Outdoor Lab Frame #s [48339-49304]

Research opportunities at Fermilab are discussed.

Bird Research Frame #s [49305-49987]

More than 230 species of birds have been identified at Fermilab. Bluebird studies are featured.

Soil Research Frame #s [49988-51125]

Research has shown that the prairie has improved the soil quality at Fermilab. Prairies increase the basic unit of soil called soil aggregates. Soil aggregates stabilize the soil, resist soil breakdown and erosion, and stimulate plant growth.

Insect Research Frame #s [51126-52008]

Research has shown that prairie insects need to be introduced into new prairies.

Prairie Research Frame #s [52009-52535]

Prairie ecologist, Dr. Betz, is highlighted.

Student Research at Fermilab's Prairies Frame #s [52536-53728]

Middle school students can participate in prairie research at Fermilab sites and learn about career opportunities.

Research Summary

IVF1. Past/Current Research Frame # [3638]

Chart showing past and current research at Fermilab prairie sites.

IVF2. Future Research Frame # [3641]

Chart showing future rsearch projects at Fermilab prairie sites.

Additional information for research may be obtained by using the Plant and Animal Slides found on the project videodisc.

Research Component

Plants

1. Kingdom ____________________

2. Phylum ____________________

3. Class ____________________

4. Order ____________________

5. Family ____________________

6. Genus ____________________

7. Species __________ __________ Common Name ____________________

Primary Habitat

8. Prairie (full sun) __________ Ecotone __________ Savannah __________

9. Native ________ Not Native __________

Characteristics

10. Size of plant ______________________________

11. Flowers

    A. Number per plant ______________________________

    B. Size (in cm) ______________________________

    C. Flowering time in nature ______________________________

    D. Flower parts

       Petals ________ Color ______________________________

       Sepals ________ Color ______________________________

       Pistil ________ Color ______________________________

       Stamens ________ Color ______________________________

       Pollen ________ Color ______________________________

E. Nonflower parts

Leaves ____________________

____

Stems ____________________

____

Seeds ____________________

____

Roots ____________________

____

Pollination

12. Wind ____________________

Animal __________ Insect __________ Bird __________ Other __________

Growth Habits

13. Grows singly__________ Grows in clones__________

How many present in clone?__________

Early Uses

____

____

____

Economic Uses

____

____

____

Adaptations

____

____

____

Resources

____

____

____

Research Component

Invertebrates

1. Kingdom ____________

2. Phylum ____________

3. Class ____________

4. Order ____________

5. Family ____________

6. Genus ____________

7. Species ____________ ____________

Common Name ____________

Primary Habitat

8. Section of Prairie (savannah, fen, marsh, meadow) ____________

9. Actual location (soil, tree, beneath rotted log, etc.) ____________

10. Description of "Home" ____________

11. Needs/Preferences ____________

Physical Characteristics

12. Number of segments or body sections ____________
13. Number of legs ____________
14. Antennae (Describe) ____________
15. Color ____________
16. Size ____________
17. Exoskeleton/Skin (Describe) ____________

18. Markings/Shape ______________________________
    A. Appendages ______________________________
    B. Body ______________________________
    C. Head ______________________________
    D. Wings ______________________________

Behavior

19. Periods of Activity (Time of Day/Night) ______________________________
20. Lives alone, colonies, pairs, etc. ______________________________
21. Symbiotic relationships (Is there another organism this creature must live near?)

____

Reproduction

22. Livebearing or Egg Laying ______________________________
23. Development (complete, incomplete metamorphosis, etc.) ______________________________

____

24. Breeding Conditions ______________________________

____

25. Male/Female Differences ______________________________

____

Food/Feeding Habits

26. Specific foods ______________________________
27. Carnivore, Omnivore, Herbivore, Parasite, etc. ______________________________
28. Food source(s) ______________________________

Fascinating Facts

____

____

____

Adaptations

____

____

Resources

____

Research Component

Amphibians/Reptiles

1. Kingdom____________________

2. Phylum____________________

3. Class____________________

4. Order____________________

5. Family____________________

6. Genus____________________

Common Name ____________________

7. Species ______________ ______________

Primary Habitat

8. Section of Prairie (savannah, forest, fen, marsh, meadow)____________________
____

9. a. Actual location of nesting place (tree, shrub, ground, etc.)____________________
____

 b. Describe nesting place____________________
____

10. Needs/Preferences____________________
____

Physical Characteristics

11. Size____________________

12. Shape____________________

13. Color____________________

14. Identifying Marks

 A. Head____________________

 B. Tail____________________

C. Feet____

D. Skin____

Behavior

15. Periods of Activity - Day/Night____________________________
16. Lives alone, colonies, pairs, etc.____________________________

Reproduction

17. Breeding Conditions (season, food supply, etc.)____________________
18. Care of young____
19. Number of eggs and color__________________________________

Food/Feeding Habits

20. Specific food(s)____
21. Carnivore, Omnivore, Herbivore______________________________
22. Food source(s)____

Fascinating Facts

Adaptations

Resources

Research Component

Birds

1. Kingdom ______________________

2. Phylum ______________________

3. Class ______________________

4. Order ______________________

5. Family ______________________

6. Genus ______________________

7. Species ______________________

Common Name ______________________

Primary Habitat

8. Section of Prairie (savannah, forest, fen, marsh, meadow) ______________________

____

9. a. Actual location of nest (tree, shrub, ground, etc.) ______________________

____

b. Describe nest ______________________

____

10. Needs/Preferences ______________________

____

Physical Characteristics

11. Size ______________________

12. Shape ______________________

13. Color (Note difference between male and female.) ______________________

14. Identifying Marks

A. Head ______________________

B. Tail ______________________________

C. Feet ______________________________

D. Beak ______________________________

E. Wing ______________________________

Behavior

15. Periods of Activity - Day/Night ______________________________

16. Lives alone, colonies, pairs, etc. ______________________________

Reproduction

17. Breeding Conditions (season, food supply, etc.) ______________________________

____

18. Care of young ______________________________

____

19. Number of eggs and color ______________________________

Food/Feeding Habits

20. Specific food(s) ______________________________

____

21. Carnivore, Omnivore, Herbivore ______________________________

22. Food source(s) ______________________________

____

Song

23. Description ______________________________

Fascinating Facts

____

____

____

Adaptations

____

____

____

Resources

____

Research Component

Mammals

1. Kingdom ______________
2. Phylum ______________
3. Class ______________
4. Order ______________
5. Family ______________
6. Genus ______________

Common Name ______________

7. Species ______________ ______________

Primary Habitat

8. Section of Prairie (savannah, forest, fen, marsh, meadow) ______________
9. Actual location (underground, tree, etc.) ______________
10. Describe "Home" ______________
____
11. Needs/Preferences ______________
____

Physical Characteristics

12. Size ______________
13. Color ______________
14. Description of Coat ______________
15. Markings/Shape
   A. Head ______________
   B. Tail ______________

C. Body____________________

D. Feet____________________

E. Other____________________

Behavior (periods of activity, family, etc.)

16.____________________

____

Reproduction

17. Livebearing or marsupial____________________
18. Number of young____________________
19. Development of young at birth____________________

____

20. Care of young____________________
21. Breeding conditions____________________

Food/Feeding Habits

22. Carnivore/Herbivore/Omnivore____________________
23. Specific food preferences____________________
24. Manner of obtaining food____________________

____

Fascinating Facts

____

____

____

Specific Adaptations

____

____

____

Resources

____

____

____

Prairie Rap

by
Patricia Franzen

Hey, everybody - I'm here to say
We're going to have some FUN today
Discovering the PRAIRIE is what it's all about
An exciting ecosystem, Man - NO DOUBT!

So what is a prairie? Did I hear someone say
A prairie is a place where today is yesterday
A place so lovely, so serene, so rare
A very special place Fermilab chose to share

The prairie winds will call you
The sun will warm your face
The rain and soil are the heart
Of this truly awesome place

A prairie is not a wasteland - not a vacant lot
As a matter of fact, that is precisely what it's NOT.
A prairie is a composite of grasses and of forbs
A place where animals thrive and spiders weave their orbs

A true, authentic prairie has only native plants
No European weeds or hot house entrants
Prairie dock and compass plant - other Silphiums galore
Big bluestem, dropseed, Indian grass and more

The prairie winds will call you
The sun will warm your face
The rain and soil are the heart
Of this truly awesome place

The prairie floor is teaming with such things as mice and voles
You can get down low and look - you'll surely see their holes
But below the surface exists a world without sleep
Fungi, insects, bacteria - and roots 20 feet deep

Stiff goldenrod so regal and New England aster
Prairie orchids, saw-toothed sunflower and rattlesnake master
Don't forget the birds like the hawk and meadowlark
Without their haunting calls, our prairie would be stark

The prairie winds will call you
The sun will warm your face
The rain and soil are the heart
Of this truly awesome place

8,000 years ago 40,000 square miles thrived
In today's America, less than 4 square miles survived
But the power of the prairie persists through fire and drought
Its only real enemy is man, without a doubt

So come and see our prairie - touch and explore
Find out why its special - learn all its lore
For as you feel the prairie, you will surely realize
That what we have right here is not an ordinary prize

The prairie winds will call you
The sun will warm your face
The rain and soil are the heart
Of this truly awesome place

The Missing Link

PURPOSE: To demonstrate the interrelationship of organisms within an ecosystem.

OBJECTIVE: The students will understand the interdependency of each organism on others within an ecosystem.

BACKGROUND: Every organism within an ecosystem fills a NICHE. This term refers to the unique placement of that organism within the food chain, its effect on the habitat of others, and its general role as a member of that particular biome. If one organism is removed, it may have an effect on the ecosystem. Obviously, the more organisms that are removed, the more immediate the effect may be. Students need to realize that organisms (both plants and animals) within an ecosystem are dependent to some degree on one another for ecological stability.

MATERIALS: None

PROCEDURE:

1. Assemble students in a line. The line need not be straight if the room size does not permit. It can even be a circle, see the Extension end of this activity.
2. Seat the student at the end of the line on a chair and instruct the remaining students to sit on the lap of the person immediately behind. (Students need to be rather tightly packed.)
3. Using the list of organisms on page 30, assign an organism name to each student. (This is for demonstration purposes only. Make clear to students that their animal or plant is not necessarily dependent on the one next to them.)
4. After all are seated and stable, noting organism's name, instruct one organism (designated student) at a time to carefully move out of position. (At this point, the next students will be seated on the knees of the student in back of them as organisms leave the ecosystem.)
5. Continue until the line (ecosystem) is on the verge of collapse. Discuss. (The removal of one student will weaken, but should not collapse the group. Removing two adjacent students will cause the collapse.)

DISCUSSION QUESTIONS:

1. Is it important that every organism remain part of the ecosystem? Why or why not?
2. How easy do you think it would be to fill a niche if one organism leaves the ecosystem? What happens if two leave? three?

3. What happens if two closely related organisms leave the ecosystem? (Remind students that they were not positioned in any particular order - use this as a hypothetical situation.)

4. How do you think this activity relates to the prairie?

EXTENSION: Have students form a circle and all sit down at once on the knees of the student behind them. Repeat procedure steps 2 - 5.

Estimating Percentages

PURPOSE: To practice estimating the percentage cover of an area. This skill is a necessary component of the quadrat study.

OBJECTIVES: The students will:

1. Estimate percentage of area covered using only visual skills.
2. Check their accuracy with actual measurements.
3. Transfer skills to quadrat study.

MATERIALS:

*Transparencies - Quadrat and Data Sheet
Meter stick
Masking tape
Colored paper of different dimensions. Use red, green, yellow, blue, orange. (Fabric or laminated paper will probably last longer.)
10 - 5x5 cm
10 - 10x10 cm
10 - 20x20 cm
10 - 30x30 cm
10 - 40x40 cm

PROCEDURE:

1. When cutting out the paper squares make sure that each color has some of every size. Then write on each square the appropriate prairie plant name: Indian grass - red, Compass plant - green, Prairie dock - yellow, Big bluestem - blue, and Butterfly weed - orange.
2. Using the masking tape and the meter stick, make six quadrats on the classroom floor. They should be one meter on each side.
3. Place the colored squares randomly from quadrat to quadrat. DO NOT cover every square centimeter. This could represent bare ground. Do not overlap squares. Take care to make sure all quadrats are different. Use no more than three squares of any one color.
4. Assign students in groups of four or five. At each quadrat students must estimate the percentage of area covered by each color. Allow each group at least three minutes at each quadrat before instructing them to move to the next.
5. When the students have estimated at all of the quadrats, assign each group to one of the quadrats and have them determine the actual area for each color. (Remind students all colored areas should not exceed 100%. The difference between the total of colored squares and 100% equals the percentage of bare ground.)
6. As a class compare the estimates to the actual percentages.

Name_______________________

Estimating Percentages

Percentage	Red	Green	Blue	Yellow	Orange	Uncovered
Estimated						
Actual						

Subtotal	Area cm^2	%
RED		
GREEN		
YELLOW		
BLUE		
ORANGE		
UNCOVERED		
TOTAL		

ESTIMATED
ACTUAL

Estimating Percentages

STATION NUMBER	RED	GREEN	BLUE	YELLOW	ORANGE	UNCOVERED
1						
2						
3						
4						
5						
6						

Calculate Actual Percentage

Name________________________

CONSIDERATIONS:

1. Use calculators to calculate measurements.
2. Area subtotals added should not exceed 10000 cm^2. Why?
3. Percentage (%) subtotals should not exceed 100%. Why?
4. Why did you use uniformly-designed squares?
5. Why is it difficult to accurately determine an actual percentage of different plants?

$$L\ cm \times W\ cm = Area\ cm^2 \qquad \frac{Area\ (cm^2)}{10000\ cm^2} = \%$$

RED

L (cm)	W (cm)	Area (cm^2)
Sub Total		cm^2
%		

GREEN

L	W	Area
Sub Total		cm^2
%		

YELLOW

L	W	Area
Sub Total		cm^2
%		

BLUE

L	W	Area
Sub Total		cm^2
%		

ORANGE

L	W	Area
Sub Total		cm^2
%		

UNCOVERED

L	W	Area
Sub Total		cm^2
%		

Quadrat Study: School Lawn

PURPOSE: To familiarize students with the techniques needed to do the quadrat study at the Fermilab prairie.

OBJECTIVES: Students will:
1. Understand the importance of sampling in science.
2. Learn how to set up a quadrat.
3. Improve their observation skills.
4. Understand how to make a chart quadrat.
5. Understand the concept of species diversity.

BACKGROUND: You have just been given the task of finding out how many dandelions or how many blades of grass are on your school grounds. How would you go about finding out? Your problem is similar to the problems scientists face all the time. How many whooping cranes are in existence? How many deer in a forest preserve? How many compass plants are in a section of prairie? You might solve your problem by getting down on your hands and knees and counting every dandelion on the school grounds. This might take you a very long time but if done carefully would give you a precise answer.

It is often unrealistic for a scientist to count every organism in her/his research area. What scientists often do is to work with a sample, a small section or plot of their research area. From their sample the scientist can then estimate many things about their research area without having spent all the time necessary to count each organism.

In this study the samples you will work with will be a meter on each side or a one meter square quadrat. From these samples you will be able to discover a great deal of information about your school ground ecosystem.

MATERIALS: Per Four Students:
- Stakes, string, rubber mallet
- Two meter sticks
- Small metric ruler
- Data sheet
- Flora Field Guide, optional
- Calculator

PROCEDURE: In this exercise students will work in groups of four using a chart quadrat of one square meter.

1. Describe "quadrat," how it is used and how one is made.
2. Show the students where to set up their quadrats.
3. It is not important that the students know the names of all of the plants in the school's lawn. Have each group of students assign each type of plant with a number, letter or a name they make up. Do this for all of the plants except the grasses; these should be represented with crosshatching. Use horizontal crosshatching to represent the first type of grass then vertical and various angles if your students can determine that there are other types of grass present.
4. Using two meter sticks and the following recording page, have the students map the location of the plants in their quadrat. First draw in the grasses using the crosshatching code. Once the grasses have been drawn in, the students will use the meter sticks to get the exact location for each of the other plants and indicate there locations on the recording page using the proper symbols.
5. Students need to get an accurate count for each species present in their quadrat and record this on the plant code sheet. For our purpose we will count each stem of grass as a separate plant. If there is simply too much grass to count this way, count the grass in a half or a quarter or a hundreth of your quadrat and multiply by the appropriate number.
6. Now students can determine the percent of cover for each species and record it on their recording page.

DISCUSSION QUESTIONS:

1. When you do a study like this at the Fermilab prairie, students will enter their data into a computer and that computer will calculate something called an Importance Value. This value tells us how important a plant is to the area. Since you do not have this computer and software at your school, we will try a simple version for this. Have students look at the number found and % cover for their plants. Ask them to determine which plant they think is the dominant or most important plant in their study.
2. Species diversity is very important to the stability of an ecosystem. If many different species are present, then the loss of one or two will probably not have a great affect. But if species diversity is low, the loss of one or two could have a major impact. In the original prairie of Illinois species diversity was probably twenty-five different species per square meter. Calculate the species diversity for your quadrat by counting the number of

different types of plants you found. Species diversity = _____ per square meter. How does the species diversity of your school lawn compare to that of the prairie? Which ecosystem would be more stable?

3. How many of each type of plant are on your entire school grounds? How could you figure this out? DO IT!
4. Scientists do not base their calculations on just one quadrat as you just did. Instead they will use the data from many quadrats. Why do you think they do this?

Name_______________________

Quadrat Study: School Lawn

CODE	NAME (optional)	NUMBER FOUND	% COVER

NUMBER OF DIFFERENT PLANTS FOUND __________

1 m^2 quadrat, scale 1 cm = 10 cm

Measure Up

PURPOSE: To provide students with experience using the equipment that will be part of their Fermilab field trip.

OBJECTIVES: The students will be able to:

1. Comfortably use equipment such as binoculars, wind meter, thermometers, psychrometer, soil moisture meter, light meter, ruler, and a soil nutrient test kit.
2. Accurately read and record data provided by the aforementioned instruments.

BACKGROUND: All thermometers are calibrated with the Celsius scale. When using the Celsius scale, this jingle will help your students relate temperatures to the more common Fahrenheit scale.

30's are HOT
20's are nice
Teens are "cool"
and zero is ice.

MATERIALS:

Binoculars
Thermometers
Cups
Water
Soil, for nutrient tests
Samples of wet and dry soil
Soil perculation tube
Stopwatch or wristwatch
Soil test kit
Several wooden blocks
Rulers
Data sheet
Psychrometers

PROCEDURE:

1. Students should work in groups of two or three.
2. Set up stations around the room so that each student team may spend 10-15 minutes per station. The recommended stations are as follows:

Station 1 Near a window or in the hall. Have the students use binoculars to focus on a particular object or place and write down a description.

Station 2 Students should read the temperature on thermometers which are in containers of soil and water.

Station 3 Students measure the lengths, widths and heights of several wooden blocks using the ruler.

Station 4 Students determine relative humidity using a sling pyschrometer and conversion chart.

Station 5 Students determine the wind speed, soil moisture, and light intensity using the proper meters. Have two containers of soil, one that is dry (A) and one wet (B). For light intensity do one indoors and one outdoors or one in direct sun and one in the shade.

Station 6 Students will determine water-holding capacity of the soil near the classroom by doing a soil perculation test.

Station 7 Students will use the soil test kits to analyze the soil for nutrient levels and pH. Students will need water and a container for the waste.

DISCUSSION QUESTIONS:

1. Why is it important not to hold the thermometer anywhere but the top when reading the temperature?
2. What does the test for soil perculation tell you about the soil?

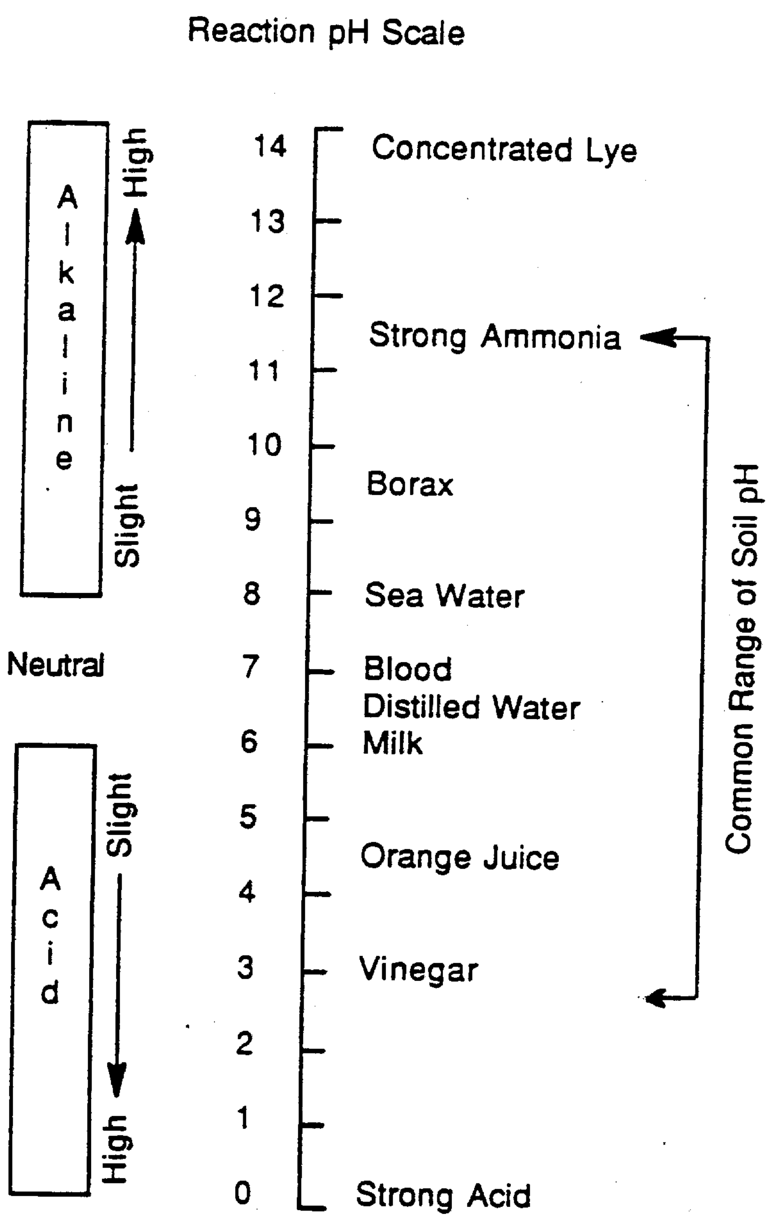


Figure 1. The pH Scale and some common substances with their pH values.

PSYCHROMETER DIFFERENTIAL TABLE - WET BULB/DRY BULB

Dry-bulb temperatures (•C)	Difference between wet-bulb and dry-bulb temperatures (•C)																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0	81	64	46	29	13															
2	84	68	52	37	22	7														
4	85	71	57	43	29	16														
6	86	73	60	48	35	24	11													
8	87	75	63	51	40	29	19	8												
10	88	77	66	55	44	34	24	15	6											
12	89	78	68	58	48	39	29	21	12											
14	90	79	70	60	51	42	34	26	18	10										
16	90	81	71	63	54	46	38	30	23	15	8									
18	91	82	73	65	57	49	41	34	27	20	14	7								
20	91	83	74	68	59	51	44	37	31	24	18	12	6							
22	92	83	76	69	61	54	47	40	34	28	22	17	11	6						
24	92	84	77	71	62	56	49	43	37	31	26	20	15	10	5					
26	92	85	78	72	64	58	52	46	40	34	29	24	19	14	10	5				
28	93	85	78	73	65	59	53	48	42	37	32	27	22	18	13	9	5			
30	93	86	79	74	67	61	55	50	44	39	35	30	25	21	17	13	9	5		
32	93	86	80	75	68	62	57	51	46	41	37	32	28	24	20	16	12	9	5	
34	93	87	81	76	69	63	58	53	48	43	39	35	30	28	23	19	15	12	8	5

Measure Up Data Sheet

Station 1

Focus on an object and use at least ten adjectives to describe it. Be sure to notice such features as color, size, shape, and movement (if any).

Station 2

Temperature of container in water __________ ^0C

Temperature of container in soil __________ ^0C

Station 3

Formula for volume of a rectangular solid is LxWxH.

Block Number	L (cm)	W (cm)	H (cm)	Calculation LxWxH	Volume cm^3
1					
2					

STATION 4

Spin the psychrometer for at least one minute.

Dry-bulb (no sock) temperature __________ ^0C

Wet-bulb (with sock) temperature __________ ^0C

Difference between wet and dry __________

Use the chart to determine the % relative humidity.

Relative Humidity = __________%

STATION 5: Wind, Soil Moisture, and Light Intensity

1. Anemometer (wind meter)
   Wind speed — Trial 1 __________mph
   Trial 2 __________mph
   Trial 3 __________mph
   Total __________mph

   Average__________mph
2. Moisture Meter
   Meter reading for soil A __________
   Meter reading for soil B __________

3. Light Meter
   Meter reading indoors __________
   Meter reading outdoors __________

STATION 6: Soil Perculation Test

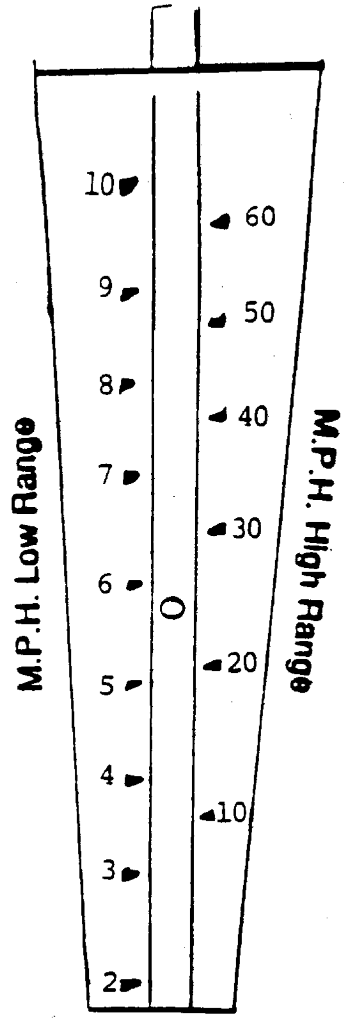
1. Place the perculation tube into the ground up to the 5 centimeters line marked on it.
2. Fill the tube with water to the 1 liter line; start the stop watch.
3. Stop the watch when all of the water has drained out of the tube.
4. Use the following formula to calculate the perculation rate:

1.00 liters/time in minutes = ______ liters per minute

STATION 7: Soil Nutrient Tests

1. Follow the directions on the test kit and complete the following chart:
2. Place a check mark in the appropriate box.

Chemical Test	Surplus	Sufficient	Adequate	Deficient	Depleted
Nitrogen N					
Potassium K					
Phosphorus P					

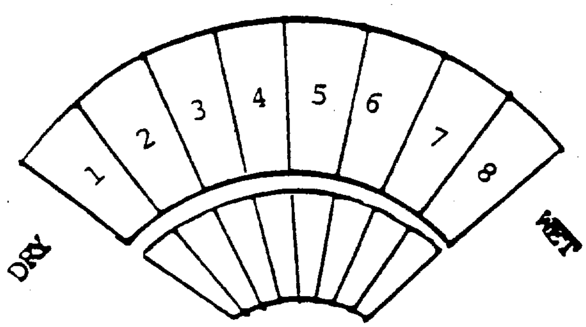


Wind Meter

If wind velocities are low, simply read wind speed noted on left side of the scale. If wind speeds are high or strong gusts are felt, place finger over the hole at point "A" and read the right side of the scale.

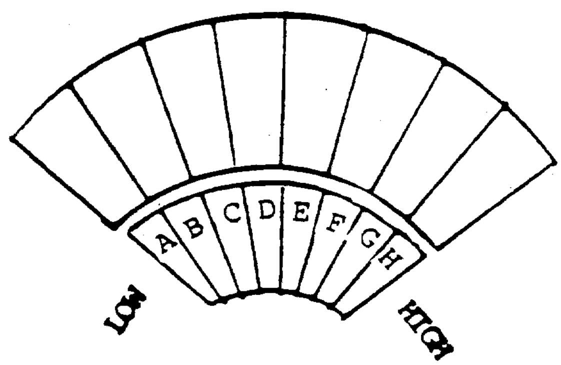
Low range wind speed on this wind meter is
M.P.H.

High range wind speed on this wind meter is
M.P.H.



The soil tested has a moisture rating of ________________

Moisture Meter



The intensity of light at the site tested is ________________

Light Intensity Meter

What's the Weather?

PURPOSE: To enable students to understand the correlation between weather and the existence of a particular biome.

OBJECTIVES: The students will be able to:

1. Collect and record data.
2. Interpret data and make references about climatic effects.
3. Compare weather patterns for different parts of the country.

BACKGROUND: The climax plant community has integrated all the environmental factors of its habitat; it is the fundamental response to the controlling condition. Among these factors are weather, soil and topography.

Weather information is readily available through newspapers and news broadcasts. The National Atmospheric and Oceanic Administration provides complete weather information for given areas near major airports that serve as weather recording stations. The Chicago area has O'Hare Airport collecting and recording extensive amounts of weather data.

MATERIALS: Newspapers
Student pages
(Weather instruments such as a thermometer, rain gauge and anemometer may be used to collect school weather data.)

PROCEDURE:

1. Have students work in pairs or individually.
2. Pick a city from the list in the newspaper weather report and daily record the high and low temperatures, as well as weather conditions, such as cloudy, rain, snow, etc.
3. Record this information for a period of 14 days including weekends.
4. Make a line graph using your data. One line (red) for the high temperatures and a second line (blue) for the lows. Since the date is the independent variable, it should be on the horizontal axis. The temperature, the dependent variable, should be on the vertical axis.
5. Research your city and include factors such as, annual rainfall, seasonal temperature variations, and geological features such as lakes, rivers, mountains, elevation, along with any other pertinent information.
6. Calculate the average high temperature for the 14 days. Calculate the average low temperature for the 14 days.
7. Use your graph to determine which day had the greatest temperature range.

DISCUSSION QUESTIONS:

1. What high and low temperatures would you predict for your city one week after the last date you collected data for?
2. What major biomes would you expect to find in or near your city?
3. How do you calculate the average temperature?
4. Do plants and animals have specific temperature requirements? Water requirements?

EXTENSIONS:

Make a composite graph of all the cities displaying the average high and low temperatures. Compare this with Chicago.

Record the weather information for a longer period of time or for two weeks during three of the four seasons.

Abiotic Natural Factors Frame #s [35612-36230]

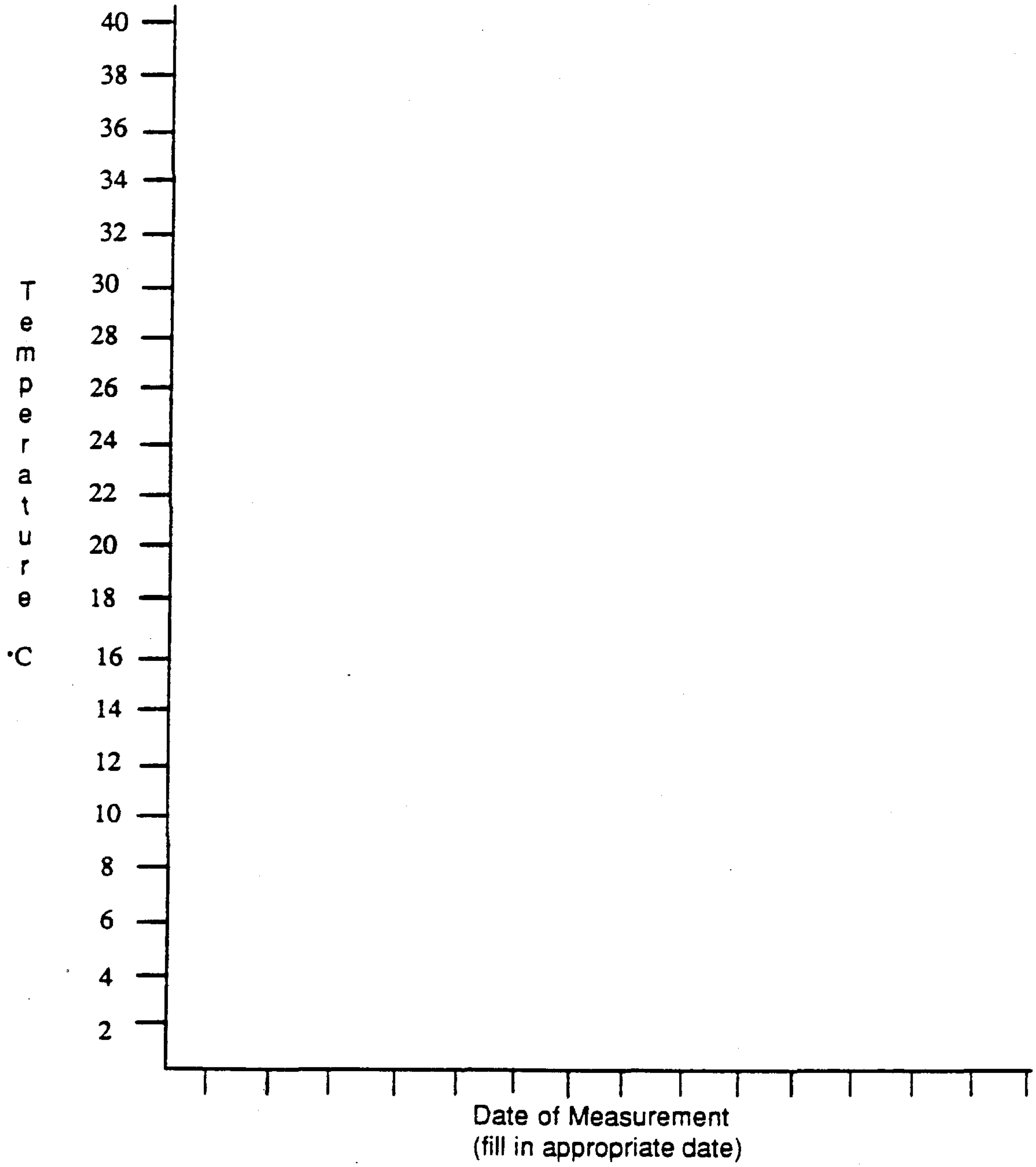
Water Frame #s [39332-41819]

What's the Weather?

Researcher(s)________________________________

____

City________________________________



Key
Red = High Temp. Blue = Low Temp.
Range = difference between high and low.

Prairie Collage - The Illinois Connection

PURPOSE: To help students visualize the beauty and diversity of the prairie.

OBJECTIVES: The students will:

1. Prioritize features of prairie important to them.
2. Produce a visual product on the prairie suitable for use with presentations in research component.

MATERIALS:

Poster board
Markers
Pictures
Other appropriate poster materials

PROCEDURE:

1. A collage is a pictorial representation of a topic; in this case "The Illinois Prairie." Students may wish to compare Illinois then and now, compare prairie and farmland, concentrate exclusively on Illinois Prairie from a historical perspective, or pursue any facet of the topic you, the teacher, deem appropriate.

2. Considering the display space in your classroom or building, designate a uniform size. (We advise 1/2 of a typical poster board as a maximum.)

3. Both words and pictures must be used. It is most effective if elements are overlapping, and color and texture varies.

4. Somewhere on the collage, include a small copy of an *original* poem. Diamante, haiku, or any other poetry form is acceptable. (See Monarch Mini-Unit for forms.)

5. To encourage creative expression, do not attach too many criteria to this project. (Obviously, a teaching team consensus will be necessary to establish further guidelines if this component is utilized outside the science classroom.) Evaluation may be based on quality as well as quantity of information, neatness, creativity, following directions, etc.

6. If this is used as a history component, consider a Prairie timeline. (Prairie Development and Decline, Prairie versus Progress, Prairie Restoration, etc.)

DISCUSSION QUESTIONS:

1. Was it easy/difficult to prioritize that which you wished to express? Why?
2. What was the theme of your collage?
3. Does your collage help you (or others) appreciate the prairie to a greater degree?

Information may be obtained by viewing the motion sequence titled *Particles and Prairies - A Research Experience for Middle School Students* Frame #s [03962-53728]

Fermilab Prairie - Past, Present, Future

PURPOSE: To explore the prairie from a historical perspective and predict the future of our present prairie systems.

OBJECTIVES:

1. The students will develop an appreciation for the size and span of existence of the original tall grass prairie.
2. Students will compare the decline and restoration of the tall grass prairie on the Fermilab site.
3. Students will analyze present and future prairie sites with consideration for lab growth and development.
4. Students will reproduce a Fermilab site map with present land use noted.
5. Students will establish a timeline from glaciation to the present.

BACKGROUND: The Fermilab prairie is reminiscent of the original tall grass prairie that once covered 40,000 square miles of Illinois. (Transparency) Currently, over 600 acres of prairie have been restored on the Fermilab site with plans for more to be planted. (Transparency) This reconstruction process has been in progress for over 20 years. As prairie plants have been added, careful notice has been taken of their progress and the succession of prairie plants. While the reconstruction process is important from an ecological perspective, Fermilab must consider carefully where plantings take place. Once a prairie has been established, it cannot be eliminated without special considerations.

MATERIALS:

* Transparencies - Illinois - original prairie land 1840 and Fermilab site map
* Student copy of Fermilab map (Figure 2)

Colored pencils - one set per student
White unwaxed shelf paper or adding machine paper
Markers

PROCEDURE:

1. Review background (See introduction.) Emphasize historical evolution of area - Indians, pioneers, emergence of towns, railroads, farms, etc.
2. Develop timeline - (student sheet) - individual research.
   Class Activity
   A. Designate individuals to find dates for the following:
      Glaciation
      Pine/Spruce Forests
      Hardwood Forests
      Prairie Succession

Indian encampments (approximate)
Lewis and Clark Exploration
First towns in area (Chicago)
Illinois Statehood
Founding of your town
Abraham Lincoln's Presidency
Civil War (Poem - Sandburg's "Grass")
Important events in your community
Fermilab Established
First prairie in site planted
Interpretive trail

B. Relate each event to prairie development, decline and restoration.

C. Record events on timeline. (Suggest 100 year increments. Obviously, most dates will fall in last 100 years. Students will note vast expanse of time from original prairie to present.) Use adding machine paper or shelf paper/markers. Paper will encircle room when completed.

3. Using color transparency as a guide, complete Fermilab line map. Have students develop their <u>own</u> legends.
   Include:
      Prairie
      Lab buildings
      Farmland
      Woodland
      Marsh
      Pond
      Etc.
4. Discuss.

DISCUSSION QUESTIONS:

1. When did prairie begin? How long did it exist as a tall grass prairie?
2. How long has it taken to destroy the prairie? Compare.
3. What caused the prairie to disappear? Could this have been changed?
4. Is it important to restore some of the tall grass prairie? Why? Why not?
5. What should Fermilab do about prairie restoration when it interferes with facility progress?

Background/History

Frame #s [19183-19767]

Frame #s [19768-21931]

Frame #s [21932-22621]

Frame #s [22622-24361]

Frame #s [24362-26017]

Fermilab Map

PREVISIT ACTIVITY
STUDENT PAGE 1

Name______________________

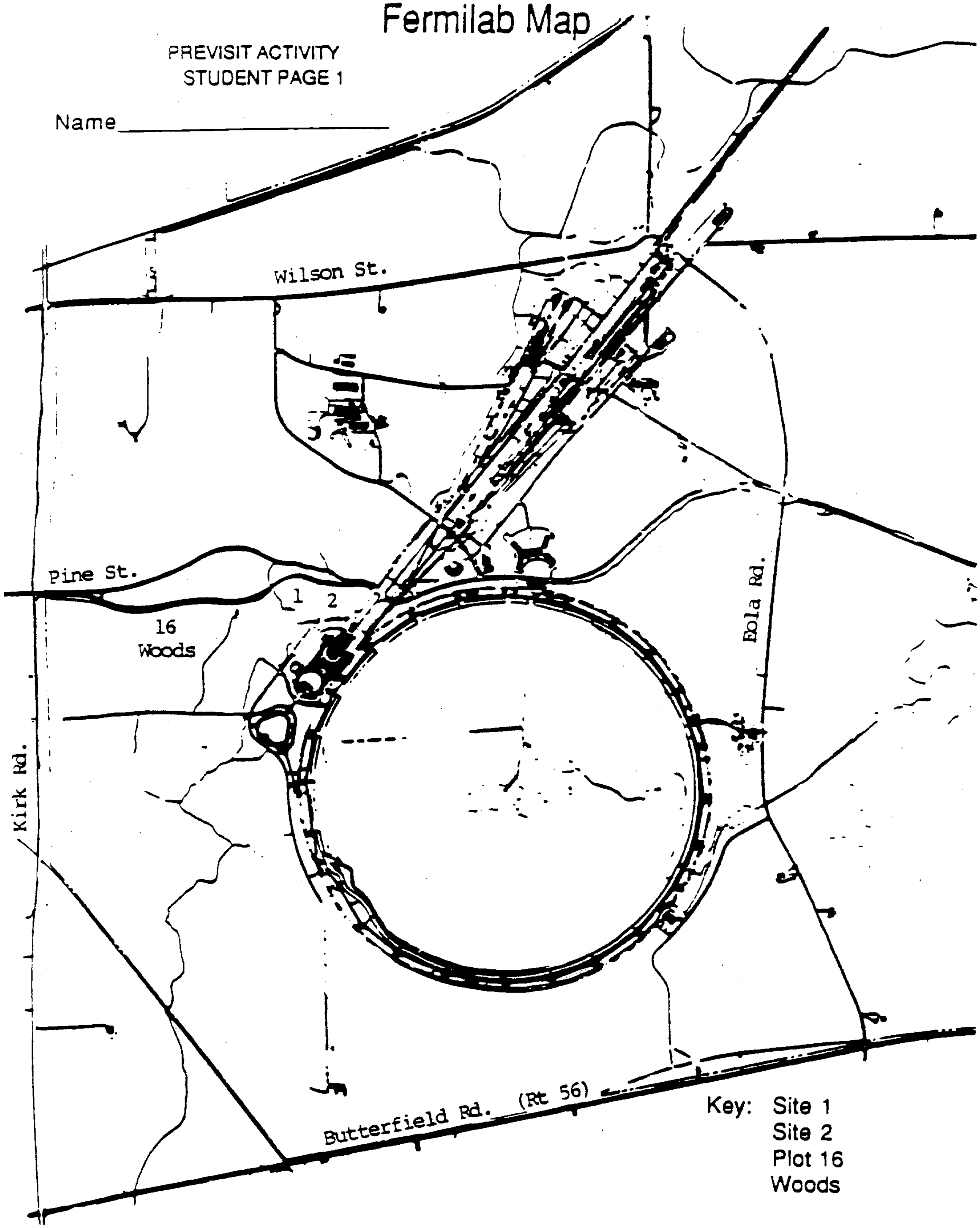


Figure 2. Fermilab Site Map

Peanut Butter and Jelly Sandwich

PURPOSE: To stress the importance of giving and receiving good directions.

OBJECTIVES: The students will:

1. Observe the consequences of poorly stated directions.
2. Recognize the importance of clearly stated directions.
3. Recognize the importance of sequence to understanding.

MATERIALS:

One jar of peanut butter
One jar of jelly
A loaf of bread
A knife
Several paper towels

PROCEDURE:

1. Ask if any students know how to make a peanut butter and jelly sandwich.
2. Choose your "victim" carefully. It is important that this be a self-confident student.
3. Position this student across the room with his/her back to you. NO PEEKING.
4. Ask student to give you directions to make a PBJ sandwich.
5. Follow directions precisely.
   - If the student says "some" peanut butter, put a TINY bit or a HUGE pile on the bread.
   - Be sure to "play up" ambiguities.
   - If student does not specifically tell you which side of the bread to use, use both sides of the same slice, etc.
6. Present "sandwich" to student participating and discuss.

DISCUSSION QUESTIONS:

Note--Be careful not to personalize discussion. The student participant may be sensitive.

1. How did you first learn to make a PBJ?
2. Is it better to use specific measurements or words such as "some", "most", etc.? Why?
3. Does the sequence (order) of steps matter. Why or why not?
4. Explain how research could be affected by the type of directions given.
5. What do you think is the best way to learn new things?

Blindman's Drawing

PURPOSE: To illustrate the importance of good verbal directions.

OBJECTIVES: The students will:

1. Recognize the importance of good verbal directions.
2. Improve their ability to give and receive verbal directions.

MATERIALS:

* Design Cards
Paper
Pen or pencil

PROCEDURE:

1. Organize students in pairs - back to back.
2. Distribute Design Cards (Kit - Set A) to one member of the pair. Have student note the number on the card. The student NOT given a card is to look ONLY at the drawing paper he or she has been given.
3. The student with the Design Card will verbally describe the design while the other student draws his/her interpretation.
4. When completed, students compare card and drawing.
5. Reverse roles with another card, Set B, for each pair.

*Note - Make sure pairs do not receive and/or are not sitting near someone with the same card. (Sets contain identical designs.)

DISCUSSION QUESTIONS:

1. Were you effective in describing the design? Why or why not?
2. Did being the first or second describer make a difference on your effectiveness? Explain.
3. Were you effective in drawing the design? Why or why not?
4. Did your turn as artist make a difference? Explain.
5. How could you have done a better job of being either describer or artist?
6. What types of processes are easiest to describe? To understand?
7. In what ways is it necessary for a scientist to be a good "describer?" A good receiver of directions?
8. How do you handle a situation that would require you to explain a process that you do not fully understand?
9. Does learning about, or experiencing a topic, make it easier to help others to understand? Why or why not?

EXTENSION:

1. Try it again with different cards. This time allow the describer to look over the shoulder of the artist. Repeat questions 1-5 and compare answers with previous methods.
2. Have the students design new cards and try again.

Homes for Birds

The actual needs of hole-nesting birds are few, and may often be met by a small expenditure of time and work. To make the preferred nesting facilities safer, however, and probably more comfortable for the occupants, certain principles of construction, design, and location should be observed. A well-built bird house should be durable, waterproof, cool and readily accessible for cleaning. Furthermore, by adopting high standards of neatness and rustic beauty in construction, bird houses may be made not only to serve the strictly utilitarian purpose of encouraging beneficial species but also to add a touch of attractiveness to the dooryard.

MATERIALS: For anyone wishing to construct his own bird houses, wood is by all means the best building material. Metal should be avoided, as it gets intensely hot when exposed to the rays of the sun. Pottery nest boxes have some points in their favor but are not readily made in the average home workshop. Nest boxes constructed of tar paper or similar products have no particular advantages over wooden ones, and the use of these materials is impracticable for some of the larger houses. In the choice of wood, an easily workable kind, as cypress, pine, or yellow poplar, is preferable; the first-named is the most durable. Sawmill waste (rough slabs with the bark on) furnishes cheap and satisfactory material for rustic houses.

PAINT: Where a rustic finish is not sought, paint is unobserved and greatly enhances the weathering qualities of bird houses. Modest tones, as brown, gray, or dull green, are generally to be preferred. Martin houses and others that are placed in exposed situations, however, may be painted white to reflect heat.

PROTECTION FROM RAIN: Roofs should be made with sufficient pitch to shed water readily; or, if levels, or nearly so, they should have a groove cut across

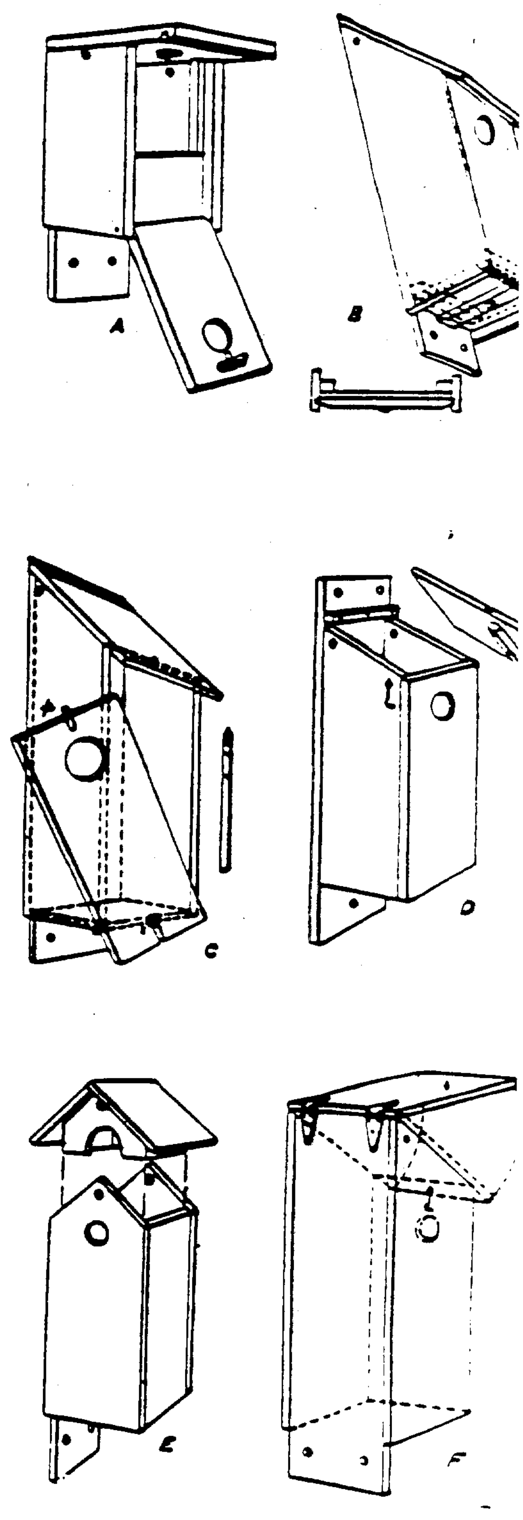


Figure 3.

the underside of the overhanging part (Figure 3) to prevent water from draining back into the interior of the house. The overhang should extend two to three inches so as to protect an entrance hole from driving rain. The opening of the nest cavity itself may be bored at an upward slant to aid in keeping out water. A strip of metal or roofing paper often helps to make the ridge of the nest box thoroughly waterproof; flat roofs should either be wholly covered with some such material or else heavily painted. In latitudes where freezing weather is the rule in winter, bird houses will last longer if the sides are prolonged beyond the bottom of the box, thus draining off water that otherwise might freeze in the crack between bottom and sides and wedge them apart. To provide for the contingency that some water may get inside the box, a few small holes may be made in the bottom.

PROTECTION FROM HEAT: If attention be paid to the principle of cool construction, the suffering of nestlings during periods of excessive heat may be lessened. Wood is in itself a fairly good heat insulator; but it must be remembered that the interior of the average nest box is small, and a single opening near the top permits little ventilation. One or two small auger holes through the walls near the top of the box will give limited circulation of air without producing drafts.

ACCESSIBILITY: All bird houses should be placed so as to be readily accessible and built so as to be easily opened and cleaned. To those interested in studying the life history of nestlings, a readily opened box is a great aid. A number of arrangements may be used to permit inspection of the nest, several of which, as applied to simple houses, are illustrated in Figure 3.

ENTRANCES: Since entrance holes for bird houses are usually made near the top, the lumber used, if dressed, should be roughened, grooved, or cleated to assist the young in climbing to the opening. Houses longer than high are comfortable and

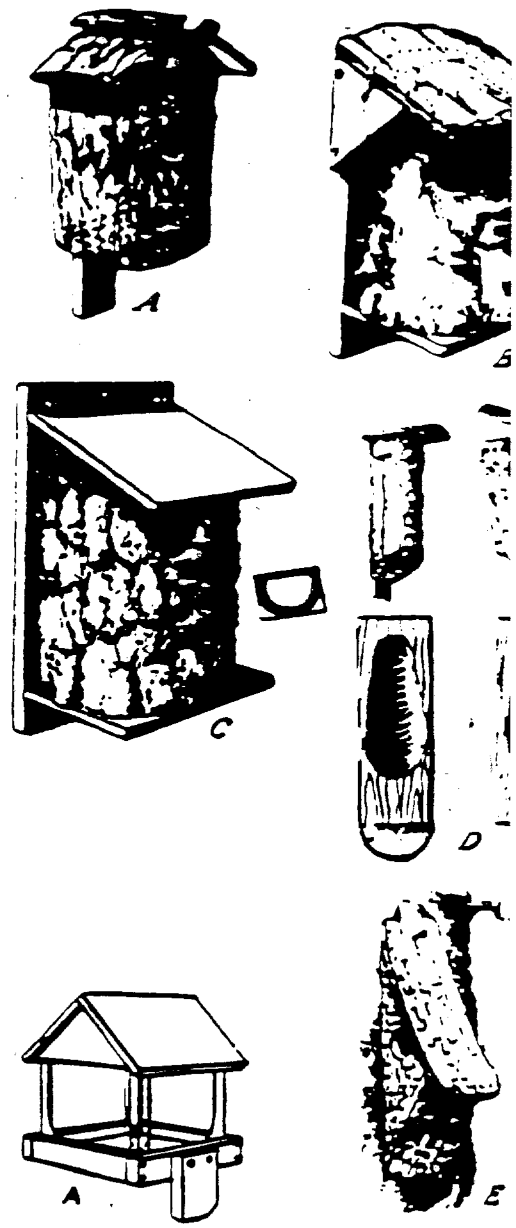
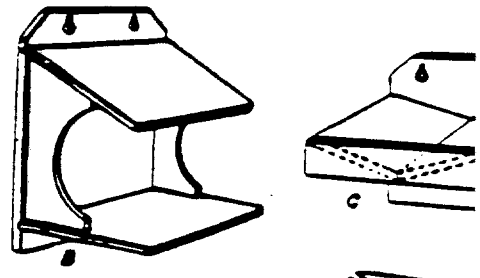
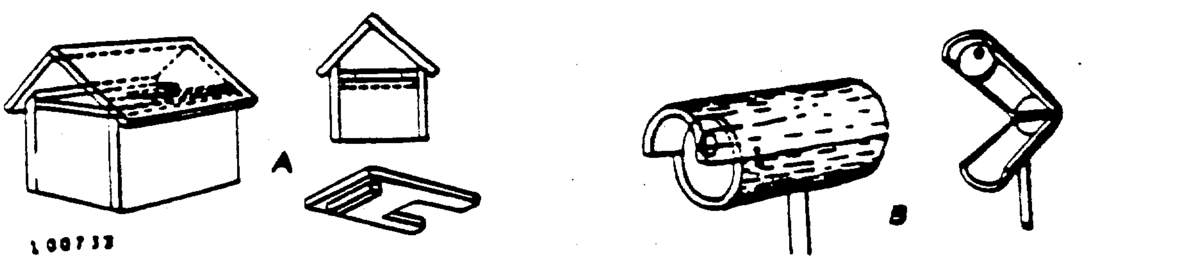


Figure 4.

convenient and seem to be liked by some species, particularly by birds that do not have an inborn preference for the type used either by woodpeckers or by birds that are partial to old woodpecker holes (Fig. 4, B). Perches at the entrances seem more of an assistance to enemies than a requirement for the occupants.

DIMENSIONS AND ELEVATION: The simplicity of construction of the single-room bird house does away with the necessity of detailed working drawings in most cases.





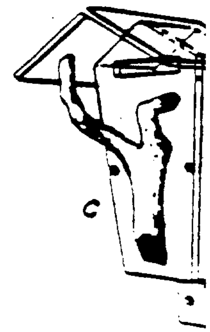


Figure 5.

SPECIES	Floor of cavity	Depth of cavity	Entrance above floor	Diameter of entrance	Height above ground
	Inches	Inches	Inches	Inches	Feet
Bluebird	5 X 5	8	6	1 1/2	5-10
Robin	6 X 8	8	**	**	6-15
Chickadee	4 X 4	8-10	6-8	1 1/8	6-15
Nuthatch	4 X 4	8-10	6-8	1 1/4	12-20
House Wren	4 X 4	6-8	1-6	1 1/4	6-10
Carolina Wren	4 X 4	6-8	1-6	1 1/2	6-10
Tree Swallow	5 X 5	6	1-5	1 1/2	10-15
Barn Swallow	6 X 6	6	**	**	8-12
Purple Martin	6 X 6	6	1	2 1/2	15-20
Song Sparrow	6 X 6	6	***	***	1-3
Flicker	7 X7	16-18	14-16	2 1/2	6-20
Woodpeckers:					
Red-headed	6 X 6	12-15	9-12	2	12-20
Downy	4 X 4	8-10	6-8	1 1/4	6-20
Hairy	6 X 6	12-15	9-12	1 1/2	12-20
Screech Owl	8 X 8	12-15	9-12	3	10-30
Saw-whet Owl	6 X 6	10-12	8-10	2 1/2	12-20
American Kestrel	8 X 8	12-15	9-12	3	10-30
Wood Duck	10-18	10-24	12-16	4	10-20

** One or more sides open.
*** All sides open.