science Logs, they can record their observations there. But, in addition, they should record the observations in a form that can be displayed and viewed by the entire class for purposes of discussion. Particularly with younger students, the format should be large and easy to understand. One possibility is to use large sheets of chart paper, one paper per observation period. All the observations made during a given week or month can be recorded on a single large sheet of paper. The paper can then be hung in the classroom, attached to a bulletin board, or displayed in the hallway. As the students make other visits to the study site they can record their observations on separate sheets and add them to the display. The sheets can include sketches, leaves, blossoms, or buds collected (fastened on with glue), photographs the students took, numerical data they might have gathered, and "impressions" they might have recorded in prose or poetry.

4. **Review the changes that have been observed in the study site.**
   Once the students have made some observations and recorded them, it will be valuable to review them in light of the lists produced in Step 2. Compare the actual observations with the expectations. As you accumulate data over time, discuss how the study site changes from one visit to another. What were the changes in vegetation, the water, the animals that live there, the moisture, the temperature, etc. Refer to the observations made during the previous visit to form comparisons. If the observations have been recorded on large sheets of paper, then it will be easy to refer to them during the discussion. Ask students to talk about what has changed and what has not changed. As a concluding activity, summarize the changes that have been observed. For younger students, the teacher can write down summaries of what the students say; older students might write a summary in their GLOBE Science Logs.

5. **Predict and explain.**
   Ask students to predict, based on what they saw on this visit and the last, what changes they expect in the study site on the next visit. Ask them to think about what is happening in the study site, what is happening with the season. What trends do they see developing? Do they think the temperature will be colder or warmer next time? Will the site be wetter or drier? Will the vegetation be more leafed out or less? Whatever observations they are tracking, ask them to predict what they think the next period's observation will bring. Ask them to explain why they expect the changes they predict. (This will also give you an insight into their reasoning process.) What do they think might be causing the changes they predict? Record these predictions on a large sheet of paper and keep it for comparison with the actual observations next time. You may also want students to record one or more predictions in their GLOBE Science Logs.

6. **Explore relationships among changes.**
   The changes that students are observing in their study site are not occurring in isolation. They are interrelated parts of seasonal change. Ask students to think about and discuss the possible relationships among the phenomena or parameters that are changing. Ask them to

discuss, for example, how changes in air temperature are related to changes in animal behavior; how changes in moisture in the ground are related to changes in plants that are growing in the ground. Look for as many relationships as possible. Ask students to explain why they think these phenomena are related to each other. As a class, write down why you think these things are related. Also ask students to write about these relationships in their GLOBE Science Logs.

7. Relate the observations to the conventional seasons.

The summer and winter solstices and the vernal and autumnal equinoxes define the conventional seasons. Explain to students that these are special days in the annual calendar, and that they are marked as the longest and shortest days and the days that have equal amounts of daylight and darkness. Ask students to think about the condition of their study site in relation to these divisions of the year. What changes do they observe that might coincide with these astronomical markers? Using the data they collect, ask students to see where they think each season actually "should" begin and end. Ask them to think about whether there are any easily defined, sharp markers of the beginning and end of each season.

8. Create a profile of your seasons.

As a culminating activity, ask students, perhaps working in small groups, to create a profile of each local season based on the observations they have made. (This activity may have to wait until you have collected sufficient data.) Ask the students to characterize not only the "height" of a season but also the transition points between seasons. Ask them to think about how the observed phenomena mark the beginning, the height, and the end of each season. Consider whether the seasons begin abruptly or gradually. For example, in monsoon areas, the onset of the first monsoon rain is sudden, followed by a more gradual drop in temperature. Consider sharing the profiles you create with other GLOBE schools that you collaborate with or use them as a way to reach out to another school in hopes of collaborating.

Assessment

- Ask students to select one aspect of the study site that they have studied, such as trees, and to describe how trees change in the study site over the course of a year. The description could be pictorial, graphical, verbal, or kinesthetic.
- Give students observations of one aspect of the study site (such as the air temperature) from two or three months of the year (such as November and December) and ask them to predict what the observation would be like in the month following and preceding the observed months (October and January). This asks them to be able to identify a trend and its direction.
- Give students the observations from a "mystery month" and ask them to tell what month they think it was and why. If it is too difficult to pinpoint the exact month, ask them to identify the season in which they think the observation was made.

Extensions

- If students are comfortable with graphical representation of data, they can create graphs showing certain study site conditions. Current temperature and precipitation would be particularly appropriate.
- Contact another GLOBE school and share your observations with them. Ask them to send you their observations at their study site. Look at their observations and try to predict how their site will change at the next observation. Compare your prediction with what they send you next.
- Investigate how seasons are portrayed in art, literature, and history. How, for example, were the seasons expressed in painting by the French Impressionists? How have seasons affected the outcomes of military battles, such as the siege of Leningrad? How are seasons portrayed in Shakespeare's plays and poetry? How did Thoreau describe the seasons in *Walden*? How are the seasons described in the Little House on the Prairie series of books?