

Observing Nature Throughout the Seasons:
A High School Biology Curriculum Unit

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Observing Throughout the Seasons

Introduction

Henry David Thoreau spent much of his time walking around his home town of Concord, Massachusetts. He went out everyday observing nature and discovering changes that occurred in local flora and fauna throughout the seasons. The goal of this curriculum unit is to get students out of doors to observe the same tract of wild-lands close to their school throughout the year. This project can be conducted in any environment; rural, urban, or suburban, all that is required is a place the students can walk to where they can observe change over time. This is a long term intra-disciplinary unit designed to last the majority of the school year. Students will have an opportunity throughout this unit to do math, journal writing, historic research, and technological skills. The tract of land which students will observe will also be the basis for other field studies, which are currently part of the Biology curriculum: the chemistry of water and the water cycle, photosynthesis and cell respiration, plant and animal classification, plant structure and growth, plant nutrition, plant reproduction and development, invertebrates, biodiversity, ecology, ecosystems and food webs. This unit is designed for a high school college-prep class, however could easily be adapted for younger students or and for an Environmental Science class.

This unit is made up of six lesson plans. The first five are to prepare students for going into the field and collecting data. The sixth lesson consists of taking students out into field to collect data. This is a project which I would do with all of my Biology classes. Trips to the field site will rotate on a weekly basis between each class. Therefore, although data will be collected on a weekly basis each class will go out only once a month. This method allows for maximum data collection and exposure to the field site for students. The day after each field excursion will be spent looking at data and inputting it into classroom computer. Time will be allowed for students to ask questions and share reflections. Students will begin to analyze data in the middle of May. Once data has been analyzed students will be asked to reflect on their findings and the future of their study site. Students will be required to put together a poster presentation and a short video or slide presentation. Students will have an in-school field trip in mid-June to present data. All classes that worked on collecting data will participate in some aspect of the presentation. School administration and town officials will be invited to presentation.

The following strands in the Massachusetts State Frameworks will be targeted throughout the year while studying our field site:

1. The Chemistry of Life
2. Structure and Function of Cells
 - 2.9 Explain the interrelated nature of photosynthesis and cellular respiration.
5. Evolution and Biodiversity
 - 5.3 Describe how the taxonomic system classifies living things into domains.
6. Ecology
 - 6.1 Explain how biotic and abiotic factors cycle in an ecosystem
 - 6.2 Use a food web to identify and distinguish producers, consumers, and decomposers, and explain the transfer of energy through trophic levels.
 - 6.3 Analyze changes in an ecosystem resulting from natural causes, changes in climate, human activity, or introduction of non-native species.

Before beginning this unit support will be solicited from school administration and a letter will be sent home to parents informing them of our unit and seeking volunteers to participate in field excursions. Fellow teachers will also be informed of project and they will be encouraged to incorporate any aspect of this unit that is possible into their classes.

Lesson 1

Setting up Journal

Lesson 2

Maps

Lesson 3

Math: how to pace, calculate pace of each student practice pacing

Lesson 4

Field Safety

Lesson 5

Field Equipment and Data Sheets

Lesson 6

Going into the Field, Map Making, Data Collecting, and Observations of study plot

Resources

1. Leslie, Clare Walker. Nature All Year Long. Greenwillow Books, NY. 1991.
2. Leslie, Clare Walker & Charles E. Roth. Nature Journaling. Storey Books Pownal, Vermont. 1998.
3. Thoreau, Henry David. Wild Fruits. W. W. Norton and Company, NY. 2000.
4. <http://www.mesillavalleymaze.com/bs/surveying.htm>
5. <http://greenmap.org/home/home.html>
6. <http://www.nrm.qld.gov.au/education/modules/primary/primarybiodiversity/resourcesheets/resourcesheet11.html>
7. <http://www.nrm.qld.gov.au/education/modules/primary/primarybiodiversity/resourcesheets/resourcesheet12.html>
8. <http://www.rootsandshoots.org/pdfs/Nature-Journaling-Scavenger-Hunt-Activity.pdf>
9. <http://www.mass.gov/dph/cdc/factsheets/fslyme.pdf>
10. <http://www.mass.gov/dfwele/dfw/nhosp/nhosp.htm>
11. [http://ww2010.atmos.uiuc.edu/\(Gh\)/guides/mtr/cld/cldtyp/home.rxml](http://ww2010.atmos.uiuc.edu/(Gh)/guides/mtr/cld/cldtyp/home.rxml)
12. <http://mac.usgs.gov/isb/pubs/booklets/symbols/>
13. http://www.mass.gov/agr/pesticides/pestfacts/ticks_leavedfa_cornell_deer.htm
14. <http://www.entomology.cornell.edu/MedEnt/TickBioFS/TickBioFS.html#N101B5>
15. http://www.fda.gov/fdac/features/796_ivy.html
16. <http://mdc.mo.gov/nathis/plantpage/flora/poivy/>

*****SAMPLE LETTER*****

Dear Parents / Guardians,

In Biology class this year we will be using public land adjacent to the school grounds to conduct an on going research project. Your child will be notified in advance as to when we will be going outside. It is important that your child be dressed appropriately for these occasions. Students should wear comfortable sturdy shoes and clothing suitable for being outside in New England. As temperature and weather conditions can vary greatly in a single day layers are always a good idea.

Any parent who wishes to help facilitate these out-of-door lessons your presence would be greatly appreciated. If you think this is something that you might enjoy and you have the time, please let me know. WE are also seeking to have some child friendly insect repellent donated to the classroom. Any contribution would be appreciated.

Sincerely,

Lesson 1 Journaling

Objectives: Students to begin journaling in nature. Students will develop better observation skills. Students will gain an appreciation for nature, silence and reflection time. Students will gain an understanding of the differences between creative and technical writing. Students will gain self-confidence and the ability to express themselves.

Introduction: Throughout the year students will go out into the field on a monthly basis. Each student will have their own journal to record observations and write reflections. The sole purpose of this initial outing will be strictly for journaling. However, future trips will combine journaling and the collection of scientific data. Students will work in teams to collect data and will have data sheets to record information.

Materials: journals, pencils, colored pencils, journaling handout, *Nature Journaling* by Clare Walker Leslie and Charles Roth, and examples of nature journals

Procedure

- Before taking students out into the field go over journaling handout with them.
- Show them examples of nature journals.
- Show students *Nature Journaling* by Clare Walker Leslie and Charles Roth.
- Remind students that they will have an opportunity while in the field to discuss discoveries with classmates and that there should be no talking during our 10 minute reflection time.
- Tell students that they will be asked to share one aspect of their observations/reflection time during class discussion when class returns to classroom.
- Take students to study site. **If you can get students to walk out to site single file and quietly they have an easier time getting into their journaling assignment.
- Have students go to their study plot.
- Give students 10 minutes of for reflection and journal writing.
- Give students an opportunity to show class points of interest.
- Give students an opportunity to do any leaf or bark rubbings.
- Go back to classroom each student can share their favorite observation.
- Students may want to staple or tape the Journaling handout into their own journal.

Assessment: Student's participation in class discussion. Journals will be periodically checked throughout the year, however they are the students.

Homework: Read *The Fall*, pp. 223 + 224 and *Winter Fruits* pp. 233 – 239 from *Wild Fruits* by Henry David Thoreau and write a reflection about the readings in your journal.

Journaling:

- Journaling can be for anyone anywhere.
- When out in the field be as quiet and as still as possible, really try to listen and allow classmates the opportunity to listen as well. Journaling helps you focus and can improve your observation skills. Below are some questions to help you.
- Record what you see.
- You may use words and or drawings to record observations.
- You may write in sentences, write a poem or simply make list
- This is not an English class or an Art class.
- What season is it?
- What time of day is it?
- What questions do you have about what you see? Hear? Smell?
- Draw the silhouette of a tree.
- Look at the branching pattern of a tree or shrub.
- Look at a leaf, its shape, and the pattern of its veins.
- Does the leaf have any holes in it? Does it look like an insect has been eating it?
- Do you see any flowers? Fruits? Seeds? What color are they? What shape are they? Where on the plant are they located? What size are they? How many do you see?
- Has it rained recently? Is the ground wet or very dry?
- What do you smell?
- What do you hear?
- What is the temperature? How does this effect plants and animals?
- Is the water frozen? Have we had a recent frost?
- Is the Brook level high or low?
- Can you see any buds on trees?
- Have leaves begun to change color? Fall to the ground? Emerge?
- Is there snow on the ground?
- Do you see any insects flying around?
- Can you hear any birds?
- Do you see any animal tracks?
- Do you see evidence of people?
- Do you see anything that you have never seen before?

Lesson 2 Maps

Introduction: Not all students are familiar with maps, especially topographical and habitat maps. As mapping skills will vary, time needs to be spent going over map prior to going outside and working on their own map. Students need to become familiar with maps and their symbols.

Objective: Students will examine a topographical map and familiarize themselves with the symbols. Students will examine various habitat and vegetation maps. Class will decided consistencies all maps should have, including the ones they will make.

Materials: pencils, colored pencils, highlighters, clear plastic rulers, topographical map, photocopies of topographical map (preferably a map of the area near school), map's worksheet, and journals, and handout of USGS symbols.

Procedure:

- Show students topographical map give them a photocopy.
- Discuss contour lines, latitude and longitude
- Pass out mapping handout and have students work on mapping exercise.
- After students complete mapping exercise have a class discussion on the maps they will create. Brainstorm characteristics all maps should include, symbols to be used and rubrics in which maps should be graded.
- Students should record the results of this brainstorming exercise into their journals.

Assessment: Students should pass in their maps and the mapping handout.

Name:

Date:

Class:

Mapping

1. Find the legend on the map and shade the legend in pink.
2. Find compass on map indicating where North is. Write with red pencil on the perimeter of your map the location of the four cardinal points, N, S, E, & W.
3. Find Township High School and highlight it yellow.
4. What color is used to indicate water?
5. What color is used to represent vegetation?
6. What is the distance in kilometers from Township High School and Eight Corners?
7. What symbol is used for marsh lands?
8. What symbol is used for railroads?
9. Using a brown colored pencil outline the railroad.
10. How much elevation is between contour lines?
11. What is the elevation of Scottow Hill?
12. What is the latitude of Township High School?
13. What is the longitude of Township High School?
14. What symbol is used for houses?
15. Are watershed boundaries indicated on map?
16. Are soil types indicated on map?
17. What symbol is used for highways?
18. What symbol is used for dirt roads?
19. Find Mill Brook and color it blue.
20. How many centimeters on this map are equal to one kilometer?

Mapping: Handout 1

SUBMERGED AREAS AND BOGS

Marsh or swamp	
Submerged marsh or swamp	
Wooded marsh or swamp	
Submerged wooded marsh or swamp	
Land subject to inundation	

Max Pool 4.3!

BUILDINGS AND RELATED FEATURES

Building	
School; house of worship	
Athletic field	
Built-up area	
Forest headquarters*	
Ranger district office*	
Guard station or work center*	
Racetrack or raceway	
Airport, paved landing strip, runway, taxiway, or apron	
Unpaved landing strip	
Well (other than water), windmill or wind generator	
Tanks	
Covered reservoir	
Gaging station	
Located or landmark object (feature as labeled)	
Boat ramp or boat access*	
Roadside park or rest area	
Picnic area	
Campground	
Winter recreation area*	
Cemetery	

BOUNDARIES

National	
State or territorial	
County or equivalent	
Civil township or equivalent	
Incorporated city or equivalent	
Federally administered park, reservation, or monument (external)	
Federally administered park, reservation, or monument (internal)	
State forest, park, reservation, or monument and large county park	
Forest Service administrative area*	
Forest Service ranger district*	
National Forest System land status, Forest Service lands*	
National Forest System land status, non-Forest Service lands*	
Small park (county or city)	

COASTAL FEATURES

Foreshore flat	
Coral or rock reef	
Rock, bare or awash; dangerous to navigation	
Group of rocks, bare or awash	
Exposed wreck	
Depth curve; sounding	
Breakwater, pier, jetty, or wharf	
Seawall	
Oil or gas well; platform	



<http://mac.usgs.gov/isb/pubs/booklets/symbols/>

Mapping: Handout 2

CONTOURS	
Topographic	
Index	
Approximate or indefinite	
Intermediate	
Approximate or indefinite	
Supplementary	
Depression	
Cut	
Fill	
Continental divide	
Bathymetric	
Index***	
Intermediate***	
Index primary***	
Primary***	
Supplementary***	

RIVERS, LAKES, AND CANALS	
Perennial stream	
Perennial river	
Intermittent stream	
Intermittent river	
Disappearing stream	
Falls, small	
Falls, large	
Rapids, small	
Rapids, large	
Masonry dam	
Dam with lock	
Dam carrying road	

VEGETATION	
Woodland	
Shrubland	
Orchard	
Vineyard	
Mangrove	

ROADS AND RELATED FEATURES	
Please note: Roads on Provisional-edition maps are not classified as primary, secondary, or light duty. These roads are all classified as improved roads and are symbolized the same as light duty roads.	
Primary highway	
Secondary highway	
Light duty road	
Light duty road, paved*	
Light duty road, gravel*	
Light duty road, dirt*	
Light duty road, unspecified*	
Unimproved road	
Unimproved road*	
4WD road	
4WD road*	
Trail	
Highway or road with median strip	
Highway or road under construction	
Highway or road underpass; overpass	
Highway or road bridge; drawbridge	
Highway or road tunnel	
Road block, berm, or barrier*	
Gate on road*	
Trailhead*	

SURFACE FEATURES	
Levee	
Sand or mud	
Disturbed surface	
Gravel beach or glacial moraine	
Tailings pond	



<http://mac.usgs.gov/isb/pubs/booklets/symbols/>

Lesson 3: Pacing

Objective: Students will learn how to pace and how to calculate the length of their pace. Students will be given an opportunity to practice pacing throughout the school.

Materials: Metric measuring tape or meter stick, masking tape, and data sheets

Procedure: Prior to activity measure the following distances around school; classroom to water fountain, water fountain to girl's bathroom, classroom to cafeteria, and cafeteria to the front office. Using masking tape and measuring tape measure 100 meters in hallway outside of classroom. Use the measuring tape to mark the beginning and end of 100 meters.

- Teach students how to walk and count paces; two steps equal's one pace.
- Teach students how to calculate the length of one pace # of paces / 100 meters.
- *Have students do this three times and take the average.
- Have students work in teams; pacing out 100 meters, calculating the length of one pace, and practicing pacing around school.
- Students should record the length of their pace into their field notebooks.
- Students should record data on data sheet and turn data sheet in at the end of the activity.

Assessment: Students should turn in their data sheet at the end of class.

PACING

Name:

Number of paces in 100 meters:

Trial 1:

Trial 2:

Trial 3:

Average number of paces in 100 meters:

Length of 1 pace (meters):

Name:

Number of paces in 100 meters:

Trial 1:

Trial 2:

Trial 3:

Average number of paces in 100 meters:

Length of 1 pace (meters)

$$\boxed{\text{Average number of paces in 100 meters}} / \boxed{100 \text{ meters}} = \boxed{\text{Length of pace, meters}}$$

After each student in team has calculated the length of their pace in meters they need to estimate the four distances listed in the chart below. Each student needs to pace out two of the distances and then calculate the distance in meters. Data should be written into chart below.

$$\boxed{\text{Number of paces}} \times \boxed{\text{Length of pace}} = \boxed{\text{Estimated distance}}$$

	Number of Paces	Distance in meters	Student's name
Classroom to Water Fountain			
Water Fountain to Girls' Bathroom			
Classroom to the Cafeteria			
Cafeteria to the Front Office			

Lesson 4 Field Safety

Introduction:

Many things can go wrong in the field. Although it is impossible to prevent any accident from occurring teachers can improve their odds by preparing their students. Students need to learn some of the potential hazards of working in the field. Poison ivy, deer ticks, dog ticks, bees, mosquitoes, ants, weather, water, clothing, footwear, and jewelry all need to be discussed.

Objective:

Students will learn basic characteristics of poison ivy, deer ticks, and dog ticks. Students will learn how to reduce their chances of having a tick bite. Students will learn how Lyme Disease is transmitted, its characteristics and its treatment.

Materials:

Journals, colored pencils, poison ivy handouts, bagged samples of poison ivy, deer and dog tick specimens, dog and deer tick handouts, Lyme Disease handout.

Procedure:

- Teacher needs to find out from school nurse students' allergies and other conditions which might affect their health in the field.
- Teacher needs to have a discussion about group safety and expected behavior. Discussion should include information about poison ivy, deer ticks, dog ticks, bees, mosquitoes, ants, weather, water, clothing, footwear, allergies, eating wild plants, and wearing jewelry.
- Teacher should pass out handouts on ticks and poison ivy and set up stations around room for students to look at samples

TICKS

From Cornell Cooperative Extension

The Black Legged Tick or Deer Tick, *Ixodes scapularis*

The blacklegged tick is the officially accepted common name for *Ixodes scapularis*, but many people refer to them as "deer ticks". Adult females are dark brown in appearance and are less than 1/8 inch (3.12mm) long. Larvae and nymphs feed on small mammals and birds. The white-footed mouse is an important host for the immature ticks, while adults are more common on deer. All stages will bite humans, but due to their small size, attachment by larvae and nymphs often goes unnoticed.¹³



The Blacklegged Tick, *Ixodes scapularis*. From left to right: female, nymph, male.
http://www.mass.gov/agr/pesticides/pestfacts/ticks_leavedfa_cornell_deer.htm

The American Dog Tick, *Dermacentor variabilis*

American dog tick females are about 1/4 inch (6.35mm) long and are chestnut brown with a silvery-gray or creamy-white scutum. Male ticks are slightly smaller, and are chestnut brown with similar light-colored vertical markings on the dorsal surface. Larvae feed on small mammals, and nymphs feed on small-to medium-sized mammals. Adults, sometimes called wood ticks, occasionally attack humans but are more common on dogs and other medium-sized animals.¹²

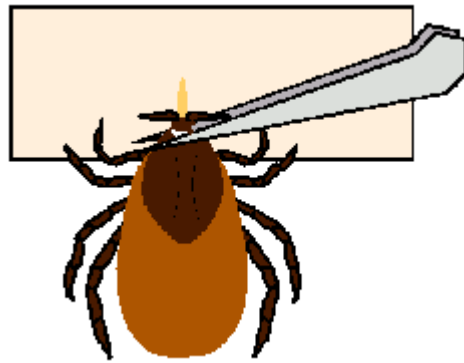


The American Dog Tick, *Deracentor variabilis*. Clockwise: nymph, larva, male, female
http://www.mass.gov/agr/pesticides/pestfacts/ticks_leavedfa_cornell_deer.htm

Guidelines on Safe Tick Removal

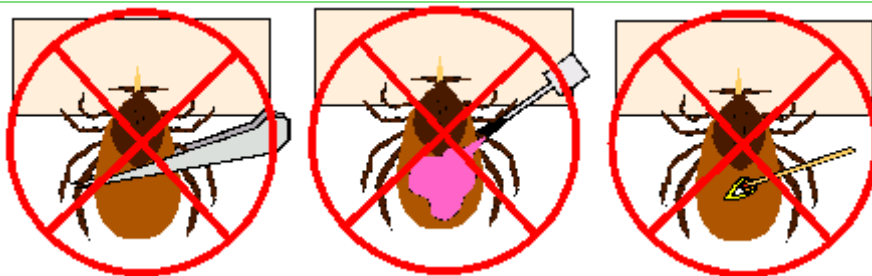
From Cornell Cooperative Extension

It is important to periodically check yourself, your children, and pets for ticks. Promptly removing a tick could reduce the likelihood of contracting certain types of tick-borne diseases such as Lyme disease. It takes time for ticks to insert their mouthparts and secrete a glue-like substance called attachment cement. The cement will harden and helps to further anchor the tick firmly in place.¹²



Proper grasp on a tick with forceps for removal.

Using thin tweezers, grasp the tick as close to the skin as possible and pull gently and slowly away from the skin. Do not twist, jerk, or pull hard on the tick or you risk leaving the mouthparts in the skin. After tick removal, disinfect the bite wound. If you find yourself scratching the bite consider covering it with a bandage to prevent a secondary bacterial infection. It is a good idea to save the tick in case it is necessary for later identification. Place the tick in a vial. Label the container with a date and note the attachment site of the tick. If you experience a rash, headaches, fever and flu-like symptoms after a recent tick bite consult your physician.¹²



NEVER use petroleum jelly, fingernail polish, a lit match, rubbing alcohol, or similar substances to remove a tick. These methods are not effective and may cause the tick to regurgitate into the bite wound.¹²

Personal Protective Measures

From Cornell Cooperative Extension

- Currently there are no protective vaccines for humans for the tick-borne diseases discussed above; consequently avoiding tick bites is the best disease-prevention strategy. You can take several to reduce your chances of being bitten by a tick.¹⁴
- Avoid known or suspected areas of tick infestation, especially during tick season.¹⁴
- Walk on cleared trails and avoid brushing up against vegetation and tall grass.¹⁴
- Wear proper clothing while in tick habitat. Clothing should be light in color to allow you to spot crawling ticks more easily. Wear closed-toed shoes, socks, long pants, and a long-sleeved shirt. Tuck pant legs into the socks and the shirt into the pants in order to slow crawling ticks.¹⁴
- Apply a tick repellent to exposed skin, around the tops of socks and waistband according to **product label directions**. Be sure that you understand the directions on the label. Some products can only be applied to clothing while others are applied to the skin. The label also contains important information on special precautions for children, hazards, and first aid. Carefully read and follow the label directions before each and every use.¹⁴
- Products containing synthetic chemicals work best against ticks. Two such products have as active ingredients DEET (*N,N*-diethyl-*m*-toluamide) or permethrin. The decision of using or not using a repellent would depend upon whether you want to reduce your risk of being bitten, the species of ticks present in the habitat, the potential for tick transmitted diseases, and whether you will be in an area subjected to heavy tick pressure.¹⁴
- DEET can be applied directly to the skin or clothing. However, DEET can damage some types of fabrics, watch faces, painted and varnished surfaces. DEET cannot be applied to skin that is covered with clothing. The United States Environmental Protection Agency (EPA) has completed an extensive reevaluation of DEET and has "*concluded that as long as consumers follow label directions and take proper precautions, insect repellents containing DEET do not present a health concern.*"¹⁴
- Conduct frequent tick checks while you are outside and examine yourself thoroughly once you come indoors. It takes time for a crawling tick to find a suitable feeding site. Thus, the more frequently you examine yourself for ticks the greater is likelihood that you will find them before they attach. Check your children thoroughly. Favorite sites for ticks to attach include but are not limited to the hairline, shoulders, armpits, waist, inner thighs, and groin area.¹⁴
- Check your pets after they come indoors. Your pets are more likely to come in contact with ticks and bring them indoors.¹⁴
- A recent study suggested that ticks could survive the cold/cold and hot/cold wash cycles of automatic washers. However, a one-hour high heat cycle in the dryer was sufficient to kill all developmental stages tested.¹⁴

POISON IVY IDENTIFICATION

From the Missouri Department of Conservation

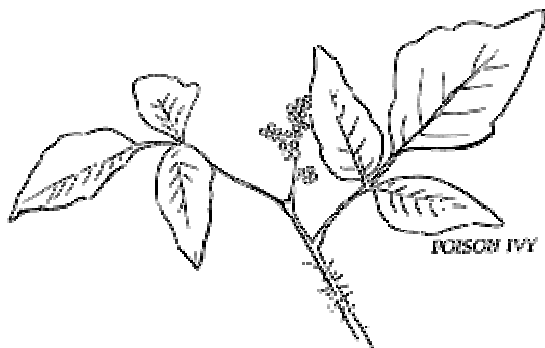
POISON IVY is a woody shrub or vine with hairy looking aerial roots. It grows to 10 feet or more, climbing high on trees, walls and fences or trails along the ground. All parts of poison ivy, including the roots, are poisonous at all times of the year.¹⁶

The toxin in poison ivy is an oil which causes an irritating skin reaction on many people. The reaction, an itchy rash with clear blisters, is variable in severity among people, and can vary from year to year on the same individual.¹⁶

The poison ivy reaction can be reduced if you change clothing immediately and wash the exposed skin with soap and water. If you can wash all the oil off exposed skin within 5 minutes of contact, no reaction will occur. Even water from a running stream is an effective cleanser. The oil from poison ivy can remain active on clothing and footwear as long as a year caution should be taken to prevent re-exposure to the oil. The oil can also be transmitted on pet fur and in the smoke of burning poison ivy.¹⁶

You can use various products such as *MultiShield* applied prior to anticipated exposure or *Tecnu Skin Cleanser* to cleanse exposed skin.¹⁶

Poison ivy is a nuisance to people but compensates by having considerable wildlife value. The white, waxy berries are a popular food for songbirds during fall migration and in winter when other foods are scarce. Robins, catbirds and grosbeaks especially like the berries. Many birds feed on insects hiding in the tangled vines. Small mammals and deer browse on the poison ivy foliage, twigs and berries.¹⁶



Poison ivy—three divided leaves center leaflet on a longer stalk; white, waxy berries along the stem; leaves alternate on the stem; erect shrub or climbing vine.¹⁶

Field Safety

Use the samples around the room and the handouts to complete the following exercise.

1. Looking at sample of poison ivy draw a colored picture of it in your journal along with a written description. Be sure to label picture.
2. How does the sample of poison ivy differ from the picture in the handout?
3. What color is the poison ivy berry ?
4. Can a person get poison ivy from another person? If yes explain how.
5. If you think you have touched poison ivy what can you do to reduce your risk of developing a rash?
6. What are some treatments for a person who has developed a rash from poison ivy?
7. What food is poison ivy related to?
8. What is the scientific name for poison ivy?
9. What is the scientific name for the dog tick?
10. How many legs does the dog tick have?
11. Draw a picture of the dog tick in your journal?
12. What is the scientific name for the deer tick?
13. How many legs does the dog tick have?
14. Draw a picture of the deer tick in your journal?
15. How big are deer ticks?
16. How big are dog ticks?
17. What family do ticks belong to?
18. What causes Lyme Disease?
19. What 4 things you can do to avoid contracting Lyme Disease.
20. What are some treatments for Lyme Disease

Lesson 5 Field Equipment and Data Sheets

Introduction:

It is important that all students are familiar with equipment and data collecting and recording methods prior to going into the field. Students will have an opportunity to handle and use field equipment.

Objective:

Students will be shown data sheets which will be used for project all year.
Discuss who is responsible for collecting and recording data.
Students will gain an appreciation for nature and a respect the for study site.
Students will develop estimating skills.

Materials:

Journals, a copy of the weather page from the local Newspaper, thermometers, classroom computer, digital camera, GPS, handout on clouds, data sheets, and worksheet for today's lesson.

Procedure:

1. Set up a water bath with a thermometer, for students to practice taking and recording water temperature.
2. Set up station for taking and recording air temperature.
3. Set up a station with field microscope and a sample to look at.
4. Set up a station with hand lenses and objects to look at.
5. Have students record data on their data sheet.
6. Discuss how to use and care for thermometer, and what to do if it breaks while in the field.
7. Give each student a copy of the data sheet, the clouds handout, and a copy of the weather page.
8. Go over clouds handout and show students how to estimate the percentage of cloud cover. Give students samples to practice estimating. Students should record their answers on worksheet.
9. Give students a copy of the weather page. Have them find the Almanac section where sunrise, sunset, day length, and moon phases are located.
10. Show students digital camera. Give all students and opportunity to practice taking a picture. Show students how to download pictures onto the computer.
11. Show students data sheet.
12. Show students where on computer data should be entered.
13. Discuss system for inputting data.
14. Show students magnifying lenses, show them where to look for magnification.
15. Show students field scopes, show them how to use them and how to calculate magnification.
16. Have students use both the field scope and the hand lenses and draw pictures under observation section of data sheet.
17. Discuss respect for nature and the integrity of a study site.

Assessment: Have students turn in worksheet at the end of class.

Plot # _____

Date: _____

Class: _____

Names:

Field Equipment Data Sheet

Sunrise:

Sunset:

Hours of Sunlight:

Air Temperature:

Surface Water Temperature:

What should you do if the thermometer breaks while you are using it in the field?

Picture 1: Cloud Type

% Cloud cover:

Picture 2: Cloud Type

% Cloud cover:

Picture 3: Cloud Type

% Cloud cover:

Were pictures taken with digital camera today?

If yes How many?

What did you take pictures of?

**Observations & Identifications:
Field Scope**

Hand Lens

Cloud Types-Common Cloud Classifications

From the University of Illinois

Clouds are classified into a system that uses Latin words to describe the appearance of clouds as seen by an observer on the ground. The table below summarizes the four principal components of this classification system ([Ahrens, 1994](#)).¹¹

Latin Root	Translation	Example
cumulus	heap	fair weather cumulus
stratus	layer	altostratus
cirrus	curl of hair	cirrus
nimbus	rain	cumulonimbus

Fair Weather Cumulus Clouds - Puffy cotton balls floating in the sky.

Fair weather cumulus have the appearance of floating cotton and have a lifetime of 5-40 minutes. Known for their flat bases and distinct outlines, fair weather cumulus exhibit only slight vertical growth, with the cloud tops designating the limit of the rising air. Given suitable conditions, however, harmless fair weather cumulus can later develop into towering cumulonimbus clouds associated with powerful thunderstorms.¹¹



Photograph by: [Holle](#)

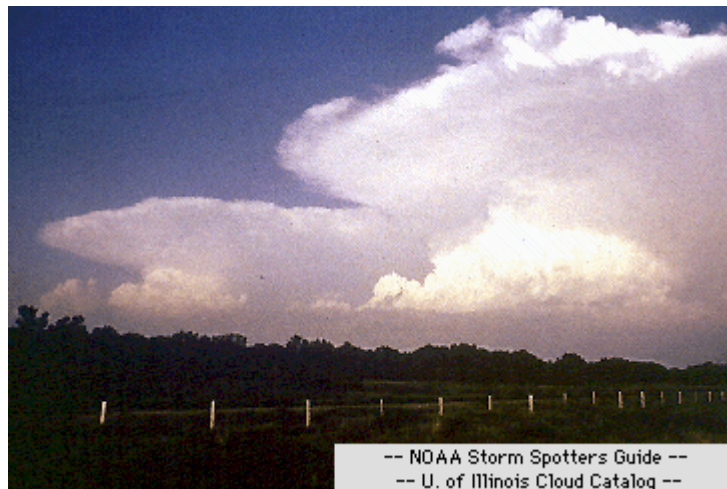
Cirrus Clouds - thin and wispy

The most common form of high-level clouds are thin and often wispy cirrus clouds. Typically found at heights greater than 20,000 feet (6,000 meters), cirrus clouds are composed of ice crystals that originate from the freezing of supercooled water droplets. Cirrus generally occur in fair weather and point in the direction of air movement at their elevation.¹¹



Cumulonimbus Clouds - reaching high into the atmosphere.

Cumulonimbus clouds (Cb) are much larger and more vertically developed than fair weather cumulus. They can exist as individual towers or form a line of towers called a squall line. Fueled by vigorous convective updrafts (sometimes in excess 50 knots), the tops of cumulonimbus clouds can easily reach 39,000 feet (12,000 meters) or higher.¹¹



Photograph by: [NOAA](#)

Lesson 6: Going into the Field, Map Making, Data Collecting, and Observations of study plot

Introduction: Students will be conducting research along a transect located on public lands adjacent to the school's athletic fields. The transect is a straight line that is 36 meters long and runs west from Prospect Street along *Goldsmith brook*. The class will be divided into 12 teams of two. Each team will be responsible for a nine meter square area along the transect. Students are to map and record the stream, large rocks, soil type, vegetation, fungi, and animals in their study plot. Data will be compiled to make one large classroom map. Each week students will return to their field site and record observations and note changes they see. Time will be given for students to observe, draw and reflect.

The team with the first study plot will also be responsible for recording the depth of the brook. Other teams will rotate data collection duties.

Objective: Students will examine a topographical map of their area familiarizing themselves with symbols. Students will examine various habitat and vegetation maps. Class will decided consistencies all maps should have, including the ones they will make. Students create a to-scale map of their wild-lands transect site.

Materials: Graph paper, pencils, colored pencils, GPS (if available), stakes, topographical map of area, photocopies of topographical map, vegetation map, maps worksheet, journals, graph paper and data sheets.

Maps

- Break class down into twelve teams.
- Assign each team a study plot (1-12). Plot 1 will be closest to Prospect Street.
- Show students topographical map of their area and give them a photocopy.
- Have students find the four cardinal points, N,S,E, & W.
- Have students find and identify the following symbols, street, trail, brook

Map Making

- Assign each team with equipment they are responsible for bringing into the field and returning back to the classroom.
- Assign teams' responsible for collecting group data: air temperature, water depth, surface water temperature, sunrise, and sunset.
- Go to field site assign students their location.
- Have students mark off their study site with stakes. Each stake should be 3 meters apart. *If GPS is available have students mark boundaries of study plot with GPS.
- Using pencils, meter sticks, and graph paper have students create a map of their plot.

Assessment: Students can pass in their maps worksheet. Students are to hand in their map at the end of class. Maps will be graded on rubrics formed during mapping exercise.

Plot # _____
Class: _____

Date: _____
Names: _____

FIELD STUDY DATA SHEET

Sunrise:

Sunset:

Hours of Sunlight:

Air Temperature:

Surface Water Temperature:

Cloud Type:

% Cloud cover:

Were pictures taken with digital camera today?

If yes How many?

What did you take pictures of?

Observations & Identifications: