FERMILAB-TM-1803

Teacher's Guide

Particles and Prairies:
The Fermilab Prairie Savannah

Friends of Fermilab
and
Fermi National Accelerator Laboratory
P.O. Box 500
Batavia, Illinois 60510

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The Power of the Prairie

GRASS

Pile the bodies high at Austerlitz and Waterloo.
Shovel them under and let me work -
I am the grass; I cover all.

And pile them high at Gettysburg
And pile them high at Ypres and Verdun.
Shovel them under and let me work.
Two years, ten years, and passengers ask the conductor:
What place is this?
Where are we now?

I am the grass.
Let me work.

Carl Sandburg
Illinois Poet

Introduction

The uniform flatness which characterizes much of the state of Illinois, including the Fermilab site, and contributes to the immensity of the original prairie came as a result of a series or glaciers which slowly crawled across the face of Central North America about 15,000 years ago. Carving through what would one day be called Illinois were four major glaciers (Wisconsinian, Illinoisan, Kansan and Nebraskan). The Illinoisan and Wisconsinian glaciers appear to have had the greatest effect on our present state contour with their southward movement. The Illinoisan advanced nearly to the present city of Carbondale and was followed by the broad ice sheet of the Wisconsinian.

About 12,000 years ago, average temperatures slowly began to rise, and the glaciers began to melt and recede. As a result of extended periods of warmth, glacial lakes formed, and eventually considerable flooding contributed to the formation of the Illinois River Valley.

During this time, as the climate cooled, vegetation primarily consisted of pine and spruce forests. Eventually, a warming trend inspired the oak and hickory forests. The trend began some 8,300 years ago and allowed for the easterly expansion of the prairie. The prolonged dry, hot xerothermic period to follow provided the climate that was conducive to the emergence of the tall grass prairie as the predominant vegetation in Illinois.

Currently, the climate in the grassland region of Illinois is punctuated by hot summers and cold winters. Precipitation generally is about 40 inches per year in this region. Rainfall is significantly less in the short grass prairies of the West.

Prairies are unusually well adapted to survive such natural phenomena as extended droughts and wild fire which would prove devastating to other plant life forms. This resilience is ironic in light of the relative fragility of the prairie at the hands of man.

The true prairie grassland that once blanketed Central North America from Indiana west to Nebraska, south to Texas and north to Saskatchewan and Alberta has been severely impacted by man's progress. Indeed, the vast grassland that once covered 40,000 square miles of Illinois has been dramatically reduced to less that four square miles of virgin prairie. While these grasslands would differ greatly in actual specific flora and fauna, all maintained the characteristic "tall grass" component. One prairie ecosystem slipped almost imperceptibly into another, forming one enormous complex grassland biome.

This biome was, for centuries, home to many tribes of nomadic Indians. While most of these tribes were seasonal residents of the Illinois prairie, they did some cultivation and harvesting of native plants. They learned about the power of the prairie fire and recognized its importance to the ecosystem. The Indians realized that their fire seemed to contribute to the vitality and diversity of the prairie.

As the European settlers entered the scene, the Indians, primarily peaceful people, were displaced. Fire was feared by many of the early pioneers and fewer burns were the result as accidental fires were extinguished. The dense grassland with its complex root system was a great impediment to the early farmer. In fact, many early pastures and croplands were in open areas of savannah rather than in the grasslands themselves because of the relative ease of planting. Pulling out a stump of a tree was much easier than breaking through the immense biomass of the prairie root system.

This grassland, over the centuries, created some of the richest farmland in the world. This fact alone helps to explain why the tragic loss of virgin prairie was scarcely noticed. As a society, we yielded to "progress" as we cultivated, built towns and established businesses throughout the prairie.

During the late fifties and early sixties, there came a vitalization of ecological studies and a resolve by some to rediscover and recreate that which was lost. Late in the summer of 1959, Robert Betz, Professor of Biology at Northeastern Illinois University, was introduced to the prairie by Floyd Swink, currently at the Morton Arboretum. As these men began botanizing together, they dreamed about restoring this nearly destroyed ecosystem.

During the 1960's, Fermilab acquired the site in Batavia which included thousands of acres of what had once been prairie. In 1971, Betz approached Fermilab with his Prairie Restoration Proposal. Restoration plans began in the main ring in 1973 with Dr. Betz, Raymond Schulenberg, former Curator of Plant Collections at Morton Arboretum, and a few dedicated Fermilab employees piloting the project. Supported by founding Fermilab Director, Robert R. Wilson, Betz and Fermilab employees established the Prairie Committee in May 1974. Plot I was planted using over 400 pounds of seed collected by 100 volunteers working throughout the area. The 9.6 acre plot yielded, to the untrained observer, only ragweed, but Betz persisted and found tiny prairie plants struggling to survive. The native flora was growing, but at this point was putting nearly all of its energy into the vital root systems necessary for survival. After a few years enough prairie plants existed to allow burning the plot.

Plantings continued over the years with new plots disked, planted and burned on a regular basis. By 1984, over a decade of restoration had taken place when Argonne National Laboratory requested that a group of terrestrial ecologists be permitted to conduct research in the Prairie Restoration Project. This added even more credibility and exposure to the project.

In 1985, Dr. Leon M. Lederman, Fermilab Director, submitted a proposal for the lab site to become a Department of Energy National Environmental Research Park. He opened the door to a variety of funding sources, and even more individuals became initiated into the prairie scene. Over 700 acres of restored prairie existed on site by 1988. The prairie at Fermilab was, at that time, the largest reconstructed prairie in the world.

The year 1989 brought the official approval of Fermilab as a DOE Research Park. Fermilab is the sixth such park in the national network. This site is considered unique because of the wide sampling of native Midwest ecosystem life forms. Also in 1989, The Margaret Pearson Interpretive Trail opened to honor the long time Manager of Public Information Office and original member of the Prairie Committee.

Continuing to work on the Prairie Committee are such dedicated volunteers as Mitchell Adamus, Robert Betz, Rudolph Dorner and Finley Markley. Thanks to their continuing efforts, we can all look forward to an even purer prairie in the future.

Teaching Suggestions

Philosophy

The advent of the 21st Century promises an exciting ascent into the future. As Fermilab stands on the brink of identifying the top quark and establishing answers to some of the most elusive questions in our universe, we pause to look back on a time not so very long ago. Rediscovering the majesty of the prairie through observation of Fermilab's prairie reconstruction is made possible through *Particles and Prairies: The Fermilab Prairie Savannah.*

It is our goal to provide participants with the opportunity to be scientists. Gathering data and making observations will increase students' knowledge and appreciation of the prairie while providing vital data. This data, in turn, will help the ongoing prairie restoration project at Fermilab.

The hands-on, interactive focus of this instructional unit is designed to enlighten a future generation to this fragile, beautiful world. In so doing, we want to accentuate the student's responsibility to maintain what remains or has been restored of our forefathers' prairie.

Teaching Strategies

Due to the interactive nature of the instructional unit, as well as the vast scope of information covered, we suggest cooperative learning strategies as a base. Distribution of tasks, jigsawing information and using the student as a teacher will accomplish best utilization of this instructional unit.

We encourage teachers to carefully consider the season chosen for prairie study. While abiotic activities and individual investigations of plants and animals may be done effectively at any time, the fall prairie offers the most varied array of mature plants. This obviously ensures a better opportunity to observe wildlife. Winter segments offer twig analysis and animal print observations while spring studies may revolve around woodland wildflowers and prairie emergence. Be sure to consult with the Fermilab Education Office regarding the status of winter and spring curriculum developments.

Prior to the on-site visit, students must be acquainted with the equipment included in the kit, should exhibit acute observational skills, and be able to identify the majority of the plants and animals keynoted. These factors all relate to specific on-site activities. Even a full day trip may be too short or unsatisfactory unless a class is able to readily become involved and understands the terminology and lab techniques covered.

The prospect of teaching prairie study may be intimidating to the uninitiated classroom teacher. It is important to realize that precious few science teachers are proficient in this area because of the rarity of prairie throughout the world. This is an important reason for establishing this instructional unit. The knowledge base you will derive by your preparation for this instructional unit, coupled with your enthusiasm for the challenge of learning a new topic, will place you in the upper echelon of teachers in the area of prairie literacy. This background and interest will be passed on to innumerable students and colleagues. Ultimately, this will serve to make our corner of the universe a better place. Is this not one of the goals of science?

Unit Sequence

All labs and activities included in *Particles and Prairies* are designed to prepare students for a successful field trip to Fermilab's restored prairie. Because of the complex nature of the varied components of the prairie, considerable hands-on, interactive experience is necessary for students to build background. The labs and activities highlighted as critical must be performed prior to the Fermilab site visit to help ensure a successful experience. As previously noted, data gathered by students will be used in the construction of an on-site data base. While not all of the lab experiences will be conducted on the school site preceding the field trip, related activities requiring similar skills will prepare students. Sequencing, observing and following directions are key skills required.

Obviously, the science teacher cannot do all the activities and labs included. We strongly encourage implementation of these materials through the interdisciplinary team. Related activities are noted on the Interdisciplinary Team grid with appropriate suggestions for specific area involvement. On an abbreviated scale, a mini-interdisciplinary experience has been developed. The Monarch Butterfly Unit, included as a postvisit activity, will provide a one- to three-day cross-curricular activity to give grade level teams an opportunity to attempt a team approach for a shorter period of time.

Not all schools function in team format, and the following key components are outlined for the science teacher to teach this as a science unit:

DAYS 1 & 2: *What is a Prairie? - discovering what your class knows about the prairie* and specific topics they would like to study. - (pp. 29-32)

DAY 3: Science Journal - (1/2 period. This would be best introduced <u>prior</u> to the unit as part of the regular science curriculum). (5-10 minutes/day subsequent days - homework). - (pp. 33-36)
Candle Eating - observing (10 minutes) - (p. 41)
Calico Beans - classifying (20-25 minutes) - (p. 43)

DAY 4: Invertebrates: Prairie and Forest - collecting and setting up (20-25

minutes) - (pp. 125-129)
Research Component - (pp. 45-58)

DAY 5: Missing Link - importance of organisms within an ecosystem (15-20 minutes) - (pp. 61-62)
Invertebrates: Prairie and Forest - examining contents and identifying and classifying organisms (20 minutes) - (pp. 125-129)

DAY 6: Estimating Percentages - estimating
(With Days 7 and 8 this three-day lab/analysis is of particular importance for late spring and fall field trip. Obviously, weather conditions may force a teacher to be flexible in scheduling. Take care to include this exercise.) - (pp. 63-69)

DAY 7: Quadrat Study: School Lawn - (pp. 71-73)

DAY 8: Quadrat Study - collecting data - (pp.75-76)
Introduce Prairie Field Guides. - (pp. 469-513)

DAY 9: Measure Up - using equipment (Alternate with other activity if necessary skills are covered in regular curriculum.) - (pp. 77-83)

DAY 10: Prepare for Field Trip - viewing slide show and student orientation (30-40 minutes) - (pp. 8-14)

POSTVISIT: Thinking Environmentally - (pp. 193-195)
Prairie Plantings - ongoing observation - (pp. 197-199)
Seed Dispersal - (pp. 201-204)
Research Raps
Comparison of School Site/Fermilab Site Activities - (pp. 205-208)

Planning Your Fermilab On-Site Visit

General Information

Fermilab's Education Office must be called to reserve a day for your on-site visit (708-840-8258). Do this as soon as possible to ensure your first choice. The field trip may be conducted in rain. Students should wear long pants and appropriate shoes and socks (poison ivy plentiful) for walking in the prairie. Remind students to be prepared for inclement weather.

Lunches and drinks must be brought from school. If yours is an exceptionally large group, lunch arrangements must be made in advance. Because of time factors and the crowded condition of the Wilson Hall cafeteria at lunchtime, purchasing food on site will not be an option. Proper disposal of materials, food, etc. brought onto the Fermilab site is the responsibility of the visiting school (so please bring some garbage bags).

Your group must be chaperoned by enough adults to give at least a 1 adult to 10 student ratio. It would be most helpful if these adults knew in advance what the students were going to do and what their function as a chaperone is. In this way the chaperones hopefully will take an active part in the day's activities and have this be a positive experience for everyone. Your group will be assisted on its visit to Fermilab by some of our volunteers. These people are to help instruct and guide your group though the various activities. Please instruct your group in the proper etiquette for a field trip. We do not want our volunteers to have to be disciplinarians.

Research Team Format

Groups must be assigned prior to arriving at Fermilab. Groups should not exceed 20 students. Subgroups of three or four students within this format may be necessary. Be prepared.

Develop a list of "Prairie Names" to identify the groups. For example:

Plant Families	Animals
Mint	Nematodes
Silphiums	Butterflies
Grasses	Pseudoscorpions
Legumes	Squirrels
Composites	Foxes
Weeds	Beetles

The time requirements for on-site lab and observation experiences vary considerably. Check the following table to get an idea of what activities might fit into a nice program

for your group. The confirmation form allows you to choose appropriate activities for your students. Something that really helps our staff and we are sure will make your field trip here go more smoothly and be more meaningful, is to have your students fully prepared. They should have completed all of the previsit activities that are required for a particular field experience. We cannot stress this enough. In this way they will know how to use most of the equipment and what type of data they are expected to obtain. They should know precisely what they are going to do for the day. The students should also have all of the data sheets they will need for the various activities (we cannot supply them).

On-Site Lab and Observation Experiences

Early Spring/Winter Activities			Late Spring/Summer/Fall		
Activity/Lab	Time/ Hours	Site (See Fig. 1)	Activity/Lab	Time/ Hours	Site
Twig Tale	1.0	Woods near Plot 16	* ** Quadrat Study & Herbarium Collection	2-3	Plot 16
			Pollinator/Consumer	2.0	Plot 16
Life in a Log	1.0	Big Woods			
			* Nature Walk		Plot 16 & Woods
* *** Abiotic Study	2.0	Plot 16 and Woods			
			* Water Quality & Diversity	2-3	Sites 1 & 2
* Invertebrates of Prairie & Forest	1.0	Woods near Plot 16	* *** Abiotic Study	2.0	Plot 16 & Woods
* Water Quality & Diversity	2-3	Sites 1 & 2	* Invertebrates of Prairie & Forest	1.0	Plot 16 & Woods
Nature Walk		Plot 16 & Woods	Herbarium Mounts/ Interactive Video	1.5	Ed Center
Interactive Video Museum	1.5	Ed Center	Airborne Insects	1.0	Plot 16
			Fire Ecology	1.0	Plot 16

* Indicates key experiences.
** Students must have completed the lab, Measure Up.
*** Students must have completed the labs: Estimating Percentages, Quadrat Study: School Lawn, Research Component, and the Prairie Slides.

ACTIVITIES - LATE SPRING, SUMMER, FALL

TIME	QUADRAT STUDY	POLLINATOR CONSUMER	ABIOTIC STUDY	WATER QUALITY & DIVERSITY	INVERTS OF PRAIRIE & FOREST	PRAIRIE INSECTS	INTERACTIVE VIDEO	HERBARIUM MOUNTS	FIRE ECOLOGY
9:00 - 9:30									
12:30 - 1:00	LUNCH								
2:30									

INTRODUCTION AND ORIENTATION AT THE EDUCATION CENTER

REASSEMBLE AT THE EDUCATION CENTER AND BOARD BUSES

ACTIVITIES - WINTER, EARLY SPRING

TIME	ABIOTIC STUDY	WATER QUALITY & DIVERSITY	TWIGS	LIFE IN A LOG	INTERACTIVE VIDEO	INVERTS PRAIRIE & FOREST	INTERACTIVE VIDEO	MUSEUM	NATURE WALK
9:00 - 9:30									
12:30 - 1:00	LUNCH								
2:30									

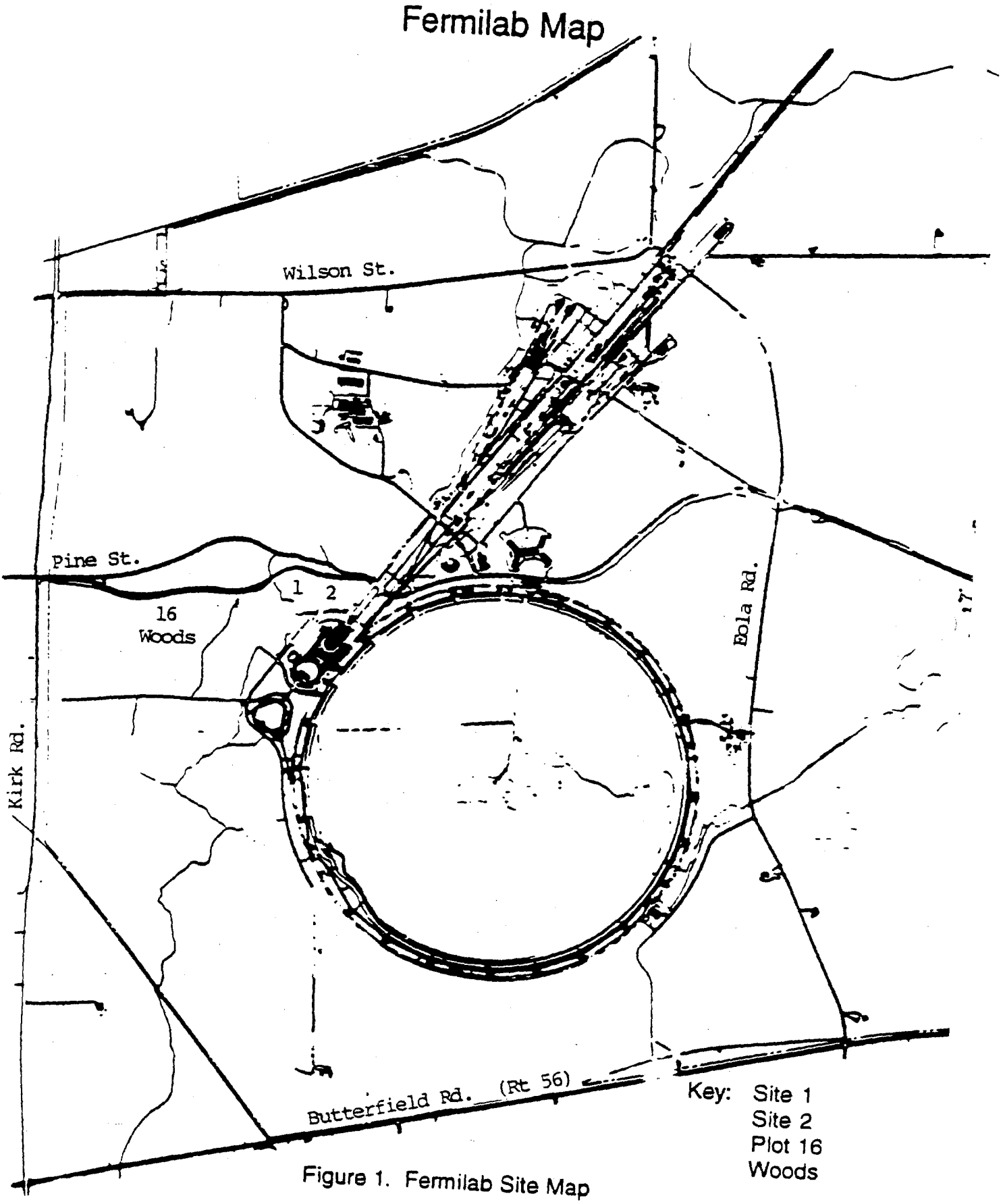


Figure 1. Fermilab Site Map

Audiovisual Resources

Introductory Video (in kit)

With each kit comes a five-minute video introducing students to the prairie and their role as researchers.

Prairie Preview Slides (in kit)

These slides will provide students with the visual background to enable them to identify the more common prairie organisms. The slides are Fermilab site specific and are of organisms likely to be encountered on the field trip.

Prairie Laser Disc (available at cost from Fermilab)

A Fermilab site specific laser disc has been developed for use manually or with a bar code reader. There is a separate laser disc manual and throughout the resource guide bar codes appear for selected topics.

Interactive Video (on site, can be used by three or four students at a time)

An important component of the Particles and Prairies program is the interactive video station, the integration of video, audio, and computer graphics and animations on a Macintosh computer with a videodisc player and video monitor. The videodisc contains video and images include approximately 900 slides with 600 slides of animals and plants of the prairie. The remainder of the 30-minute program on the videodisc consists of short video segments on the reconstruction project, early history of the site of the Fermilab prairie, the Fermilab prairie as an "outdoor lab," and abiotic and biotic components of the prairie. Videodisc technology allows random access of these videodisc "bites." All of this material is tied together by software in which related video "bites" are linked. For example, in the abiotic component, students can view video on the wind. Afterwards they have the choice of learning more about other abiotic components or learning about seed dispersal. The seed dispersal segment is also available under the topic of plants and insects.

Students visiting the Science Education Center will have an opportunity to use the station as part of their field trip. Software will allow students to explore the video material interactively and play games related to the various topics. Unlike a videotape or book, multimedia is a nonlinear experimental medium. The interactivity provided with the computer allows a student to have control of space and move quickly from one subject area to another without being constrained by the medium. It engages more than one sense. For example, a concentration game introduces students to the calls of prairie birds. Students are motivated to learn because they can control what they view and can focus on areas of particular interest or topics requiring clarification. They can see aspects of the prairie that they might miss in one visit to the prairie, such as a part of the prairie not open to the public or the prairie in different seasons. A series of

slides show the changes of the prairie over a two-year period. Another series shows how the prairie changes over three months after a burn. Students can use a controller to watch these time-lapse series.

The software is also a tool for identification. For example, after determining the color and blooming time, they can search through images of plants looking at all plants with that color and blooming time. Once they identify the plant, they can print out the description to take back with them to their school.

Evaluation

We discourage formalized testing over this material. Teacher's discretion is preferred in evaluation. Suggestions include:

- Active participation
- Research sheets
- Rap song
- Journal

Process Skills

Activities	Following Directions	Observing	Measuring	Recording	Classifying	Analyzing	Interring	Predicting	Communicating	Interpreting	Experimenting	Formulating Questions	Synthesizing
PREVISIT ACTIVITIES													
What is a Prairie?	•			•	•			•			•		
Student Priorities	•			•				•			•		
Slide Show/Video		•							•		•		
Journal		•	•		•	•	•	•	•		•	•	
Peanut Search	•	•	•	•	•			•	•				
Sustained Writing	•	•	•	•				•					
Candle Eating		•				•			•				
Calico Beans	•	•	•	•	•	•		•	•				•
Research Component	•		•	•	•	•		•	•				•
Prairie Rap	•				•			•	•				•
Missing Link	•	•				•	•		•		•		
Estimating Percentages	•	•	•		•		•	•	•				
Quadrat: School Lawn	•	•	•	•	•	•	•	•	•	•	•	•	
Measure Up	•	•	•						•				
What's the Weather?	•	•	•		•		•	•	•		•		
Prairie Collage	•	•						•	•				
Fermilab Prairie	•	•	•		•	•	•	•	•			•	
Peanut Butter Jelly Sandwich	•	•			•	•		•	•			•	
Blindman's Drawing	•	•	•		•	•		•	•			•	
Bird Houses	•		•									•	
*Pollinators/Consumers	•	•	•	•	•	•	•	•	•		•	•	
*Invertebrates: Prairie & Forest	•	•	•	•	•	•	•	•	•	•	•	•	

*At School or Fermilab

Process Skills

Activities	Following Directions	Observing	Measuring	Recording	Classifying	Analyzing	Inferring	Predicting	Communicating	Interpreting	Experimenting	Formulating Questions	Synthesizing
FERMILAB ACTIVITIES													
*Pollinators/Consumers	•	•	•	•	•	•	•	•	•		•	•
*Invertebrates: Prairie & Forest	•	•	•	•	•	•	•	•	•	•	•	•
Abiotic Study: Prairie & Forest	•	•	•	•	•	•	•	•	•	•	•	•
Herbarium Mounts	•	•		•				•				•
Nature Walk	•	•	•	•		•		•	•			
Quadrat Study: Prairie	•	•	•	•	•	•	•	•	•	•	•	•
Fire Ecologies	•	•	•					•				•
Water: Quality and Diversity	•	•	•	•	•	•	•	•	•	•	•	•
A Microhabitat: Life in a Log	•	•	•	•	•	•	•	•	•			
Prairie Insects	•	•	•	•	•	•		•	•		•	•
The Twig Tale	•	•	•	•	•	•	•	•	•			
									•	•	•	•
									•			•
POSTVISIT ACTIVITIES												
Baked Potato Lab	•	•	•	•	•	•	•	•	•	•		
Thinking Environmentally					•	•	•	•	•			
Prairie Plantings	•	•			•	•	•	•		•		•
Seed Dispersal	•	•	•	•	•	•	•	•	•			
Compare School/Fermilab Data		•			•	•	•	•	•		•	
Soil Structure	•	•	•		•	•			•	•	•	•
Real Estate Ads					•	•	•	•	•			

* At School or Fermilab

Interdisciplinay Connections

Activities and Time Requirements		Science	English	Reading	S Studies	Math	Other
PREVISIT ACTIVITIES							
What is a Prairie?	2 Periods	•	•	•			
Slide Show/Video	1 Period	•			•		
Journal	5-10 min./Period	•	•	•			
Peanut Search	1 Period	•					
Sustained Writing	10-15 minutes	•	•				
Candle Eating	1/4 Period	•					
Calico Beans	1/2 - 1 Period	•					
Research Component (LINKED)	3 Periods	•	•	•			
Prairie Rap (LINKED)	1 Period						Music
Missing Link	1/2 Period	•			•		
Estimating Percentages	2 Periods	•				•	
Quadrat Study: School Lawn	2 Periods						
Measure Up	1 Period	•				•	
What's the Weather?	Ongoing	•				•	
Prairie Collage	Homework		•	•			
Fermilab Prairie	3 Periods				•		
Peanut Butter/Jelly Sandwich	1/4 Period	•					
Blindman's Drawing	1 Period		•	•			
Homes for Birds	10 Periods						Construction
Pollinator/Consumer	2 Periods	•					
Invertebrates: Prairie & Forest	2 Periods	•					

Interdisciplinay Connections

Activities and Time Requirements		Science	English	Reading	S Studies	Math	Other
POSTVISIT ACTIVITIES							
Baked Potato Invertebrate Trap	1 Period	•					
Thinking Environmentally	1 Period	•			•		
Prairie Plantings	1 Period	•					
Seed Dispersal	1 Period	•					
Soil Structure	1 Period	•					
Real Estate Ads	3 Periods				•		Art
Monarch - Mini Unit	Depends on Discipline	•	•	•	•	•	
Comparison of School/Fermilab Data	1 Period						

Suggested Supervisory Assignments for Fermilab Visit

Activities and Time Requirements		Science	English	Reading	S Studies	Math
FERMILAB SITE ACTIVITIES						
Abiotic Study: Prairie & Forest	2.0 Hours	•				
Herbarium Mounts/Interactive Video	1.5 Hours		•	•		
Nature Walk						
Quadrat	2-3 Hours					
Fire Ecologies	1 Hour				•	
Water: Quality and Diversity	2-3 Hours	•				
A Microhabitat: Life in a Log	1 Hour	•				
Prairie Insects	1 Hour	•	•	•	•	•
Twig Tale	1 Hour	•				
*Invertebrates: Prairie & Forest	1 Hour	•				
*Pollinators/Consumers	1.5 Hours				•	•

State Goals

As a result of their schooling, students will:

Biological and Physical Sciences

STATE GOAL FOR LEARNING 1

Have a working knowledge of the concepts and basic vocabulary of biological, physical and environmental sciences and their application to life and work in a contemporary technological society.

STATE GOAL FOR LEARNING 2

Have a working knowledge of the social and environmental implications and limitations of technological development.

STATE GOAL FOR LEARNING 3

Have a working knowledge of the principles of scientific research and their application in simple research projects.

STATE GOAL FOR LEARNING 4

Have a working knowledge of the processes, techniques, methods, equipment and available technology of science.

Mathematics

STATE GOAL FOR LEARNING 1

Be able to perform the computations of addition, subtraction, multiplication and division using whole numbers, integers, fractions and decimals.

STATE GOAL FOR LEARNING 2

Be able to understand and use ratios and percentages.

STATE GOAL FOR LEARNING 3

Be able to make and use measurements, including those of area and volume.

STATE GOAL FOR LEARNING 6

Be able to understand and use methods of data collection and analysis, including tables, charts and comparisons.

STATE GOAL FOR LEARNING 7

Be able to use mathematical skills to estimate, approximate and predict outcomes and to judge reasonableness of results.

Social Sciences

STATE GOAL FOR LEARNING 2

Be able to demonstrate a knowledge of world geography with emphasis on that of the United States.

STATE GOAL FOR LEARNING 5

To apply the skills and knowledge gained in the social sciences to decision making in life situations.

What is a Prairie?

PURPOSE: To determine what students already know about the prairie.

OBJECTIVE: The student will recognize that much about the prairie is familiar and will categorize class-generated information into meaningful classifications.

BACKGROUND: This exercise is a valuable scheme-building activity that will fulfill its objective in any discipline. You may wish to have another academic teacher use this as a cross-curricular experience.

MATERIALS: Blackboard, overhead or large newsprint with markers
* Student pages
Scratch paper

* Starred items are included with the unit.

PROCEDURE:

1. Brainstorm with your class information about the prairie by asking, "When you think of a prairie, what comes to mind?

2. Accept all answers as valid and place the word or words on overhead, blackboard or newsprint. Encourage students to limit answers to one or two words. (approximately 15 minutes)

3. Continue until you have at least 40 responses. (Be sure not to cut off contributions too quickly. It is important that everyone has a chance to respond.)

4. Instruct students to copy words onto scratch paper and <u>individually</u> separate their responses into no more than five labeled categories. Label the circles on Student Page 1. (Remind students that these categories may be different than their classmates.) Write the appropriate responses in the labeled circle on Student Page 1. (approximately 15 minutes)

5. NEXT DAY: Teacher will separate class into groups of three or four students. (You may wish to utilize cooperative learning structure for activity.) Each student will share their category titles with the group, and the group will agree upon no more than <u>five</u> composite categories. (Leave students to their own devices for selection. Observe group dynamics.) Allow no more than 20 minutes to complete selecting, categorizing and writing responses on Student Page 2.

6. Reconvene class and ask all groups to share categories. List all topic titles on board or newsprint. Eliminate duplicates and ask for class suggestions to narrow titles to no more than five categories. Organize responses into five final groups. Students will fill out Student Page 3. (15-20 minutes)

7. VERY IMPORTANT! Homework Assignment - Instruct each student to write a short essay, compose a poem or draw a picture depicting what they think a prairie will look like. Collect and save until the day of the prairie trip.

Particles and Prairies - A Research Experience for Middle School Students Frame #s [03962-53728]

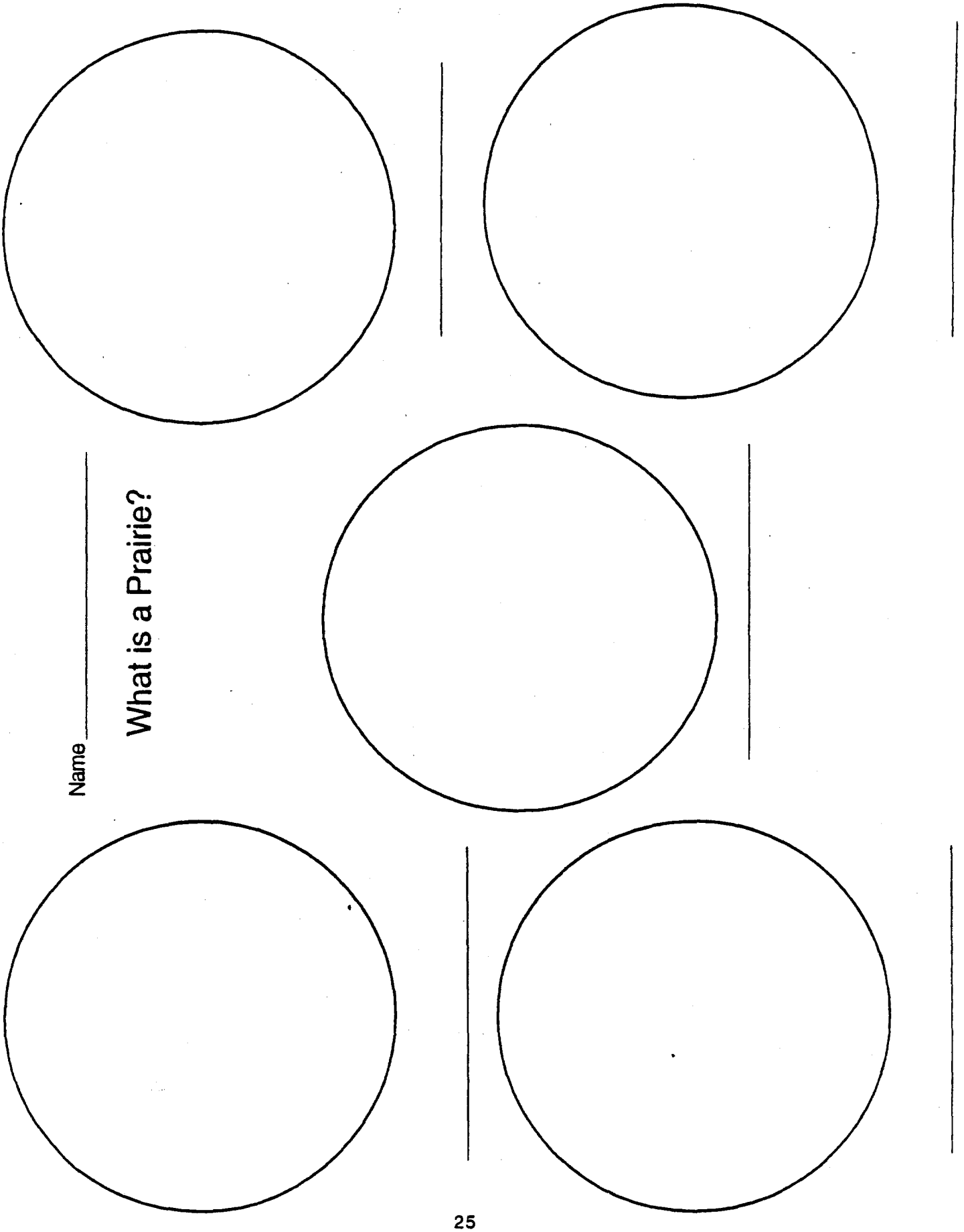
This is a combination of all motion sequences and includes the history, ecology, research and restoration of the Fermilab prairies. Teachers should note that all of the following motion sequence presentation topics are shown.

Name _____

What is a Prairie?

Name _____

What is a Prairie?



Name_____

What is a Prairie?

What is a Prairie? Student Priorities

PURPOSE: To establish areas of student interest for future study.

OBJECTIVES: The students will:

1. Assume "ownership" of the unit by establishing learning priorities.
2. Rank priorities allowing this list to become a base for cooperative learning groups.
3. Select organisms to be studied on the research component/rap song.

MATERIALS: Organism List - One per four students
* Student page
Pen or pencil

PROCEDURE:

1. Complete "Groups" Introductory activity.
2. Ask each student to indicate at least three general areas of interest regarding the prairie. (This should be based on the individual's interest, and not be influenced by the direction of their peers.)
3. Note categories on the board and record the number of responses for each category. Rank categories according to class interest.
4. Hand out the list of organism names so that each student has access to one. About one per four students or whatever works for your classroom. Instruct each student to list on their student recording sheets, at least two plants and two animals of particular personal interest.
5. Collect the sheets and construct cooperative learning groups giving each student at least one favored organism. Cooperative groups should be assigned at least one organism from each category. Make sure all organisms are being researched.

DISCUSSION QUESTIONS: Guide a general discussion about priorities as topics are recorded on board.

1. Do the topics reflect background information generated in the "Groups" strategy? Why or why not?
2. What is the most popular topic? Why?
3. What is the least popular topic? Why?
4. Is there ever any benefit in learning about that which you do not like? Explain.

*Note: The teacher should have no problem integrating favored student topics into the construct of a team unit.

Prairie Organisms

Amphibians/Reptiles
American Toad
Blanding's Turtle
Common Garter Snake
Dekay's Snake
Fox Snake
Leopard Frog
Plains Garter Snake
Smooth Green Snake
Tiger Salamander

Birds
Blue Jay
Bobolink
Flicker
Goldfinch
Grouse
Indigo Bunting
Meadow Lark
Red-tailed Hawk
Robin
Woodcock
Yellow Warbler

Invertebrates
Ant - Mound Builder
Aphid
Bumble Bee
Cicada Nymph
Crayfish
Cricket
Dogbane Beetle
Dragonfly
Etracheous
Grasshopper
Katydid
Ladybug
Monarch Butterfly
Mosquito
Orb Weaver Spider
Painted Lady
Robber Fly
Soil Nematode
Soldier Beetle
Springtail
Tumblebug, Dung Beetle
Walking Stick
Weevil

Mammals
Cottontail
Coyote
Deer Mouse
Fox Squirrel
Franklin Ground Squirrel
Meadow Vole
Pocket Gopher
Red Fox
13-lined Ground Squirrel
Woodchuck

Plants
Big bluestem
Compass plant
Culver's root
Indian grass
Little bluestem
Mountain mint
Prairie blazing star
Saw-toothed sunflower
Stiff goldenrod
Switch grass
Tall coreopsis
Wild bergamot

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.

What is a Prairie? Student Priorities

Name_____

PURPOSE: To discover the prairie topics that your class would most like to explore.

MATERIALS: Student page
Pen or pencil

PROCEDURE:
1. List at least three topics related to the prairie about which you wish to learn. What are your reasons?
2. Think about all the animals and plants listed. List two plants and two animals that are of interest to you. Why did you choose these?

I. Class Priorities:

What would you like your class to study regarding the prairie? What interests you?

Topics of Interest	Reasons
1.	
2.	
3.	

II. Individual Interests:

Choose two plants and two animals you would like to learn more about. Every effort will be made to allow you to have at least one of your choices in your research group.

Organisms	Reason
Animal _____	
Animal _____	
Plant _____	
Plant _____	

Science Journal*

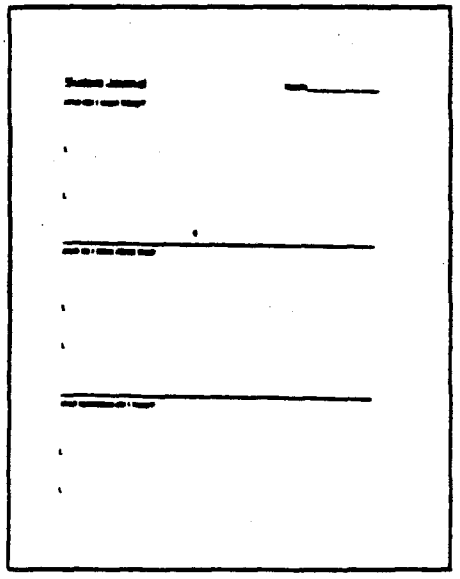
PURPOSE: To use the "writing connection" to assist students as they conceptualize activities and labs pertaining to the prairie.

OBJECTIVES:
1. Students will restate that which they have learned in terms or symbols understandable to them.
2. Students will react to material presented by stating attitudes and/or feelings.
3. Students will determine what they still want to know about topics explored.

MATERIALS: Journal
Pen or pencil

PROCEDURE:
1. Teacher will suggest that students divide daily journal page or paper into three components. (Need not be equal length.)
   A. What did I learn today?
   B. What do I think about this?
   C. What questions do I have?
      (What do I hope to learn?)
2. Encourage a variety of response strategies. (Noted in subsequent sections.)
3. Assure students that they will not be penalized for unconventional writing strategies, spelling, grammar, etc.
4. Periodically check students progress.

Sample Page: (*You may choose to use this product in evaluation.)



Journal Suggestions

1. Time/Order Sequence

_____

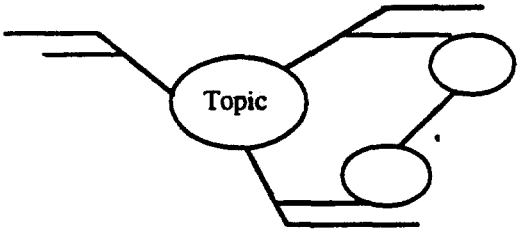
1. _____
2. _____
3. _____

2. Cause → Effect

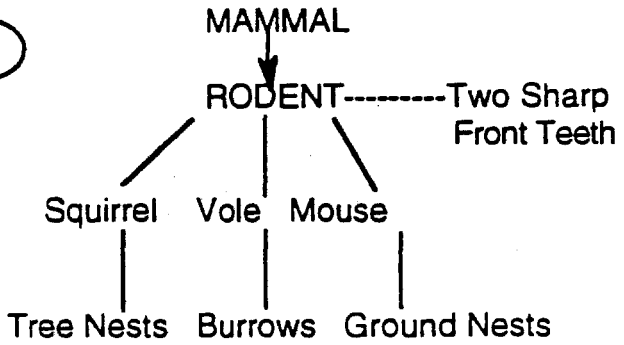
3. Problem → Solution

4. Problem → Solution → Result

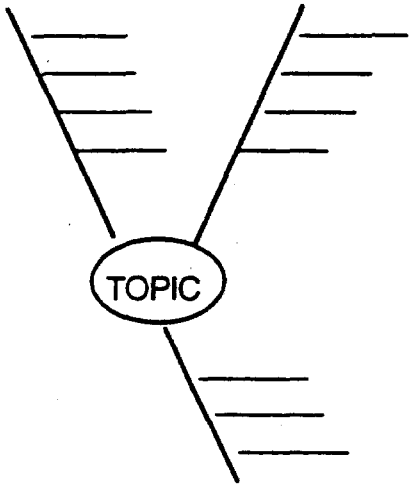
5. Mind Map



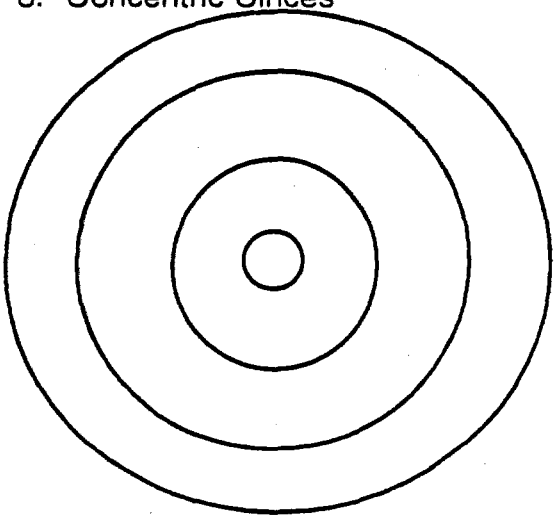
6. Word Map (example)



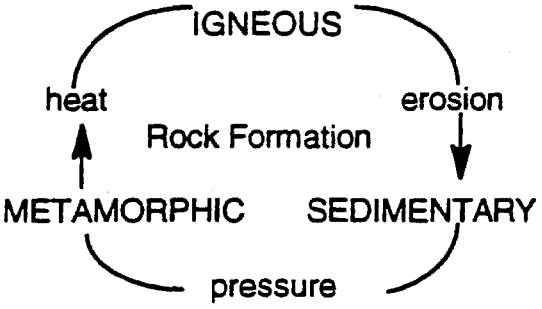
7. Spider Web



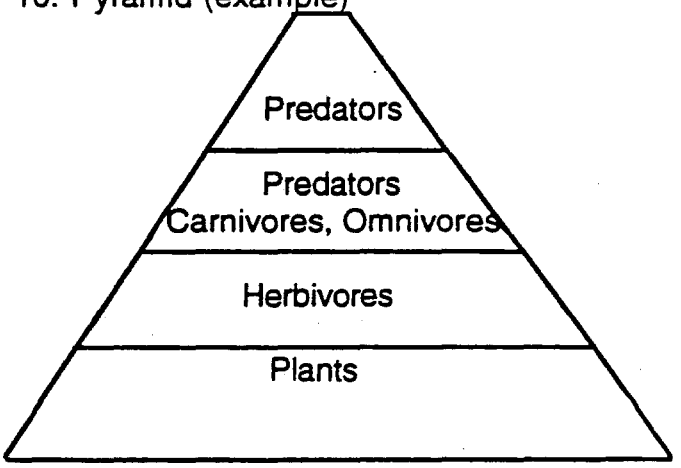
8. Concentric Circles



9. Cycle (example)



10. Pyramid (example)

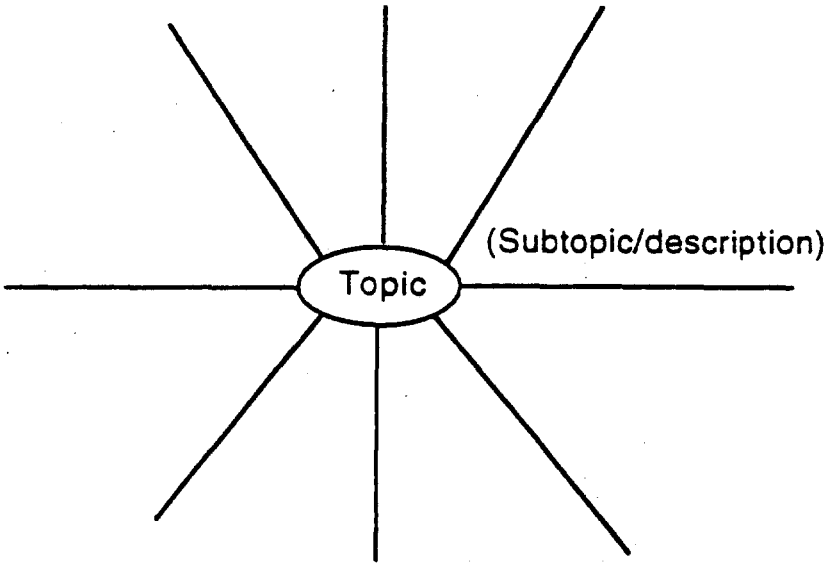


11. Matrix (example)

Animal	Antennae	Mouth Parts	Legs
Spider	None	Sucking	8
Butterfly	Long, Smooth	Sucking Proboscis	6
Grasshopper	Short, Smooth	Chewing	6
Moth	Feathered	*None on Proboscis	6

*doesn't eat in adult stage

12. Sunburst



13. Verbal description -
    Encourage word "pictures," poetry, etc. ...

14. Illustrations

15. Creative symbolism of any description

Peanut Search

PURPOSE: To improve students' observation skills.

OBJECTIVES: The students will:

1. Recognize that characteristics can be categorized differently by different people.
2. Practice observation skills by identifying peanuts based on physical characteristics.
3. Associate characteristics with classification in nature.

MATERIALS:
Paper or journal
Pen or pencil
One peanut (Shell ON) per student

PROCEDURE:

1. Distribute one peanut (in shell) to each student.
2. Instruct students to verbally <u>and</u> pictorally describe their peanut in journal or on paper. Advise the students not to mark the peanuts in any way.
3. Collect all peanuts and place on a center table or tray. Space them far enough apart so students do not crowd.
4. Students must identify and claim their <u>own</u> peanuts. (Peanuts claimed by more than one student must be awarded based on description provided.)
5. Collect all peanuts again and place them on a center table or tray. Have the students exchange peanut descriptions and then find someone else's peanut based on the description.
6. MUNCH the peanuts!

DISCUSSION QUESTIONS:

1. What are some characteristics common to all the peanuts?
2. What specific characteristics did you use to separate your peanut from the others?
3. Are all peanuts created equally? Explain.
4. How do we use characteristics to separate organisms in nature?
5. How do we use physical characteristics to classify plants and animals?
6. How does this activity apply to the prairie?

Sustained Writing

PURPOSE: To improve students' observation skills.

OBJECTIVES: The students will:

1. Focus upon a specific site noting details which could be overlooked with a cursory glance.
2. Compile observations noting details which are similar to and different from peers.
3. Appreciate the intricacy of common sights.

MATERIALS: Journal or paper on clipboard
Pen or pencil
1/2 Meter length of string (Ends tied to form circle.)

PROCEDURE:

1. In an outdoor school site area, instruct students to place string "circle" on the ground. (Be sure students are separated by enough area so they will not be distracted.)
2. Students will write for a minimum of 10 minutes (nonstop) describing everything within the circle.
3. Have the students go over their own (or another student's) writing and underline the observations that are <u>detailed</u> and <u>specific</u>: (Ignore general statements.)
4. Process observations with class discussion.

DISCUSSION QUESTIONS:

1. How did you feel about the assignment BEFORE you began? Did you think that it would be easy, difficult, boring, etc.?
2. Was the timed writing an easy task? Why or why not?
3. Compare your observations when you began to those you made at the end. Which was more detailed? Why?
4. How might this exercise help you in observing the prairie?

EXTENSION:

1. Repeat the activity throughout the unit several times with the same student in the same space. How has this area changed?
2. Continue this activity sporadically throughout the school year noting seasonal changes.

Candle Eating

PURPOSE: To improve students' observation skills.

OBJECTIVES: The students will:

1. Appreciate the importance of careful observation as opposed to assumption by association.
2. Recognize that events or items are not necessarily what they appear to be.
3. Relate the importance of observation skills from a scientific perspective.

MATERIALS:
One potato
One paring knife or apple corer
Several hazelnuts (Filberts) - NOT dry roasted (Brazil nuts work.)
Matches

PROCEDURE:

1. PRIOR TO CLASS - prepare "candle."
   A. Pare potato into candle shape (dip in "Fruit Fresh" or lemon juice to retain color. Wrap in plastic or place in plastic bag until ready to use.)
   B. Carve a "wick" out of a hazelnut. Place on "candle."
2. Display "candle" to class. Light wick and ask for oral observations. (Hazelnut has enough oil to support flame.)
3. After typical "candle-like" observations have been offered, blow out "candle."
4. Bite off top of candle and eat. (You probably won't want a BIG bite.)
5. Discuss.

DISCUSSION QUESTIONS:

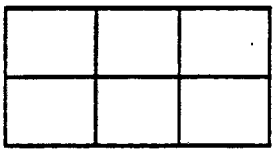
1. Why were students giving "candle" characteristics to a potato and a hazelnut?
2. Think about some occurrences in nature that are not what they seem to be. Name two.
3. Define a good observer.
4. Why is it important for a researcher to be a good observer?

Calico Beans

PURPOSE: To improve students' classification skills.

OBJECTIVES: The students will:

1. Categorize and group beans based on physical characteristics.
2. Recognize a variety of effective ways to categorize information.
3. Relate categorizing by physical characteristics to classification of plants and animals.

MATERIALS: Minimum of 12 different types of beans for each student
(Rice or other reuseable materials may be included.)
Paper divided into sixths---> 
Pen or pencil

PROCEDURE:

1. Mix all beans and distribute a handful to each student.
2. Instruct students to group "like" beans on sections of paper. Be sure to use at <u>least</u> four sections.
3. Label sections according to specific characteristics used to categorize beans. (Examples: smooth, spotted, white, round)
4. When all students have completed their bean classification, have them mix up their beans again. The students should then exchange papers and use their classmate's classification system to classify the beans.
5. Return the papers to their owners. Record all appropriate responses on the board or overhead. Combine similar responses (i.e., gold, yellow).
6. Compare rationales and discuss.

DISCUSSION QUESTIONS:

1. Did everyone categorize in the same manner? Why or why not?
2. Was anyone "wrong?" Is everyone able to justify their category?
3. Think of some ways we categorize (classify) items in our daily lives. List at least three ways.
4. Why might classification be important in science?
5. How do biologists use classification to identify and study plants and animals?

Research Component

PURPOSE: To familiarize students with specific prairie organisms they may encounter at Fermilab.

OBJECTIVES: The students will:

1. Research at least five organisms representing plants, invertebrates, birds, mammals, reptiles and amphibians.
2. Share this information as "experts" to the class members by composing a "rap" song.
3. Assemble a class field manual.

MATERIALS:

* Data sheets
Rap music tape
Teacher resource sheets in Materials section of this book

PROCEDURE:

1. Divide class into cooperative learning groups. Group students heterogeneously according to ability with high achievers, average students and low achievers in each group. Groups should contain three or four members. Student roles may include:
   chairperson
   recorder(s)
   reporter(s)
2. Xerox data sheets as follows:
   Plants: green
   Invertebrates: yellow/pastel
   Mammals: pink
   Birds: blue
   Amphibians/reptiles: yellow/goldenrod
3. Distribute data sheets so groups have at least one of each. Several groups may have more than one of a given category. Emphasize that <u>not every blank</u> will need to be filled. Some information is obscure and may be difficult to find (see data sheets included in the kit).
4. In the box on the data sheet have the students accurately draw and color the organism.
5. Play rap background music and distribute rap lyrics as model for presentations. Rap song may be introduced in music class.
6. Allow a minimum of two days for research and one day for presentations. Presentations may be a post-lab experience.

DISCUSSION QUESTIONS:

1. Whose animals/plants are most important? Why?
2. The most interesting facts about our organisms are _____.

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 _____

Common Name _____

7. Species _____ _____

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 _____

Common Name _____

7. Species _____

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 X W cm = Area cm^2

$$\frac{\text{Area } (cm^2)}{10000\ cm^2} = \%$$

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?

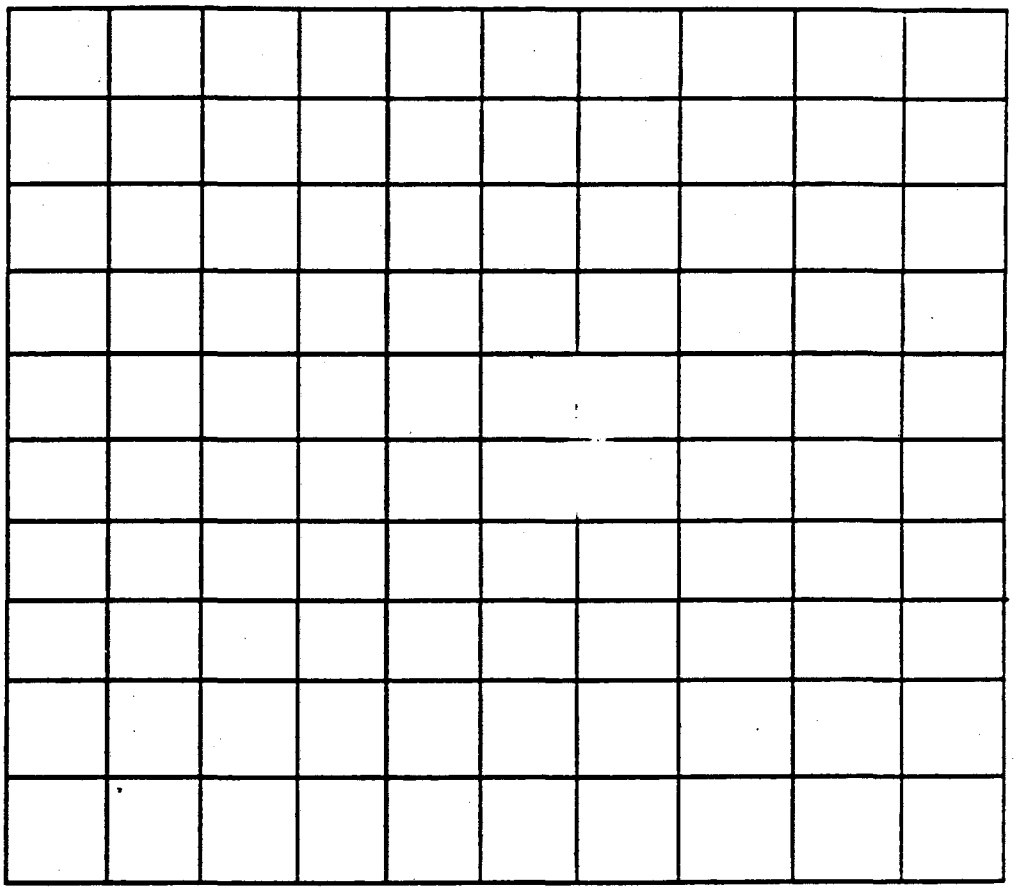
Name_____

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?

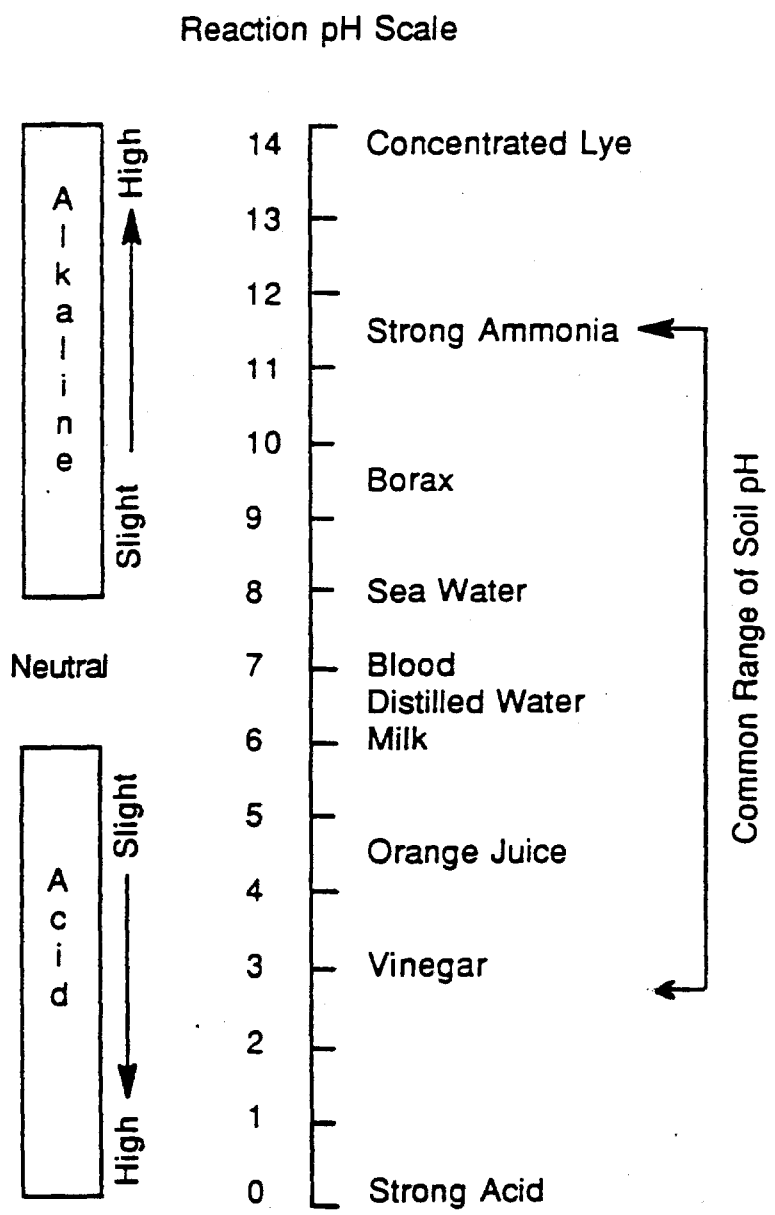


Figure 1. The pH Scale and some common substances with their pH values.

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

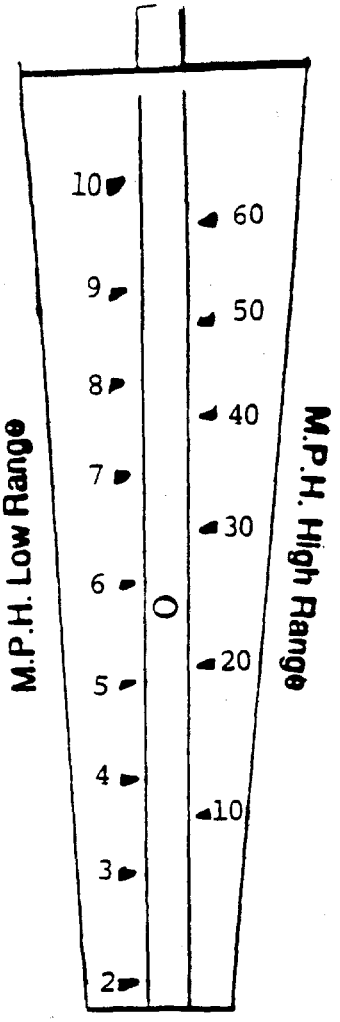
1. Place the perculation tube into the ground up to the 5 centimeters line marked on it.
2. Fill the tube with water to the 1 liter line; start the stop watch.
3. Stop the watch when all of the water has drained out of the tube.
4. Use the following formula to calculate the perculation rate:

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					

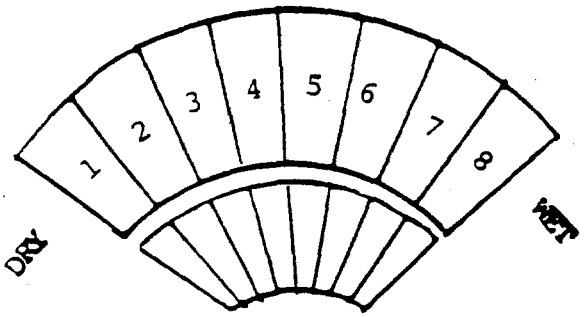


Wind Meter

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.

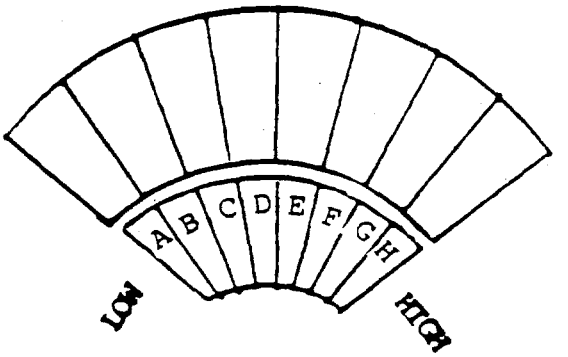
Low range wind speed on this wind meter is
M.P.H.

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]

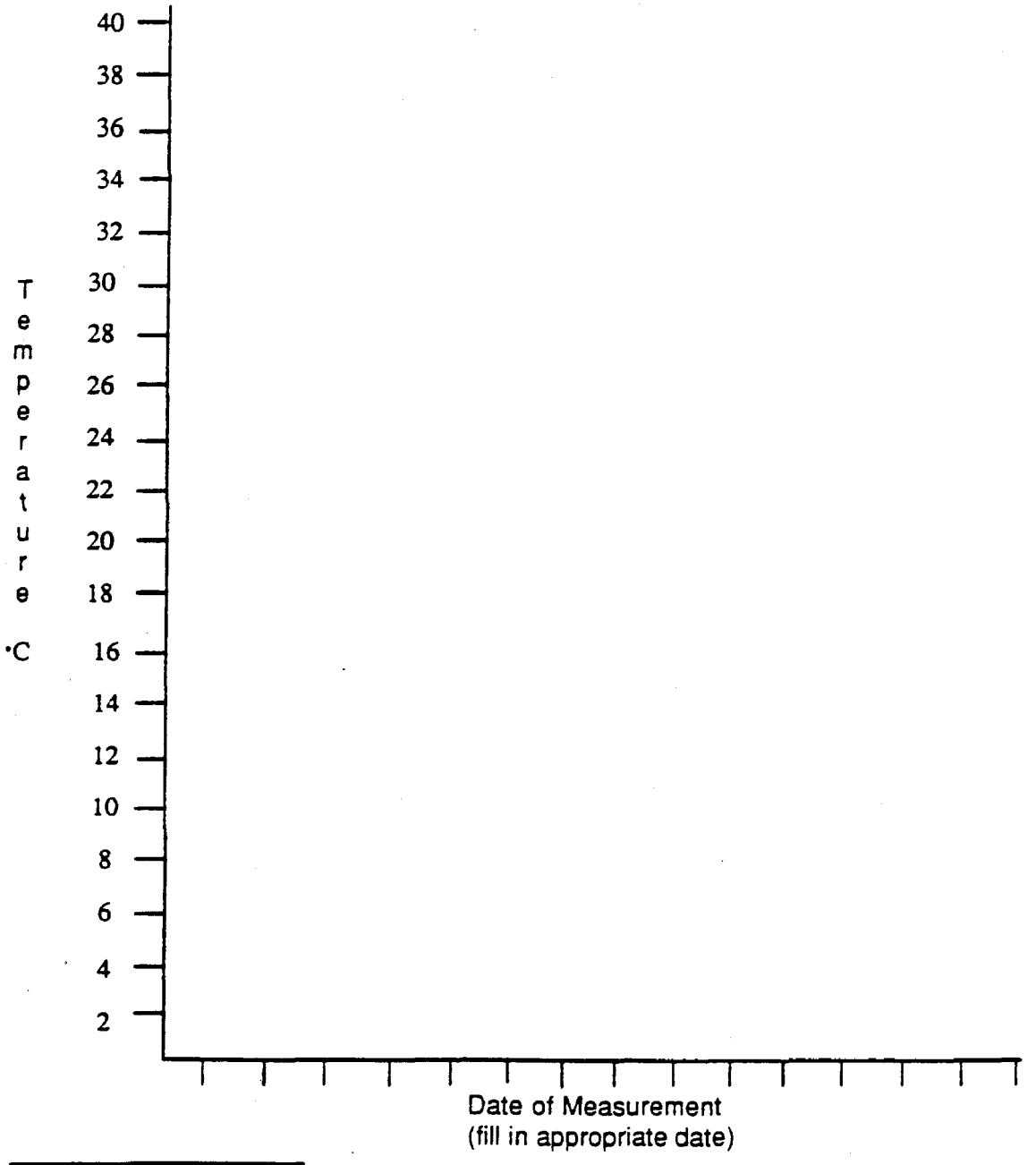
Water Frame #s [39332-41819]

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 <u>cannot</u> 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_____

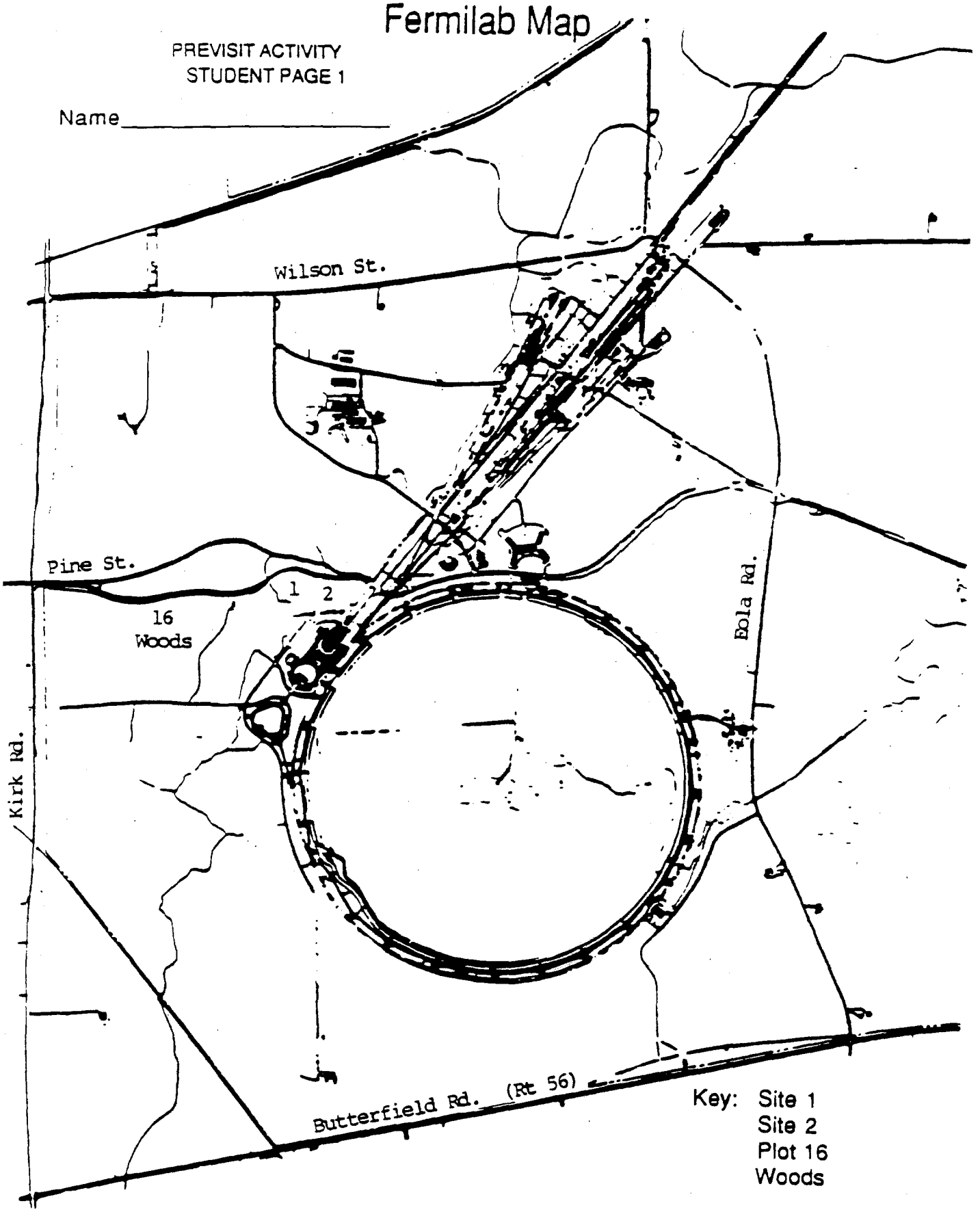


Figure 2. Fermilab Site Map

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

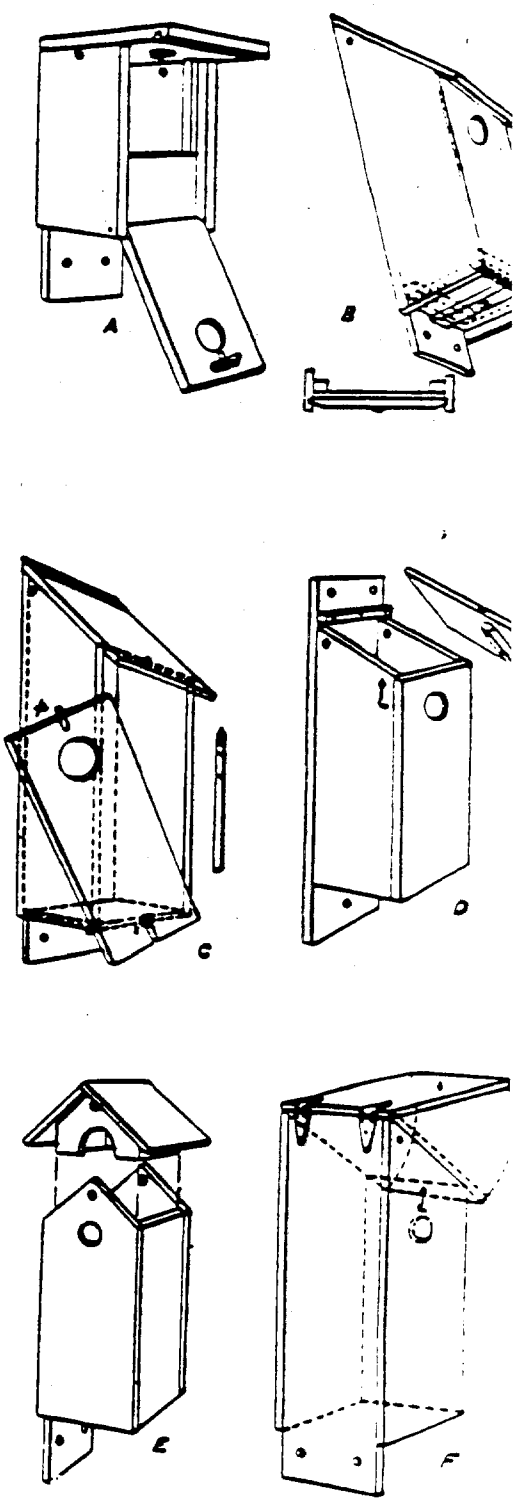


Figure 3.

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

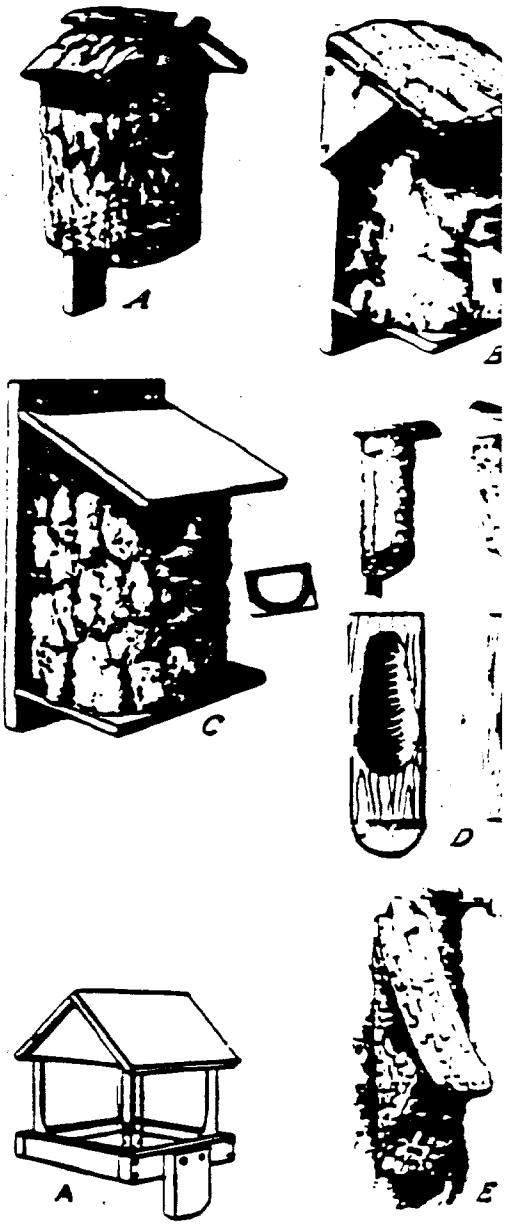
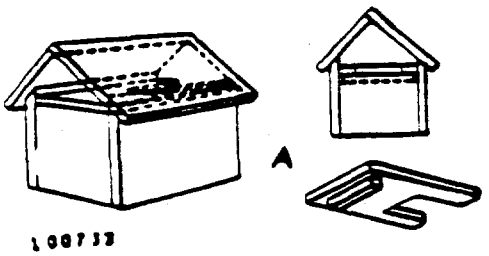
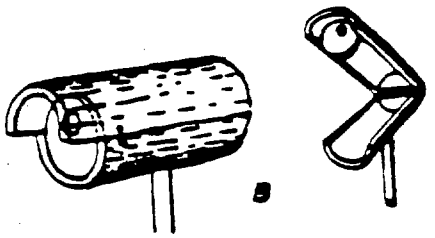


Figure 4.

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.





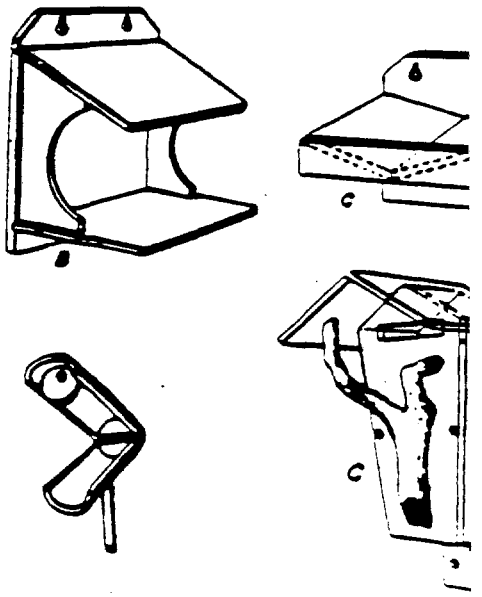


Figure 5.

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.

Pollinators and Consumers

PURPOSE: To study the interrelationships between specific plants and animals.

OBJECTIVES: The students will:

1. Correctly identify specific pollinators, consumers, predators and plants involved in the study.
2. Accurately observe and report data.
3. Interpret data and accurately relate this interpretation to the definition of pollination and the balance necessitating predation in the prairie.

BACKGROUND: Pollination and predation are necessary events in the prairie ecosystem. In order for reproduction to take place, pollen must be removed from the stamen's anther on one plant and introduced to the pistal's stigma on another plant usually of the same species. Wind, and to a much lesser degree, water are pollinators, but much pollination is dependent upon insects.

In order to maintain a balance in nature, insects do a certain amount of plant damage and, some prey upon other insects in the prairie. These acts rather than being purely destructive are important in the maintenance of the ecosystem.

Because of the diversity of insects in a prairie, the student will concentrate on honeybees, bumblebees and butterflies as the primary pollinators, realizing, of course, that many other insects are involved in this process.

The observations of the consumers (herbivores and carnivores) will need to be somewhat generic in nature. Without access to understandable insect/arachnid field guides, a general description of the consumer will be sufficient. (i.e., spider, beetle, larva, etc.)

Students will be focusing on a wide variety of forbs (flowers) and will need to be familiar with the primary prairie plants if this lab is done on a prairie site. This exercise will be easily accomplished on an open field site near a school building with students observing insects on common flowers such as clover, dandelions, or garden flowers.

This lab can be adapted easily to a school field site if a local prairie is not readily available. The Fermilab prairie would be ideal for follow-up or as an on-site activity. Data collected will be site specific for Fermilab and may contribute to our overall efforts in determining the status of the educational prairie site.

MATERIALS:

* *Particles and Prairies Field Guide*, found in the Materials section of this book. (If lab is conducted on a prairie site.)
Clipboard
* Data sheets
Pencils with erasers
Watch with second hand or stopwatch
Binoculars - one pair per group. (Not mandatory, but very helpful.)
Insect medication if allergic to specific insect bites.
Perseverance, energy and P.M.A. (positive mental attitude).

PROCEDURE:

PRELAB

1. Prior to lab, students should develop the following hypotheses:
   - Will pollinators tend to visit only one kind of flower, or several different species?
   - Will a favored flower have specific features that make it more attractive? If so, what are these characteristics?
   - Will you see evidence of any animals eating or, in any way damaging plants in the prairie? If so, what do you think will be occurring?
   - Will you see evidence of any animals eating or, in any way damaging other animals in the prairie? If so, what do you think will be occurring?
   - Are insects good or bad for the prairie? Explain your response.
2. Ask students to individually contemplate their hypotheses and write them down on the Data Sheet 1.
3. As a class brainstorm hypotheses. Use newsprint or some other permanent method to record class consensus.
4. At the end of the exercise, students will use their data to draw conclusions.

LAB

1. Assign students to cooperative groups of three or four students. Students should divide observation and data collecting tasks within their group. No one set of students can accomplish all four tasks unless several trips to the field are scheduled. In each group at least one student should be assigned to each of the following tasks:
   - Locate and identify pollinator. (Data Sheet 2)
   - Observe every visit and the length of time at each flower, even if it is only a few seconds. (Data Sheet 2)
   - Identify all flowers the pollinator visits in a 10-minute period. (Data Sheet 3)
2. Student groups enter prairie or field to gather data, being careful NOT to trample vegetation in the process!

3. Students find and describe at least five different evidences of plant damage and attempt to identify source(s) of damage. (Data Sheet 4)
4. Students observe and record at least two examples of predation. (one animal capturing, killing or devouring another animal) (Data Sheet 5)

POSTLAB

1. Present list of hypotheses from prelab.
2. Collect and record class data for pollinators. (Data Sheet 6) (Reproduce on board or use overhead projector.)
3. Ask students to note similar data and any obvious deviations from expected results.
4. Repeat process for plant damage. (Data Sheet 7)
5. Repeat process for predators. (Data Sheet 8)
6. Compare data collected with hypotheses from prelab.
6. Process data collected with hypothesis from prelab. Be sure to note sources of error in class conclusion if necessary.

DISCUSSION QUESTIONS:

See Data Sheets (6,7, & 8)

1. Which original hypothesis was best supported? Which was disproven? Are you surprised? Why? Why not?
2. Can you think of sources of error?
3. Which forb appeared to be most popular? Why?
4. Were any forbs not visited at all? How might they be pollinated if not by insects?
5. List advantages/disadvantages of pollinators and consumers.
6. Were any pollinators also consumers? If so, name them.
7. Can we do without either pollinators or consumers? Why or why not?

CONCLUSION: Compile all data. Ask students to note all similarities and tendencies to construct class conclusion. Include all topics covered in hypothesis. Consider sources of error if necessary.

The *Particles and Prairies* Videodisc may be used to support this activity.

Name _____

Pollinators and Consumers
Data Sheet 1

Think about the kind of invertebrate life you may see on the prairie. What might these spiders and insects be doing? How might they be affecting the plants and other animals around them? Take time to write a well-constructed hypothesis for each of the questions below. The conclusions will be done at the end of the lab.

1. Will pollinators tend to visit only one kind of flower or several different species?

   Hypothesis:

   Conclusion:

2. Will a "favored" flower have specific features that make it more attractive? If so, what might these characteristics be?

   Hypothesis:

   Conclusion:

3. Will you see evidence of any animals eating, or in any way, damaging plants in the prairie? If so, what do you think will be occurring?

   Hypothesis:

   Conclusion:

4. Are insects good or bad for the prairie? Explain your response.

Name_____

Group #_____

Pollinators and Consumers

PURPOSE: To observe specific invertebrates as they move from flower to flower and to determine preferences to specific plants. To observe plant and animal destruction and to determine the source of this damage.

PROCEDURE:

1. In your group, decide who will do each of the following tasks:
   - Locate and identify pollinator. (Data Sheet 2)
   - Observe every visit and the length of time at each flower, even if it is only a few seconds. (Data Sheet 2)
   - Identity all flowers the pollinator visits in a 10-minute period. (Data Sheet 3)
2. Enter prairie or field to gather data. BE CAREFUL NOT to trample vegetation in the process!
3. Find and describe at least five different evidences of plant damage and attempt to identify source(s) of damage. (Data Sheet 4)
4. Observe and record at least two examples of predation. (one animal capturing, killing or devouring another animal) (Data Sheet 5)
5. Write a conclusion to your hypothesis recorded on Data Sheet 1.

Name _____

Group # _____

Pollinator Observation Sheet
Data Sheet 2

Record how much time in seconds the insect spends at a specific flower. Record flight interval times between revisits. At the end of the 10 minutes, add up the total amount of time in seconds at a flower and the total amount of time in seconds in flight. Divide by 600 (the # of seconds in 10 minutes) and determine the percentage of time at each activity.

Insect Observed_____

$$\frac{\text{Total number of seconds at flower}}{600} \times 100 = \text{percentage of time pollinating}$$

$$\frac{\text{Total number of seconds in flight}}{600} \times 100 = \text{percentage of time flying}$$

TIME IN SECONDS ON FLOWER	TIME IN SECONDS IN FLIGHT	FLOWER OBSERVED	TIME IN SECONDS ON FLOWER	TIME IN SECONDS IN FLIGHT	FLOWER OBSERVED

TIME IN SECONDS ON FLOWER	IN FLIGHT	FLOWER OBSERVED	TIME IN SECONDS ON FLOWER	IN FLIGHT	FLOWER OBSERVED

Total Number of Seconds on Flower_____ Total Number of Seconds in Flight_____

Pollinators and Consumers Data Sheet 3: Preferred Forb (Flower) Observation Sheet

Name_____

Group #_____

DIRECTIONS: Identify the type of forbs your pollinator visits. Be sure to use descriptive adjectives to develop a "word picture" of the plants. Remember, your insect may visit many or just a few types of plants. Record data for each TYPE of flower, not each individual visit. (Example: If your insect visits a clover 16 times, you only need to describe clover once.)

Name of Forb	Color	Forb Odor	Leaf Odor	# of Petals	Location of Pollen	Developmental State of Forb (open, bud, withered)	Other
Flower 1							
Flower 2							
Flower 3							
Flower 4							
Flower 5							

Pollinators and Consumers Data Sheet 4: Plant Damage Observation Sheet - Plants

Name_____

Group #_____

DIRECTIONS: Make an effort to find FRESH damage. It would be best to observe damage as it is occurring in order to identify the consumer. Find at least five examples.

Plant Being Consumed	Description of Damage	Location of Damage	General Condition of Rest of Plant	Description of Consumer	Name of Consumer

Pollinators and Consumers Data Sheet 5: Predation Observation Sheet - Animals

Name_____

Group#_____

DIRECTION: Do you see any evidence of predation? Note any instances where you observe an animal capturing, killing or devouring another animal. You will need at least two examples.

Predator	Description of Predator	Victim	Description of Victim	Scene of "Crime"	Cause of Death

Pollinators and Consumers
Class Data Sheet 6: Pollinators

DIRECTIONS: Student groups will take turns reporting data one source at a time until all data has been exhausted. (Many students may have similar data.)

Group #	Pollinator	# of Kinds of Forbs Visited	Names of Forbs	# of Visits to Forb
1				
2				
3				
4				
5				

Group #	Pollinator	# of Kinds of Forbs Visited	Names of Forbs	# of Visits to Forb
6				
7				
8				

Pollinators and Consumers
Class Data Sheet 7: Plant Damage

DIRECTIONS: Student groups will take turns reporting data one source at a time until all data has been exhausted. (Many students may have similar data.)

Affected Plant	Type of damage	Amount of damage minor, moderate, major	Consumer

Pollinators and Consumers
Class Data Sheet 8: Predators

DIRECTIONS: Student groups will take turns reporting data one source at a time until all data has been exhausted. (Many students may have similar data.)

Victim	Cause of Death	Consumer

Invertebrates in the Prairie and Forest

PURPOSE: To compare numbers and types of invertebrates that can be found within the vegetative litter or just at or below the soil surface of the prairie and the forest.

OBJECTIVES: Students will:

1. Identify six major groups of terrestrial invertebrates.
2. Use a dichotomous key.
3. Compare the invertebrate fauna of the prairie with that of the forest.

BACKGROUND: One of the most remarkable characteristics of the flowering prairie is its capacity to maintain itself. It is distinguished by the fact that it provides a rich food source for various forms of animal and plant life by the fact that its remains do not accumulate permanently. There is an inevitable piling up of materials on the prairie floor that remains until the area is burned. This activity is intended for a prairie that has not experienced fire for several years. Refer to *Fire Ecology* lab for the importance of the Prairie Fire.

The surface of the forest floor may appear to be a lifeless carpet of refuse and dead leaves, but immediately below the top layer are the decaying remains of other seasons, occupied by a busy community of tiny organisms. Deeper still, the humus, dark spongy material formed from the litter, is honeycombed with passageways and burrows of insects, worms, moles, and the roots of plants.

The invertebrates found within the vegetative litter or just at or below the soil surface are a major part of an ecosystem that often goes unnoticed. These animals represent a wide variety of feeding strategies and habitat requirements. A familiarity with the major invertebrate phyla found on the forest floor and the base of the prairie will help one to understand the complexities of these systems.

Materials:

* Particles and Prairies Invertebrate Field Guide
* Particles and Prairies Invertebrate Dichotomous Key
* Berlese Funnel Setup
* Particles and Prairies Invertebrate Wanted Posters

Sampling equipment such as:

- Trowels
- Assorted bags or containers
- Plastic petri dishes
- Probes (may be as simple as plastic straws cut on an angle)
- Magnifying lenses (Reflective light or dissecting microscopes are recommended.)

Procedure:

1. Select the sampling sites. (Invertebrate analysis using a Berlese funnel can be done in a variety of habitats. If access to a prairie or a forest is not available, two other ecosystems may be substituted.) Each student team (a four-member team is suggested) needs a small defined plot to sample. Sample plots may be defined with string, small hoops or other devices that can be standardized. A suggested plot size is about 30 cm^2.
2. Using the sampling equipment, the student should collect all the material within the plot including about one centimeter of the surface soil. The students should place the sample in a plastic bag or container and label the sample with the date, location and any other pertinent data you wish to include.
3. Upon your return to the classroom, set up the Berlese funnel apparatus according to the diagram. The students should empty the contents of their sample bags into the funnel. Label information should follow the sample. (Multiple Berlese funnel setups are useful for speeding up the collection process.) The light bulb should be positioned above the material close enough to provide heat and light, but not so close to promote a fire. Keep the light burning day and night for at least 24 hours. Depending on the type and amount of material collected, several days or more may be needed to drive all of the invertebrates into the collecting bottle.
4. Using a spoon, transfer small quantities of the collected material to open petri dishes. One collection jar should provide enough material for four or more dishes. Replenish the alcohol as it evaporates since it preserves the specimens and, when using magnification, provides uniform light diffraction.
5. Using magnification and a probe, students should analyze the material for invertebrates. Students should record the number and phylum for each invertebrate. Have the students sketch the organisms they find.

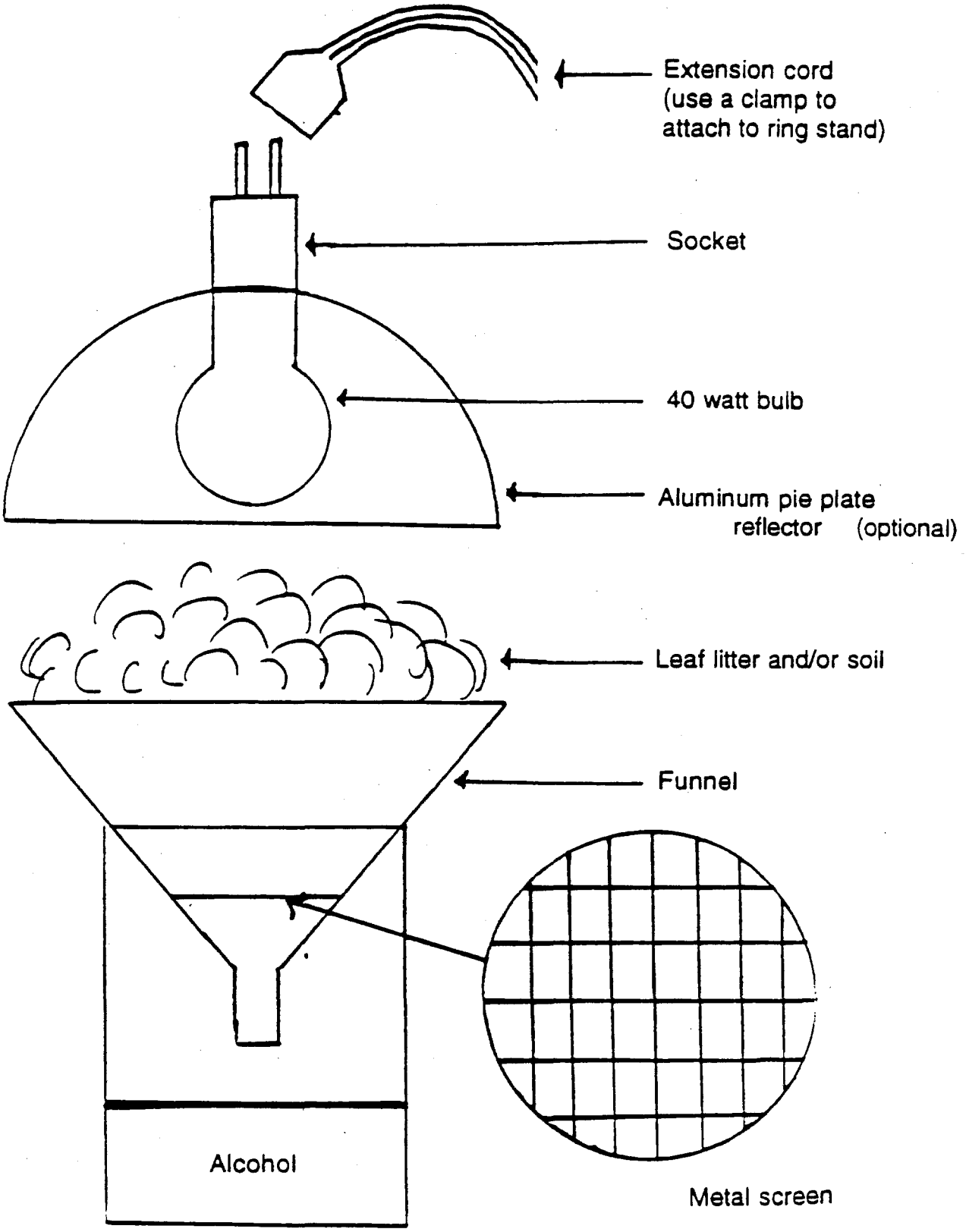
DISCUSSION QUESTIONS:

1. What are the differences and similarities between the invertebrate populations of the prairie and the forest?
2. Do the types of invertebrates found indicate certain environmental conditions? certain fauna or flora? (Life history research is helpful here.)
3. What questions can you pose about invertebrates, biomass and energy transfer in these ecosystems? What measurements might you make to answer your questions?

EXTENSION: Collect leaf litter from an area around school. (vacant lot, forest, etc.) Compare organisms.

The *Particles and Prairies* Videodisc may be used to support this activity.

Berlese Apparatus



Name_____

Sample Location _____
(prairie, forest, savannah, etc.)

Invertebrates in the Prairie and Forest Data Sheet

Name of organism	Sketch	Number Found	What do they eat?	NICHE: Scavenger, Herbivore, Carnivore, etc.

Abiotic Study: Prairie and Forest

PURPOSE: To compare the environmental conditions of the prairie to that of a forest.

OBJECTIVES: The students will:
1. Accurately record data.
2. Interpret data to draw conclusions about why plants grow where they do.

BACKGROUND: In the prairie different flowers bloom from mid-spring through the fall. In the forest next to the prairie we have only early spring wildflowers. Also, the plants found in these two ecosystems are different even though the two ecosystems are right next to each other. Why is this?

Although these ecosystems are very close to each other there must be some reason why the two ecosystems contain such different plants. In this study the students will collect the abiotic data that might help explain these plant differences.

One of the important abiotic factors in an ecosystem is the soil. Therefore you should know about how soil is formed. The land areas of the earth once were barren rock with no soil cover. These exposed rocky masses were constantly acted upon by winds, rains, ice (glaciers) and water. The rocks began to break down. When the first land plants, pioneer plants, moved onto the land, they were small and adapted to hold onto rock surfaces. The weathering actions of the physical forces along with the chemical influences of the early plants continued the breakdown of the rocks. Plants died and their bodies added nutrients to the soil in the making that gave it some of the properties we look for in productive soil. After a long period of time, all these forces produced soil pretty much like the soils of today. Soil building is still going on in many places, and some aspects of the process can be observed.

Mosses and lichens are pioneer plants. They are adapted to living on rock surfaces and they contribute to the disintegration of the rocks over long periods of time as part of the soil building. You can find exposed rocks or boulders in wooded areas and adjacent places. Many will already have begun to break down and will have lichens and mosses attached as well as some other plants which managed to find a place in a tiny crevice or in an accumulation of materials in a depression or cavity on the surface of the rock.

MATERIALS: Data sheets
For each group:
Thermometer
Wind gauge
Psychrometer
Light intensity meter
Soil moisture meter
Soil percolation tube
Water supply
Waste container
Soil test kit with laminated instructions
Stopwatch or wristwatch
Meter stick

PROCEDURE:
1. The students will require instruction in the use of the meters, gauges and the soil test kit.
2. Collect data and answer discussion questions.

DISCUSSION QUESTIONS:
1. Which ecosystem had the highest temperature at each level?
   1 meter
   15 centimeters
   ground level
   5 centimeters below ground level
2. Which ecosystem had the most wind?
3. Which ecosystem had the highest relative humidity?
4. Which ecosystem had the greatest light intensity?
5. Which ecosystem had the most soil moisture?
6. High wind, low relative humidity and high temperatures all cause water to be lost from plants. In order to survive in an area like this the plants must be specially adapted. In which ecosystem would we probably find more plants adapted to prevent water loss?
7. Why do you think fewer plants grow on the forest floor?
8. The soil supplies the needed nutrients for the plants in both ecosystems. Unfortunately our prairie is not a virgin prairie with its thick rich soil. This area had been farmed for many years thus altering the soil. Three of the most important nutrients for good plant growth are Nitrogen (N), Phosphorus (P), and Potassium (K). Nitrogen is essential for proper plant cell metabolism and protein formation. Nitrogen gives plants their dark green color and helps the growth of leaves and stems. Phosphorus is the soil nutrient responsible for the formation of healthy roots. Phosphorus also encourages the blooming of flowers, seed formation and resistance to disease and weather extremes. Potassium is the soil nutrient that stimulates flowering and helps

produce sugar and starch during photosynthesis. Did you find any difference in the nutrient levels between the two ecosystems? If so, what was the difference?

9. The soil pH is very important to the plants of any ecosystem because it determines which nutrients will be soluble and therefore available to the plants. This is because plants can only take in nutrients that are dissolved in water. If the pH is wrong, then a nutrient might be present in the soil but not dissolved in the water around the plant and therefore cannot be taken in by the plant. At or near 6.7, all the different nutrients a plant needs are soluble, and therefore available. Was there any difference in the soil pH between our two ecosystems? If so, what was it? If there was a difference, which ecosystem had a pH closer to the ideal?
10. Soils are made of particles that vary in size and shape. These range from tiny clay particles to relatively large sand particles. This soil texture greatly determines the available water, minerals and nutrients to the the plants as well as how well the plants are able to germinate and take root.
11. Why do we find different species of plants living in these two ecosystems?
12. In the prairie the spring flowers are usually short followed by taller summer blooming plants and then very tall fall blooming plants. Why do you think this is?
13. In the forest we do not find this layering effect of flowers as we do in the prairie; we only find spring wildflowers. Why do you think this is?

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

Name_____

Date_____

Abiotic Study: Prairie and Forest

In the prairie different flowers bloom from the spring through the fall. In the forest next to the prairie we have only the spring wildflowers. Also, the plants found in these two ecosystems are different even though the two ecosystems are right next to each other. Why is this?

Although these ecosystems are very close to each other there must be some reason why the two ecosystems contain such different plants. In this study you will collect the abiotic data that might help explain the plant differences.

PURPOSE: To compare the environmental conditions of the prairie to that of a forest.

PROCEDURE: Complete collect data and answer questions.

MATERIALS: Data sheets

For each group:
- Thermometer
- Wind gauge
- Psychrometer
- Light intensity meter
- Soil moisture meter
- Soil percolating tube
- Water supply
- Waste containers
- Soil test kit with laminated instructions
- Stopwatch or wristwatch
- Meter stick

PRAIRIE DATA TABLE

Atmospheric Conditions

	Site 1	Site 2	Site 3	Average for Sites
Relative Humidity	%	%	%	%
Wind Speed	mph	mph	mph	mph
Light Intensity *				

* For light intensity use A = 1 , B = 2, etc. for averaging purposes.

Soil Conditions

Soil Temperature

	Site 1	Site 2	Site 3	Average for Sites
1 meter above				
15 centimeters above				
ground level				
5 centimeters below surface				

Soil Chemistry

Nitrate Nitrogen	ppm (NO_3^--N)
Phosphate Phosphorus	ppm (PO_4-P)
Potassium	ppm (K)

Soil texture _____

Soil pH _____ Soil perculation _____ liters per minute

FOREST DATA TABLE

Atmospheric Conditions

	Site 1	Site 2	Site 3	Average for Sites
Relative Humidity	%	%	%	%
Wind Speed	mph	mph	mph	mph
Light Intensity *				

* For light intensity use A = 1, B = 2, etc. for averaging purposes.

Soil Conditions

Soil Temperature

	Site 1	Site 2	Site 3	Average for Sites
1 meter above				
15 centimeters above				
ground level				
5 centimeters below surface				

Soil Chemistry

Nitrate Nitrogen	ppm (NO_3^--N)
Phosphate Phosphorus	ppm (PO_4-P)
Potassium	ppm (K)

Soil texture _____

Soil pH _____ Soil perculation _____ liters per minute

QUESTIONS:

General Abiotic Analysis

Which ecosystem had the highest temperature at each level?

1 meter above ground _____
15 centimeters above ground _____
ground level _____
5 centimeters below surface _____

Which ecosystem had the most wind? _____

Which ecosystem had the highest relative humidity? _____

Which ecosystem had the greatest light intensity? _____

Which ecosystem had the most soil moisture? _____

High wind, low relative humidity and high temperatures all cause water to be lost from plants. In order to survive in an area like this the plants must be specially adapted. In which of our two ecosystems would we probably find more plants adapted to prevent water loss? _____

Why do you think so few plants grow on the forest floor?

Soil Analysis

The soil supplies the needed nutrients for the plants in both ecosystems. Unfortunately our prairie is not a virgin prairie with its thick rich soil. This area had been farmed for many years thus altering the soil. Three of the most important nutrients for good plant growth are Nitrogen (N), Phosphorus (P), and Potassium (K). Nitrogen is essential for proper plant cell metabolism and protein formation. Nitrogen gives plants their dark green color and helps the growth of leaves and stems. Phosphorus is the soil nutrient responsible for the formation of healthy roots. Phosphorus also encourages the blooming of flowers, seed formation and resistance to disease and weather extremes. Potassium is the soil nutrient that stimulates flowering and helps produce sugar and starch during photosynthesis. Did you find any difference in the nutrient levels between the two ecosystems? If so, what was the difference?

The soil pH is very important to the plants of any ecosystem because it determines which nutrients will be soluble and therefore available to the plants. This is because plants can only take in nutrients that are dissolved in water. If the pH is wrong, then a nutrient might be present in the soil but not dissolved in the water around the plant and therefore cannot be taken in by the plant. At or near 6.7, all the different nutrients a plant needs are soluble, and therefore available.

Was there any difference in the soil pH between our two ecosystems?
If so, what was it?

If there was a difference, which ecosystem had a pH closer to the ideal?

Why do we find different species of plants living in these two ecosystems?

In the prairie the spring flowers are usually short followed by taller summer blooming plants and then very tall fall blooming plants. Why do you think this is?

In the forest we do not find this layering effect of flowers as we do in the prairie; we only find spring wildflowers. Why do you think this is?

Soils are made of particles that vary in size and shape. These range from tiny clay particles to relatively large sand particles. This soil texture greatly determines the available water, minerals and nutrients to the the plants as well as how well the plants are able to germinate and take root.

Was there a difference in the soil texture between the two ecosystems?

If there was a difference, try to you use it to explain some of the differences in plant species between the two ecosystems.

Water-Holding Capability

BACKGROUND: Soil is a major reservoir of water for plants and man. Its porous structure enables it to hold enormous quantities of water that fall as rain or snow. Soils differ in their ability to hold water. Good soils with their plant cover can absorb and hold much more water than sandy soils.

How do the water-holding capabilities of the prairie and forest soils compare?

What are some possible reasons for these differences?

Herbarium Specimen Collection

PURPOSE: To develop a permanent set of classroom prairie plant specimens.

OBJECTIVES: The students will:
1. Select and identify specific prairie plants.
2. Produce a series of herbarium mounts suitable for classroom display.

MATERIALS:
Plant press
Mounting paper
Diluted Elmer's glue
Plant labels
Selected plant specimens
Laminator (Optional)

PROCEDURE:
1. Select specimen.
2. Arrange specimen on plant press blotter paper.
3. Place in plant press.
4. Tighten plant press.
5. Allow specimen to dry for at least one week.
6. Carefully remove specimen by the stem from plant press when dry.
7. Position on mounting paper.
8. Apply several drops of glue along the stem, leaves, etc. (Not necessary if laminated.)
9. Label accurately with scientific name, common name, and short description. (See *Particles and Prairies Plant Key.*)
10. Laminate. (Optional)

Note* These samples could serve in future years as visual aids for the research component.

Nature Walk

PURPOSE: To provide an opportunity for students to witness organisms in their natural settings or to observe evidence of the organisms.

OBJECTIVES: The students will:
1. Observe living things accurately.
2. Record the signs of living things.

BACKGROUND: Animal observation records are of great value to Fermilab's Prairie Committee. The evidence of specific animal life is another barometer of a healthy ecosystem. Observation sheets compiled by students and recorded over a period of time in the same habitat will help Fermilab manage and maintain its diverse array of wildlife.

Early pioneers encountered countless hardships as they settled in the plains and valleys of Illinois. In an effort to capture the flavor of a time long past, Fermilab offers an opportunity for student and teachers to explore restored prairie sites and unspoiled woodland areas. As the teacher prepares students for the nature walk, encourage the students to picture themselves as pioneer kids. What might their clothing be like? What kind of chores would they be doing? What would they do for recreation?

Fermilab's on-site outdoor laboratory provides a unique combination of marsh, farmland meadow, prairie, savannah and forest. Each of these habitats provides a different environment which support a wide and varying array of plant and animal life. As your group is walking between study sites, have your students on the lookout for wildlife. The following check list of the common organisms should prove helpful. Have at least one check list per group. It would also be helpful if the students could become familiar with the bird calls for the common birds at the lab. These can be found on the laser disc.

MATERIALS: Observation checklist
Clipboards with pens or pencils
Binoculars (optional)

PROCEDURE:
1. Students must remain quiet to maximize the possibility of observing wildlife.
2. Instruct students to stay on designated walkways and paths. (There is an abundance of poison ivy year round.)
3. Care must be taken not to trample, pick or otherwise damage organisms.

Nature Walk Observation Sheet

Name _____

School _____

Nature of Observation

	visual	call	tracks	scat	nest	other
BIRDS						
Blue Jay						
Bluebird						
Bobolink						
Flicker						
Goldfinch						
Indigo Bunting						
Meadowlark						
Red-tailed Hawk						
Red-winged Blackbird						
Robin						
Sparrow						
Yellow Warbler						
Other						
MAMMALS						
Chipmunk						
Cottontail						
Coyote						
Deer Mouse						
Fox Squirrel						
Ground Squirrel, 13-lined						
Meadow Vole						
Opossum						
Raccoon						
Shrew						
Skunk						
White-tailed Deer						
Woodchuck						
REPTILES						
Garter Snake						
Fox Snake						
Other						
AMPHIBIANS						
American Toad						
Leopard Frog						
Other						

Quadrat Study: Reconstructed Prairie

PURPOSE: To find out if the planting and maintenance methods used at Fermilab are effective ways for improving the prairie.

OBJECTIVES: Students will look at two key things about the prairie to find out what is happening:

1. Are we increasing the species diversity? Species diversity refers to how many different species of prairie plants we have. In a true prairie we find hundreds of different species. Our restored prairie will not come close to this. We hope in time that our maintenance methods will increase the species diversity of prairie plants and decrease the diversity of weeds.
2. What plants are the most important at this time in the restoration area? This is an interesting question because it is not simply asking which plant is here in the greatest number. What if one plant is much larger than another or one plant is common only in one location? Thus with your data we can calculate an "Importance Value." This will give us an accurate picture of which plants are having the greatest impact on this area.

BACKGROUND: The prairie land presently on site at Fermilab is reminiscent of the original tall grass prairie that once covered 400,000 square miles of the Midwest. Currently, over 700 acres of prairie has been planted on the Fermilab site with plans for more in the future. This reconstruction process has been in progress for over 20 years. As prairie plants have been added, careful notice has been taken as to their progress and the succession of these plants.

MATERIALS: Per Group:

Meter square quadrat
Two meter sticks
Small metric ruler
Flora Field Guide
Data sheet

PROCEDURE: In this exercise students will work in groups of three or four. Prior to the lab be sure to establish student roles, one as recorder, one as counter, and a collective effort to identify plants to help ensure success.

1. Show students where to set up quadrats.
2. Using two meter sticks and the following data page, students will map the location of the plants in their quadrat, drawing grasses first.

3. Once the grasses have been drawn in, students will use the meter sticks to get the exact location of each forb.
4. Students will get an accurate count for each species present in their quadrat and record this on the plant code sheet. This will be easy for the forbs but difficult for the grasses. 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 of your quadrat and multiply by the appropriate number.
5. Determine the percent cover for each species.

DISCUSSION QUESTIONS:

1. To get the most accurate analysis of the data collected we will look at all the quadrats sampled.
2. Proceed back to the Education Center and let each group enter their data into the computer. The computer is programed to add all the data and then to do a series of calculations.
3. The key value we are looking for is the <u>importance value</u> of a species. It tells us how important a particular plant is to the planting. The higher the value the greater the importance of that plant at this time. It will be interesting to see if and how these values change as future classes examine the study area using the class data.
   - What plant has the highest importance value?
   - What grass has the highest importance value?
   - What forb has the highest importance value?
   - What weed has the highest importance value?

   Obtain the importance values from last year. Are the same plants on both lists? Have students list any changes that have taken place.
5. For long-term analysis of this area we would like to get an idea of the species diversity and how many different plants are there per meter square. Have students enter into the computer the number of different species of prairie plants found in their quadrat and also the number of different weed species found. The computer will use the class data and calculate the species diversity for each.
   - Diversity of prairie plants.
   - Diversity of weedy plants.
   - Diversity of prairie plants last year.
   - Diversity of weedy plants last year.

   Have students explain any change in the diversity values and predict how we would like these values to change in the future.

Name_____

Quadrat Study: Reconstructed Prairie

PURPOSE: To find out if the planting and maintenance methods used at Fermilab are effective ways for improving the prairie.

OBJECTIVES: You will look at two key things about the prairie to find out what is happening:

1. Are we increasing the species diversity? Species diversity refers to how many different species of prairie plants we have. In a true prairie we find hundreds of different species. Our restored prairie will not come close to this. We hope in time that our maintenance methods will increase the species diversity of prairie plants and decrease the diversity of weeds.
2. What plants are the most important at this time in the restoration area? This is an interesting question because it is not simply asking which plant is here in the greatest number. What if one plant is much larger than another or one plant is common only in one location? Thus with your data we will calculate an <u>importance value</u>. This will give us an accurate picture of which plants are having the greatest impact on this area.

BACKGROUND: The prairie land presently on site at Fermilab is reminiscent of the original tall grass prairie that once covered 400,000 square miles of the Midwest. Currently, over 700 acres of prairie has been planted on the Fermilab site with plans for more in the future. This restoration process has been in progress for over 20 years. As prairie plants have been added, careful notice has been taken as to their progress and the succession of the prairie plants.

MATERIALS: Per Group

- Meter square quadrat
- Two meter sticks
- Small metric ruler
- Flora Field Guide
- Data sheet

PROCEDURE: In this exercise you will work in groups of three or four. You will use a chart quadrat of one square meter. A quadrat, as the name implies, is (usually) a square sample of the area to be studied. Because it is impractical, often impossible, to count and map every plant in an entire area we will concern ourselves with randomly selected samples from which we may draw conclusions. A chart quadrat is special in that we will not only count the number of each species but will draw the location of each.

Please remember the prairie is a fragile area; just our presence will have a detrimental effect; be as careful as possible and please do not pick any plants.

1. Your instructor will show you where to set up your quadrat.

2. Using two meter sticks and the following recording page, map the location of the plants in your quadrat. Your area is probably dominated by grasses; draw these in first using the crosshatching code on the plant code sheet. Remember, if you cannot identify which grass you have, check with your instructor.

3. Once the grasses have been drawn in, use the meter sticks to get the exact location of each forb (flowering plant). Transfer this information to the recording page. Again, use the plant code sheet to find the correct code for each plant.

4. Now, get an accurate count for each species present in your quadrat and record this on the plant code sheet. This will be easy for the forbs but difficult for the grasses. 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 of your quadrat and multiply by the appropriate number.

5. Now, determine the percent of cover for each species. This is an estimate of what percent of the meter square each species occupies. Again, grasses will probably have the greatest percent of cover. Record this on the plant code sheet.

6. Proceed back to the Education Center and enter your data into the computer. The computer is programed to add your data to the rest of the class data and then to do a series of calculations.

7. The key value we are looking for is the importance value of a species. It tells us how important a particular plant is to the planting. The higher the value, the greater the importance of that plant at this time. It will be interesting to see if and how these values change as future classes examine the study area using your data.

DISCUSSION QUESTIONS:

1. What plant has the highest importance value?

2. What grass has the highest importance value?

3. What forb has the highest importance value?

4. What weed has the highest importance value?

5. Obtain the importance values from last year. Are the same plants on both lists? If any changes have taken place, please list them:

6. For long-term analysis of this area we would like to get an idea of the species diversity and how many different plants are there per meter square. Enter into the computer the number of different species of prairie plants you found in your quadrat and also the number of different weed species you found. The computer will use the class data and calculate the species diversity for each.

   Diversity of prairie plants_____

   Diversity of weedy plants_____

   Diversity of prairie plants last year_____

   Diversity of weedy plants last year_____

7. Explain any change in the diversity values.

8. How do you think we would like these values to change in the future?

Prairie Plants Data Sheet

CODE	NAME	NUMBER FOUND	% COVER
R	RATTLESNAKE MASTER		
S	STIFF GOLDENROD		
D	PRAIRIE DOCK		
C	COMPASS PLANT		
W	ROSINWEED		
Y	YELLOW CONEFLOWER		
B	BLACK-EYED SUSAN		
T	TALL COREOPSIS		
A	SAW-TOOTHED SUNFLOWER		
F	SHOWY TICK TREFOIL		
E	WILD BERGAMOT		
M	MOUNTAIN MINT		
	BIG BLUESTEM		
	LITTLE BLUESTEM		
	INDIAN GRASS		
	SWITCH GRASS		
	PRAIRIE CORD GRASS		
N	NEW ENGLAND ASTER		
O	NODDING WILD ONION		
P	PURPLE CONEFLOWER		

H	WOOLY SUNFLOWER		
I	BUSH CLOVER		
L	BLAZING STAR		
J	FOXGLOVE BEARD TONGUE		
G	GRAY GOLDENROD		
K	CULVERS ROOT		
Q	WILD QUININE		

NUMBER OF DIFFERENT PRAIRIE PLANTS FOUND _____

Weeds Data Sheet

CODE	NAME	NUMBER FOUND	% COVER
1	BLACK RASPBERRY		
2	DAISY FLEABANE		
3	WILD CARROT		
4	WHITE SWEET CLOVER		
5	YARROW		
6	CURLED DOCK		
7	COMMON RAGWEED		
8	BIRDFOOT TREFOIL		
9	GROUND CHERRY		
10	TALL GOLDENROD		
11	COMMON MILKWEED		
12	RED CLOVER		
13	CANADA THISTLE		
14	REED CANARY GRASS		
15	TIMOTHY		
16	SQUIRRELTAIL		
17	ALSIKE CLOVER		
18	HAIRY VETCH		
19	HAIRY ASTER		

CODE	NAME	NUMBER FOUND	% COVER
20	BLACK MEDICK		
21	YELLOW WOOD-SORREL		
22	BULL THISTLE		
23	KENTUCKY BLUEGRASS		
24	HUNGARIAN BROME		
25	RAGWORT		
26	EARLY WINTER CRESS		
27	DRUMMOND'S ASTER		
28	DANDELION		
29	YELLOW SWEET CLOVER		
30	HEAL-ALL		
31	EVENING-PRIMROSE		

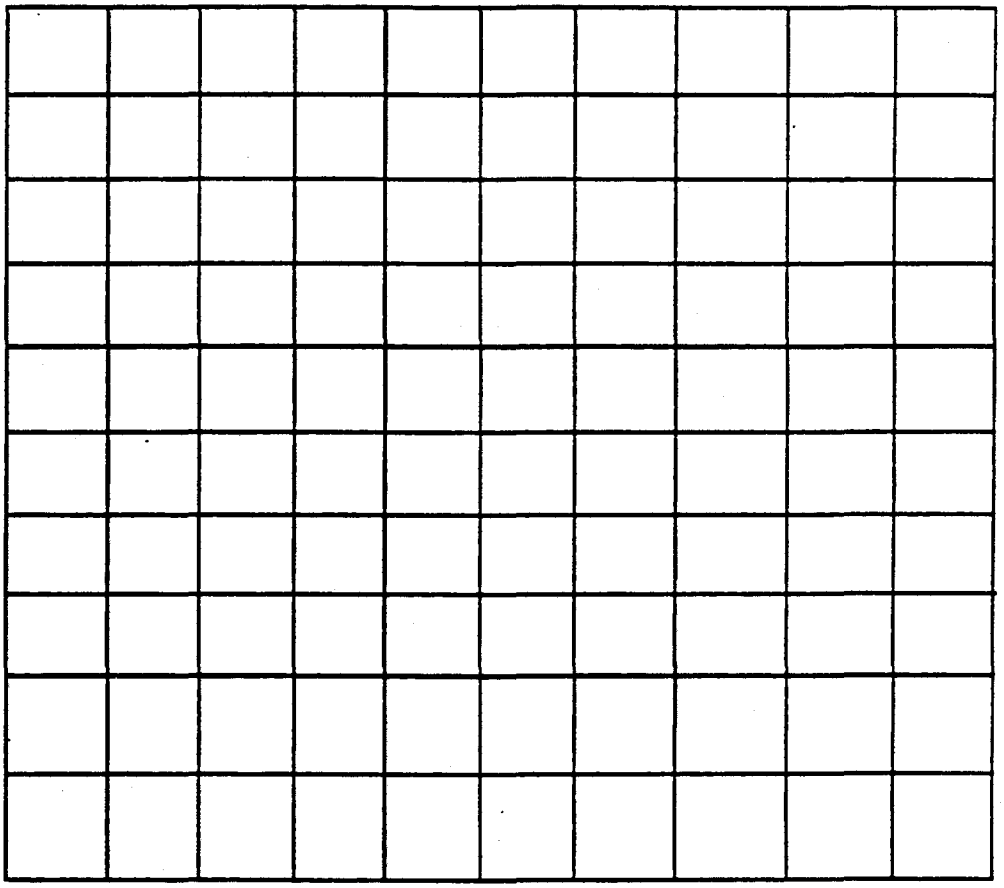
NUMBER OF DIFFERENT WEEDS FOUND _____

Name_____

Group number_____

Quadrat Study: Reconstructed Prairie

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



Group Data

Number of different prairie plants found _____

Number of different weedy plants found _____

Fire Ecologies

PURPOSE: To become familiar with the positive and negative effects of prairie (and forest) fires on wildlife species and their habitat.

OBJECTIVE: Students will be able to identify, describe, and evaluate some possible positive and negative effects on wildlife that result from prairie (and forest) fires.

BACKGROUND: In managing public lands, government agencies for many years have been making a slow movement to change their attitudes toward fires. Whereas, once all fires were suppressed or vigorously fought, some now are allowed to burn as part of a natural cycle within the forest, savannah and prairie ecosystems. In fact, there has been a movement to "prescribe" fires under some conditions and in some places in an effort to replicate natural cycles that contribute to maintaining healthy ecosystems.

Such "prescribed burns" are planned and tended by qualified individuals. Such fires are designed to reduce the fuel load in a given area. Reducing the fuel load in a given area, for example, can prevent fires from getting so hot that they eliminate virtually all life forms and even scorch the soil, sterilizing it. That is, fires every two or three years, in the prairie, can maintain this grassland preventing trees and shrubs from taking over. In the forest, fires every five to ten years can clear away the heavy underbrush without harming the larger trees. A major fire, such as the Yellowstone fire of 1988, with a 70-year accumulation of brush and maturing timber, can cause intensively hot and destructive fires.

It is still correct, of course, that humans should take precautions in camping situations. "Smokey the Bear" and his "Only you can prevent forest fires," is still a warning against carelessness in causing fires through error and accidents.

It is still correct, of course, that fires can have negative as well as positive effects. Forest products companies would rather harvest trees than see them burn. If a fire is too large and too fast, wildlife cannot easily move to safety. Loss of vegetation can have a variety of effects, including impact on wildlife and increase in silting and sedimentation in the surrounding waters.

There are, however, some benefits as well, particularly in the case of those smaller burns that do not get exceedingly hot. For example, prairie and forest burns can:

1. Maintain and enhance fire, dependent habitats such as prairies, savannahs and jack pine forests.
2. Increase soil productivity by releasing and recycling nutrients tied up in litter and undergrowth.
3. Prepare soil for germination of some seeds.
4. Activate heat-dependent seed varieties, such as lodgepole pines.
5. Contribute to an "edge effect," providing a greater variety of food and shelter sources for wildlife.
6. Open up the habitat, generating new growth, diversity and abundance of food plants for some of the herbivores.

MATERIALS: Videos: *From Beneath the Ashes* (Argonne National Laboratory: The New Explorers Series) 28 minutes.*

Yellowstone's Burning Question (Nova) 60 minutes.*

* (These videos are available for previewing at the Fermilab Education Center.)

Reference material from library and/or site work involving soil analysis equipment.

Plant and animal identification guides

Student pages

PROCEDURE

1. Begin this activity with a discussion of prairie and forest fires. Students' reactions will probably be negative at first; point out that while one harmful effect is the destruction of habitat and the killing of wildlife, in some cases fire improves habitat and contributes to the long-term well-being of wildlife.
2. Brainstorm possible positive and negative consequences of prairie and savannah fires for wildlife. Specify wildlife and give examples. Discuss how prairie plants and animals survive fire.
3. Take a field trip to Fermilab or other site where the prairie or forest had recently been burned. This will be compared with a similar area that has not burned in recent history. (NOTE: If such a trip is not possible, *From Beneath the Ashes* may be used along with some reference work in the library.)
4. If the field trip is possible, prepare students to:
   a. make and record their observations of the variety and quantity of vegetation, evidence of wildlife;
   b. take small soil samples in the various areas for testing purposes. These soil samples should be tested for structure, organic and inorganic parts and chemical composition.
5. Ask the student to organize and present the findings of their research. See student worksheet. Ask students to summarize their findings, including short-term and long-term effects to wildlife in each area, both positive and negative. They should

include in their summary an assessment of the importance of fire in natural systems, as well as its effectiveness as a management tool. In the situations they studied, ask them to evaluate the role of fire, including its positive and negative consequences. Their findings should include a listing of those situations in which fire is generally most beneficial, those in which it is most harmful and those where it has little effect. Ask them to address any limitations in their study; that is, any aspect of their research which prevents them from generalizing their findings to all fires affecting wildlife.

EXTENSIONS:

1. Also discuss other impacts from wild and controlled burns. What is the public attitude toward fires in forest and grassland areas? What are the broad range of consequences of fires and lack of fires, on local economy, on aesthetic value, ecological value and agricultural value? What are the trade-offs in allowing and preventing fires? Come up with a set of recommendations for conditions under which fires should be allowed. Check your recommendations against present guidelines used by the U.S. Forest Service and state wildlife agency.
2. Find out the history of fire management in the U.S. Contrast policies of native American Indian people and federal agencies.
3. Add a study of succession to this activity.
4. Study the Yellowstone fire of 1988.

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Name_____

Consequences To Species			
Short-Term Benefit	Long-Term Benefit	Short-Term Harm	Long-Term Harm

Plants	Animals

Name_____

	Soil Data	Plant Species	Associated Wildlife/ Evidence	Wildlife Observed
Recent Fire Area				
No Recorded Fire				

WATER

PART A: AQUATIC DIVERSITY
PART B: WATER QUALITY

PURPOSE: To recognize indicators of environmental quality in streams and ponds.

OBJECTIVES: The student will:
1. Identify several aquatic animals and count the types (diversity).
2. Determine the relative quality of a stream or a pond based on chemical and physical tests.

BACKGROUND: The question of water quality on the Fermilab site is of considerable interest to both the physicists and the ecologists. Water is of great importance to the physicists of Fermilab because it is the primary cooling source for computers, superconducting magnets, (beam lines) and the central utility building as an industrial coolant. When water levels are reduced research may be halted until safe levels are restored.

Because of the warmth of the water being cycled into the ponds and streams, an unnatural environment exists in portions of the Lab. This may promote eutrophication, a condition in still ponds which results in an imbalance between plants and animals. Eutrophication generally is due to the natural aging process coupled with the addition of certain types of run off. This is a problem at Fermilab. Unnatural warmth, fertilizers from surrounding farms and industrial pollution are all contributing factors. Increasing goose populations result in abnormally high nitrogen concentrations, also a concern.

Most natural bodies of water capable of sustaining life have pH values ranging from 5.0 to 8.5. Values higher or lower than these or sudden changes in value may be a sign of pollution.

Oxygen enters the water through plant photosynthesis and by diffusion from the atmosphere. It is removed by respiration and decomposition. The amount of dissolved oxygen in a body of water is affected by the temperature, the amount of plant biomass, the depth of light penetration, the flow velocity, and the amount of organic material to be decomposed.

High nitrate concentrations may mean pollution from fertilizers, sewage, animal waste, or the natural decay of dead organisms. At

Fermilab the adjacent farm fields and high goose population increases the importance of monitoring the nitrate concentration. Phosphorus in the form of phosphates enters the water from the same sources as nitrogen in the form of nitrates. High levels of nitrates and phosphates accelerate the eutrophication process.

Carbon dioxide is present in all surface waters usually in amounts less than 10 ppm. It is essential for green plants. Dissolved carbon dioxide has no harmful physiological effect on humans but high concentrations of dissolved carbon dioxide are corrosive and have been known to kill fish.

Alkalinity is the measure of the capacity of water to neutralize acids and is due primarily to the presence of bicarbonate, carbonate and hydroxide ions. High concentrations of these ions may be related to high algal activity. Aquatic plants and animals have varying alkalinity requirements.

In general, hardness is considered to be a measure of the calcium and magnesium content of water. Aquatic plants and animals have varying hardness requirements.

The student researcher will contribute significantly to the ecological awareness of the Fermilab facility in their water quality testing efforts. Data collected at varying sites and compiled over a period of time may reveal trends that will be of considerable benefit to ecologists and other scientists. Since site water sources provide moisture for our deeply rooted prairie plants, this is a vital topic in prairie maintenance. Students need to understand the potential of their research work. Not only will they be improving their scientific awareness and skill levels, but students will be providing valuable data to be used on site. Their accuracy will be dependent on their ability to follow directions and work carefully. Every effort must be made to ensure reliable data.

A wide diversity of organisms generally would indicate better water quality. However, the specific types present need to be considered because some types are more tolerant of pollution than others. The actual biomass or amount living material may increase due to pollution, but the diversity generally goes down.

MATERIALS PART A:

Aquatic Organisms Field Guide (In the Materials Section)
Data Sheets, Aquatic Diversity
Sampling equipment, such as nets, trays, assorted containers
Plastic trays, white
Magnifying lenses
Eyedroppers
Forceps
Fermilab Site Map

PROCEDURE

1. If you choose this activity for your students, all materials and equipment <u>except for student pages</u> will be provided by the Fermilab Education Office. At each sampling site it is necessary to constantly monitor the students behavior. Students are not to go into the water and any rocks that are examined should be returned to their original location.
2. After placing about two inches of water into the plastic trays, students should collect as many types of animals as possible and place them into the trays. Look on and under rocks and logs. Some organisms will be attached to these substrates.
3. Students should complete the Aquatic Diversity sheet (Student page 1).
4. When the observations are completed, all of the organisms should be carefully returned to the stream or pond.
5. Ideally, this activity should be repeated at other sites or at different times of the year. At least one water source should be a running stream. Since the Fermilab field trip allows time for only one site, a school site source might provide an interesting comparison.

DISCUSSION QUESTIONS:

1. Did the sampling site have a high or low degree of diversity? A variety of different kinds of plants and animals is usually an indication of a healthy ecosystem?
2. Does the diversity change with the seasons? How could you find out?

EXTENSION: Construct a food web with the organisms you identified. Make sure you have a producer.

MATERIALS PART B:

Water quality test kit (Fermilab's Education Office uses Hach brand kits)
Thermometer
Meter sticks or tape measure
Fermilab Site Map

PROCEDURE:

1. If you choose this activity for your students, all materials and equipment except for student pages will be provided by the Fermilab Education Office. The chemical tests will be performed by the students under the supervision of Fermilab Education Office Docents as a laboratory activity.
2. Have students follow closely the written and verbal directions provided by the Docents.
3. Complete the Water Quality: Abiotic Data Sheet. Be sure to bring enough copies of the data sheet for your students.
4. To measure the water velocity, mark a 10-meter distance on the shore. Measure the amount of time it takes a floating object (small stick) to go the 10 meters.
5. Ideally, this activity should be repeated at other sites or at different times of the year. At least one water source should be a running stream. Since the Fermilab field trip allows time for only one site, a school site source might provide an interesting comparison.

DISCUSSION QUESTIONS:

1. Why are the ecologists concerned with the water quality at Fermilab?
2. How might the water quality be maintained and/or improved?

Aquatic Diversity

You will undoubtedly find much evidence of animal life at your water site. Be sure to notice specifically WHERE the organism was collected. (swimming in the water, under the rocks, on the surface, clinging to debris)

Select three types of organisms to document on:

1. The organism that is most abundant.
2. The organism that is least abundant.
3. The organism (other than those above) that you believe is the most interesting.

Fill out data sheet for each site.
Data - Site 1

	Sketch	Location	# Found	Possible Identity

How many different TYPES of animals did you find? _____

Data - Site 2

	Sketch	Location	# Found	Possible Identity

How many different TYPES of animals did you find? _____

Water Quality: Abiotic Background

I. Temperature Ranges (Approximate) Required for Healthy Habitat

Warm water	Middle range	Cold
Greater than 20° C	12.8° - 20° C	12.8° C
much plant life	some plant life	stonefly
many fish diseases	some fish diseases	caddisfly
most bass	caddisfly	mayfly
crappie	water beetles	
carp	stonefly	
catfish	mayfly	
bluegill		
caddisfly		

II. pH Ranges for Fermilab Site Specific Organisms

ACID NEUTRAL ALKALINE

1 2 3 4 5 6 7 8 9 10 11 12 13

Bacteria

1.0 ——— 13.0

Plants
(algae, rooted, etc.) 6.5 ——— 13.0
Carp, suckers, catfish,
some insects 6.0 ——— 9.0
Bass, crappie, bluegills 6.5 ——— 9.0
Snails, clams, mussels 7.0 ——— 9.0
Largest variety of animal (mayfly,
stonefly, caddisfly) 6.5 ——— 7.5

III. Dissolved Oxygen Requirements for Fermilab Site Specific Aquatic Life
Dissolved Oxygen in Parts Per Million (ppm)

(below 20° C) (above 20° C)

Cold-water organisms Warm-water organisms

6 ppm ——— 5 ppm

IV. Nitrate Nitrogen
A concentration above 0.30 parts per million (ppm) is considered high and can contribute to excessive algae growth.

V. Phosphate Phosphorus
A concentration that exceeds an annual average 0.015 ppm can contribute to excessive algae growth. If the reading is greater than 0.1 ppm, the water has probably become polluted from outside sources.

VI. Carbon dioxide
Most surface waters have carbon dioxide concentrations of less than 10 ppm.

VII. Alkalinity
Alkaline waters reflect a presence of bicarbonate, carbonate and hydroxide ions. Different aquatic species of plants and animals have different alkalinity requirements.

VIII. Hardness
Hard water is caused by calcium and magnesium. Just like alkalinity, different aquatic species of plants and animals have different alkalinity requirements.

Water Quality: Abiotic Data

Identification of sites.

Site 1 _____

Site 2 _____

Comparison of Sites

	Site 1	Site 2
Air Temperature	° C	° C
Water Temperature	° C	°C
Water Velocity	m/second	m/second
O_2 (dissolved)	ppm (O_2)	ppm (O_2)
Nitrate Nitrogen	ppm (NO_3^--N)	ppm (NO_3^--N)
Phosphate Phosphorus	ppm (PO_4-P)	ppm (PO_4-P)
pH		
Carbon dioxide	ppm (CO_2)	ppm (CO_2)
Alkalinity	ppm ($CaCO_3$)	ppm ($CaCO_3$)
Calcium Hardness	ppm ($CaCO_3$)	ppm ($CaCO_3$)

Water velocity can be measured by marking a 10-meter distance near the middle of a shallow stream or on the shore of a deep stream. Throw a buoyant NATURAL object (twig or leaf) in the center of the stream; with a sweep second hand, determine the exact time it takes the object to travel the 10-meter distance. Then divide 10 meters by the number of seconds; this gives you the velocity of the water in meters per second.

Calculations for stream velocity:

$$\frac{\text{10 meters}}{\text{\# of seconds}} = _____ \text{ meters per second}$$

Analyzing Your Data

1. Noting the Abiotic Background information on p. 171, which site is the "healthiest" for living organisms?
   Why?

2. If you notice abnormally high or low readings at either site, what is an explanation? Be specific.

   Site 1

   Site 2

3. What ways would you use to make the water at each site a better environment for living organisms?

   Site 1

   Site 2

A Microhabitat: Life in a Log

PURPOSE: To familiarize students with the diversity of organisms utilizing fallen timber as a habitat and contributing to the decomposition of the wood.

OBJECTIVE: The students will:

1. Note the different types of organisms existing on, in and below a rotting log.
2. Study the habitat selected by these organisms and relate this information to the organism's position on the food web.

BACKGROUND: In a natural setting, ground litter (including leaves, twigs, animal excrements and remains, as well as fallen timber) contribute to the ongoing organic recycling necessary to replace nutrients and minerals into the soil. The breakdown of this material is the job of countless microorganisms such as various bacteria, and many macroorganisms, primarily fungi and invertebrates. Through the life functions of these organisms, vital nutrients and minerals are reduced to a form that can be absorbed by the roots of other plants. These plants then become the producers for consumers (herbivores and omnivores) who will continue the cycle.

MATERIALS:
Hand lens
Notebook
Digging blade or knife
Ruler
Collecting containers (bags, jars, etc.)
Forceps
Data sheet

PROCEDURE:

1. Carefully observe the bark. Note color and texture variations. Check for the presence of fungi, lichens, and mosses. Note the relative amount of sunshine and dampness present in the area of the log.
2. Carefully lift a section of bark from the log, try to find a small piece that is easily separated. You may find a wide variety of invertebrates such as beetles, ants, termites, pillbugs, centipedes and a diverse collection of larvae. If fungi is present, webs of yellow and white threads may be seen. These threads are the feeding sources for the fungi. Certain types of bacteria which you cannot see even with your hand lens live along these threads and do the actual decomposing.

3. Carefully observe any visible invertebrate life. Notice any adaptations that help it live in this environment such as exoskeleton, mouth parts and eyes. Be sure to put organisms and bark back as you found them.
4. If the log can be easily lifted and replaced, study the underside. Be sure to observe both the log and the ground under the log. Make comments as indicated above.

DISCUSSION QUESTIONS:

1. How many different organisms did you find? Can you identify them?
2. What are some of the differences between the organisms found in and on the log?
3. Can you tell if the organisms are carnivores, herbivores or scavengers? How?
4. An oak log needs at least 8 to 10 years to completely decompose. How long has the log you are observing been disintegrating?
5. As you observed the underside of the log, did you see any indication that the soil was becoming enriched? Describe what you observed.
   How do you think new soil forms?

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Hand lens
Notebook
Digging blade or knife
Ruler
Collecting containers (bags, jars, etc.)
Forceps
Data sheet

PROCEDURE:

1. Carefully observe the bark. Note color and texture variations. Check for the presence of fungi, lichens, and mosses. Note the relative amount of sunshine and dampness present in the area of the log.
2. Carefully lift a section of bark from the log, try to find a small piece that is easily separated. You may find a wide variety of invertebrates such as beetles, ants, termites, pillbugs, centipedes and a diverse collection of larvae. If fungi is present, webs of yellow and white threads may be seen. These threads are the feeding sources for the fungi. Certain types of bacteria which you cannot see even with your hand lens live along these threads and do the actual decomposing.
3. Carefully observe any visible invertebrate life. Notice any adaptaions that help it live in this environment such as exoskeleton, mouth parts and eyes. Be sure to put organisms and bark back as you found them.

4. If the log can be easily lifted and replaced, study the underside. Be sure to observe both the log and the ground under the log. Make comments as indicated above.

DISCUSSION QUESTIONS:

1. How many different organisms did you find? Can you identify them?

2. What are some of the differences between the organisms found in and on the log?

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4. An oak log needs at least 8 to 10 years to completely decompose. How long has the log you are observing been disintegrating?

5. As you observed the underside of the log, did you see any indication that the soil was becoming enriched? Describe what you observed. How do you think new soil forms?

Name_____

Life in a Log Data Sheet

SURFACE

Organism	Description and Drawing (Include measurements.)	Adaptations

UNDER THE BARK

Organism	Description and Drawing (Include measurements.)	Adaptations

UNDER THE LOG

Organism	Description and Drawing (Include measurements.)	Adaptations

Using the wanted posters, attempt to identify the organisms you observed.

Prairie Insects

PURPOSE: To collect and examine insects found on leaves and in the air in the prairie plant community.

OBJECTIVES: The student will:
1. Identify some of the insects native to the Fermilab prairie.
2. Document specific insect species in Plot 16.
3. Note adaptations of insects which help ensure their success in this environment.

MATERIALS:
Sweep nets
Wide mouth jars
Hand lenses
Insect Field Guides

PROCEDURE:
1. Students will collect insects by making wide sweeps with nets, fanning out in several directions within an area.
2. Grasping the center of the net to contain insects in the bottom, students will carefully deposit collections in a jar.
3. *Examine the contents of the jars and record on your data sheet.*

DISCUSSION QUESTIONS:
1. What insect or type of insect was most prevalent?
2. Did anyone notice wider diversity than others? Why do you think *this did or did not happen?*
3. When you examined the insect collections, were there any species that were obviously different, yet had many of the same characteristics (hard shells, bright colors, lacy wings, long legs, etc.)?
4. Referring to question 3, why do you think these insects have these characteristics? Give at least three.
5. The above questions refer to adaptations. These adaptations help ensure the success of these organisms. What are some adaptations you have to help ensure your success in your environment? Name at least three.

Prairie Insects Data Sheet

PURPOSE: To collect and examine insects found on leaves and in the air in the prairie plant community.

OBJECTIVES: The student will:
1. Identify some of the insects native to the Fermilab prairie.
2. Document specific insect species in Plot 16.
3. Note adaptations of insects which help ensure their success in this environment.

MATERIALS: Sweep nets
Wide mouth jars
Hand lenses
Insect Field Guides

PROCEDURE:
1. Students will collect insects by making wide sweeps with nets, fanning out in several directions within an area.
2. Grasping the center of the net to contain insects in the bottom, students will carefully deposit collections a jar.
3. Examine contents of jars and record on data sheet.

Collect, examine and classify by placing in groups the insects you have collected. Record your results below.

INSECT	PLOT NUMBER	NUMBER FOUND	ADAPTATIONS

INSECT	PLOT NUMBER	NUMBER FOUND	ADAPTATIONS

The Twig Tale

PURPOSE: To provide students with a winter activity that will improve their observation skills.

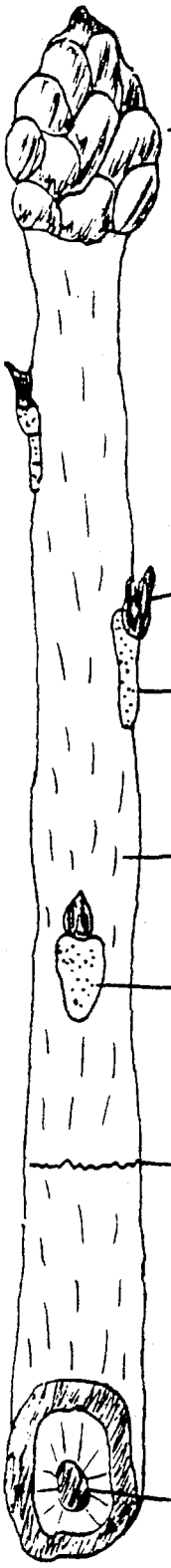
OBJECTIVES: The students will:
1. Identify trees during the months when the leaves are not present.
2. Learn the parts of a twig.

MATERIALS: Winter tree finder
Hand lens
Twigs

PROCEDURE:
1. If students are to become familiar with the use of a key, they need an opportunity to study it. A classification activity should be done prior to this activity.
2. The students should be provided with twigs and a hand lens, and should be able to identify the parts listed on the following page. A transparency can be made of this page.

DISCUSSION QUESTIONS:
1. What do you think will happen if the terminal bud of the twig is cut off?
2. What do you think will grow from the lateral bud?
3. Would a twig survive if the lenticels were covered with a tar-like substance?
4. What are the tiny dots inside the leaf scar?
5. About how old is your twig?

Twig Key



Terminal Bud

In the spring the twig will grow longer from this bud. It is often much larger than the lateral buds, but is absent from the twigs of some trees.

Lateral Bud

Branches grow from the lateral or side buds. There is usually less growth here than at the terminal bud.

Leaf Scar

This scar indicates where a leaf was attached last summer.

Lenticels

These cork-filled pores permit the green, living inner bark to breathe.

Vein Scar

These dots on the leaf scars are the broken-off cork-filled ends of the tubes that supplied water to the leaf.

Bud Scale Scar

This scar indicates where last year's terminal bud was. The distance from this scar to the end of the twig (terminal bud) represents one year's growth.

Pith

The pith is the soft inner core of the twig.

Baked Potato Invertebrate Trap
(Extension of the Invertebate Lab)

PURPOSE: The purpose of this activity/lab is to capture and examine invertebrates in the soil.

OBJECTIVES: Students will identify organisms found in the soil.

MATERIALS:
Baked Potatoes - halved - three halves per group
Small plastic "baggies"
Dissection probes, toothpicks or shish-kabab skewers
Hand lenses or dissection microscopes

PROCEDURE:
1. Prepare baked potatoes and place cut side down on a section of moist soil.
2. Repeat in well-drained and dry soil.
3. Allow to remain in place 24-48 hours undisturbed.
4. Remove potato carefully from soil and examine. (Invertebrates may have penetrated interior of potato - use probe to examine.)
5. Use hand lenses to observe. Classify according to type. (Insect, worm, snail, etc.)
6. Collect group data and build conclusion based on all soil types.

DISCUSSION QUESTIONS:
1. Does there appear to be a difference in the types of organisms at each site? Explain.
2. Why might such differences occur?
3. Compare these organisms to those discovered with Berlese Funnel. Are there any differences? Why or why not?
4. Can you think of any other "bait" for invertebrates? Name at least three. What might you find?
5. Why are these organisms in the soil?
6. Are soil invertebrates considered good or bad? Explain.
7. Did the type of soil make a difference in the number or type of organisms?

Baked Potato Invertebrate Trap
Data Sheet

List and describe organisms found in potato.

Sample Location _____ (prairie, forest, school lawn, etc.)

Name of Organism	Sketch	Number Found	What Do They Eat?	NICHE: Scavenger, Herbivore, Carnivore, etc.

Thinking Environmentally

PURPOSE: To gain information concerning changes in attitude about wildlife and environment.

OBJECTIVES: The student will be able to:

1. Give an example of a change in attitudes related to an animal and/or the environment.
2. Describe factors which may influence changes in attitude.

BACKGROUND: Attitudes toward wildlife, the environment and appropriate uses of natural resources have changed and continue to change over time. They also vary greatly from culture to culture.

MATERIALS: Paper
Magazine and newspaper articles of an environmental nature

PROCEDURE:

1. Initiate a discussion with students about whether or not they think people's attitudes about some subjects might change, for example over a generation. Fashion in clothing, furnishing and food might serve as examples to begin. Ask them about changes in attitudes in wildlife, the environment, uses of natural resources and lifestyles. Discuss their suggestions and list any topics they may suggest.
2. Ask the students to compile a notebook or a bulletin board of articles from newspapers and magazines concerning wildlife or the environment. If the student is unsure of an article, have the student bring it in.
3. Ask the students to work in groups of two to four. Students should then generate a list of questions relating to wildlife and the environment that they might ask of adults or friends in their community or family. For example:
   - How do you feel about wildlife?
   - Does wildlife live in your neighborhood?
   - Did wildlife live in your neighborhood when you were growing up?
   - What problems, if any, involving wildlife are you concerned about?
   - What recommendations, if any, do you have for solving these problems?
   - What are the general changes, if any, do you think there are in society's attitudes toward wildlife and the environment, perhaps some changes you think are good and some you do not?

4. Review the questions generated by each group of students before they conduct their interviews.
5. Ask the students to interview at least one long-living person in their community.
6. Ask the students to interview each other.
7. Suggest that the students interview others, such as, wildlife managers, members of city council, farmers, ranchers, animal welfare groups, hunting club members, private conservation group members and other community representatives.
8. Compile the results of the interviews. Have the students summarize the results of their interviews in a one-page format.
9. Discuss with the students their findings, including what changes on attitudes have taken place, if any, and what factors contribute to any changes in attitudes that they have identified.

DISCUSSION QUESTIONS:

1. Describe how you think most people form their attitudes, what they know and how they feel about animals..
2. Give two examples of attitudes: what they know and how they feel about animals that you have reasons to believe are based on wrong information or not enough information.
3. Give an example of a change in attitude about an animal or issue that has occurred in this country during the past 100 years. How did this change come about?

EXTENSION: Identify a local controversy involving or affecting wildlife or other natural resources. Fact find. How did it develop? What attitudes and information are involved? What possible solutions are available?

SUGGESTED READINGS:

Wild Strawberries, by Shel Silverstein.
Where the Wild Things Are, by Maurice Sendack.

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Rebuilding: Why? Frame #s [5576 - 6788] 40 seconds

Rebuilding a prairie offers educational opportunities to study a vanishing ecosystem. Aesthetic values and historical significance are discussed. The environmental and practical reasons follow.

Environmental Reasons Frame #s [6789 - 8870] 1 minute 8 seconds

Prairies allow for plant and animal diversity which leads to a healthy ecosystem. The prairie's impact on the environment (soil and air) and the prairie as a laboratory is discussed.

Prairie Plantings

PURPOSE: To grow prairie plants from seeds.

OBJECTIVES: The students will:
1. Successfully produce a prairie plot from seeds provided.
2. Recognize the needs of prairie plants.

BACKGROUND: A strong root system will develop during the first growing season. Once established, the plant should thrive on little or no care. These plants are better adapted to the region and will provide the best chances for success.

MATERIALS: Prairie seeds
Sterilized garden soil
Wooden flats/or suitable planting containers
Water (NOT softened)
Suitable outdoor growing area for containers
Suitable permanent outdoor site

PROCEDURE: Potting Container: Outdoors - A wooden flat or large pots may be used.
Indoors - A four-inch plastic pot, or larger, would be desirable. An 8 oz. recycled yogurt container with adequate drainage would be sufficient and can save space. All containers must have proper drainage.
Permanent outdoor site - Choose a site that has full sun. The size of your prairie plot is not critical. The site should be of manageable dimension, be open to burns and be accessible to hose for watering.
Soil: For best results, use regular garden soil that has been sterilized in a microwave thoroughly to destroy weed seeds. Commercial potting soil is not recommended because it may not duplicate garden soil or prairie soil adequately. Use approximately five cups of soil in the microwave for five minutes (or one cup per minute).
Stratification: Most prairie seeds need at least two months of cool, moist conditions just like they would be exposed to under natural conditions. Mix seed with an equal volume of moist sand or vermiculite. Place a plastic bag, seal and refrigerate below 40 degrees F for two months.
Planting Seeds: Use fresh, local seeds. Plant larger seeds no more than 1/2" deep. Smaller seeds should be sprinkled on damp soil. Do not allow soil surface to dry out.
Outdoors - This can and should be a student activity. Divide up your site into individual plots (a square meter per student or small

group). Have students prepare the ground for planting using hand gardening tools. They should remove as much growth as possible, but getting down to the barren soil is not necessary. Prairie plants are native species and will eventually phase out nonnative types. A paper cup (6-8 oz.), filled with seed, per square meter is sufficient. Spread the seed out evenly by hand broadcasting. Firm them into the soil by hand raking and patting. Water the seeds and do not allow the soil to dry out until germination of seeds has been well established.

Watering: If soil is watered before seed planting, then seeds will not become exposed or wash away. If watering is needed, it would be advisable to water from the bottom by placing the container or pot in a saucer of water. Softened water (the product of a water softener) should be avoided.

Germination: Prairie seeds may take from two to six weeks to germinate, or possibly longer. The seed leaves will appear first, followed by the true leaves. At the growth of the first true leaves, transplanting to individual containers is recommended.

Growth: The growth of stem, leaves, and flowers usually occurs at a slower rate than the developing root system. Flowering usually occurs after the first growing season.

Lighting: Natural daylight would be the most desirable. Grow-light fluorescent bulbs with a timer set for twelve hours of daylight or more is sufficient. Seedlings should be as close as possible to the light source, or they may grow long and inferior.

Hardening: Prairie plants thrive in full sunlight. Indoor seedlings should be gradually "hardened" by exposing them to the morning sunlight for several days before planting in full sunlight.

Transplanting: Seedlings transplanted with a ball of soil attached to their root systems will suffer less shock, and survival will be greatly increased. Plant seedlings 8 to 12 inches apart in full sun in well-drained soil. Water as needed. The last half of the month of May is ideal because of cooler temperatures and moist soil as well as avoiding a late frost.

Biotics: Plants and Animals Frame #s [26633 - 28716]
1 minute 8 seconds

The ecological significance and impact on prairies of food webs, diversity of habitat and organisms, and fire are explained. The prairie's destruction has resulted in monocultures and fields of foreign weeds.

Abiotics: Natural Factors Frame #s [36231 - 37561]
43 seconds

Abiotic factors include the sun, wind, water, soil, and fire. These factors along with weather are responsible for shaping the prairie.

Seed Dispersal

PURPOSE: To familiarize students with a variety of common seeds and investigate the different mechanisms of dispersal.

OBJECTIVES: The students will:
1. Be familiar with mechanisms of seed dispersal.
2. Better understand how certain plants have adapted to the environment.

BACKGROUND: Wildlife interactions contribute to the diversity and balance of ecological systems. One compelling example is the process of seed dispersal. Many seeds are carried by animals, whether in the coats of furbearing animals carried and dropped by some birds. Other seeds are adapted to be carried or scattered by wind, water or gravity.

If commercial seeds have been treated with fungicide, they should be washed before handling.
Remind students NOT to overhandle prairie seeds as they will be used for planting.

MATERIALS: Packet of prairie seeds, and other types of seeds
Plant classification guides
Hand lens
Picks or probes to manipulate prairie seeds without handling.
*Data sheets
Nonprairie plant seeds provided by teacher or student
Method of Dispersal:
- Wind - ash, elm, maple, sycamore, dandelion
- Animal - acorn, beggar tick, magnolia, sycamore, burr, peach pit, blackberries
- Gravity - acorn, magnolia, coconut, peach pit, pine
- Water - coconut
- Mechanical forces - pine, bean, pea

PROCEDURE:
1. Stations should be set up so that students can rotate from one to the other every three minutes. Each station should include a number, the common name of the plant, a hand lens, scientific name of the plant, several seed samples for handling and one seed affixed to the station number.
2. Students are to fill in the data sheet as they rotate from station to station. Students may be in pairs or cooperative learning groups.

DISCUSSION QUESTIONS:

1. *What would happen if all of the seeds from an adult plant* attempted to grow near the parent plant instead of being scattered (dispersed)?
2. What characteristics would a seed need if it was dispersed by the wind? gravity?
3. What appendages would a seed need if it was dispersed by "hitchhiking" in a dog's fur?
4. Explain how the seeds you observed has adapted to the environment.

EXTENSIONS:

1. Invent a seed.
2. View pollen grains under the microscope; compare size with a seed from the same plant.
3. Have student bring in other seeds home and explain the dispersal mechanisms.

Seed Collecting and Planting
Frame #s [12768 - 15777] 55 seconds

Seed collecting from nearby prairies and the procedures for preparing and planting the future prairie are shown.

Seed Dispersal Frame #s [43101 - 43910] 26 seconds

Seeds are dispersed by wind, water, animals, or mechanical means. This helps plant species to expand their territories.

Seed Dispersal Data Sheet

Station Number _____

Drawing

Common name _____
Scientific name _____
Probable means of dispersal _____
_____
_____

Station Number _____

Drawing

Common name _____
Scientific name _____
Probable means of dispersal _____
_____
_____

Station Number _____

Drawing

Common name _____
Scientific name _____
Probable means of dispersal _____
_____
_____

Station Number _____

Drawing

Common name _____
Scientific name _____
Probable means of dispersal _____
_____
_____

Comparison of School and Fermilab Data

PURPOSE: To compare school site and Fermilab observations and data.

OBJECTIVES: Students will:
1. Note differences between school site (Eurasian) grasslands and restored prairie at Fermilab.
2. Determine positive and negative attributes of both areas.
3. Develop an appreciation for the diversity and unique nature of organisms on the Fermilab prairie site.

BACKGROUND: Various lab experiences have been designed for use on and off the Fermilab site. Depending on equipment available on school site, an interesting comparison of various aspects of these ecosystems could prove beneficial in the conceptualization of the unique nature of the prairie.

MATERIALS: Completed student data sheets for any or all of the following:
1. Pollinators and Consumers
2. Quadrat Study
3. Abiotic Study
4. Water: Aquatic Diversity; Water Quality
5. Leaf Litter

Comparison student data sheet master

PROCEDURE:
1. Complete both a school site and prairie study of a specific lab.
2. Put students in small groups and provide each group with copies of all completed data sheets.
3. Have groups complete comparison data sheet for <u>EACH</u> lab <u>INDEPENDENTLY</u>.
4. Discuss results. Use board or overhead projector to itemize similarities and differences.
5. Develop a class conclusion establishing differences and similarities between Eurasian site and prairie.

DISCUSSION QUESTIONS: Utilize with <u>EACH</u> lab <u>INDEPENDENTLY</u>.
1. How are the sites similar? Be specific.
2. How do they differ? Be specific.
3. List three attributes/disadvantages of each.
4. Should prairies be preserved and/or restored? Give at least three reasons for your opinion.
5. Someday you may be a parent. What will you tell your child about the prairie? Be sure to include at least three important points. Have students role play from different perspectives.

Particles and Prairies - A Research Experience for Middle School Students (Combined Motion Sequences)
Frame #s [03692 - 53728] Approx. 28 minutes

This is a combination of all motion sequences and includes the history, ecology, research and restoration of the Fermilab prairies. Teachers should note that all of the following motion sequence presentation topics are shown.

Comparison of School and Fermilab Data

Name_____

Title of Lab Experiment_____

	School Site	Fermilab
Similarities		
Differences		
Positive Attributes		
Negative Attributes		
Surprises!!		

SOIL STRUCTURE

SOIL STRUCTURE

BACKGROUND: Naturally formed soils have similar basic structure. This can be seen in an excavation that is more than five feet deep or cut for a roadway extending through a hillside.

The relatively thin dark layer of topsoil lies above a lighter-colored subsoil. Below the two upper layers is one of bedrock (dolomite or limestone in our area), usually five feet or more below the surface.

PROCEDURE:

1. Fill a jar three-fourths of its height with water. Add a selected soil sample to raise the level so that the jar is about full. Tightly screw on the cap and shake vigorously. Allow the jar to stand quietly until all the soil solids have settled. (See diagram.)
2. Measure the depth of the different layers, in centimeters, and record, noting that good topsoil consists of particles of fine sand, some clay and humus.

DISCUSSION QUESTIONS:

1. Take a small amount of material from each layer. Rub it between your fingers. How are the textures different?
2. Which layer would hold water best? How do you know?

EXTENSION: Attempt this method with another soil type.

Soil Research Frame #s [49988 - 51125] 37 seconds

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.

The Particles and Prairies Videodisc has a series of still pictures entitled "Soil Analysis and Techniques" that may enhance this activity. Refer to the Videodisc Guide.

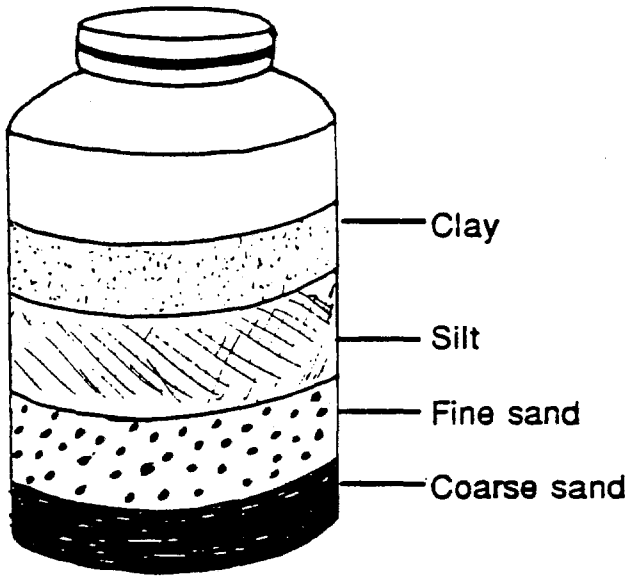


Figure 1. Separation of layers of materials that make up a sample of soil. Other soils will show other layers and different thicknesses of the layers. Why do the layers separate this way?

Real Estate Ad - How to Sell a Prairie

PURPOSE: To develop a sales poster for one acre of tall grass prairie.

OBJECTIVES:
1. Students will illustrate beauty and drama of the prairie as they see it.
2. Students will prioritize attributes of the prairie.
3. Students will project the potential of the prairie from economic and aesthetic aspects.

MATERIALS:
Art supplies as designated by teacher
Student Page
Posterboard - (Assign a uniform size to be used by all students.)

PROCEDURE:
1. Instruct students to complete student page.
2. Include all information on poster in a creative manner.
3. Discuss prairie attributes. (Some students will focus on flora and fauna; others will see potential as homesite or farmsite, etc.).
4. Encourage creativity, color and diversity.

DISCUSSION QUESTIONS:
1. If a neighbor had all his grass lawn removed and planted with prairie plants, what would your reaction be?
2. Our world is facing a severe food shortage. How might prairie restoration be of benefit? Is this practical?
3. Is the prairie worth restoring? Why or why not?

EXTENSION: With a partner, role play these two situations. Be sure to exchange responsibility in the primary role.

1. You are a prairie advocate speaking to an individual who does not know what a prairie actually is. Try to convince the person that prairies should be preserved and restored.

2. You are a parent in the year 2005 A.D. Your child asks you to describe a prairie. You want your child to appreciate a prairie. You want your child to appreciate the uniqueness of the prairie. What do you say?

Be prepared to repeat your role playing in front of the class.

Name _____

Real Estate Ad

Congratulations! You are a successful real estate agent who has acquired a prairie listing. Knowing about the wonderful qualities of the prairie, you want to advertise in the best possible way. Use this sheet to help you organize your information and create a brochure designed to influence even the most skeptical buyer to purchase this acre of prairie.

Size: 1 Acre Cost: _____

Qualities of Prairie

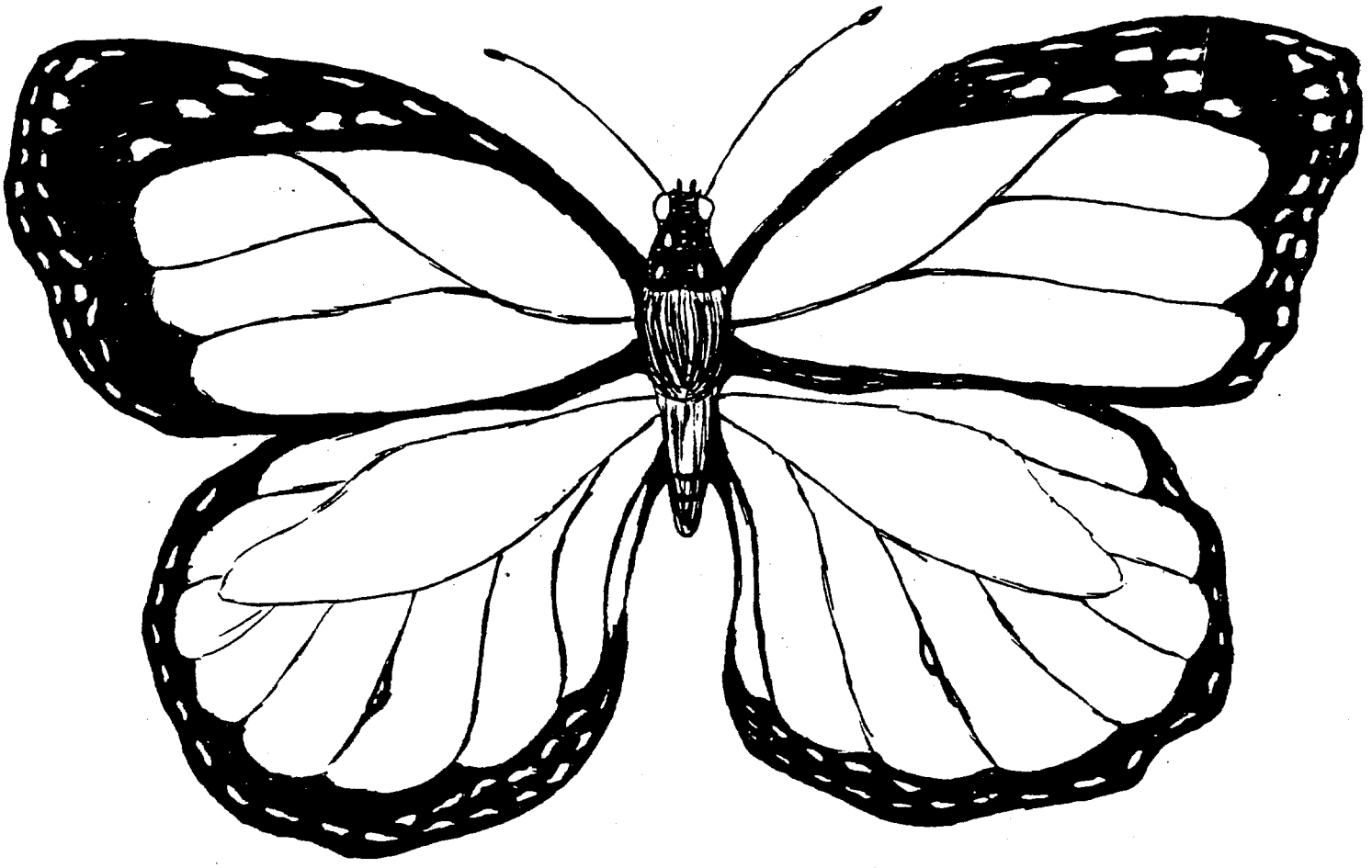
A. What is on this acre of prairie?

B. How could this prairie be used?

C. Future value of prairie?

Be sure to provide a colorful picture of the prairie in its present state and/or your interpretation of what the prairie could look like in the future.

Interdisciplinary Mini-Unit
Monarch Butterfly



Interdisciplinary Monarch Mini-Unit
Developed by Team I
Madison Junior High
Naperville School District 203

Lyn Crabbe
Mary Currier
Larry Cwik
Patricia Franzen
Gundy Sprouse
David Weiseman

Interdisciplinary Activities

Science:

2 days - Collecting, rearing and releasing Monarch butterflies.
Journal time.
Life cycle of the Monarch - science journal.

Math:

1 day - Calculating the distance traveled by a Monarch butterfly.
Calculating the mass and area of a flock of Monarch butterflies.

Social Studies:

1 day - Mapping the migratory routes of the Monarch butterfly.
Comparing climate, topography, terrain, of summer and winter sites.

Reading/English:

1 day - Monarch Poetry.

3 days - Creative story from Monarch's perspective.

The concept of an integrated Monarch unit originated at Madison Junior High in Naperville School District 203. Their unit has been modified to better fit the Particles and Prairies format.

Refer to Miracle of the Monarch's, by Kim Harris, and Monarch Butterfly, Illinois Department of Conservation, for additional background.

Science Component

1. Journal Record Keeping - Allow 5-10 minutes on Mondays and Fridays for journaling. If daily journals are part of your interdisciplinary unit, this is a perfect option.

2. Collecting, rearing and releasing of Monarch butterflies must be initiated mid-August through early September with the collecting of eggs and larva. Refer to "Tips for Collecting and Rearing Monarchs" for specific instructions.

3. Observe stages of Monarch metamorphosis using collected specimens. Follow up with Life Cycle Sequence Puzzle Page.

Tips for Collecting and Rearing Monarchs

In middle Illinois the appropriate time of locating monarch eggs and larvae is mid-August until the first week in September. Once you are able to identify the monarch eggs, they are easier to obtain in greater number than the caterpillar. Also eggs hatched in captivity seem to have less disease and parasites.

Locate a patch of milkweed with very few aphids and ants. Monarchs are rarely found on insect-infested plants. When looking for eggs and larvae, gently bend the milkweed stalk downward so the underside of leaves is showing. This is where most of the monarch eggs and caterpillars will be found. When an egg or caterpillar is located, remove the leaf it is on and place the "critter" and leaf in a container with a lid (i.e., butter tub, ice cream container, etc.). All monarchs that are found during your search may be stored in the same container until you get back home or to school.

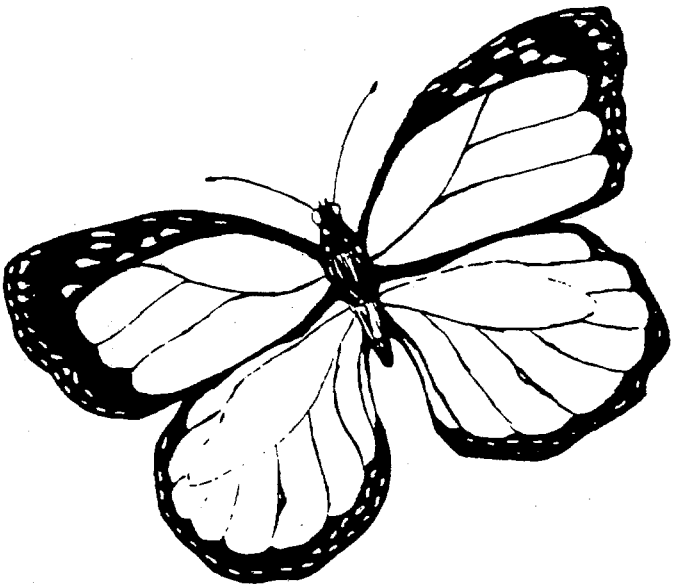
When you arrive at home or school place the caterpillars on freshly cut milkweed stalks placed in some water. Pop bottles work quite well. Watch the stalks carefully for freshness. Changing the caterpillars to fresh stalks at least every other day is recommended. If the milkweed is old, tough, and dry, the caterpillars will be unable to feed and will starve to death. If the caterpillar is two or more centimeters long, pick it up gently and place it on its new home. If it is smaller, cut a section of the leaf with the caterpillar on it and place it on the fresh plant. Be sure to put newspapers under them . . . you do want them paper trained. Be sure to change the paper frequently to help eliminate the chance of disease.

After caring for the newly found caterpillars it is time to care for the eggs. Select a leaf that you found with an egg on it. Cut out a section of leaf with the egg on it and place them on a fresh milkweed stalk. Another way to deal with the unhatched eggs is to cut a section of leaf with the egg still attached and place it in the lid of a box along with all other eggs. You can quickly observe the eggs to determine which are ready to hatch. When the egg turns grey or dark at the top, the head is developing and will soon hatch. At this point in time, place the egg and piece of leaf it is attached to on a fresh milkweed stalk. The "box lid" method must be monitored closely; otherwise the caterpillars will hatch and have no food source.

Shari Morkin
Bloomington, Illinois

** Monarch Series (egg to butterfly) **

Monarch Egg on Milkweed (1.2 x .9 mm)	2197		Monarch Chrysalis or Pupa	2229	
Monarch Egg on Milkweed (1.2 x .9 mm)	2201		Monarch Butterfly Emerging from Chrysalis	2233	
Monarch Caterpillar Newly Hatched (.5mm)	2205		Monarch Butterfly Emerging from Chrysalis	2237	
Monarch Caterpillar or Larva	2209		Monarch Butterfly Drying Wings on Chrysalis	2241	
Monarch Caterpillar or Larva	2213		Monarch Butterfly Drying Wings on Chrysalis	2245	
Monarch Caterpillar Preparing to Form Chrysalis	2217		Monarch Butterfly Drying Wings on Chrysalis	2249	
Monarch Caterpillar Changing to Pupa (Chrysalis)	2221		Monarch Butterfly Drying Wings on Chrysalis	2253	
Monarch Chrysalis or Pupa	2225		Monarch Butterfly Emerged	2257	



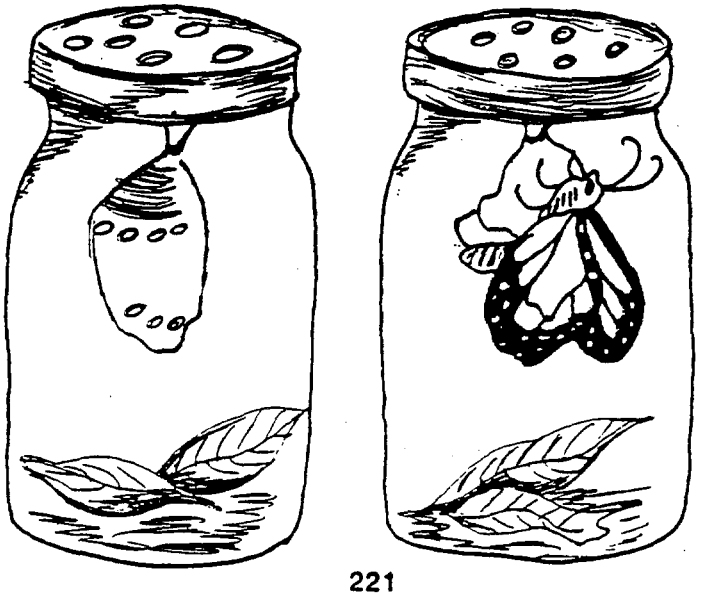
Journal Record Keeping of Monarch Data

Entomologist _____

Science Period _____

Watch the development of our team's Monarchs and listen carefully to your teacher's explanations. Twice a week--on Monday and Friday--write a Journal Record of your observations of the growth of the chrysalis. Feel free to take preliminary notes!

Include the following:
Size
Color
Shape
Distinguishing Characteristics



The Life Cycle of a Monarch Butterfly

Entomologist _____

Science Period _____

Arrange the order of events in a Monarch's life in proper sequence using numbers 1-10.

_____ The butterfly splits the chrysalis and begins to enter the world outside the cellophane-like casing.

_____ The caterpillar's skin splits open and a black hook appears. The hook takes the place of the caterpillar's legs that drop off with the skin.

_____ The female Monarch lays tiny green or yellow eggs on milkweed leaves.

_____ After a few hours the Monarch's wings are completely dried and ready for exercise.

_____ After about 1-1/2 weeks (10 days), black and orange wings can be seen through the transparent chrysalis. The butterfly is nearly mature.

_____ A small caterpillar (larva) hatches from the egg. Its only job is to eat for about 2 weeks. The caterpillar will shed its skin several times during this period.

_____ At this point, the wings are crumpled and quite small. Fluid from the insect's body is pumped into the wings. As the veins fill with this fluid, the wings expand and stiffen.

_____ The caterpillar hangs upside down like the letter "J." As the Monarch's days as a caterpillar ends, its antennae droop and it prepares for a change.

_____ The caterpillar becomes enclosed in the chrysalis (pupa) and becomes a "little green house with gold nails."

_____ The caterpillar grows to about 2" long. At this point, it stops eating and spins a silk-like button to attach itself to a spot.

The Life Cycle of a Monarch Butterfly

Arrange the order of events in a Monarch's life in proper sequence using numbers 1-10.

8 The butterfly splits the chrysalis and begins to enter the world outside the cellophane-like casing.

5 The caterpillar's skin splits open and a black hook appears. The hook takes the place of the caterpillar's legs that drop off with the skin.

1 The female Monarch lays tiny green or yellow eggs on milkweed leaves.

10 After a few hours the Monarch's wings are completely dried and ready for exercise.

7 After about 1-1/2 weeks (10 days), black and orange wings can be seen through the transparent chrysalis. The butterfly is nearly mature.

2 A small caterpillar (larva) hatches from the egg. Its only job is to eat for about 2 weeks. The caterpillar will shed its skin several times during this period.

9 At this point, the wings are crumpled and quite small. Fluid from the insect's body is pumped into the wings. As the veins fill with this fluid, the wings expand and stiffen.

4 The caterpillar hangs upside down like the letter "J." As the monarch's days as a caterpillar ends, its antennae droop and it prepares for a change.

6 The caterpillar becomes enclosed in the chrysalis (pupa) and becomes a "little green house with gold nails."

3 The caterpillar grows to about 2" long. At this point, it stops eating and spins a silk -like button to attach itself to a spot.

The Particles and Prairies Videodisc has a series of still pictures entitled "Monarch Series - Egg to Butterfly" found under the "Prairie Invertebrates" that may enhance this activity.

Entomologist_____

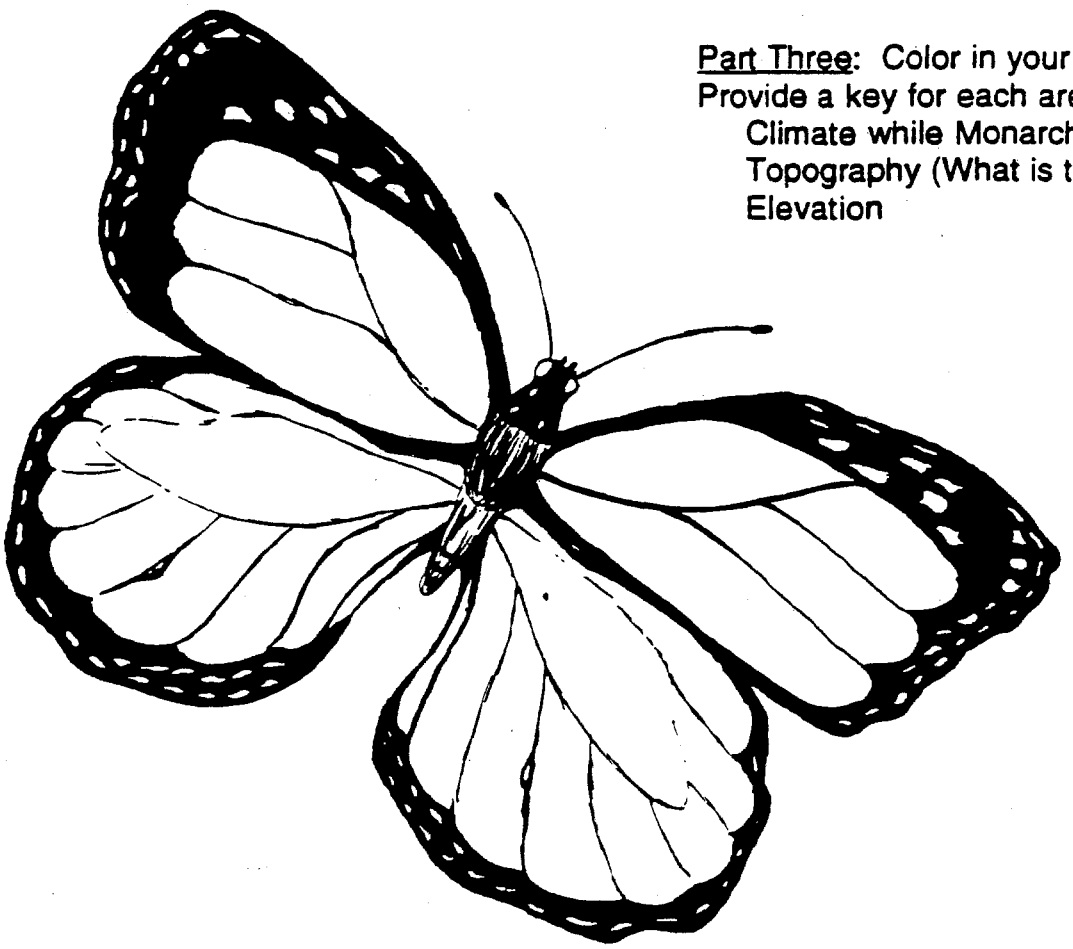
Social Studies Period____

Monarch Migration Routes

Part One: Locate the following on your copy of the North American map:

Illinois	Texas	California
Florida	Mexico	Canada

Part Two: Plot the Southern migration routes taken by the monarch butterflies so that they can hibernate for the winter. In math class you will produce a key plotting total distance traveled.



Part Three: Color in your map appropriately.
Provide a key for each area showing:
- Climate while Monarchs are present
- Topography (What is the land like?)
- Elevation

Map of North America

Entomologist _____

English Period _____

Poetry

Create a poem about the Monarch using one of these formats. Be sure to notice how the examples match the instructions for each type of poem.

Haiku

- Three lines of 5, 7 and 5 syllables.
- Emphasis on syllables - NO RHYME.

The flighty Monarch
orange and black fast rushing wings
delicate beauty

Cinquain

- The term cinquain is taken from the French and Spanish words for five.
- Five lines which may be syllablic or word ordered. (Example is word ordered.)
- Each line has a specific formula:

Line 1 - 2 syllables (or words) Title
Line 2 - 4 syllables (or words) description of the title
Line 3 - 6 syllables (or words) description of action
Line 4 - 8 syllables (or words) description of feeling
Line 5 - 2 syllables (or words) restatement of title

Monarch larva
light green and gold,
creeping, crawling, munching, moving, curving, climbing
single-mindedly, systematically devouring the stately, fragrant milkweed plant
Immature Jewel

Diamante

- A diamond-shaped poem depicting extremes.
- The parts of speech patterns are very specific.

Noun
adjective, adjective
participle, participle, participle
noun, noun, noun, noun
participle, participle, participle
adjective, adjective
noun

caterpillar
green, gold
eating, growing, slowing
warmth, milkweed, prairie, chrysalis
resting, changing, emerging
drying, fluttering
butterfly

Entomologist _____

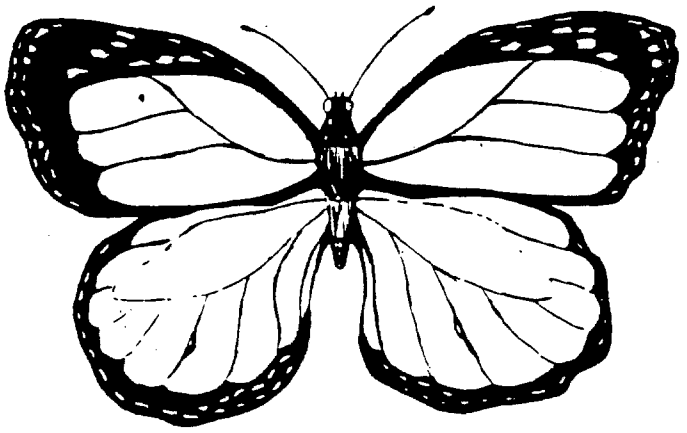
English Period _____

Monarch Creative Writing: 1st Person

You are going to write a first person narrative from the Monarch butterfly's point of view. It will be your job to tell the story of the Monarch from its point of view. Since this will be an extended writing, it's important to complete many pre-writing activities in all your classes. That way you can easily become the Monarch. Over the next few days jot down any observation, thoughts, and questions that occur to you. You are also welcome to complete some research on your own! Monarch poetry and journal entries will help you as you create your story.

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Complete your rough draft on your own paper.



Monarch Story Editing

Entomologist_____

English Period_____

Personal Proofreading

Proofread and edit for the following:

Format of Story:

[ ] The story is between one and two pages--not just one page!
[ ] The story covers the entire life cycle--from egg to butterfly.
[ ] The story is told from the first person point of view--"I flew away."
[ ] The story has a creative name.

Additions to Story. After you complete your rough draft, consider the following:

[ ] Choose at least one part of the story and expand on the storyline--in other words, make it longer!
[ ] Add FIVE additional descriptive adjectives--words telling *Which* one? *What kind? How many?, or How much?*
[ ] Add FIVE additional descriptive adverbs--words telling *How?, When?, Where?, How often?, or To what extent?*
[ ] Add a simile--a comparison of two objects using *like, as, or than*--For example, "I flew **like a booming jet plane** on my way to California."
[ ] Add personification--a phrase that gives an inanimate object living characteristics--For example, "The flower hugged me as I was munching its nectar."
[ ] Add alliteration--a phrase where the beginning sounds of world are the same--For example, "The wind whipped the milkweed plant as I wriggled along it."

For Extra Credit:

[ ] Add a metaphor--a comparison of two objects, not using the words like, as, or than --For example, "The **glass jar became a prison** as I impatiently awaited my release from the science classroom."

Corrections in the Story:

[ ] Check for proper spelling of any work you think might be misspelled.
[ ] Check for proper punctuation.
[ ] Check for proper capitalization.

[ ] Check that you have used complete sentences.
[] Check that sentences begin with capital letters and end with appropriate punctuation.
[ ] Draw a line showing where the right-hand margin needs to be.
[ ] Write yourself a note if you forgot to skip a line under the title.
[] Check that you started a new paragraph with each new idea--For example, changes in the monarch's life stages, or changes in the setting. One page should not be just one paragraph--probably two or three!
[ ] If you used dialogue, check that you started a new paragraph each time a different character started speaking.
[ ] Eliminate all uses of the word **you** unless you have the characters speakin one another.

Group Editing

your editing group:

_____

_____

_____

Complete the following:

[ ] Read your story aloud for the group.
[ ] Have each person tell you one thing that could be improved.
[ ] Have each person tell you one thing he/she especially liked.
[ ] Trade papers and help each find additional errors in spelling, punctuation, capitalization, paragraphing, and sentence structure.
[ ] Help each other make certain the additional adjectives, adverbs, simile, personification, and alliteration were added.

Final Copy

Complete the following for your final copy:

1. Title Page: Use the plain paper your teacher gives you for your title page. Your title page needs to include the title of the story, your name, your English class period, the due date, and an illustration that you have either drawn and colored or found and neatly cut out and attached. You are also welcome to do a computer-generated title page.

2. Final Copy of Story: Neatly recopy your story on loose-leaf paper--front sides only --remembering to leave right- and left-hand margins. Do not write on the bottom two lines of any sheet. You do not need to use a proper heading; instead, put just your name and page number in the upper right-hand corner. If you would like to type or word process your story, you are welcome to do so, but **you must do the keyboarding yourself.** A note from home verifying that you personally typed the story must be turned in with your story.

3. Staple your final copy of the story behind the title page.

4. Staple your rough draft to the back of the Editing Instruction Sheets. You will submit your work in two separate piles.

Monarch Math

1. Using your map from social studies, develop a mileage key. How far did your Monarch actually travel?

2. A Monarch can cruise up to 25 mph. However, during an ideal day, a Monarch may advance only 50 miles. Based on question #1, how long will the migratory trip take?

3. A Monarch weighs (mass) only about .5 gram when it starts a journey. If there are 28 grams in an ounce, how many butterflies are in an ounce of Monarchs?

   In a pound of Monarchs?

4. At the end of the trip, the Monarch may weigh 5 times more than when it begins. How heavy is a flock of 5,000 Monarchs before and after the trip?

5. Researchers tell us that 200,000,000 Monarchs eventually will reach Mexico. What is the mass (weight) of this flock?

   in grams?

   in pounds?

   Remember, this is the <u>end</u> of the trip.

   Can you think of reasons why a Monarch is capable of cruising at 25 mph?

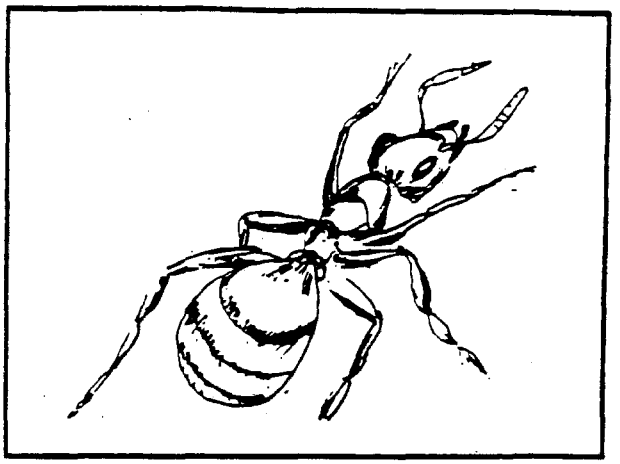
   Why do you think a Monarch weighs more at the end of the trip?

Invertebrate Data Sheets

1.	Ant - Mound Builder	309
2.	Aphid	311
3.	Bumble Bee	313
4.	Cicada Nymph	315
5.	Crayfish	317
6.	Cricket	319
7.	Dogbane Beetle	321
8.	Dragonfly	323
9.	Dung Beetle - Tumblebug	325
10.	Entracheous	327
11.	Grasshopper	329
12.	Katydid	331
13.	Ladybug	333
14.	Monarch Butterfly	335
15.	Mosquito	337
16.	Orb Weaver Spider	339
17.	Painted Lady	341
18.	Robber Fly	343
19.	Soil Nematode	345
20.	Soldier Beetle	347
21.	Springtail	349
22.	Walking Stick	351
23.	Weevil	353

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Hymenoptera
5. Family Formicidae
6. Genus
7. Species



Common Name Ant - Mound Builder

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) savannah, meadow
9. Actual Location
10. Description of "Home" mounds as high as 2' and as wide as 5'
11. Needs/Preferences well-drained prairie soil

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe) active, segmented, hairless
15. Color red/brown/black
16. Size 1 cm
17. Exoskeleton/Skin (Describe) hard chitinous exoskeleton
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 animal or plant this creature must live near?)

Reproduction

22. Livebearing or Egg Laying egg layers
23. Development (complete, incomplete metamorphosis, etc.) complete metamorphosis
24. Breeding Conditions queen lays eggs in colony nest, fertilized by males

25. Male/Female Differences_____

_____

Food/Feeding Habits

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

Fascinating Facts

29._____

_____

30._____

_____

31._____

_____

Adaptations

In your own words, explain how this creature has adapted to its environment to meet its needs. List at <u>least</u> three ways.

1._____

_____

2._____

_____

3._____

_____

4._____

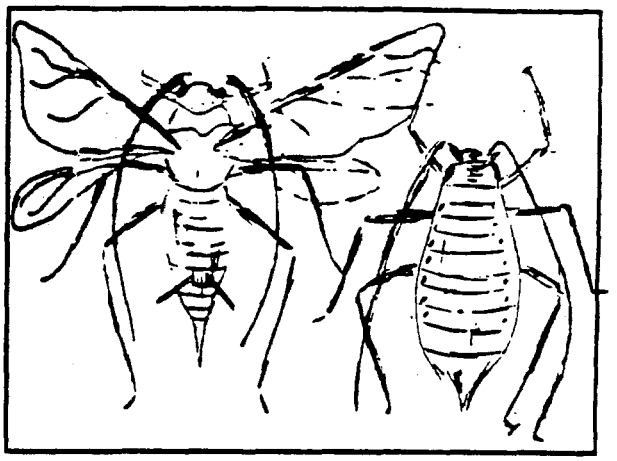
_____

5._____

_____

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Homoptera
5. Family Aphidae
6. Genus
7. Species



Common Name Aphids

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) aphid types in mesic to dry habitats
9. Actual Location (soil, tree, beneath rotted log, etc.) plants
10. Description of "Home" on primary host - secondary host - primary host
11. Needs/Preferences must live in association with specific host plant

Physical Characteristics

12. Number of segments or body sections three-winged form
13. Number of legs six
14. Antennae (Describe) two smooth/curved back over body
15. Color white - reddish waxy
16. Size usually less than 3 mm
17. Exoskeleton/Skin (Describe) soft body/pear shape
18. Markings/Shape
    A. Appendages two antennae/six legs/two cornicles near posterior end
    B. Body pear-shaped
    C. Head eyes adjacent to antennae
    D. Wings distinct venation/generally held vertically to body

Behavior

19. Periods of Activity (Time of Day/Night) greatest activity - day
20. Lives alone, colonies, pairs, etc. colonies - also often associated with ants
21. Symbiotic relationships (Is there another animal or plant this creature must live near?) particular host plants/ants (tended to like herds of cows by ant colonies

Reproduction

22. Livebearing or Egg Laying egg layers
23. Development (complete, incomplete metamorphosis, etc.) eggs over winter and

hatch into immature females: parthenogenesis (without fertilization)

24. Breeding Conditions ants often collect aphid eggs and protect them over winter

25. Male/Female Differences only females are produced parthenogenetically; after 2-3 generations, males are produced which mate and lay more eggs

Food/Feeding Habits

26. Specific foods plant feeders
27. Carnivore, Omnivore, Herbivore, Parasite, etc. herbivore
28. Food source(s) migrate from plant to plant depending on stage of life

Fascinating Facts

29. cause serious damage to cultivated plants

30. soft bodied - somewhat pear shaped

31. discharge from anus a clear watery liquid - honeydew
ants feed on honedew (see reproduction)

Adaptations

In your own words, explain how this creature has adapted to its environment to meet its needs. List at <u>least</u> three ways.

1.

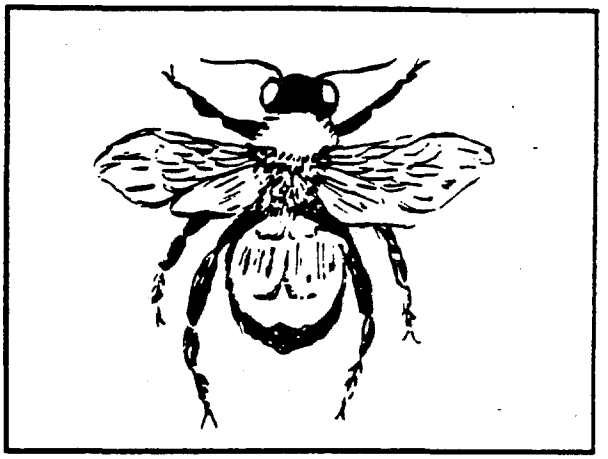
2.

3.

Aphids 2265

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Hymenoptera
5. Family Bombidae
6. Genus Bombus
7. Species _____ _____



Common Name Bumble Bee

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all sections where flowers are in bloom
9. Actual Location (soil, tree, beneath rotted log, etc.) deserted mouse nest or fields, sometimes underground
10. Description of "Home" underground chamber lined with fine grass and roots
11. Needs/Preferences young queens hibernate through winter in sheltered areas

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe) two
15. Color black with yellow markings
16. Size 15-25 mm
17. Exoskeleton/Skin (Describe) hairy
18. Markings/Shape
    A. Appendages "pollen baskets" along sides of hind legs
    B. Body black, with stiff, yellow hairs
    C. Head _____
    D. Wings _____

Behavior

19. Periods of Activity (Time of Day/Night) daytime
20. Lives alone, colonies, pairs, etc. colonial
21. Symbiotic relationships (Is there another animal or plant this creature must live near?) _____

Reproduction

22. Livebearing or Egg Laying egg layer
23. Development (complete, incomplete metamorphosis, etc.) _____

complete metamorphosis

24. Breeding Conditions in the spring eggs are laid into pollen-filled wax cells

25. Male/Female Differences

Food/Feeding Habits

26. Specific foods nectar and pollen

27. Carnivore, Omnivore, Herbivore, Parasite, etc. herbivore

28. Food source(s) flowering plants

Fascinating Facts

29.

30.

31.

Adaptations

In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. it has a sting which can inject venom into their enemies

2. their stings can be reused, unlike that of the honey bee

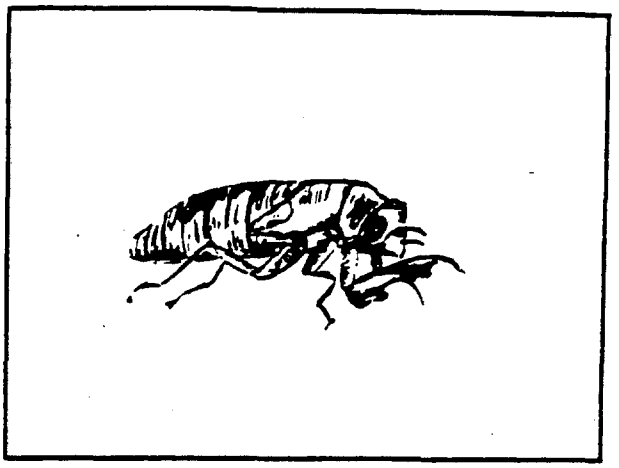
3. they visit flowers that other types of bees won't, such as red clover

4. these are our native bees, whereas honey bees are introduced from Europe

Bumble Bee 2009

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Homoptera
5. Family Cicadidae
6. Genus Stictocephala
7. Species _____



Common Name Cicada Nymph

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all habitats
9. Actual location (soil, tree, beneath rotted log, etc.) nymphs live entirely underground
10. Description of "Home" they burrow through tunnels to food sources
11. Needs/Preferences need adequate food supply

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe) _____
15. Color usually brown
16. Size approximately 2.5 cm (one inch)
17. Exoskeleton/Skin (Describe) a hard skin
18. Markings/Shape
    A. Appendages _____
    B. Body _____
    C. Head _____
    D. Wings none

Behavior

19. Periods of Activity (Time of Day/Night) both
20. Lives alone, colonies, pairs, etc. lives alone
21. Symbiotic relationships (Is there another animal or plant this creature must live near?) _____

Reproduction

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

24. Breeding Conditions eggs pressed into bark c ing stems.
hatch within several weeks

25. Male/Female Differences

Food/Feeding Habits

26. Specific foods nymphs feed entirely on sap from plant roots
27. Carnivore, Omnivore, Herbivore, Parasite, etc. herbivore
28. Food source(s) plant roots

Fascinating Facts

29.

30.

31.

Adaptations

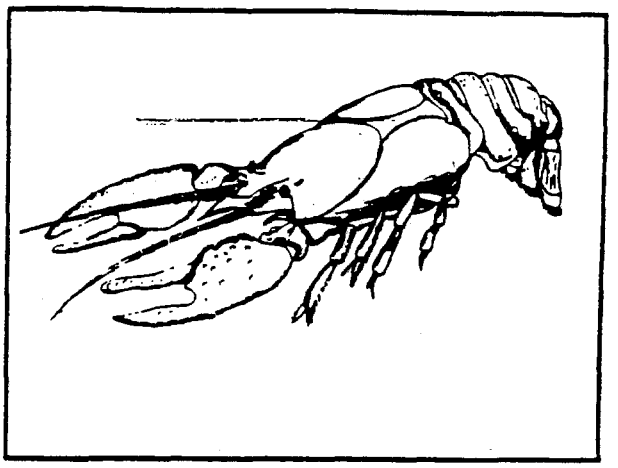
In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. specialized front pair of legs for borrowing
2. a piercing mouth part to pierce root tissue
3. lives below ground where it has adapted to darkness, dampness, and soil conditions and structure

Cicada Nymphs 2029

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Crustacea
4. Order Decapoda
5. Family
6. Genus
7. Species



Common Name Crayfish

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all habitats
9. Actual Location (soil, tree, beneath rotted log, etc.) on soil, below soil in burrows, and in water
10. Description of "Home" a burrow in the soil, sometimes with a soil covering or mound covering the top entrance
11. Needs/Preferences moisture to prevent its gills from drying

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs ten
14. Antennae (Describe) two
16. Size to six inches or longer
17. Exoskeleton/Skin (Describe) present
18. Markings/Shape
    A. Appendages
    B. Body
    C. Head
    D. Wings

Behavior

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

Reproduction

22. Livebearing or Egg Laying egg layer
23. Development (complete, incomplete metamorphosis, etc.) young resemble the adult
24. Breeding Conditions usually during spring

25. Male/Female Differences

Food/Feeding Habits

26. Specific foods omnivorous - any available plant and animal matter; loves earthworms
27. Carnivore, Omnivore, Herbivore, Parasite, etc. omnivore
28. Food source(s)

Fascinating Facts

29.

30.

31.

Adaptations

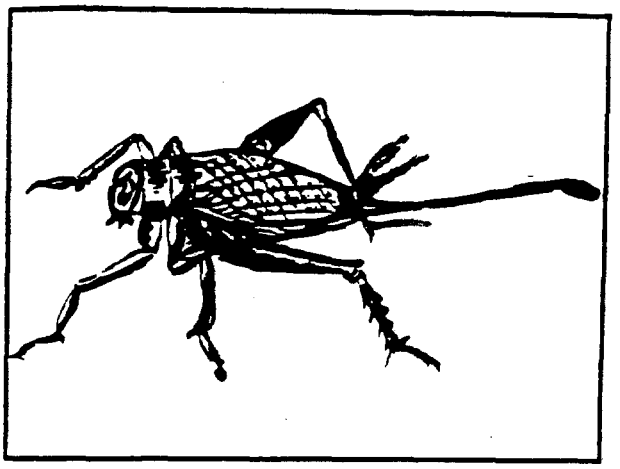
In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. builds tunnels, burrows, and sometimes covers on burrows made of mud
2. specialized large pincers for defense and food gathering
3. can regenerate lost appendages, especially before the adult stage

Crayfish 2037

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Orthoptera
5. Family Gryllidae
6. Genus Gryllus
7. Species Gryllus pennsylvanicus



Common Name Cricket

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all habitats
9. Actual Location (soil, tree, beneath rotted log, etc.) usually near ground, under leaves, bark, etc.
10. Description of "Home" under logs, stones, or in soil burrows
11. Needs/Preferences adequate food supply

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe) long and tapering
15. Color black to dark reddish brown
16. Size 12 mm or longer (up to one inch or more)
17. Exoskeleton/Skin (Describe) hard
18. Markings/Shape
    A. Appendages
    B. Body
    C. Head
    D. Wings

Behavior

19. Periods of Activity (Time of Day/Night) both, but usually night
20. Lives alone, colonies, pairs, etc. usually alone; sometimes several hide under a sheltered area

21. Symbiotic relationships (Is there another animal or plant this creature must live near?)_____

Reproduction

22. Livebearing or Egg Laying egg layer
23. Development (complete, incomplete metamorphosis, etc.) incomplete metamorphosis
24. Breeding Conditions lays eggs in moist soil
25. Male/Female Differences

Food/Feeding Habits

26. Specific foods usually vegetable matter; sometimes carnivorous
27. Carnivore, Omnivore, Herbivore, Parasite, etc. herbivore, sometimes carnivore
28. Food source(s) terrestial

Fascinating Facts

29.
30.
31.

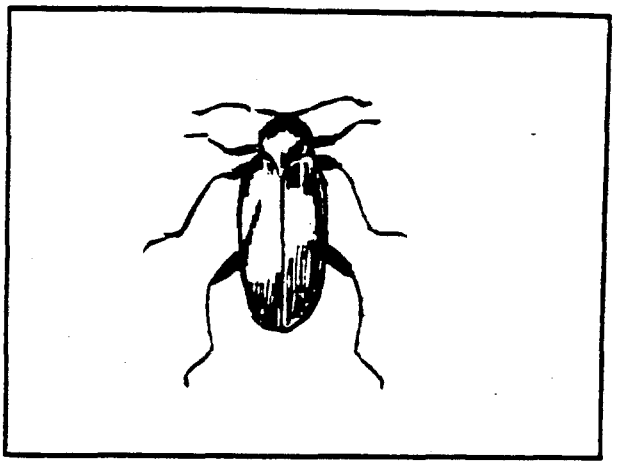
Adaptations

In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. crickets that live near the soil are usually black or gray in color
2. crickets that live above ground in plants are usually green
3. some crickets fly rather well to reach new feeding areas as well as to escape from predators
4. strong, jumping legs for quick escape from predators
5. the females of some species of crickets have a long ovipositor for depositing eggs below the surface of the soil

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Coleoptera
5. Family Chrysomelidae
6. Genus Chrysochus
7. Species Chrysochus auratus



Common Name Dogbane Beetle

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) prairie, savannah, meadow
9. Actual Location (soil, tree, beneath rotted log, etc.) on dogbane
10. Description of "Home" feeds on leaves
11. Needs/Preferences lives only on dogbane plants

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe)
16. Size nearly one and a half cm
17. Exoskeleton/Skin (Describe)
18. Markings/Shape
    A. Appendages
    B. Body
    C. Head
    D. Wings

Behavior

19. Periods of Activity (Time of Day/Night) usually daytime
20. Lives alone, colonies, pairs, etc. varies
21. Symbiotic relationships (Is there another animal or plant this creature must live near?)

Reproduction

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

24. Breeding Conditions _____

25. Male/Female Differences _____

Food/Feeding Habits

26. Specific foods dogbane leaves only
27. Carnivore, Omnivore, Herbivore, Parasite, etc. herbivore
28. Food source(s) _____

Fascinating Facts

29. _____

30. _____

31. _____

Adaptations

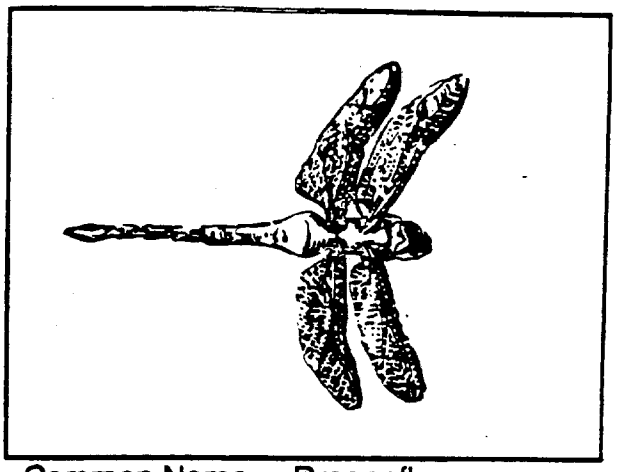
In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. jaws designed for chewing leaf tissue
2. adult stage coordinated with maturity of dogbane plant
3. _____

Dogbane Beetle on Dogbane 2049

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Odonata
5. Family Aeshnidae
6. Genus
7. Species



Common Name Dragonfly

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all habitats for the adult stage
9. Actual Location (soil, tree, beneath rotted log, etc.) flies freely
10. Description of "Home"
11. Needs/Preferences eggs are laid in water where they hatch and the nymphs develop

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe) short and bristle-like
15. Color blue, green, or brown
16. Size 57 - 120 mm
17. Exoskeleton/Skin (Describe) hard skin covering present
18. Markings/Shape
    A. Appendages
    B. Body long and thin
    C. Head large eyes cover head
    D. Wings

Behavior

19. Periods of Activity (Time of Day/Night) adult - daytime; immature - both day and night
20. Lives alone, colonies, pairs, etc. alone and in pairs
21. Symbiotic relationships (Is there another animal or plant this creature must live near?)

Reproduction

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

incomplete metamorphosis

24. Breeding Conditions eggs laid into submerged plants

25. Male/Female Differences

Food/Feeding Habits

26. Specific foods mosquitoes, flies

27. Carnivore, Omnivore, Herbivore, Parasite, etc. carnivore

28. Food source(s) the immature nymph stage feeds underwater on invertebrates and small vertebrates (tadpoles, fish).

Fascinating Facts

29.

30.

31.

Adaptations

In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. the males fight for their mates, and then guard them during egg laying

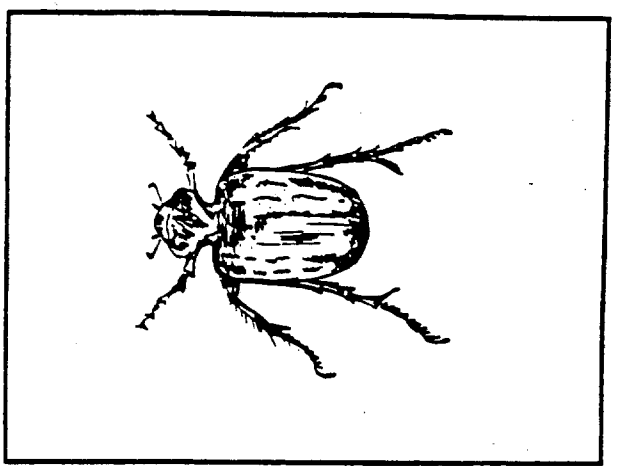
2. they can detect and avoid polluted areas

3. they utilize terrestrial food suply when adults and the aquatic food supply in the nymph stage

Dragonfly 2053

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Coleoptera
5. Family Scarabaeidae
6. Genus Ataenius



Common Name Dung Beetle or Tumblebug

7. Species Ataenius cognatus

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all habitats
9. Actual Location (soil, tree, beneath rotted log, etc.) manure
10. Description of "Home" manure (feces)
11. Needs/Preferences hibernates under dry cow manure

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe) two
15. Color reddish black
16. Size 4.8 - 5.1 mm
17. Exoskeleton/Skin (Describe)
18. Markings/Shape
    A. Appendages
    B. Body
    C. Head
    D. Wings

Behavior

19. Periods of Activity (Time of Day/Night) nocturnal
20. Lives alone, colonies, pairs, etc. variable
21. Symbiotic relationships (Is there another animal or plant this creature must live near?) cows

Reproduction

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

complete metamorphosis

24. Breeding Conditions

25. Male/Female Differences

Food/Feeding Habits

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

Fascinating Facts

29.

30.

31.

Adaptations

In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. utilizes a food source not preferred by many other organisms

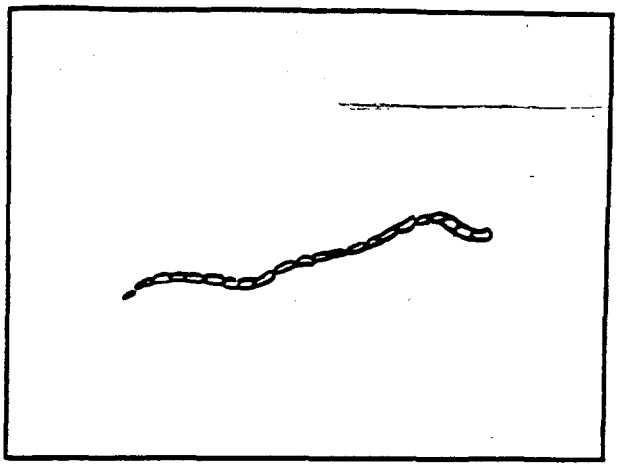
2.

3.

Dung Beetle or Tumblebug 2273

Invertebrates

1. Kingdom Animalia
2. Phylum Annelida
3. Class
4. Order
5. Family
6. Genus
7. Species



Common Name Entracheous

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) moist habitats
9. Actual Location (soil, tree, beneath rotted log, etc.) usually moist soil
10. Description of "Home"
11. Needs/Preferences

Physical Characteristics

12. Number of segments or body sections a segmented worm
13. Number of legs none
14. Antennae (Describe) none
15. Color white
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 animal or plant this creature must live near?)

Reproduction

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

24. Breeding Conditions _____

25. Male/Female Differences _____

Food/Feeding Habits

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

Fascinating Facts

29. _____

30. _____

31. _____

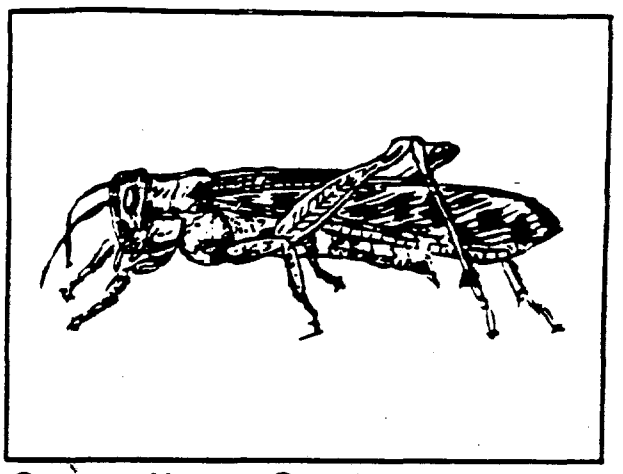
Adaptations

In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. a native segmented worm
2. _____
3. _____
4. _____
5. _____

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Orthoptera
5. Family Acrididae
6. Genus
7. Species



Common Name Grasshopper

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all habitats
9. Actual Location (soil, tree, beneath rotted log, etc.) terrestrial
10. Description of "Home"
11. Needs/Preferences adequate herbacious cover and food supply

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe) relatively short on the short-horned species
15. Color green, brown, gray
16. Size to two inches or more
17. Exoskeleton/Skin (Describe) tough layer
18. Markings/Shape
    A. Appendages red legs on some species
    B. Body
    C. Head
    D. Wings two pairs

Behavior

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

Reproduction

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

incomplete metamorphosis

24. Breeding Conditions eggs laid 5- 4 at a time, in a pod, which is buried

25. Male/Female Differences

Food/Feeding Habits

26. Specific foods many species of grasses and forbs
27. Carnivore, Omnivore, Herbivore, Parasite, etc. herbivore
28. Food source(s)

Fascinating Facts

29.

30.

31.

Adaptations

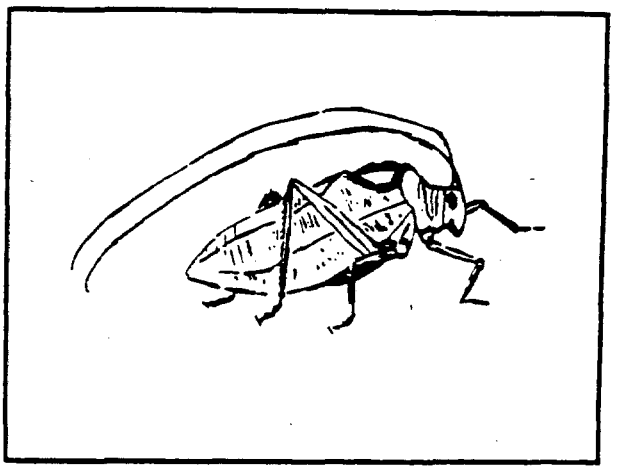
In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. they can "sing" by rubbing the hind legs against the front wings
2. they can fly to escape danger
3. they can fly to escape predators

Red-Legged Grasshopper 2133

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Orthoptera
5. Family Tettigoniidae
6. Genus
7. Species



Common Name Katydid

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all habitats
9. Actual Location (soil, tree, beneath rotted log, etc.) terrestrial
10. Description of "Home" on plants, trees, shrubs
11. Needs/Preferences green leaves

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe) extremely long
15. Color green
16. Size 14-75 mm
17. Exoskeleton/Skin (Describe) hard
18. Markings/Shape
    A. Appendages
    B. Body
    C. Head
    D. Wings

Behavior

19. Periods of Activity (Time of Day/Night) both day and night
20. Lives alone, colonies, pairs, etc. varies; no specific preferences
21. Symbiotic relationships (Is there another animal or plant this creature must live near?)

Reproduction

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

24. Breeding Conditions eggs laid in plant tissues

25. Male/Female Differences

Food/Feeding Habits

26. Specific foods green leaves, stems, flower parts
27. Carnivore, Omnivore, Herbivore, Parasite, etc. herbivore
28. Food source(s) plants

Fascinating Facts

29.

30.

31.

Adaptations

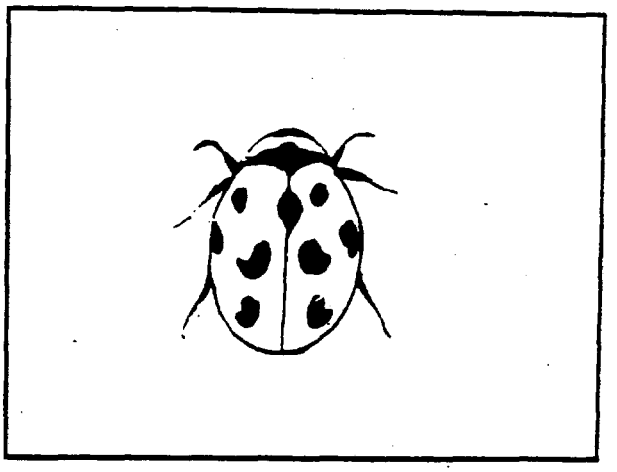
In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. they can "sing" to one another providing identification during courtship and mating
2. strong wings for flight to various food sources
3. flight to escape enemies

Katydid 2077

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Coleoptera
5. Family Coccinellidae
6. Genus
7. Species



Common Name Ladybug

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) varied
9. Actual Location (soil, tree, beneath rotted log, etc.) frequent leaves, stems, and flowers
10. Description of "Home"
11. Needs/Preferences wherever favorite foods are located

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe) short, club, 3-6-segmented
15. Color yellow, orange or red with black markings or black with yellow to reddish markings
16. Size 0.8 - 10.0 mm
17. Exoskeleton/Skin (Describe) hard
18. Markings/Shape
    A. Appendages
    B. Body broadly oval to nearly spherical
    C. Head partly or completely concealed by pronotum
    D. Wings front wings are bordered cases for hind wings; various numbers of spots, depending on species, on front wings

Behavior

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

Reproduction

22. Livebearing or Egg Laying egg layer
23. Development (complete, incomplete metamorphosis, etc.) complete metamorphosis with resting pupal stage
24. Breeding Conditions during the growing season
25. Male/Female Differences

Food/Feeding Habits

26. Specific foods aphids and scale insects
27. Carnivore, Omnivore, Herbivore, Parasite, etc. carnivore
28. Food source(s)

Fascinating Facts

29.

30.

31.

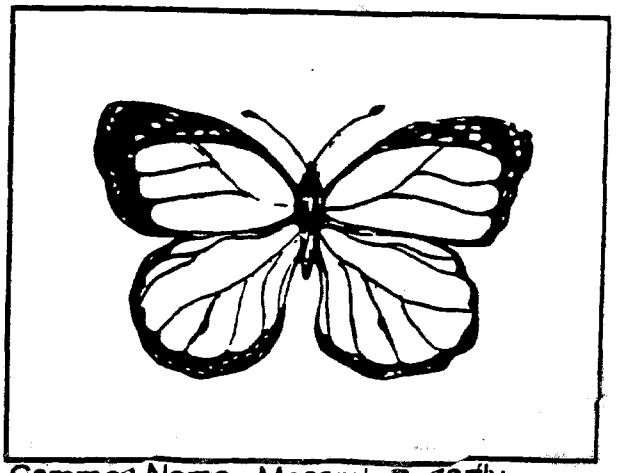
Adaptations

In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. females enhance genetic variability by selecting mates based on rarer colors
2. when threatened, they retract their legs and antennae into their dome-shaped shields, like a turtle
3. larvae release distasteful chemicals when ruptured which can gum up an enemy's antennae and mouth
4. adults release the same substance from their knee joints when injured

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Lepidoptera
5. Family Danaidae
6. Genus Danaus
7. Species Danaus plexippus



Common Name Monarch Butterfly

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all habitats
9. Actual location (soil, tree, beneath rotted log, etc.) terrrestrial, above ground
10. Description of "Home" a North American species that requires the milkweed family of plants
11. Needs/Preferences

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe) club is weakly swollen
15. Color bright, burnt-orange with black margins with white dots
16. Size 3 1/2" - 4 inches
17. Exoskeleton/Skin (Describe)
18. Markings/Shape
    A. Appendages Forelegs end in spiny knobs in females
    B. Body
    C. Head
    D. Wings

Behavior

19. Periods of Activity (Time of Day/Night) daytime
20. Lives alone, colonies, pairs, etc. alone, in pairs; may migrate in colonies
21. Symbiotic relationships (Is there another animal or plant this creature must live near?) milkweed

Reproduction

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

complete metamorphosis

24. Breeding Conditions warm weather

25. Male/Female Differences

Food/Feeding Habits

26. Specific foods a variety of milkweed species
27. Carnivore, Omnivore, Herbivore, Parasite, etc. herbivore
28. Food source(s) adults feed on pollen of different plants; immature caterpillars feed upon the leaves of the milkweed family

Fascinating Facts

29.

30.

31.

Adaptations

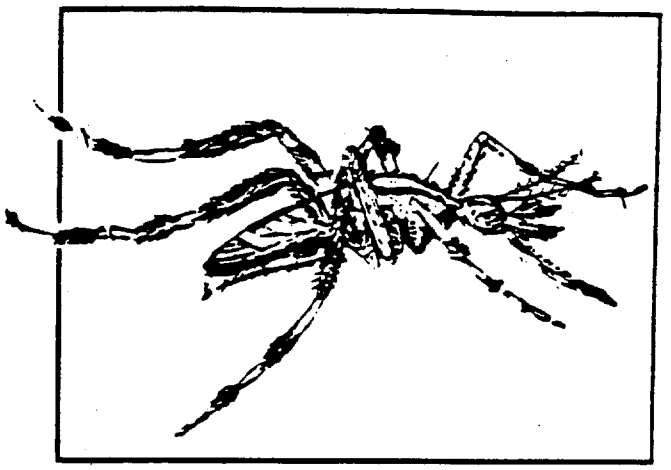
In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. they have bad-tasting body fluids, so the birds leave them alone
2. they migrate south for better wintering conditions and north for better feeding sources
3. can pollinate the rather difficult milkweed species

Monarch Butterfly 2097

Invertebrates

1. Kingdom Animalia
2. Phylum Invertebrate
3. Class Insecta
4. Order Diptera
5. Family Culicidae
6. Genus
7. Species



Common Name Mosquito

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) lowland, marsh, meadow, savanna
9. Actual location (soil, tree, beneath rotted log, etc.) eggs/larva - water; adults - entirely aerial
10. Description of "Home" eggs/larva/pupa - standing water, pools or ponds; adults - everywhere reasonably near water source
11. Needs/Preferences

Physical Characteristics

12. Number of segments or body sections three: head/thorax/abdomen
13. Number of legs six - segmented
14. Antennae (Describe) two - ciliated
15. Color tan-grey abdominal striping evident
16. Size >1 cm
17. Exoskeleton/Skin (Describe) chitin - fragile
18. Markings/Shape
    - A. Appendages segmented legs - may appear striped
    - B. Body three sections - abdomen segmented
    - C. Head large eye (compound)
    - D. Wings single pair - elongated/delicate

Behavior

19. Periods of Activity (Time of Day/Night) most active dawn/dusk - any time other than direct sun
20. Lives alone, colonies, pairs, etc. mated pair - male dies
21. Symbiotic relationships (Is there another animal or plant this creature must live near?)

Reproduction

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

complete metamorphosis

24. Breeding Conditions water (still) must be present
eggs may be laid in moist soil and will hatch when water becomes available

25. Male/Female Differences female - long proboscis (mouthpart)
male - rudimentary mouth parts - does not eat - mates and dies

Food/Feeding Habits

26. Specific foods blood - adult; tiny pond animals - larva

27. Carnivore, Omnivore, Herbivore, Parasite, etc. carnivore (larva and adult

28. Food source(s) larva - small pond creatures; adult - blood of warm-blooded animals

Fascinating Facts

29. carriers of diseases such as encephalitis, malaria, tularemia
NO evidence that mosquito carries AIDS

30. belongs to same order as gnats and flies

31.

Adaptations

In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1.

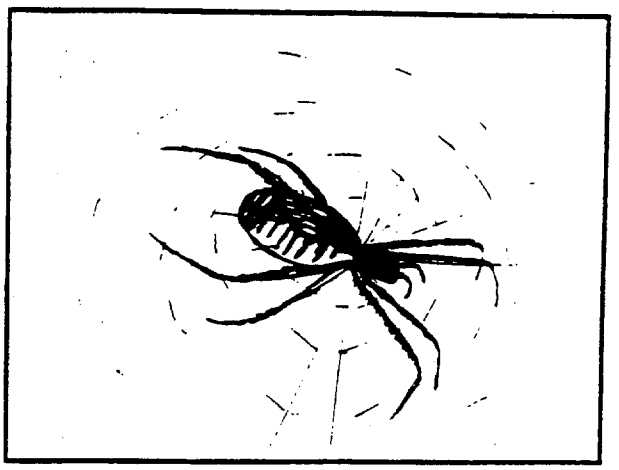
2.

3.

Mosquito 2285

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Arachnida
4. Order Araneida
5. Family Araneidae
6. Genus
7. Species



Common Name Orb Weaver Spider

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all habitats
9. Actual Location (soil, tree, beneath rotted log, etc.) aboveground
10. Description of "Home" a geometric web
11. Needs/Preferences taller, rigid structures to anchor its web

Physical Characteristics

12. Number of segments or body sections two
13. Number of legs eight
14. Antennae (Describe) none
15. Color light to dark brown, with five whitish spots forming cross
16. Size 1/2", excluding legs
17. Exoskeleton/Skin (Describe)
18. Markings/Shape
    A. Appendages
    B. Body large, in comparison to legs
    C. Head
    D. Wings none

Behavior

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

Reproduction

22. Livebearing or Egg Laying egg layer
23. Development (complete, incomplete metamorphosis, etc.) straight from eggs to spiders

24. Breeding Conditions in autumn, 600-800 eggs are laid in a silken cocoon

25. Male/Female Differences

Food/Feeding Habits

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

Fascinating Facts

29.

30.

31.

Adaptations

In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. webs are built in gaps between vegetation, which are likely to be in the flight path of insects
2. uses a chemical to paralyze its prey
3. each species has its specific color pattern

Orb Weaver 2109

Amphibians/Reptiles

1. Kingdom Animalia
2. Phylum Chordata
3. Class Reptilia
4. Order Squamata
5. Family Colubridae
6. Genus Elaphe
7. Species Elaphe vulpina

Common Name Fox Snake

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) prefers prairies; also in adjoining habitats - savanna, marsh, sedge meadow
9. a. Actual location of nesting place (tree, shrub, ground, etc.) on the ground; in a tree stump or log
   b. Describe nesting place eggs are deposited in a moist medium
10. Needs/Preferences needs a large, protected habitat where it can successfully carry out its life cycle

Physical Characteristics

11. Size females average 870 mm long; males average 960 mm long
12. Shape the body is very muscular
13. Color
14. Identifying Marks
    A. brown body with conspicuous blotches on neck and body
    B. a large snake with a thick body that is not slender
    C.
    D.

Behavior

15. Periods of Activity - Day/Night usually active in daylight except it may hunt on warm summer nights
16. Lives alone, colonies, pairs, etc. usually lives alone

Reproduction

17. Breeding Conditions (season, food supply, etc.) mating occurs in the spring

18. Care of young none

19. Number of eggs and color an average of eight white eggs are laid in a protected cavity; the eggs hatch after 60 days of incubation

Food/Feeding Habits

20. Specific food(s) feeds on small mammals such as mice and small rats; may feed upon bird eggs and young birds
21. Carnivore, Omnivore, Herbivore carnivore
22. Food source(s)

Fascinating Facts

23. this beautiful, harmless snake is a very useful constrictor, feeding upon small mammals
24. declining due to habitat loss
25. usually destroyed because of its resemblence to rattlesnakes; this snake deserves full protection

Adaptations

1. *has a habit of vibrating its tail when alarmed; named the "hardwood rattler"* because it makes a noise similar to the rattling of a rattlesnake
2. this behavior is performed in self-defense
3. a similar species is the Eastern milk snake
4.
5.

Western Foxsnake 2329

Amphibians/Reptiles

1. Kingdom Animalia
2. Phylum Chordata
3. Class Amphibia
4. Order Anura
5. Family Ranidae
6. Genus Rana
7. Species Rana pipiens

Common Name Leopard Frog

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) prairie, marsh, sedge meadow, fens
9. a. Actual location of nesting place (tree, shrub, ground, etc.) a cluster of eggs are laid in a marsh

   b. Describe nesting place mating and egg laying occur in early spring
10. Needs/Preferences needs a sufficient amount of water to fufill its life cycle

Physical Characteristics

11. Size 65 mm average length
12. Shape a frog that has a slim body
13. Color a green or brown body with spots that are greenish brown to black-edged with pale yellow or green; the spots are often paired
14. Identifying Marks
    - A. Head long, with bluntly-pointed snout projecting beyond lower jaw
    - B. Tail only in the tadpole stage
    - C. Feet hind legs long and muscular for jumping; webbed
    - D. Skin smooth; dorolateral folds present

Behavior

15. Periods of Activity - Day/Night active during day and night, especially when moist conditions prevail
16. Lives alone, colonies, pairs, etc. lives alone

Reproduction

17. Breeding Conditions (season, food supply, etc.) breeds in early spring

18. Care of young none

19. Number of eggs and color a female may lay up to 5,000 eggs

Food/Feeding Habits

20. Specific food(s) invertebrates and anything that can be swallowed whole

21. Carnivore, Omnivore, Herbivore carnivore; tadpoles mainly herbivores

22. Food source(s)

Fascinating Facts

23. adult females are slightly longer than males

24. the male has a pad on the inner side of his thumb throughout the year

25. in early spring males inflate their throats and sing to attract a mate

Adaptations

1. long legs for jumping and escaping predators

2. hind toes are webbed for swimming

3. the longer herbivorous intestine of the tadpole begins to shrink and modify to a shorter carnivorous intestine of the terrestrial frog stage

4. preys upon moving prey

Leopard Frog 2369

Amphibians/Reptiles

1. Kingdom Animalia
2. Phylum Chordata
3. Class Reptilia
4. Order Squamata
5. Family Natricidae
6. Genus Thamnophis
7. Species Thamnophis radix

Common Name Plains Garter Snake

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) an animal of prairie habitat
9. a. Actual location of nesting place (tree, shrub, ground, etc.) livebearing; 12-24 or more young born in summer
   b. Describe nesting place
10. Needs/Preferences needs prairie habitat with adequate vegetation cover for survival; also found in marsh and fen habitats

Physical Characteristics

11. Size 450 mm average length
12. Shape
13. Color a black or dark body with a median stripe that is usually orange
14. Identifying Marks
    A. Head a stripe along either side of the body; the stripe on the
    B. Tail side involves, on the front of the body, only the third and
    C. Feet fourth row of scales
    D. Skin

Behavior

15. Periods of Activity - Day/Night most active in daylight
16. Lives alone, colonies, pairs, etc. lives alone; may hibernate alone or in a colony

Reproduction

17. Breeding Conditions (season, food supply, etc.) mating occurs mainly in spring

18. Care of young none

19. Number of eggs and color livebearing

Food/Feeding Habits

20. Specific food(s) the diet consists primarily of earthworms, frogs, tadpoles, and sometimes fish
21. Carnivore, Omnivore, Herbivore carnivore
22. Food source(s) moist soil where earthworms are easy to find; marsh areas

Fascinating Facts

23. formerly abundant on prairies; declining due to habitat alteration and loss
24. a frequent food for hawks, bitterns, herons, raccoons, and other carnivores; inoffensive; important in the food web
25. food web
26. similar species is the common garter snake
27. may attempt to bite in self-defense when alarmed; usually calms down and becomes docile
28. sometimes releases a fowl-smelling fluid in self-defense

Adaptations

1. protective coloration
2. adapted to dry, medium, and moist habitat conditions
3. feeds on a variety of animal life
4.
5.

Plains Garter Snake 2317

Amphibians/Reptiles

1. Kingdom Animalia
2. Phylum Chordata
3. Class Reptilia
4. Order Squamata
5. Family Colubridae
6. Genus Opheadrys
7. Species Opheadrys vernalis Common Name Smooth Green Snake

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) prairie and prairie remnants
9. a. Actual location of nesting place (tree, shrub, ground, etc.) in soil

   b. Describe nesting place under objects such as a rock or grass clump
10. Needs/Preferences sunny location where adequate shelter is available

Physical Characteristics

11. Size males average 238 mm long; females average 325 mm long
12. Shape slender body
13. Color a green back and a whitish, yellow-tinged belly
14. Identifying Marks
    - A. Head
    - B. Tail
    - C. Feet
    - D. Skin the scales are smooth and are in fifteen rows

Behavior

15. Periods of Activity - Day/Night diurnal
16. Lives alone, colonies, pairs, etc. lives alone

Reproduction

17. Breeding Conditions (season, food supply, etc.) mating occurs usually in the spring
18. Care of young no care given to young or eggs

19. Number of eggs and color usually four or five white eggs laid in the soil or under objects; incubation from four to twenty-four days

Food/Feeding Habits

20. Specific food(s) invertebrates prefer soft-bodied insects such as crickets and caterpillars; feed upon spiders
21. Carnivore, Omnivore, Herbivore carnivore
22. Food source(s)

Fascinating Facts

23. inoffensive and docile; often climbs about in bushes and grass
24. generally will not survive well in captivity; needs a varied diet; requires basking in direct sunlight
25. formerly common in prairies; currently declining in numbers due to habitat loss and cannot survive where insecticides contaminate their food supply

Adaptations

1. a green body color on the back provides excellent camouflage and protection
2. a slender body provides efficient movement through the dense tangle of stems and leaves
3. may hibernate in an ant mound
4. an efficient insect controller
5.

Smooth Green Snake 2325

Amphibians/Reptiles

1. Kingdom Animalia
2. Phylum Chordata
3. Class Amphibia
4. Order Caudata
5. Family Ambystomidae
6. Genus Ambystoma
7. Species Ambystoma tigrinum

Common Name Tiger Salamander

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) prairies, savanna, open woods
9. a. Actual location of nesting place (tree, shrub, ground, etc.) in water, where egg masses are laid
   b. Describe nesting place
10. Needs/Preferences needs a marsh or body of water for egg laying and survival of aquatic immatures from March through August in northern Illinois

Physical Characteristics

11. Size our largest terrestrial salamander, reaching 10-12 inches in length
12. Shape a long, low body with four short legs and a tail
13. Color black to deep brown body color with yellow spots irregular in size and shape covering the body.
14. Identifying Marks
    A. Head
    B. Tail
    C. Feet 4 feet; unwebbed (frogs and toads have webbed hind feet)
    D. Skin smooth skin (reptiles have scales)

Behavior

15. Periods of Activity - Day/Night nocturnal; overcast, rainy days
16. Lives alone, colonies, pairs, etc. lives alone

Reproduction

17. Breeding Conditions (season, food supply, etc.) mates and lays eggs in spring, usually the month of March

18. Care of young none

19. Number of eggs and color lays from 20 to more than 100 eggs in a jelly-like mass attached to submerged stems

Food/Feeding Habits

20. Specific food(s) feeds on any animal small enough to be swallowed whole; readily eats earthworms and insects
21. Carnivore, Omnivore, Herbivore carnivore
22. Food source(s)

Fascinating Facts

23. prefers a solitary existence in burrows on prairie and savanna
24. migrates to breeding marshes and ponds in early spring, where eggs are deposited in clusters
25. with the destruction of prairies and more than 99% of Illinois marshlands, this interesting amphibian is becoming less common

Adaptations

1. the tiger salamander is an amphibian that has adapted to life away from the shady forests; it can survive the intense summer heat and
2. dry winds by making its own burrows, or by using the burrows of other animals
3.
4.
5.

Tiger Salamander 2381

Bird Data Sheets

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Birds

1. Kingdom Animalia
2. Phylum Chordata
3. Class Aves
4. Order Passeriformes
5. Family Corvidae
6. Genus Cyanocitta
7. Species Cyanocitta cristata

Common Name Blue Jay

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) forest
9. a. Actual location of nest (tree, shrub, ground, etc.) coniferous tree or thicket
   b. Describe nest platform of twigs, bark, grass, and paper
10. Needs/Preferences

Physical Characteristics

11. Size 11 - 12 1/2" (30 cm)
12. Shape
13. Color (Note difference between male and female) light blue and white pale-gray underparts
14. Identifying Marks
    A. Head crest
    B. Tail bright blue with white spots
    C. Feet
    D. Beak

Behavior

15. Periods of Activity - Day/Night day
16. Lives alone, colonies, pairs, etc. companies or loose flocks

Reproduction

17. Breeding Conditions (season, food supply, etc.)
18. Care of young male feeds mate and young

19. Number of eggs and color 4 to 6 eggs - olive or buff with brown spots

Food/Feeding Habits

20. Specific food(s) nuts, vegetable matter, acorns, beechnuts

21. Carnivore, Omnivore, Herbivore omnivore
22. Food source(s) spiders, snails, salamanders, tree frogs, cocoons, mice, eggs of other birds

Song

23. Description tull-ull call raucous jay-jay

Fascinating Facts

24. screams at hawks, cats, and snakes

25. will appropriate robin nests

26. will attack and kill larger birds such as woodpeckers

Adaptations

1. will settle around man

2.

3.

4.

5.

Birds

1. Kingdom Animalia
2. Phylum Chordata
3. Class Aves
4. Order Passeriformes
5. Family Icteridae
6. Genus Dolichonyx
7. Species Dolichonyx oryzivorus

Common Name Bobolink

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) meadow and marshes
9. a. Actual location of nest (tree, shrub, ground, etc.) ground

   b. Describe nest weed stems, lined with fine grasses
10. Needs/Preferences

Physical Characteristics

11. Size 6-8" (15-20 cm)
12. Shape
13. Color (Note difference between Male and Female) female is yellowish with dark stripes; male white patches on back and wings
14. Identifying Marks
    - A. Head buff with dark stripes
    - B. Tail
    - C. Feet
    - D. Beak small and conical

Behavior

15. Periods of Activity - Day/Night day
16. Lives alone, colonies, pairs, etc.

Reproduction

17. Breeding Conditions (season, food supply, etc.)
18. Care of young

19. Number of eggs and color 4-7 brownish eggs, spotted with brown and purple

Food/Feeding Habits

20. Specific food(s) seeds

21. Carnivore, Omnivore, Herbivore omnivore

22. Food source(s) seeds, caterpillars, grasshoppers, beetles

Song

23. Description a metallic "clink"

Fascinating Facts

24. travels as far as 5,000 miles from winter quarters to summer territory

25.

26.

Adaptations

1. found homesites in hayfields and damp meadows

2.

3.

Bobolink 1317

Birds

1. Kingdom Animalia
2. Phylum Chordata
3. Class Aves
4. Order Piciformes
5. Family Picidae
6. Genus Colaptes
7. Species Colaptes cafer

Common Name Flicker

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) savanna, forest
9. a. Actual location of nest (tree, shrub, ground, etc.) tree or gate-post or telephone pole (cavity)
   b. Describe nest chips line the nest
10. Needs/Preferences farms and cutover woods

Physical Characteristics

11. Size 12 1/2 - 14" (30 cm)
12. Shape
13. Color (Note difference between male and female) male has red moustache (nape)
14. Identifying Marks
    A. Head brownish gray on cheeks and throat
    B. Tail white rump
    C. Feet 3 front; 1 back - perching
    D. Beak long, curved

Behavior

15. Periods of Activity - Day/Night day
16. Lives alone, colonies, pairs, etc. pairs

Reproduction

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

18. Care of young male helps incubate - taking the night shift

19. Number of eggs and color 6 to 8 white eggs

Food/Feeding Habits

20. Specific food(s) insects

21. Carnivore, Omnivore, Herbivore omnivore

22. Food source(s) ants, grasshoppers, berries, acorn, beetles, larvae

Song

23. Description explosive - "clap" - loud - wicka - wicka

Fascinating Facts

24. male drums on a hollow trunk to warn off rivals and to inform his mate

25. only woodpeckers that feed on the ground

26.

Adaptations

1. will accept a bird box

2.

3.

Northern Flicker 1509

Birds

1. Kingdom Animalia
2. Phylum Chordata
3. Class Aves
4. Order Passeriformes
5. Family Fringillidae
6. Genus Spinus
7. Species Spinus tristis

Common Name Goldfinch

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) bushy thickets weedy grasslands, forest
9. a. Actual location of nest (tree, shrub, ground, etc.) upright fork of a small sapling or a shrub
   b. Describe nest well-made cup of grass, bark strips, and plant down
10. Needs/Preferences

Physical Characteristics

11. Size 4 1/2 - 5" (11-14 cm)
12. Shape
13. Color (Note difference between Male and Female) male is bright yellow with a white rump, black forehead, white edges on black wings and tail
14. Identifying Marks
    A. Head
    B. Tail black
    C. Feet
    D. Beak

Behavior

15. Periods of Activity - Day/Night day
16. Lives alone, colonies, pairs, etc. flocks

Reproduction

17. Breeding Conditions (season, food supply, etc.) midsummer - late summer when seeds are available
18. Care of young

19. Number of eggs and color 4 or 5 pale blue eggs

Food/Feeding Habits

20. Specific food(s) seeds

21. Carnivore, Omnivore, Herbivore herbivore

22. Food source(s)

Song

23. Description sweet call: per-chic-o-ree

Fascinating Facts

24. one brood per year because they nest so late

25.

26.

Adaptations

1.

2.

3.

Goldfinch 1297

Birds

1. Kingdom Animalia
2. Phylum Chordata
3. Class Aves
4. Order Galliformes
5. Family Tetraonidae
6. Genus Bonasa
7. Species Bonasa umbellus

Common Name Grouse

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) forests, farmlands, pastures
9. a. Actual location of nest (tree, shrub, ground, etc.) ground

   b. Describe nest shallow depression lined with leaves and concealed under bushes
10. Needs/Preferences

Physical Characteristics

11. Size 16-19" (40-48 cm)
12. Shape
13. Color (Note difference between male and female) brown black ruffs
14. Identifying Marks
    A. Head
    B. Tail fan-shaped, black banded
    C. Feet
    D. Beak

Behavior

15. Periods of Activity - Day/Night day
16. Lives alone, colonies, pairs, etc.

Reproduction

17. Breeding Conditions (season, food supply, etc.)
18. Care of young

19. Number of eggs and color 8-11 pinkish-buff eggs; plain spotted with dull brown

Food/Feeding Habits

20. Specific food(s)

21. Carnivore, Omnivore, Herbivore

22. Food source(s)

Song

23. Description female - soft hen-like clucks

Fascinating Facts

24. male sits on a log and beats wings, creating a drumming sound

25. highly esteemed game birds

26.

Adaptations

1. Grouse grow comb-like rows of bristles on toes, which serve as snowshoes

2.

3.

4.

5.

Birds -

1. Kingdom Animalia
2. Phylum Chordata
3. Class Aves
4. Order Passeriformes
5. Family Fringillidae
6. Genus Passerina
7. Species Passerina cyanea

Common Name Indigo Bunting

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) meadow, forest edge, pastures, fields
9. a. Actual location of nest (tree, shrub, ground, etc.) ground or shrub

   b. Describe nest a woven cup of grass stems and dead leaves
10. Needs/Preferences

Physical Characteristics

11. Size 5 1/4 - 5 3/4" (14 cm)
12. Shape
13. Color (Note difference between male and female) male - vivid blue female - brown with paler, streaked underparts
14. Identifying Marks
    A. Head
    B. Tail
    C. Feet
    D. Beak sparrowlike

Behavior

15. Periods of Activity - Day/Night day
16. Lives alone, colonies, pairs, etc. pairs

Reproduction

17. Breeding Conditions (season, food supply, etc.) middle of May

18. Care of young male doesn't incubate eggs, but brings food to female on the nest and helps feed the young

19. Number of eggs and color three or four bluish-white eggs

Food/Feeding Habits

20. Specific food(s) insects and weed seeds

21. Carnivore, Omnivore, Herbivore omnivore

22. Food source(s) weeds

Song

23. Description high-pitched song: sweet-sweet, where-where, here-here, see it-see it

Fascinating Facts

24. beneficial to the farmer and fruit grower

25.

26.

Adaptations

1.

2.

3.

Indigo Bunting 1473

Birds

1. Kingdom Animalia
2. Phylum Chordata
3. Class Aves
4. Order Passeriformes
5. Family Icteridae
6. Genus Sturnella
7. Species Sturnella magna

Common Name Meadow Lark

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) meadow, plains
9. a. Actual location of nest (tree, shrub, ground, etc.) ground

   b. Describe nest hollow (like a footprint) - dried grasses with a lining of pine needles, horsehair - dome-shaped roof
10. Needs/Preferences

Physical Characteristics

11. Size 8 1/2 - 11" (21-28 cm)
12. Shape
13. Color (Note difference between male and female) yellow throat; brownish-streaked; bold black "V" on the breast
14. Identifying Marks
    A. Head brown
    B. Tail stubby with white feathers
    C. Feet
    D. Beak

Behavior

15. Periods of Activity - Day/Night day
16. Lives alone, colonies, pairs, etc. flocks

Reproduction

17. Breeding Conditions (season, food supply, etc.) late winter
18. Care of young female alone incubates

19. Number of eggs and color 3 to 7 white splotched with brown and lavender

Food/Feeding Habits

20. Specific food(s) insects - cutworms, caterpillars, beetles, grass-hoppers, grubs
21. Carnivore, Omnivore, Herbivore carnivore primarily
22. Food source(s) weed seeds, waste grain

Song

23. Description sweet, plaintive whistle: tee-you, tee-yair

Fascinating Facts

24. polygamy is not unusual
25. youngsters (birds) demolish their nest
26. song is used in Hollywood soundtracks

Adaptations

1.
2.
3.
4.
5.

Birds

1. Kingdom Animalia
2. Phylum Chordata
3. Class Aves
4. Order Falcniformes
5. Family Accipitridae
6. Genus Buteo
7. Species Buteo jamaicensis

Common Name Red-tailed Hawk

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) forest adjacent to open country
9. a. Actual location of nest (tree, shrub, ground, etc.) tall tree or rocky ledge
   b. Describe nest substantial structure of sticks lined with shreds of bark and bits of fresh green vegetation
10. Needs/Preferences

Physical Characteristics

11. Size 18-25" (46-63 cm)
12. Shape stocky
13. Color (Note difference between male and female) whitish breast
14. Identifying Marks
    A. Head
    B. Tail rust-colored
    C. Feet claw
    D. Beak hooked

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 2 or 3 brown-spotted white eggs

Food/Feeding Habits

20. Specific food(s) small rodents

21. Carnivore, Omnivore, Herbivore carnivore

22. Food source(s)

Song

23. Description high-pitched descending scream with a horse quality

Fascinating Facts

24.

25.

26.

Adaptations

1.

2.

3.

Red-tailed Hawk 1533

Birds

1. Kingdom Animalia
2. Phylum Chordata
3. Class Aves
4. Order Passeriformes
5. Family Icteridae
6. Genus Agelaius
7. Species Agelaius phoeniceus

Common Name Red-winged Blackbird

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) savanna and marsh, swamps, meadows, pastures
9. a. Actual location of nest (tree, shrub, ground, etc.) ground

   b. Describe nest basket of rushes, filled in with peat or rotten wood, with a lining of fine grasses
10. Needs/Preferences

Physical Characteristics

11. Size 7 - 9.5" (17-24 cm)
12. Shape
13. Color (Note difference between Male and Female) male is black with red epaulets bordered in yellow or buff; female is brown
14. Identifying Marks
    A. Head
    B. Tail
    C. Feet
    D. Beak

Behavior

15. Periods of Activity - Day/Night
16. Lives alone, colonies, pairs, etc. colonies or flocks

Reproduction

17. Breeding Conditions (season, food supply, etc.) 2 or 3 broods a year
18. Care of young only female

19. Number of eggs and color 3 to 5 bluish-green eggs

Food/Feeding Habits

20. Specific food(s) weed seeds and waste grain

21. Carnivore, Omnivore, Herbivore herbivore

22. Food source(s) plants

Song

23. Description gurgling ok-a-lee

Fascinating Facts

24. monogamy is the rule

25. half the fledglings do not survive - due to mink, foxes, weasels, water snakes

26. male boldly attacks crows and hawks that try to invade

Adaptations

1.

2.

3.

Red-winged Blackbird 1545

Birds

1. Kingdom Animalia
2. Phylum Chordata
3. Class Aves
4. Order Passeriformes
5. Family Thurdidae
6. Genus Turdus
7. Species Turdus migratorius

Common Name Robin

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) forest (open), woodland, agricultural land
9. a. Actual location of nest (tree, shrub, ground, etc.) tree or on a ledge or windowsill
   b. Describe nest well-made cup of mud reinforced with grass and twigs, lined with softer grasses
10. Needs/Preferences

Physical Characteristics

11. Size 9"-11" (23-28 cm)
12. Shape
13. Color (Note difference between male and female) gray above head and tail black in males - dull gray in females
14. Identifying Marks
    A. Head
    B. Tail
    C. Feet
    D. Beak

Behavior

15. Periods of Activity - Day/Night day
16. Lives alone, colonies, pairs, etc. pairs

Reproduction

17. Breeding Conditions (season, food supply, etc.)
18. Care of young

19. Number of eggs and color 3-5 blue eggs

Food/Feeding Habits

20. Specific food(s) berries, worms, seeds

21. Carnivore, Omnivore, Herbivore omnivore

22. Food source(s)

Song

23. Description series of rich caroling notes rising and falling in pitch: cheer-up cheerily, cheer-up cheerily

Fascinating Facts

24.

25.

26.

Adaptations

1.

2.

3.

4.

5.

Birds

1. Kingdom Animalia
2. Phylum Chordata
3. Class Aves
4. Order Charadriiformes
5. Family Scolopacidae
6. Genus Philohela
7. Species Philohela minor

Common Name Woodcock

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) moist woodlands or thickets
9. a. Actual location of nest (tree, shrub, ground, etc.) ground

   b. Describe nest dead leaves or rushes
10. Needs/Preferences

Physical Characteristics

11. Size 11" (28 cm)
12. Shape
13. Color (Note difference between male and female) rufous below "dead leaf" pattern above
14. Identifying Marks
    A. Head
    B. Tail
    C. Feet
    D. Beak long

Behavior

15. Periods of Activity - Day/Night day
16. Lives alone, colonies, pairs, etc.

Reproduction

17. Breeding Conditions (season, food supply, etc.)
18. Care of young

19. Number of eggs and color 4 brown-spotted buff eggs

Food/Feeding Habits

20. Specific food(s) earthworms, insect larvae

21. Carnivore, Omnivore, Herbivore carnivore

22. Food source(s) occasionally vegetable matter

Song

23. Description loud buzzy beep similar to nighthawk

Fascinating Facts

24. spectacular aerial courtship flights

25.

26.

Adaptations

1.

2.

3.

Woodcock 1633

Birds

1. Kingdom Animalia
2. Phylum Chordata
3. Class Aves
4. Order Passeriformes
5. Family Parulidas
6. Genus Dendroica
7. Species Dendroica petechia

Common Name Yellow Warbler

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) thickets along streams
9. a. Actual location of nest (tree, shrub, ground, etc.) upright fork in a small sapling
   b. Describe nest well-made cup of bark, plant fibers
10. Needs/Preferences

Physical Characteristics

11. Size 4.5 - 5" (11-13 cm)
12. Shape
13. Color (Note difference between male and female) bright yellow with a light olive green tinge on back; male has fine rusty streaks on breast
14. Identifying Marks
    A. Head
    B. Tail
    C. Feet
    D. Beak sharp

Behavior

15. Periods of Activity - Day/Night day
16. Lives alone, colonies, pairs, etc.? pairs

Reproduction

17. Breeding Conditions (season, food supply, etc.)
18. Care of young

19. Number of eggs and color 4- ale blue eggs thickly spotted w/ brown

Food/Feeding Habits

20. Specific food(s) spiders, caterpillars, scale insects

21. Carnivore, Omnivore, Herbivore carnivore

22. Food source(s)

Song

23. Description bright and musical - sweet-sweet-sweet

Fascinating Facts

24. most widespread of the warblers

25. one of the principal victims of the cowbird

26.

Adaptations

1. nests in mangroves in tropical areas - may have a chestnut head or crown patch

2.

3.

Yellow Warbler 1649

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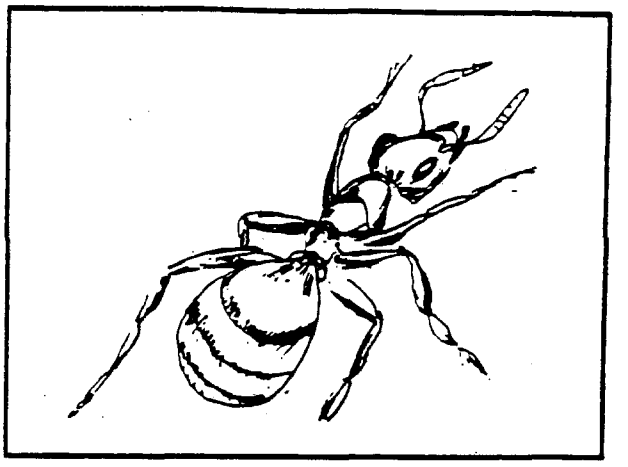
Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Hymenoptera
5. Family Formicidae
6. Genus
7. Species



Common Name Ant - Mound Builder

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) savannah, meadow
9. Actual Location
10. Description of "Home" mounds as high as 2' and as wide as 5'
11. Needs/Preferences well-drained prairie soil

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe) active, segmented, hairless
15. Color red/brown/black
16. Size 1 cm
17. Exoskeleton/Skin (Describe) hard chitinous exoskeleton
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 animal or plant this creature must live near?)

Reproduction

22. Livebearing or Egg Laying egg layers
23. Development (complete, incomplete metamorphosis, etc.) complete metamorphosis
24. Breeding Conditions queen lays eggs in colony nest, fertilized by males

25. Male/Female Differences_____

_____

Food/Feeding Habits

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

Fascinating Facts

29._____

_____

30._____

_____

31._____

_____

Adaptations

In your own words, explain how this creature has adapted to its environment to meet its needs. List at <u>least</u> three ways.

1._____

_____

2._____

_____

3._____

_____

4._____

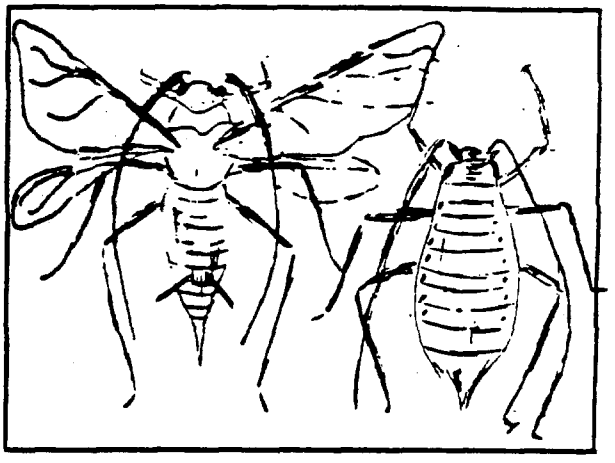
_____

5._____

_____

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Homoptera
5. Family Aphidae
6. Genus
7. Species



Common Name Aphids

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) aphid types in mesic to dry habitats
9. Actual Location (soil, tree, beneath rotted log, etc.) plants
10. Description of "Home" on primary host - secondary host - primary host
11. Needs/Preferences must live in association with specific host plant

Physical Characteristics

12. Number of segments or body sections three-winged form
13. Number of legs six
14. Antennae (Describe) two smooth/curved back over body
15. Color white - reddish waxy
16. Size usually less than 3 mm
17. Exoskeleton/Skin (Describe) soft body/pear shape
18. Markings/Shape
    A. Appendages two antennae/six legs/two cornicles near posterior end
    B. Body pear-shaped
    C. Head eyes adjacent to antennae
    D. Wings distinct venation/generally held vertically to body

Behavior

19. Periods of Activity (Time of Day/Night) greatest activity - day
20. Lives alone, colonies, pairs, etc. colonies - also often associated with ants
21. Symbiotic relationships (Is there another animal or plant this creature must live near?) particular host plants/ants (tended to like herds of cows by ant colonies

Reproduction

22. Livebearing or Egg Laying egg layers
23. Development (complete, incomplete metamorphosis, etc.) eggs over winter and

hatch into immature females: parthenogenesis (without fertilization)

24. Breeding Conditions ants often collect aphid eggs and protect them over winter

25. Male/Female Differences only females are produced parthenogenetically; after 2-3 generations, males are produced which mate and lay more eggs

Food/Feeding Habits

26. Specific foods plant feeders
27. Carnivore, Omnivore, Herbivore, Parasite, etc. herbivore
28. Food source(s) migrate from plant to plant depending on stage of life

Fascinating Facts

29. cause serious damage to cultivated plants

30. soft bodied - somewhat pear shaped

31. discharge from anus a clear watery liquid - honeydew
ants feed on honedew (see reproduction)

Adaptations

In your own words, explain how this creature has adapted to its environment to meet its needs. List at <u>least</u> three ways.

1.

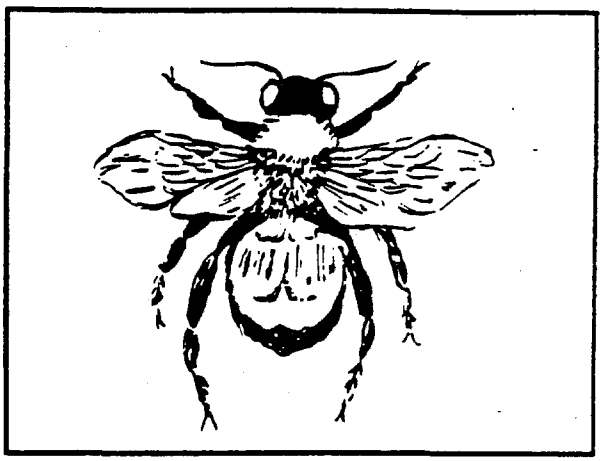
2.

3.

Aphids 2265

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Hymenoptera
5. Family Bombidae
6. Genus Bombus
7. Species _____ _____



Common Name Bumble Bee

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all sections where flowers are in bloom
9. Actual Location (soil, tree, beneath rotted log, etc.) deserted mouse nest or fields, sometimes underground
10. Description of "Home" underground chamber lined with fine grass and roots
11. Needs/Preferences young queens hibernate through winter in sheltered areas

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe) two
15. Color black with yellow markings
16. Size 15-25 mm
17. Exoskeleton/Skin (Describe) hairy
18. Markings/Shape
    A. Appendages "pollen baskets" along sides of hind legs
    B. Body black, with stiff, yellow hairs
    C. Head _____
    D. Wings _____

Behavior

19. Periods of Activity (Time of Day/Night) daytime
20. Lives alone, colonies, pairs, etc. colonial
21. Symbiotic relationships (Is there another animal or plant this creature must live near?) _____

Reproduction

22. Livebearing or Egg Laying egg layer
23. Development (complete, incomplete metamorphosis, etc.) _____

complete metamorphosis

24. Breeding Conditions in the spring eggs are laid into pollen-filled wax cells

25. Male/Female Differences

Food/Feeding Habits

26. Specific foods nectar and pollen

27. Carnivore, Omnivore, Herbivore, Parasite, etc. herbivore

28. Food source(s) flowering plants

Fascinating Facts

29.

30.

31.

Adaptations

In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. it has a sting which can inject venom into their enemies

2. their stings can be reused, unlike that of the honey bee

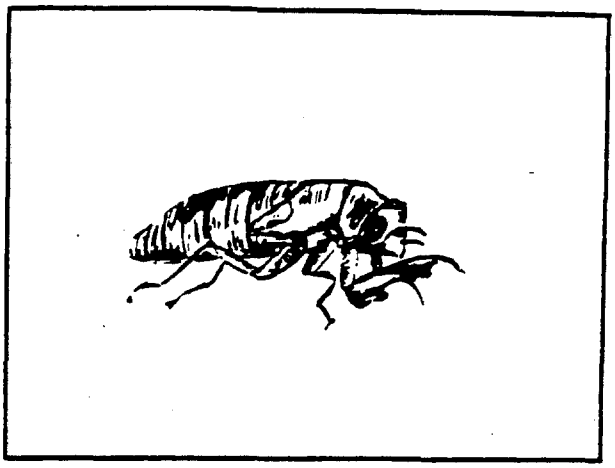
3. they visit flowers that other types of bees won't, such as red clover

4. these are our native bees, whereas honey bees are introduced from Europe

Bumble Bee 2009

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Homoptera
5. Family Cicadidae
6. Genus Stictocephala
7. Species _____



Common Name Cicada Nymph

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all habitats
9. Actual location (soil, tree, beneath rotted log, etc.) nymphs live entirely underground
10. Description of "Home" they burrow through tunnels to food sources
11. Needs/Preferences need adequate food supply

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe) _____
15. Color usually brown
16. Size approximately 2.5 cm (one inch)
17. Exoskeleton/Skin (Describe) a hard skin
18. Markings/Shape
    A. Appendages _____
    B. Body _____
    C. Head _____
    D. Wings none

Behavior

19. Periods of Activity (Time of Day/Night) both
20. Lives alone, colonies, pairs, etc. lives alone
21. Symbiotic relationships (Is there another animal or plant this creature must live near?) _____

Reproduction

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

24. Breeding Conditions eggs pressed into bark c ng stems.
hatch within several weeks

25. Male/Female Differences

Food/Feeding Habits

26. Specific foods nymphs feed entirely on sap from plant roots
27. Carnivore, Omnivore, Herbivore, Parasite, etc. herbivore
28. Food source(s) plant roots

Fascinating Facts

29.

30.

31.

Adaptations

In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. specialized front pair of legs for borrowing

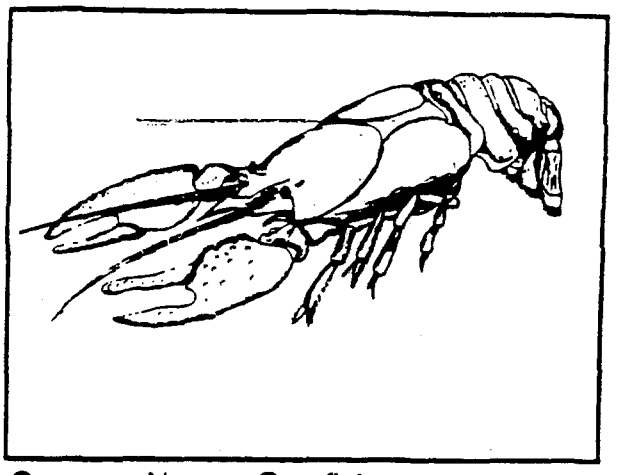
2. a piercing mouth part to pierce root tissue

3. lives below ground where it has adapted to darkness, dampness, and soil conditions and structure

Cicada Nymphs 2029

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Crustacea
4. Order Decapoda
5. Family
6. Genus
7. Species



Common Name Crayfish

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all habitats
9. Actual Location (soil, tree, beneath rotted log, etc.) on soil, below soil in burrows, and in water
10. Description of "Home" a burrow in the soil, sometimes with a soil covering or mound covering the top entrance
11. Needs/Preferences moisture to prevent its gills from drying

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs ten
14. Antennae (Describe) two
16. Size to six inches or longer
17. Exoskeleton/Skin (Describe) present
18. Markings/Shape
    A. Appendages
    B. Body
    C. Head
    D. Wings

Behavior

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

Reproduction

22. Livebearing or Egg Laying egg layer
23. Development (complete, incomplete metamorphosis, etc.) young resemble the adult
24. Breeding Conditions usually during spring

25. Male/Female Differences

Food/Feeding Habits

26. Specific foods omnivorous - any available plant and animal matter; loves earthworms
27. Carnivore, Omnivore, Herbivore, Parasite, etc. omnivore
28. Food source(s)

Fascinating Facts

29.

30.

31.

Adaptations

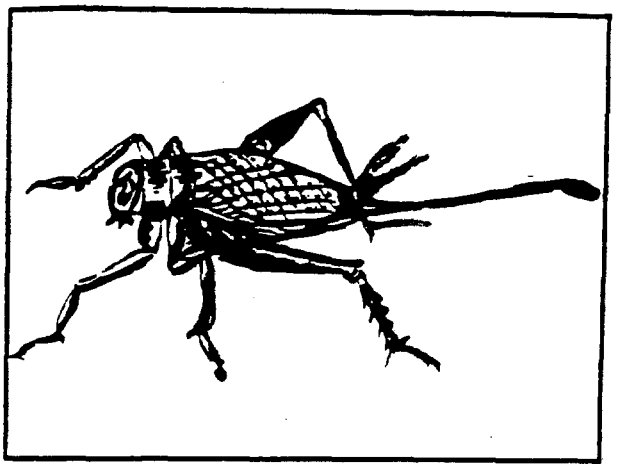
In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. builds tunnels, burrows, and sometimes covers on burrows made of mud
2. specialized large pincers for defense and food gathering
3. can regenerate lost appendages, especially before the adult stage

Crayfish 2037

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Orthoptera
5. Family Gryllidae
6. Genus Gryllus
7. Species Gryllus pennsylvanicus



Common Name Cricket

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all habitats
9. Actual Location (soil, tree, beneath rotted log, etc.) usually near ground, under leaves, bark, etc.
10. Description of "Home" under logs, stones, or in soil burrows
11. Needs/Preferences adequate food supply

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe) long and tapering
15. Color black to dark reddish brown
16. Size 12 mm or longer (up to one inch or more)
17. Exoskeleton/Skin (Describe) hard
18. Markings/Shape
    A. Appendages
    B. Body
    C. Head
    D. Wings

Behavior

19. Periods of Activity (Time of Day/Night) both, but usually night
20. Lives alone, colonies, pairs, etc. usually alone; sometimes several hide under a sheltered area

21. Symbiotic relationships (Is there another animal or plant this creature must live near?)_____

Reproduction

22. Livebearing or Egg Laying egg layer
23. Development (complete, incomplete metamorphosis, etc.) incomplete metamorphosis
24. Breeding Conditions lays eggs in moist soil
25. Male/Female Differences

Food/Feeding Habits

26. Specific foods usually vegetable matter; sometimes carnivorous
27. Carnivore, Omnivore, Herbivore, Parasite, etc. herbivore, sometimes carnivore
28. Food source(s) terrestial

Fascinating Facts

29.
30.
31.

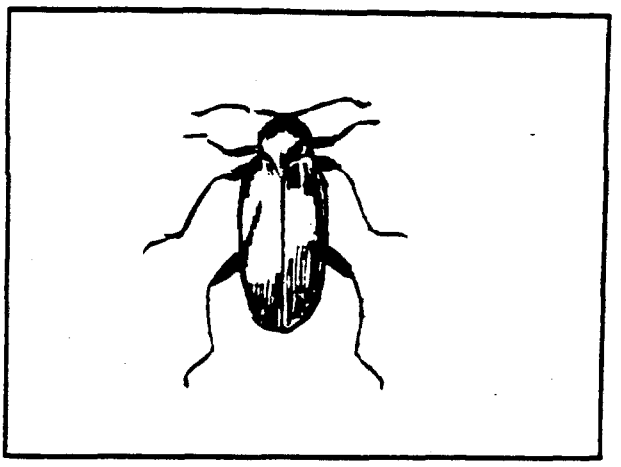
Adaptations

In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. crickets that live near the soil are usually black or gray in color
2. crickets that live above ground in plants are usually green
3. some crickets fly rather well to reach new feeding areas as well as to escape from predators
4. strong, jumping legs for quick escape from predators
5. the females of some species of crickets have a long ovipositor for depositing eggs below the surface of the soil

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Coleoptera
5. Family Chrysomelidae
6. Genus Chrysochus
7. Species Chrysochus auratus



Common Name Dogbane Beetle

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) prairie, savannah, meadow
9. Actual Location (soil, tree, beneath rotted log, etc.) on dogbane
10. Description of "Home" feeds on leaves
11. Needs/Preferences lives only on dogbane plants

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe)
16. Size nearly one and a half cm
17. Exoskeleton/Skin (Describe)
18. Markings/Shape
    A. Appendages
    B. Body
    C. Head
    D. Wings

Behavior

19. Periods of Activity (Time of Day/Night) usually daytime
20. Lives alone, colonies, pairs, etc. varies
21. Symbiotic relationships (Is there another animal or plant this creature must live near?)

Reproduction

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

24. Breeding Conditions_____

25. Male/Female Differences_____

Food/Feeding Habits

26. Specific foods dogbane leaves only
27. Carnivore, Omnivore, Herbivore, Parasite, etc. herbivore
28. Food source(s)_____

Fascinating Facts

29._____

30._____

31._____

Adaptations

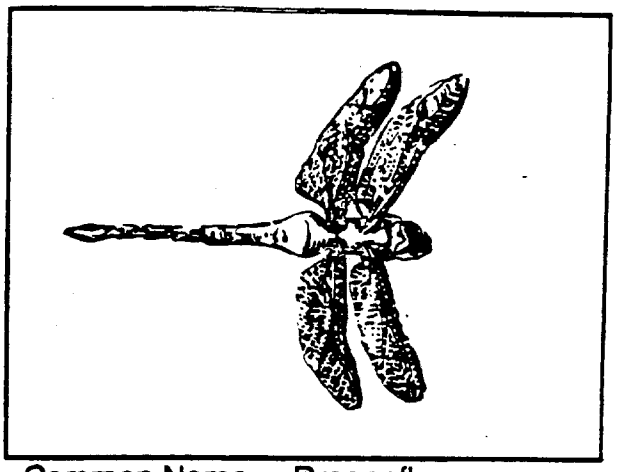
In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. jaws designed for chewing leaf tissue
2. adult stage coordinated with maturity of dogbane plant
3._____

Dogbane Beetle on Dogbane 2049

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Odonata
5. Family Aeshnidae
6. Genus
7. Species



Common Name Dragonfly

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all habitats for the adult stage
9. Actual Location (soil, tree, beneath rotted log, etc.) flies freely
10. Description of "Home"
11. Needs/Preferences eggs are laid in water where they hatch and the nymphs develop

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe) short and bristle-like
15. Color blue, green, or brown
16. Size 57 - 120 mm
17. Exoskeleton/Skin (Describe) hard skin covering present
18. Markings/Shape
    A. Appendages
    B. Body long and thin
    C. Head large eyes cover head
    D. Wings

Behavior

19. Periods of Activity (Time of Day/Night) adult - daytime; immature - both day and night
20. Lives alone, colonies, pairs, etc. alone and in pairs
21. Symbiotic relationships (Is there another animal or plant this creature must live near?)

Reproduction

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

incomplete metamorphosis

24. Breeding Conditions eggs laid into submerged plants

25. Male/Female Differences

Food/Feeding Habits

26. Specific foods mosquitoes, flies

27. Carnivore, Omnivore, Herbivore, Parasite, etc. carnivore

28. Food source(s) the immature nymph stage feeds underwater on invertebrates and small vertebrates (tadpoles, fish).

Fascinating Facts

29.

30.

31.

Adaptations

In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. the males fight for their mates, and then guard them during egg laying

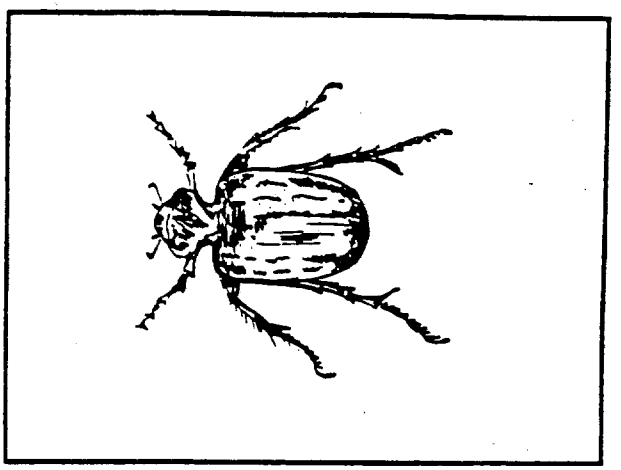
2. they can detect and avoid polluted areas

3. they utilize terrestrial food suply when adults and the aquatic food supply in the nymph stage

Dragonfly 2053

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Coleoptera
5. Family Scarabaeidae
6. Genus Ataenius



Common Name Dung Beetle or Tumblebug

7. Species Ataenius cognatus

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all habitats
9. Actual Location (soil, tree, beneath rotted log, etc.) manure
10. Description of "Home" manure (feces)
11. Needs/Preferences hibernates under dry cow manure

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe) two
15. Color reddish black
16. Size 4.8 - 5.1 mm
17. Exoskeleton/Skin (Describe)
18. Markings/Shape
    A. Appendages
    B. Body
    C. Head
    D. Wings

Behavior

19. Periods of Activity (Time of Day/Night) nocturnal
20. Lives alone, colonies, pairs, etc. variable
21. Symbiotic relationships (Is there another animal or plant this creature must live near?) cows

Reproduction

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

complete metamorphosis

24. Breeding Conditions

25. Male/Female Differences

Food/Feeding Habits

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

Fascinating Facts

29.

30.

31.

Adaptations

In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. utilizes a food source not preferred by many other organisms

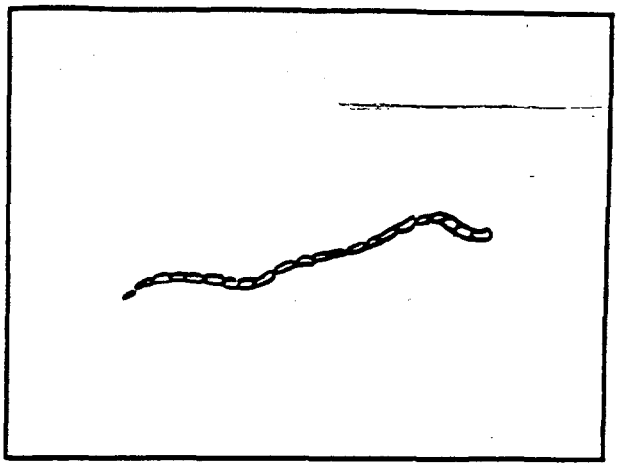
2.

3.

Dung Beetle or Tumblebug 2273

Invertebrates

1. Kingdom Animalia
2. Phylum Annelida
3. Class
4. Order
5. Family
6. Genus
7. Species



Common Name Entracheous

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) moist habitats
9. Actual Location (soil, tree, beneath rotted log, etc.) usually moist soil
10. Description of "Home"
11. Needs/Preferences

Physical Characteristics

12. Number of segments or body sections a segmented worm
13. Number of legs none
14. Antennae (Describe) none
15. Color white
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 animal or plant this creature must live near?)

Reproduction

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

24. Breeding Conditions _____

25. Male/Female Differences _____

Food/Feeding Habits

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

Fascinating Facts

29. _____

30. _____

31. _____

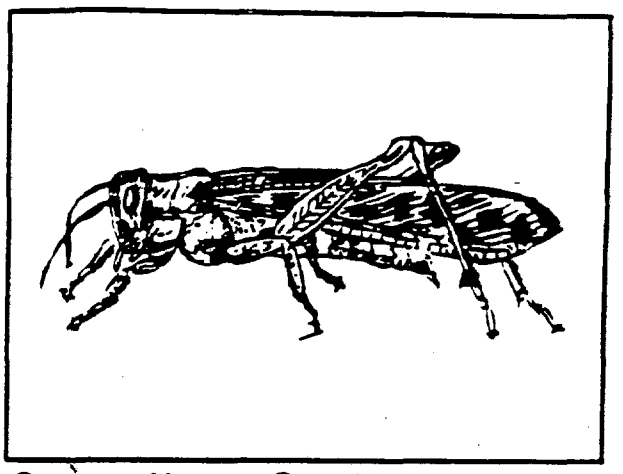
Adaptations

In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. a native segmented worm
2. _____
3. _____
4. _____
5. _____

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Orthoptera
5. Family Acrididae
6. Genus
7. Species



Common Name Grasshopper

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all habitats
9. Actual Location (soil, tree, beneath rotted log, etc.) terrestrial
10. Description of "Home"
11. Needs/Preferences adequate herbacious cover and food supply

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe) relatively short on the short-horned species
15. Color green, brown, gray
16. Size to two inches or more
17. Exoskeleton/Skin (Describe) tough layer
18. Markings/Shape
    A. Appendages red legs on some species
    B. Body
    C. Head
    D. Wings two pairs

Behavior

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

Reproduction

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

incomplete metamorphosis

24. Breeding Conditions eggs laid 5- 4 at a time, in a pod, which is buried

25. Male/Female Differences

Food/Feeding Habits

26. Specific foods many species of grasses and forbs
27. Carnivore, Omnivore, Herbivore, Parasite, etc. herbivore
28. Food source(s)

Fascinating Facts

29.

30.

31.

Adaptations

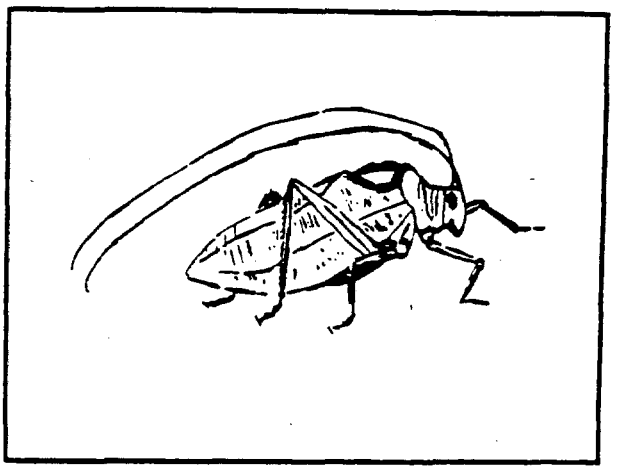
In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. they can "sing" by rubbing the hind legs against the front wings
2. they can fly to escape danger
3. they can fly to escape predators

Red-Legged Grasshopper 2133

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Orthoptera
5. Family Tettigoniidae
6. Genus
7. Species



Common Name Katydid

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all habitats
9. Actual Location (soil, tree, beneath rotted log, etc.) terrestrial
10. Description of "Home" on plants, trees, shrubs
11. Needs/Preferences green leaves

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe) extremely long
15. Color green
16. Size 14-75 mm
17. Exoskeleton/Skin (Describe) hard
18. Markings/Shape
    A. Appendages
    B. Body
    C. Head
    D. Wings

Behavior

19. Periods of Activity (Time of Day/Night) both day and night
20. Lives alone, colonies, pairs, etc. varies; no specific preferences
21. Symbiotic relationships (Is there another animal or plant this creature must live near?)

Reproduction

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

24. Breeding Conditions eggs laid in plant tissues

25. Male/Female Differences

Food/Feeding Habits

26. Specific foods green leaves, stems, flower parts
27. Carnivore, Omnivore, Herbivore, Parasite, etc. herbivore
28. Food source(s) plants

Fascinating Facts

29.

30.

31.

Adaptations

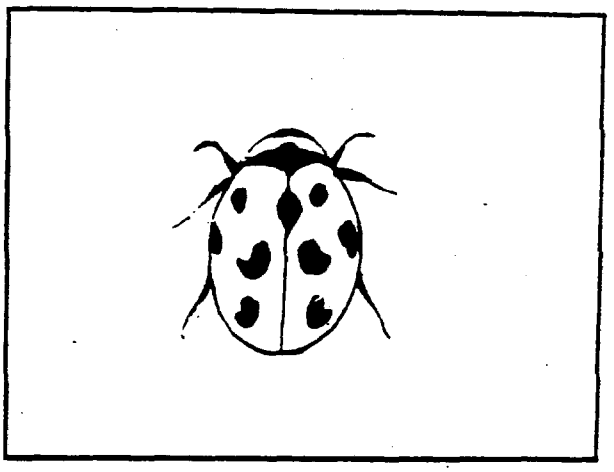
In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. they can "sing" to one another providing identification during courtship and mating
2. strong wings for flight to various food sources
3. flight to escape enemies

Katydid 2077

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Coleoptera
5. Family Coccinellidae
6. Genus
7. Species



Common Name Ladybug

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) varied
9. Actual Location (soil, tree, beneath rotted log, etc.) frequent leaves, stems, and flowers
10. Description of "Home"
11. Needs/Preferences wherever favorite foods are located

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe) short, club, 3-6-segmented
15. Color yellow, orange or red with black markings or black with yellow to reddish markings
16. Size 0.8 - 10.0 mm
17. Exoskeleton/Skin (Describe) hard
18. Markings/Shape
    A. Appendages
    B. Body broadly oval to nearly spherical
    C. Head partly or completely concealed by pronotum
    D. Wings front wings are bordered cases for hind wings; various numbers of spots, depending on species, on front wings

Behavior

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

Reproduction

22. Livebearing or Egg Laying egg layer
23. Development (complete, incomplete metamorphosis, etc.) complete metamorphosis with resting pupal stage
24. Breeding Conditions during the growing season
25. Male/Female Differences

Food/Feeding Habits

26. Specific foods aphids and scale insects
27. Carnivore, Omnivore, Herbivore, Parasite, etc. carnivore
28. Food source(s)

Fascinating Facts

29.

30.

31.

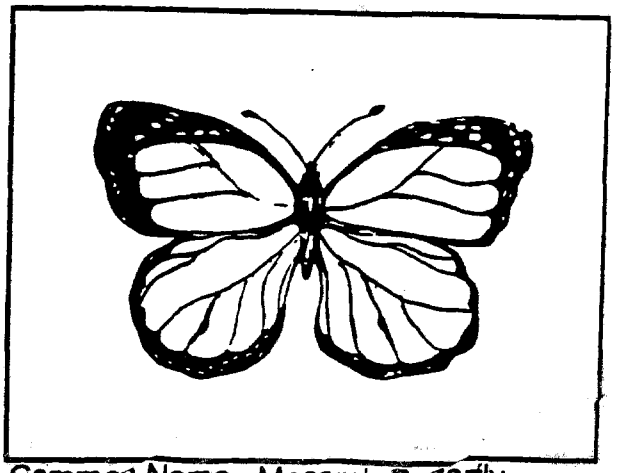
Adaptations

In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. females enhance genetic variability by selecting mates based on rarer colors
2. when threatened, they retract their legs and antennae into their dome-shaped shields, like a turtle
3. larvae release distasteful chemicals when ruptured which can gum up an enemy's antennae and mouth
4. adults release the same substance from their knee joints when injured

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Lepidoptera
5. Family Danaidae
6. Genus Danaus
7. Species Danaus plexippus



Common Name Monarch Butterfly

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all habitats
9. Actual location (soil, tree, beneath rotted log, etc.) terrrestrial, above ground
10. Description of "Home" a North American species that requires the milkweed family of plants
11. Needs/Preferences

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe) club is weakly swollen
15. Color bright, burnt-orange with black margins with white dots
16. Size 3 1/2" - 4 inches
17. Exoskeleton/Skin (Describe)
18. Markings/Shape
    A. Appendages Forelegs end in spiny knobs in females
    B. Body
    C. Head
    D. Wings

Behavior

19. Periods of Activity (Time of Day/Night) daytime
20. Lives alone, colonies, pairs, etc. alone, in pairs; may migrate in colonies
21. Symbiotic relationships (Is there another animal or plant this creature must live near?) milkweed

Reproduction

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

complete metamorphosis

24. Breeding Conditions warm weather

25. Male/Female Differences

Food/Feeding Habits

26. Specific foods a variety of milkweed species
27. Carnivore, Omnivore, Herbivore, Parasite, etc. herbivore
28. Food source(s) adults feed on pollen of different plants; immature caterpillars feed upon the leaves of the milkweed family

Fascinating Facts

29.

30.

31.

Adaptations

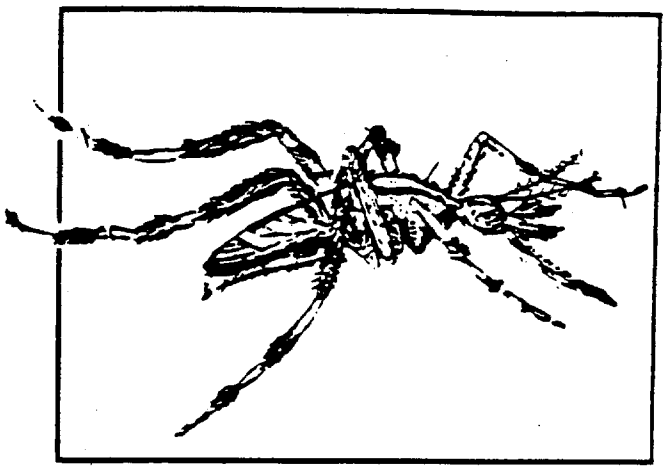
In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. they have bad-tasting body fluids, so the birds leave them alone
2. they migrate south for better wintering conditions and north for better feeding sources
3. can pollinate the rather difficult milkweed species

Monarch Butterfly 2097

Invertebrates

1. Kingdom Animalia
2. Phylum Invertebrate
3. Class Insecta
4. Order Diptera
5. Family Culicidae
6. Genus
7. Species



Common Name Mosquito

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) lowland, marsh, meadow, savanna
9. Actual location (soil, tree, beneath rotted log, etc.) eggs/larva - water; adults - entirely aerial
10. Description of "Home" eggs/larva/pupa - standing water, pools or ponds; adults - everywhere reasonably near water source
11. Needs/Preferences

Physical Characteristics

12. Number of segments or body sections three: head/thorax/abdomen
13. Number of legs six - segmented
14. Antennae (Describe) two - ciliated
15. Color tan-grey abdominal striping evident
16. Size >1 cm
17. Exoskeleton/Skin (Describe) chitin - fragile
18. Markings/Shape
    - A. Appendages segmented legs - may appear striped
    - B. Body three sections - abdomen segmented
    - C. Head large eye (compound)
    - D. Wings single pair - elongated/delicate

Behavior

19. Periods of Activity (Time of Day/Night) most active dawn/dusk - any time other than direct sun
20. Lives alone, colonies, pairs, etc. mated pair - male dies
21. Symbiotic relationships (Is there another animal or plant this creature must live near?)

Reproduction

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

complete metamorphosis

24. Breeding Conditions water (still) must be present
eggs may be laid in moist soil and will hatch when water becomes available

25. Male/Female Differences female - long proboscis (mouthpart)
male - rudimentary mouth parts - does not eat - mates and dies

Food/Feeding Habits

26. Specific foods blood - adult; tiny pond animals - larva

27. Carnivore, Omnivore, Herbivore, Parasite, etc. carnivore (larva and adult

28. Food source(s) larva - small pond creatures; adult - blood of warm-blooded animals

Fascinating Facts

29. carriers of diseases such as encephalitis, malaria, tularemia
NO evidence that mosquito carries AIDS

30. belongs to same order as gnats and flies

31.

Adaptations

In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1.

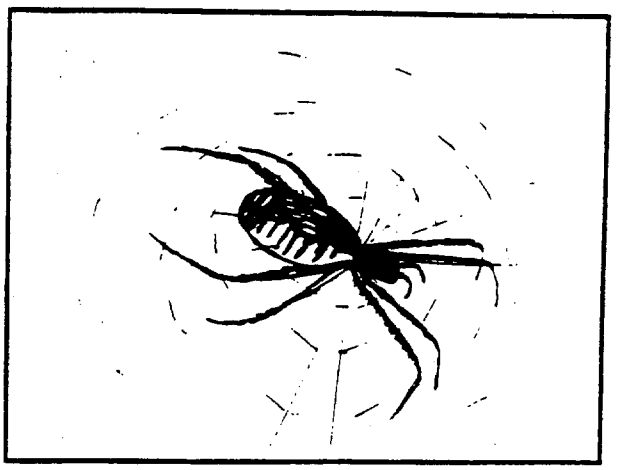
2.

3.

Mosquito 2285

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Arachnida
4. Order Araneida
5. Family Araneidae
6. Genus
7. Species



Common Name Orb Weaver Spider

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all habitats
9. Actual Location (soil, tree, beneath rotted log, etc.) aboveground
10. Description of "Home" a geometric web
11. Needs/Preferences taller, rigid structures to anchor its web

Physical Characteristics

12. Number of segments or body sections two
13. Number of legs eight
14. Antennae (Describe) none
15. Color light to dark brown, with five whitish spots forming cross
16. Size 1/2", excluding legs
17. Exoskeleton/Skin (Describe)
18. Markings/Shape
    A. Appendages
    B. Body large, in comparison to legs
    C. Head
    D. Wings none

Behavior

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

Reproduction

22. Livebearing or Egg Laying egg layer
23. Development (complete, incomplete metamorphosis, etc.) straight from eggs to spiders

24. Breeding Conditions in autumn, 600-800 eggs are laid in a silken cocoon

25. Male/Female Differences

Food/Feeding Habits

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

Fascinating Facts

29.

30.

31.

Adaptations

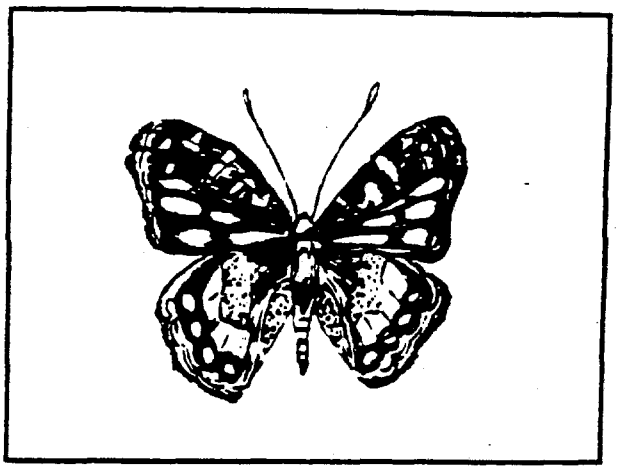
In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. webs are built in gaps between vegetation, which are likely to be in the flight path of insects
2. uses a chemical to paralyze its prey
3. each species has its specific color pattern

Orb Weaver 2109

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Lepidoptera
5. Family Nymphalidae
6. Genus Vanessa
7. Species Vanessa cardui



Common Name Painted Lady

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all habitats
9. Actual Location (soil, tree, beneath rotted log, etc.)
10. Description of "Home" caterpillars mainly feed upon the leaves of composites, pussy toes and mallows
11. Needs/Preferences adults seek many flowering species

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe) two
15. Color salmon orange, with black, blue, and white spots and blotches
16. Size 2 - 2 1/2 inches
17. Exoskeleton/Skin (Describe)
18. Markings/Shape
    A. Appendages
    B. Body
    C. Head
    D. Wings

Behavior

19. Periods of Activity (Time of Day/Night) daytime
20. Lives alone, colonies, pairs, etc. usually alone
21. Symbiotic relationships (Is there another animal or plant this creature must live near?) thistle

Reproduction

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

24. Breeding Conditions warm weather preferred

25. *Male/Female Differences*

Food/Feeding Habits

26. Specific foods thistle, mallows, pussy toes
27. Carnivore, Omnivore, Herbivore, Parasite, etc. herbivore
28. Food source(s)

Fascinating Facts

29.

30.

31.

Adaptations

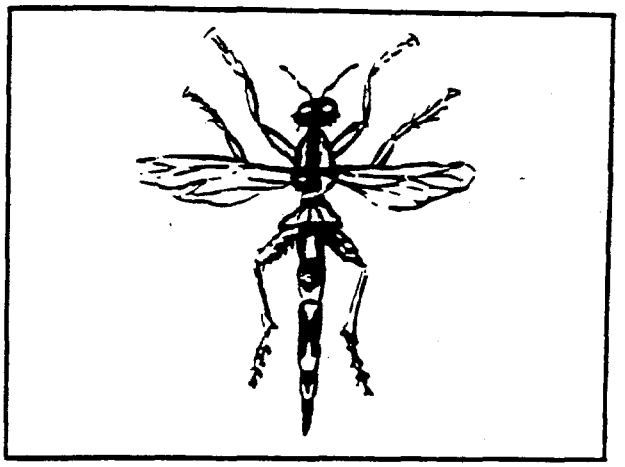
In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. one-way migrations to better climates
2. flexible migration patterns due to climate and food sources
3. immatures feed upon plants that other species do not prefer

Painted Lady 2117

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Diptera
5. Family Asilidae
6. Genus
7. Species



Common Name Robber Fly

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all habitats
9. Actual Location (soil, tree, beneath rotted log, etc.) above soil
10. Description of "Home"
11. Needs/Preferences feeds upon other insects

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe) short
15. Color brown, gray
16. Size 5-30 mm
17. Exoskeleton/Skin (Describe) hairy
18. Markings/Shape
    A. Appendages long, spindly legs
    B. Body
    C. Head hollowed out between eyes, bearded
    D. Wings one pair

Behavior

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

Reproduction

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

complete metamorphosis

24. Breeding Conditions

25. Male/Female Differences

Food/Feeding Habits

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

Fascinating Facts

29.

30.

31.

Adaptations

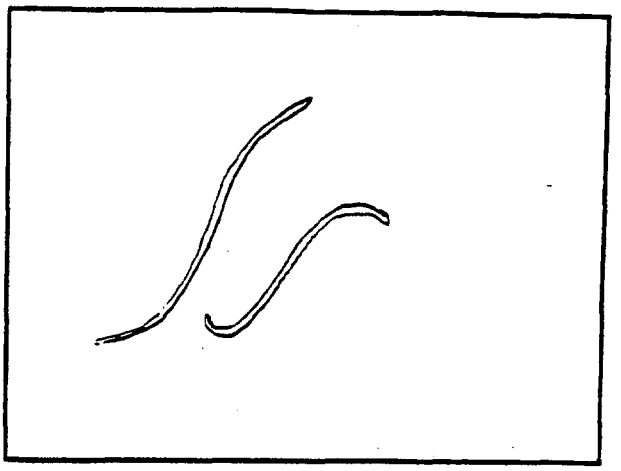
In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. their long legs allow them to quickly spring long distances to catch their prey
2. they can mimic their prey in order to be inconspicuous
3. they can maneuver well while in flight

Robber Fly 2141

Invertebrates

1. Kingdom Animalia
2. Phylum Aschelminthes
3. Class Nematoda
4. Order
5. Family
6. Genus
7. Species



Common Name Soil Nematodes

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all areas
9. Actual Location (soil, tree, beneath rotted log, etc.) all locations
10. Description of "Home"
11. Needs/Preferences a consumer

Physical Characteristics

12. Number of segments or body sections none
13. Number of legs none
14. Antennae (Describe) none
15. Color whitish and transparent
16. Size 0.5 - 5.0 mm
17. Exoskeleton/Skin (Describe)
18. Markings/Shape
    A. Appendages
    B. Body
    C. Head
    D. Wings

Behavior

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

Reproduction

22. Livebearing or Egg Laying egg layer and livebearing species
23. Development (complete, incomplete metamorphosis, etc.) does not apply; young resemble adults

24. Breeding Conditions

25. Male/Female Differences

Food/Feeding Habits

26. Specific foods
27. Carnivore, Omnivore, Herbivore, Parasite, etc. all apply
28. Food source(s) different species feed on different food sources

Fascinating Facts

29.

30.

31.

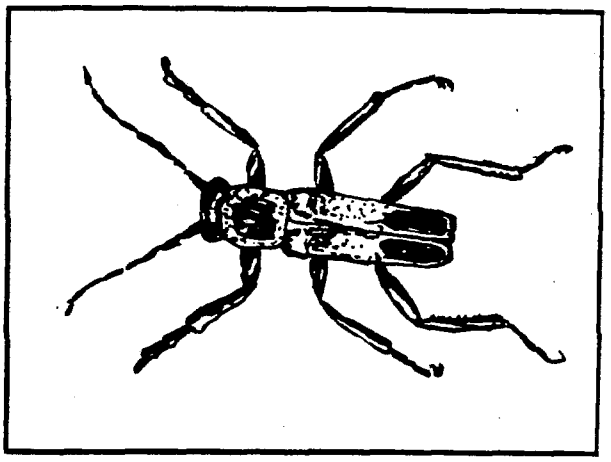
Adaptations

In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. some are parasitic and live on or in another organism
2. some are herbivorous and live in or on plant tissues
3. some are onmivorous and feed on dead plant and animal matter
4.
5.

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Coleoptera
5. Family Cantharidae
6. Genus Podabrus



7. Species Podabrus pennsylvanicus Common Name Soldier Beetle

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all sections
9. Actual Location (soil, tree, beneath rotted log, etc.) on goldenrod
10. Description of "Home"
11. Needs/Preferences goldenrod flowers

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe) long, filiform, and 11-segmented
15. Color dark, with reddish to orange markings
16. Size 8.5 - 12.5 mm
17. Exoskeleton/Skin (Describe) hard
18. Markings/Shape
    A. Appendages
    B. Body
    C. Head
    D. Wings leather-like elytra

Behavior

19. Periods of Activity (Time of Day/Night) daytime
20. Lives alone, colonies, pairs, etc. alone and in pairs
21. Symbiotic relationships (Is there another animal or plant this creature must live near?)

Reproduction

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

complete metamorphosis

24. Breeding Conditions eggs laid in soil where the larvae live and pupation takes place

25. Male/Female Differences

Food/Feeding Habits

26. Specific foods aphids, grasshopper eggs
27. Carnivore, Omnivore, Herbivore, Parasite, etc. omnivore
28. Food source(s) goldenrod flowers: nectar, petals

Fascinating Facts

29.

30.

31.

Adaptations

In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. its breeding cycle is coordinated with the goldenrod bloom

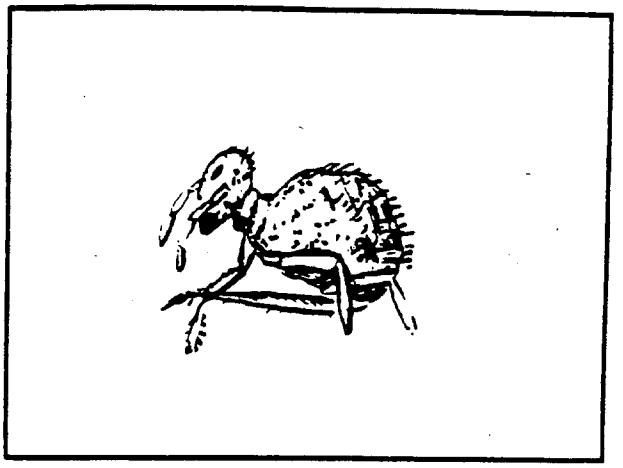
2. flight used to travel freely to different blooming goldenrods

3.

Soldier Beetle 2149

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Collembola
5. Family
6. Genus
7. Species



Common Name Springtail

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all habitats
9. Actual Location (soil, tree, beneath rotted log, etc.) soil, fungi, or under bark
10. Description of "Home"
11. Needs/Preferences

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe) short, 4-6 segmented
15. Color
16. Size 6mm or less
17. Exoskeleton/Skin (Describe)
18. Markings/Shape
    A. Appendages
    B. Body
    C. Head
    D. Wings none

Behavior

19. Periods of Activity (Time of Day/Night) day or night
20. Lives alone, colonies, pairs, etc. variable
21. Symbiotic relationships (Is there another animal or plant this creature must live near?)

Reproduction

22. Livebearing or Egg Laying egg layer
23. Development (complete, incomplete metamorphosis, etc.) no metamorphosis

24. Breeding Conditions_____

25. Male/Female Differences_____

Food/Feeding Habits

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

Fascinating Facts

29._____

30._____

31._____

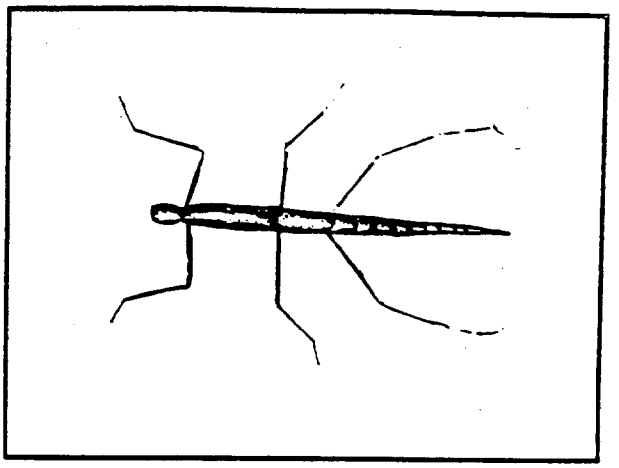
Adaptations

In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. "springtails" have a unique tail for maneuverability
2. _____
3. _____
4. _____
5. _____

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Orthoptera
5. Family Phasmatidae
6. Genus Megaphasma
7. Species Megaphasma dentricus



Common Name Walking Stick

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all habitats
9. Actual Location (soil, tree, beneath rotted log, etc.) on plants
10. Description of "Home" plants
11. Needs/Preferences specific plants such as willows, legumes, cherries

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe) long and thin, threadlike
15. Color greenish to reddish brown
16. Size 75-150 mm
17. Exoskeleton/Skin (Describe)
18. Markings/Shape
    A. Appendages long and slender
    B. Body long and slender
    C. Head
    D. Wings none on native species (present on tropical species)

Behavior

19. Periods of Activity (Time of Day/Night) both day and night
20. Lives alone, colonies, pairs, etc. alone
21. Symbiotic relationships (Is there another animal or plant this creature must live near?)

Reproduction

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

incomplete metamorphosis

24. Breeding Conditions

25. Male/Female Differences

Food/Feeding Habits

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

Fascinating Facts

29.

30.

31.

Adaptations

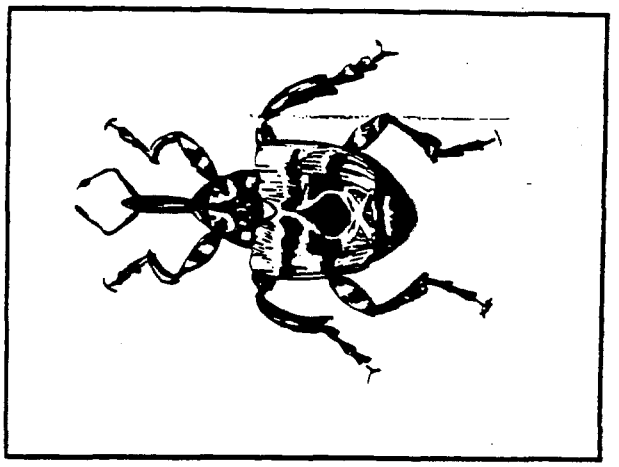
In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. camouflage into the environment by closely resembling twigs
2. they have evolved rhythmic swaying movements to conceal themselves among the moving foliage
3. immatures can regenerate lost limbs

Walking Stick 2169

Invertebrates

1. Kingdom Animalia
2. Phylum Arthropoda
3. Class Insecta
4. Order Coleoptera
5. Family Anthribidae
6. Genus Trigonorrhinus
7. Species Trigonorrhinus sticticus



Common Name Weevil

Primary Habitat

8. Section of Prairie (savanna, fen, marsh, meadow) all habitats
9. Actual Location (soil, tree, beneath rotted log, etc.) various plants and blossoms of buttonbush
10. Description of "Home"
11. Needs/Preferences hibernates under logs

Physical Characteristics

12. Number of segments or body sections three
13. Number of legs six
14. Antennae (Describe) pale reddish, 11-segmented
15. Color brown with dark brown and grayish yellow markings
16. Size 2.5 - 3.0 mm
17. Exoskeleton/Skin (Describe)
18. Markings/Shape
    A. Appendages pale reddish
    B. Body scale-like hairs
    C. Head deflexed head
    D. Wings faint punctures

Behavior

19. Periods of Activity (Time of Day/Night) usually daylight
20. Lives alone, colonies, pairs, etc. varies
21. Symbiotic relationships (Is there another animal or plant this creature must live near?)

Reproduction

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

complete metamorphosis

24. Breeding Conditions

25. Male/Female Differences

Food/Feeding Habits

26. Specific foods fungi, dead wood, vegetation, and seeds
27. Carnivore, Omnivore, Herbivore, Parasite, etc. primarily herbivore
28. Food source(s)

Fascinating Facts

29.

30.

31.

Adaptations

In your own words, explain how this creature has adapted to its environment to meet its needs. List at least three ways.

1. special mouth parts for feeding
2. usually small as it can easily enter seeds and pods
3. wings for easy movement to food source

Weavil 2177

Mammal Data Sheets

1. Cottontail 357
2. Coyote 359
3. Deer Mouse 361
4. Fox Squirrel 363
5. Franklin Ground Squirrel 365
6. Meadow Vole 367
7. Pocket Gopher 369
8. Red Fox 371
9. Thirteen-lined Ground Squirrel 373
10. Woodchuck 375

Mammals

1. Kingdom Animalia
2. Phylum Chordata
3. Class Mammalia
4. Order Lagomorpha
5. Family Leporidae
6. Genus Sylvilagus
7. Species Sylvilagus floridanus Common Name Cottontail

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) woods - brushy areas
9. Actual Location (underground, tree, etc.) thickets and brush piles
10. Describe "Home" depression or hidden area
11. Needs/Preferences

Physical Characteristics

12. Size length: 14 3/4 - 18 1/4" (375-463 mm); weight: 2-4 lbs. (900-1800 g)
13. Color grayish brown
14. Description of Coat
15. Markings/Shape
    A. Head forehead has white spot
    B. Tail cottony white
    C. Body
    D. Feet whitish
    E. Other rust-colored nape; long ears

16. **Behavior** (periods of activity, family, etc.)
    3-4 litters per year

Reproduction

17. Livebearing or marsupial livebearing
18. Number of young 1-9
19. Development of young at birth
20. Care of young nursed at dawn and dusk
21. Breeding conditions

Food/Feeding Habits

22. Carnivore/Herbivore/Omnivore herbivore
23. Specific food preferences seeds, sprigs, bark
24. Manner of obtaining food use incisors

Fascinating Facts

25. female mates within hours of giving birth
26. few rabbits live more than a year
27.

Specific Adaptations - In your own words, list at least three specific ways this mammal has adapted to its environment.

1. high reproductive rate
2.
3.

Cottontail Rabbit 1845

Mammals

1. Kingdom Animalia
2. Phylum Chordata
3. Class Mammalia
4. Order Carnivora
5. Family Canidae
6. Genus Canis
7. Species Canis latrans Common Name Coyote

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) brushy areas
9. Actual Location (underground, tree, etc.) riverbanks, sides of canyons
10. Describe "Home" underground burrow
11. Needs/Preferences

Physical Characteristics

12. Size length: 41 3/8 - 52" (105-132 cm); weight: 20-40 lbs. (9.1-18.2 kg)
13. Color grizzled gray or reddish gray with buff underparts
14. Description of Coat
15. Markings/Shape
    A. Head nose pad 1" (25 mm)
    B. Tail bushy tail with black tip
    C. Body
    D. Feet
    E. Other legs - rusty or yellowish with dark vertical line on lower foreleg

16. **Behavior** (periods of activity, family, etc.)
hunts in small groups or pairs
vocalizations at dusk, dawn, and during the night

Reproduction

17. Livebearing or marsupial livebearing
18. Number of young 1-19 born in April or May
19. Development of young at birth
20. Care of young
21. Breeding conditions

Food/Feeding Habits

22. Carnivore/Herbivore/Omnivore carnivore
23. Specific food preferences rabbits, mice, ground squirrels, gophers, frogs, birds, snakes, insects, fruit, and carrion
24. Manner of obtaining food may combine hunting efforts with one or two

Fascinating Facts

25. best runner in the family
26. runs with tail down
27. strong swimmer

Specific Adaptations - In your own words, list at least three specific ways this mammal has adapted to its environment.

1.
2.
3.

Coyote 1853

Mammals

1. Kingdom Animalia
2. Phylum Chordata
3. Class Mammalia
4. Order Rodentia
5. Family Cricetidae
6. Genus Peromysius
7. Species Peromysius maniculatus Common Name Deer Mouse

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) prairies, woodlands
9. Actual Location (underground, tree, etc.) underground burrows or hollow logs
10. Describe "Home"
11. Needs/Preferences

Physical Characteristics

12. Size length: 4 3/4 - 8 3/4" (119-222 mm); weight: 3/8 - 1 1/8 oz. (10-33 g)
13. Color grayish to reddish brown
14. Description of Coat
15. Markings/Shape
    A. Head
    B. Tail distinctly bi-colored and short-haired - long
    C. Body
    D. Feet large
    E. Other

16. **Behavior** (periods of activity, family, etc.)

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 omnivore
23. Specific food preferences seeds, nuts, small fruits, berries, insects, centipedes
24. Manner of obtaining food stores food in hollow logs or protected areas

Fascinating Facts

25. _____

26. _____

27. _____

Specific Adaptations - In your own words, list at least three specific ways this mammal has adapted to its environment.

1. _____

2. _____

3. _____

Deer Mouse 1857

Mammals

1. Kingdom Animalia
2. Phylum Chordata
3. Class Mammalia
4. Order Rodentia
5. Family Sciuridae
6. Genus Sciurus
7. Species Sciurus niger Common Name Fox Squirrel

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) woods
9. Actual Location (underground, tree, etc.) tree
10. Describe "Home" leaf nests, large and hidden
11. Needs/Preferences

Physical Characteristics

12. Size length: 9-14" (222-262 mm); weight: 1-3 lbs. (454-1350 g)
13. Color gray with yellow below or bright rust
14. Description of Coat
15. Markings/Shape
    A. Head
    B. Tail large bushy with yellow-tipped hairs
    C. Body
    D. Feet
    E. Other

16. **Behavior** (periods of activity, family, etc.)
active in the morning and late afternoon burying nests

Reproduction

17. Livebearing or marsupial livebearing
18. Number of young 2-4
19. Development of young at birth helpless
20. Care of young kept in the nest for 7-8 weeks

21. Breeding conditions 2 litters per year

Food/Feeding Habits

22. Carnivore/Herbivore/Omnivore herbivore
23. Specific food preferences nuts, fruits, hickory nuts, maple seeds, and acorns
24. Manner of obtaining food usually cuts and hauls an entire cob to a feeding perch

Fascinating Facts

25. largest tree squirrel

26.

27.

Specific Adaptations - In your own words, list at least three specific ways this mammal has adapted to its environment.

1.

2.

3.

4

Fox Squirrel In Bur Oak 1869

Mammals

1. Kingdom Animalia
2. Phylum Chordata
3. Class Mammalia
4. Order Rodentia
5. Family Sciuridae
6. Genus Spermophilus
7. Species Spermophilus franklinii Common Name Franklin Ground Squirrel

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) grassy areas
9. Actual Location (underground, tree, etc.) underground
10. Describe "Home" burrows concealed in tall grass with some mounds
11. Needs/Preferences

Physical Characteristics

12. Size length: 15 - 15 5/8" (381-397 mm); weight: 17 5/8 - 24 5/8 oz. (500-700 g)
13. Color brownish-gray peppered with black
14. Description of Coat
15. Markings/Shape
    A. Head
    B. Tail blackish mixed with buff bordered with white
    C. Body
    D. Feet
    E. Other

16. **Behavior** (periods of activity, family, etc.)
gathers in small colonies but usually solitary
active on sunny days - retires when sky is overcast

Reproduction

17. Livebearing or marsupial livebearing
18. Number of young 5-8 born in May
19. Development of young at birth young are aboveground at 1 month old; disperse several weeks later
20. Care of young

21. Breeding conditions_ _____

Food/Feeding Habits

22. Carnivore/Herbivore/Omnivore___omnivore_____
23. Specific food preferences__green vegetation, corn, clover, seeds, berries, caterpillars or other insects; small birds and mammals may be eaten_____
24. Manner of obtaining food_____

Fascinating Facts

25. largest and darkest ground squirrel_____
26. 90% of life spent underground_____
27. birdlike whistling call during the mating season_____

Specific Adaptations - In your own words, list at least three specific ways this mammal has adapted to its environment.

1. adds a layer of fat and hibernates from October to April_____
2. _____
3. _____

Franklin Ground Squirrel 1877

Mammals

1. Kingdom Animalia
2. Phylum Chordata
3. Class Mammalia
4. Order Rodentia
5. Family Cricetidae
6. Genus Microtus
7. Species Microtus pennsylvanicus Common Name Meadow Vole

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) woodlands, marshes, grassy fields
9. Actual Location (underground, tree, etc.) underground burrows and surface runways
10. Describe "Home" may nest in a depression or under matted vegetation
11. Needs/Preferences runways 1" wide in dense vegetation grass cutting 1 - 1 1/2" piles

Physical Characteristics

12. Size length 5 1/2 - 7 3/4" (140-195 mm); weight: 3/4 - 2 1/2 oz. (20-70 g)
13. Color yellowish or reddish-brown peppered with black
14. Description of Coat usually gray with silver tips
15. Markings/Shape
    A. Head
    B. Tail long
    C. Body
    D. Feet dark
    E. Other inconspicuous ears

16. **Behavior** (periods of activity, family, etc.)

Reproduction

17. Livebearing or marsupial livebearing
18. Number of young
19. Development of young at birth helpless
20. Care of young

21. Breeding conditions

Food/Feeding Habits

22. Carnivore/Herbivore/Omnivore herbivore
23. Specific food preferences green vegetation and tubers - flowers
24. Manner of obtaining food produces grass cuttings and the vole reaches up and cuts off the stalk and continues until the seed heads are reached

Fascinating Facts

25. eat almost all their own weight daily

26. stamp their hindfeet when alarmed

27.

Specific Adaptations - In your own words, list at least three specific ways this mammal has adapted to its environment.

1. stores large caches of food

2.

3.

Meadow Vole 1913

Mammals

1. Kingdom Animalia
2. Phylum Chordata
3. Class Mammalia
4. Order Rodentia
5. Family Geomyidae
6. Genus Geomys
7. Species Geomys bursarius Common Name Pocket Gopher

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) prairie areas with sandy loam
9. Actual Location (underground, tree, etc.) mounds
10. Describe "Home" burrow
11. Needs/Preferences

Physical Characteristics

12. Size length: 7 3/8 - 14 1/8" (187-357mm); weight: 4 1/2 - 12 1/2 oz. (127-354 g)
13. Color varies with soil
14. Description of Coat fur can lie forward or backward
15. Markings/Shape
    A. Head
    B. Tail long, sparsely haired
    C. Body
    D. Feet white
    E. Other small ears; fur-lined cheek pouches

16. **Behavior** (periods of activity, family, etc.)
solitary

Reproduction

17. Livebearing or marsupial livebearing
18. Number of young 2-11; 1-2 litters per year
19. Development of young at birth
20. Care of young leave home at 2 months

21. Breeding conditions_____

Food/Feeding Habits

22. Carnivore/Herbivore/Omnivore__herbivore_____
23. Specific food preferences_____roots and tubers_____
24. Manner of obtaining food_____forage_____

Fascinating Facts

25. big yellow incisors that grow throughout the animal's life

26. they do not need to drink (H_2O from vegetation)

27.

Specific Adaptations - In your own words, list at least three specific ways this mammal has adapted to its environment.

1.

2.

3.

4.

5.

Mammals

1. Kingdom Animalia
2. Phylum Chordata
3. Class Mammalia
4. Order Carnivora
5. Family Canidae
6. Genus Vulpes
7. Species Vulpes fulva Common Name Red Fox

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) wooded areas or brushlands
9. Actual Location (underground, tree, etc. ground
10. Describe "Home" den in sparse ground cover or hollow log cache mounds nearby
11. Needs/Preferences

Physical Characteristics

12. Size length: 35 3/8 - 40 3/8" (90-103 cm); weight: 7 7/8 - 15 lbs. (3.6-6.8 kg)
13. Color rusty-reddish with white underparts
14. Description of Coat
15. Markings/Shape
    A. Head
    B. Tail
    C. Body
    D. Feet black
    E. Other prominent pointed ears

16. **Behavior** (periods of activity, family, etc.)
nocturnal

Reproduction

17. Livebearing or marsupial livebearing
18. Number of young 1-10 kits born in March to May
19. Development of young at birth

20. Care of young 1-month olds play aboveground; both parents feed meat; meat is predigested by mother and regurgitated

21. Breeding conditions disperse at four months

Food/Feeding Habits

22. Carnivore/Herbivore/Omnivore omnivore

23. Specific food preferences corn, berries, apples, cherries, birds, mammals, mice, rabbits, squirrels, woodchucks, grasshoppers, crickets, crayfish, beetles, caterpillars

24. Manner of obtaining food hunts

Fascinating Facts

25. do not den up during the winter

26.

27.

Specific Adaptations - In your own words, list at least three specific ways this mammal has adapted to its environment.

1.

2.

3.

Red Fox 1933

Mammals

1. Kingdom Animalia
2. Phylum Chordata
3. Class Mammalia
4. Order Rodentia
5. Family Sciuridae
6. Genus Spermophilus
7. Species Spermophilus Tridecemlineatus Common Name Thirteen-Lined Ground Squirrel

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) shortgrass prairie
9. Actual Location (Underground, Tree, etc.) underground
10. Describe "Home" burrow with radiating runways
11. Needs/Preferences

Physical Characteristics

12. Size length: 6 3/4 - 11 3/4" (170-297 mm); weight: 3 7/8 - 9 1/2 oz. (110-290 g)
13. Color brownish with 13 alternating brown and white longitudinal lines: rows: whitish spots within dark lines
14. Description of Coat
15. Markings/Shape
    A. Head
    B. Tail
    C. Body
    D. Feet
    E. Other

16. **Behavior** (periods of activity, family, etc.)
diurnal - especially active on warm days
solitary or somewhat colonial hibernator (October-March)

Reproduction

17. Livebearing or marsupial livebearing
18. Number of young 8-10 born in May
19. Development of young at birth

20. Care of young

21. Breeding conditions

Food/Feeding Habits

22. Carnivore/Herbivore/Omnivore omnivore

23. Specific food preferences caterpillars, grass and weed seeds, grasshoppers; eat bird flesh, mice or shrews

24. Manner of obtaining food

Fascinating Facts

25.

26.

27.

Specific Adaptations - In your own words, list at least three specific ways this mammal has adapted to its environment.

1. adds a layer of fat and stores food in burrow for winter

2. rolls into a stiff ball and decreases respiration to breathe every five minutes

3.

Thirteen-Lined Ground Squirrel 1885

Mammals

1. Kingdom Animalia
2. Phylum Chordata
3. Class Mammalia
4. Order Rodentia
5. Family Sciuridae
6. Genus Marmota
7. Species Marmota monax Common Name Woodchuck

Primary Habitat

8. Section of Prairie (savanna, forest, fen, marsh, meadow) pastures, meadows, woods
9. Actual Location (underground, tree, etc.) underground
10. Describe "Home" large burrows with mounds
11. Needs/Preferences

Physical Characteristics

12. Size length: 16 1/2 - 52 1/4" (418-820 mm); weight: 4 3/8 - 14 lbs. (2-64. kg)
13. Color grizzled brown - uniformly colored
14. Description of Coat
15. Markings/Shape
    A. Head
    B. Tail bushy
    C. Body
    D. Feet dark brown or black
    E. Other small ears

16. **Behavior** (periods of activity, family, etc.)
active in early morning and late afternoon

Reproduction

17. Livebearing or marsupial livebearing
18. Number of young 4-5
19. Development of young at birth blind and naked born in April or early May
20. Care of young only females

21. Breeding conditions _____

Food/Feeding Habits

22. Carnivore/Herbivore/Omnivore herbivore
23. Specific food preferences green vegetation, grasses, clover, alfalfa, plantain
24. Manner of obtaining food _____

Fascinating Facts

25. good swimmer and climber
26. gives sharp, loud whistle when alarmed
27. when angry, it chatters its teeth, hisses, squeals, and growls

Specific Adaptations - In your own words, list at least three specific ways this mammal has adapted to its environment.

1. puts on a heavy layer of fat for hibernation
2. curls up in a ball, body temperature drops from 97 degrees to less than 40 degrees
3. breathing slows to once every 6 minutes

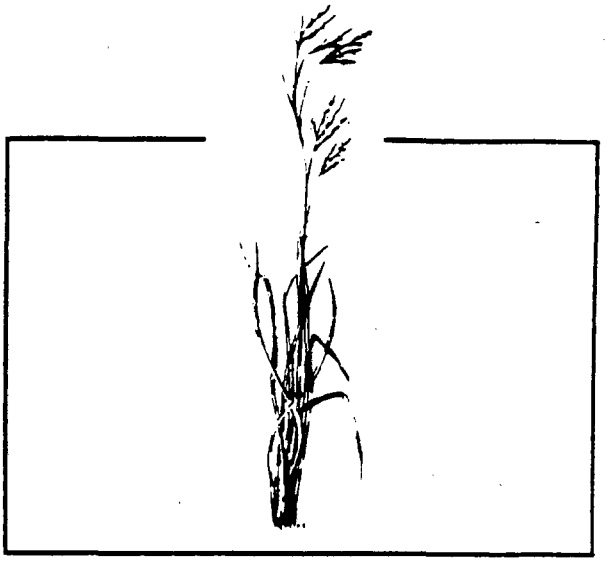
Ground Hog or Woodchuck 1893

Plant Data Sheets

1.	Big bluestem	379
2.	Compass plant	381
3.	Culver's root	385
4.	Indian grass	387
5.	Little bluestem	389
6.	Mountain mint	391
7.	Prairie blazing star	393
8.	Prairie brome	395
9.	Prairie cord grass	397
10.	Prairie dock	399
11.	Prairie dropseed	401
12.	Rattlesnake master	403
13.	Rough blazing star	405
14.	Saw-toothed sunflower	407
15.	Stiff goldenrod	409
16.	Switch grass	411
17.	Tall coreopsis	413
18.	Wild bergamot	415

Plants

1. Kingdom Plantae
2. Phylum Tracheophyta
3. Class Angiospermae
4. Order Campanulales
5. Family Gramineae
6. Genus Andropogon



7. Species Andropogon gerardi Common Name Big bluestem grass (Turkey-foot grass)

Primary Habitat

8. Prairie (full sun) X Ecotone _____ Savanna X
9. Native X Not Native _____

Characteristics

10. Size of plant 1 to 2 meters or more (3 feet to 8 feet)
11. Flowers
    A. Number per plant _____
    B. Size (in cm) _____
    C. Flowering time in nature July, August, September
    D. Flower parts
       Petals _____ Color _____
       Sepals _____ Color _____
       Pistil _____ Color _____
       Stamens _____ Color _____
       Pollen _____ Color yellow
    E. Nonflower parts
       Leaves long and arched; the lower leaves are usually covered with silky hair

       Stems upright, appear bluish, so named big bluestem

       Seeds fruit always one-seeded; each plant produces many seeds; the seed head usually branches into three of four parts resembling a turkey's foot, and is also named "turkey-foot grass"

       Roots fibrous, deep, 5 cm to 3 meters or more

Pollination

12. Wind X
    Animal
    Insect
    Bird
    Other

Growth Habits

13. Grows singly X Grows in clones
    How many present in clone?

Early Uses

1. the early settlers grazed livestock extensively on bluestem prairie
2. an important food for large and small native herbivores
3. Chippewas used root decoction for stomachaches, gas;
   Omahas used leaf tea as an external wash to relieve fevers, general debility
4. diuretic, analgesic

Economic Uses

1. it is relished by livestock and usually eaten in preference to other grasses
2. through over use and abuse this native grass has been killed out or greatly reduced on most of its original area since 1885
3. ranchers and farmers should never graze shorter than 6 to 8 inches during the growing season or the grasses will decrease and be replaced by less desirable species of plants

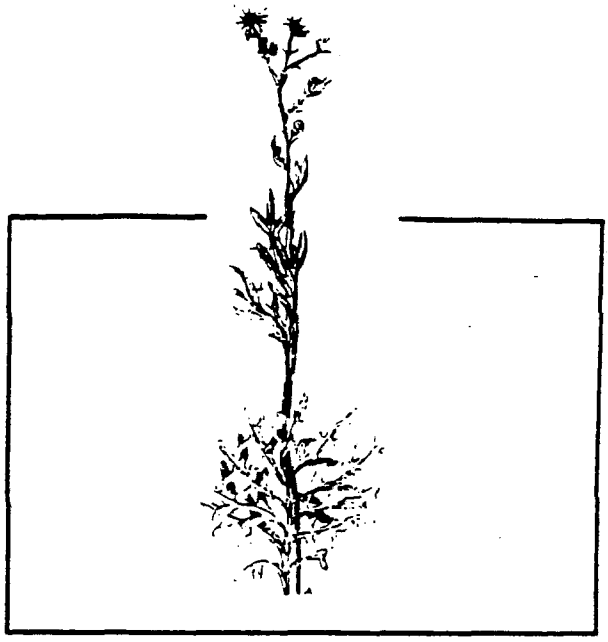
Adaptations

1. a deep-root system insures survival during prolonged dry spells
2. tall stems and thick leaves important wildlife resources
3. deep, fibrous roots to 9 meters (10 or more feet) deep provide excellent soil building properties
4.

Big bluestem grass *Andropogon gerardi* 57

Plants

1. Kingdom Plantae
2. Phylum Tracheophyta
3. Class Angiospermae
4. Order Campanulales
5. Family Compositae
6. Genus Silphium



7. Species Silphium laciniatum Common Name Compass plant

Primary Habitat

8. Prairie (full sun) X Ecotone _____ Savanna _____
9. Native X Not Native _____

Characteristics

10. Size of plant 1 to 3 meters or more (3 feet to 8 feet)
11. Flowers- capitate (head-like, very densely clustered)
    A. Number per plant several flowers per stem; the outer ray flowers produce the seed
    B. Size (in cm) like a small sunflower
    C. Flowering time in nature July-September
    D. Flower parts
       Petals many Color yellow
       Sepals many Color green
       Pistil many Color _____
       Stamens many Color _____
       Pollen _____ Color yellow
    E. Nonflower parts
       Leaves leaves alternate, deeply pinnately divided or lobed, large, wide, oak-like vertical leaves; extremely large leaves on the lower one-third of the plant; serrated
       Stems tall flower stalk 3 to 10 feet tall; stems leafy
       Seeds fruit is an achene (a one-seeded nutlet); the outer ray flowers produce the seed
       Roots tuberous, deep, up to twenty feet deep

Pollination

12. Wind_____
    Animal
    Insect___X_____
    Bird_____
    Other_____

Growth Habits

13. Grows singly___X_____ Grows in clones_____
    How many present in clone?_____

Early Uses

1. when in bloom a gummy material appears along the upper one-third of the main stem; this resinous material was used by Indians as a chewing gum
2. used as a direction indicator, or "compass" by early Americans
3. American Indians used root tea as a general tonic for debility; worm repellent; leaf tea emetic, once used for coughs, lung ailments, asthma
4. resin said to be diuretic
5. root tea used for coughs, asthma, gonorrhea
6. warning: of unknown toxicity

Economic Uses

1. compass plant is palatable, nutritious and is eaten by all classes of livestock, particulary when the vegetation is young
2. consumed by prairie herbivores
3. it is an important indicator of range condition; it decreases on native rangeland that is overgrazed or improperly managed

Adaptations

1. large leaves point north and south with the leaf surface facing the morning and afternoon sun

2. because of its "directional leaves," it has been given the name compass plant

3. a deep-root system, which may reach to twenty feet into the soil

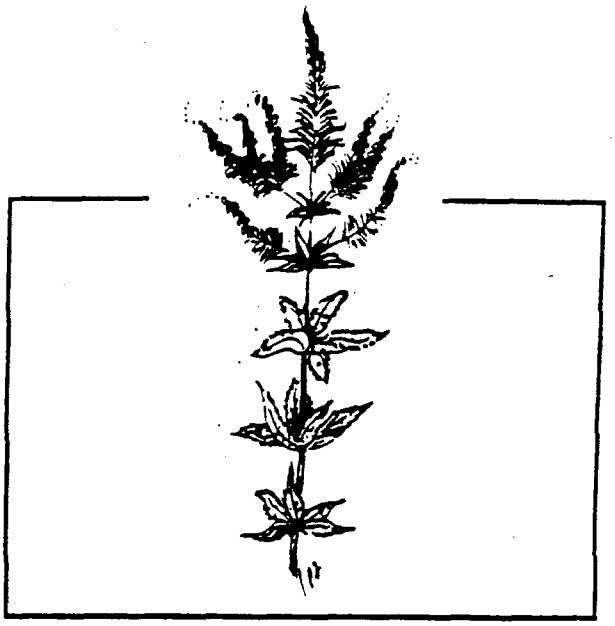
4. leaves have many tiny, stiff hairs that feels sandpapery, which may provide protection from insects as well as protection from the hot sun and dry wind

5. the ray flowers (often called petals) produce the seed; the central disc flowers of the garden sunflower, Helianthus annuuas, produce the seed and the ray flowers are infertile

6. usually, the presence of this plant is an indication of a moist, deep subsoil

Compass plant *Silphium laciniatum* 997

Plants



1. Kingdom Plantae
2. Phylum Tracheophyta
3. Class Angiospermae
4. Order Campanulales
5. Family Scrophulariaceae
6. Genus Veronicastrum
7. Species Veronicastrum virginicum Common Name Culver's root

Primary Habitat

8. Prairie (full sun) X Ecotone _____ Savanna X
9. Native X Not Native _____

Characteristics

10. Size of plant averages 1 meter or more
11. Flowers
    A. Number per plant numerous, in spikes, white, showy
    B. Size (in cm) _____
    C. Flowering time in nature July
    D. Flower parts
       Petals _____ Color white, united, at least at the base; small
       Sepals _____ Color _____
       Pistil _____ Color _____
       Stamens _____ Color _____
       Pollen _____ Color _____
    E. Nonflower parts
       Leaves mostly in whorls of 3 to 7, lance-shaped, toothed
       Stems erect
       Seeds small
       Roots tuberous

Pollination

12. Wind_____
    Animal
    Insect___X___
    Bird_____
    Other_____

Growth Habits

13. Grows singly___X___ Grows in clones___X___
    How many present in clone?_____

Early Uses

1. American Indians used root tea as a strong laxative, to induce sweating, to induce vomiting; diuretic
2. used similarly by physicians
3. traditionally, dried root is used; fresh root is a powerful laxative
4. potentially toxic

Economic Uses

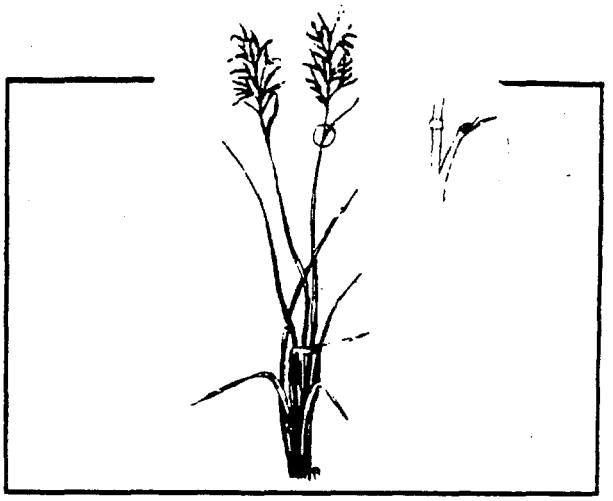
1. unknown
2.
3.

Adaptations

1. common on the few black-soil prairie remnants
2. many insects are attracted to the flowering spikes
3.

Culver's root - white in center
Veronicastrum virginicum 1209

Plants



1. Kingdom Plantae
2. Phylum Tracheophyta
3. Class Angiospermae
4. Order Campanulales
5. Family Gramineae
6. Genus Sorghastrum
7. Species Sorghastrum nutans Common Name Indian grass

Primary Habitat

8. Prairie (full sun) X Ecotone ____ Savanna X
9. Native X Not Native ____

Characteristics

10. Size of plant averages 1 to 2 meters or more
11. Flowers
    A. Number per plant ____
    B. Size (in cm) ____
    C. Flowering time in nature August, September
    D. Flower parts
       Petals ____ Color ____
       Sepals ____ Color ____
       Pistil ____ Color ____
       Stamens ____ Color ____
       Pollen ____ Color yellow
    E. Nonflower parts
       Leaves up to 1 cm wide, 50 cm or longer
       Stems upright; it is readily distinguished from big bluestem (andropogon gerardi) by its slightly more erect habit of growth
       Seeds fruit always one-seeded; each plant produces many seeds
       Roots fibrous, deep

Pollination

12. Wind ___X___
    Animal
    Insect _____
    Bird _____
    Other _____

Growth Habits

13. Grows singly ___X___ Grows in clones _____
    How many present in clone? _____

Early Uses

1. food source and cover for many herbivores

Economic Uses

1. very nutritious and readily eaten by all classes of livestock, either as green forage or dry prairie hat
2. highly productive when not overgrazed
3. high protein content compared to nonnative pasture grasses

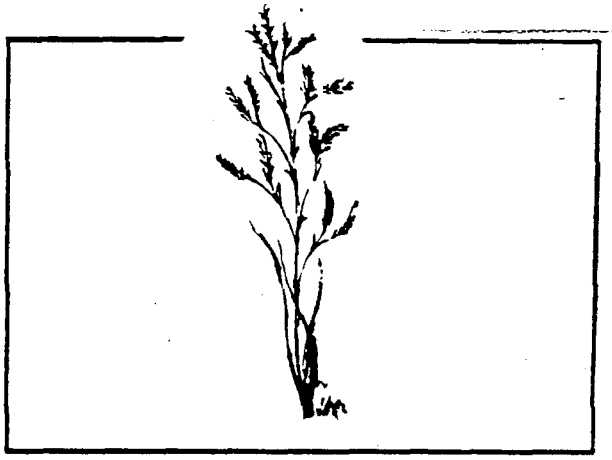
Adaptations

1. easily identified by the prominent, claw-like ligule where the leaf blade attaches to the sheath
2. a deep-root system, 1 meter to 3 meters or more deep, can enable it to withstand a wide range of extremes
3. an important grass of the tallgrass prairie, providing food and shelter for numerous animals
4. deep, fibrous roots are important soil builders
5. excellent fuel source for prairie fires

Indian grass *Sorghastrum nutans* 1117

Plants

1. Kingdom Plantae
2. Phylum Tracheophyta
3. Class Angiospermae
4. Order Campanulales
5. Family Gramineae
6. Genus Andropogon
7. Species Andropogon scoparius Common Name Little bluestem grass



Primary Habitat

8. Prairie (full sun) X Ecotone ____ Savanna X
9. Native X Not Native ____

Characteristics

10. Size of plant 150 cm tall or more (2 to 5 ft. tall)
11. Flowers
    A. Number per plant ____
    B. Size (in cm) ____
    C. Flowering time in nature August, September
    D. Flower parts
       Petals ____ Color ____
       Sepals ____ Color ____
       Pistil ____ Color ____
       Stamens ____ Color ____
       Pollen ____ Color yellow
    E. Nonflower parts
       Leaves blue-green or green color leaf blades
       Stems little bluestem can be identified by its flat, bluish-colored basal
       Seeds little bluestem can be identified by its flat, bluish colored basal shoots and its leaf blade which tend to fold
       Roots a dense, fibrous root system two to three meters in depth

Pollination

12. Wind X
    Animal
    Insect
    Bird
    Other

Growth Habits

13. Grows singly X Grows in clones
    How many present in clone?

Early Uses

1. an important, native, warm-season perennial mid grass that was widely distributed in America
2. a nutritious food source for many herbivores
3. little bluestem has been used for grazing livestock and for hay production since the first days of settlement

Economic Uses

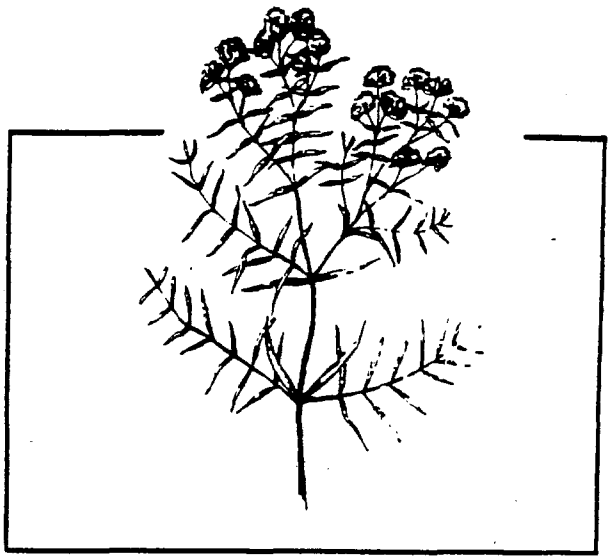
1. cattle have for many years been shipped to bluestem ranges to fatten for the market
2. little bluestem and other native grasses and forbs are being successfully seeded on thousands of acres of formerly cultivated land
3. native prairie grasses and forbs are efficient soil builders

Adaptations

1. fibrous root systems 2 to 3 meters deep or more enable survival during periods of drought
2. has adapted to herbivore grazing
3. when little bluestem is continually grazed closer than 4 to 6 inches (12.5 cm) during the growing season, it is finally killed out and replaced by less productive plants
4. important in the food chain and food web cycles
5. deep, fibrous roots are excellent soil builders

Little bluestem grass *Andropogon scoparius* 61

Plants



1. Kingdom Plantae
2. Phylum Tracheophyta
3. Class Angiospermae
4. Order Campanulales
5. Family Labiatae
6. Genus Pycnanthemum
7. Species Pycnanthemum virginianum Common Name Mountain mint

Primary Habitat

8. Prairie (full sun) X Ecotone ____ Savanna X
9. Native X Not Native ____

Characteristics

10. Size of plant 1/2 to 1 meter tall
11. Flowers
    A. Number per plant flowers in small clusters in the axils of leaves or bracts
    B. Size (in cm) very small, less than 1 cm
    C. Flowering time in nature July to September
    D. Flower parts
       Petals ____ Color white
       Sepals ____ Color ____
       Pistil ____ Color ____
       Stamens ____ Color ____
       Pollen ____ Color ____
    E. Nonflower parts
       Leaves opposite leaves are narrow and lance-shaped, rounded at the base and pointed at the tip
       Stems is four-angled and covered with a whitish bloom
       Seeds tiny with a smooth to rough surface
       Roots ____

Pollination

12. Wind_____
    Animal
    Insect____X____
    Bird_____
    Other_____

Growth Habits

13. Grows singly____X____ Grows in clones____X____
    How many present in clone?_____

Early Uses

1. Medicine-unspecified and as a poultice on dog and other animal bites
2. to bait mink traps
3. tea brewed for a general tonic and as a treatment for mild indigestion and for the chills and fever

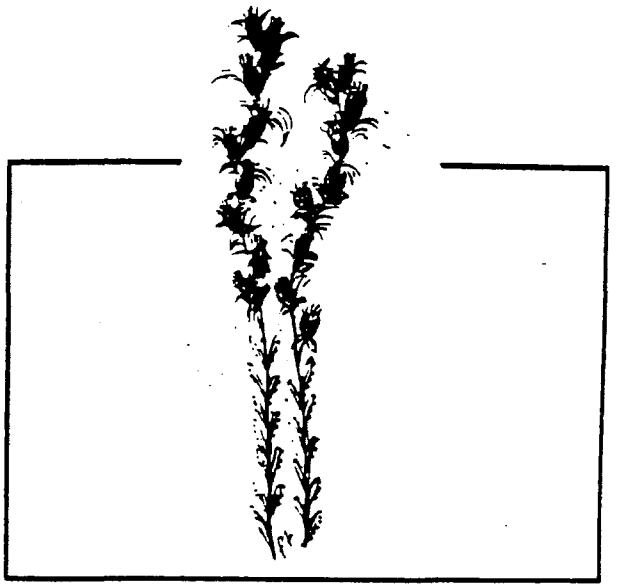
Economic Uses

1.
2.
3.

Adaptations

1. flowers have a lower lip with three rounded lobes and an upper lip that may have a slight notch
2.
3.
4.
5.

Plants



1. Kingdom Plantae
2. Phylum Tracheophyta
3. Class Angiospermae
4. Order Campanulales
5. Family Compositae
6. Genus Liatris
7. Species Liatris pycnostachya Common Name Prairie blazing star

Primary Habitat

8. Prairie (full sun) X Ecotone _____ Savanna _____
9. Native X Not Native _____

Characteristics

10. Size of plant to one meter or more (to five feet or more)
11. Flowers
    A. Number per plant many; flower heads far more dense than Liatris aspera; produced on a spike, more than 15 flowers per head
    B. Size (in cm) small, variable
    C. Flowering time in nature July, early August
    D. Flower parts
       Petals _____ Color pink
       Sepals _____ Color green
       Pistil _____ Color _____
       Stamens _____ Color _____
       Pollen _____ Color _____
    E. Nonflower parts
       Leaves basal leaves well developed and present at flowering time
       Stems erect
       Seeds fruit is on achene (a one-seeded nutlet)
       Roots extend deep into the soil

Pollination

12. Wind_____
    Animal
    Insect___X___
    Bird_____
    Other_____

Growth Habits

13. Grows singly___X___ Grows in clones_____
    How many present in clone?_____

Early Uses

1. root tea was used as a folk remedy for kidney and bladder ailments, and also gargled for sore throats
2. root used externally in poultice for snakebites
3. thought to be diuretic, tonic

Economic Uses

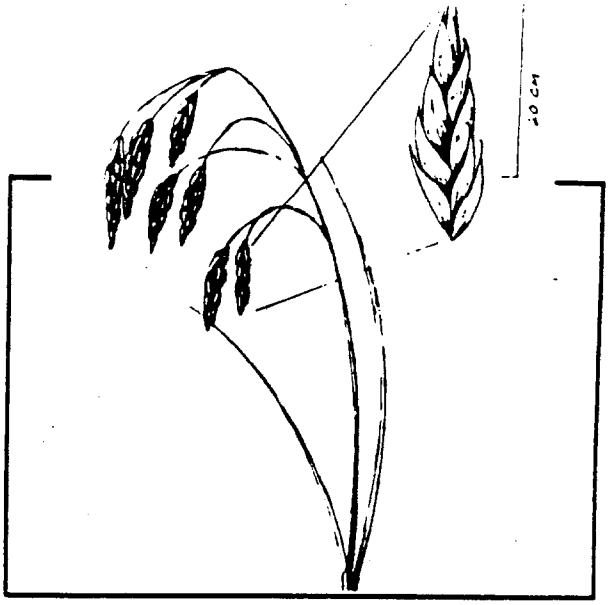
1. unknown
2.
3.

Adaptations

1. adapted to drought
2. attracts many pollinators
3. this species is restricted to prairie remnants
4.

Prairie blazing star *Liatris pycnostachya* 613

Plants



1. Kingdom Plantae
2. Phylum Tracheophyta
3. Class Angiospermae
4. Order Campanulales
5. Family Gramineae
6. Genus Bromus
7. Species Bromus kalmii Common Name Prairie brome

Primary Habitat

8. Prairie (full sun) X Ecotone ____ Savanna X
9. Native X Not Native ____

Characteristics

10. Size of plant up to 1 meter tall, but usually shorter
11. Flowers
    A. Number per plant ____
    B. Size (in cm) ____
    C. Flowering time in nature June, July
    D. Flower parts
       Petals ____ Color ____
       Sepals ____ Color ____
       Pistil ____ Color ____
       Stamens ____ Color ____
       Pollen ____ Color ____
    E. Nonflower parts
       Leaves narrow, to 12 cm or more
       Stems straight, with the top forming an arch where the flowers are located
       Seeds fruit always one-seeded
       Roots fibrous, to 0.5 m or more

Pollination

12. Wind ____X____
    Animal
    Insect _____
    Bird _____
    Other _____

Growth Habits

13. Grows singly ____X____ Grows in clones _____
    How many present in clone? _____

Early Uses

1. unknown
2.
3.

Economic Uses

1. unknown
2.
3.

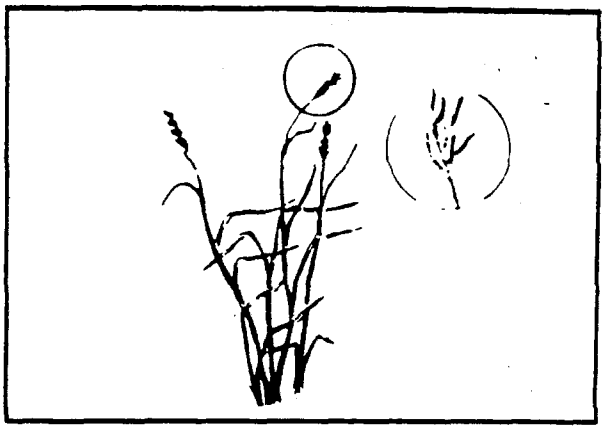
Adaptations

1. survives only in prairie remnants
2. this species has a limited natural range in our area and has been further restricted by the destruction of its habitats
3. identified when in bloom and when in seed by its characteristic arch at the top
4.

Prairie brome *Bromus kalmii* 269

Plants

1. Kingdom Plantae
2. Phylum Tracheophyta
3. Class Angiospermae
4. Order Campanulales
5. Family Gramineae
6. Genus Spartina
7. Species Spartina pectinata Common Name Prairie cord grass



Primary Habitat

8. Prairie (full sun) X Ecotone _____ Savanna _____
9. Native X Not Native _____

Characteristics

10. Size of plant averages from 1 to 2 meters or more (3 to 8 feet tall)
11. Flowers
    A. Number per plant _____
    B. Size (in cm) _____
    C. Flowering time in nature July - August
    D. Flower parts
       Petals _____ Color _____
       Sepals _____ Color _____
       Pistil _____ Color _____
       Stamens _____ Color _____
       Pollen _____ Color _____
    E. Nonflower parts
       Leaves long leaves, edges are serrated; if one moves his hand downward along the edge of the leaf blade, a cut may result
       Stems sturdy
       Seeds fruit always one-seeded; each plant produces many seeds
       Roots rhizomatous underground stems, dense, deep-root systems

Pollination

12. Wind ___X___
    Animal
    Insect _____
    Bird _____
    Other _____

Growth Habits

13. Grows singly ___X___ Grows in clones ___X___
    How many present in clone? few to many

Early Uses

1. possibly used for grass lodges by native Americans
2.
3.

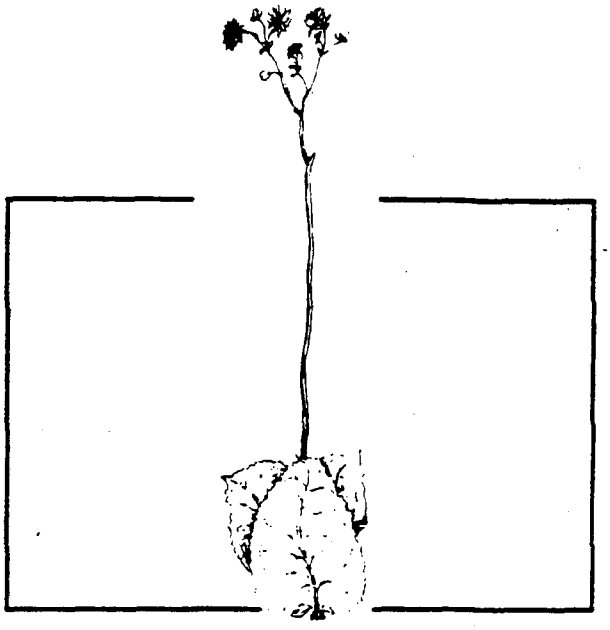
Economic Uses

1. unknown
2.
3.

Adaptations

1. medium moist to moist conditions
2. numerous underground stems and roots hold soil
3. dense roots are soil builders
4. deep roots enable survival during drought
5. an important part of the tall grass prairie
6. withstands fire, provides excellent fuel

Prairie cord grass *Spartina pectinata* 1133



Plants

1. Kingdom Plantae
2. Phylum Tracheophyta
3. Class Angiospermae
4. Order Campanulales
5. Family Compositae
6. Genus Silphium
7. Species Silphium terebinthinaceum Common Name Prairie dock

Primary Habitat

8. Prairie (full sun) X Ecotone _____ Savanna _____
9. Native X Not Native _____

Characteristics

10. Size of plant averages 1 to 2 meters or more (3 feet to 8 feet tall)
11. Flowers
    A. Number per plant several flowers per stem; the outer ray flowers produce the seed
    B. Size (in cm) like a small sunflower
    C. Flowering time in nature July to September
    D. Flower parts
       Petals many Color yellow
       Sepals many Color green
       Pistil many Color _____
       Stamens many Color _____
       Pollen _____ Color _____
    E. Nonflower parts
       Leaves leaves all essentially basal, very large serrated, heart-shaped
       Stems leafy, smooth
       Seeds fruit is an achene (a one-sided nutlet)
       Roots a large, deep taproot

Pollination

12. Wind_____
    Animal
    Insect___X_____
    Bird_____
    Other_____

Growth Habits

13. Grows singly_____X_____ Grows in clones_____
    How many present in clone?_____

Early Uses

1. American Indians used root tea as a general tonic for debility; worm repellent; leaf tea emetic, once used for coughs, lung ailments, asthma
2. resin said to be diuretic
3. root tea used for coughs, asthma, gonorrhea
4. warning: of unknown toxicity

Economic Uses

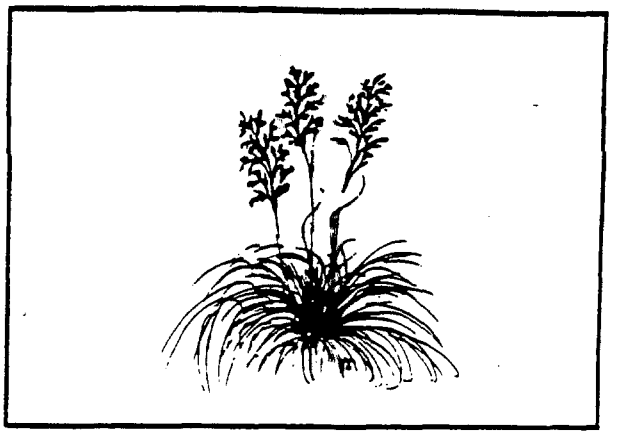
1. unknown
2.
3.

Adaptations

1. large leaves with short, stiff, sandpaper-like hairs provide some protection from herbivores, the hot summer sun, and the warm, dry winds
2. the species name "terebinthinaceum" refers to the terpentine-like fluids within the plant (especially when crushed)
3. a deep taproot enables this plant to survive dry conditions adequately
4. a close relative of the compass plant, this species produces resin similar to the compass plant

Prairie dock *Silphium terebinthinaceum* 1025

Plants



1. Kingdom Plantae
2. Phylum Tracheophyta
3. Class Angiospermae
4. Order Campanulales
5. Family Gramineae
6. Genus Sporobolus
7. Species Sporobolus heterolepis Common Name Prairie dropseed

Primary Habitat

8. Prairie (full sun) X Ecotone_____ Savanna_____
9. Native X Not Native_____

Characteristics

10. Size of plant 0.5 m to 1 m high
11. Flowers
    - A. Number per plant_____
    - B. Size (in cm)_____
    - C. Flowering time in nature August
    - D. Flower parts
      - Petals_____ Color_____
      - Sepals_____ Color_____
      - Pistil_____ Color_____
      - Stamens_____ Color_____
      - Pollen_____ Color_____
    - E. Nonflower parts
      - Leaves thin, long, mainly basal
      - Stems
      - Seeds the fruit is always one-seeded
      - Roots fibrous, thick, deep

Pollination

12. Wind ___X___
    Animal
    Insect _____
    Bird _____
    Other _____

Growth Habits

13. Grows singly ___X___ Grows in clones _____
    How many present in clone? _____

Early Uses

1. unknown

2.

Economic Uses

1. unknown

2.

Adaptations

1. roots reach 1 meter or more and provide excellent soil-building properties

2. this is a characteristic grass of mesic prairie; it is an indicator of prairie remnant

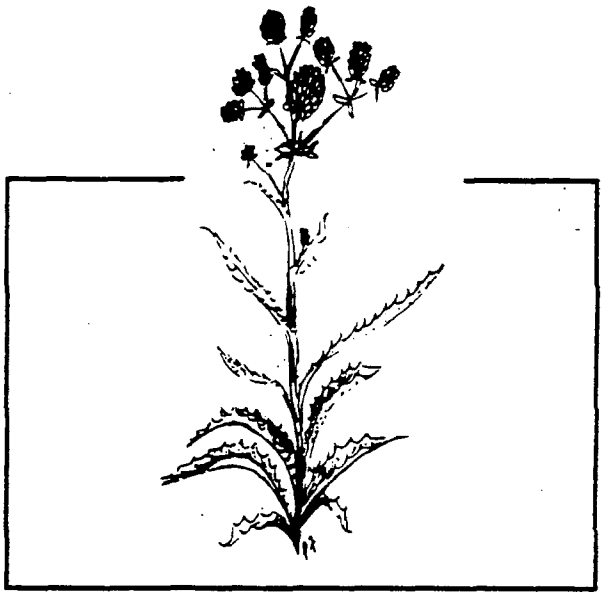
3. forms a thick clump

4. bobolinks: the songbirds typical of northern prairies, select a prairie dropseed clump for nesting

5. provides shelter and food for many forms of animal life

6. when in bloom, the aroma smells similar to popcorn (some say it smells like burnt popcorn .

Prairie dropseed *Sporobolus heterolepis* 1141



Plants

1. Kingdom Plantae
2. Phylum Tracheophyta
3. Class Angiospermae
4. Order Campanulales
5. Family Umbelliferae
6. Genus Eryngium
7. Species Eryngium yuccifolium Common Name Rattlesnake master

Primary Habitat

8. Prairie (full sun) X Ecotone _____ Savanna _____
9. Native X Not Native _____

Characteristics

10. Size of plant averages 1 meter or more (36 inches tall)
11. Flowers
    A. Number per plant Eryngium has dense, capitate (head-like; very densely clustered) clusters of flowers
    B. Size (in cm) _____
    C. Flowering time in nature July
    D. Flower parts
       Petals 5 Color white to whitish green; tiny, covered by bristly bracts
       Sepals 5 Color _____
       Pistil 1 Color _____
       Stamens 5 Color _____
       Pollen _____ Color _____
    E. Nonflower parts
       Leaves long, thick, yucca-like leaves have teeth or spines along the margin; parallel-veined
       Stems straight, green
       Seeds brown or black
       Roots deep-rooted

Pollination

12. Wind_____
    Animal
    Insect____X_____
    Bird_____
    Other_____

Growth Habits

13. Grows singly____X_____ Grows in clones_____
    How many present in clone?_____

Early Uses

1. the Eryngium group has been referred to as having medicinal value since the time of Hippocrates (477-360 B.C.)
2. extracts from the roots as well as raw roots were recommended by English doctors in the 16th Century for liver trouble and other ailments
3. used as food by native herbivores
4. according to legend, the American Indians used the root as a medicine to cure rattlesnake bites, toothaches, bladder trouble, for coughs, neuralgia; also an emetic; a diuretic
5. chewing the root increases saliva flow

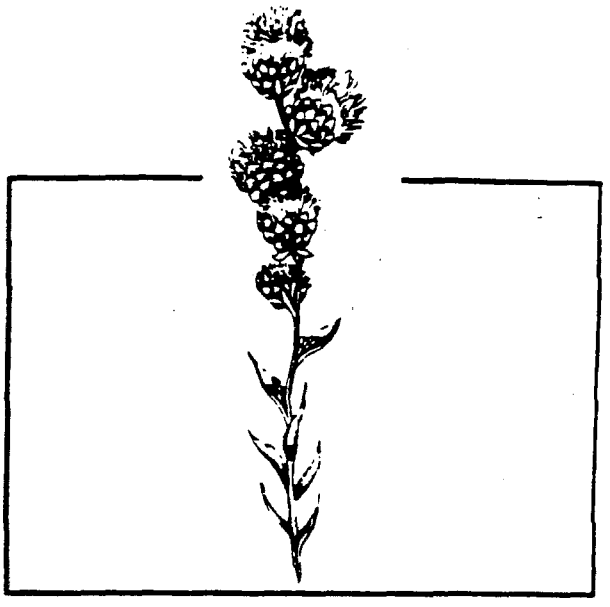
Economic Uses

1. new growth is nutritious and readily eaten by all classes of livestock
2. _____

Adaptations

1. seed heads have a honey-like odor
2. the flower head resembles a thistle, the leaves resemble yucca, and belongs to the carrot family
3. a deep-root system enables survival during drought
4. prairie invertebrates play a role in the ecology of this plant
5. the rattlesnake master is a reliable indicator of prairie remnants or a disturbed area that was once prairie

Rattlesnake master *Eryngium yuccifolium* 457



Plants

1. Kingdom Plantae
2. Phylum Tracheophyta
3. Class Angiospermae
4. Order Campanulales
5. Family Compositae
6. Genus Liatris
7. Species Liatris aspera Common Name Rough blazing star, Button blazing star

Primary Habitat

8. Prairie (full sun) X Ecotone ____ Savanna X
9. Native X Not Native ____

Characteristics

10. Size of plant to one meter or more (to three feet or more)
11. Flowers
    A. Number per plant many: flower heads separated, not dense
    B. Size (in cm) small, variable, more than 15 flowers per head (cluster): many clusters of flowers along a spike
    C. Flowering time in nature August and September
    D. Flower parts
       Petals ____ Color pink
       Sepals ____ Color green
       Pistil ____ Color ____
       Stamens ____ Color ____
       Pollen ____ Color ____
    E. Nonflower parts
       Leaves basal leaves well -developed and present at flowering time
       Stems erect 900 mm or more
       Seeds Fruit is on achene (a one-seeded nutlet)
       Roots extend deep into the soil

Pollination

12. Wind_____
    Animal
    Insect___X___
    Bird_____
    Other_____

Growth Habits

13. Grows singly___X___ Grows in clones_____
    How many present in clone?_____

Early Uses

1. root tea was used as a folk remedy for kidney and bladder ailments, and also gargled for sore throats
2. root used externally in poultice for snakebites
3. thought to be diuretic, tonic

Economic Uses

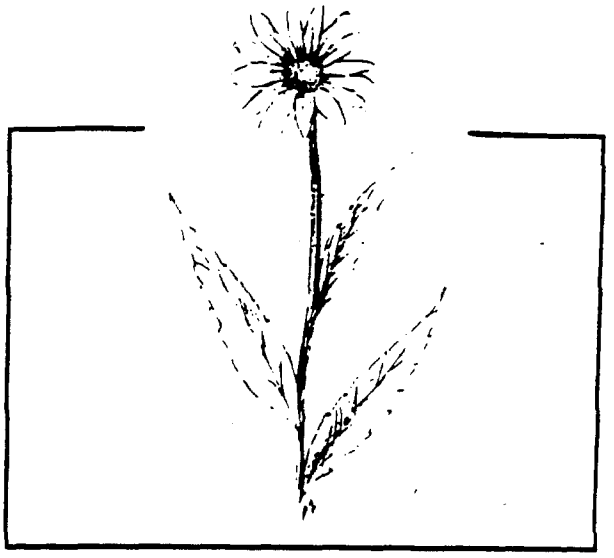
1. unknown
2.
3.

Adaptations

1. adapted to drought
2. attracts many pollinators, including migrating Monarch butterflies
3.

Rough blazing star *Liatris aspera* 589

Plants



1. Kingdom Plantae
2. Phylum Tracheophyta
3. Class Angiospermae
4. Order Campanulales
5. Family Compositae
6. Genus Helianthus
7. Species Helianthus grosseserratus Common Name Saw-toothed sunflower

Primary Habitat

8. Prairie (full sun) X Ecotone ____ Savanna X
9. Native X Not Native ____

Characteristics

10. Size of plant 1-2 meters or more (2 feet to 10 feet)
11. Flowers
    A. Number per plant several to many
    B. Size (in cm.) a small sunflower: variable
    C. Flowering time in nature August - September
    D. Flower parts
       Petals ____ Color yellow
       Sepals ____ Color green
       Pistil ____ Color ____
       Stamens ____ Color ____
       Pollen ____ Color yellow
    E. Nonflower parts
       Leaves firm, alternate, the lower surfaces pale and densely pubescent (hairy); numerous, narrowly lanceolate to oval, more than 5mm broad
       Stems usually glabrous (without hair), often glaucous (covered by a white or pale, often waxy bloom)
       Seeds fruit is an achene (a one-seeded nutlet)
       Roots ____

Pollination

12. Wind_____
    Animal
    Insect___X___
    Bird_____
    Other_____

Growth Habits

13. Grows singly___X___ Grows in clones__X___
    How many present in clone? several to many

Early Uses

1. unknown, but another species, Helianthus annuus, was used by American Indians to make flower tea for lung ailments, malaria

2. leaf tea taken for high fevers; astringent; poultice on snakebites and spider bites

3. seeds and leaves said to be diuretic, expectorant

Economic Uses

1. unknown

Adaptations

1. long yellow petals attract insects

2. ripe sunflower seeds, smaller than the garden sunflower, produces ample food for wildlife

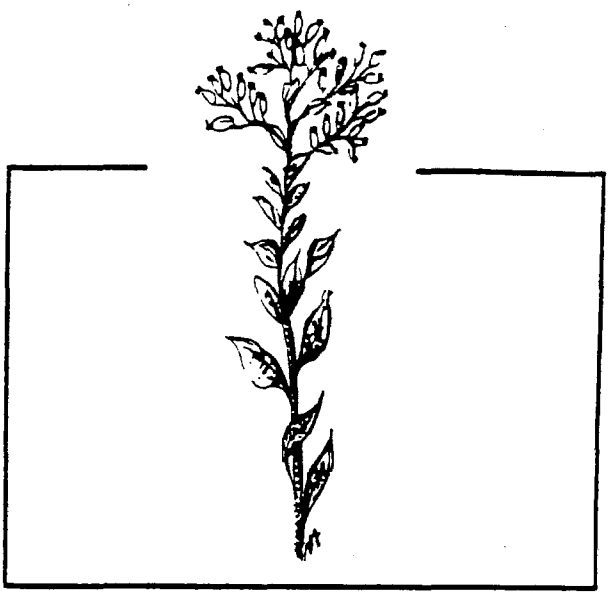
3. provide nesting sites for goldfinch

4. seeds that are transported to newly-disturbed areas repopulate quickly

5. a pioneer prairie plant that thrives in newly-disturbed areas

Saw-toothed sunflower
Helianthus grosseserratu

549



Plants

1. Kingdom Plantae
2. Phylum Tracheophyta
3. Class Angiospermae
4. Order Campanulales
5. Family Compositae
6. Genus Solidago
7. Species Solidago rigida Common Name Stiff goldenrod

Primary Habitat

8. Prairie (full sun) X Ecotone _____ Savanna _____
9. Native X Not Native _____

Characteristics

10. Size of plant averages 1 meter or more (2-4 feet tall)
11. Flowers
    A. Number per plant the flower heads are rounded or flat, numerous
    B. Size (in cm) tiny flowers form the flower head
    C. Flowering time in nature August to October
    D. Flower parts
       Petals _____ Color yellow
       Sepals _____ Color green
       Pistil _____ Color yellow
       Stamens _____ Color yellow
       Pollen _____ Color yellow
    E. Nonflower parts
       Leaves long-stemmed basal leaves; leaves are stiff, thick, fine-toothed, rough, numerous, alternate, moderately wide and covered with inconspicuous minute hairs which feel "velvety"

       Stems upright, densely covered with velvety hairs

       Seeds small seeds similar to dandelion; spreads with the wind

       Roots two meters deep or more; thick, woody roots

Pollination

12. Wind_____ _____
    Animal
    Insect_____X_____
    Bird_____
    Other_____

Growth Habits

13. Grows singly____X_____ Grows in clones___X_____
    How many present in clone?__several_____

Early Uses

1. unknown; another species, Solidago canadensis, the Canada goldenrod was used by American Indians who used the root for burns; flower tea for fevers; snakebites; crushed flowers chewed for sore throats

2. contains quercetin, a compound reportedly useful in treating hemorrhagic nephritis

3.

Economic Uses

1. it is eaten by livestock only in the early stages of growth

2.

Adaptations

1. root systems go down two meters or more; can withstand drought

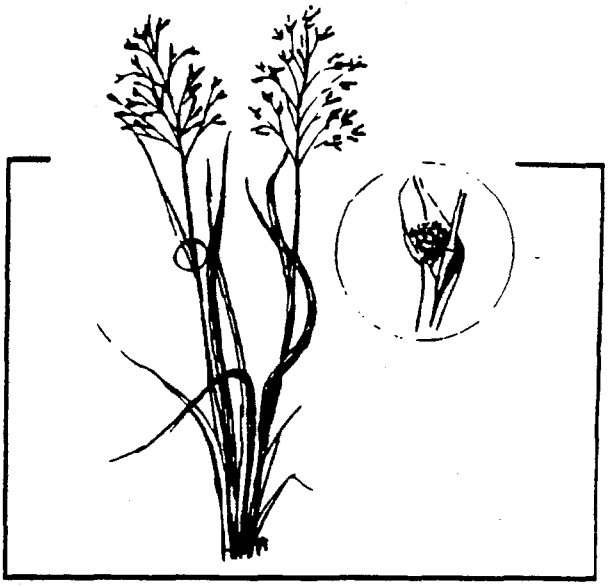
2. the bright gold flowers attract many pollinator insects

3. the flattish-topped heads and the velvety hair covering the leaves and stems offer some protection to invertebrates and moisture loss; this is also a useful identification feature

4.

Stiff goldenrod *Solidago rigida* 1097

Plants



1. Kingdom Plantae
2. Phylum Tracheophyta
3. Class Angiospermae
4. Order Campanulales
5. Family Gramineae
6. Genus Panicum
7. Species Panicum virgatum Common Name Switch grass

Primary Habitat

8. Prairie (full sun) X Ecotone ____ Savanna X
9. Native X Not Native ____

Characteristics

10. Size of plant 150 cm or more (3 to 6 feet or taller)
11. Flowers
    A. Number per plant ____
    B. Size (in cm) ____
    C. Flowering time in nature July, August
    D. Flower parts
       Petals ____ Color ____
       Sepals ____ Color ____
       Pistil ____ Color ____
       Stamens ____ Color ____
       Pollen ____ Color ____
    E. Nonflower parts
       Leaves the green to bluish-green leaves are usually from one-fourth to one-half inch wide and 6 to 18 inches long (15 cm to 45 cm long)
       Stems tall stems to 150 cm or more
       Seeds a larger, one-seeded fruit
       Roots vigorous, deep, fibrous roots

Pollination

12. Wind X
    Animal
    Insect
    Bird
    Other

Growth Habits

13. Grows singly X Grows in clones
    How many present in clone?

Early Uses

1. a very nutritious source of food for native herbivores
2. used as livestock forage and hay by early settlers

Economic Uses

1. is readily eaten by all classes of livestock, either as green forage or prairie hay
2. when continually grazed closer than 5 to 7 inches during the growing season, it decreases and is replaced by less productive plants
3.

Adaptations

1. drought-resistant
2. winter hardy
3. grown under a wide range of soil and climatic conditions
4. deep, thick, fibrous roots are excellent soil builders
5.

Switch grass *Panicum Virgatum* 749

Plants

1. Kingdom Plantae
2. Phylum Tracheophyta
3. Class Angiospermae
4. Order Campanulales
5. Family Compositae
6. Genus Coreopsis
7. Species Coreopsis tripteris Common Name Tall coreopsis

Primary Habitat

8. Prairie (full sun) X Ecotone _____ Savanna X
9. Native X Not Native _____

Characteristics

10. Size of plant averages one meter or more
11. Flowers
    A. Number per plant several to many
    B. Size (in cm) variable
    C. Flowering time in nature August to October
    D. Flower parts
       Petals _____ Color yellow
       Sepals _____ Color _____
       Pistil _____ Color _____
       Stamens _____ Color _____
       Pollen _____ Color _____
    E. Nonflower parts
       Leaves leaflets lanceolate to elliptic or elliptic-oblong, usually more than 5 mm wide, divided to the midrib into three to several leaflets
       Stems tall stems, to 1 meter high
       Seeds fruit is an achene (a one-sided nutlet)
       Roots _____

Pollination

12. Wind_____
    Animal
    Insect___X___
    Bird_____
    Other_____

Growth Habits

13. Grows singly___X___ Grows in clones___X___
    How many present in clone? several to many

Early Uses

1. coreopsis tinctoria, the garden coreopsis, was used by the American Indians in making root tea for diarrhea, and as an emetic
2. _____
3. _____

Economic Uses

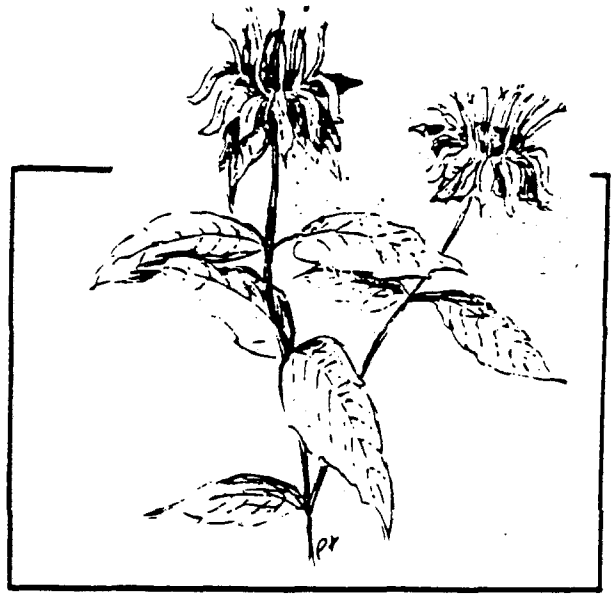
1. unknown
2. _____
3. _____

Adaptations

1. yellow petals guide insects to the nectar
2. produces numerous seeds forwarded by wildlife, one of the favorite foods of goldfinches
3. spreads by seeds as well as underground stems called rhizomes
4. _____

Tall coreopsis *Coreopsis tripteris* 345

Plants



1. Kingdom Plantae
2. Phylum Tracheophyta
3. Class Angiospermae
4. Order Campanulales
5. Family Labiatae
6. Genus Monarda
7. Species Monarda fistulosa Common Name Wild bergamot

Primary Habitat

8. Prairie (full sun) X Ecotone X Savanna X
9. Native X Not Native

Characteristics

10. Size of plant up to 1 meter (about 3 feet)
11. Flowers
    A. Number per plant
    B. Size (in cm) 4
    C. Flowering time in nature June, July
    D. Flower parts
        Petals Color pink to lavender tubes
        Sepals Color
        Pistil Color
        Stamens Color
        Pollen Color
    E. Nonflower parts
        Leaves opposite
        Stems square
        Seeds
        Roots a clump of fibrous rootlets and rhizomes

Pollination

12. Wind_____
    Animal
    Insect____X____
    Bird_____
    Other_____

Growth Habits

13. Grows singly____X____ Grows in clones__X____
    How many present in clone?_____

Early Uses

1. oil used to treat pimples and similar skin eruptions
2. treat fevers, sore throats, colds and headache
3. tea used to treat stomach disorders

Economic Uses

1. herbs and flavorings
2. aromatic oil
3. _____

Adaptations

1. _____
2. _____
3. _____

Wild bergamot *Monarda fistulosa* 709

Soil Invertebrates

Key to Common Phyla of Terrestrial Macro-Invertebrates

1 Segmented body with paired, segmented appendages; bilateral symmetry; chitinous exoskeleton..... **Arthropoda**

1' Body may or may not be segmented; symmetry is bilateral (may appear to be radial);
appendages not be present; hardened plates or sclerites not present...**2**

2(1') Segmented body without appendages; setae present.....**Annelida**

2 Body not segmented; body wall smooth, with no setae.....**3**

3(2') Wormlike; small to minute (less than 1 mm in length).....**Nematoda**

3' Ventral foot present; body may be protected by a shell.....**Mollusca**

Key to Common Classes of Terrestrial Arthropods

1 Appendages not apparent; sclerites may be minute or internal ..... **Insecta**

1' Walking legs present.....**2**

2(1') Flight wings present (may be covered by a pair of thick, outer wings).....**Insecta**

2' Wings absent.....**3**

3(2') Four pairs of walking legs; first pair of appendages modified into chelicerae; body has two distinct divisions.....**Arachnida**

3' Not as above.....**4**

4(3') Three pairs of walking legs; one pair of antennae; body has three distinct regions.....**Insecta**

4' Not as above.....**5**

5(4') Body is dorsoventrally flattened; two pairs of antennae (first pair are vestigal); seven pairs of walking legs.....**Malacostraca**

5' Not as above.....**6**

6(5') Wormlike, cylindrical or slightly flattened body with many pairs of legs.....**7**

6' Body is elongate and dorsoventrally flattened; 15 or more pairs of legs; each body segment bears a single pair of legs; antennae consist of 14 or more segments; last two pairs of legs are directed backwards.....**Chilopoda**

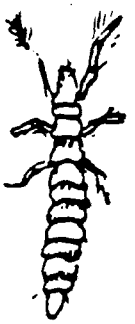
7(6) Most body segments bear two pairs of legs; antennae short.....**Diplopoda**

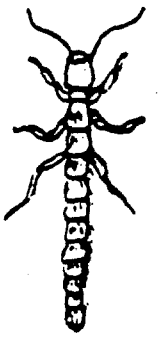
7' Body segments bear a single pair of legs; small to minute (1-8 mm) in length; antennae variable.....**8**

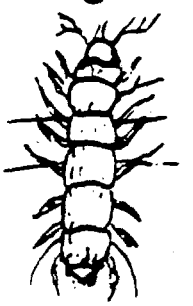
8(7') Antennae bear three apical branches; overall length is 1.0-1.5 mm; 10-12 pairs of legs.....**Symphyla**

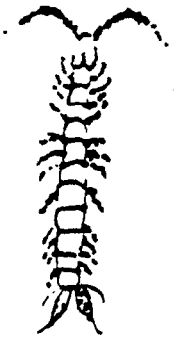
8' Antennae unbranched; overall length is 1-8 mm; nine pairs of legs...**Pauropoda**

Soil Organisms


PROTURAN

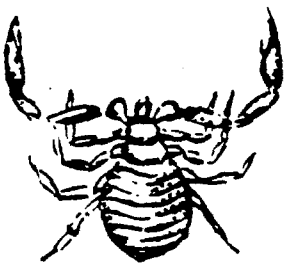

DIPLURAN

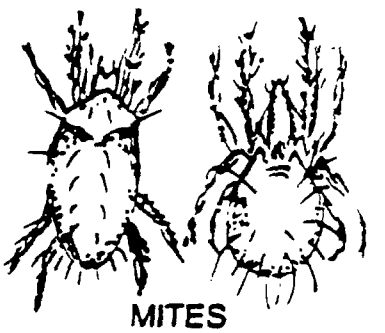

PAUROPOD

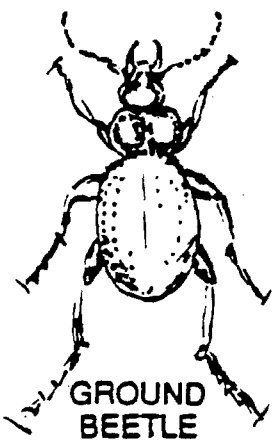

SYMPHYLAN

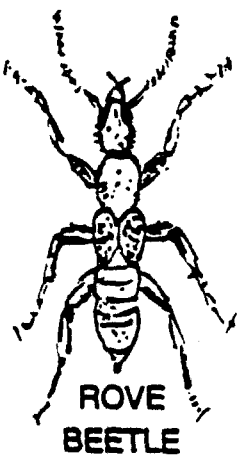
EARTHWORM

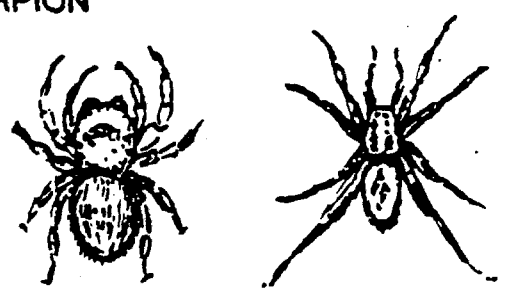
ANT

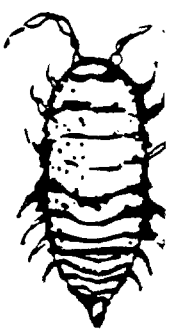

PSEUDOSCORPION


MITES


GROUND BEETLE

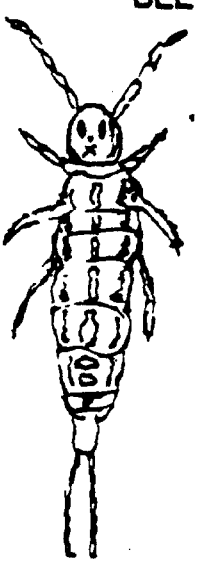

ROVE BEETLE

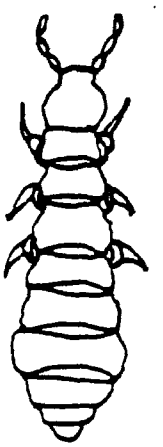

SPIDERS


PILLBUG

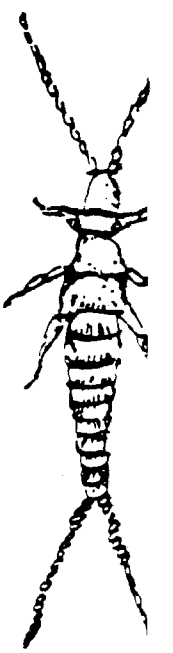
MILLIPEDE

SPRINGTAILS





CENTIPEDE


DIPLURAI

Wanted Posters

1.	Ant	425
2.	Centipede	427
3.	Dipluran	429
4.	Dipluran	431
5.	Earthworm	433
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19.	Springtail	461
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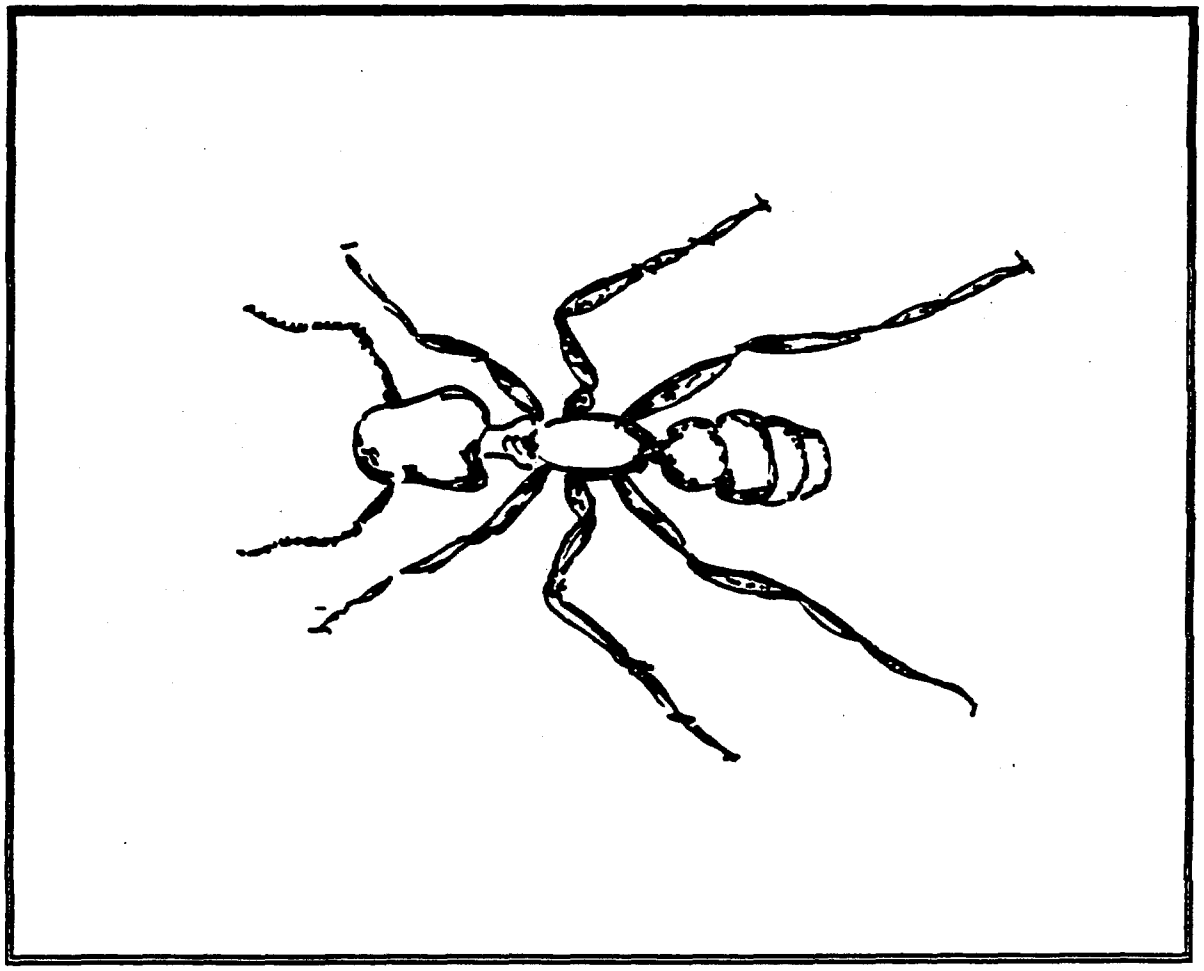
WANTED

**For Being
an
Omnivore**



Ant

This organism has been known to eat:

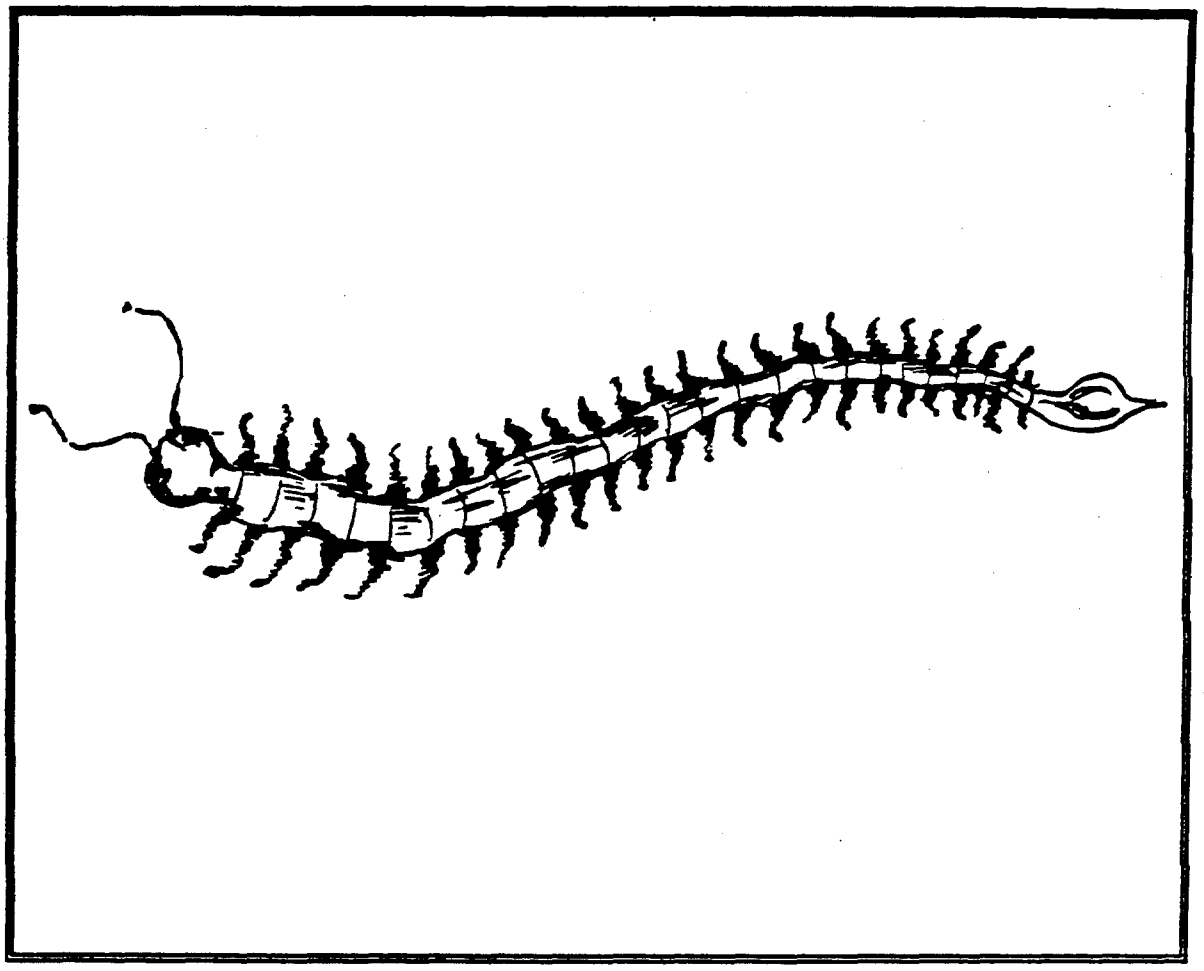
Plants, animals, and fungus.

Classification:

Kingdom..... Animalia
Phylum ..... Arthropoda
Class ..... Insecta
Order ..... Hymenoptera
Family ..... Formicidae

WANTED

For Being
a
Predator, Carnivore



Centipede

This organism has been known to eat:

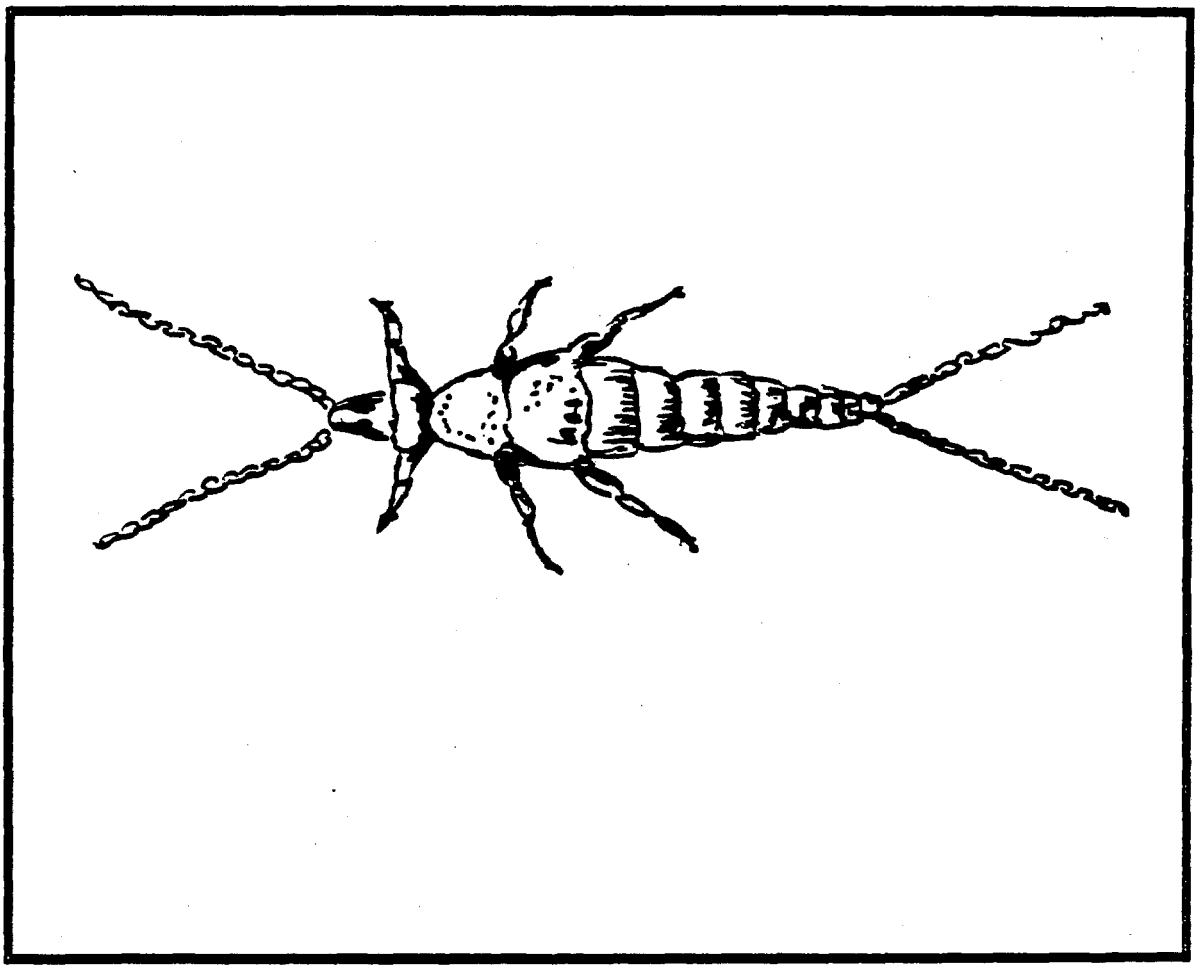
Insects

Classification:

Kingdom ..... Animalia
Phylum ..... Arthropoda
Class ..... Chilopoda

WANTED

For Being
a
Herbivore



Dipluran

This organism has been known to eat:

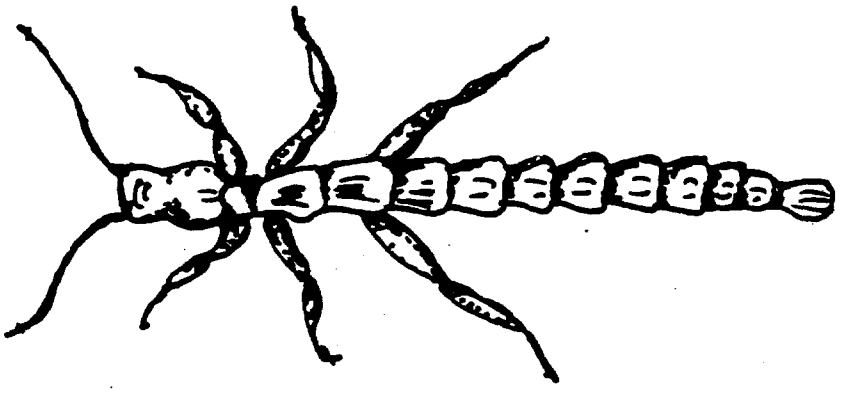
Plant material

Classification:

Kingdom ..... Animalia
Phylum ..... Arthropoda
Class ..... Insecta
Order ..... Diplura

WANTED

For Being
a
Herbivore



Dipluran

This organism has been known to eat:

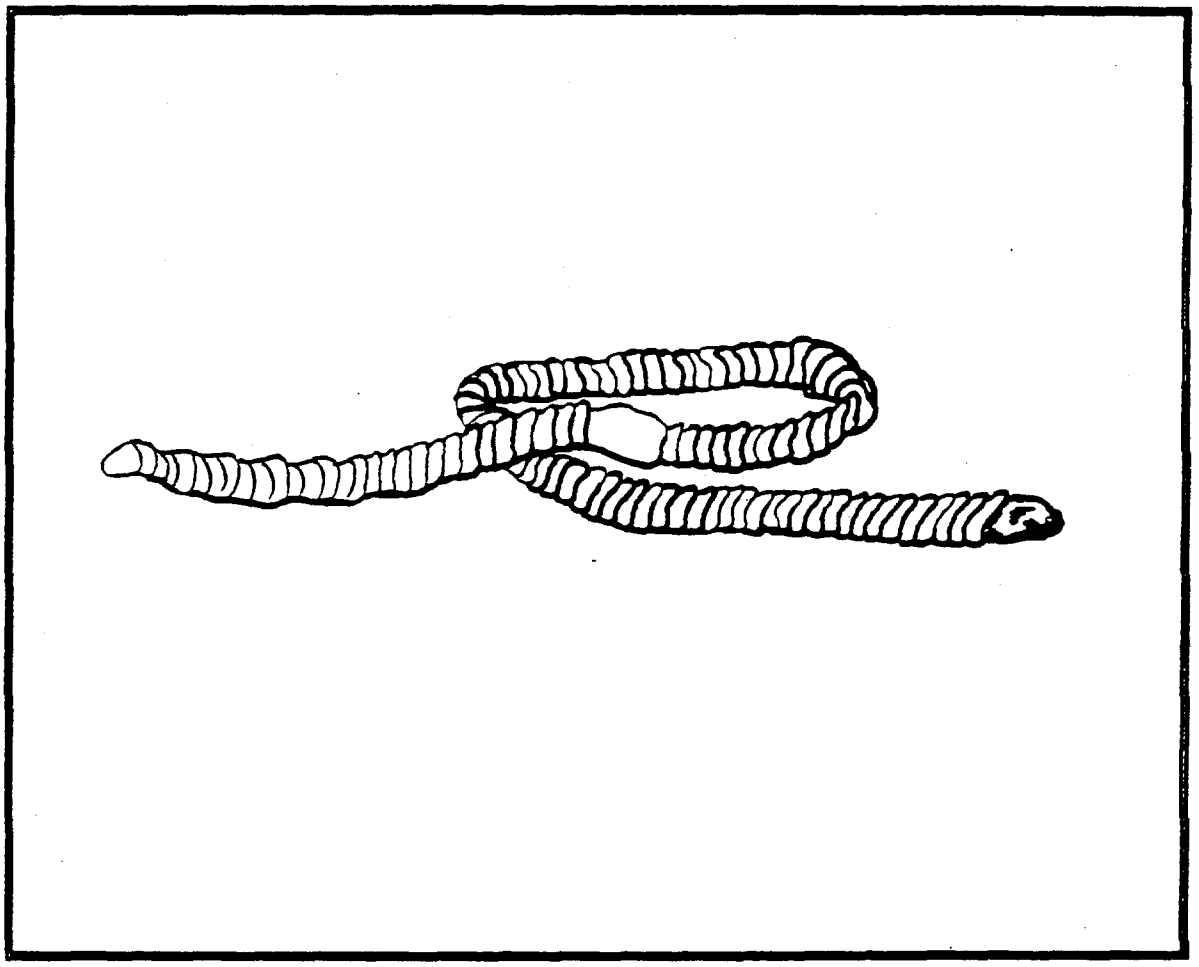
Plant material

Classification:

Kingdom ..... Animalia
Phylum ..... Arthropoda
Class ..... Insecta
Order ..... Diplura

WANTED

For Being
a
Herbivore



Earthworm

This organism has been known to eat:

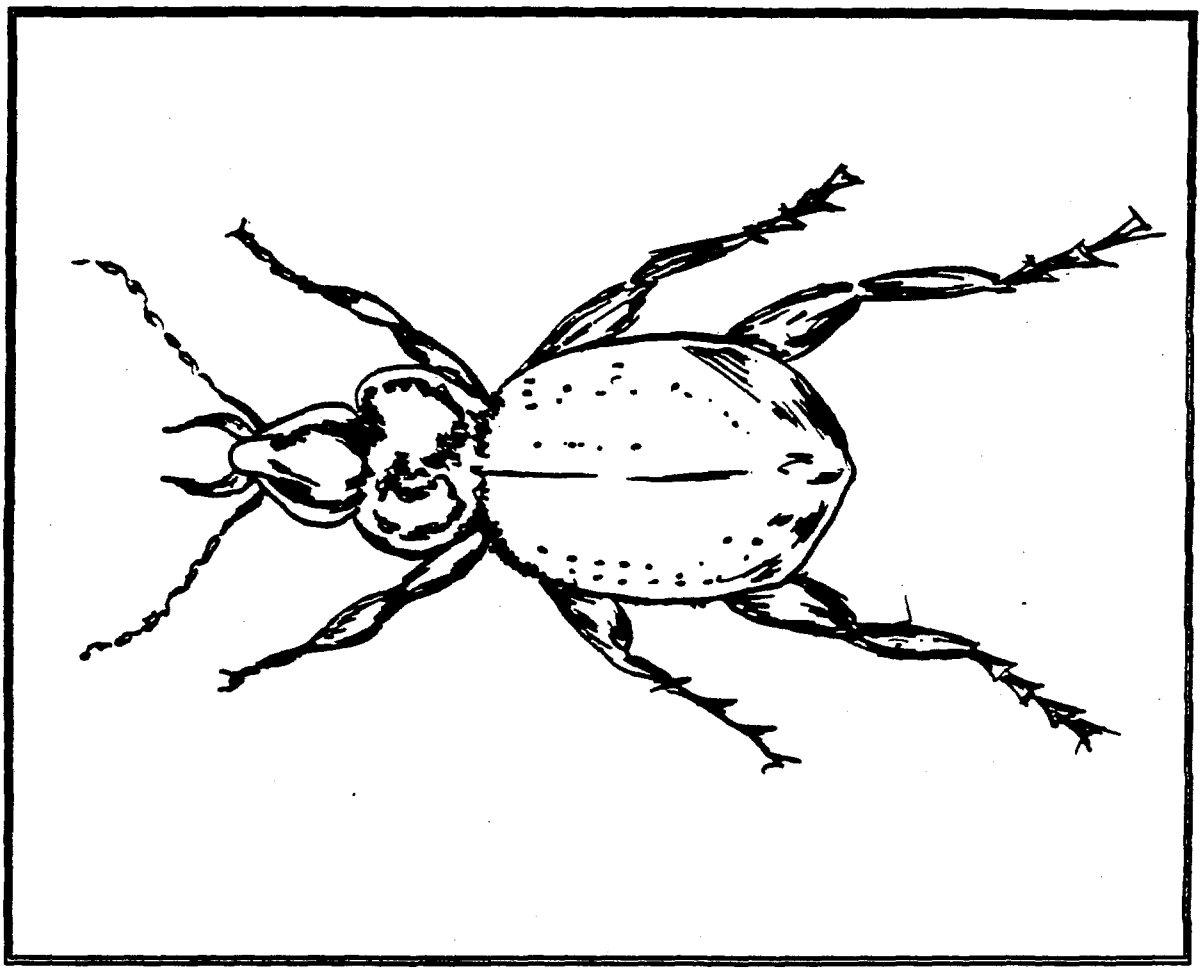
Plant material

Classification:

Kingdom ..... Animalia
Phylum ..... Annelida

WANTED

For Being
a
Predator, Carnivore



Ground Beetle

This organism has been known to eat:

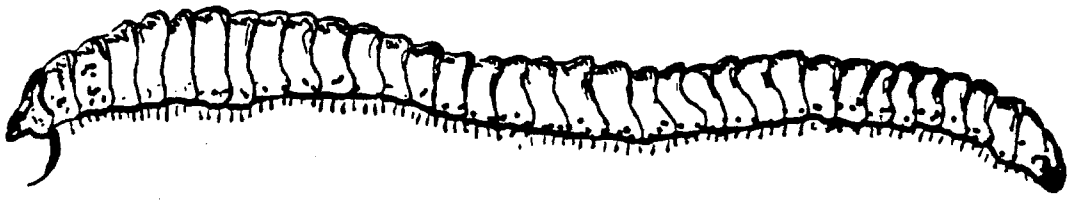
Small insects.

Classification:

Kingdom ..... Animalia
Phylum ..... Arthropoda
Class ..... Insecta
Order ..... Coleoptera
Family ..... Carabidae

WANTED

For Being
a
Herbivore



Millipede

This organism has been known to eat:

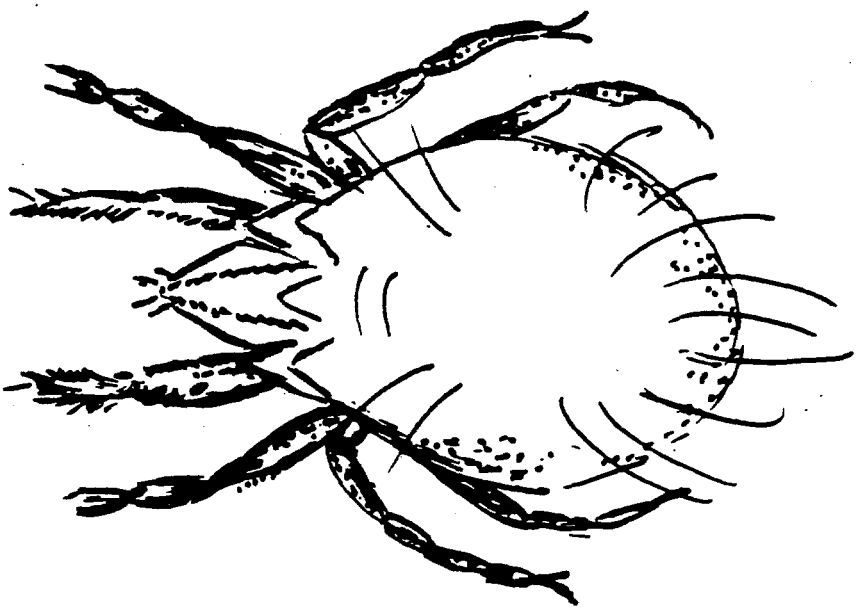
Plant material

Classification:

Kingdom ..... Animalia
Phylum ..... Arthropoda
Class ..... Diplopoda

WANTED

For Being
a / an
Predator, Carnivore, Omnivore, Parasite, Scavenger, Herbivore



Mite

This organism has been known to eat:

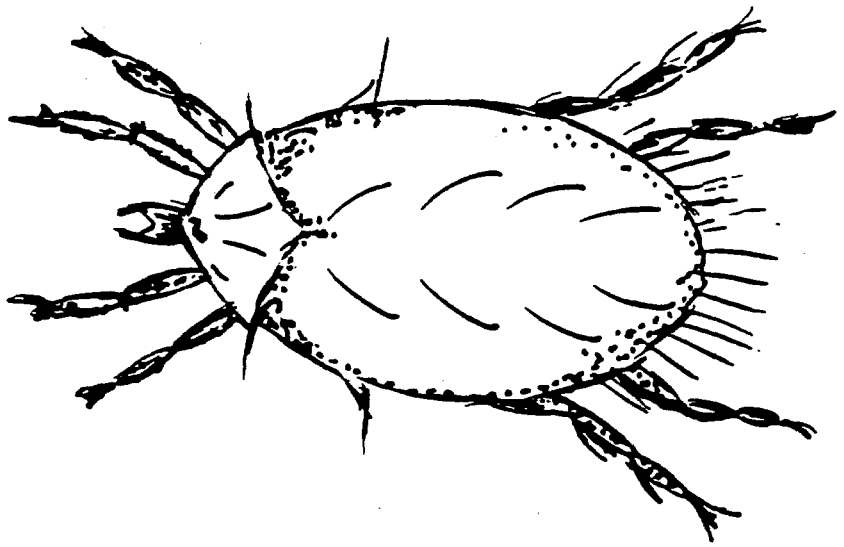
Most anything, depending on the species: small insects, plants, as parasites on larger animals including man.

Classification:

Kingdom ..... Animalia
Phylum ..... Arthropoda
Class ..... Arachnida
Order ..... Acari

WANTED

For Being
a / an
Predator, Carnivore, Omnivore, Parasite, Scavenger, Herbivore



Mite

This organism has been known to eat:

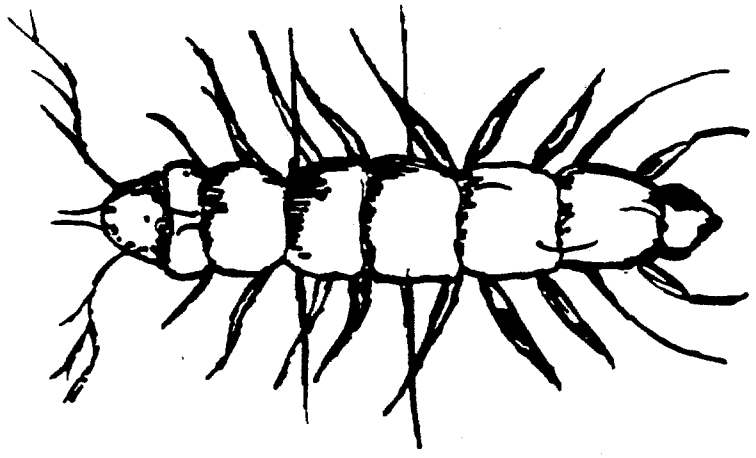
Most anything, depending on the species: small insects, plants, as parasites on larger animals including man.

Classification:

Kingdom ..... Animalia
Phylum ..... Arthropoda
Class ..... Arachnida
Order ..... Acari

WANTED

For Being
a
Herbivore



Pauropod

This organism has been known to eat:

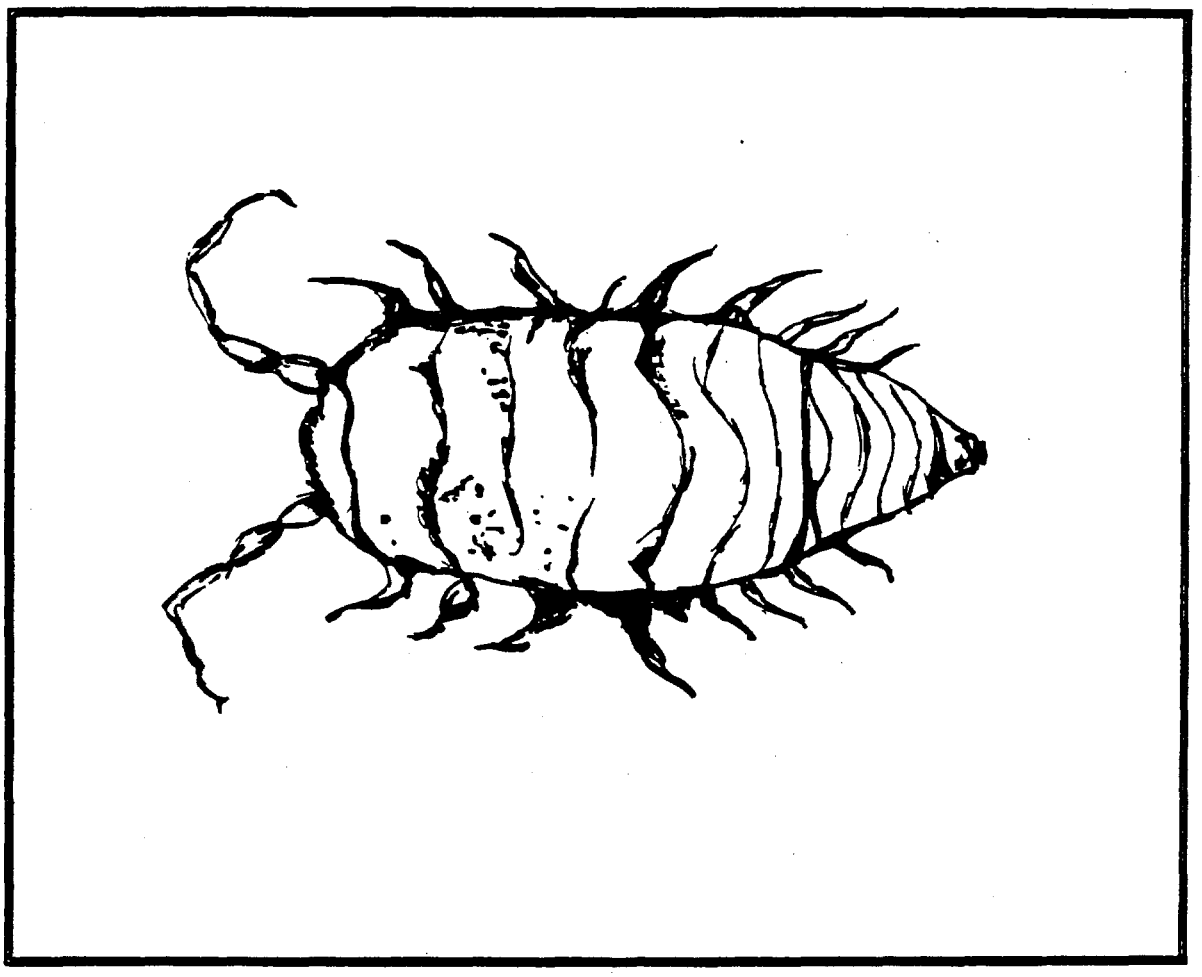
Plant material

Classification:

Kingdom ..... Animalia
Phylum ..... Arthropoda
Class ..... Pauropda

WANTED

For Being
a
Herbivore



.Pillbug, Sowbug

This organism has been known to eat:

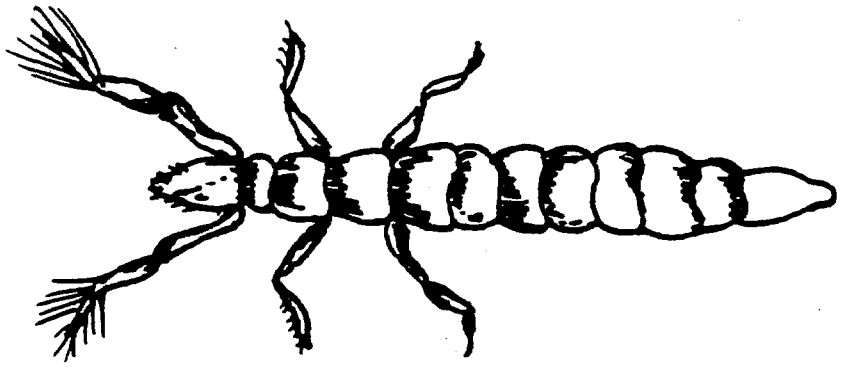
Plant material

Classification:

Kingdom ..... Animalia
Phylum ..... Arthropoda
Class ..... Crustacea
Order ..... Isopoda

WANTED

For Being
a
Scavenger



Proturan

This organism has been known to eat:

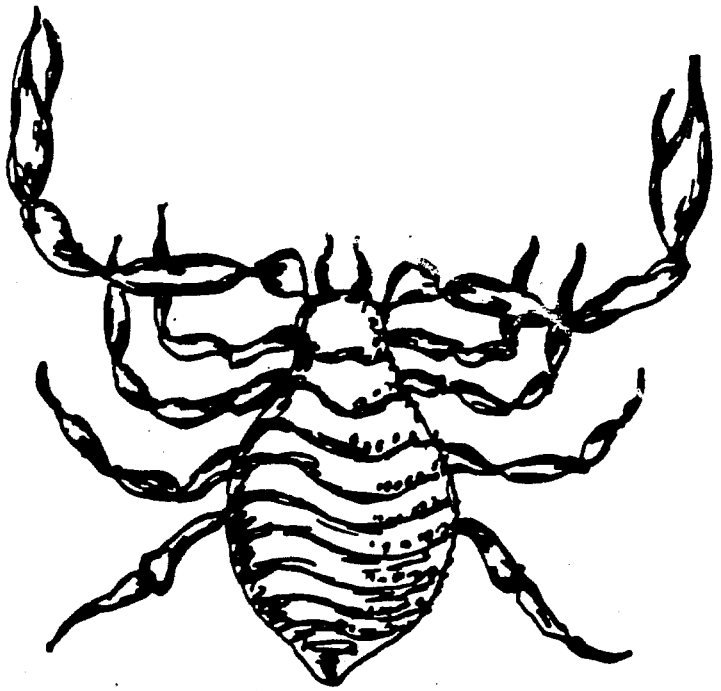
Decaying plant and animal material.

Classification:

Kingdom ..... Animalia
Phylum ..... Arthropoda
Class ..... Insecta
Order ..... Protura

WANTED

For Being
a
Predator, Carnivore



Pseudoscorpion

This organism has been known to eat:

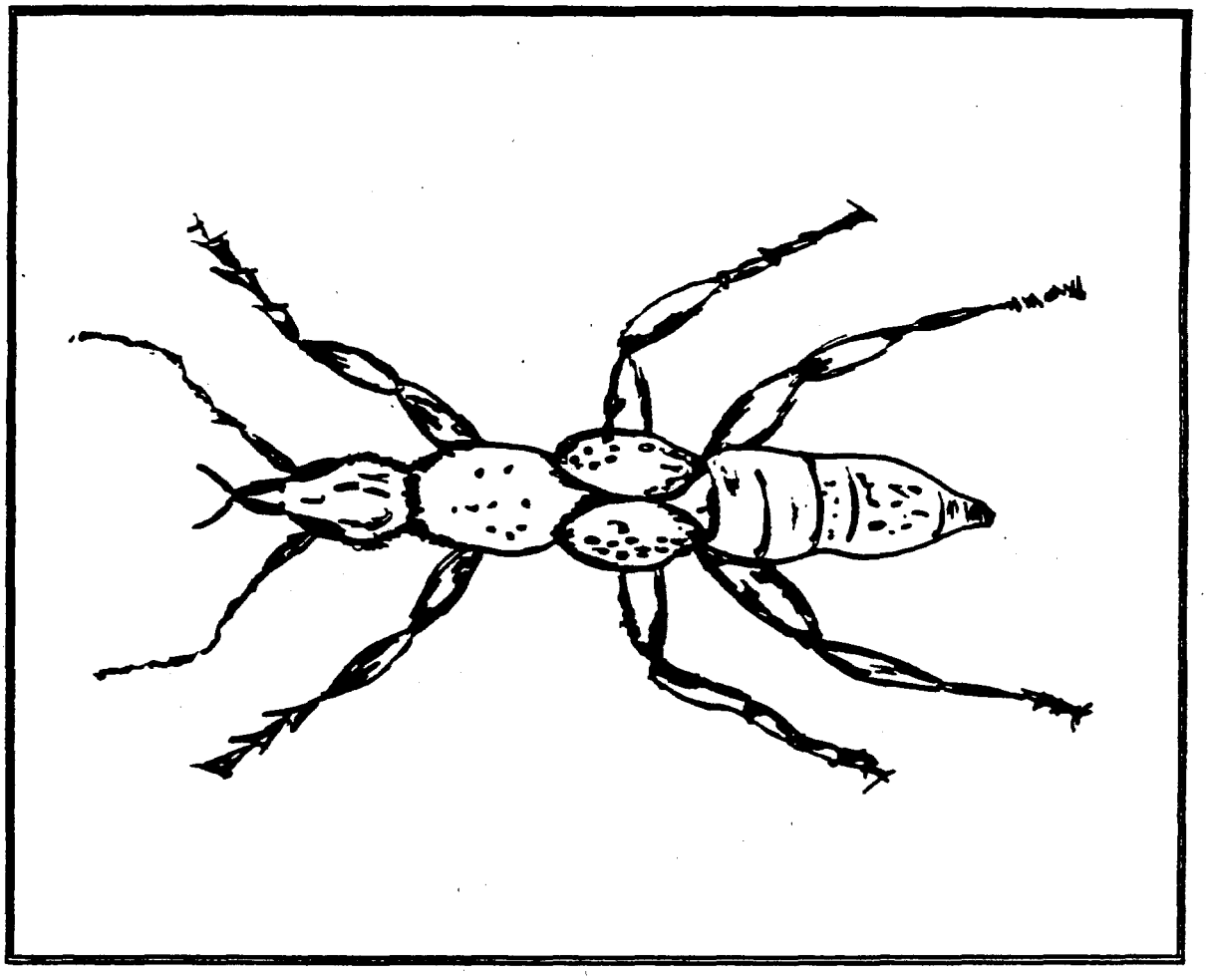
Very small insects, such as springtails.

Classification:

Kingdom ..... Animalia
Phylum ..... Arthropoda
Class ..... Arachnida
Order ..... Pseudoscorpionida

WANTED

For Being
a
Predator, Carnivore



Rove Beetle

This organism has been known to eat:

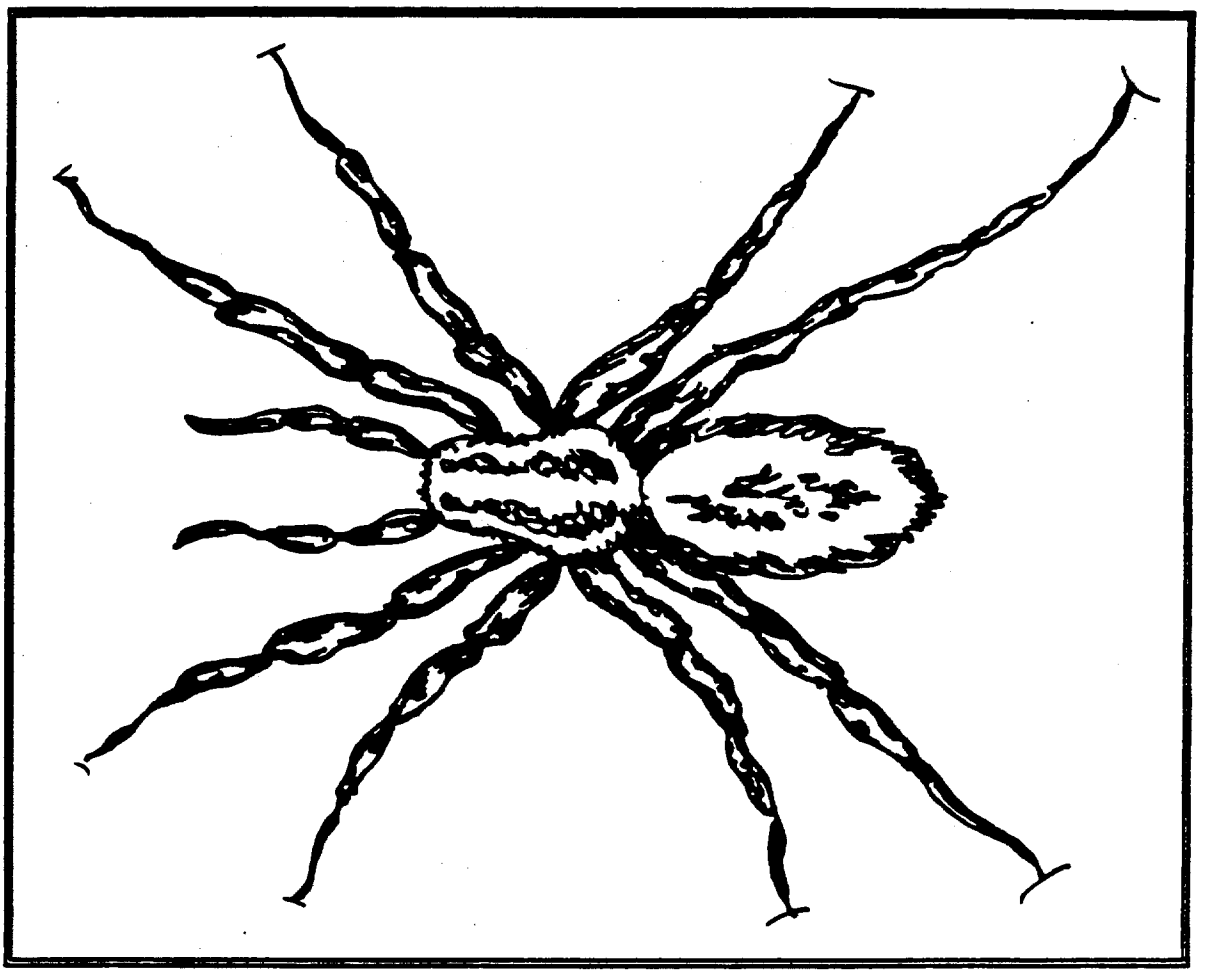
Small insects.

Classification:

Kingdom ..... Animalia
Phylum ..... Arthropoda
Class ..... Insecta
Order ..... Coleoptera
Family ..... Staphylinidae

WANTED

For Being
a
Predator, Carnivore



Spider

This organism has been known to eat:

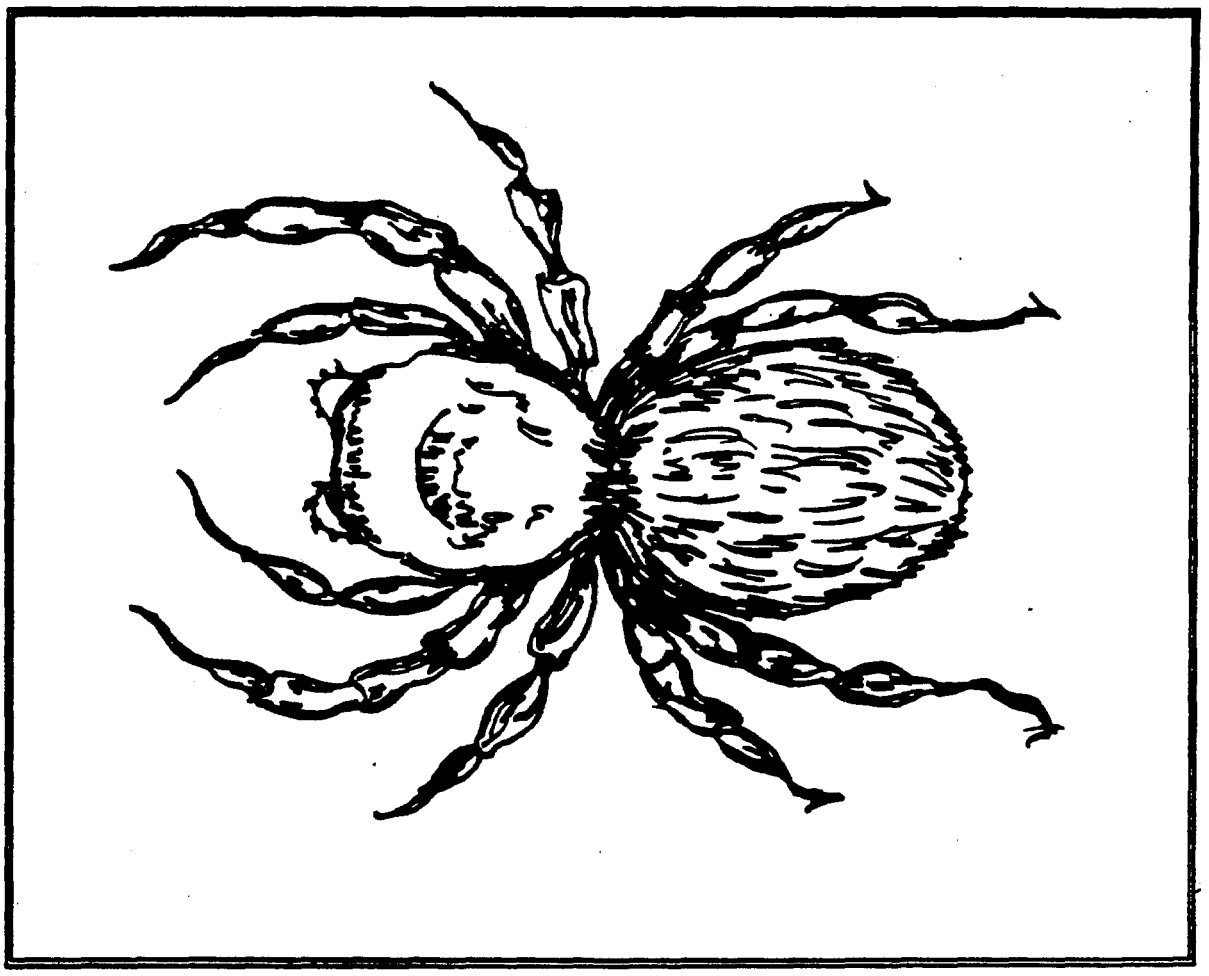
Small insects

Classification:

Kingdom ..... Animalia
Phylum ..... Arthropoda
Class ..... Arachnida
Order ..... Araneida

WANTED

For Being
a
Predator, Carnivore



Spider

This organism has been known to eat:

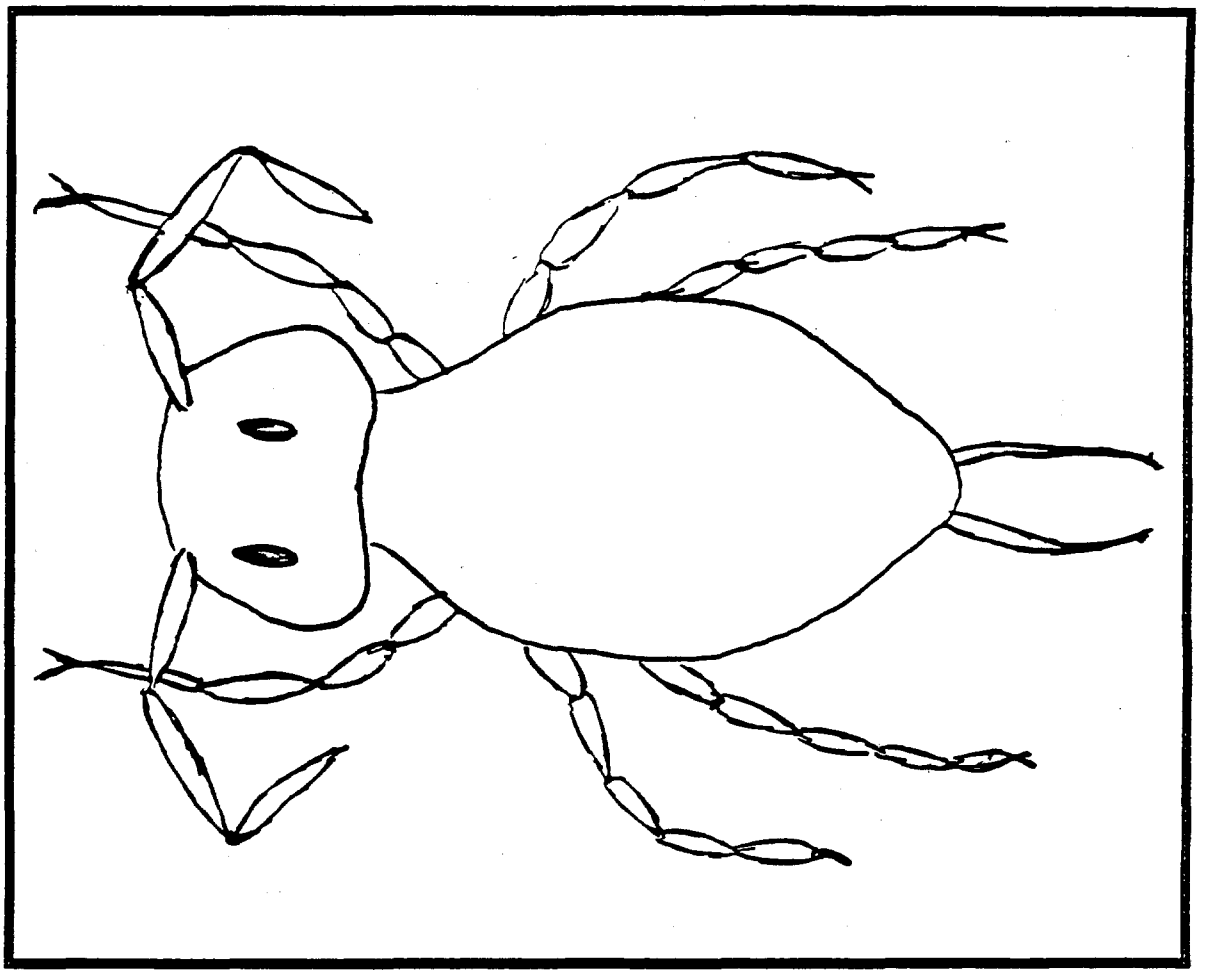
Small insects

Classification:

Kingdom ..... Animalia
Phylum ..... Arthropoda
Class ..... Arachnida
Order ..... Araneida

WANTED

For Being
a
Scavenger



Springtail

This organism has been known to eat:

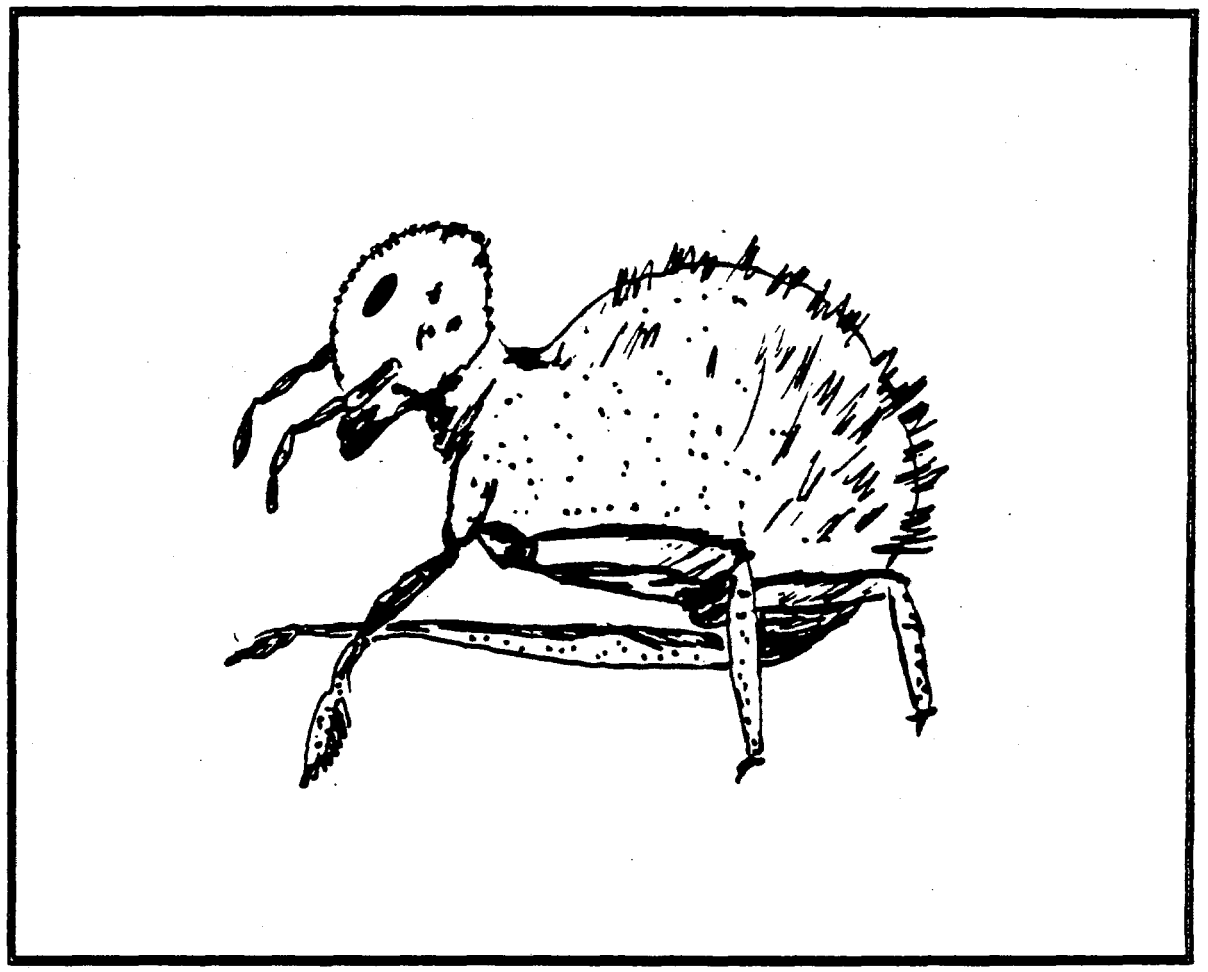
Decaying plant and animal material, fungus, feces and bacteria.

Classification:

Kingdom ..... Animalia
Phylum ..... Arthropoda
Class ..... Insecta
Order ..... Collembola

WANTED

For Being
a
Scavenger



Springtail

This organism has been known to eat:

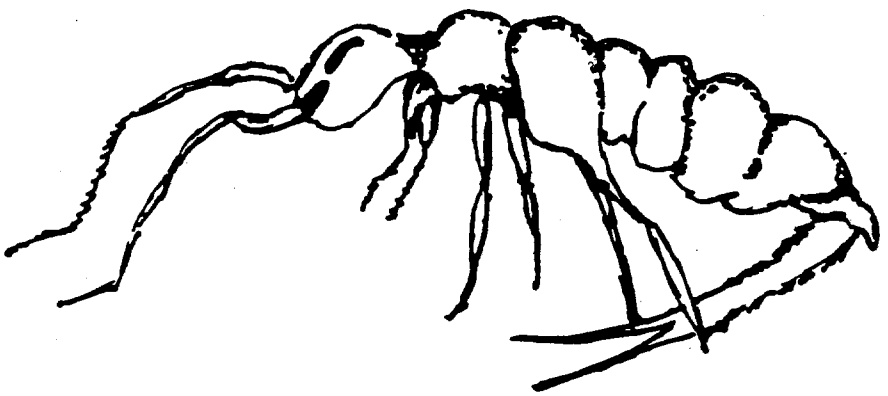
Decaying plant and animal material, fungus, feces and bacteria.

Classification:

Kingdom ..... Animalia
Phylum ..... Arthropoda
Class ..... Insecta
Order ..... Collembola

WANTED

For Being
a
Scavenger



Springtail

This organism has been known to eat:

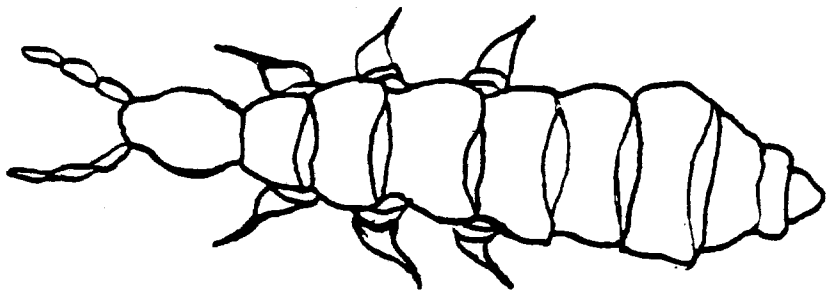
Decaying plant and animal material, fungus, feces and bacteria.

Classification:

Kingdom ..... Animalia
Phylum ..... Arthropoda
Class ..... Insecta
Order ..... Collembola

WANTED

For Being
a
Scavenger



Springtail

This organism has been known to eat:

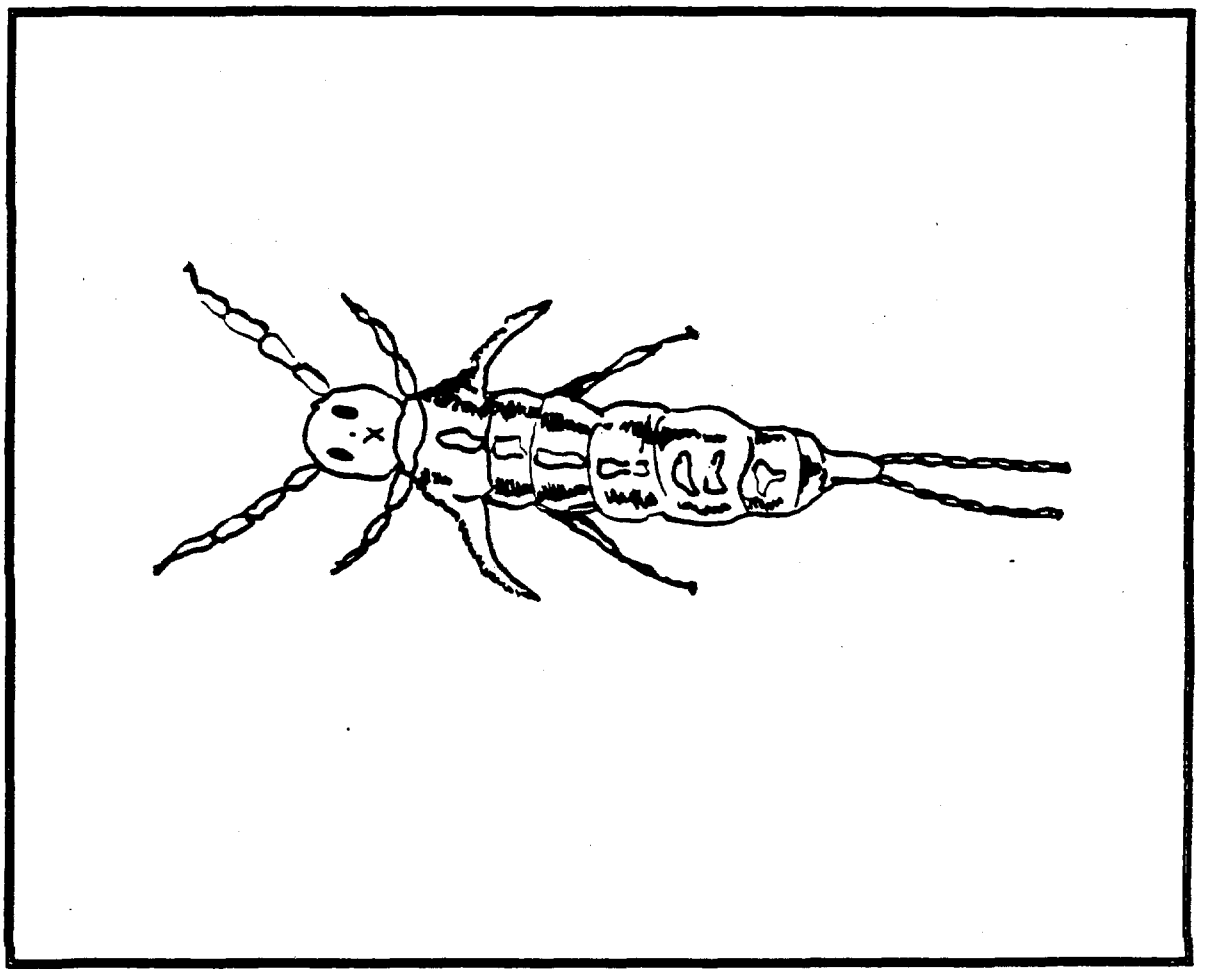
Decaying plant and animal material, fungus, feces and bacteria.

Classification:

Kingdom ..... Animalia
Phylum ..... Arthropoda
Class ..... Insecta
Order ..... Collembola

WANTED

For Being
a
Scavenger



Springtail

This organism has been known to eat:

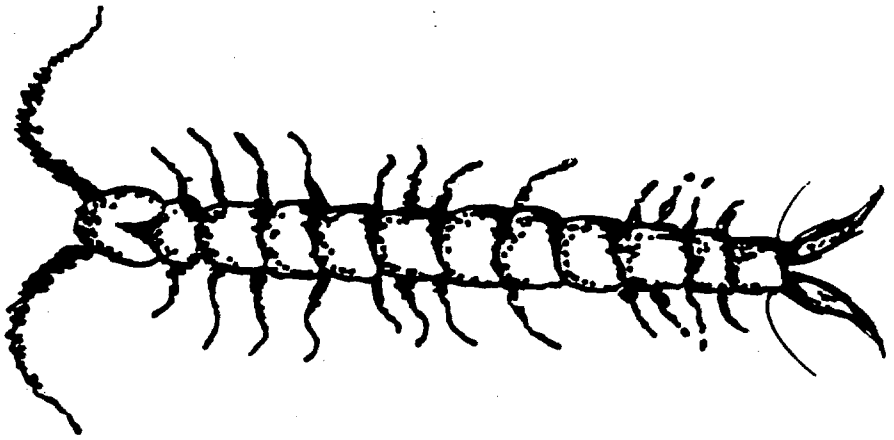
Decaying plant and animal material, fungus, feces and bacteria.

Classification:

Kingdom ..... Animalia
Phylum ..... Arthropoda
Class ..... Insecta
Order ..... Collembola

WANTED

For Being
a
Herbivore



Symphylan

This organism has been known to eat:

Plant material

Classification:

Kingdom ..... Animalia
Phylum ..... Arthropoda
Class ..... Symphyla

Quadrat Study Keys and Field Guides

Prairie Forb Identification Key

1. Plants with leaves that have parallel veins and leaves that are usually long and thin...**Gramineae** (Grass family) See Prairie Grass Identification Key.

1. Plants with leaves that do not have parallel veins (except one) and leaves that are not usually long and thin...**forbs**.....2

   2. Stems that have four edges (square)...Mints.....3

      3. Opposite, larger leaves, arrow-shaped, velvety, and pink to lavender flowers in a concentric arrangement, blooms in July, August, 1 to 3 feet tall...**Wild bergamot, Monarda fistulosa** (mint family)

      3. Opposite, thin, grass-like leaves and tiny white cluster of flowers in a flattish head. Blooms in July, August. Crushed leaves smell very mint-like, 1 to 3 feet tall...**Mountain mint, Pycnanthemum virginranum** (mint family)

   2. Stems that do not have four edges, but are round.....4

      4. Leaves that are parallel-veined.....5

         5. Leaves that are long, thick, yucca-like, with teeth or spines along the margin, parallel-veined, with conspicuous teeth or spines that look sharp (but are not). Flowers are very small clustered in a very dense head the size of a quarter, blooms July, August, 3 feet or more. . . **Rattlesnake master, Eryngium yuccafolium** (carrot family)

      4. Leaves not parallel-veined.....6

         6. Leaves large (usually much larger than a slice of bread), flowers yellow.....7

            7. Leaves large and mainly basal, feel like sandpaper, yellow flowers near the top of a tall stem (3 to 10 feet tall).....8

               8. Leaf heart-shaped, basal-serrated, rough like sandpaper, (looks like an elephant ear) flowers on a tall, hairless stalk that resembles a sunflower, blooms July to September, 3 to 10 feet tall... **Prairie dock, Silphium terebinthinaceum** (sunflower family)

8. Leaf upright, basal, deeply divided, sandpapery, points north and south. Flowers on a tall, hairy stalk that resembles a sunflower, blooms July to September, 3 to 10 feet tall...**Compass plant, Silphium laciniatum** (sunflower family)

6. Leaves not basal, not large (usually smaller than a slice of bread), and grow along an upright stem.....9

9. Leaves in whorls of 4 or more, flowers on a spike, stems and leaves velvety.....10

10. Flowers white, tiny, attached to a central spike near the top of the plant, blooms June, July, 2 to 6 feet tall...**Culver's root, Veronicastrum virginicum** (figwort family)

9. Leaves not in whorls, flowers pink, orchid or yellow (not white) flowers on a spike or cluster.....11

11. Flowers pink or orchid, leaves very narrow, similar to grass leaves.....12

12. Spikes of small, pink or orchid-colored, small flowers in clusters.....13

13. Flowers arranged closely along spike, blooms July, August, 2 to 6 feet tall...Marsh blazing star, Liatris spicata (smooth stem) or **Prairie blazing star, Liatris pycnostachia** (hairy stem)

13. Flowers arranged and spaced like buttons along the spike, blooms August, September, 1 to 5 feet tall...**Rough blazing star, Liatris aspera** (sunflower family)

11. Flowers yellow, not appearing spike-like, but clustered at the top of a stem.....14

14. Yellow flowers smaller than a dime 15

15. Flowers in clusters forming a cap-like head 16

16. Velvety leaves, small yellow flowers clustered at the top, blooms August, September, plants to 6 feet...**Stiff goldenrod, Solidago rigada** (sunflower family)

16. Alternate, longer grass-like leaves, much longer than wide, numerous, flowers arranged on a cone-like infloresence, plants to 6 feet tall...**Tall goldenrod, Solidago altissima,** (sunflower family)

14. Flowers not forming dense clusters, larger than a dime, flowers with visible yellow petals 17

17. Opposite, compound, smooth leaves, 3 to 5 leaflets or more, yellow flowers the size of a quarter, sunflower shaped plants to 2 to 7 feet, blooms August, September...**Tall coreopsis, Coreopsis tripteris** (sunflower family)

17. Opposite or alternate, simple, somewhat hairy, leaves that are sometimes serrated, yellow flowers the size of a silver dollar near the top of a 2 foot stem, blooms August, September...**Saw-toothed sunflower, Helianthus grasseserratus,** (sunflower family)

SUNFLOWER FAMILY

Prairie dock
Compass plant
Prairie blazing star
Rough blazing star
Stiff goldenrod
Tall goldenrod
Tall coreopsis
Saw-toothed sunflower

CARROT FAMILY

Rattlesnake master

MINT FAMILY

Wild bergamot
Mountain mint

FIGWORT FAMILY

Culver's root

Prairie Forbs and Grasses

WILD CARROT: WEED

Flower	white, flat topped, often a small purple flower in center
Leaves	alternate, finely divided
Stems	hairy
Height	2-3 ft.

WHITE SWEET CLOVER: WEED

Flower	white, slender tapering clusters
Leaves	alternate, in three parts, toothed
Stem	smooth
Height	2-8 ft.

Prairie Forbs and Grasses

RATTLESNAKE MASTER: PRAIRIE

Flower	white, ball-like
Leaves	alternate, spiny-edged, yucca-like
Stem	smooth
Height	1.5 - 4 ft.

YARROW: WEED

Flower	white, flat cluster, five petals
Leaves	alternate, fern-like, much-dissected
Stem	smooth
Height	1-3 ft.

Prairie Forbs and Grasses

BLACK RASPBERRY: WEED

Flower	white
Leaves	alternate, usually white beneath
Stem	has thorns
Height	up to 3 feet

DAISY FLEABANE: WEED

Flower	white
Leaves	alternate, toothed
Stem	hairy
Height	1-3 ft.

Prairie Forbs and Grasses

WILD BERGAMOT: PRAIRIE

Flowers	purple
Leaves	alternate, almost opposite
Stem	square
Height	2-3 ft.

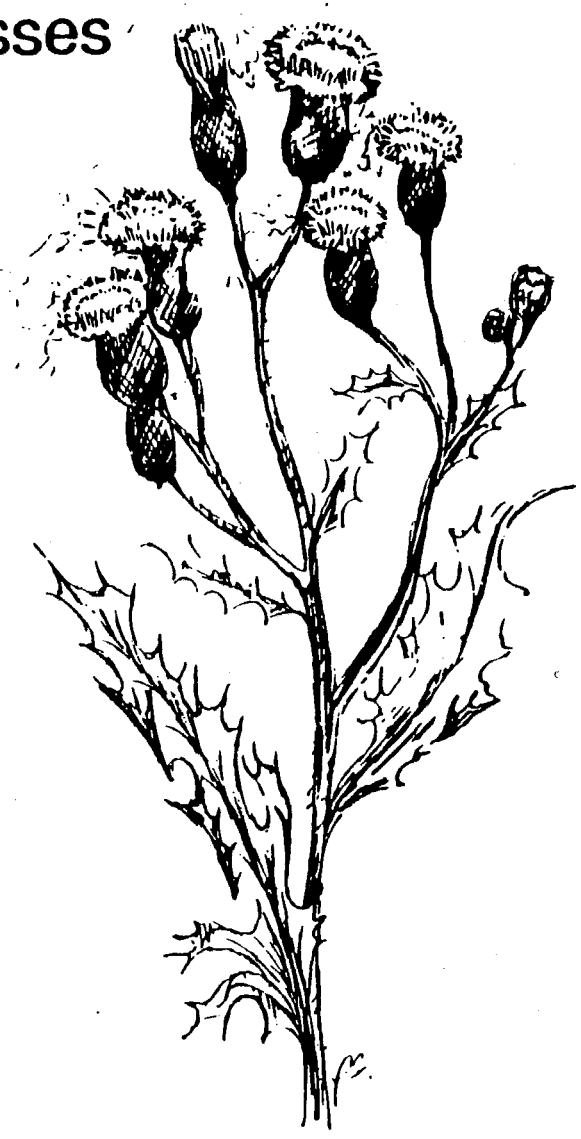
SHOWY TICK TREFOIL: PRAIRIE

Flowers	pink
Leaves	alternate, divided into three parts, hairy
Stem	hairy
Height	2-6 ft.

Prairie Forbs and Grasses

TALL GOLDENROD: WEED

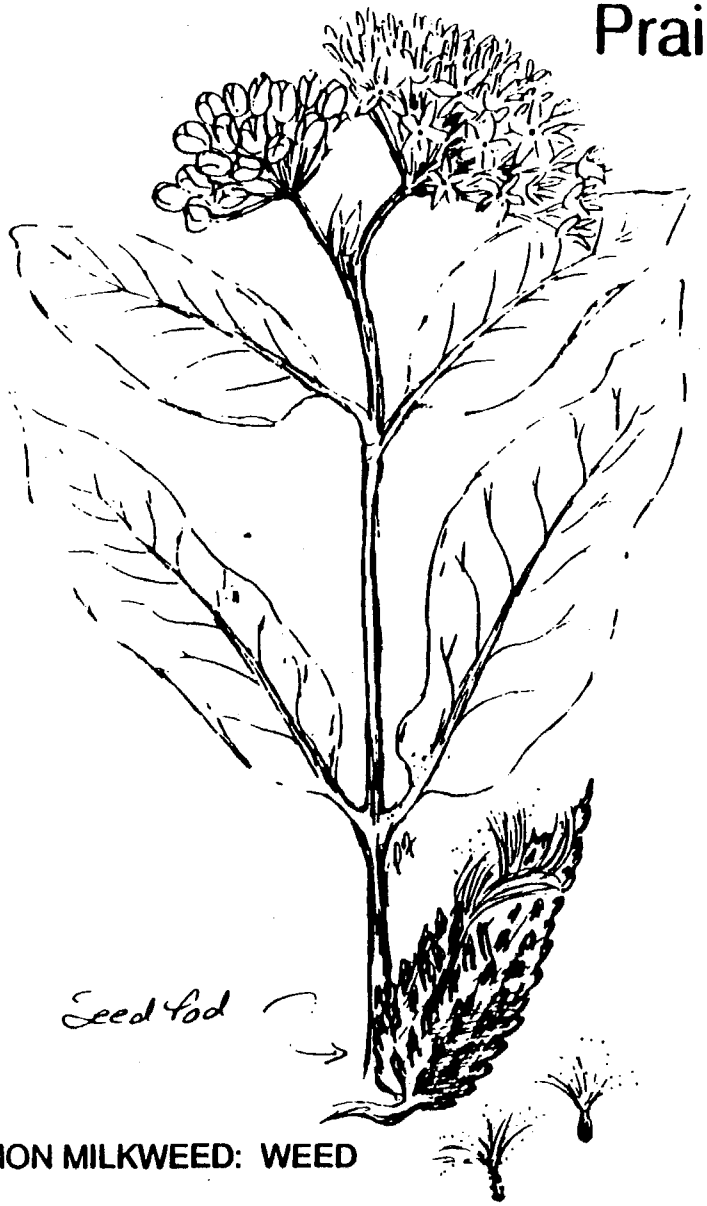
Flower	yellow
Leaves	alternate, toothed, hairy beneath
Stem	hairy
Height	3-6 ft.



CANADA THISTLE: WEED

Flower	red or pink, many small flowers
Leaves	sharp, pointed, with wavy edges
Stem	smooth
Height	1-5 ft.

Prairie Forbs and Grasses



COMMON MILKWEED: WEED

Flower	purple, ball shaped cluster
Leaves	opposite, soft hair feels like wool, milky juice,
Stem	hairy
Height	3-5 ft.

RED CLOVER: WEED

Flower	red-purple, small ball-like
Leaves	alternate, have three parts, have triangular markings
Stem	some hairs
Height	6-16 inches

Prairie Forbs and Grasses

STIFF GOLDENROD: PRAIRIE

Flower	yellow
Leaves	alternate, small upper leaves
Stem	hairy
Height	1-5 ft.

BLACK-EYED SUSAN: PRAIRIE

Flower	yellow, brown center
Leaves	alternate, hairy large lower leaves
Stem	hairy
Height	1-3 ft.

Prairie Forbs and Grasses

ROSINWEED: PRAIRIE

Flower	yellow, sunflower-like
Leaves	opposite, tooth, rough to the touch
Stem	smooth and hairy
Height	2-6 ft.

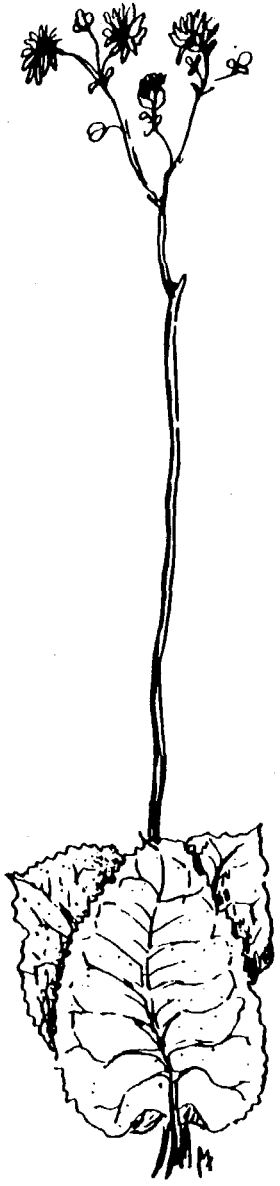
TALL COREOPSIS: PRAIRIE

Flower	yellow
Leaves	opposite, divided into three or five parts
Stem	smooth, has a light green or white look
Height	3-9 ft.

Prairie Forbs and Grasses

COMPASS PLANT: PRAIRIE

Flower	yellow, sunflower-like
Leaves	huge, oak-like, deeply cut
Stem	hairy
Height	4-10 ft.



PRAIRIE DOCK: PRAIRIE DOCK

Flower	yellow, sunflower-like
Leaves	huge, "heart" shaped
Stem	smooth
Height	4-10 ft.

Prairie Forbs and Grasses

BIRDFOOT TREFOIL: WEED

Flower	yellow
Leaves	alternate, but looks opposite
Stem	smooth
Height	6-24 inches

GROUND CHERRY: WEED

Flower	yellow, bell-like, forms papery bladder with a yellow "cherry" inside
Leaves	alternate because they are divided into five parts
Stem	smooth or hairy
Height	1-5 feet

Prairie Forbs and Grasses

YELLOW CONEFLOWER: PRAIRIE

Flower	yellow
Leaves	deeply cut, white hairs beneath
Stem	hairy
Height	3-5 ft.

SAW-TOOTHED SUNFLOWER: PRAIRIE

Flower	yellow
Leaves	tooth, often white beneath
Stem	smooth
Height	4-10 ft.

Prairie Forbs and Grasses

COMMON RAGWEED: WEED

Flower	green
Leaves	alternate, deeply cut
Stem	smooth
Height	1-5 ft.

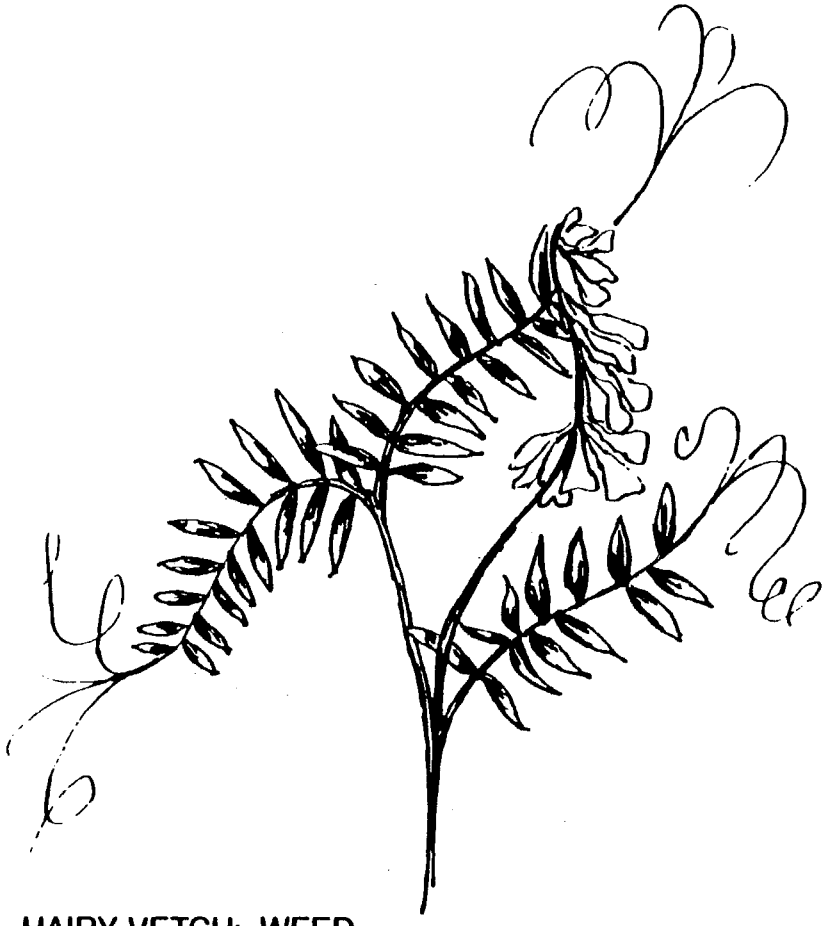
CURLED DOCK: WEED

Flower	green to brown
Leaves	alternate, leaf edges wavy
Stem	smooth
Height	1-4 ft.

Prairie Forbs and Grasses

ROUGH BLAZING STAR: PRAIRIE

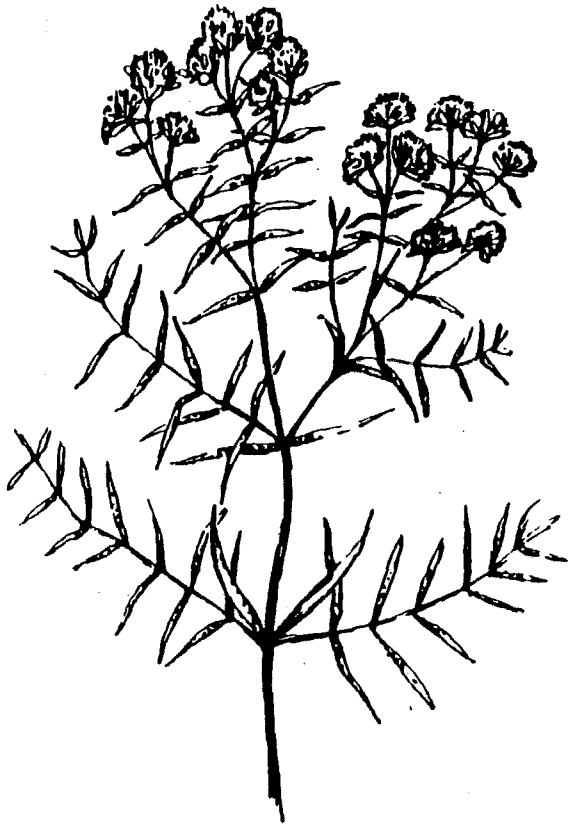
Flower	pink to purple
Leaves	alternate, narrow
Stem	smooth
Height	6-30 inches



HAIRY VETCH: WEED

Flower	blue with some white
Leaves	alternate, 6 to 8 pairs of leaflets
Stem	hairy
Height	2-3 feet

Prairie Forbs and Grasses



MOUNTAIN MINT: PRAIRIE

Flower	white, flat-topped
Leaves	opposite, broad at base
Stem	square
Height	1-2 1/2 ft.

ALSIKE CLOVER: WEED

Flower	white to pink, small ball-like
Leaves	alternate, have three parts, have no markings on leaflets
Stem	smooth
Height	1-2 ft.

Prairie Grass Identification Key

1. Plants with leaves not parallel-veined... **Forbs**

1. Plants with narrow, long leaves that are parallel-veined... **Grasses**.....2

    2. Inflorescence (flower cluster) arching... **Prairie brome grass** (1 to 3 feet)

    2. Inflorescence not arching.....3

        3. Inflorescence shape like a turkey's foot... **Big bluestem** (3 to 7 feet)

        3. Inflorescence not shaped like a turkey's foot.....4

            4. Inflorescence appearing fuzzy, growing in a clump... **Little bluestem** (1 to 3 feet)

            4. Inflorescence not appearing fuzzy.....5

                5. Clump, with long, narrow basal leaves only and smells like burnt popcorn when in bloom... **Prairie dropseed** (1 to 3 feet)

                5. Basal leaves present, but the flowering stem is taller and contains a few leaves.....6

                6. Inflorescence appearing feather-like... **Indian grass** (3 to 6 feet)

                6. Inflorescence not appearing feather-like.....7

                7. Inflorescence widely branched, leaf edges not sharp... **Switch grass** (3 to 6 feet)

                7. Inflorescence not widely branched.....8

                8. Inflorescence appearing cone-like with leaf edges very sharp... **Prairie cord grass** (3 to 6 feet)

Note: Inflorescence - the discrete flowering portion or portions of a plant.

Prairie Forbs and Grasses

TIMOTHY: WEED

Inflorescence very dense. Height: 1.5-3 ft.

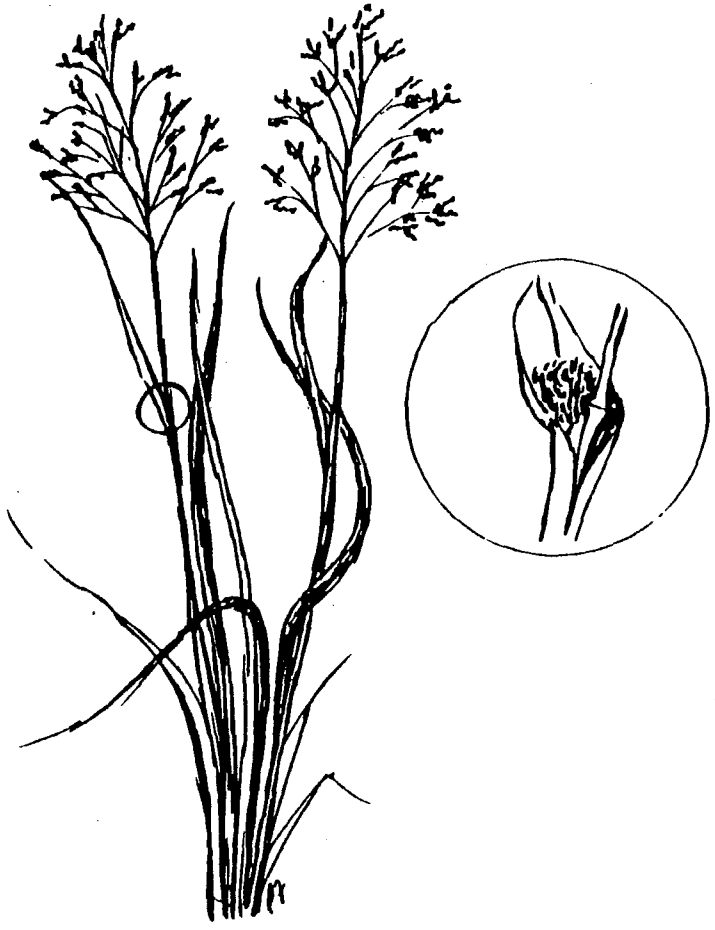
LITTLE BLUESTEM: PRAIRIE

Usually grows in clumps. Height 1-3 ft.

Prairie Forbs and Grasses

BIG BLUESTEM: PRAIRIE

The inflorescence or flowering area is divided into three parts like the foot print of a turkey; thus its other common name turkey foot. Height up to 8 feet.



SWITCH GRASS: PRAIRIE

A loose flower head, flowers or seeds on short stems away from main stem
Height: 3-6 ft.

Prairie Forbs and Grasses

SQUIRREL TAIL: WEED

Looks like the tail of a squirrel. Height: 1-2 ft.

REED CANARY GRASS: WEED

Very dense inflorescence. Height: 1.5-4.5 ft.

Prairie Forbs and Grasses

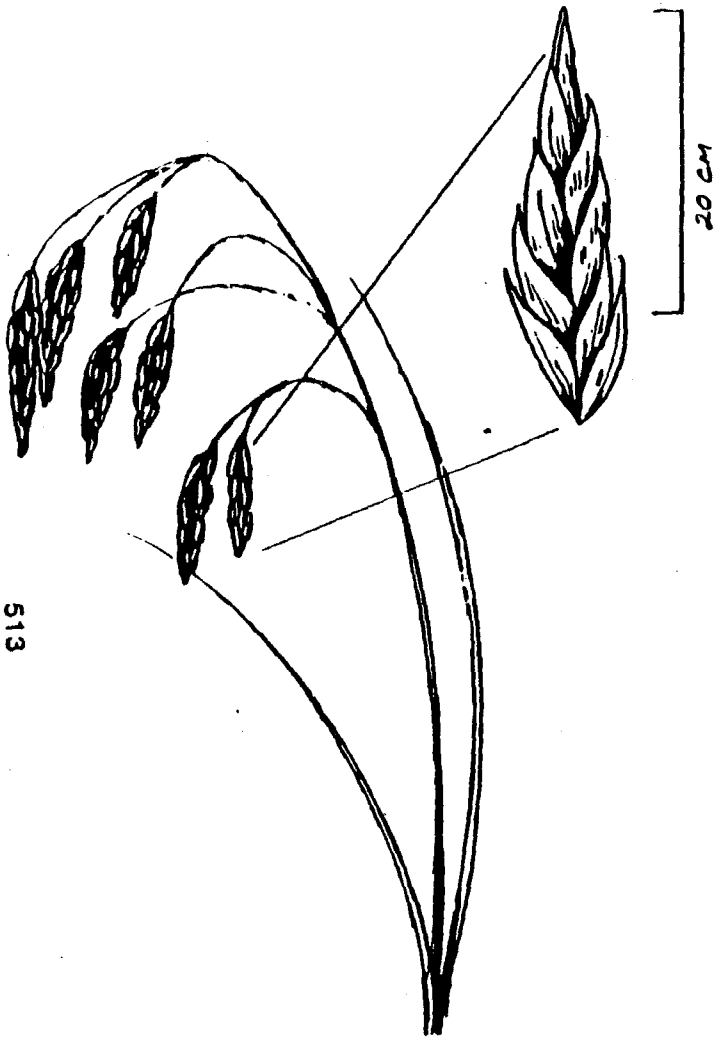
INDIAN GRASS: PRAIRIE

The inflorescence looks somewhat like a feather.
Height: 2.5-6 ft.

PRAIRIE CORD GRASS: PRAIRIE

A very rough coarse plant. The edges of the leaves are like a saw and will cut you if you are not careful. Height: 3-6 ft.

Prairie Forbs and Grasses



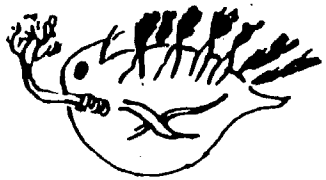
PRAIRIE BROME: PRAIRIE

Inflorescence hanging down. Height: 1.5- 3 ft.

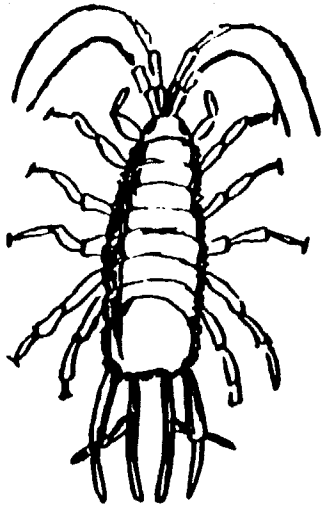
Water: Aquatic Diversity

Aquatic Invertebrates

MUSSEL

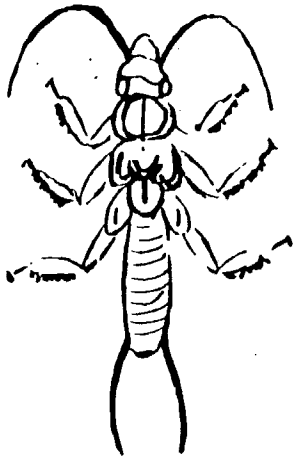


DAPHNIA



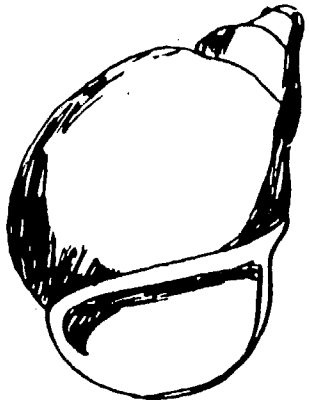
ASELLUS

ADULT

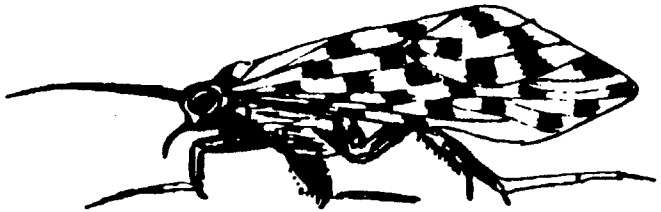


NYMPH

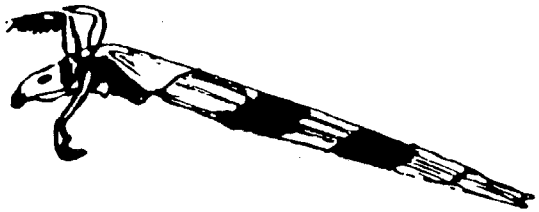
STONEFLY



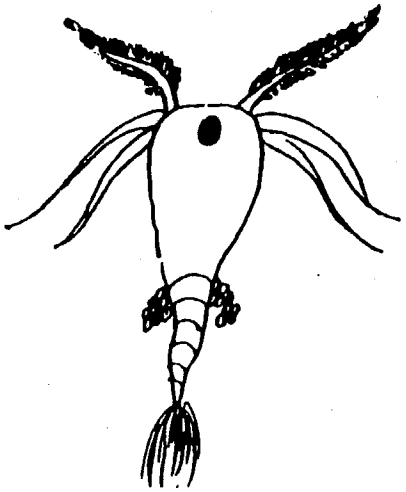
SNAIL



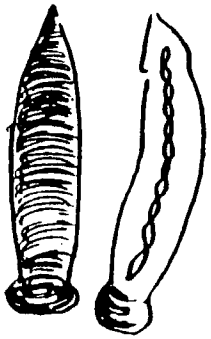
CADDIS FLY



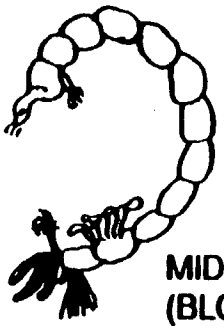
CADDIS FLY LARVA



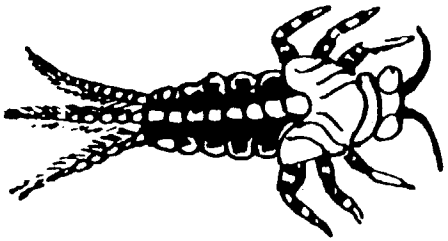
CYCLOPS



LEECHES



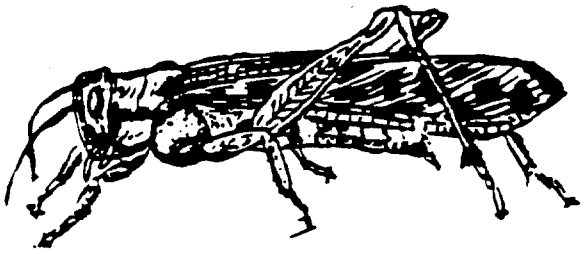
MIDGE LARVA
(BLOODWORM)



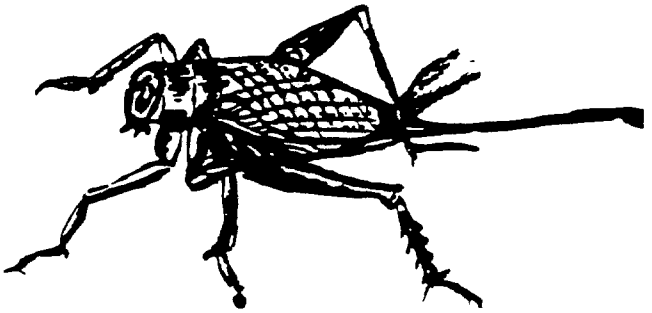
MAYFLY LARVA

Nature Walk and Prairie Insects

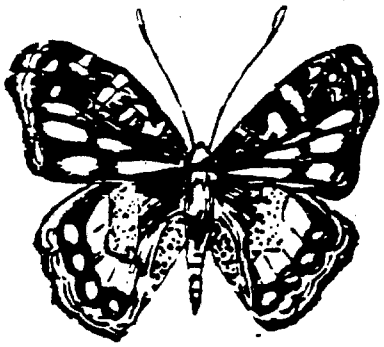
Terrestrial Invertebrates



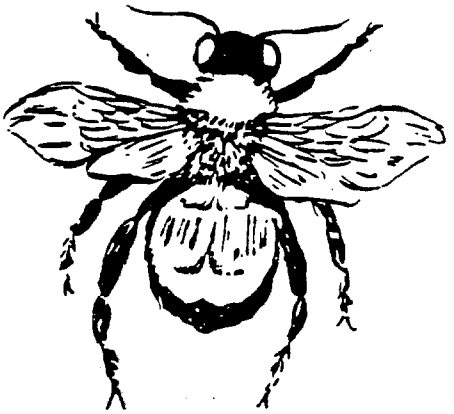
GRASSHOPPER



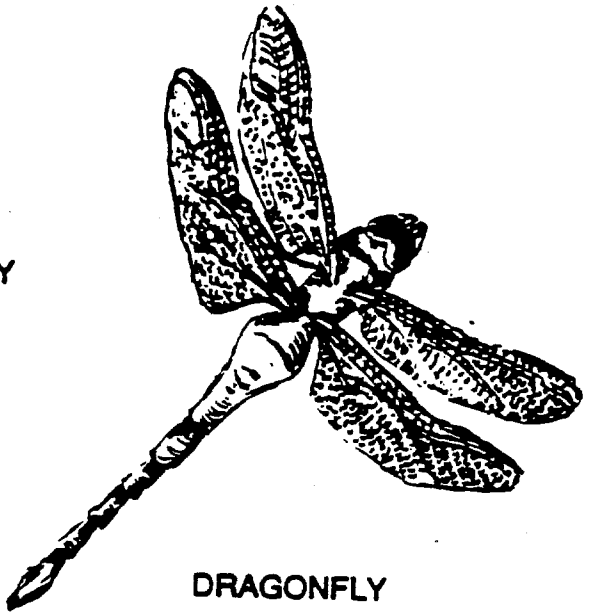
CRICKET



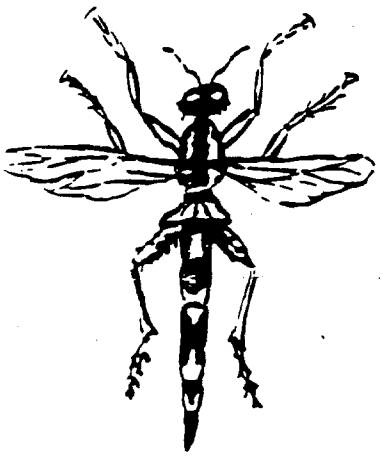
PAINTED LADY BUTTERFLY

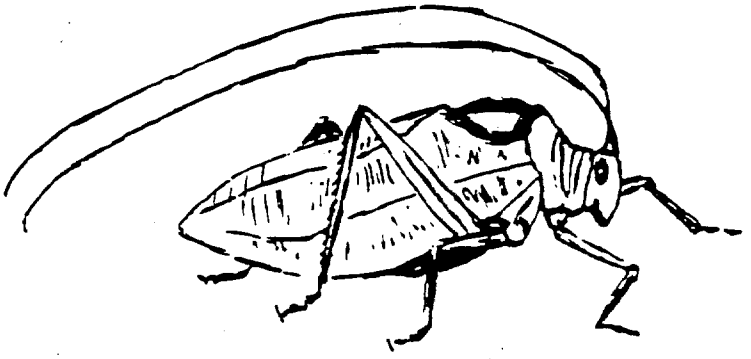


BUMBLE BEE



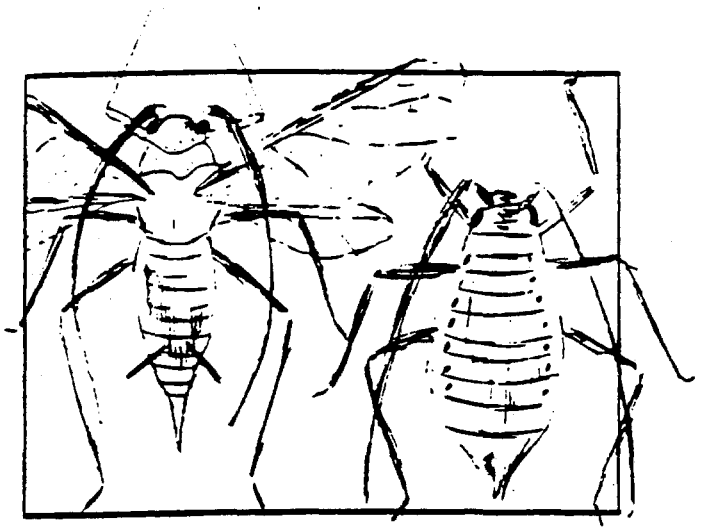
DRAGONFLY





KATYDID

Terrestrial Invertebrates



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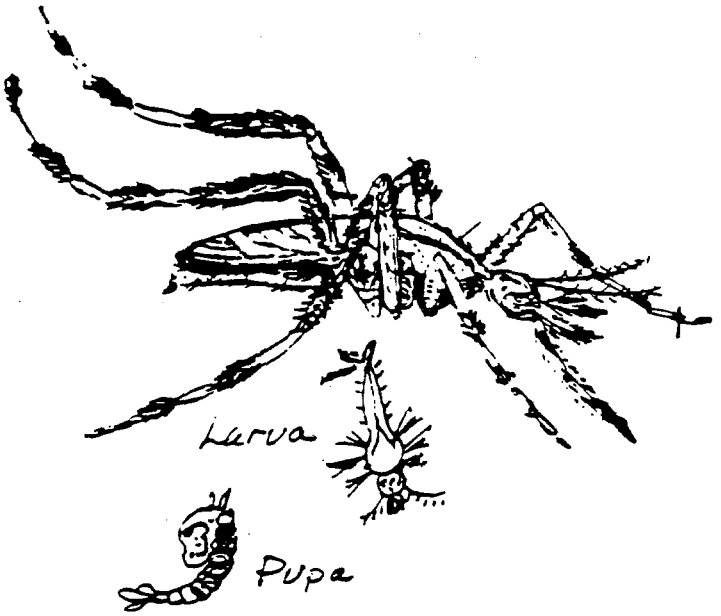
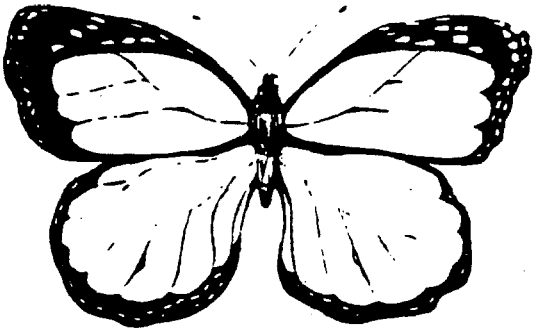


MOSQUITO

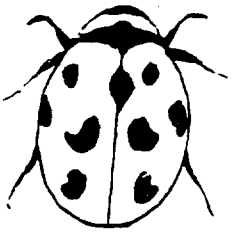
ANT - MOUND BUILDER



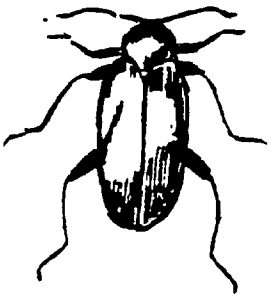
MONARCH BUTTERFLY

Terrestrial Invertebrates

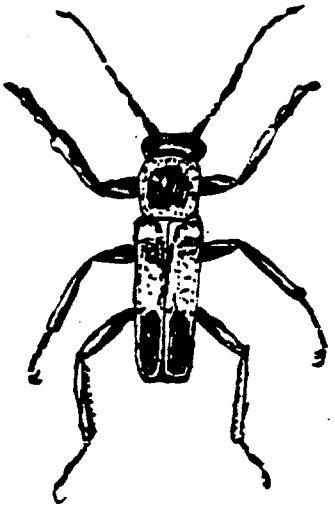
CICADA NYMPH



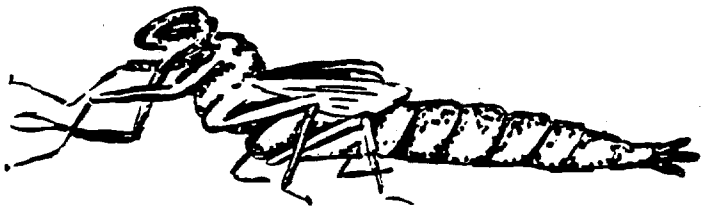
LADYBIRD BEETLE



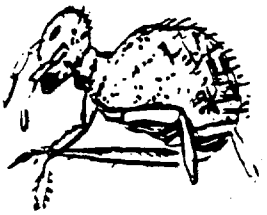
DOGBANE BEETLE



SOLDIER BEETLE

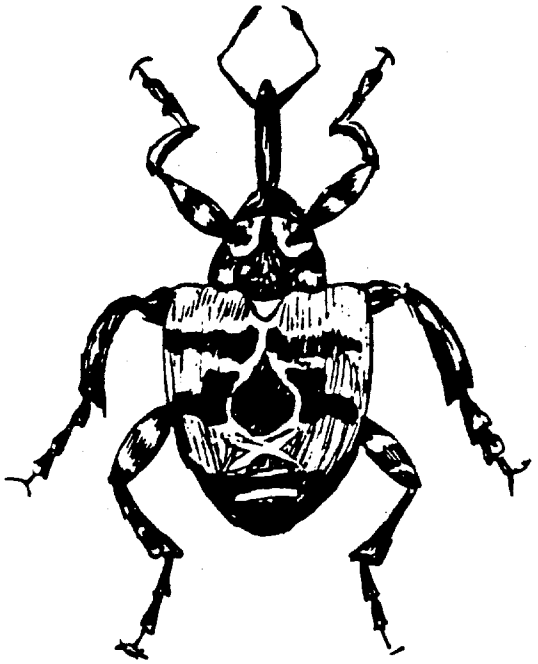


DRAGONFLY NYMPH

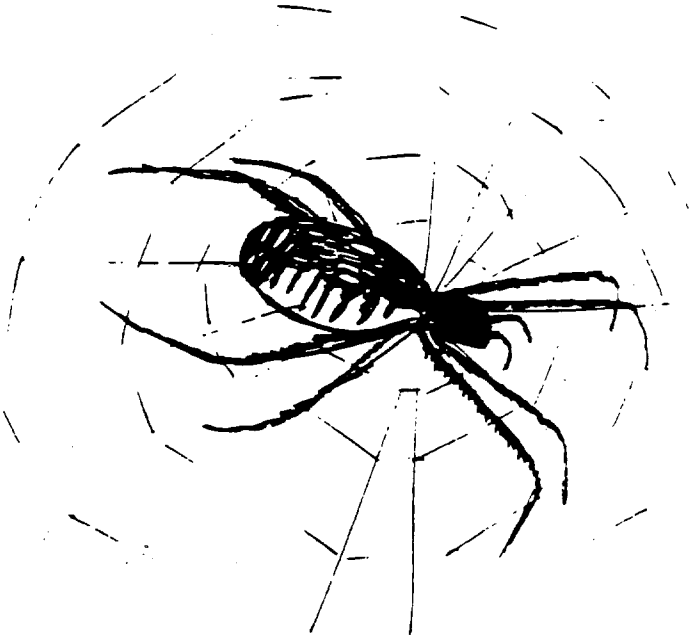


SPRINGTAIL

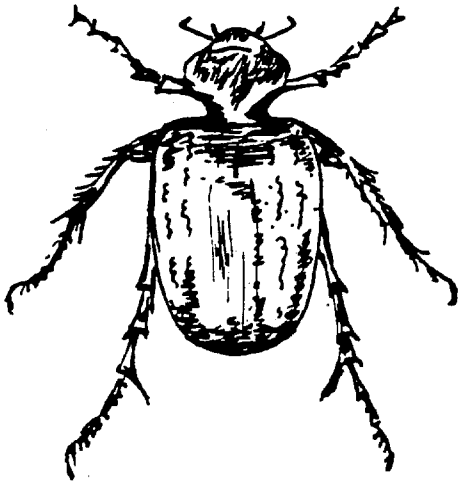
Terrestrial Invertebrates



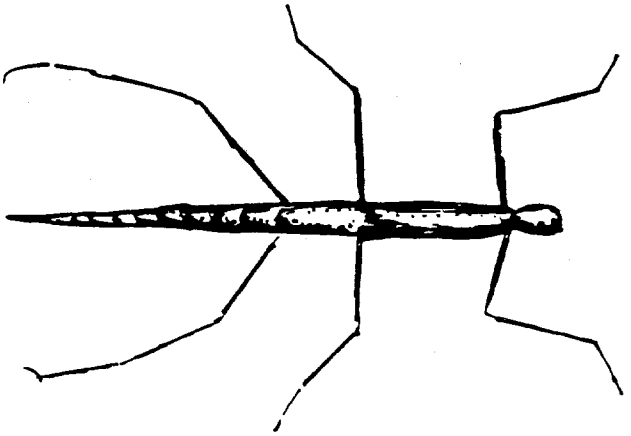
WEEVIL



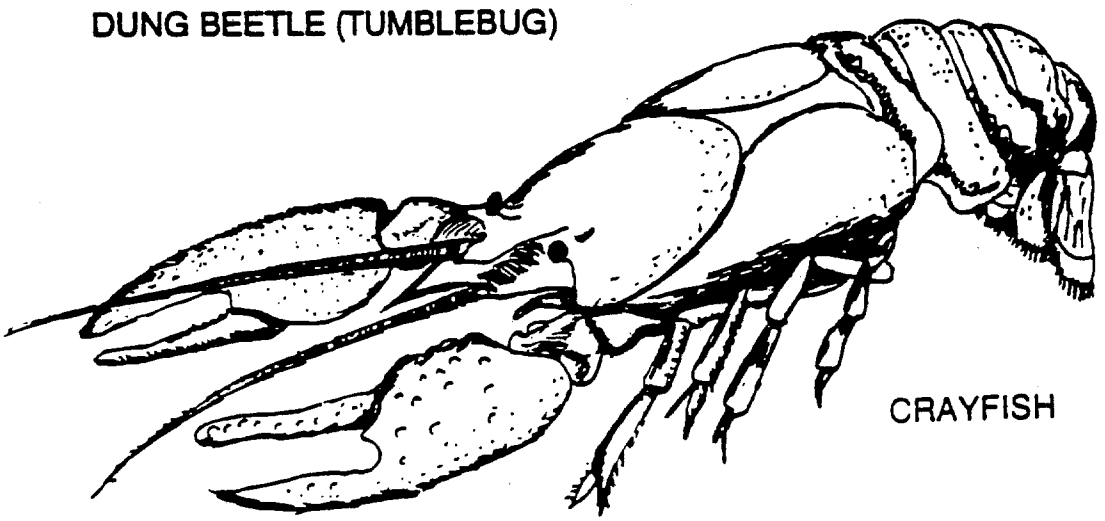
ORB WEAVER SPIDER



DUNG BEETLE (TUMBLEBUG)



WALKING STICK



CRAYFISH

Some Animal Tracks in Prairie and Savannah

Not drawn to scale.

Domestic Dog:

Domestic Cat:

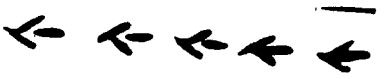
Cat Family - no claw marks
Cat prints - smaller than dog
roundish points

Walking

Crow:

Toenail Drag Approx. 2.5", 6.5 cm

Pheasant:



Approx. 2.4", 6 cm

Note: Alternate Pattern

Fox:

Dog family - dog, fox, coyote, wolf. Toenails present, four toes surrounding pad, front feet larger than rear.

Approx 2.5", 5-6 cm Running Walking

Raccoon:

Usually found near water or, in developed areas, near trash. Look for evidence of water prey (crayfish, fish).

White-Tailed Deer:

Approx. 2.75", 7 cm

Opossum:

The opossum has a prehensile tail and is most frequently seen in trees. It is a marsupial and carries its young in a pouch until they are old enough to ride on mama's back.

Cottontail Rabbit:

*Note - pattern indicating hind feet in front of front feet. Think about <u>how</u> a rabbit hops.

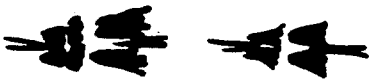
Approx. 3 - 4", 7.5 - 10 cm

Deer Mouse:

Occasionally toe and/or tail marks are present.

.5", 1 cm

Jumping



Meadow Mouse or Vole:

Front foot has only four toes. In winter, look for vole burrows under the snow.

Front foot has only four toes.

Grey Squirrel:

Jumping animals which live in trees use front feet in unison, unlike rabbits which stagger front feet. Again, notice small front feet in <u>BACK</u> of hind feet. Why?

Front

Hind

Approx. 2.25", 5.5 - 6 cm

Prairie Slide List

	Title	Source
1.	Big Bluestem	Fermilab
2.	Indian Grass	Fermilab
3.	Little Bluestem	Richard Billings
4.	Compass Plant	Richard Billings
5.	Prairie Dock	Fermilab
6.	Wild Bergamot	Richard Billings
7.	Yellow Coneflower	Richard Billings
8.	Bison	Fermilab
9.	White-tailed Deer	Mitchell Adamus
10.	Button Blazing Star	Mitchell Adamus
11.	Shooting Star	Mitchell Adamus
12.	Tall Coreopsis	Fermilab
13.	Stiff Goldenrod	Richard Billings
14.	Rosinweed	Richard Billings
15.	Bur Oak	Richard Billings
16.	Bur Oak Bark	Richard Billings
17.	Grasshopper-Katydid	Mitchell Adamus
18.	Soldier Beetle	Robert Wolff
19.	Aphid	James Rowan
20.	Cricket	James Rowan
21.	Tumblebug	James Rowan
22.	Dogbane Beetle	Fermilab
23.	Monarch	Fermilab
24.	Weevil	Ronald Panzer
25.	Orb Weaver Spider	Ronald Panzer
26.	Painted Lady Butterfly	Richard Billings
27.	Bluebird	Chicago Academy of Sciences
28.	Red-tailed Hawk	Chicago Academy of Sciences
29.	Bobolink	Cornell Laboratory of Ornithology
30.	Meadow Lark	Cornell Laboratory of Ornithology
31.	Yellow Warbler	Cornell Laboratory of Ornithology
32.	Dickcissel	Cornell Laboratory of Ornithology
33.	Snapping Turtle	Mitchell Adamus
34.	Leopard Frog	John Banaszak
35.	Tiger Salamander	John Banaszak
36.	Plains Garter Snake	Kenneth Moerzwa
37.	Smooth Green Snake	Ellin Beltz
38.	Red Fox	Mitchell Adamus
39.	13-Lined Ground Squirrel	Mitchell Adamus
40.	Meadow Vole	Mitchell Adamus