



Leopold Education Project

Lessons in a Land Ethic



“The objective is to teach the student to see the land, to understand what he sees, and to enjoy what he understands.” –Aldo Leopold

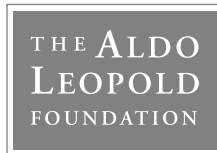


The Aldo Leopold Foundation • www.aldoleopold.org

Lessons in a Land Ethic



Leopold Education Project



Aldo Leopold Foundation

P.O. Box 77

Baraboo, WI 53913

www.aldoleopold.org

608-355-0279

Table of Contents

About Aldo Leopold	iv
About <i>A Sand County Almanac</i>	v
About the Leopold Education Project.....	vi
LEP Resources.....	viii
Using this Guide and Acknowledgments	ix

Lessons Corresponding to Essays in *A Sand County Almanac*

JANUARY

January Thaw.....	1
-------------------	---

FEBRUARY

Good Oak.....	6
---------------	---

MARCH

The Geese Return	12
------------------------	----

APRIL

Come High Water	16
Draba and Bur Oak	18
Sky Dance	21

MAY

Back from the Argentine	24
-------------------------------	----

JUNE

The Alder Fork—A Fishing Idyl	28
-------------------------------------	----

JULY

Great Possessions	31
A Prairie Birthday	36

AUGUST

The Green Pasture 40

SEPTEMBER

The Choral Copse 43

OCTOBER

Smoky Gold 47
Too Early 50
Red Lanterns 53

NOVEMBER

If I Were the Wind 57
Axe-in-Hand 60
A Mighty Fortress 63

DECEMBER

Home Range 67
Pines above the Snow 70
65290 74

Glossary 78

Aldo Leopold Bibliography 83

Aldo Leopold

CONSIDERED BY many as the father of wildlife management and of the United States' wilderness system, Aldo Leopold was a conservationist, forester, philosopher, educator, writer, and outdoor enthusiast.

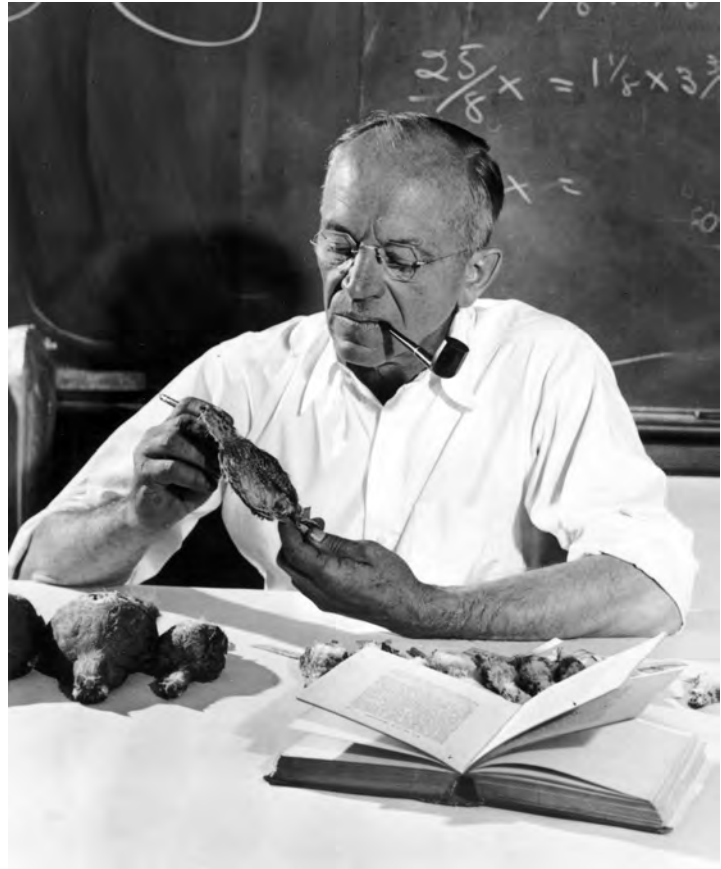
Born in 1887 and raised in Burlington, Iowa, Aldo Leopold developed an interest in the natural world at an early age, spending hours observing, journaling, and sketching his surroundings. Graduating from the Yale Forest School in 1909, he eagerly pursued a career with the newly established U.S. Forest Service in Arizona and New Mexico. By the age of 24, he had been promoted to the post of Supervisor for the Carson National Forest in New Mexico. In 1922, he was instrumental in developing the proposal to manage the Gila National Forest as a wilderness area, which became the first such official designation in 1924.

Following a transfer to Madison, Wisconsin in 1924, Leopold continued his investigations into ecology and the philosophy of conservation, and in 1933 published the first textbook in the field of wildlife management. Later that year he accepted a new chair in game management—a first for the University of Wisconsin and the nation.

In 1935, he and his family initiated their own ecological restoration experiment on a worn-out farm along the Wisconsin River outside of Baraboo, Wisconsin. Planting thousands of pine trees, restoring prairies, and documenting the ensuing changes in the flora and fauna further informed and inspired Leopold.

A prolific writer, authoring articles for professional journals and popular magazines, Leopold conceived of a book geared for general audiences examining humanity's relationship to the natural world. Unfortunately, just one week after receiving word that his manuscript would be published, Leopold experienced a heart attack and died on April 21, 1948 while fighting a neighbor's grass fire that escaped and threatened the Leopold farm and surrounding properties. A little more than a year after his death Leopold's collection of essays *A Sand County Almanac* was published. With over two million copies sold, it is one of the most respected books about the environment ever published, and Leopold has come to be regarded by many as the most influential conservation thinker of the twentieth century.

Leopold's legacy continues to inform and inspire us to see the natural world "as a community to which we belong."



A Sand County Almanac

A Sand County ALMANAC

AND SKETCHES HERE AND THERE

By ALDO LEOPOLD



ADMIRERED BY an ever-growing number of readers and imitated by hundreds of writers, *A Sand County Almanac* written by Aldo Leopold serves as one of the cornerstones for modern conservation science, policy, and ethics. First published by Oxford University Press in 1949—one year after Leopold’s death—it has become a classic in the field equaled in its lasting stature only by Henry David Thoreau’s *Walden*.

While Aldo Leopold was writing in the 1940s he could not have imagined the far-reaching impact his book would have. Over two million copies have been printed and it has been translated into twelve languages.

Long respected in his own fields of forestry and wildlife management, Aldo Leopold was a prolific writer for scientific journals and conservation magazines. However, in 1937, sometime after his fifty-third birthday, Leopold became increasingly focused on reaching the general public with his conservation message. Working over a twelve-year period, Leopold wrote, re-wrote, and re-wrote again, essays that both informed people of how the natural world worked, and inspired people to take action to ensure the future health of the land and water that sustains all life.

Not only was this influential book late to develop in Leopold’s mind, it was very nearly never completed. A week after Oxford University Press agreed to publish his manuscript, titled “Great Possessions,” Aldo Leopold suffered a heart attack and died while fighting an escaped grass fire on a neighbor’s property.

Lead by Luna Leopold, Aldo’s son, a group of Leopold’s family and colleagues collaborated on the final editing of the book, reluctantly agreeing to one significant change; renaming the book from Leopold’s working title “Great Possessions” to *A Sand County Almanac and Sketches Here and There*.

Through science, history, humor, and prose, Leopold utilizes *A Sand County Almanac* and its call for a Land Ethic to communicate the true connection between people and the natural world, with the hope that the readers will begin to treat the land with the love and respect it deserves.

Leopold Education Project

ABOUT THE LEOPOLD EDUCATION PROJECT

The Leopold Education Project (LEP) is an innovative, interdisciplinary conservation and environmental education curriculum based on the essays in *A Sand County Almanac*. Originally created by a Wisconsin high school science teacher, LEP uses Leopold's writings as a springboard for engaging students in natural science curriculum. The nonprofit conservation group Pheasants Forever adopted the curriculum in the early '90s, and LEP became the environmental education arm of the organization. Using their ties with chapter groups across the country, Pheasants Forever organized a robust network of state coordinators and facilitators that could bring the curriculum to teachers nationwide. Over the last twenty years, more than 15,000 educators have attended a LEP workshop! More recently, the original curriculum was expanded to include new activities, incorporate new technologies such as GPS, and facilitate teaching in non-formal educational settings, like nature centers and zoos. Beginning in 2013, LEP has found a new home with the Aldo Leopold Foundation. We are thrilled to welcome the more than twenty state coordinators and countless LEP educators into our fold and look forward to this program's continued growth! You can purchase some of the Leopold Education Project materials in our bookstore.

EDUCATING FOR ENVIRONMENTAL VALUES

The LEP was developed mainly for use by teachers, although other educational groups and private citizens can benefit from the materials. One major premise of the LEP is that Leopold's writings are both sound science and excellent literature, and that they can be used as a springboard for meaningful environmental education. Whenever possible, students should experience the essays as part of each lesson, either before, during, or after the main activities. Although the over-riding purpose of the lessons is to promote responsible decision making regarding our impact on ecosystems, the developers do not advocate particular positions on value-sensitive issues such as hunting, using wetlands, applying pesticides and herbicides, or any others. The LEP's underlying theory about these controversial topics is that given a supportive classroom climate to study a variety of positions and viewpoints, students will develop responsible environmental values on their own. Responsible values include the sustaining of natural cycles, the preserving of plant and animal species, and the exercising of caution before changing ecosystems in major ways without careful study of future consequences.

APPRECIATING AND UNDERSTANDING THE LAND

Leopold believed that people should learn how to discover beauty in commonplace events and places. He saw aesthetics as a measure of how we view the rightness or wrongness of our actions and believed that people were motivated to act by both beauty and duty in natural communities. When we view the components of land: soil, water, plants, and animals (including humans) as members of the same community, we are more likely to make decisions that allow natural cycles to continue to renew themselves.

Leopold advocated a harmonious relationship between humans and the components of the earth as a way to achieve land health. When we extend moral considerations beyond humans to include soil, water, plants, and non-human animals, we develop a personal environmental ethic. With this type of ethic,

we are more likely to choose a lifestyle that continually re-examines our relationship to the land, and by placing rational restraints upon ourselves, the critical earth cycles are more likely to be preserved. Through reading about Leopold's recorded discoveries and participating in meaningful activities, students will expand their awareness and appreciation of nature and their ecological understandings.

PROVIDING DIRECT EXPERIENCES – TEACHING OUTDOORS

Another major premise underlying the LEP is that educators should provide students direct experiences with the natural and cultural worlds outside the school. One way to accomplish this is to make greater use of the outdoors as a learning laboratory. Whenever possible, the developers recommend first-hand contact with human and non-human nature. Modern learning theory supports an experimental approach that allows students to construct meanings from their activities and to develop concepts and skills based on their past knowledge.

In order to promote critical thinking, teachers should provide students with opportunities to explore the world directly. Even in heavily populated suburban and urban areas, a wide array of useful resources can be found outside. Leopold believed that "...the weeds in a city lot convey the same lesson as the redwoods." The LEP encourages teachers to adapt lessons to suit not only particular students and settings, but also various teaching and learning philosophies. In order to be effective, the LEP lessons must be viewed as flexible guides to important knowledge about how the world works and how we function on the planet. We encourage creativity and experimentation in using these lessons in a variety of subject matter areas.

Written by Clifford E. Knapp, Retired, Northern Illinois University.

LEP Resources

The Leopold Education Project has an assortment of resources for teachers and non-formal educators to help bring Leopold into their lessons and activities. These resources are available in the Aldo Leopold Foundation's bookstore or by taking an LEP Educator Workshop. Look in the Leopold Events calendar on the Aldo Leopold Foundation website (www.aldoleopold.org) for workshops near you. If you don't see one listed, contact the State Coordinator in your state to make arrangements for one.

A SAND COUNTY ALMANAC (1949)

Aldo Leopold's classic book of essays is one of the most respected and striking environmental works of the twentieth century. First published in 1949 by Oxford University Press, the *Almanac* contains month-by-month descriptions of Leopold's relationship with the natural world. Combining an ecologically sound understanding of science with excellent literary prose, the *Almanac* can serve to inspire students to develop their own respect, admiration, and love for the land.

GREEN FIRE (2011)

The film *Green Fire* explores the life and legacy of famed conservationist Aldo Leopold, and the many ways his land ethic philosophy lives on in the work of people and organizations all over the country today. It shares highlights from Leopold's life and extraordinary career, explaining how he shaped conservation and the modern environmental movement. It also illustrates Leopold's continuing influence, exploring current projects that connect people and land at the local level.

LEOPOLD EDUCATION PROJECT EXPLORATION CARDS (2013)

An updated version of the previous LEP Task Cards! A set of 28 cards for educators to use as prompts in helping people of all ages explore the outdoors. Each card features a different activity based on essays from *A Sand County Almanac*.

EXPLORING THE OUTDOORS WITH ALDO LEOPOLD (2009)

Exploring the Outdoors with Aldo Leopold was created as part of the Leopold Education Project to get youth and their families outdoors learning about nature. The hands-on activities are designed to teach observation skills, plant and animal identification, natural history, land stewardship, and outdoors skills. Each one is based on an essay from Aldo Leopold's classic book, *A Sand County Almanac*. The 16 activities are organized by themes and include background information, a list of supplies, procedure cards, and handouts. This activity guide can be used by interpreters, naturalists, park rangers, zoo educators, teachers, youth group leaders, and others who want to offer a unique learning experience in an outdoor setting.

LESSONS IN GPS TECHNOLOGY (2009)

Get your students studying nature using modern technology! The 11 lessons in this new 32-page curriculum will help you teach your students to use GPS receivers and put those skills to use to navigate, track, follow an animal's path, learn about wildlife, explore an area and construct a map and evaluate different ecological communities. Each lesson includes a quote from *A Sand County Almanac* by Aldo Leopold, learning outcomes, background information, packing list and a detailed explanation of how to use the lesson to engage, explore, explain and evaluate. Have fun exploring and learning outdoors!

Using this Teacher's Guide

The lessons found in this teacher's guide are based on 22 essays found in *A Sand County Almanac*. Titles, as well as the order of lessons in this guide are identical to the essays in the *Almanac*. Before beginning each lesson, teachers and students should read the corresponding *Almanac* essay. For each lesson in this guide, there are two components: 1) teacher's information and 2) student worksheets.

TEACHER'S INFORMATION

The teacher's information is designed to aid teacher's in planning, leading, and evaluating each lesson. Each lesson includes: objectives, background information, materials, procedures, evaluation, and extensions.

- Objectives are stated. However, teachers may modify when appropriate.
- Background information is provided to enrich each lesson.
- Materials needed to conduct each lesson are inventoried.
- Procedures for each lesson are described, but variations from lesson procedures are encouraged. For some lessons, outdoor and indoor activities are included.
- Evaluation methods are suggested for assessment of student skills, values, and knowledge gained.

In addition to the above, sidebar information includes key quotes from the corresponding essay, related subjects, key words, and related essays. The list of related subjects is not meant to be all-inclusive; teachers are encouraged to use an interdisciplinary approach to reinforce concepts learned in a variety of subjects. The key words listed can be found in the glossary at the end of this volume.

STUDENT WORKSHEETS

Student worksheets are provided with each lessons. The content of each worksheet corresponds to the procedures and objectives provided with each lesson.

ACKNOWLEDGMENTS

This guide was first published in 1994. It was assembled by the Leopold Education Project with Gary Laib, a high school science teacher from Poynette, Wisconsin, as the lead author. Dr. Clifford Knapp, retired from the education faculty at Northern Illinois University, served as the principal advisor. Members of the writing and advisory committee for the first edition include: Kevin Beverly, Educator, Language Arts, DeKalb, Ill.; Joe Bybee, Resource Conservationist, DeKalb County Soil and Water Conservation District, Ill.; Anne Donnellan, Educator, Science Appleton, Wis.; Daniel Kane, Resource Conservationist Boone County Soil and Water Conservation District, Ill.; Kathy Luczynski, Educator, Science, Downers Grove, Ill.; Carolyn Mohr, Educator, Science, Buffalo Grove, Ill.; Michael Platt, Executive Director, Heartland Water Resources, Peoria, Ill.; and Malcom Swan, Ph.D.; Professor Emeritus Northern Illinois University. Second edition updates made by Pheasants Forever staff: Russell Sewell, Vice President of Education; Ann McCarthy, Conservation Education Specialist; Robert Usgaard, Conservation Education Specialist; and Kari Erkkila, Editorial Assistant. Third edition updates made by Aldo Leopold Foundation staff: Jeannine Richards, Communications Coordinator, and Carson Main, Education Assistant. Photos from the Aldo Leopold Archives housed at the University of Wisconsin–Madison and Aldo Leopold's classroom slides housed at the Aldo Leopold Foundation.

January Thaw

Key Quote:

“Each year, after the midwinter blizzards, there comes a night of thaw when the tinkle of dripping water is heard in the land. It brings strange stirrings, not only to creatures abed for the night, but to some who have been asleep for the winter.”

OBJECTIVES

Students will be able to:

1. Identify and interpret three different animal signs in winter.
2. Compare and contrast their experiences with Leopold’s observations.

BACKGROUND

Winter is not a dead season. Animals survive this season by using various strategies. Activities such as moving, feeding, breathing, and other functions follow cycles with the changing of the seasons. Much can be learned from studying various animal signs in the winter, such as tracks, browse evidence, urine stains, feces, and tunnels.

Competition for the requirements of life exist among all organisms. Birds of prey are able to coexist by occupying different ecological niches. For example, hawks are diurnal (hunt by day) while owls are nocturnal (hunt by night), allowing them to exist in the same home range.

MATERIALS

Outdoors

- Field guide to animal tracks
- Map of area to be studied
- Container for collecting materials

Indoors

- White canvas board 18” x 24”
- Black, red, and green fine point markers
- Glue



- Hollow twigs to represent hollow logs
- 6” piece of 1/2” diameter plastic pipe
- Plaster of paris track molds
- Field guide to mammals
- Slides of mammals and their tracks
- Field guide to animal tracks

PROCEDURES

Outdoors

1. Have students divide into pairs and locate a set of animal tracks, and have individuals of each pair follow the tracks in opposite directions.
2. Ask students to imagine they are a skunk or another animal and locate where they would make their winter dens.
3. Have students record their findings on a sketch map of the area studied. Suggest that they record the map in their journal.
4. Have them use an animal track guide or pictures to identify some animal tracks found.
5. Have students search for and interpret other evidence of animal activities in the snow, such as tunnels, colored snow (from urine and droppings), wing marks, and browsed vegetation. Students may collect evidence (where and

when appropriate) to share with others.

Indoors

1. Have students make their own animal-track molds using plaster of paris.
2. Have students draw tracks and other features on their own or a teacher-designed canvas board.
3. Have students complete the worksheet.

EVALUATION

1. Have students sketch three different kinds of animal tracks or signs observed in this activity and explain what they show.
2. Have students compare and contrast what they found with what Leopold wrote about.

EXTENSIONS

1. Put flour on the windowsill, and place bait, such as bird seed, cracker crumbs or popcorn on the windowsill to attract birds for observation.
2. Use cameras to take photos of animal evidence.
3. Write or tell descriptive accounts of one of the animal signs found.
4. Fill a sandbox with wet clay and place bait in the middle of it to attract animals. After animals have visited the bait site, view and interpret their tracks.

Subjects

Language arts, science

Key Words

Hibernating (hibernation), browse, bird band, thaw, marsh, microtine

Related Essay

“Home Range”

January Thaw

Student Worksheet

Name: _____

Date: _____ Period: _____

INTRODUCTION

This essay reflects the observations made when tracking a skunk during a “January Thaw.”

WHAT TO DO (OUTDOORS)

1. Reread the first two paragraphs about the hibernating skunk.
 - a. Working in pairs, locate a set of tracks and follow them, each member of the pair working in opposite directions.
 - b. What animal did you track?
 - c. Describe your finding.
 - d. Upon regrouping, what did both of you find out about the animal’s activities?
2. Go to an outdoor setting, and search the area for evidence of animal dens, or places where you would “den up” if you were a skunk.
3. Reread the passage about the meadow mouse.
 - a. Search the area, and locate some tunnels through the grass and snow.
 - b. Based on the condition of plants in the area, describe any evidence of mouse or vole activity.

January Thaw

Student Worksheet

Name: _____

Date: _____ Period: _____

- c. If you were a meadow mouse, what would you be doing if there were a blanket of snow on the ground? How would you react to plants and other animals?
- d. How would your reactions be different if there were a January thaw? Explain.
4. Reread the passage about the skunk tracks entering the woods.
- Why do you think the rabbit urine was pinkish?
 - Can you find evidence of any prey species that were eaten by predators? If so, describe the evidence.
 - The owl and hawk are able to exist in the same locale, even though both are birds of prey. Though the hawk and the owl compete for the same prey species, how are they both able to find enough food to survive?
5. Reread the passage about the skunk tracks leading on.
- Were you able to find any “dead-end” tracks such as those described in the passage? If so, describe where they ended.
 - When you followed the set of tracks, did the animal seem to have a purpose for its wanderings? Explain.

January Thaw

Name: _____

Student Worksheet

Date: _____ Period: _____

WHAT TO DO (INDOORS)

1. Using mammal slides and field guides, learn the identity of mammals and their tracks common to your state.
2. Using track molds and plaster of Paris, make casts of various animal tracks.
3. The white canvas-board can be used to represent a snowy landscape one would encounter in January.
 - a. Using the black marker, design various habitat situations using symbols to represent tracks in the snow and habitat features. For example:

> > > = deer tracks

oooo = grassy open areas

XXXX = rabbit tracks

++++ = shrubs

***** = fox tracks

dddd = deciduous trees

^^^^ = coniferous trees

- b. Using the red marker for blood, indicate where a rabbit was killed by a fox; use green to shade in the conifers.
 - c. Glue small twigs together to make “brush piles,” and set up on board.
 - d. Use small hollow “twigs” to represent hollow logs.
4. To obtain the most realistic view of each habitat, “walk through the area” by looking through a piece of the plastic pipe, thus limiting the amount of area seen at one time.
 5. Discuss the experience as it relates to “January Thaw.”

Good Oak



OBJECTIVES

Students will be able to:

1. Take a tree cross section and identify some of its important structures.
2. Relate the characteristics of annual growth rings to environmental conditions present at the time of their growth. Students will then use this information to determine the age of a tree and how the annual rings are related to historical events.

BACKGROUND

The essay “Good Oak” describes the cutting and splitting of an oak tree into firewood. As the annual rings of wood are cut, Leopold relates important moments in conservation history. The student worksheet

outlines some of the structures found in a tree cross-section.

MATERIALS

Outdoors

- Tree stumps
- Saw (if needed)
- World almanac or other historical reference

INDOORS

- Tree cross sections (“beaver cookies”)
- Saw (if needed)
- World almanac or other historical reference

PROCEDURES

Outdoors and Indoors

1. If possible, locate a tree stump. If not available, use tree cross-sections.

Key Quotes

“There are two spiritual dangers in not owning a farm. One is the danger of supposing that breakfast comes from the grocery, and the other that heat comes from the furnace.”

“We sensed that these two piles of sawdust were something more than wood: that they were the integrated transect of a century; that our saw was biting its way, stroke by stroke, decade by decade, into the chronology of a lifetime, written in concentric annual rings of good oak.”

Subjects

Language arts, botany

Key Words

Frequency curve, fauna, flora, cord, Dust Bowl, refuge, prairie, pith, kerf, maul, raker teeth, radial, cross grain

Related Essays

“Bur Oak”

“Mighty Fortress”

2. Be sure students understand all the important structures of a tree cross-section. Have them observe the cross sections, and complete the worksheet.
3. Show students how to count annual rings from the bark to the pith. Have them relate this information to historical events and environmental conditions.
4. Conclude the lesson by discussing the spiritual danger of supposing that heat comes from a furnace (as mentioned by Leopold in the essay).

EVALUATION

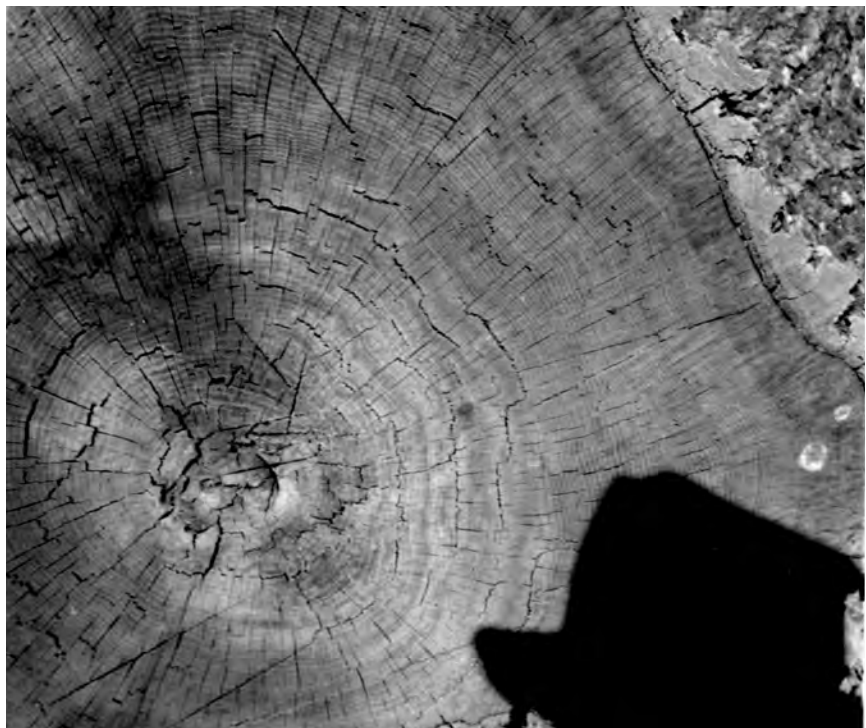
1. Students are given a sample tree cross-section. Ask them

to make up a history for that tree’s life that would explain the variations in the width of annual growth rings.

2. Have them label the parts of a tree cross section and then graphically correlate the annual rings to a time line.

EXTENSIONS

1. Provide an increment borer or borings from tree trunks. Have them relate the tree’s growth to a historical time line.
2. Using a calorimeter, compare heat content of pines and oaks.



Good Oak

Name: _____

Student Worksheet

Date: _____ Period: _____

INTRODUCTION

This essay is one of the most quoted essays in *A Sand County Almanac*. In this essay, Leopold relates events that occurred during the life of an oak tree being cut down for firewood. In doing so, Leopold eloquently connects the heat received from the firewood to the land, and demonstrates why there is spiritual danger in “believing that heat comes from the furnace.”

WHAT TO DO

1. If possible, locate a tree stump outdoors for use in this experience. If not, use a section of a tree stump sometimes referred to as a “beaver cookie.”
2. The following is a description of the cross section of a tree stump.

The outside of the stump is covered by bark. In older stumps, the bark has two shades of color. The outer bark is scaly and provides protection; the inner bark is the living part in which food is carried down through the trunk toward the roots. To accomplish this, the inner bark contains vessels known as phloem. In young tree stems, the bark is the same color and the scaly part is missing, not yet developed.

Most of the stump is made up of wood cells, or xylem. The darker wood in the center of an old stump is heartwood, which helps support the tree: the lighter colored wood around the heartwood is the sapwood, which carries water and food up the tree from the roots to the leaves. In the center of the trunk is the small pith, which is a food and water storage area.

Some trunks have lines which radiate from the center pith like spokes of a wheel. These lines are vascular rays, which carry food inward from the inner bark (phloem) to the wood cells (xylem).

By looking closely at the cross section, you will see a number of circles called annual rings, one of which is formed each year by the cambium located between the wood and bark.

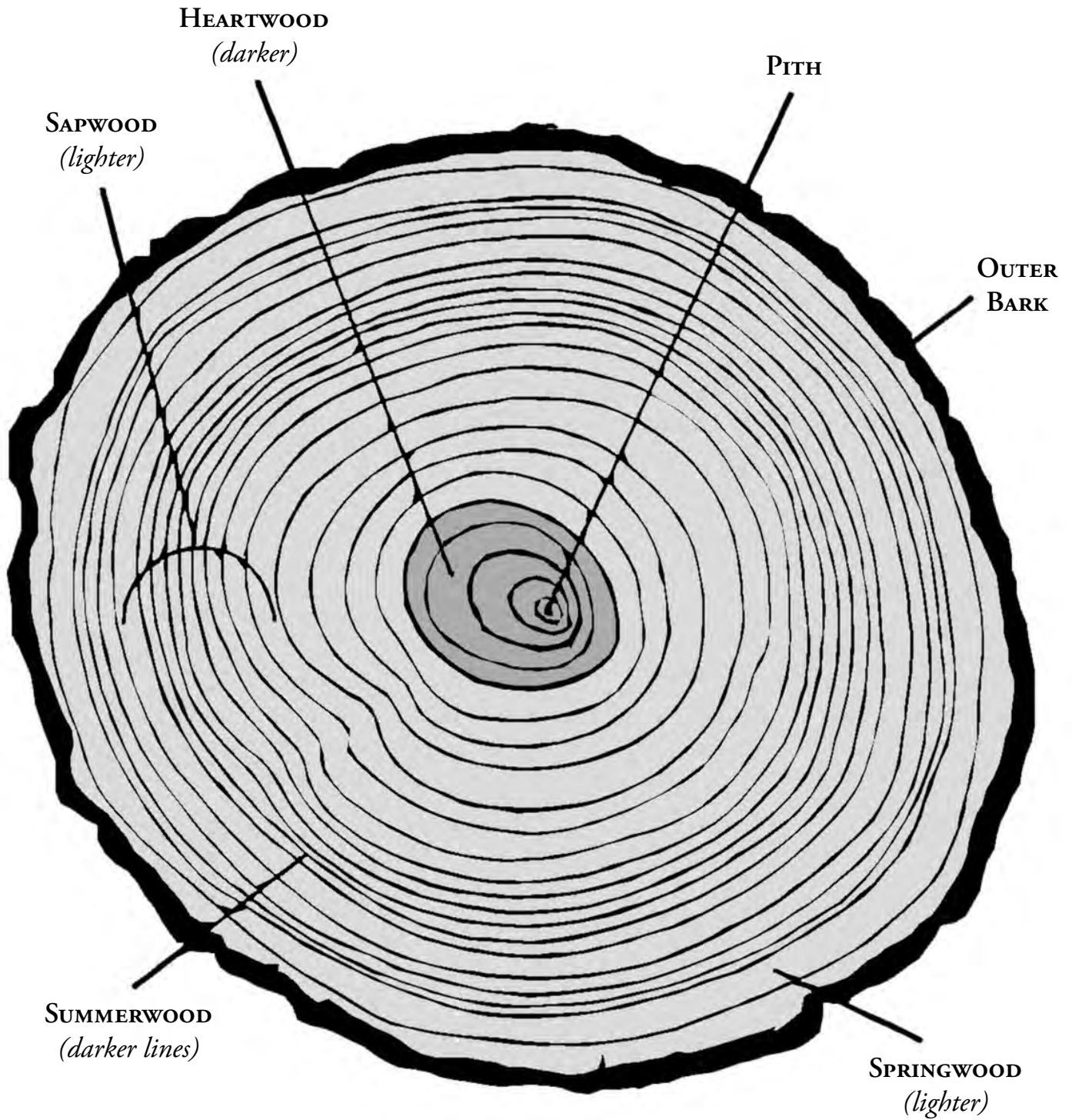
Examine an annual ring closely, and notice the large pores (cells) making up the first wood produced in the spring (springwood); this layer is generally much narrower than the rest of the annual ring. The summerwood is the second layer of wood in an annual ring, made up of small cells. A complete annual ring is made up of springwood and summerwood. By counting the number of annual rings, you can tell the age of the tree. Growth in the length of branches is accomplished by the elongation of buds along the twigs.

Good Oak

Student Worksheet

Name: _____

Date: _____ Period: _____



Good Oak

Student Worksheet

Name: _____

Date: _____ Period: _____

a. When you were six years old, you may have enjoyed swinging from a tree branch that was five feet off the ground. How far above the ground was the branch when you were twelve years old? Explain.

b. Sketch the details of the stump, and label all the structures listed in the description of a tree cross-section.

c. How old were you and your parents when your tree formed its first annual ring? Who was president at that time? How many presidents have we had since then?

Your age _____

Your parents' ages _____

Who was president? _____

How many presidents? _____

d. Did the tree grow the same amount each year? Give reasons for differences in the width of annual rings. Using this information, write a brief history of your tree.

Good Oak

Name: _____

Student Worksheet

Date: _____ Period: _____

e. On a separate sheet, draw a sample of your tree's cross section. Label four events in human history that have occurred for any span of ten years your tree was alive. Explain why each event is significant.

f. What theme did the historical events in the essay have in common?

g. What tools did Leopold use to cut and split the good oak? What tools are used today?

3. Reread the opening paragraph of "Good Oak."

a. Why do you think Aldo Leopold wrote an essay about an old oak?

b. What does spiritual danger mean to you?

c. What spiritual danger is there in supposing that heat comes from a furnace?

4. Why do you think Leopold called the oak "good"?

The Geese Return

OBJECTIVES

The students will be able to:

1. Identify two types of waterfowl through direct observation and by using a field guide.
2. List components in the diet of geese.
3. Describe at least three characteristics of geese.

BACKGROUND

A favorite time for reading and discussing this essay is March, when migrating geese are available for our audio/visual pleasure. Geese migrate in the spring and fall of each year. During hunting season (in the fall), the geese fly high over the marshes and fields, but upon their return in the spring, they fly much lower and take their time.

Geese flying overhead are usually seen in one of several formations, the two most common being the V-formation and the straight line angling off to one side from the leader. It is generally believed that the geese fly in these formations because they provide the flock with the most aerodynamically efficient arrangement, with each goose flying in the “draft” of the one in front of it, thereby taking advantage of the reduced wind resistance/drag provided by this alignment. If the lead goose tires, he/she usually drops to the end of the line and lets another one lead for a while. In this way, no single goose has to lead the line for the whole time, and the flock as a whole flies farther with less wasted energy.

Teachers should try to have students observe a flock using

Key Quote

“One swallow does not make a summer, but one skein of geese, cleaving the murk of a March thaw, is the spring.”



Subjects

Science

Key Words

Skein, slough, pinion, oxbow, Pleistocene, ice sheet, tundra

Related Essays

“Sky Dance”

“Back from the Argentine”

this formation, or view a picture of a flock flying in formation, to begin the activity. Ask students to guess why geese fly this way, and then try running or riding bicycles in a similar formation (see procedures below). They should also try other formations and compare them to the ones geese use, to see which ones work best. This will lead into a discussion of why the geese fly in these formations.

MATERIALS

Outdoors

- Field guide to birds
- Binoculars (optional)

Indoors

- Field guide to birds
- Audiovisuals on waterfowl and marshes

PROCEDURES

Outdoors

1. Direct students to role-play, by running or riding bicycles, like a flock of geese flying in formation.
2. Have students complete the outdoor observation exercise on their worksheets.

Indoors

1. Show the films on waterfowl and marsh life. Use the field guides to identify the various waterfowl species.
2. Discuss the essay in relation to these visual aids.

EVALUATION

1. Have the students list two different types of waterfowl they have sighted, and list at least three identifying characteristics of each.
2. Have students draw a picture of waterfowl feeding in their habitat and label the food being eaten.

EXTENSIONS

1. Build three-dimensional models of geese, complete with appropriate habitats.
2. Visit your local Conservation Department office to learn more about waterfowl management programs.
3. Contact your local Ducks Unlimited chapter to learn more about waterfowl and wetland management.
4. Reread the passage describing Leopold spending April nights listening to the sounds of the marsh.
 - a. If possible, some evening in spring, sit near a marsh and listen to the conversations being carried on.
 - b. Describe the conversations you have heard, identifying as many speakers as possible.

The Geese Return

Name: _____

Student Worksheet

Date: _____ Period: _____

INTRODUCTION

How many times have you asked yourself, as you sighted strings of geese winging north or south, “Where have they been? Where are they going? What have they seen?”

WHAT TO DO (OUTDOORS)

1. Visit a nearby area where you can find geese.
 - a. What species of waterfowl have you seen on this outing?

 - b. How many individuals of each species did you count?

 - c. Have you noticed any “loners,” such as those described in the essay? If so, describe their behavior.

 - d. After observing ducks and geese, explain how you can tell the difference between the two types of waterfowl based on flight behavior.

2. Observe waterfowl feeding.
 - a. What kinds of food are available to geese in this area?

 - b. Is there any evidence of other animals competing with geese for this food? If so, describe.

The Geese Return

Name: _____

Student Worksheet

Date: _____ Period: _____

3. Reread the passage about geese proclaiming the seasons.
 - a. Why does there seem to be a difference between the behavior of November and March geese?

4. Why did Leopold wish that he were a muskrat, eye-deep in the marsh?

5. Are wetlands worth preserving, even though they breed mosquitoes and other animals possibly annoying or harmful to humans?

WHAT TO DO (INDOORS)

1. Watch films on waterfowl and marsh life.
 - a. Use field guides to identify as many waterfowl and other wildlife species as possible.

 - b. Are there foods that are identifiable in the films? If yes, what are they?

 - c. Discuss the essay in relation to these visual aids.

Come High Water



Key Quotes

“Our lumber pile, recruited entirely from the river, is thus not only a collection of personalities, but an anthology of human strivings in upriver farms and forests.”

“There are degrees and kinds of solitude... I know of no solitude so secure as one guarded by a spring flood.”

OBJECTIVES

The students will be able to:

1. Demonstrate persuasive writing skills using points brought out in this essay as references.
2. Find other uses for objects salvaged from a river or garbage heap.

BACKGROUND

This essay tells of Leopold and his family being stranded at the “shack” because of the rising waters of the Wisconsin River, a mere 150 yards away.

The essay further relates the retrieval of old boards from the river, used to patch the shack, build benches, and provide a library of stories. It is interesting to note that Leopold’s essay, written in the 1940s, promotes the concept of reusing discarded items. Today our society struggles

with the problems of dwindling natural resources, coupled with the solid waste disposal crisis. Leopold’s foresight provides an excellent starting point for a class discussion on the ethics of resource consumption.

MATERIALS

Outdoors and Indoors

- None

PROCEDURES

Outdoors and Indoors

1. Take students to a nearby river (or, if there is no river nearby, have them go through their garbage at home) and find at least one item for which they can find another use. Have the items brought to class and discuss their usefulness. Students should brainstorm other uses for the items in addition to those given by each student.

Subjects

Language arts, ecology, art

Key Words

Terrestrial

Related Essays

“Too Early”

“Great Possessions”

2. Lead a discussion on the ethical implications of discarding still useful items in a world of dwindling natural resources and crowded landfills. Discussion may include the following question: “Why did Leopold say that a salvaged board was twice as valuable as one bought from the lumber yard?”
3. Assign students to write a persuasive essay stating and defending their position on a resolution based on the discussion in #2, or, defending a position on the following statement: “Solitude (is/is not) important to a person’s well-being.” (Refer to the last two paragraphs of the essay).

EVALUATION

1. Students must bring in a

discarded item and explain another use for it.

2. Student essays are evaluated using criteria determined by the class. For example, attributes of good essays could be brainstormed by the class after having read several students rough drafts. Names can be “blanked out” for privacy before being read. Grades would then be given based on how many of the criteria are met, and how well.

EXTENSIONS

1. Make a gift out of a discarded item.
2. Spend an hour (or longer period) entirely alone—with no computers, cell phones, televisions, radio, books, or human contact of any kind. Record your thoughts or feelings.



Draba and Bur Oak



Key Quote

“He who hopes for spring with upturned eye never sees so small a thing as Draba. He who despairs of spring with downcast eye steps on it, unknowing. He who searches for spring with his knees in the mud finds it, in abundance. Altogether it is of no importance—Just a small creature that does a small job quickly and well.”

OBJECTIVES

The students will be able to:

1. Compare and contrast the characteristics of draba and bur oak.
2. Explain the impact of settlers on prairies.

BACKGROUND

Plants and animals are survivalists. The bur oak is able to withstand the stress of fires because of its thick, corky bark. “Bur Oak” describes the relationship between the bur oak, prairie fires, and the winter hunger pangs of rabbits, while “Draba” provides an interesting contrast by describing a plant that is so tiny that it is insignificant to the unknowing observer.

MATERIALS

Outdoors

- None

Indoors

- Jack pine cones
- Hot plate
- Metal can (for Extension #1).

PROCEDURES

Outdoors

1. Have students look for evidence of girdling on shrubs and trees.
2. Have students observe a bur oak and draba. Name three characteristics that help them survive.
3. Discuss the battle between bur oaks and prairie plants as described by Leopold in the essay “Bur Oak.”

Subjects

Social studies, science,
language arts

Key Words

Peat bog, geeing, hawing,
girdling, forest

Related Essays

“Good Oak”
“The Community Concept”
“Cheat Takes Over”

Indoors

1. Have students look up bur oak and draba in the reference books, comparing and contrasting their characteristics. This may work well in small groups.
2. Same as #3, outdoors.

EVALUATION

The teacher will read the student's answers to #4 and #5 on the worksheet.

EXTENSIONS

1. Place a closed Jack pine cone in a metal can, and heat it up on a hot plate or stove. Observe what happens. Relate this to the effects of a forest fire.

2. Plant seeds collected from the Jack pine.
3. Debate the issue of human caused change in landscapes and plant communities. Is it right for humans to change plant communities or how much change is acceptable?

Draba and Bur Oak

Name: _____

Student Worksheet

Date: _____ Period: _____

INTRODUCTION

Leopold describes two plants; one a small flower, the other: a large, robust tree. The essay “Draba” is short, not even one page in length, while the essay “Bur Oak” is much longer and rich with history. Yet, through simple words, Leopold gives equal importance to both plants as he describes some of their characteristics.

WHAT TO DO

1. Go outside and look for evidence of girdling on trees and shrubs in the area. Describe your findings.

2. If possible, find a bur oak or draba, and write down three characteristics that help it survive.

a.

b.

c.

3. Using reference books, list at least three similarities and three differences between a draba and a bur oak.

SIMILARITIES	DIFFERENCES

4. In a short paragraph, explain how the plant communities of Wisconsin were changed by settlers. Is it right for humans to change plant communities?

Sky Dance

Key Quotes

“It is fortunate, perhaps, that no matter how intently one studies the hundred little dramas of the woods and meadows, one can never learn all of the salient facts about any one of them.”

“The drama of the sky dance is enacted nightly on hundreds of farms, the owners of which sigh for entertainment, but harbor the illusion that it is to be sought in theaters. They live on the land, but not by the land.”

“The woodcock is a living refutation of the theory that the utility of a game bird is to serve as a target, or to pose gracefully on a slice of toast.”



OBJECTIVES

The students will be able to:

1. Describe the courtship ritual differences between two species of birds.
2. Work in a small group to perform the courtship ritual of one of the two identified birds.
3. List the components of the woodcock’s “dance.”

BACKGROUND

The male woodcock has one of the most stunning courtship displays in the avian world. A roundish, almost neckless bird, it is found in woodlands and dry fields where it is said to eat more than its weight in earthworms daily. Every spring during its mating season it begins its

nightly “sky dance” so vividly described in Leopold’s essay.

MATERIALS

Outdoors and Indoors

- Reference materials on bird courtship behaviors

PROCEDURES

Outdoors

1. If possible, take students to an area where they can observe a bird’s courtship ritual. Allow them time to fill in their worksheets.
2. Using references, present students with background information to supplement Leopold’s essay.
3. Have students investigate different mating behaviors using the reference materials.

4. Using information from their research, students should work in small groups to perform a “dance” (courtship ritual) of the bird species of their choice.

Indoors

Follow procedures above, deleting #1.

EVALUATION

Direct students to complete their worksheet and evaluate their response to questions #2 and #3.

EXTENSION

Write an original tale explaining why the woodcock dances for its mate.

Subjects

Science, physical education

Key Words

Foot-candle

Related Essay

“The Sand Counties”



Sky Dance

Name: _____

Student Worksheet

Date: _____ Period: _____

INTRODUCTION

In this essay, the “sky dance” of the woodcock is described. In describing the dance, Leopold raises questions about the woodcock’s mating behaviors; answers, for which were not known at the time he wrote the essay. However, Leopold felt it fortunate that there were many unknowns, for what he did not know about the woodcock heightened the experience of each observation.

WHAT TO DO

1. Review “Sky Dance.”
2. If possible, go to an area where you’ll see birds. Observe and record in the chart below at least two different birds courtship rituals. (If you are unable to do this, use reference materials to fill in the chart).

BIRD SPECIES OBSERVED	COURTSHIP BEHAVIOR

3. Using Leopold’s essay, or a description found in a reference book, list the parts of the woodcock’s dance in the order in which they occur.

4. Form a small group as directed by your teacher. Your group will create and perform a symbolic interpretation of the courtship ritual of the bird of your choice. Use space on the back of this page to record the key points of the ritual.

5. Should areas where birds perform courtship rituals be set aside and protected from human interference?

Back from the Argentine

OBJECTIVES

The students will be able to:

1. Identify at least three local birds found in marsh, prairie, and woodland habitats.
2. Select one migratory bird species and identify its areas of summer, winter, and permanent residences on a map.
3. Record field notes of the birds observed, including dates, weather conditions, habitat, and behavior.
4. Use a field guide to identify the ranges of at least three birds.

BACKGROUND

Upland plovers, also called upland sandpipers (*Bartramia longicauda*), spend winter months on the pampas of Argentina and Patagonia, South America. In North America,

they are found in prairies and wide open grassy fields. Lack of habitat and excessive hunting has nearly caused their extinction. Now, some are nesting in cultivated fields, which may be the salvation of the species.

Due to human pressures on some bird species, governments have passed laws to protect them. The Federal Migratory Birds Treaty Act signed by the U.S. and Canada in 1918 and by Mexico in 1937, controls the shooting of migratory birds in these three countries. This law also prohibits people from bringing bird skins and feathers into the country.

A similar law prohibits anyone from moving a nesting pair of birds or from killing birds or possessing their remains. The U.S. Fish and Wildlife Service in the Department of

Key Quotes

*“Sit down on a tussock,
cock your ears at the sky,
dial out the bedlam of the
meadowlarks and redwings,
and soon you may hear it:
the flight song of the upland
plover, just now back from
the Argentine.”*

*“Universal gunpowder, plus
the lure of plover-on-toast
for post-Victorian banquets,
had taken too great a toll.
The belated protection of the
federal migratory bird laws
came just in time.”*



Subjects

Science, social sciences
(geography)

Key Words

Precocial, migratory,
pampas, brooding, the
Argentine

Related Essays

“The Geese Return”
“Marshland Elegy”

the Interior is responsible for enforcing these federal laws.

MATERIALS

Outdoors

- Binoculars
- Field guide to birds
- Map of North and South America (optional)

Indoors

- Field guide to birds
- Audiovisuals on birds
- Map (optional)

PROCEDURES

Outdoors

1. Demonstrate how to use the contents of a field guide to birds, especially noting the summer, winter, and permanent residences.
2. Direct students to locate information on the upland plover. Have them color code its summer and winter residences on a map.
3. Go outside to identify birds according to habitat and record field notes at each location.

Indoors

1. Refer to outdoor procedures, substituting audiovisuals for the outdoor experience.

EVALUATION

Select a migratory bird common to your area. Using field guides, have students list three of the bird’s distinguishing characteristics, its habitat, and its range.

EXTENSIONS

1. Find plans for building birdhouses for different species, construct and place them outdoors in the proper habitats.
2. Investigate federal and state bird laws, and describe how they could affect you.
3. Investigate the life cycle of a migratory bird, and write a report.
4. In the spring, locate a bird nest and keep a journal of your observations.

Back from the Argentine

Name: _____

Student Worksheet

Date: _____ Period: _____

INTRODUCTION

The essay concerns the return of the upland plover from Argentine. After reading this, one can identify other birds returning from their winter habitats.

WHAT TO DO

1. Visit various habitats (e.g., marsh, prairie, woodland), and note the birds found. Fill in the worksheet on the next page, and discover which ones have made a return from South America.
2. Describe the behavior of one of these migrants.
3. The U.S. Government has made laws to protect migratory birds. What authority should the states have over the birds when they are within their boundaries?

Back from the Argentine

Name: _____

Student Worksheet

Date: _____ Period: _____

HABITAT TYPE	BIRD SPECIES	MIGRANT OR RESIDENT?	DATE	WEATHER

The Alder Fork

OBJECTIVES

Students will be able to:

1. Use a guide to identify local fish.
2. Use reference materials on fish to determine habitat requirements for three species of fish, including one type of trout.
3. Use a thermometer and a depth-measuring device to determine and record the temperature and depth of an aquatic area.

BACKGROUND

In this essay, Leopold describes his thoughts and feelings while fly fishing for trout on the Alder Fork. He tried various types of artificial flies designed to imitate aquatic insects and successfully caught several fish. He decided that it was not the size of the fish that counted, but the adventures experienced.

MATERIALS

Outdoors

- Thermometer
- Field guide to fish
- Depth-measuring device (e.g., meter stick, rope)

Indoors

- Field guide to fish
- Audio-visual and reference materials on fish
- Pail
- Ice



- Water
- Thermometer

PROCEDURES

Outdoors

1. List on the board all of the fish the students know are in the local aquatic habitats (include types of habitat; e.g., pond, stream, lake, river).
2. Use a guide to fish species to identify their characteristics.
3. Choose one habitat to visit.
4. Test the water in various locations for its depth and temperature. Include temperatures at various depths. Record these on the worksheet.
5. Compare the findings to information obtained from reference material regarding

Key Quote

“I shall now confess to you that none of those three trout had to be beheaded, or folded double, to fit in their casket. What was big was not the trout, but the chance. What was full was not my creel, but my memory.”

Subjects

Language arts, mathematics, science

Key Words

Riffles, smudge, white throats, false cast, creel, dry fly, spent gnat, brown miller

Related Essay

“The Green Pastures”

- fish habitat requirements.
6. Find out what habitat requirements are needed for trout.
 7. Determine if trout could live in the habitats tested.
 8. To experience the water temperature requirements for trout, fill a pail with cold water and cool the water down with ice to the optimum temperature for trout. Have individuals dip their hand or foot into the pail of water. Do the same for the water temperature requirements of carp. Compare these water temperatures to the average temperature of bath or shower water.

Indoors

1. List local fish on the chalk board along with their habitat (e.g., pond, stream).
2. Use outdoor procedures while viewing audiovisuals on stream, river, and/or lake habitats.
3. End activity with #5 from worksheet. This could be a journal writing. Music with water sounds may be mood setting.

EVALUATION

Select a species of local fish and ask the students to imagine they are that fish. They should describe their physical

characteristics and write an essay including information such as their preferred habitat, water depth, temperature, and cover.

EXTENSIONS

1. Cook and serve some trout at school.
2. Draw and label parts of a fish. Provide a preserved specimen for observation.
3. Include more water quality tests, such as dissolved oxygen and clarity.
4. Have a local fly fishing expert show the class some fly fishing equipment and demonstrate fly casting techniques.
5. Ask the local fish manager to shock a section of a lake or stream to see what kinds of fish are there. Describe the experience in your journal.
6. Visit a local fish market to see the types of fresh water and marine fish available to the consumer. Why are some more expensive than others?

The Alder Fork

Name: _____

Student Worksheet

Date: _____ Period: _____

INTRODUCTION

Specific environmental conditions are necessary for a species to survive.

WHAT TO DO

1. What is the preferred water temperature range for two local fish species and one trout species?
2. Using a thermometer, check the water temperature of several locations, being sure to include the temperature at different depths.

LOCATION	DESCRIPTION	DEPTH	TEMPERATURE

3. In which area(s) would you expect to find specific fish?
4. Share any fishing experiences you have had.
5. Locate the fishing regulations for your state. Should all ethical fishing behavior be controlled by law? Defend your answer.

Great Possessions

Key Quote

“Expanses unknown to deed or map are known to every dawn, and solitude, supposed no longer to exist in my county, extends on every hand as far as the dew can reach.”



OBJECTIVES

The students will be able to:

1. List at least three skills used in scientific thinking.
2. Distinguish between two types of observations — quantitative and qualitative.

BACKGROUND

There are several skills involved in scientific thinking. Some of these skills involve observing closely (using the senses to obtain information), interpreting logically (explaining reasons or giving meaning to observations), and keeping accurate records.

Leopold used all of these as he enjoyed the dawning of a new day proclaimed by singing birds. He made sure that he was comfortable and prepared to collect information. We, too,

must be prepared and observant to “catch” events as they occur.

MATERIALS

Outdoors and Indoors

- Pencil/pen
- Paper

PROCEDURES

Outdoors and Indoors

1. Ask students to think about and list physical conditions under which they think best.
2. Ask them to relate some of the skills involved in scientific thinking (close observation, logical interpretation, and record keeping) to Leopold’s essay.
3. Allow students a brief opportunity to sit by themselves and record observations, using as many of the senses as possible. The

out-of-doors provides variety, but staying indoors will work too.

4. Students will read the definitions of quantitative and qualitative observations, and give examples of each from their own experience and from Leopold's description.

EVALUATION

1. Given examples of various observations, have students decide which sense was involved and what types of observation they are (e.g., quantitative or qualitative).
 2. Have students explain the relationship between observations and interpretation.
 3. Have students list at least three skills involved in scientific thinking.
2. Have students produce their own wake-up records of what they would like to hear.
 3. Learn how to use a light meter (one in a camera will do), and repeat Leopold's morning experience outside—anywhere.
 4. Why do you suppose Leopold titled this essay "Great Possessions"?
 5. Draw and color a picture of what you think Leopold's shack might look like.
 6. Have students tell about a pleasant time they had in a natural setting (e.g., a park, a cabin setting, camping, etc.).

EXTENSION

1. Play a recording (record your own tape of morning sounds

or have students create their own early morning recording) of natural sounds that a person may wake up to at dawn. (For example, in the city, on a farm, in a field, near a pond, in a backyard).

Subjects

Science

Key Words

Morning star, copse, olfactory

Related Essay

"Come High Water"



Great Possessions

Name: _____

Student Worksheet

Date: _____ Period: _____

INTRODUCTION

Thinking requires certain skills and conditions. These vary from person to person, situation to situation, and purpose to purpose. Scientific thinking skills involve close observation, logical interpretation, experimentation, and accurate record keeping.

WHAT TO DO

1. How or under what conditions do you come up with a “great” idea?
2. Fill in the categories below with words or phrases found in the essay that show Leopold’s use of scientific thinking.

Observations:

- a.
- b.
- c.
- d.
- e.
- f.
- g.
- h.

Logical Interpretations:

- a.
- b.
- c.
- d.
- e.

Great Possessions

Name: _____

Student Worksheet

Date: _____ Period: _____

Accurate Record Keeping:

- a.
- b.
- c.
- d.
- e.
- f.
- g.
- h.

3. How many of the five senses did Leopold use in making his observations?

a. Why are the senses important to scientific investigation?

b. What did Leopold discover through his observations?

4. Reread the fourth paragraph, "This daily ceremony..."

a. What physical conditions helped Leopold think, observe, and record?

b. Compare and contrast Leopold's thinking conditions and your desired thinking conditions listed in #1.

Great Possessions

Name: _____

Student Worksheet

Date: _____ Period: _____

5. Go outside and sit in a spot of solitude (have at least four meters of space between you and another student). Record as many observations as you can. You will have ten minutes. Remember to use as many senses as possible.
 - a. How many senses did you use?

6. Now close your eyes for two minutes, and add any other observations.
 - a. Did you add any to your list after closing your eyes? Why or why not?

 - b. Did you use any adjectives when writing your observations (e.g., green grass)? If so, list a few examples.

 - c. Did you interpret the sources of sounds, even though you were unsure of what was really producing them? If so, give two examples.

 - d. Did you use numbers in describing your observations, such as five dandelions or one bird call?

7. Observation involving numbers are called quantitative observations. Descriptive observations using other adjectives are called qualitative observations.
 - a. List any quantitative observations you can find in Leopold's essay.

 - b. List at least five qualitative observations you can find in the essay.

 - c. Of what value are each type of observation to scientists?

8. Out of school, take your journal to your secret spot, get comfortable, think, observe and interpret for at least fifteen minutes. In your journal, record observations, thoughts, and interpretations. Then write about your own "Great Possessions."

Prairie Birthday



Key Quote:

“If I were to tell a preacher of the adjoining church that the road crew has been burning history books in his cemetery, under the guise of mowing weeds, he would be amazed and uncomprehending. How could a weed be a book?”

OBJECTIVES

The students will be able to:

1. Describe some adaptations of Silphium or similar plants and explain why they often survive drought.
2. Record the number of plant species in bloom in two different locations and compare the findings.
3. Compare the height of a common plant above ground to the length of the root below ground.

BACKGROUND

Leopold liked to observe plants flowering in a small triangular graveyard and elsewhere.

Because the mower couldn't reach some of the original prairie plants, they still remain in some places. He especially liked the compass plant or cutleaf Silphium that sends up yellow blooms each July. He regretted that most people never got to know the Silphium and therefore never missed it when it vanished.

MATERIALS

Outdoors

- Shovel
- Meter stick or other measuring device
- Plant identification books

Indoors

- Plant identification books

Subjects

Science

Key Words

Corollas, scythe, weed, diked

Related Essay

“Illinois Bus Ride”

- Audiovisuals of prairie and/or other plants

PROCEDURES

Outdoors

1. Go outside to observe a prairie or other type of similar plant community (lawn, field). If a Silphium is available, have the students observe and sketch its key characteristics. If Silphium is not available, use a dandelion or another plant found in abundance.
2. If several dandelions can be found, have the students carefully dig out a few to compare the lengths of the above and below ground parts. (Compare these measurements to the length of the above/below ground parts of a lawn grass).
3. Have students make a survey of two different areas, and record the number of species blooming in each. Have them compare the data to those gathered by Leopold in the suburbs and on campus and on a farm. Explain your results. Have students try to determine when the plants first bloomed.

Indoors

Refer to outdoor procedures, substituting audio/visual materials for outdoor experiences if possible.

EVALUATION

Have students explain orally or in writing how the Silphium is adapted for survival. Note: If root length and blooming time are mentioned as key characteristics.

EXTENSIONS

1. Grow seeds (avocado, radish, mung beans) and tubers (sweet or white potato) in water-soaked paper towels or in containers of water. Record the length of the roots and shoots daily for a period of time.
2. Find prairie plants along abandoned railroad right-of-ways, in old cemeteries, and in other “protected” places.
3. Draw a cross-section of a prairie showing the length of the above and below ground plant parts.

Prairie Birthday

Name: _____

Student Worksheet

Date: _____ Period: _____

INTRODUCTION

Become familiar with Silphium and other plants.

WHAT TO DO

1. Review the passage concerning the Silphium and its ability to survive droughts.
 - a. What is another name for Silphium?
 - b. Locate a Silphium. If you can locate more than one species, describe each. Why do you think Leopold liked this plant?
 - c. With a shovel, attempt to dig up a dandelion, trying to get the entire root system.
 - d. How does the percentage of above-ground growth of prairie plants compare with the percentage of underground growth?
 - e. How does the percentage of above and below ground growth of prairie plants compare with that of non-prairie plants?
 - f. What other plants are in bloom this time of the year, and which have bloomed earlier and are not now seen?

Prairie Birthday

Name: _____

Student Worksheet

Date: _____ Period: _____

2. Read the passage about the loss of flora and its causes.

a. Find an “idle spot” on some property you’re familiar with and describe its unique features.

b. Why does Leopold recommend keeping “idle spots” as a part of nature?

3. Should “idle spots” be kept only for human uses, or should they be set aside for the benefit of the plants and animals too? Explain.

The Green Pasture



Key Quote

“I know a painting so evanescent that it is seldom viewed at all, except by some wandering deer. It is a river who wields the brush, and it is the same river who, before I can bring my friends to view his work, erases it forever from human view. After that it exists only in my mind’s eye.”

OBJECTIVES

The students will be able to:

1. Sketch natural objects without looking at the paper.

BACKGROUND

Do not be misled by the title. This essay is not about cows and grass. It concerns the moods of the river on silt and sand bars, and the growth of a green plant, *Eleocharis*, a type of sedge called a spikerush. The river is viewed as an artist creating paintings that come and go with the flow of water.

MATERIALS

Outdoors and Indoors

- Pencil
- Drawing paper

PROCEDURES

Outdoors

1. Have the students go to a stream or riverbank and find a comfortable place to sit and observe a section of a silt or sandbar.
2. Direct them to look carefully at a portion of the bank, sandbar or silt bar. Using a pencil and paper, students should sketch the scene but never look at the paper or lift the pencil. (This sharpens their observation skills.)
3. After completion, the sketches should be displayed for all to see. The process of observing should be stressed, not the product.

Subjects

Art, science, language arts

Key Words

Silt

Related Essay

“Come High Water”

Indoors

1. Use pictures or video of sand bars or the sandy banks of a river.
2. Using a pencil and paper, students should sketch the scene but never look at the paper or lift the pencil.
3. After completion, the sketches should be displayed for all to see. The process of observing should be stressed, not the product.

EVALUATION

Using another location, have students sketch again, following

the same procedure. Make sure they follow the directions.

EXTENSIONS

1. Use field guides to identify some of the plants found on the “green pastures.”
2. Write a poem or story based on the sketch.
3. Compare the sketches from the river or stream to those from other plant communities.



The Green Pasture

Name: _____

Student Worksheet

Date: _____ Period: _____

INTRODUCTION

This essay presents the opportunity to walk along a sandbar looking for “Green Pastures.”

WHAT TO DO

1. Review the essay “The Green Pastures.”
 - a. What are the green pastures described by Leopold?

 - b. How are the “pictures” painted?

2. Look for and list human evidence along the bank or sand bar.
 - a. How does this make you feel?

 - b. Is it right to use streams for waste disposal? Defend your answer.

The Choral Copse

Key Quote

“By September the day breaks with little help from the birds. The silence is suddenly broken by a dozen contralto voices, no longer able to restrain their praise of the day to come.”

OBJECTIVES

Students will be able to:

1. Recognize behavioral changes in animal species due to seasonal changes.
2. Recognize changes in plant life due to seasonal changes.
3. Relate seasonal changes to personal changes in activities.

BACKGROUND

By September in much of the Northern hemisphere, nature is beginning to prepare for winter. Trees lose their leaves, squirrels cache acorns and other nuts, birds gather for the southern migration, and humans clean up the remains of their gardens and lawns.

MATERIALS

Outdoors

- Light meter (optional)
- Field guides
- Plant press

Indoors

- Slides/films/pictures of fall colors
- Tapes of nature sounds

PROCEDURES

Outdoors

1. Locate an outdoor setting where animal activity is obvious so students can observe behaviors.
2. Observe and discuss changes in plant life.
3. Relate seasonal changes to





personal changes (e.g., dress, transportation, yard work, recreation).

Indoors

1. View slides/films/pictures of nature in autumn.
2. Relate the audiovisuals to "The Choral Copse."
3. Relate seasonal changes to personal changes (e.g., dress, transportation, yardwork, recreation).

EVALUATION

Evaluate responses to worksheets and the level of student participation in the discussion.

EXTENSIONS

1. With light meter and field guides, visit a natural area and experience the dawn.
2. Construct, erect, and maintain a bird feeder through winter.
3. Record in a journal the events at a bird feeder throughout the winter.
4. Experiment with different types of bird feed to determine preferences by various species.

Subjects

Biology, language arts, social studies, industrial arts

Key Words

Copse, light intensity, candle power

Related Essay

"Great Possessions"

The Choral Copse

Name: _____

Student Worksheet

Date: _____ Period: _____

INTRODUCTION

Leopold writes of the musical changes at dawn, of nature's awakening from a night's sleep.

WHAT TO DO (OUTDOORS)

1. Review the essay "The Choral Copse."
 - a. Explain why July provides more varied "dawn music" than does September.

 - b. In an outdoor setting, compare and contrast animal behavior observed in the fall and in the spring.

 - c. Of what value is the "music of nature" to you?

2. Collect and press leaves of various trees from your area (don't take too many from each tree).
 - a. Did these leaves come from a copse? Explain.

 - b. Mount the collected, pressed leaves in your journal, and identify by common and scientific name.
3. Relate seasonal changes to personal changes.
 - a. Dress.

 - b. Transportation.

 - c. Yard work.

 - d. Recreation.

The Choral Copse

Name: _____

Student Worksheet

Date: _____ Period: _____

4. Reread “The Choral Copse”

a. Why do you think Leopold entitled this essay, “The Choral Copse”?

b. Does any choral copse have an effect on your life? Explain.

WHAT TO DO (INDOORS)

1. Review “The Choral Copse.”

2. Explain why July provides more “varied dawn music” than does September.

3. View slides, films, videos of nature in autumn.

a. Relate the audiovisuals to “The Choral Copse.”

b. Relate seasonal changes to personal changes:

- Dress.
- Transportation.
- Yard work.
- Recreation.

c. Why do you think Leopold entitled this essay “The Choral Copse”?

d. Does any choral copse have an effect on your life? Explain.

Smoky Gold

Key Quotes

“The tamaracks chance from green to yellow when the first frosts have brought woodcock, fox sparrows, and juncos out of the north. Troops of robins are stripping the last white berries from the dogwood thickets, leaving the empty stems as a pink haze against the hill. The creekside alders have shed their leaves, exposing here and there an eyeful of holly. Brambles are aglow, lighting your footsteps grouseward.”

“Hunts differ in flavor, but the reasons are subtle. The sweetest hunts are stolen. To steal a hunt, either go into a wilderness where no one has been, or else find some undiscovered place under everybody’s nose.”



OBJECTIVES

The students will be able to:

1. Recognize at least three characteristics of tamarack.
2. Compare and contrast tamarack with at least one coniferous tree and one deciduous tree.
3. Debate the issue of hunting, giving at least two reasons supporting it and two reasons opposing it.
4. Identify how Leopold uses distractions to increase his awareness of his surroundings.

BACKGROUND

This essay describes a hunting experience Leopold had with his dog among the smoky gold tamaracks. Leopold’s keen powers of observation

are uniquely characterized as distractions. Adams county is located along the Wisconsin River in central Wisconsin.

MATERIALS

Outdoors

- Tree identification books
- Specimens or slides/pictures of tamarack, pine, spruce, cedar, and other trees.

Indoors

- Specimens or slides/pictures of tamarack, pine, spruce, cedar, and other trees.

PROCEDURES

Outdoors

1. Where possible, visit natural areas inhabited by tamarack, pines, spruce, and cedar.
2. Identify “distractions” while

outdoors as Leopold did. Try to “read” the stories of the past from what you find.

3. Try “stealing a hunt” by finding a distant place in nature where no one has been or a place close by which is undisturbed.

Indoors

1. Use specimens/slide/pictures to study the characteristics of tamarack, pine, spruce, and cedar.
2. Provide time for students to relate hunting experiences they have had or heard about. Allow those lacking hunting experiences to relate their stories too.
3. Divide the class into groups (pro-hunting, anti-hunting, pro-choice, and undecided) and debate the issue of hunting. Summarize conclusions.
4. Discuss the detrimental and/or beneficial aspects of distractions.

EVALUATION

Consider student responses on the worksheet and their participation in the debate.

EXTENSIONS

1. Collect and preserve specimens of coniferous trees. Label and identify by common and scientific name.
2. Write an essay describing your “Smoky Gold.” Share your essay with the class.
3. Research how Adams county, Wisconsin or your own county has changed since the writing of “Smoky Gold.” Do you think Leopold would approve of these changes? Explain.
4. On the map of the Midwest, highlight the range of tamarack growth.

Subjects

Biology, literature, social studies

Key Words

Buck, sand barrens, sodden muck, velvet (on antlers), whorl, chronometer

Related Essay

“Red Lanterns”



Smoky Gold

Name: _____

Student Worksheet

Date: _____ Period: _____

INTRODUCTION

Leopold encourages the reader to get away from it all; to don the hunting frock and venture forth into the woods to commune with nature and attempt to savor a few of nature's gifts.

WHAT TO DO

1. If possible, visit natural areas inhabited by tamaracks, pine, spruce, and cedar.
 - a. Compare and contrast the characteristics of tamarack with deciduous trees. Note the similarities and differences.

 - b. Compare and contrast the characteristics of tamarack with coniferous trees. Record your findings.

2. Reflect on the hunting aspects of the essay.
 - a. Relate to the class a hunting experience you have had or heard about.

 - b. After dividing into groups, debate the issue of hunting. Take the position of a pro-hunter, anti-hunter, or a pro-choice hunter (i.e., one who hunts only certain species) or someone who is undecided.

3. While hunting in Adams county, Leopold encountered several "distractions."
 - a. What is meant by the word "distraction"?

 - b. List several distractions you have experienced within the past hour.

 - c. Which of these distractions were beneficial and why?

 - d. Which of these distractions were detrimental and why?

 - e. Do you think Leopold's distractions were beneficial or detrimental? Explain.

Too Early



Key Quote

“Early risers feel at ease with each other, perhaps because, unlike those who sleep late, they are given to understatement of their own achievements.”

OBJECTIVES

The students will be able to:

1. Accurately sketch the constellation Orion and label the main stars.
2. Locate Orion among other constellations, either outdoors or on a constellation chart.
3. Discuss the emotions stirred up by the sounds of nature (e.g., owls hooting, geese honking, wolves howling, loons crying, etc.)
4. Create a colored sketch depicting Leopold’s “Too Early.”

BACKGROUND

Leopold stimulates the imagination by painting a vivid

audio-visual picture of early morning activities in nature.

MATERIALS

- Star chart
- Book on astronomy
- Protractor
- Ruler
- Watercolors/markers/colored
- Pencils
- Nature tapes

PROCEDURES

1. Provide students with information on constellations.
2. Provide students with materials to sketch and label the main stars of Orion – Betelgeuse Meissa, Bellatrix,

Subjects

Astronomy, geometry, psychology, art

Key Words

Anserine, Orion

Related Essay

“The Geese Return”

- Mintaka, Alnilam, Alnitak, Saiph, and Rigel.
3. Provide opportunities for students to share their emotional experiences at the sound of geese, wolves, owls, loons, etc.
 4. Provide opportunities for students to compare emotional experiences connected with the sounds of nature to human-related sounds such as a car wash, terrified scream, gunshot, horns blaring, different types of music, etc.
 5. Provide art materials to allow students to depict “Too Early” in picture form.

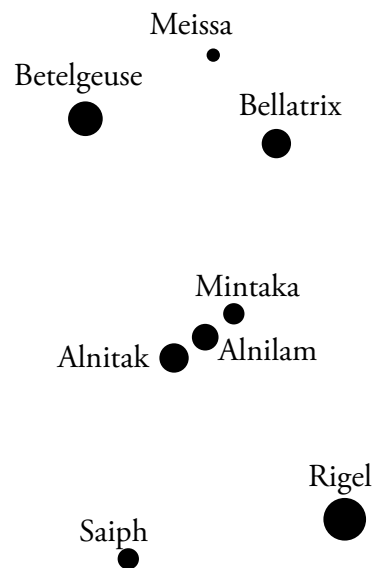
EVALUATION

Evaluate class participation and determine how creative the sketch “Too Early” is.

EXTENSIONS

1. Accurately sketch several constellations.
2. Make tape recordings of night and day sounds of nature and humans. Present it to the class and discuss emotions generated by both sets of sounds.
3. Make a tape recording of sounds pleasing to the ear and those which are annoying.

4. Discuss the relationship between ear size, niche, and habitat of various species of animals.
5. “Owls ‘hear with their eyes!’” Research and write an explanation of the statement.
6. Make a video of several scenes (e.g., nature, cemetery, traffic, construction site: person in a rocking chair, person sleeping, etc.). Dub in sounds contrary to the scene. Share this with the class, and discuss their reactions.



Too Early

Name: _____

Student Worksheet

Date: _____ Period: _____

INTRODUCTION

“Getting up too early is a vice habitual to horned owls, stars, geese and freight trains.”

WHAT TO DO

1. Obtain information on constellations.
 - a. With protractor and ruler, accurately sketch the constellation Orion, and label its main stars.
 - b. Either outdoors or on a constellation chart, locate Orion in relationship to the other constellations.

2. Listen to the sounds of nature.
 - a. What emotions are stirred up in you as you listen?

 - b. Compare these emotions with those experienced from human-related noises such as a car crash, human scream, gunshot, blaring horns, and different types of music.

3. Reread “Too Early.”
 - a. Produce a colored sketch of the images created as you read the essay.

 - b. Why do you suppose Leopold felt secure in knowing that freight trains were “single minded”?

Red Lanterns

Key Quotes

“Red lanterns have lighted my way on many a pleasant hunt in many a region, but I think that blackberries must first have learned how to glow in the sand counties of central Wisconsin.”

“Almost anything may happen between one red lantern and another.”



OBJECTIVES

The students will be able to:

1. Explain why leaves of many trees and shrubs turn different colors in the fall.
2. Identify one other plant, by its common and scientific names, which could share the name “Red Lantern.”
3. Identify five plants, by their common and scientific name, which produce their own distinctive “lanterns” in the fall (e.g., yellow orange, brown, or a combination of colors).
4. Compare and contrast the characteristics of Hungarian (gray) partridge and ruffed grouse.
5. Using art supplies, make an accurate colored sketch of the partridge and grouse.
6. Describe the life history of

the Hungarian partridge and ruffed grouse to include: mating, nesting, brood rearing, food habits, cover requirements, and delineation of their range on a map of North America.

BACKGROUND

Aldo Leopold, an avid hunter, tells of hunting partridge in thorny blackberry bushes—his “red lanterns”—in the fall. The color changes which reveal “red lanterns” occur as a result of a change in the amount of chlorophyll in the leaves, thus revealing the other pigments which have been masked.

MATERIALS

Outdoors

- Tree and shrub guides
- Book(s) on game bird life histories

- Map of North America
- Watercolors/colored pencils/ chalk
- General botany book

Indoors

- Slides, films or pictures of fall colors
- General botany book
- Book(s) on game bird life histories
- Map of North America
- Watercolors/colored pencils/ chalk

PROCEDURES

Outdoors

1. Discuss with students why the leaves of trees and shrubs turn color in the fall.
2. Have the students go outdoors and identify and record, by common and scientific names, one plant which may share the title of “Red Lantern.”
3. Have students go outdoors, identify and record the common and scientific names of five plants which produce their own distinctive “lanterns” in the fall.
4. Have students conduct a literature review on ruffed grouse and Hungarian partridge and record their ranges, habitat requirements (mating, brood rearing, nesting, and cover), food habits, and seasonal

behaviors. If possible, visit an area where either of the species is known to occur.

Indoors

1. Discuss with students why the leaves of trees and shrubs turn color in the fall.
2. Show slides, pictures or films of fall colors and discuss difference in colors noted.
3. See #4 in Outdoor Procedures

EVALUATION

1. Using art supplies, photographs, and/or parts of plants, have students explain the processes involved when leaves change color and how the change of seasons affects their own lives.
2. Using art supplies, have students explain some of the differences (either physical or behavioral) between ruffed grouse and Hungarian partridge.

EXTENSIONS

1. Collect leaves representing various fall colors, press them, and mount them on botany specimen sheets or other materials, and record collection data for each specimen (locale, date, species, collector).
2. Determine the cost of outfitting oneself for hunting partridge or grouse using sporting goods catalogs.

Subjects

Biology, art, language arts

Key Words

Solarium, sand counties, olfactory, white-throats, white-flag

Related Essays

“Smoky Gold”
“Red Legs Kicking”

Red Lanterns

Name: _____

Student Worksheet

Date: _____ Period: _____

INTRODUCTION

“At sunset on the last day of the grouse season, every blackberry blows out his light.”

WHAT TO DO (OUTDOORS)

1. Review “Red Lanterns.”
2. Referring to a botany book, look up information on why leaves of trees and shrubs turn color in the fall.
 - a. Discuss the process of color change in leaves.
 - b. Using field guides to trees and shrubs, go outside and record the common and scientific names of one or more plants which may share the distinctive title of “Red Lanterns.”
 - c. Using field guides to trees and shrubs, go outside and record the common and scientific names of five plants which produce their own distinctive colored “lantern” (yellow, orange, brown or a combination of colors).
3. If possible, locate a live or preserved specimen of a Hungarian partridge and/ or ruffed grouse in a zoo or museum (use pictures if no specimens are available). Describe the physical characteristics of each bird including body size, feather coloration, wing and beak shape, and leg and foot characteristics.
4. Review the essay “Red Lanterns” and, in your journal, write a poem about you experiencing “red lanterns.”

WHAT TO DO (INDOORS)

1. Read “Red Lanterns.”

Red Lanterns

Name: _____

Student Worksheet

Date: _____ Period: _____

2. Consult a botany book and look up information on why leaves of trees and shrubs turn color in the fall.
 - a. Discuss the process of color change in leaves.

 - b. View slides, pictures or a film on fall colors and discuss differences in colors noted.

3. Consult a book on game birds and locate life history information on the Hungarian (gray) partridge and the ruffed grouse.
 - a. Compare and contrast the characteristics of the Hungarian partridge and ruffed grouse.

 - b. Using art supplies provided, make accurate colored sketches of each of these game birds.

 - c. Complete the following sheet, summarizing the life histories of the two game birds.

	GRAY PARTRIDGE	RUFFED GROUSE
MATING		
NESTING		
RAISING YOUNG		
FOOD		
HABITATS		

- d. On an outlined map of North America, indicate by shading with colored pencils the ranges where each of these game birds can be found.

4. In your journal, write a poem about any “red lanterns” you may have experienced.

If I Were the Wind

Key Quotes

“A tree tries to argue, bare limbs waving, but there is no detaining the wind.”

“...for the wind has gone with the geese. So would I—if I were the wind.”



OBJECTIVES

Students will be able to:

1. Explain what wind is.
2. Observe at least three ways evidence of wind can be seen around them.

BACKGROUND

A definition of wind is air which is moving. Generally winds are created from differences in temperature. This may occur over land lying adjacent to a body of water, producing a warm/ cold temperature variation.

MATERIALS

- Flag and flag pole
- Windssock or other object outside to determine wind direction (able to be seen through a classroom window or from outdoors)

PROCEDURES

1. Have students gather outside near a flag pole or other object that will show wind direction. If you can't go outdoors, view something from a window.
2. Use the worksheet and Leopold's essay to stimulate questions on what wind is and how it affects life.
3. Conclude the activity by helping students to see the impact the wind (in the winter months) would have on species of migrating wildlife if they did not migrate.

EVALUATION

1. Have students divide up into small groups and research information on major destructive windstorms. Have

the small groups report on their findings.

2. Have students explain what they do in their homes to get ready for winter. Then have them pick an animal and research how it protects itself against the winter wind.

EXTENSIONS

1. Using an anemometer, have students measure wind velocity in both protected and unprotected areas. Then relate that to where animals are found.

2. Discuss wind direction and velocity at different times of the year, and relate it to when birds migrate.
3. Make a wind vane or other simple weather instrument.



Subjects

Weather (meteorology), earth science, language arts

Key Words

Conservationist, leader, drouth, brush, slough

Related Essay

“65290”

If I Were the Wind

Name: _____

Student Worksheet

Date: _____ Period: _____

INTRODUCTION

This essay tells of further preparation of the “land” for the onslaught of winter. From this activity, you will have a better idea of what wind is and how it is measured.

WHAT TO DO

1. Review the essay “If I Were The Wind.”

a. What is wind?

b. What affects the direction of wind?

c. Locate a flag on a flag pole outside, and determine what direction the wind is coming from.

d. In the essay, where does Leopold give evidence that wind is present?

e. Where can you see evidence of wind around you?

f. What creates the sounds that we associate with winds?

Axe-in-Hand

OBJECTIVES

Students will be able to:

1. Measure the growth of a tree's stem (using a centimeter measuring tape) and then make some assumptions about the environmental conditions that affected different growing years.
2. Identify what a plant bias is and express their biases concerning plants.

BACKGROUND

Hardwoods and softwoods refer to broad-leaf and cone-bearing trees respectively. It should be noted that there are significant degrees of "hardness" within the two types of trees. As an example, the wood of an oak tree is much harder than that of a cottonwood even though both are hardwoods.

Many factors affect tree growth. One of the most important is climate. Trees grow well in the southeastern U.S. because the characteristics favorable for growth are present there. These factors include precipitation, temperature, and length of daylight. This accounts for the success of pine plantations in this area.

Calculating the annual growth of a broad-leaf tree (hardwood) can be done by observing a two to three foot branch. Beginning at the terminal bud (at the very tip



of the small lateral branch), measure the distance to the first terminal bud-scale scar. This distance represents the newest year's growth. The bud-scale scar looks like small rings or collars around the twig. Each section between two bud-scale scars represents another year's growth. A short distance would mean less than desirable climatic conditions for that given year.

Annual growth on conifers (softwoods) can be measured also. Conifer branches appear to be in layers. The gaps between the layers represent the annual vertical growth of the tree. Wider gaps indicate faster annual growth.

MATERIALS

Outdoors

- Centimeter measuring tapes

Key Quote

"When some remote ancestor of ours invented the shovel, he became a giver: he could plant a tree. And when the axe was invented, he became a taker: he could chop it down. Whoever owns land has thus assumed, whether he knows it or not, the divine function of creating and destroying plants."

Subjects

Science (botany, ecology),
mathematics (charts or
graphing)

Key Words

Conservationist, leader,
brush, bud scale scar,
droughty, catkin

Related Essay

“Good Oak”

Indoors

- Specimens (e.g., hickory, oak) of various hardwoods showing at least three years growth. If possible a portion of a conifer (perhaps the Christmas tree could be recycled)
- Centimeter measuring tapes
- Tree identification keys

PROCEDURES

1. Review what an annual ring is (see Essay: “Good Oak”).
2. Make available a measuring tape and either live trees or branch specimens that students can measure.
3. Using a hardwood stem, show students how to measure the newest year’s growth by locating the branch’s terminal bud and bud scale scar (growth ring) from the previous year. The students then can measure other yearly growth by measuring from bud scale scar to bud scale scar.
4. As time and resources allow, you may want to show students how to measure yearly growth on softwoods.
5. Have students record their data on the chart provided on the student worksheet.
6. Discuss with students what climatic conditions might affect a tree’s growth.
7. After students have reread

the essay portion on weeds, discuss what a weed is, and have them share their plant biases.

EVALUATION

1. Have students pair off and pick a tree species that they want to defend. They should be able to come up with at least three reasons why their plant should never be considered someone else’s weed. Presentations could be in the form of a debate.
2. Have students make a bar graph of the data on tree growth. Then have the students write a summary of what the graph shows.

EXTENSIONS

1. Have a visiting speaker (e.g., forest ranger, conservationist, or other knowledgeable person on trees) come to your class to discuss differences between hard and softwoods, “weed trees,” growth conditions, etc.
2. Visit a pine plantation or local forest preserve. Look for signs of competition between pines and other species as described in Leopold’s essay. If identification keys are available, have students try to identify at least ten different species of trees.

Axe-in-Hand

Name: _____

Student Worksheet

Date: _____ Period: _____

INTRODUCTION

There are many reasons why a person prefers one plant species over another. Leopold presents his own biases about the white pine and the red birch.

WHAT TO DO

1. Using specimens of trees made available to you, measure the newest growth of a branch following your teacher's instructions.

a. Record the data on the chart.

b. Next, measure the same tree branch's growth from two years ago. Record your data.

TREE SPECIES	LENGTH OF LAST YEAR'S GROWTH (CM)	LENGTH OF GROWTH TWO YEARS AGO (CM)

c. How do you account for any differences in growth of a tree from one year to the next?

d. Identify at least three plants that you consider to be weeds (this could include trees).

e. Discuss your preference for certain types of plants and explain your bias.

A Mighty Fortress

Key Quote

“My woodlot is riddled by all the ailments wood is heir to... But it soon becomes clear that these same diseases made my woodlot a mighty fortress, unequalled in the whole country.”



OBJECTIVES

Students will be able to:

1. Identify a diseased and damaged plant caused by parasites, wind, or other forces.
2. Name the symbiotic relationships that exist between diseased and damaged plants and the animals that use them.

BACKGROUND

Hollow trees are refuges for many animals in the forest (e.g., raccoons, squirrels, foxes, bats, ants, grubs, termites, bees, mice, wood ducks, owls, woodpeckers and starlings). There are many factors that contribute to the killing of a tree. One act caused by animals is girdling. Once the bark is stripped from –the tree’s

trunk it eventually dies. Forest managers also use this method in forests to selectively kill some trees.

MATERIALS

Outdoors

- One hollow log
- A large area outdoors with signs of plant damage and diseases

Indoors

- One hollow log
- A collection of damaged or diseased plants, (e.g., galls, fungi damage, insect damage, wind damage)

PROCEDURES

Outdoors

1. Find a large area where plants grow (e.g., woodlot, abandoned grassy field, etc.)

2. Direct students to locate various plants that show signs of damage or disease. Have them look at all parts of the plants—leaves, stems, buds, bark, etc.
3. Have students complete the worksheet.

Indoors

1. Have various plant specimens displayed at different stations around the classroom.
2. Provide students with ample time to observe the plant and write down the types of damage on the worksheet.

EVALUATION

1. Design a lab exercise in which students go to stations and explain the plant damage observed and how each example benefits a particular animal.

2. On posterboard, have students create a habitat with at least three damaged plants and three animals living together in a symbiotic relationship.

EXTENSIONS

1. If you have access to a camera, take pictures of various animal fortresses and have your students view and discuss them.
2. Have students research girdling and how it is used in woodland or forest management.

Subjects

Botany, ecology, entomology, language arts

Key Words

Coon, girdling, game animal, heartwood, pest, cover, gall, high year, slough, wahoo, fungus

Related Essays

“Good Oak”

“Pines Above the Snow”



A Mighty Fortress

Name: _____

Student Worksheet

Date: _____ Period: _____

INTRODUCTION

Like people and other animals, plants are subject to diseases. This essay discusses the use that nature makes of old diseased trees.

WHAT TO DO

1. Examine the hollow log your teacher has provided.
 - a. How did the log get this way?

 - b. What kinds of animals do you think would call this place “home”?

2. Reread the passage about the woods being headquarters for a family of coons.
 - a. How was the maple a good sanctuary for the coon family?

 - b. What caused the tree to become diseased?

3. Reread the passage about the plague of rabbits.
 - a. What is “girdling”?

 - b. What evidence of this occurrence does Leopold describe?

 - c. Why might a forest manager girdle a tree?

A Mighty Fortress

Student Worksheet

Name: _____

Date: _____ Period: _____

4. Reread the passage about the flock of a dozen chickadees.
a. What brings the chickadees to the woodlot?

5. Using the chart below, examine different plants. Describe how they were damaged and what animals benefited.

PLANT SPECIES	HOW DAMAGED	BENEFICIARY

Home Range

Key Quotes

“The wild things that live on my farm are reluctant to tell me, in so many words, how much of my township is included within their daily or nightly beat.”

“Every farm is a textbook on animal ecology; woodsmanship is the translation of the book.”



OBJECTIVES

The students will be able to:

1. Interpret the evidence of “signs” left by at least three different animals using natural settings or pictures.
2. Define the term “home range” and identify the approximate size of the home range for at least three local animals.

BACKGROUND

Leopold describes the area of land used by rabbits, chickadees, deer, and grouse, and the plants used for food and shelter. He learned about the home range of animals by observing them directly and by finding evidence of their behaviors.

MATERIALS

Outdoors

- Animal identification books

Indoors

- Audiovisuals about animal evidence
- Sketches of animal evidence
- Animal identification books

PROCEDURES

Outdoors

1. Discuss some of the possible animal evidence that might be found outdoors and the size of the area needed for particular animals to find food, shelter, water, and adequate space.
2. Take the students outside to a suitable area. In teams of two

to three, direct them to locate animal evidence and make sketches of their findings on 5"x8" cards (one sign/card).

3. Ask them to choose one animal sign they can identify and see if it can be found in several places in the area. Have them guess what the home range of that animal might be. (Identification books may be used).
4. Direct each group of two to three students to pair up with another group and have them try to guess the name of the animal that left each sign, using one card at a time.

Indoors

1. Show audiovisuals about animal evidence.
2. Refer to outdoor procedures, substituting audiovisuals for the outdoor experience or use the sketches of animal evidence provided.



EVALUATION

The teacher could select an example of one animal sign (the actual evidence or a sketch), and ask the students to identify the animal that caused it and the approximate size of its home range.

EXTENSIONS

1. Invite a biologist or bird bander into class to talk about animals signs and home range.
2. Have the students try to duplicate animal signs outdoors, and have other students attempt to identify the animals that made them.
3. Find out what scientists have learned about home range since Leopold wrote this essay in the 1940s.

Subjects

Science (ecology)

Key Words

Home range, bud scales, budding, popple, woodsmanship, ecology

Related Essays

"65290"

"January Thaw"

Home Range

Name: _____

Student Worksheet

Date: _____ Period: _____

INTRODUCTION

The essay briefly describes some of the activities of rabbits, chickadees, deer, and grouse as they find food, shelter, water, and adequate space within their home-range areas.

WHAT TO DO

1. Review the sections in the essay “Home Range” that describe the home ranges of the animals on Leopold’s farm.
2. Record the names of at least three local animals, and sketch an example of the evidence they leave. Estimate the size of their home range based on what you discover.

ANIMAL	EVIDENCE	HOME RANGE AREA

3. Read about each animal you studied and find out more information about each, especially their home ranges.
 - a. What animal did you choose?
 - b. What types of evidence could be found if you studied the animal in more depth?
 - c. How have humans affected the home range of the animals you investigated?

Pines Above the Snow



Key Quotes

“The pine’s new year begins in May, when the terminal bud becomes ‘the candle.’”

“But he who lives with pines knows that candle has a deeper meaning, for at its tip burns the eternal flame that lights a path into the future.”

OBJECTIVES

The students will be able to:

1. Identify at least five types of conifers (e.g., spruce, fir, pine, cedar, and tamarack).
2. Explain at least two factors that affect pine tree growth.

BACKGROUND

Commercial tree shaping is the clipping back of candles to produce a tighter, conical-shaped tree. Leopold relates an individual pine’s “short year” to calamities that may have occurred in nature, such as “some local bottlenecks in that dark laboratory we call soil.” This bottleneck could be rock, compacted soil or other obstructions that restrict

root growth and up-taking of nutrients and water.

MATERIALS

Outdoors

- A tree farm, forest preserve, or schoolyard that has five types of conifers

- Candles

- Matches

Indoors

- Candles

- Matches

- Five conifer branches or pictures of the five kinds showing details of “leaf” arrangements and number, tree shape, and new growth
- A slide or photograph of a white pine forest

Subjects

Science, art, language arts

Key Words

Candle, leader, terminal bud, whorl

Related Essay

“Axe-in-Hand”

PROCEDURES

Outdoors and Indoors

1. Using actual trees or pictures, have students become familiar with the “leaf,” bark, branching pattern, and new growth (candles) of each tree type.
2. Have students complete the worksheet where applicable.
3. For #6 on student worksheet, you may want to do the candle lighting as a demonstration instead of as a small group activity.

EVALUATION

1. Using photographs or actual specimens, have students make a collection of coniferous tree “leaves” and identify each by genus and species.
2. Take students outside and have them sketch an adult specimen of each conifer, and

the identifying characteristics of each, e.g., leaf shape, leaf arrangement, etc.

EXTENSIONS

1. Have students plant a conifer on their own property or in a pot, so that they can observe the “new beginnings” or candles of the seedling.
2. The age of a white pine can usually be determined by counting the number of branch layers (whorls). The years where the layers are close together designate “hard years.” Have students find a pine tree and sketch it, indicating the age and number of “hard years.”
3. Visit a park or forest preserve with existing pines. Find evidence of pine browsing by deer and note the extent of the browsing in different species of pines.



Pines Above the Snow

Name: _____

Student Worksheet

Date: _____ Period: _____

INTRODUCTION

This essay deals with the planting of pines, trees which Aldo Leopold loved for several reasons. He tells of the previous year's growth in pines and the winter events that affect the following year's growth.

WHAT TO DO

1. Using the resources available, locate the various structures of each coniferous tree.
 - a. Identify the "leaf" shape, number of "leaves" per cluster, and length of each "leaf."

 - b. Are the tree branches soft or prickly? Do they grow out horizontally or slope up or down?

 - c. Describe what the candle (new growth) looks like.

 - d. Describe the bark, noting its color and surface texture.

 - e. What is the purpose of clipping or shearing the candles of pines that are destined to become Christmas trees?

2. Attempt to locate an old pine that has a flattened crown like the one Leopold describes.
 - a. Make a sketch of it.

Pines Above the Snow

Name: _____

Student Worksheet

Date: _____ Period: _____

3. Reread the passage describing the hard years that pines must survive and the dark laboratories (soil) they grow in.

a. If possible, examine several trees and find what might be classified as a “hard year” based on the information in the reading.

b. Discuss reasons why this may have been a hard year.

c. What is Leopold describing when he mentions a bottleneck?

4. Reread the passage about the chit-chat of the woodland inhabitants.

a. Describe evidence of “pine-parts utilization” mentioned in the reading.

5. Carefully light a candle and watch the flame flicker.

a. Describe the visual and symbolic similarities to a pine “candle.”

65290



OBJECTIVES

The students will be able to:

1. Explain the process and purpose of banding birds.
2. State the importance of bird habitat.
3. Explain two adaptations birds have made to increase their chances for survival.

BACKGROUND

The purpose of bird banding is to better understand the migration routes, lifespans, breeding, and wintering areas for different species. Bird banding involves placing small, coded metal or plastic bands around the lower portion of the bird's leg. An estimated half million birds are banded annually in North America. Less

than five percent of these birds are recaptured.

The most common capture method is the "mist net," similar to a very fine nylon badminton net. Larger birds are captured with "cannon" nets that are shot out over the birds. Both methods are considered safe for birds if the bander is skilled.

MATERIALS

Outdoors

- Area where birds can be trapped and banded

Indoors

- Video on bird banding

PROCEDURES

1. Have students view the audiovisuals on bird banding or observe a live

Key Quotes

"To band a bird is to hold a ticket in a great lottery."

"It is an exercise in objectivity to hold a ticket on the banded sparrow that falleth, or on the banded chickadee that may some day re-enter your trap, and thus prove that he is still alive."

Subjects

Ornithology, ecology,
language arts

Key Words

Banding, flatiron corners,
evolution, pupae

Related Essay

“Home Range”

demonstration by a bird
bander.

2. Using the worksheet, have students complete the questions.
3. Have students go to the library and find out as much as they can about one bird species. Then have them explain to the rest of the class some of the special considerations and problems related to trapping and banding that species.

EVALUATION

Have students describe the adverse conditions that affected the survival of Leopold’s chickadees. Using this list, ask them to explain ways they would cope with similar adverse climatic situations.

EXTENSIONS

1. Invite someone from the Audubon Society, Forest Preserve District, or local zoo to make a presentation on bird banding.
2. Have students investigate other methods of trapping birds for banding. Hold a discussion on whether or not banding is a humane thing to do to birds.



INTRODUCTION

Biologists band birds as part of their studies of home range and migration. In this essay, Leopold tells of the annual return of a chickadee bearing the band number 65290 for five consecutive years.

WHAT TO DO

1. View audiovisuals on bird banding.

a. Describe the process used (in the audiovisuals) to trap and band birds.

b. Compare this procedure with the process described in Leopold's essay.

2. Reread the sections of the essay beginning with "It seems likely that weather is the only killer so devoid..."

a. Describe how 65290 and its relatives coped with the drizzles of winter.

b. Leopold comments that chickadees survived the hazards of winter by "keeping calm." Explain why this is necessary using examples from the essay.

c. From the essay, describe the type of habitat necessary for chickadee survival during the winter.

d. What other species of wildlife might be adversely affected by winter drizzle?

3. Should humans play a part in helping birds survive severe winter weather or should they “let nature take its course”?

Glossary

ANSERINE – referring to geese (from the Latin word).

ARGENTINE (*usually the Argentine*) – a country in South America located between the Andes Mountains and the Atlantic Ocean.

BIRD BAND – a small, narrow band of metal inscribed with a number attached around the leg of a bird used to obtain information on avian breeding, migration, distribution, etc.

BROODING – incubating eggs by the mother bird.

BROWN MILLER – a dry fly pattern using mallard duck feathers for the wings and tail and orange material ribbed with gold tinsel for the body.

BROWSE (*verb*) – to eat twigs and leaves of woody plants. Deer, moose and their relatives are browsers. (*noun*) – leaves or twigs that are eaten by deer, moose, or other animals.

BRUSH – low to medium height woody vegetation.

BUCK – a male deer.

BUD SCALE SCAR – the location on a twig showing where the leaf or terminal bud from the previous year grew. Buds are protected by scales before they open to reveal new leaves.

BUDDING – the act of grouse eating the buds of plants.

CANDLE – the name given to the terminal bud of a conifer in the spring because the new growth has a slender, waxy appearance.

CANDLE POWER – a measure of light intensity expressed in units called candles.

CATKIN – a pendulous, spike-like cluster of flowers in trees such as aspens, oaks, willows, and birches.

CHRONOMETER – a instrument to measure time with great accuracy.

CONSERVATIONIST – a person who advocates or practices the conservation of natural resources.

COON – short for raccoon.

COPSE – a close cluster of trees or shrubs originating from shoots or root suckers rather than seed (coppice).

CORD – a unit of measurement for firewood, 4 feet high by 4 feet wide by 8 feet long.

COROLLA – all of the petals on a flower.

CREEL – a basket carried or worn by a person fishing. It is used to hold the catch.

CROSS GRAIN – a direction, across the wood fiber, either diagonally or spirally in relation to the main direction of tree growth.

DIKED – mounded soil in order to impound water.

DROUGHTY – describing a period of dryness (drouth or drought).

Glossary

DRY FLY – a floating imitation of an aquatic insect, usually made by attaching fur, feathers, and other materials to a fish hook.

DUFF – a general term for material on the ground in a forest, including fresh leaves, grass, and other plant parts, litter, and well-decomposed organic material and humus.

DUST BOWL – a region that suffers from drought and dust storms. In the 1930s poor farming practices were combined with a lack of rain to create severe wind erosion. (See John Steinbeck's *The Grapes of Wrath*).

ECOLOGY – the branch of science that deals with the relationship of organisms to their environment.

EVOLUTION – a scientific theory explaining the process of change in organisms over long periods of time.

FALSE CAST – in fly fishing, the line is cast back and forth in the air several times before allowing it to fall, letting the fly hit the water.

FAUNA – animals found in a particular region or habitat.

FLATIRON CORNER – triangular corner of a field.

FLORA – plants found in a particular region or habitat.

FOOT CANDLE – a unit for measuring illumination. The illumination produced by a standard candle at a distance of one foot.

FOREST – a complex community of plants and animals in which trees are the most conspicuous members.

FREQUENCY CURVE – a line drawn on a graph to indicate, in this case, the survival rate of oaks over time.

FUNGUS – a living organism that does not photosynthesize like plants, but usually is saprophytic or parasitic. Examples include yeasts, molds, mildews, rusts, and mushrooms.

GALL – a swelling or an excrescence of plant tissue, often on leaves, due to fungal infection or an insect parasite. Example: gallnut from an oak.

GAME ANIMAL – an animal that is considered to be hunted, fished or trapped for human consumption (fur or meat) and sport (examples: deer, geese, bass, muskrat).

GEEING – word of command to a horse, ox, or other work animal directing them to turn to the right.

GIRDLING – stripping or gnawing a section of bark around the trunk of a tree or shrub. This may eventually kill the plant if the cambium cells are cut.

GIZZARD – the muscular enlargements, immediately following the crop in the alimentary canal of birds, used for grinding food, best developed in seed-eating birds.

HARDWOOD – the wood of a broad-leaved tree (dicotyledon) such as oak, birch, and aspen. The term is not related to the actual hardness of the wood.

HAWING – word of command to a horse, ox, or other work animal, directing them to turn to the left.

Glossary

- HEARTWOOD** – the older, hard, non-living central portion of wood, usually darker in color, denser and more durable than the surrounding sapwood.
- HIBERNATION** – the act of passing the winter, or a portion of it, in a state of sleep, a torpid or resting state.
- HIGH YEAR** – of an animal's population cycle, when the populations for a particular species are at or near their maximum abundance.
- HOME RANGE** – an area of land over which an individual animal travels to obtain food, water, shelter, and space requirements needed to survive and reproduce.
- ICE SHEET** – a glacier that once covered much of the continent.
- KERF** – a cut made by an axe, saw, or other tool across the trunk or limb of a tree.
- LEADER** (*on a pine*) – the top candle or growth portion of a tree.
- LEAF SCAR** – an area of woody tissue located where the stem of the leaf fell from the twig.
- LIGHT INTENSITY** – light brightness.
- LOAM** – a soil containing relatively equal amounts of sand and silt with a somewhat smaller proportion of clay (7-27% clay, 28-50% silt, and less than 52% sand).
- MARSH** – a level area more or less covered with shallow water; a marsh exists where no efficient drainage system has developed. A marsh supports only grasses and aquatic vegetation, as opposed to a swamp, which supports trees and shrubs.
- MAUL** – a very heavy hammer (sledgehammer) used to drive stakes or wedges.
- MICROTINE** – relating to the meadow vole. The scientific name for the genus is *Microtus*.
- MIGRATORY** (*migration*) – movement from one area to another occurring with the change of seasons.
- MORNING STAR** – a planet when it appears in the morning before sunrise. Usually refers specifically to Venus, the brightest of the planets and one that rarely appears far from the sun.
- OLFACTORY** – relating to the sense of smell.
- ORION** – a constellation containing the bright star Rigel. (This star pattern is also known as “The Hunter,” since the Greek mythological figure Orion was a hunter.)
- OXBOW** – a crescent-shaped bend in a river that has been cut off from the main channel by land.
- PAMPAS** – vast grassy plains, especially in Argentina, east of the Andes Mountains in South America.
- PEAT BOG** – a soft, wet, spongy, area made from decaying sphagnum moss and other plants.
- PINIONS** – the wings of a bird; specifically the outer rear edges of the wing containing the primary feathers.
- PITCH** – a resin obtained from various coniferous trees and sometimes used for its medical value.

Glossary

PITH – the central column of spongy cellular tissue in the stems and branches of dicotyledonous (woody) plants, such as sumac.

PLEISTOCENE – a relatively recent period of geologic time beginning 1.7 million years ago and ending about 10,000 years ago (the Great Ice Age).

POPPLE – another name for poplar (a type of quick-growing tree), including aspen and cottonwoods.

PRAIRIE – a grassland community dominated by grasses and other plants. Trees are uncommon.

PRECOCIAL – referring to young birds that are down-covered and able to move freely when hatched, such as quail or pheasants.

PUPAE – the third (cocoon) stage of complete metamorphosis (life cycle) of an insect.

PYROLA (*twin flower*) – Latin name for a short-stemmed genus of perennial herbs (example: wintergreen).

RADIAL – radiating from the center of a circle or wheel; in Good Oak, Leopold uses it to refer to a split from the center of a tree trunk to the bark.

RAKER TEETH – the teeth of a saw which pull the sawdust out of a kerf (the cut made by a saw).

REFUGE – an area of land and/or water set aside by a governmental agency or private landowner to provide an undisturbed area suitable for wildlife habitat.

RIFFLES – shallows extending across a stream, causing broken water on the surface.

SAND BARRENS – sandy areas with little or no vegetative covering.

SAND COUNTIES – general name for the counties in Central Wisconsin along the Wisconsin River, site of Leopold's "Sand County" farm. This area includes, but is not limited to, Adams, Juneau, Portage, Sauk, and Wood Counties.

SCYTHE – a tool for cutting grain or grass (a sickle).

SILT – particles of earth material between the sizes of clay and sand, often carried and deposited by flowing water.

SKEIN – a flock of geese or similar birds in flight.

SLOUGH – a swamp, marsh, bog or pond, especially as part of a backwater, inlet or bayou.

SMUDGE – slowly burning material that produces smoke to keep mosquitoes and other insects away.

SODDEN MUCK – saturated soil rich in organic material.

SOFTWOOD – cone-bearing trees (conifers) such as pine, fir, and spruce. The term is not related to the actual hardness of the wood.

SOLARIUM – a glass-enclosed room that allows sunshine to enter in this use of the word the area located under briars where woodcock and partridge hide.

SPENT GNAT – a dry fly pattern (brown and yellow) designed to imitate a gnat, mosquito, or other insect as it rests on the surface of the water.

Glossary

TERMINAL BUD – large buds that appear at the end of twigs.

TERMINAL CLUSTER – group of buds at the end of twigs.

TERRESTRIAL – relating to land, as distinct from air or water.

THAW – the period of time in late winter or early spring when snow and ice begin to melt. In “January Thaw,” Leopold describes such a period that began in the middle of winter (in January) and lasted, perhaps, only a brief time, a typical occurrence in the Midwest.

TUNDRA – a treeless plain characteristic of arctic and subarctic regions. The subsoil is permanently frozen.

VELVET (*on antlers*) – the furry skin covering growing antlers on deer and other related animals.

WAHOO – a shrub or small shrubby tree, especially a species also called burning bush or spindle-tree.

WHITE FLAG – the underside of a white-tailed deer’s tail. When frightened, a deer will run away and lift the tail to expose the white hair.

WHITE THROATS – White-throated sparrows (birds) with beautiful high-pitched calls.

WHORL – circular arrangements of leaves or branches. Usually referring to branches formed on some coniferous trees during one year’s growth.

WEED – a plant considered by someone to be out of place or not wanted.

WOODSMANSHIP – knowledge and skills that help a person survive in the wilderness by using what nature provides.

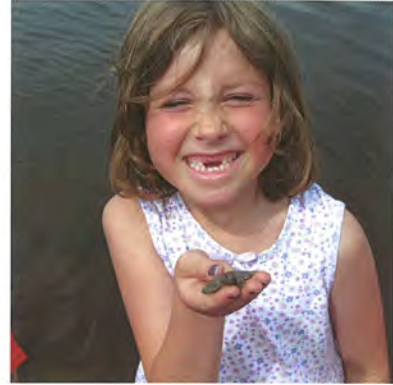
Aldo Leopold Bibliography

ALDO LEOPOLD'S MAJOR WORKS

- Brown, David E. and Carmony, Neil B., eds., 1990. *Aldo Leopold's Southwest*. (Twenty-six early writings). University of New Mexico Press, Albuquerque. Originally published as Aldo Leopold's Wilderness by Stackpole Books.
- Callicott, J. Baird and Freyfogle, Eric T. , eds., 1999. *Aldo Leopold: For the Health of the Land*. (previously unpublished essays and other writings) Island Press/Shearwater Books, Washington DC.
- Flader, Susan and Callicot, J. Baird, eds, 1991. *The River of the Mother of God and Other Essays by Aldo Leopold*. University of Wisconsin Press, Madison.
- Leopold, Aldo. 1933. *Game Management*. Charles Scribner's Sons. Reprinted in 1986 by University of Wisconsin Press, Madison.
- Leopold, Aldo. 1949. *A Sand County Almanac and Sketches Here and There*. Oxford University Press, New York.
- Leopold, Luna B., ed., 1953. *Round River: From the Journals of Aldo Leopold*. Oxford University Press, New York.
- Meine, Curt and Knight, Richard L., eds. 1999. *The Essential Aldo Leopold*. University of Wisconsin Press, Madison.

SELECTED PUBLICATIONS ABOUT ALDO LEOPOLD

- Anderson, Peter. 1995. *Aldo Leopold: American Ecologist*. Franklin Watts/Grolier, New York.
- Callicott, J. Baird, ed., 1987. *Companion to A Sand County Almanac*. University of Wisconsin Press, Madison.
- Dunlap, Julie. 1993. *Aldo Leopold: Living With the Land*. Twenty-First Century Books/Henry Holt, New York.
- Flader, Susan L. 1974. *Thinking Like A Mountain: Aldo Leopold and the Evolution of an Ecological Attitude Toward Deer, Wolves and Forests*. University of Missouri Press, Columbia.
- Lorbiecki, Marybeth. 1996. *A Fierce Green Fire, an illustrated biography*. Falcon Publishing Co., Helena, MT.
- McCabe, Robert. 1987. *Aldo Leopold: The Professor*. Palmer Publications, Amherst, WI.
- McCabe, Robert, ed. 1989. *Aldo Leopold: Mentor*. Department of Wildlife Ecology, University of Wisconsin, Madison.
- Meine, Curt. 1988. *Aldo Leopold: His Life and Work*. University of Wisconsin Press, Madison.
- Ross, John and Beth. 1998. *Prairie Time: The Leopold Reserve Revisited*. University of Wisconsin Press, Madison.
- Tanner, Thomas, ed. 1987. *Aldo Leopold: The Man and His Legacy*. Soil Conservation Society of America, Ankeny, IA.
- Vickery, J.D. 1986. *Wilderness Visionaries*.



The Aldo Leopold Foundation

P.O. Box 77

Baraboo, WI 53913

608.355.0279

608.356.7309 *fax*

mail@aldoleopold.org

www.aldoleopold.org