Grade 6 Nature Walk: Volunteer Guide

On the first walk, students will mark out a 1x1 meter plot of land along the stream near the back playground. Each month, students will visit this plot and note conditions. Before going to the plot, they will gather as a group to note general conditions.

Walks last 30 minutes (except the first walk, which is longer due to choosing the plot).

Supplies:

Students:

- clipboard with worksheet to complete. In the classroom, they keep a folder of worksheets from previous walks so that they can refer back to them for assignments.
- pencil
- Beaufort Scale wind guide

Walk leaders:

- kit with a thermometer, Beaufort Scale wind guide, prompt sheet, and trowel.

For the entire class:

- pole with attached string (for measuring shadow angle) and attached surveyor tape (for measuring wind speed)
- meter stick
- protractor
- sheet for recording sun and temperature measurements (use this as a reference month by month, as students don't bring out their individual notes from previous months).

As a class at the compass

Gather the class at the compass in the back parking lot. Volunteers need to direct the kids. Ask for students to hold the pole, string, meter stick, etc. As you measure this date, students will record on their individual sheets. Ask one student, or volunteer, to record for the group.

General conditions: Prompt students with questions such as:

- Is today seasonable?
- Can you see the moon? Can you feel the sun on your face?
- What is the cloud cover (stratus, cirrus, cumulus)?
- How does this compare to last month?

Wind speed and direction: At the compass, have a student hold up the pole up over their head. The pole has surveyor tape on top.

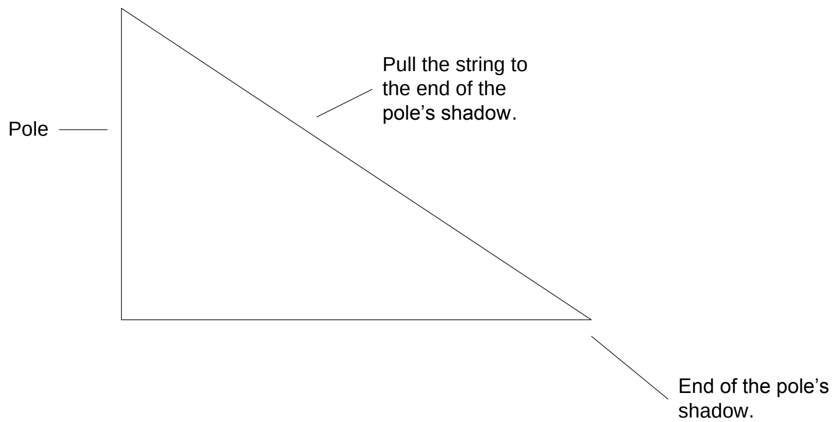
- What way is the tape blowing? Use the compass for direction. If the tape is blowing North, the wind is coming from the South.
- Is the wind variable or steady? Use the wind guide to estimate the wind speed.

Shadow length: To measure the shadow:

1. Set the pole in the middle of the compass. Note the shadow that the pole makes. You may need to ask students to move out of the way of the shadow.
2. Use the meter stick to measure the length of the shadow.
3. Have a student record this for the class on the group sheet.

4. Have a student call out the recording from last month. How does it compare to this month? (It will be longer than last month if you approaching Dec 21; it will be shorter than last month if you are past Dec 21.)

Angle measurement: We are measuring the angle that the sun appears in the sky due to the tilting of the earth on its axis.



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1. Have a student pull out the string (at the top of the pole) to the end of the pole's shadow. You will be forming a right triangle with the pole, the shadow, and the string.
2. Use the protractor to measure the angle where the string hits the pavement. Put the middle point of the protractor at the point where the shadow ends. Line up the string against the protractor. This is the angle measurement. Students record this on their sheets.
3. Have a student record the angle for the class.
4. Have a student call out the recording from last month. How does it compare to this month? (It will be smaller than last month if you approaching Dec 21; it will be larger than last month if you are past Dec 21.)

*****See the end of this guide for more info about shadow and angle.***

At their plots in small groups

Temperature: After you finish at the compass, class will break into groups and move to their plots. On their way, they can record the air temp at the thermometer at the edge of parking lot. This is always in the sun. There is another thermometer, usually in the shade, as they enter the plot area. This second reading is optional if it is not on the way to the plot.

Here the students will work through their worksheets. Their plot is not just the ground, but the entire 1x1 meter area extending upward.

Remind them that they may be using this data for homework, essays, or other assignments so take plenty of notes. They can sketch if they like.

Get started by taking the ground and water temperatures. While the thermometers are recording, you can continue on with observations. (Ground is usually colder than water in winter because the water is moving and stays warmer. In fall and spring, ground can be warmer than the water because it conducts heat and retains it. For example, a suddenly cold day will not affect the ground as much as it will affect the water.)

Prompt the students with such questions as:

Non-Living:

- Dirt: Dig with a trowel. Any signs of insects? Is the ground frozen? Thawing? Is the dirt moist or dry? Can you smell it? (decaying leaves)
- Water: What are the conditions of the water? (frozen, dry, overflowing, bubbling) Can you hear it running?
- Sun: Can you feel it? Does it reach your plot? Are some areas sunny and others not?
- Air: Is it moving? Cold?

Plants:

- What colors do you see on the ground? In the trees?
- Look up at the tree cover. Are the leaves moving? Have they fallen? Are new buds blooming? Is sun coming through?
- What plants are in your plot?
- How many different types of leaves do you see?
- Can you smell decaying leaves, spring blossoms?

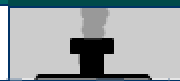
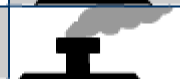
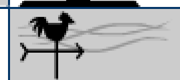
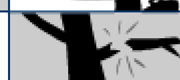
Animals:

- Any evidence of animal life? Look for burrows, tracks in snow, nibbled leaves, ant hills, spider webs.
- Is there shelter for an animal in your site?
- Is there food to attract an animal in your site?
- Can you hear any animals?

Comparisons/Predictions

- How do these conditions compare to last month? What do you predict for next month?
- Why are there these changes between months?
- Are today's conditions seasonal?

Beaufort Scale

Beaufort number	Wind Speed (mph)	Seaman's term		Effects on Land
0	Under 1	Calm		Calm; smoke rises vertically.
1	1-3	Light Air		Smoke drift indicates wind direction; vanes do not move.
2	4-7	Light Breeze		Wind felt on face; leaves rustle; vanes begin to move.
3	8-12	Gentle Breeze		Leaves, small twigs in constant motion; light flags extended.
4	13-18	Moderate Breeze		Dust, leaves and loose paper raised up; small branches move.
5	19-24	Fresh Breeze		Small trees begin to sway.
6	25-31	Strong Breeze		Large branches of trees in motion; whistling heard in wires.
7	32-38	Moderate Gale		Whole trees in motion; resistance felt in walking against the wind.
8	39-46	Fresh Gale		Twigs and small branches broken off trees.
9	47-54	Strong Gale		Slight structural damage occurs; slate blown from roofs.
10	55-63	Whole Gale		Seldom experienced on land; trees broken; structural damage occurs.
11	64-72	Storm		Very rarely experienced on land; usually with widespread damage.
12	73 or higher	Hurricane Force		Violence and destruction.

Name: ______________________________

Nature Journal Notes/Organizer

Paragraph # 1: Introduction

Date: ______________________

Time: ______________________

Weather:

- wind (speed and direction): ______________________________
- air temperature: ______________________
- clouds: ______________________________
- other (your feelings): ______________________________________

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Sun's shadow: ________________ Angle of sun: ______________

Ground temperature: ____________

Water temperature: ____________

Paragraph # 2: Living Things (Identify and thoroughly describe in detail.)

Paragraph # 3: Non-living Things (Identify and thoroughly describe in detail.)

Paragraph # 4: Compare and Contrast (Changes between this walk and last walk and possible explanations for why these changes may have occurred.)

Paragraph # 5: Conclusions (Wrap up your feelings, future hopes/predictions for upcoming walks, etc.)

Sketches: (At least 2)

GRADE SIX NATURE WALKS

Grade Six Nature Walks are scheduled monthly from mid fall to June, last 30 to 45 minutes, and are based on:

1. Careful seasonal observations of a small ecosystem in the schoolyard

2. Independent recording in a Science Journal of their ecosystem as it changes over time

3. Making and recording measurements in metric and centigrade

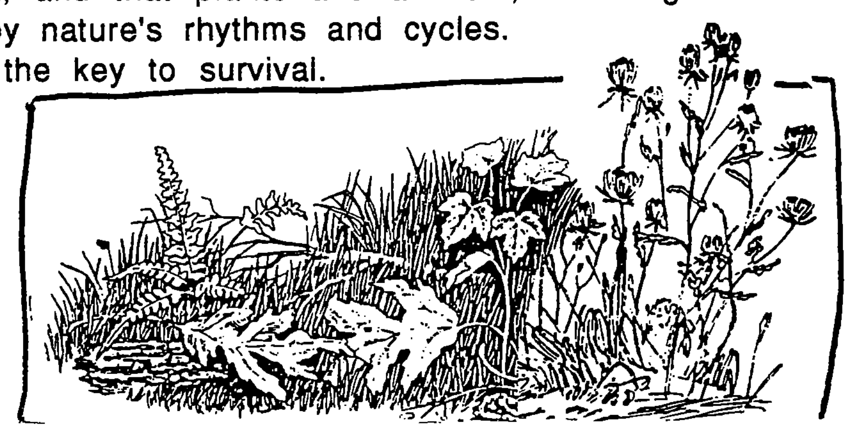
4. Demonstrating understanding of concepts including: producer, consumer, decomposer, food/energy cycle, and ecosystem.

5. Realizing the interdependence of everything in an ecosystem, including non-living, weather, plants and animals.

This Unit grows specifically out of the Grade Five Forest Ecosystem Nature Walk in the Acton Arboretum, but also provides students the opportunity to demonstrate science skills and information gained during their seven years at Conant.

The Unit also interfaces with several facets of the Grade Six curriculum. As part of their study of Archeology, students have learned how to map a specific area of their schoolyard using graph paper to make a grid. Students will locate their individual ecosystem in the same area of the schoolyard used for Archeology and similarly map its location. Students will take measurements in metric and centigrade.

Hopefully children will realize that ecosystems are dynamic and continually changing, that everything is connected and interdependent, and that plants and animals, including themselves, are affected by nature's rhythms and cycles.
Adaptation is the key to survival.



Background on shadow and angle

For the first few sessions, you may need to review some basic concepts about how the shadow changes during the seasons.

Shadow length and time of day

It might be clearer to students to first think about how a shadow changes during a day (the earth's rotation around its axis).

- The shadow changes according to the time of day that you measure a shadow. On any day, when is your shadow the shortest (noon)? Where is the sun in the sky at this time? (it is at the highest point it will reach this day).
- When is a shadow longest during a day? (early morning or late afternoon) Where is the sun at this point? (lower in the sky).
- What time is it now? It is shortly before noon, so the sun is almost at its highest point for today.
- What is the length of the shadow? How will this change at 3:00 pm today? 5:00 pm today? (it will be longer because the sun will be lower in the sky.)
- Since we are going out the same time each day, we do not need to worry about how the time of day affects the shadow. Our data will reflect only the seasonal change
- (Daylight savings – for the sessions after these changes, keep the time change in mind.)

Shadow length and seasonal change

Now think about how a shadow changes during seasons (the earth's orbit around the sun)

- What is the longest day of the year? (June 21) What can you tell me about the sun on this day? This is the day that we have the most sunlight.
- Why? Because the sun sets and rises at its further points north. On this day, the sun gets to its highest point in the sky because it has the longest path to cross the sky. Perhaps you've noticed that in the summer the sun reaches parts of your yard that it does not reach in winter.
- When the sun is high in the sky, the shadow is short (think of the noontime shadow above).
- What is the shortest day of the year? (Dec 21) The sun will be at its lowest height on this day – it has the shortest path to travel. How will this affect the shadow? It will be longer.
- For next month, will the days be longer or shorter than today? At this time next month, will the sun be higher or lower than it is today? If the sun is higher (days are longer), the shadow will be shorter. If the days are shorter, sun is lower, shadow will be longer.

Angle measurement change during seasons

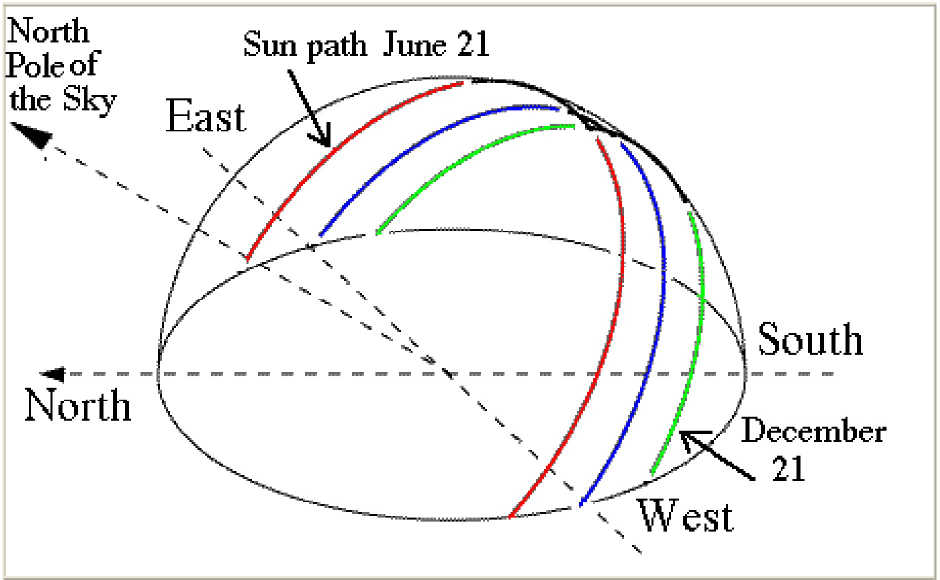
- We are measuring the angle the sun appears in the sky due to the tilting of the earth on its axis.
- In winter, the rays hit at a shallow angle, and we receive less warmth. The angle that we measure will be lower.
- As winter leads to spring, the rays hit at a larger angle and we receive more warmth. The angle that we measure will be higher.

Here is more information. (Copied from http://www-istp.gsfc.nasa.gov/stargaze/Sunangle.htm)

In the US and in other mid-latitude countries north of the equator (e.g those of Europe), the sun's daily trip (as it appears to us) is an arc across the southern sky. (Of course, it's really the Earth that does the moving.) The **sun's greatest height** above the horizon occurs at noon, and how high the sun then gets depends on the season of the year--it is highest in mid-summer, lowest in mid-winter.

As fall advances towards winter, the location of sunrise moves south, as does the location of sunset. The steepness of the curve traced by the Sun does not change, nor does the rate ("speed") with which the Sun appears to move along it, but the **length** of the curve changes, it becomes shorter. Around December 21 --the "**winter solstice**" halfway between the equinox dates (typically, September 23 and March 21) sunrise and sunset are as far south as they can go (at any one location). As a result, the Sun has its shortest path for the year, the day is at its shortest and night is at its longest. Other days of that season are short, too, which is one reason for the colder weather in winter.

The same also holds for the Earth. The rays of the summer sun, high in the sky, arrive at a steep angle and heat the land much more than those of the winter sun, which hit at a shallow angle. Although the length of the day is an important factor in explaining why summers are hot and winter cold, the angle of sunlight is probably more important. In the arctic summer, even though the sun shines 24 hours a day, it produces only moderate warmth, because it skims around the horizon and its light arrives at a low angle.



The apparent path of the Sun across the sky.

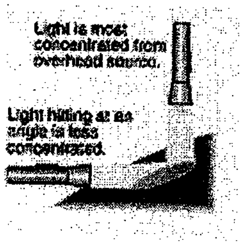
Reasons for the Seasons

by Jon Kahl
(figures from Jack William's *The USA Today Weather Book*)

Are the seasons caused by the distance between the sun and the earth? Is winter colder because during that season the earth is farther away from the sun?

The amount of sunlight the earth receives is called *insolation*: *in*coming *sola*r radia*tion*

Two factors cause insolation to change.

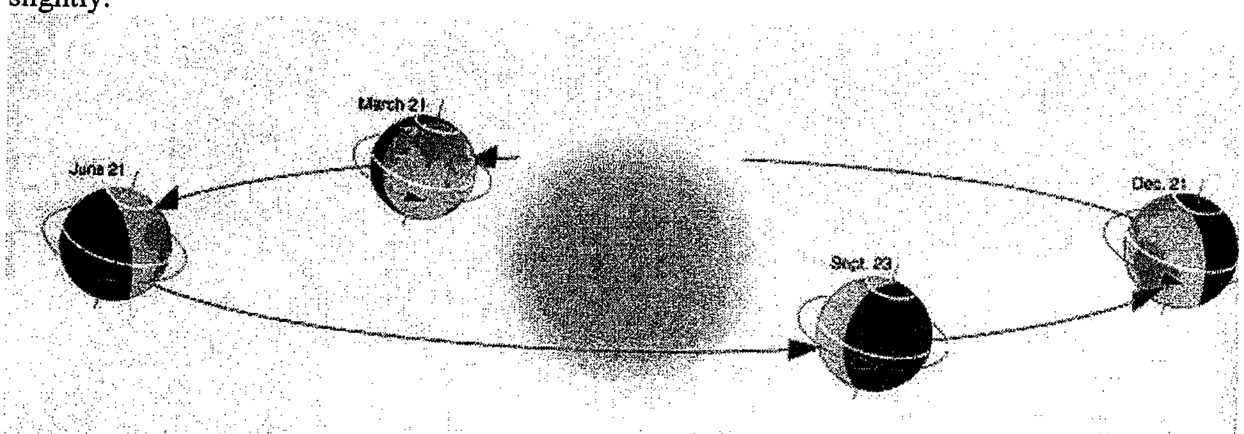


- *Length of day* (because more hours of daylight mean more insolation)
- *The angle that sunlight strikes the earth's surface*

The diagram to the left shows that when the sun shines directly overhead, the sunlight is concentrated in a small area. When the sun is lower in the sky, the sunlight is not as intense because it gets spread out over a larger area.

Why are summer days longer and winter days shorter?

As the earth revolves around the sun, it's axis (a line connecting the North and South poles) is tilted slightly.



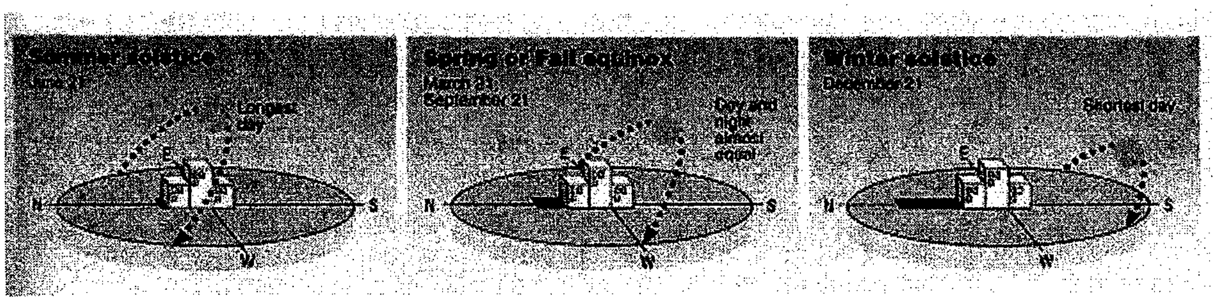
On June 21, the summer solstice, the top of the axis (the North Pole) is pointed directly toward the sun. Areas north of the equator experience longer days and shorter nights.

On December 21, the winter solstice, the top of earth's axis is pointed directly away from the sun. Areas north of the equator experience shorter days and longer nights.

Halfway in between the summer and winter solstices are the equinoxes. At these times the earth's axis is pointing neither toward nor away from the sun. On both equinoxes, all locations on earth receive exactly 12 hours of daylight and 12 hours of night.

What changes the angle at which sunlight strikes the earth?

As the sun rises in the east and sets in the west, it follows a path that changes with the seasons.



During winter the sun's highest point in the sky is quite low. During the summer the sun gets much higher and provides more direct, concentrated heating.

Questions

1. As the earth revolves around the sun, it's actually about 5 million miles closer in January than it is in July. Despite being closer, Wisconsin weather is much colder in January than in July. Why?
2. Why are noontime shadows longer in winter than in summer?

Comments? Send email to Prof. Jon Kahl | Go back to the CoVis page

exploration

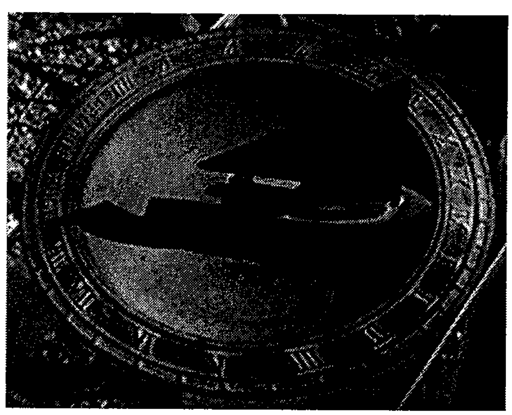
Liftoff Home

Sundials

The earliest and simplest form of sundial is the shadow stick. The time of day is judged by the length and position of the stick's shadow. Some nomadic peoples still use this method for timekeeping. The technical name for a shadow stick is a *gnomon*. As the sun moves through the sky from sunrise to sunset, the shadow of the gnomon rotates "clockwise." The shadow is shortest when the sun is directly in the south, defining local noon.

As early as 3500 B.C. the Egyptians began building slender, tapering, four-sided obelisks which served as timepieces. The moving shadow of the obelisk formed a type of sundial, and markers arranged about the base separated the day into divisions as well as indicating the longest and shortest days of the year.

However, because of the earth's tilt, the sun's path through the sky changes slightly from day to day, so the shadow cast by the gnomon is not the same every day. Many sundials overcome this problem by angling the gnomon and aiming it north. This type of gnomon is called a *style*. Because its alignment compensates for the Earth's tilt, the hour marks remain the same all year round.



In the quest for accuracy, many types of sundials evolved, including some very complex portable sundials. In about 30 B.C. Marcus Vitruvius, a Roman architect, described 13 different sundial designs used in Greece, Asia Minor, and Itay. The invention of more accurate mechanical clocks and the standardization of time using time zones made sundials obsolete. Now sundials are used mostly for ornamental purposes.

Next: How a Sundial Works

Updated August 24, 1998. Contacts

Read More At:
The North American Sundial Society

Sundials on the Internet by The British Sundial Society

Sundial Mottoes by The British Sundial Society

Glossary:
gnomon
style
obelisk

Egyptian Obelisk

Marcus Vitruvius
A 1st century B.C. Roman architect who authored a famous 10-volume treatise named "De Architectura". The books dealt with city planning and architecture; temple constuction; public and private buildings; clocks; hydraulics and civil and military devices.

De Architectura was a classic text book from Roman times to the Renaissance.