LEAF

Enriching Students.
Sustaining Forests.

The Wisconsin K-12 Forestry Education Program

Wisconsin K-12 Wildland Fire Lesson Guide

The United States Forest Service provided funding for this project through its

Northeastern Area State and Private Forestry State Fire Assistance Program

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LEAF is a partnership program between

Wisconsin Department of Natural Resources - Division of Forestry

and

Wisconsin Center for Environmental Education

College of Natural Resources
University of Wisconsin-Stevens Point

LEAF - Learning, Experiences, & Activities in Forestry

The Wisconsin K-12 Forestry Education Program

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LEAF was created to help promote forestry education in Wisconsin schools. In 2001, Wisconsin K-12 forestry education stakeholders evaluated the current status of and the needs for Wisconsin-based K-12 forestry education. A variety of programs existed, but voids were identified in delivery and dissemination of educational materials and services. To offer a more unified effort, stakeholders supported the development of a comprehensive program that would enhance existing efforts.

During the spring of 2001, legislation was written to establish the LEAF Program as a partnership between the Wisconsin Department of Natural Resources - Division of Forestry and the Wisconsin Center for Environmental Education at the College of Natural Resources, University of Wisconsin-Stevens Point. Funding for the program is provided through a surcharge on the sale of seedlings from Wisconsin Department of Natural Resources - Division of Forestry nurseries.

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A RATIONALE FOR WILDLAND FIRE EDUCATION IN WISCONSIN

Wildland fire is a major issue that federal, state, and local agencies have to deal with. Nationally, large forested areas of the West and South have burned as a result of drought, hot weather, fuel load, and human carelessness. Here in the Great Lakes Region, our fire regimes, population density, and culture differ from those of the Western and Southern United States. Although historically Wisconsin has experienced major catastrophic fire events, conditions in recent years have limited large-scale fire. Even so, Wisconsin Department of Natural Resources fire crews annually respond to 1,500 fires that burn more than 5,000 acres. Catastrophic fires, such as the Cottonville Fire in Adams County in 2005, still threaten lives, property, and resources.

The wildland/urban interface is increasing in Wisconsin as each year 3,000 new parcels are carved out of existing forestland holdings (based on 2000 to 2005 average). On many of these parcels, homes and cabins are being built. More and more people are moving into forested areas, and estimates predict that housing density in Wisconsin's forested regions will continue to rise. If Wisconsin experiences a large catastrophic fire event, the cost in property alone would be extremely large.

How do most of these fires start? Ninety percent of all wildland fires in Wisconsin are started by humans. As more individuals move into the wildland/urban interface, the number of fires and the possibility for catastrophic fires increase. Burning debris, sparks from equipment such as chain saws and all-terrain vehicles, and campfire/ash disposal are the most common ways that humans cause fire. Each of these modes of fire generation is preventable. Education is necessary to develop an informed and caring citizenry who will take action to prevent useless fires and who support the use of prescribed burning as a management tool.

The LEAF wildland fire materials were created to assist Wisconsin teachers in developing safe and responsible citizens who inhabit or visit wildland areas. The topic of wildland fire has great potential to captivate and interest students. Wildland fires are front-page news events. They are visually and physically powerful natural phenomena with a complex history and a complex role in today's society. Students of all ages tend to be engaged by the awesome nature of wildland fire.

The topic of wildland fire has great potential for integration into many subject areas. The exploration of fire involves hard science disciplines as well as the social sciences. Wildland fire issues are complex, and their resolution requires an understanding of the environment, economics, social policy, and human behavior. The study of wildland fire can help students understand issues in both a landscape and historical context.

When discussing wildland fire, it is very important that both the positive and negative aspects of wildland fire be presented. An understanding of ecological fire (prescribed fire) requires students to use reason and look beyond the danger of fire. This becomes important because the acceptance and use of prescribed fire is necessary to sustain ecosystems and reduce the risk of future catastrophic wildfires.

INTRODUCTION TO THE GUIDE

The ***LEAF Wisconsin K-12 Wildland Fire Lesson Guide*** provides educators with lessons designed to teach students basic wildland fire principles. There is one wildland fire lesson for each unit of the ***LEAF Wisconsin K-12 Forestry Education Lesson Guide*** (K-1, 2-3, 4, 5-6, 7-8, 9-12). Subject areas addressed in the lessons may include English Language Arts, Geography, Health, Mathematics, Science, Social Studies, and Visual Arts. The *Wisconsin Model Academic Standards* were referenced and helped guide the development of the material. The standards, subject areas, and multiple intelligences that each lesson encompasses are listed in the appendix.

The ***LEAF Wildland Fire Lesson Guide*** is based on principles outlined in the ***LEAF Conceptual Guide to K-12 Wildland Fire Education in Wisconsin***. The Conceptual Guide has two main parts – a conceptual framework and a scope and sequence. Together they outline wildland fire education concepts appropriate for Wisconsin's K-12 students and the grade level at which they should be taught. All the information in the Conceptual Guide is organized under four themes – "What Is Wildland Fire?," "Why Is Wildland Fire Important?," "How Do We Manage Wildland Fire?," and "What Is the Future?" (see pages iv to ix).

BACKGROUND SECTION

At the beginning of each lesson in this guide, you will find useful background information for teaching the activities in that lesson. In addition to the lesson-specific background information, this guide contains in-depth wildland fire information on pages 152 to 163. Users of this guide will find the information helpful in expanding personal knowledge of wildland fire science, history, and management.

WEBSITE CONNECTION

Supporting materials for teaching about wildland fire are available on the LEAF website. Resources include full color digital maps and images, in-depth background information, links to web resources, and more. The wildland fire web pages will be updated and enhanced over time, so visit often for the newest materials.

Go to *www.uwsp.edu/leaf* and navigate to the Wildland Fire Resources section.

OTHER LEAF MATERIALS

As Wisconsin's K-12 forestry education program, LEAF's mission is to provide Wisconsin's educators with high quality forestry education materials for use in the classroom and field. This is achieved through workshops, special events, and curriculum consulting.

This ***LEAF Wisconsin K-12 Wildland Fire Lesson Guide*** is a supplement to the ***LEAF Wisconsin K-12 Forestry Education Lesson Guide*** (LEAF Guide). The LEAF Guide is comprised of six grade specific units: K-1, 2-3, 4, 5-6, 7-8, and 9-12. You will find descriptions of the units and lessons on page 178. The LEAF Guide is obtained by participating in a LEAF workshop. Workshop participants receive forestry background information and practical experience using the LEAF Guide. Workshops vary in length and format, sometimes including an option for graduate credit and/or hands-on field experiences.

LEAF WISCONSIN K-12 URBAN FOREST LESSON GUIDE

The *Urban Forest Lesson Guide* uses the places we live to provide a context for understanding forests. Lessons are designed to be used in conjunction with the *LEAF K-12 Forest Lesson Guide*. A section called "LEAF Links" is included in each urban forest lesson and describes when and how to link the urban forest lesson to original LEAF guide lessons.

VISIT OUR WEBSITE AT WWW.UWSP.EDU/LEAF

The LEAF website is a great source for information and resources. On it, you will find:

- Workshops offered
- Information on LEAF special events
- On-line tree identification key
- LEAF lesson enhancements
- Educator opportunities
- On-line publications
- Field experience providers
- School forest information and assistance

LESSON FORMAT

Lesson Grade Level and Title

BIG IDEAS
The subconcepts covered in the lesson as defined by the *LEAF Wildland Fire Conceptual Framework*. (Subconcept Number)

OBJECTIVES
Knowledge and skills students acquire as a result of doing the lesson.

SUBJECT AREAS
List of subjects addressed in the lesson.

LESSON/ACTIVITY TIME
Total time required to complete the lesson and breakdown of time required for each lesson component.

TEACHING SITE
Recommended location for teaching.

NUTSHELL
Brief summary of the lesson.

BACKGROUND INFORMATION
Information that supports, accentuates, and expands on the information addressed in the Procedure.

PROCEDURE
INTRODUCTION
A short discussion or activity that sets the mood for the rest of the lesson.

ACTIVITIES
Step-by-step instructions for the process involved in teaching the concepts.

CONCLUSION
A wrap-up and review of concepts of the lesson.

VOCABULARY
Key terms used or introduced in the lesson.

MATERIALS LIST
Items needed to complete the lesson. Listed as per student, group of students, class, or teacher.

TEACHER PREPARATION
Preparation needed before teaching the lesson.

SAFETY PRECAUTIONS
Necessary precautions to teach the lesson safely.

SUMMATIVE ASSESSMENT
Culminating questions or activities that have students apply learned information or skills to new situations.

REFERENCES
List of materials used in creating the lesson.

RECOMMENDED RESOURCES
Additional books, websites, or materials that will enhance the lesson.

KEY TO SYMBOLS USED THROUGHOUT THE LESSONS
 Teacher Page

 Student Page

 Teacher Page (Key)

9TH-12TH GRADE LESSON
Wildland Fire Issues and Education

NUTSHELL
In this lesson, students conduct research to determine the need for wildland fire education. Students learn about wildland fire issues in Wisconsin through reading a memo and conducting guided Internet research. They discuss and use the scientific method and public opinion surveys as a class. After creating and conducting a survey about wildland fire, the class analyzes the results and discusses their findings and the need for wildland fire education.

BIG IDEAS
- The ignition of wildland fire can be caused by human activity (e.g., debris burning and other outdoor burning, machine sparks, children playing with matches, power lines, fireworks) or natural sources (e.g., lightning, spontaneous combustion). Human activity is responsible for most wildland fires in Wisconsin. (Subconcept 2)
- Current conditions are a result of past events. Decisions about the use of prescribed fire and the suppression of wildland fire affect present and future society. (Subconcept 13)
- Fire can play an important role in the restoration and maintenance of ecosystems. In Wisconsin, periodic fire is an important component of a variety of plant communities. (Subconcept 18)
- Homeowners have a responsibility to protect their property from wildland fire. The location, landscaping, maintenance, and design of a home can influence the threat of wildland fire to residents and their property. (Subconcept 27)
- The wildland/urban interface is an area where human structures exist among wildland fuels. As people move into fire prone areas, the potential for ignition of wildland fire increases, and buildings and other human-made objects become a possible fuel source. (Subconcept 32)
- The use of some wildland fire management techniques (e.g., prescribed fire, construction of firebreaks, forest thinning) can be controversial because of safety issues and aesthetic impact. The use of these techniques is sometimes misunderstood. (Subconcept 33)

OBJECTIVES
Upon completion of this lesson, students will be able to:
- Identify and explain four wildland fire issues in Wisconsin
- List the four steps of the scientific method and explain how and why it is used
- Explain the purpose of a public opinion survey and describe its use

SUBJECT AREAS
English Language Arts, Science, Social Studies

LESSON/ACTIVITY TIME
- Total Lesson Time: 220 minutes
- Time Breakdown:

Introduction	20 minutes
Activity 1	20 minutes
Activity 2	45 minutes
Activity 3	75 minutes + outside class time
Activity 4	45 minutes
Conclusion	15 minutes

TEACHING SITE
Classroom and Computer Lab

MATERIALS LIST

FOR EACH STUDENT

- Copy of Student Page **1**, *Wildland Fire Memo*
- Copy of Student Page **6**, *Public Opinion Survey*
- Copy of Student Page **7**, *Wildland Fire Public Opinion Survey*

FOR EACH STUDENT PAIR (ONE OF THE FOLLOWING)

- Copy of Student Page **2**, *Wildland Fire Topic 1 – Causes of Wildfire in Wisconsin* **OR** Copy of Student Page **3**, *Wildland Fire Topic 2 – Wildland/Urban Interface* **OR** Copy of Student Page **4**, *Wildland Fire Topic 3 – Prescribed Fire* **OR** Copy of Student Page **5**, *Wildland Fire Topic 4 – Protecting Property from Wildfire*

FOR THE TEACHER

- Overhead transparency of Teacher Page **1**, *The Scientific Method*
- Chalk/marker board
- Overhead projector

TEACHER PREPARATION

- Make an overhead transparency of Teacher Page **1**, *The Scientific Method*
- Make computer lab reservations for conducting the web research and analyzing results.

BACKGROUND INFORMATION

Over the past quarter-century, the major causes of wildland fire have remained somewhat constant. During this time, human activity has been responsible for more than 90 percent of all wildland fires. These activities include the burning of debris, sparks from railroad cars, cigarettes, campfires, and more. Many of these fires are due to careless behaviors.

The risk of human-caused fire increases annually as people buy properties in wooded areas on which to recreate or build homes and cabins. More people in "wildland" areas means more potential for human-caused fire. These properties are located in what is referred to as the wildland/urban interface. Many of these properties are in fire prone areas. Loss of life and property is possible in these regions.

It is possible to take measures to better ensure a structure such as a home will survive a wildland fire.

A program known as Firewise (www.firewise.org) promotes measures that save structures. These measures include creating a defensible space around the home, eliminating flammable plants and materials near the structure, and keeping trees and shrubs properly spaced. Many individuals don't believe a wildfire will ever affect them, but losses happen somewhere each year. Education is important to keep the threat in the minds of people and hopefully motivate them to protect their property by taking Firewise measures.

VOCABULARY

Bias: An opinion or belief that strongly favors one side of an issue.

Knowledge: Awareness and understanding of facts.

Likert Scale: A rating system used to determine a person's perception of an issue. For example, a number system from 1-5 is used and "1" indicates a respondent strongly agrees with the statement and "5" indicates a respondent strongly disagrees.

Perception: The feelings, attitudes, views, and judgments that a person has about something or someone.

Phenomenon: An observable fact or event.

Prescribed Fire: A fire used to deliberately burn wildland fuels under specific conditions to meet desired management goals (e.g., fuel management, disease and pest control, wildlife habitat).

Public Opinion Survey: A survey used to measure public understanding and perception of an issue.

Sample Population: The subgroup of a target population that is actually studied.

Sampling: The process of selecting a group of people to be studied from within a larger population being studied.

Scientific Method: A method of research in which a problem is identified or observed, a hypothesis is formulated, and the hypothesis is tested.

Target Population: The group of interest in a research project.

Wildfire: A wildland fire that ignites and spreads without the intent of the landowner.

Wildland Fire: An outdoor fire involving primarily vegetative fuels.

Wildland/Urban Interface: An area where human structures are in close proximity to wildland fuels.

Prescribed fire is used as a management tool to maintain fire dependent ecosystems like prairies and oak savannas and to reduce fuel buildup in forests. These fires are typically conducted by personnel that have training in fire control and suppression. Great care is taken to conduct these fires during periods of lower fire danger and to ensure that they do not spread to other areas. In recent years, prescribed fires in the nation have escaped control and created larger scale wildfires. These high-visibility fires have caused many citizens to fear and oppose the use of prescribed fire. Education on the use and measures taken to contain prescribed fires is important.

For more information on wildland fire, see the Wildland Fire Background starting on page 152.

PUBLIC OPINION SURVEYS

A public opinion survey is conducted by interviewing a random sample of people. A random sample is the result of a process whereby a selection of participants is made from a larger population and each subject is chosen entirely by chance. Two of the most common ways that public opinion polls are completed are by telephone and face-to-face interviews. Other methods include mail, on-line and self-administered surveys.

Using statistical methods, the margin of error can be calculated to provide an estimate of how much the results of the sample may differ from the entire population. Errors in measuring the response may be due to bias in the survey questions. Bias can be caused by flaws in question wording, question order, question response options, and whether all segments of the population have been surveyed. Survey results can be adjusted by weighting results to account for specific population groups that have not responded. Weighting uses known estimates of the total population provided by the Census Bureau to adjust the final results. It's not uncommon to weight data by age, gender, education, race, etc. in order to achieve the correct demographic proportions.

PROCEDURE

INTRODUCTION – WILDLAND FIRE IN WISCONSIN

1. Tell the class that at the current time, wildland fire is a concern of the federal and state governments as well as many agencies and individuals. Ask students to discuss what they know about wildland fire. Lead the discussion to include destructive wildfire (e.g., the Peshtigo Fire in 1871, the Cottonville Fire in 2005) and the use of prescribed fire (e.g., fire ecology, fire dependent communities, Native American use of fire).

2. Tell students that local, state, and federal agencies have been trying to determine the primary causes of some major wildland fire problems. Tell the class you have a classified memo written by a top government fire official. Classified memos (i.e., communications that the author does not expect you to see) can be very enlightening.

   Hand a copy of Student Page **1**, *Wildland Fire Memo* to each student. Give them a few minutes to read the memo and ask questions.

3. Explain to students that during the next few class periods they will try to determine what the public's level of knowledge about wildland fire is and speculate if the knowledge level might affect wildland fire incidence in Wisconsin. Ultimately, they will try to answer the question, "Is wildland fire education necessary?"

ACTIVITY 1 – THE SCIENTIFIC METHOD

1. Tell students that the research they will conduct is based on the scientific method. Place a copy of Teacher Page **1**, *The Scientific Method* on the overhead projector. Have a student read the four steps of the scientific method. They are as follows:

   - Observation to **describe** a phenomenon or group of phenomena
   - Formulation of a hypothesis to **explain** the phenomena
   - Use of the hypothesis to **predict** the results of a new observation (e.g., an experiment)
   - Performance of research to **test** the predictions

2. Ask the class to look at the bold word in each of the four steps (i.e., describe, explain, predict, test). To help them understand the process, tell them that it is quite easy to put the four steps into practice on something that is already common sense.

   Guide them through the following simple example: Ask the class if they have ever been really hungry. Have them **describe** how it feels. *(It feels like my stomach is empty or hollow and I get tired and cranky.)* Have them **explain** why they feel that way. *(I haven't eaten in a while and there is nothing in my stomach.)* In this situation, that is their hypothesis. Ask them how they would stop being hungry. *(I could eat.)* Ask them to **predict** what would happen if they ate. *(The feeling would go away. I would be full, not hungry.)* Ask them how they could **test** this prediction. *(I could eat!)*

3. Emphasize that the challenge of the scientific method is to put it into practice on phenomena that we do not yet understand. Have your class brainstorm some phenomena that we do not fully understand. *(The list can include such things as the cause of the northern lights, the beginning of the universe, the behavior of subatomic particles, the effects of certain drugs, etc.)* Explain that in this case, the phenomenon not yet understood is the extent of people's knowledge about wildland fire in Wisconsin.

4. There are two unanswered questions on Teacher Page **1**, *The Scientific Method*. Discuss and answer the questions as a class. The answers should be similar to the following:

   - **What is the purpose of the scientific method?** The scientific method is the process by which scientists, collectively and over time, try to construct an accurate representation of the world. The scientific method allows scientists to work across cultures and languages to analyze, critique, and improve upon the work of other scientists. The primary objective of the scientific method is to minimize the bias that an individual scientist may have in his or her research.
   - **Who uses the scientific method?** The scientific method is used by all professions that attempt to explain a phenomenon. Phenomena can include such things as violent crime, change in the chemical properties of materials, the flow of money in a community, and cancer. The professionals that explain and predict the phenomena (e.g., sociologists, chemists, economists, doctors) all use the scientific method.

ACTIVITY 2 - WILDLAND FIRE TRENDS

1. Tell the class that in order to conduct research about people's knowledge of wildland fire in Wisconsin, they must first have some background about wildland fire themselves. Explain that they will gather two types of information. The first will be general and the second will be about one of four wildland fire topics that affect people in Wisconsin. Each of these topics has social, economic, and/or ecological concerns related to it. It is their task to use the Internet to investigate and understand the topics. They will need to be able to explain the topic to the rest of the class.

   Explain that the four topics were introduced in the classified memo they read earlier. Have a student read each of the trends aloud to the class (the underlined sections on the memo).

   - **Memo Statement:** Humans cause most of the destructive wildfires in Wisconsin. *Topic 1: Causes of Wildfire in Wisconsin*
   - **Memo Statement:** A growing number of people are building homes in fire prone areas. *Topic 2: Wildland/Urban Interface*
   - **Memo Statement:** There is public resistance to the use of prescribed fire. *Topic 3: Prescribed Fire*
   - **Memo Statement:** People who live in fire prone areas do not always protect their property from wildland fire. *Topic 4: Protecting Property from Wildfire*

2. Pair students and assign each pair to one of the four topics. Be sure that students are evenly distributed among the four topics. Each pair should have access to at least one computer. If each student has a computer, have the pairs sit next to each other in the computer lab. Give each pair a copy of either Student Page **2**, OR Student Page **3**, OR Student Page **4**, OR Student Page **5** for their topic. Have students complete steps one through five.

The web pages students need to access are on the LEAF website. Navigate to *www.leafprogram.org*. Click on the wildland fire section. Navigate to the educator resources for the 9-12 lesson. Each topic has its own page of links for students to follow. **NOTE:** Resources will continue to be added to this section of the LEAF website. As this is done, the navigation structure of the pages may change. Please check the location of the pages needed for this lesson each time you teach it so you can provide students with directions on how to find the pages they need.

Assist students with their research and answer any questions they may have in the process.

3. Once students have completed steps one through five on their student pages, explain that it is now time to conduct research to determine if the hypothesis is correct. Their research will be done through a survey.

ACTIVITY 3 – PUBLIC OPINION SURVEY

1. Tell the class that in conducting their research, they will use a process called public opinion surveying. The process is widely used in many different fields. It is used by corporations to market products to consumers, by hospitals to understand their patients' needs, and by politicians to understand how the public feels about important issues.

   Ask the class if they have ever seen or ever taken a public opinion survey. Allow a few students to provide examples. Ask the class to think of some attributes of a public opinion survey. Answers may include the following:

   - Population
   - Face-to-face interview
   - True/False questions
   - Multiple choice questions
   - Questions with a numbered scale of 1-5 (Likert Scale)
   - Sample size
   - Margin of error
   - Mailed survey
   - Bias
   - Telephone interviews

2. Hand each student a copy of Student Page **6**, *Public Opinion Surveying*. Have different students read each section and discuss the information on the handout. Help students understand the difference between population and sample and stress the importance of avoiding bias. Answer any questions that arise.

3. Have the students get back into the same pairs they were in for their web investigation. Ask students to refer back to the hypothesis they wrote about why the phenomenon they researched is occurring. Have students from each of the four topic groups share their hypothesis with the rest of the class. All hypotheses should relate to the author believing the phenomena are occurring because people are not knowledgeable enough about wildland fire. As a class, choose one hypothesis that the survey questions will address. It should be well-written and represent students' thoughts but still be focused on the author believing the phenomena are occurring because people are not knowledgeable enough about wildland fire. Write the hypothesis on the board. Explain that they will now create questions for a public opinion survey that will study people's level of knowledge about wildland fire in Wisconsin.

4. Tell each pair that they must write two questions about their topic for the public opinion survey. The questions must be true/false questions and must be based on facts they gathered in their research. They can use the notes they took on their student pages as reference. Write guidelines (see the next page for a listing) for creating good survey questions on the board.

Good survey questions ...

- are well-written, use proper English, and contain no slang terms
- do not lead the reader to answer in a certain way
- are based on fact and have only one right or wrong answer (An opinion question such as, "Wisconsin trees are the most beautiful in the fall," is not appropriate. A more appropriate question on the same topic would be, "Some people enjoy looking at Wisconsin trees in the fall because of their colors.")
- cover general information about a topic, not specific or picky details ("Wisconsin's state tree is the sugar maple" is a more appropriate true or false question for a survey of the general public than "School children voted the sugar maple as Wisconsin's state tree in 1893.")

5. Once pairs have finished writing their questions, have all the pairs with the same topic get together in a group. Have each pair share their questions with the rest of the topic group. Tell each topic group that it is their job to choose two questions from all the pairs' questions to put on the final survey. They should work to come to agreement on which questions best represent their topic. Each topic group must then choose one or two spokespeople for the group. They will need to summarize what they learned about their topic for the rest of the class and share the two questions that were chosen.

6. When all the groups have chosen their questions, have the spokespeople for each group summarize their topic and share their questions with the rest of the class. Write each question on the board and have students fill them in on Student Page **7**, *Wildland Fire Public Opinion Survey*.

7. Ask students what the third step in the scientific method is. *(Predicting the results of the experiment.)* It is now time for students to predict how people will answer the survey questions. In their original pairs, have students predict how respondents will answer each question and record this on their topic specific student page (either Student Page **2**, OR **3**, OR **4**, OR **5**).

   The opinion questions for the survey have already been created for students. Have students read through questions nine and 10 and predict what the average answer will be.

8. Tell students it is now time to conduct the survey. Each student must find 10 individuals to interview by tomorrow's class. They should verbally ask people the questions and record the answers on the survey. Explain that if people are allowed to read the survey questions and see other people's answers, it could introduce bias. To decrease bias, they should also try to interview a diverse group of people (e.g., adults, fellow students, relatives, neighbors).

ACTIVITY 4 – ANALYZING RESULTS

1. It is now time to analyze the results of the survey. Have students calculate the percentage response for the true and false answers for each question on their survey using the following equation, where "X" is either true or false.

$$\text{\% of Response for "X"} = \left[\frac{\text{No. of Responses for "X"}}{\text{Total No. of Responses}}\right] \times 100$$

Example: Question 1 had four true responses and six false responses.

(4 ÷ 10) x 100 = 40% True
(6 ÷ 10) x 100 = 60% False

Have students calculate the average response for the Likert Scale questions using the following equation:

Average Response = [(No. of Responses for Likert Scale "1" x 1) + (No. of Responses for Likert Scale "2" x 2) + (No. of Responses for Likert Scale "3" x 3) + (No. of Responses for Likert Scale "4" x 4) + (No. of Responses for Likert Scale "5" x 5)] ÷ Total No. of Responses

Example: Question 1 had two "1" responses, two "2" responses, three "3" responses, one "4" response, and two "5" responses.

[(2 x 1) + (2 x 2) + (3 x 3) + (1 x 4) + (2 x 5)] ÷ 10 = 2.9 (Average Response)

NOTE: The preceding calculations can be done directly in an Excel spreadsheet. If you are using a computer lab, you can have the students build the equations in the spreadsheet.

2. Once the results are compiled, have students get back into their research pairs. Have them compare their results to their predictions and then determine if the results support the class hypothesis. Ask each pair to come up with a reason (i.e., a conclusion) about why the results did or did not support the hypothesis.

3. Have each pair present their results and conclusion to the rest of the class.

CONCLUSION – FINAL DISCUSSION

1. After all the groups have presented, lead a class discussion to outline the conclusions of the survey. Make a list of conclusions on the board. The following questions may help to guide the discussion:

   - How well did people do on the true/false portion of the survey?
   - What were the average responses for the Likert Scale questions?
   - Did your predictions hold up?
   - Do you feel your hypothesis is correct?
   - Based on the survey results, would public education about wildland fire in Wisconsin increase people's knowledge of the issues?
   - Based on the results of this survey, is wildland fire education necessary? Why or why not?

2. Once the conclusions are listed, ask the class if they think that the results of their survey are an accurate representation of the Wisconsin public's opinion. Use the following questions to guide the discussion and introduce the notion of bias.

   - Do the people you surveyed represent all the types of people who make up Wisconsin? Why or why not?
   - Is there bias in this sample? (Is there a diversity of ages, careers, ethnicities, income, etc.?)
   - Do you think that things such as age, income levels, ethnicity, and educational background influence a person's opinions? What else might influence a person's opinions?
   - What types of people are not represented in your survey?
   - What type of sample population do you think would best determine the opinions of the Wisconsin public?
   - How might you select the sample population to minimize bias?
   - What factors, other than knowledge and perception, might influence a person's decisions about wildland fire?

FORESTERS IN THE CLASSROOM

Wisconsin Department of Natural Resources fire personnel make classroom visits. To find a staff member in your county, go on-line to *www.dnr.state.wi.us/staffdir/SearchCounty.asp*, click on your county, and type "fire" into the subject box.

SUMMATIVE ASSESSMENT

Have students write an editorial for the school or local newspaper about wildland fire in Wisconsin and the importance of wildland fire education.

REFERENCES

Polling 101. The Roper Center. World Wide Web: *www.ropercenter.uconn.edu/education/polling_fundamentals.html*.

Pyne, S. J. (1982). Fire in America: A Cultural History of Wildland and Rural Fire. Princeton, NJ: Princeton University Press.

Vogrin, V. (2002, Winter). Fire and Society: A Burning Issue. Clearing, 112, 9-12.

Wisconsin Department of Natural Resources. (2005, April). Spreading like Wildfire: Planning fire prevention as communities grow into wildlands. Wisconsin Natural Resources. PUB FR-309-2005.

RECOMMENDED RESOURCES

ACTIVITY GUIDES

Fire! An Event-based Science Module Student Edition by Russell G. Wright. (White Plains, NY: Dale Seymour Publications, 2001.) Students study the Yellowstone National Park Fire of 1988 to learn about the chemical nature of fire and its ecological effects.

FireWorks Curriculum: Featuring Ponderosa, Lodgepole, and Whitebark Pine Forests by Jane Kapler Smith and Nancy E. McMurray. (Fort Collins, CO: U.S. Department of Agriculture Forest Service, Rocky Mountain Research Station, General Technical Report RMRS-GTR-65, 2000.) The FireWorks Curriculum is a compilation of fire lessons for grades K-10. Some of the information is specific to western fire regimes but many of the activities convey basic information about fire safety and fire behavior that is useful for younger students. A free copy of the curriculum is available at *www.fs.fed.us/rm/pubs/rmrs_gtr65.html*. Workshop participation is required to obtain additional materials needed for some lessons.

Wildland Fire Primer: A Guide for Educators prepared by John Owen and Pat Durland. (Boise, ID: U.S. Department of the Interior Bureau of Land Management, National Interagency Fire Center, 2002.) The Wildland Fire Primer presents the concepts and messages that the National Interagency Fire Center determines necessary for effective wildland fire education.

RECOMMENDED RESOURCES

BOOKS

Fire in America: A Cultural History of Wildland and Rural Fire by Stephen J. Pyne. (University of Washington Press, 1997.) In this book, the author explores the efforts of various American cultures to master wildfire and use it to shape the landscape.

Introduction to Wildland Fire by Stephen J. Pyne. (NY: John Wiley and Sons, 1996.) This book covers the fundamental physics and chemistry of fire, fire behavior, wildland fuels, the interactions of fires and weather, ecological effects of fires, the cultural and institutional framework of fire management, planning efforts for fire management, suppression strategies, prescribed fires, and global fire management.

MAGAZINE

Spreading Like Wildfire: Planning fire prevention as communities grow into wildlands. (*Wisconsin Natural Resources* magazine April 2005, PUB FR-309-2005.) A series of articles related to wildland fire in Wisconsin by DNR staff. Available on-line at: *www.wnrmag.com/supps/2005/apr05/intro.htm*.

WEBSITES

Fire and Aviation Management – National Park Service
www.nps.gov/fire
The U.S. National Park Service offers resources and variety of wildland fire education materials.

Fire and Aviation Management – USDA Forest Service
www.fs.fed.us/fire/
The USDA Forest Service website contains information about fire management and fire ecology.

Firewise Communities
www.firewise.org
Learn about the Firewise program and find educator resources including videos on a variety of topics such as Firewise building practices and the dynamics of wildfire.

National Interagency Fire Center
www.nifc.gov
Find information on current wildfires burning in the U.S., wildland fire statistics, images, educator resources, and much more.

Project Learning Tree – Fire Education
www.plt.org
Navigate to the Special Initiatives section of the Project Learning Tree website to find materials related to fire ecology.

Sampling (statistics) – Wikipedia
http://en.wikipedia.org/wiki/Sampling_(statistics)
Wikipedia has an overview of statistical samplings including definitions and descriptions of various types of sampling.

Wisconsin Department of Natural Resources - Forest Fire Program
http://dnr.wi.gov/org/land/forestry/Fire/
Information related to wildland fire in Wisconsin from the Wisconsin DNR. Includes Firewise information, regulations and permits, prevention information, an overview and photos of suppression equipment, weather indices, and the current fire danger around the state.

www.eFire.org
www.efire.org/
An on-line bookstore for wildland fire education. Find wildfire information, links, resources, and materials for purchase.

THE SCIENTIFIC METHOD

THE 4 STEPS OF THE SCIENTIFIC METHOD

1. Observation to **DESCRIBE** a phenomenon or group of phenomena.
2. Formulation of a hypothesis to **EXPLAIN** the phenomenon.
3. Use of the hypothesis to **PREDICT** the results of a new observation (e.g., an experiment).
4. Performance of research to **TEST** the predictions.

What is the purpose of the Scientific Method?

Who uses the Scientific Method?

WILDLAND FIRE MEMO

Dear CLASSIFIED,

I am writing in response to your memo #132. To begin, I agree that it seems ironic that for much of the 20th century, societies have done everything possible to stop wildland fires in the name of fear and progress. Yet today, people are the major cause of destructive wildfire. I do not agree that people do this purposely. It is obvious that most of these fires are unintentional. They are caused by common activities such as outdoor burning, the use of machinery, misuse of matches, etc.

This begs the question, “Are people poorly educated about this issue, are we uncaring, or are we both?”

It is my experience that education must be a central strategy in stopping destructive wildfire and promoting beneficial fire through prescribed burning. If we look at four major wildland fire trends, it may be that lack of knowledge is the main cause.

1. **Humans cause most of the destructive wildfires in Wisconsin.**
   It is obvious to me that education is a major factor here. The question that needs to be answered is, “Is lack of knowledge the only cause?” Even if people knew that their actions could cause a destructive wildfire, would they stop? What is their perception of the risk of outdoor burning or playing with fireworks? Are some of these activities (like machinery use and smoking) things that people feel they need to do regardless of the consequences?

2. **A growing number of people are building homes in fire prone areas.**
   Many forested areas have a fire history. Every one hundred years or so, a fire burns through the forest and it regenerates. Many forests are overdue for fire – meaning, it is only a matter of time before a fire occurs. Surprisingly, people are building houses in these forests. In these wildland/urban interface areas there is an increased potential for loss of life and property. What, besides lack of knowledge, would cause this behavior?

3. **There is public resistance to the use of prescribed fire.**
   Because of our 60-year history of stopping all wildland fire, many ecosystems that depend on fire have been damaged. Animal and plant habitat has been lost and fuels have built up to dangerous levels. The use of prescribed fire by experienced land managers can renew ecosystems and prevent fuel buildup. Yet, people do not seem to understand the difference between this helpful type of fire and destructive wildfire. Lack of knowledge must be a factor.

4. **People who live in fire prone areas do not always protect their property from wildland fire.**
   When people chose to live in areas known to be at high risk for wildland fire they could take measures to protect their home and property from destruction. There are even special programs designed to teach them about their options. Why doesn’t everyone take advantage of opportunities to protect their property from wildland fire? If they knew there were reasons to protect their property and that there were programs to help them do so, would they?

I suggest that we research the importance of education in these issues. That is to say, we need to know the answer to the question, “Is wildland fire education necessary?” I think a public opinion survey would do the trick, but I’ll leave the details up to you.

Best regards,

WILDLAND FIRE TOPIC 1
CAUSES OF WILDFIRE IN WISCONSIN

1. **Go to the website given by your teacher.**
2. **Read the general information about wildland fire in Wisconsin.**
3. **Explore the web links to learn about causes of wildfire in Wisconsin.** As you explore the links, answer these questions:

   a. What are the major causes of wildfire in Wisconsin? _____
   _____
   _____

   b. What is being done to prevent these causes? _____
   _____
   _____

   Remember, you will need to present information about your topic to the rest of the class. Take some notes about the topic that will help you summarize the information for the rest of the class.

4. **DESCRIBE the phenomenon,** "Humans cause most of the destructive wildfires in Wisconsin."
   _____
   _____
   _____
   _____

5. **Based on information from the classified memo, what hypothesis do you think the author would formulate to EXPLAIN why the phenomenon is occurring?**_____
   _____
   _____
   _____
   _____

••• STOP here until you are given further instructions. •••

6. **Write two true/false questions about the causes of wildfire in Wisconsin for the public opinion survey.**

   a. _____
   _____
   _____

   b. _____
   _____
   _____

7. **PREDICT how the majority of people will respond to the survey questions.**

1. True | False	4. True | False	7. True | False	9. 1 | 2 | 3 | 4 | 5
2. True | False	5. True | False	8. True | False	10. 1 | 2 | 3 | 4 | 5
3. True | False	6. True | False		

WILDLAND FIRE TOPIC 2
WILDLAND/URBAN INTERFACE

1. **Go to the website given by your teacher.**
2. **Read the general information about wildland fire in Wisconsin.**
3. **Explore the web links to learn about the wildland/urban interface.** As you explore the links, answer these questions:

   a. What is the wildland/urban interface? _____
   _____
   _____

   b. How does the wildland/urban interface relate to wildfire in Wisconsin? _____
   _____
   _____

   Remember, you will need to present information about your topic to the rest of the class. Take some notes about the topic that will help you summarize the information for the rest of the class.

4. **DESCRIBE the phenomenon,** "A growing number of people are building homes in fire prone areas."
   _____
   _____
   _____
   _____

5. **Based on information from the classified memo, what hypothesis do you think the author would formulate to EXPLAIN why the phenomenon is occurring?** _____
   _____
   _____
   _____
   _____

••• STOP here until you are given further instructions. •••

6. **Write two true/false questions about the causes of wildfire in Wisconsin for the public opinion survey.**

   a. _____
   _____
   _____

   b. _____
   _____
   _____

7. **PREDICT how the majority of people will respond to the survey questions.**

1. True | False	4. True | False	7. True | False	9. 1 | 2 | 3 | 4 | 5
2. True | False	5. True | False	8. True | False	10. 1 | 2 | 3 | 4 | 5
3. True | False	6. True | False		

WILDLAND FIRE TOPIC 3
PRESCRIBED FIRE

1. **Go to the website given by your teacher.**
2. **Read the general information about wildland fire in Wisconsin.**
3. **Explore the web links to learn about prescribed wildfire.** As you explore the links, answer these questions:

   a. What are the benefits of prescribed fire? _____
   _____
   _____

   b. Why might some people have a negative view of prescribed fire? _____
   _____
   _____

   Remember, you will need to present information about your topic to the rest of the class. Take some notes about the topic that will help you summarize the information for the rest of the class.

4. **DESCRIBE the phenomenon,** "People misunderstand the use and benefit of prescribed fire."
   _____
   _____
   _____
   _____

5. **Based on information from the classified memo, what hypothesis do you think the author would formulate to EXPLAIN why the phenomenon is occurring?** _____
   _____
   _____
   _____
   _____

••• STOP here until you are given further instructions. •••

6. **Write two true/false questions about the causes of wildfire in Wisconsin for the public opinion survey.**

   a. _____
   _____
   _____

   b. _____
   _____
   _____

7. **PREDICT how the majority of people will respond to the survey questions.**

1. True | False	4. True | False	7. True | False	9. 1 | 2 | 3 | 4 | 5
2. True | False	5. True | False	8. True | False	10. 1 | 2 | 3 | 4 | 5
3. True | False	6. True | False		

WILDLAND FIRE TOPIC 4
PROTECTING PROPERTY FROM WILDFIRE

1. **Go to the website given by your teacher.**
2. **Read the general information about wildland fire in Wisconsin.**
3. **Explore the web links to learn about protecting property from wildfire.** As you explore the links, answer these questions:

   a. How can property be protected from wildfire? _____
   _____
   _____

   b. Why might people not take steps to protect their property from wildfire? _____
   _____
   _____

   Remember, you will need to present information about your topic to the rest of the class. Take some notes about the topic that will help you summarize the information for the rest of the class.

4. **DESCRIBE the phenomenon,** "People who live in fire prone areas do not always protect their property from wildland fire." _____
   _____
   _____
   _____

5. **Based on information from the classified memo, what hypothesis do you think the author would formulate to EXPLAIN why the phenomenon is occurring?** _____
   _____
   _____
   _____
   _____

••• STOP here until you are given further instructions. •••

6. **Write two true/false questions about the causes of wildfire in Wisconsin for the public opinion survey.**

   a. _____
   _____
   _____

   b. _____
   _____
   _____

7. **PREDICT how the majority of people will respond to the survey questions.**

1. True | False	4. True | False	7. True | False	9. 1 | 2 | 3 | 4 | 5
2. True | False	5. True | False	8. True | False	10. 1 | 2 | 3 | 4 | 5
3. True | False	6. True | False		

PUBLIC OPINION SURVEY

SURVEYING

PURPOSE

To determine public understanding of a specific issue and determine public perception of the issue's importance.

OPINION = KNOWLEDGE + PERCEPTION

Public opinion has two components – knowledge and perception.

- *Knowledge* is the awareness and understanding of facts. To determine public knowledge, surveys pose questions based on factual information. This type of question has both a correct and incorrect answer.
- *Perception* can be defined as the feelings, attitudes, views, and judgments that a person has about the world around them. To determine how a person perceives an issue, surveys commonly allow respondents to rank the importance of an issue and rate their level of agreement with a specific statement.

TYPES OF QUESTIONS

- *True/False Questions* present respondents with the option of describing a statement as correct or incorrect. True/False questions are used to determine a respondent's knowledge about the facts surrounding an issue.
- *Likert Scale Questions* present respondents with the option of rating their agreement with a statement. Likert questions use a number system from 1 to 5. "1" indicates that a respondent strongly agrees with the statement, "2" indicates they agree, "3" indicates a neutral response, "4" indicates that they disagree, and "5" indicates they strongly disagree. Likert questions are used to determine a respondent's perception of an issue.

SAMPLING

PURPOSE

The purpose of sampling is to identify a group of people who accurately represents the population that you are studying. It is often impractical if not impossible to survey an entire population. Sampling allows researchers to survey a smaller group within the population and make accurate conclusions.

TARGET POPULATION

The target population is the group you are studying. The group can be as large as the American public or as small as the students in a classroom.

SAMPLE POPULATION

The sample population is the part of the target population that is actually studied. The sample population should be selected to avoid bias.

BIAS

Inaccuracy of research results may be caused by flaws in research methods. Bias is an opinion or belief that strongly favors one side of an issue. Bias can occur in the sample population if it does not represent the target population. Bias can also be caused by factors in the survey itself, including choice of words, sentence structure, and the sequence of questions.

WILDLAND FIRE PUBLIC OPINION SURVEY

INSTRUCTIONS (read to survey respondent): "As I read each statement, please choose true or false."

QUESTION	Respondent 1	Respondent 2	Respondent 3	Respondent 4	Respondent 5	Respondent 6	Respondent 7	Respondent 8	Respondent 9	Respondent 10
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										

INSTRUCTIONS (read to survey respondent): "For each statement, please choose a number between 1 and 5 to indicate how you feel about it. The numbers indicate the following: 1 = Strongly Agree, 2 = Agree, 3 = Neutral, 4 = Disagree, 5 = Strongly Disagree."

QUESTION	Respondent 1	Respondent 2	Respondent 3	Respondent 4	Respondent 5	Respondent 6	Respondent 7	Respondent 8	Respondent 9	Respondent 10
9. Wildland fire education is important for Wisconsin residents. (1, 2, 3, 4, or 5)										
10. I support the use of taxpayer dollars for wildland fire education for Wisconsin residents. (1, 2, 3, 4, or 5)										

WILDLAND FIRE BACKGROUND

DEFINING WILDLAND FIRE

THE TWO SIDES OF WILDLAND FIRE

Wildland fire includes two types of fire – wildfire and prescribed fire. Wisconsin **wildfires** can start through human causes such as debris burning or arson, or through natural causes such as lightning. Naturally caused wildfires are somewhat rare in Wisconsin, with most wildfires resulting from human activities. Wildfires can take lives, destroy homes and property, and leave charred landscapes. Although not planned by the landowner, wildfire can also have positive effects by helping to maintain fire dependent ecosystems.

Prescribed fires are used to mimic ecological or "natural" fires that have been part of ecosystems throughout history. Prescribed fires are ignited and controlled by land managers. When used safely and correctly they produce outcomes desired by landowners. The outcomes can include such things as restoring animal habitat, reducing fuels to prevent dangerous wildfires, and controlling pests and diseases.

COMBUSTION

Combustion is the act of burning and is a form of oxidation. Oxidation occurs when oxygen is combined with another substance. The rusting of iron ($2Fe + 3O_2 = Fe_2O_3$ + energy) is an example of oxidation. The combustion of gasoline ($2C_8H_{18} + 25O_2 = 16CO_2 + 18H_2O$ + energy) is also oxidation. As you can see in the equation, the combustion of gasoline releases energy. The energy is released from the breaking of the carbon-hydrogen bonds that hold organic compounds together. The energy released is the heat we feel when a fire burns.

Combustion can also be viewed as the opposite of photosynthesis. In photosynthesis, plants create energy from sunlight by combining water and carbon dioxide to make sugar and oxygen ($6CO_2 + 6H_2O = 6H_{12}O_6 + 6O_2$). In combustion, the sugars are broken down. The energy is released as heat, and CO_2 and H_2O are the major components of smoke.

It is important to keep in mind that this is a very simple understanding of combustion and that thousands of chemical reactions are taking place during a wildland fire. But, put simply, the heat from a fire can be seen as the same energy that plants took from the sun. Photosynthesis and combustion (as well as respiration) are the major parts of the carbon cycle – a cycle essential to all life on earth.

THE FIRE TRIANGLE

Fire behavior can be defined as the manner in which fire reacts to the environment. For fire to ignite and spread, three elements must be present – heat, fuel, and oxygen. There must be heat to start and continue the combustion process, fuel to burn, and oxygen to facilitate combustion. The three elements can be seen as sides of the fire triangle. If any one of the sides is removed, the fire will extinguish.

HEAT TRANSFER

For fire to spread, heat must move from one piece of burning fuel to another. This movement is called **heat transfer**. Heat is transferred by **radiation**, **convection**, and **conduction**. Radiant heat is heat that travels in a wave. It is the heat that warms you as you sit near a campfire or a warm stove. Convection heat is heat that moves as heated air or gas. It is the heat that rises off of a campfire or above a boiling pot of water. Conduction is heat that moves through a material. Think of a metal spoon as it comes out of a hot cup of tea. Each type of heat transfer can warm, dry, and ignite fuels.

FUEL CHARACTERISTICS

Fuel characteristics determine how intense a wildland fire burns and how far it spreads. These characteristics include the type of fuel, its chemistry, size, and shape. The quantity of fuel and the way it is arranged also influence fire behavior.

Examples of fuel include trees and tree litter, grass, shrubs, and logging slash. Light fuels, such as grass, burn very fast and hot, while heavy fuels, such as logging slash, burn for long periods of time. Light fuels dry much faster. Their moisture varies throughout the day as temperature, humidity, and wind speed changes. Often the fire danger increases during the day and decreases as night approaches.

Often, the most dangerous characteristic of fuel can be the arrangement. Fire can occur as **ground fire** (burning organic material in the soil), as **surface fire** (burning the fuels found directly on the surface of the earth), and as **crown fire** (fire that moves through the tops of trees). Fuels that reach from the ground to the crowns of trees are called **ladder fuels**. Ladder fuels can cause fire to escalate from a surface fire to a crown fire. When fire enters the crowns of trees, it becomes very dangerous and uncontrollable.

WEATHER AND TOPOGRAPHY

Weather and topography are major influences on fire behavior. Weather is constantly changing because of local, regional, and continental influences – making it difficult to predict fire behavior. Weather influences can dry fuels and cause fire to spread. The three most common weather characteristics that determine when fire danger is high are moisture in the air, temperature, and wind. As precipitation and humidity decrease, fuels become more susceptible to fire. High temperatures and winds can quickly dry fuels and feed flames.

Fuel arrangement and weather patterns are influenced by topography. The landscape can influence which fuels get direct sunlight, which fuels receive more moisture from rainfall, and which areas have more exposure to wind. Landscape features can also channel wind currents, causing extreme changes in fire behavior. Heat travels upward and can preheat and ignite fuels, causing fire to move very quickly up slopes.

EXTREME FIRE BEHAVIOR

Extreme fire behavior creates very dangerous fire situations. It can lead to wildfires that may be unpredictable and uncontrollable. Extreme fire behaviors include torching, crowning, and spotting. **Torching** occurs when a surface fire ignites the crowns of individual trees and shrubs as it advances. This type of fire is spread by an advancing surface fire. **Crowning** occurs when a fire moves into the crowns of trees. **Spotting** occurs as fires produce sparks or embers that are carried away from the fire by convection or wind currents. Spots occur as new fires start outside of the original fire area, usually ahead of the advancing fire.

THE FIRE SEASON

In Wisconsin, most dangerous wildfires occur during the months of March, April, and May. This time of year, known as the **fire season**, is especially dangerous because much of the landscape is absent of living plants, and trees have not yet grown leaves. Green plant material helps maintain moisture levels on the ground, in the shrub layer, and in the forest canopy. Without green plants, dry climate conditions, winds, and increasing temperatures can quickly dry plant material found in grassy and forested areas, creating dangerous fire conditions.

Spring is not the only time of year people in Wisconsin need to be cautious of wildfire. Dry spells throughout summer and fall can also lead to dangerous fire situations. Dangerous fire situations occur when **relative humidity** is low, winds are strong and/or constant, temperatures are high, and fuels are readily available to burn. Fire conditions are constantly monitored by the U.S. Forest Service and the Wisconsin Department of Natural Resources - Division of Forestry. (At the time of printing, the following websites contained up-to-date information on fire conditions – *http://activefiremaps.fs.fed.us* and *www.dnr.state.wi.us/org/land/forestry/Fire/index.htm*.)

FIRE ECOLOGY

Wildland fire harms some species and benefits others, while some species remain unaffected. The interaction between fire and different species causes short and long-term changes in ecosystem functions, forest structure, and ecosystem composition.

Wildland fire influences **ecosystem functions**. Ecosystem functions support life. They include the fixation of energy, the flow of energy through food webs, and the cycling of matter. A very hot fire can remove seed sources and sterilize soil. In such cases, it may take years for a forest to return. A wildland fire that is less extreme can mineralize (decompose) organic material such as leaves, sticks, and logs very quickly – making nutrients available to plants. The process of decomposition that normally occurs on the forest floor can take years, and even decades, without wildland fire. Wildland fire can clear forest trees, shrubs, and other organic material. This increases sunlight penetration and stimulates plant growth, fixing energy into an ecosystem through photosynthesis.

New plant growth after wildland fire provides food to many types of animals. Food webs can be dramatically altered by wildland fire.

Wildland fire changes **forest structure**. Forest structure is the vertical and horizontal spacing of trees in a forest. Vertical layers are the overstory and the understory. Horizontal spacing is the density of tree cover across the landscape. The overstory consists of the largest trees in the forest that capture direct sunlight. The understory consists of smaller trees, shrubs, and herbaceous plants. Below the understory is the leaf litter and the topmost, organic-rich soil layer known as duff. All aspects of forest structure can be altered by wildland fire. For example, over time, fire could change a dense mixed hardwood forest into an oak savanna with widely spaced trees and a grassy understory.

Wildland fire changes the **composition** of an ecosystem. The type and distribution of plants and animals in an area is altered by wildland fire. Many plants cannot survive wildland fire. Maple species are a good examples of plants that cannot survive fire. Plants can also be resistant or resilient to wildland fire. A good example of a resistant plant is a large oak tree. The thick bark on an oak tree protects the living **cambium** from fire's heat. When many other trees and plants die in a wildland fire, large oak trees will remain. Another good example of a resilient plant is a jack pine tree. Wildland fires often destroy entire jack pine stands. Individual jack pine trees cannot survive the heat of a wildland fire. However, jack pine cones open and release seeds during periods of high heat ensuring that jack pine trees will recolonize after a fire.

In general, wildland fire in Wisconsin influences ecosystems in predictable ways. The following summaries of ecosystem responses to fire apply to ecosystems in Wisconsin that are fire dependent and fire tolerant. Though there are often exceptions, the summaries are very useful for understanding the ecological role of fire.

FIRE EFFECTS ON VEGETATION

- Increase in species diversity.
- Increase in biomass production.
- Short-term increase in annual and biennial species.
- Increase in flower, seed, fruit, or nut production.
- Improved forage quality, both in nutrition and palatability.
- Long-term shift in dominance away from plants with most of their biomass above ground to plants with most of their biomass below ground.

FIRE EFFECTS ON ANIMALS

- Initial drop in numbers and species resulting from mortality among invertebrates, reptiles, and small mammals.
- Eventual increase in animal numbers and species resulting from the increase of plant productivity and improved habitat structure.
- Should a species be totally removed or driven out from a site after a fire, it will recover only if individuals from another site are close enough to recolonize it.

FIRE EFFECTS ON SOIL

- Reduction in litter, duff, and humus layers above the mineral soil surface, resulting in warmer soil temperatures.
- Increase in fertility and organic matter within the mineral soil resulting from increased plant root and soil microorganism activity.

WISCONSIN FIRE DEPENDENT ECOSYSTEMS

Fire has been an important part of forest and grassland ecosystems in central and eastern North America for 25 to 30 million years. Many plants and animals have adapted to survive and flourish after wildland fires. For the past five to six thousand years, half the state of Wisconsin has been covered by fire dependent and fire tolerant ecosystems such as prairies, sedge meadows, oak savannas, and pine barrens. Periodic distributed fire has created a mosaic of ecosystems across the landscape – with some ecosystems isolated from wildland fire and others periodically exposed. Wisconsin's ecosystem diversity depends on the periodic occurrence of wildland fire. For more information on specific Wisconsin fire dependent ecosystems, see the LEAF website fire section at *www.leafprogram.org*.

WILDLAND FIRE AND SOCIETY

HUMANS AND FIRE

For wildfires to occur, a source of ignition is needed. In Wisconsin, human activities cause the majority of wildfire ignitions. On average, 97 percent of wildfires each year in Wisconsin are caused by humans. Outdoor burning, sparks from railroads, machinery, and many individual and group activities that occur in rural, forested or grassland areas can cause accidental wildfires. Often these activities involve fireworks, campfires, off-road vehicles, and use of gas-powered tools such as lawnmowers and chain saws. In some instances, wildfires are caused by natural sources such as lightning and microbial activity.

FIRE REGIMES

Regions in Wisconsin differ in **climate**, **topography**, **land cover**, **land use**, and land use history. These differences create distinct fire regimes. A **fire regime** is a cultural and biological system that defines the distribution, intensity, and frequency of fires in a given area. As suggested by the definition, there are two components to a fire regime – human activity and natural processes.

Both human and natural influences change over time. Forest **succession** and **climate change** are examples of natural processes that cause changes on the landscape over time. **Species introduction** and **land conversion** are examples of human activities that cause change.

The relationship between humans and the landscape is complex. It is well understood that today's human activities will influence future fire regimes. We are currently living in fire regimes shaped by the activities of human populations that came before us. An understanding of fire regimes, including both natural and human history, is necessary to manage ecosystems and to reduce the risk of catastrophic fire.

WISCONSIN'S HUMAN FIRE HISTORY

After the recession of the last glaciers, approximately 10,000 years ago, Native American populations migrated into Wisconsin. By the late 1400s, Wisconsin's native population was estimated at 60,000 people. Native people used fire to corral and hunt animals, to create animal habitat, and to clear areas for agriculture. These fires played a partial role in influencing Wisconsin's land cover. In the south, these fires expanded grasslands, prairies, and savannas. In the north, the many small fires cleared trees and shrubs, making way for sun-loving trees and plants. This expanded the patchwork of tree stands with different ages, structures, and compositions that were common across northern Wisconsin.

As European settlers moved to Wisconsin, they began to log, farm, and build towns. The widespread logging in the north and the conversion of the prairies in the south changed the fire regimes. In the north, many small fires were allowed to burn by populations who felt that as long as the fires weren't near their homes, they were only helping clear more farmland. On occasion, the small fires turned into large, intense fires fueled by the dead trees and slash left behind after logging. The extent and intensity of the fires was much greater than the fires started by Native American populations.

The most significant fire in Wisconsin's history was the Peshtigo Fire of 1871 that burned in Wisconsin and Michigan. The fire killed as many as 1,500 people and burned 1.5 million acres. In 1887, a wildfire nearly wiped out the city of Marshfield. In 1894, the Comstock Fire burned 64,000 acres in Barron and Washburn Counties, and the Phillips Fire burned 100,000 acres in Price County. Many other larger fires ravaged the state during this time, but the only documentation is in survey notes, personal journals, and newspaper clippings. Prior to 1930, it is estimated that some 2,500 fires burned half-a-million acres each year.

In the southern part of Wisconsin, the occurrence of fire was reduced due to agriculture. The conversion of land to agriculture and the decrease in fire reduced habitat for many of the large animals that lived in southern Wisconsin at the time. Bison, elk, and cougar that depended on the grasslands, prairies, and savannas were **extirpated** from the landscape.

With the hiring of E. M. Griffith as superintendent of forestry in Wisconsin in 1904, fire control efforts began in earnest. In 1905, Griffith appointed 249 town fire wardens around the state. Over the next 50 years, federal and state agencies, as well as county governments, developed the infrastructure for statewide fire control. A cooperative system of fire towers, radio communications, chartered aircraft, plows, tankers, and paid and volunteer fire fighters was put into place. Through the 1920s, 1930s, and 1940s, fire control efforts gained another powerful tool – fire prevention. In 1944, scattered prevention efforts were unified and nationalized with the use of Smokey Bear. His story and message helped fire prevention and control efforts become more effective.

Today, it is accepted that the effectiveness of fire prevention and suppression has had an impact on forest and grassland ecosystems that depend on fire to maintain their existence. Forest and grassland ecosystems that depend on fire have been severely reduced in size. Periodic fire thins many forests by clearing small trees and shrubs. In the absence of fire, some forests have grown thick with small trees that can fuel very intense wildfires.

In recent years, forest management has proven to be an effective way to reduce fuel buildup and decrease the risk of catastrophic fire. Prescribed fire has been shown to be a safe way to reduce fuel buildup as well as manage fire dependent ecosystems. The safe and correct use of prescribed fire and forest management is increasing, but their benefits are often unknown or misunderstood by the public.

THE COTTONVILLE FIRE

On May 5, 2005, Wisconsin's largest wildland fire in 25 years burned in Adams County, Wisconsin. Since 1932, there have been 41 major fires in the Adams County area. Jack and red pine cover much of this area and are extremely flammable during low moisture periods. Ignition of the fire was started by a human who was burning debris during a dry, warm, and windy day. The fire escaped his control and spread for 11 hours. The fire burned 3,410 acres, 30 homes, 60 outbuildings, and millions of dollars worth of timber. Suppression costs of the fire alone cost more than $287,000. This fire may have been avoided if the individual had followed the guidelines listed on the burning permit he was issued.

WILDLAND FIRE MANAGEMENT

AGENCIES RESPONSIBLE

In Wisconsin, wildland fire management is achieved through cooperation among Wisconsin citizens and municipal, county, state, and federal agencies. The cooperation of local police and fire departments with state and national agencies is essential to wildfire control. In Wisconsin, local fire departments, the Wisconsin Department of Natural Resources, the U.S. Forest Service, the U.S. Fish and Wildlife Service, and agencies from neighboring states all cooperate to manage wildland fire. All these agencies depend on funding from local, state, and federal taxes.

Wildland fire management uses the principles of fire behavior and an understanding of human fire practices to eliminate unwanted fires and promote beneficial ones. The goal of wildland fire management can be cultural (e.g., to protect historic sites from wildfire), ecological (e.g., to use controlled fire to maintain animal habitat), and economic (e.g., to protect property).

WILDFIRE PREVENTION

Wildfire prevention is a strategy used to reduce damage from fire through education, engineering, and enforcement methods. These fundamental steps help prevent accidental ignitions and reduce fire **risks** and **hazards**.

For more than 50 years, Smokey Bear has been at the forefront of wildfire education. Though the Smokey Bear prevention programs are the most visible, many other fire prevention programs exist for K-12 students. A variety of state and national agencies have developed educational materials that advance fire safety messages, help students understand fire ecology, promote the benefits of prescribed fire, and advertise career opportunities in wildland fire management.

It is important that both children and adults understand that outdoor fires can ignite and spread very rapidly. Throughout Wisconsin's history, many destructive fires were started accidentally and grew quickly beyond the control of citizens and sometimes even firefighters. The Cottonville Fire in May of 2005 is a modern example of an accidental ignition, attempted control by a landowner, and a fire that grew rapidly out of control.

Education and engineering methods are used in tandem to protect communities from the risks of wildfire. The Firewise Communities program has been very successful in educating homeowners about the proper location, construction, and landscaping of homes to reduce the risks of wildland fire.

The state of Wisconsin enforces forest fire regulations and restrictions. The regulations make the following activities unlawful:

- Burning without a permit, if required
- Burning materials other than wood, leaves, brush, grass, cardboard, and dry paper
- Failure to extinguish fires
- Allowing fire to escape
- Arson
- Destruction of property
- Negligent handling of burning material

Burning debris is the number one cause of accidental fire in Wisconsin. Burning permits are required in many parts of the state to conduct outdoor burning. Burning permits are free and can be obtained by contacting a local DNR office, emergency fire warden, or local fire official.

WILDFIRE SUPPRESSION

Wildfire suppression involves both **presuppression** activities and the active **suppression** of unwanted fire. Without presuppression preparation, the control of wildfire can be difficult or impossible.

Presuppression activities are conducted to reduce wildfire risk and prepare fire suppression forces. Presuppression activities include the construction and maintenance of roads, airports, and water infrastructure, the training of fire suppression teams, the management of fire prone forests, and the development and testing of suppression equipment.

When a wildfire occurs, fire suppression forces act to protect human life, property, and natural resources – in that order of priority. To accomplish these goals, fire suppression teams use three main strategies – evacuation, fire containment, and structural protection.

Evacuation is conducted to protect human life in and around a fire area. The first evacuation priority is to evacuate people from the fire area and fire path. In many instances wildfires have already engulfed or are threatening homes as firefighters arrive on the scene. Evacuation is often difficult because people do not want to leave their possessions. Fire evacuation requires that an area be designated and maintained to supply evacuees with food, shelter, and information. The shelter is often the area where officials communicate with local residents. To ensure the safety of local residents, news media, and sightseers, the fire perimeter needs to be secured. Local and state police often post officers at all entry roads into a fire area.

As evacuation efforts begin, an incident command center is established to coordinate fire suppression resources and provide information to the news media. Fire suppression teams then plan and initiate fire containment strategies to slow and stop the spread of wildfire. In Wisconsin, a widely used fire containment strategy is fuelbreak construction. Creating a “fuelbreak” or “fireline” involves removing the flammable organic matter found on or near the surface of the ground (e.g., plants, leaves, sticks, and black soil) to expose the mineral soil. Surface fires do not spread in mineral soil. Breaks are constructed to contain the lateral spread of fire. They can be constructed by crews using specialized hand tools or with heavy equipment.

Fire containment also involves the use of water and fuel reduction. The application of water reduces fuel temperatures and limits the oxygen available to a fire. Water can be applied on or in front of the fire using aircraft, heavy trucks, pumps from nearby water sources, and backpack water cans. Removing fuels in front of a fire reduces the fire intensity and improves the effectiveness of water use and line construction.

Fuels can be removed by clearing vegetation, but are also removed by lighting surface fires in the wildfire path. The fires burn away much of the ground level fuel, and when lit correctly, can deprive the wildfire of oxygen.

In tandem with evacuation, fire suppression crews protect structures, placing priority on homes and other buildings that have adequate defensible space. Suppression crews create breaks around structures and apply water from aerial drops by airplanes, heavy trucks, or local water sources. The effectiveness of structural protection depends on building and landscape design, housing patterns, and the intensity and behavior of the fire.

PRESCRIBED FIRE

Prescribed fire is an effective management tool that land managers can use to manipulate vegetation. Fire can be used to create and maintain animal habitat and reduce the risk of wildfire from an overabundance of fuels.

Prescribed fire is essential to the health of many Wisconsin ecosystems. For the 5,000 years prior to European settlement, half the state was covered by fire dependent ecosystems. Today, though, there is a higher frequency of fires and the size of the fires is much smaller, averaging about 10 acres in size. Wisconsin's pre-European history was characterized by infrequent, but very large fires (often greater than 10,000 acres). The large fires sustained ecosystems such as prairies and oak savannas.

Aggressive fire suppression policies protect property and investments and make much of Wisconsin's landscape safe for homes and businesses. This has come at a cost to native ecosystems. As fire has been removed from the landscape, ecosystems have changed, often limiting habitat for certain plants and animals and creating dangerous fire conditions due to the buildup of fuels.

In Wisconsin, an estimated 12,000 to 22,000 acres are purposefully burned using prescribed fire each year. By controlling the timing, frequency, and intensity of fire, fire managers have shown that they can create and sustain fire dependent ecosystems. Through rigorous safety precautions such as monitoring weather and fuel conditions, notifying adjacent landowners, and having suppression crews on-hand, fire managers have shown that prescribed fire is also very safe.

THE WILDLAND/URBAN INTERFACE

Over the last few decades, more and more people have abandoned city and suburban living for a more rural setting. In Wisconsin, new rural houses serve as permanent or seasonal homes and are often found in forested areas. Unfortunately, not everyone adapts to the fire danger that exists in wildland areas and protects their home and property correctly.

Today, not only do firefighters have to deal with the wildland fuels, but the structures that are mixed in with them as well. This area has come to be known as the Wildland/Urban Interface (WUI) and it is one of the biggest challenges to wildland and structural fire agencies. The simple fact is that in the event of a large fire, there will not be enough resources to protect every home.

Put yourself in the driver's seat of a fire truck at the scene of a large fire. Depending on the area, hundreds of homes may be threatened over the course of the fire. Your first priority is the safety of your personnel and citizens in the area. You may have many homes assigned to you to attempt to protect either before or after the fire front passes.

With the water you have, you can probably wet down two or three homes before having to refill your truck with water. On top of all this, you have limited visibility due to smoke, constant radio communications, the confusion of a panicked citizenry evacuating the area, and others trying to enter the area to get a firsthand look. Since time will not allow you to give attention to all the structures in your area before the fire arrives, you must determine where you can safely send your vehicle and personnel.

Unfortunately, even though housing in the WUI is increasing, the number of available firefighters and equipment is not increasing at the same rate. Oftentimes, firefighters in fire prone areas are working as volunteers and may not be fully aware of the potential problems in a community they are helping to protect.

Homeowners and fire officials can form a partnership to increase safety in the WUI. In this situation, homeowners take principle responsibility for assuring low home ignitability. Fire officials provide technical assistance as well as emergency response. The ideal situation is for homes to be designed, built, and maintained to withstand a wildfire without the intervention of the fire department. Homeowners can achieve this by following **Firewise practices**.

Firewise practices focus on three main areas to help property be compatible with the surrounding land – access, the surrounding vegetation and the structure itself.

ACCESS

Would firefighters be able to get to your home if there were a fire in the area? Driveways should be at least 12 feet wide with 14 feet of overhead clearance. Driveways longer than 150 feet or with sharp curves may need to be closer to 20 feet wide. A locked or closed gate can make entry to property impossible.

THE SURROUNDING VEGETATION
How easily can a fire spread from the adjacent vegetation to your home? The area within approximately 30 feet around all structures is thought of as a home's **defensible space**. If modified properly, this area can keep low-intensity surface fire from reaching structures. It can also provide a relatively safe area for firefighters to work in if they are able to help protect a home. This area should be kept mowed short, raked free of fallen leaves and needles, and green throughout the growing season. Remember that spring is when most wildfires occur in Wisconsin; cleanup at this time of year is essential.

THE STRUCTURE ITSELF
How flammable is your home? Any building on a property is potential fuel in a wildfire including garages, campers, and storage sheds. Anything attached to a structure is part of the structure. Roofs, rain gutters, and decks are natural traps for leaves, pine needles, and embers from a fire. These areas should be kept free of all material that could allow an ember to smolder and start a fire. Do not store flammable materials or allow debris to fill in under decks and overhangs. Chimneys, eaves, and vents should be kept covered with wire mesh to keep embers from blowing into structures.

To learn if your community is at risk, visit *www.fws.gov/fire/downloads/listedriskcomm.pdf*.

CAREERS IN WILDLAND FIRE

As development in rural, forested, and grassland areas increases, so does the need for professionals working in the field of wildland fire management. In addition, the effectiveness of prescribed fire and its increased use by many land managers requires professional training.

There are many career paths available in wildland fire management ranging from highly technical careers in research to education and public policy. Careers in wildland fire management include the following fields:

- **Forest Management:** Forestry professionals manage forested areas to reduce the risk of catastrophic fires, produce timber, and sustain forest services.
- **Range Management:** Rangeland professionals manage grasslands for livestock production and habitat conservation.
- **Fire Suppression:** Wildland and structural firefighters control accidental wildfires to protect lives, property, and natural resources.
- **Fire Education:** Communication and education professionals help people take positive actions to prevent destructive wildfire, protect their communities, and ensure that fire remains a part of the ecological landscape.
- **Fire Ecology:** Biologists study and manage ecosystems to sustain native plant and animal communities.
- **Research and Development:** Scientific researchers develop and test technologies and innovations to suppress fires, protect homes, and protect firefighters.
- **Land Use Planning:** Natural and human resource professionals work cooperatively to determine methods and policies to make human communities more compatible with fire prone landscapes.

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APPENDIX

GLOSSARY

BIAS: An opinion or belief that strongly favors one side of an issue.

BURN BARREL: A metal receptacle, most often a barrel, used for burning waste outdoors. Waste includes materials legal to burn such as wood and paper and materials illegal to burn such as plastic and metal.

CAMBIUM: The growing part of a trunk of a tree.

CLIMATE: Weather conditions for a region including temperature, precipitation, and wind.

CLIMATE CHANGE: The long-term fluctuations in precipitation, temperature, and wind caused mainly by variations in earth's orbital rotations, volcanic activity, human land use practices, and the combustion of fossil fuels.

COMPOSITION: The species in a community.

CONDUCTION: Transfer of heat through a material.

CONVECTION: Transfer of heat through a liquid or gas.

CROWN FIRE: A fire that spreads across the tops of trees or shrubs.

CROWNING: The movement of fire from a surface fire into the crown of trees. This is usually accomplished through ladder fuels.

CUTOVER: Land that has been logged. This term is often used as "the Cutover," which refers to northern Wisconsin after it was heavily logged during the period from the 1850s to the 1920s.

DANGEROUS: Something that can hurt you.

DEFENSIBLE SPACE: The area within 30 feet of a structure.

ECOSYSTEM FUNCTION: A function that supports life including the fixation of energy, cycling of matter, and flow of energy through food webs.

EXTIRPATED: The extinction of a species from a specific area.

FIRE BEHAVIOR: The manner in which a fire reacts to its environment.

FIRE INTENSITY: The amount of heat released per second as a wildland fire burns in a specified area; calculated by measuring the flame length, rate of spread, and heat per unit area.

FIRE PREVENTION: A variety of actions taken to decrease the risk of ignition of wildland fires; accomplished through education, engineering, and enforcement of laws.

FIRE REGIME: A cultural and biological system that defines the size, distribution, intensity, and frequency of fire in a given area.

FIRE SEASON: The periods of the year when wildland fires are likely to occur; there are two main fire seasons in Wisconsin – spring (March to June) and fall (September to November).

FIRE TRIANGLE: The three elements (i.e., fuel, oxygen, heat) necessary for combustion to occur.

FIREWISE BUILDINGS: Buildings designed with features that reduce the risk of the building burning in a wildfire. Firewise buildings use fire resistant materials, have open areas without fuels surrounding the house, and have good access roads.

FIREWISE PRACTICES: Actions homeowners can take to protect their homes from wildfire.

FOREST STRUCTURE: The vertical and horizontal spacing of trees in a forest. Vertical layers are the overstory and the understory. Horizontal spacing is the density of tree cover across the landscape.

FOREST THINNING: The removal of some of the trees in a forest; often done to reduce the risk of wildfire.

FUEL: Any material that can burn; any substance that contributes to the growth or spread of fire.

FUEL CHARACTERISTICS: Properties including quantity, chemistry, compaction, continuity, moisture content, and size.

GROUND FIRE: A fire that burns the organic material in the soil layer such as peat or duff.

HAZARD: Potential for a fire to start and spread.

HEAT TRANSFER: Energy transfer by radiation, convection, or conduction.

IGNITE: To cause something to start burning.

INFORMED DECISION: Deciding how to act on something after learning more about it.

KNOWLEDGE: Awareness and understanding of facts.

LADDER FUELS: Fuels which provide a vertical path for fire to move from ground level to the crowns of trees.

LAND CONVERSION: The change of an area from one land use to another.

LAND COVER: The ecological features present across the landscape such as forest, urban area, and field.

LAND USE: The human activities occurring across a landscape such as forest management, land development, and agriculture.

LIKERT SCALE: A rating system used to determine a person's perception of an issue. For example, a number system from 1-5 is used and "1" indicates a respondent strongly agrees with the statement and "5" indicates a respondent strongly disagrees.

NEWS ANCHOR: A person at a television station who reads the news and connects stories to reporters on the scene.

PERCEPTION: The feelings, attitudes, views, and judgments that a person has about something or someone.

PHENOMENON: An observable fact or event.

PRESCRIBED FIRE: A fire used to deliberately burn wildland fuels under specific conditions to meet desired management goals (e.g., fuel management, disease and pest control, wildlife habitat).

PRESUPPRESSION: Activities undertaken to prepare for fire suppression; includes the construction of access roads, preparation of suppression strategies, and training of suppression teams.

PROP: An object used by an actor or actress in a play.

PUBLIC OPINION SURVEY: A survey used to measure public understanding and perception of an issue.

RADIATION: Heat that travels in a wave.

RATE OF SPREAD: The speed (feet per minute) at which a wildland fire moves into new fuels.

RELATIVE HUMIDITY: The ratio of the amount of water vapor in the air at a specific temperature to the maximum amount that the air could hold at that temperature, expressed as a percentage.

RESPONSIBLE ADULT: A grown-up who takes care of something and uses it safely.

RISK: Potential for a fire to ignite.

SAFE: Something that won't hurt you.

SAMPLE POPULATION: The subgroup of a target population that is actually studied.

SAMPLING: The process of selecting a group of people to be studied from within a larger population being studied.

SCIENTIFIC METHOD: A method of research in which a problem is identified or observed, a hypothesis is formulated, and the hypothesis is tested.

SCRIPT: The words that actors read during a play.

SPECIES INTRODUCTION: The arrival and establishment of organisms that are not native to an ecosystem.

SPOTTING: The ignition of new fires outside of the original fire area caused by wind-blown sparks or embers.

SUCCESSION: The gradual change from one biological community to another.

SUPPRESSION: The act of confining and extinguishing a wildland fire.

SURFACE FIRE: A fire that burns fuels on the forest floor such as leaf litter and small vegetation.

SYSTEM DIAGRAM: A tool that helps describe how complex systems work; they are helpful in showing how a change in one factor may affect another factor.

TARGET POPULATION: The group of interest in a research project.

TOPOGRAPHY: The relative elevation and configuration of features in a landscape.

TORCHING: The ignition and flare-up of a tree or small group of trees, usually from bottom to top.

WILDFIRE: A wildland fire that ignites and spreads without the intent of the landowner.

WILDLAND FIRE: An outdoor fire involving primarily vegetative fuels.

WILDLAND/URBAN INTERFACE: An area where human structures are in close proximity to wildland fuels.

WISCONSIN MODEL ACADEMIC STANDARDS

LEAF Wildland Fire lessons address Wisconsin Model Academic Standards in English Language Arts, Environmental Education, Mathematics, Science, Social Studies, and Visual Arts. On the following pages, you will find the standards listed by lesson along with an explanation of how they are addressed by each lesson.

K-1ST GRADE LESSON: MY FEELINGS ABOUT FIRE

VISUAL ARTS A.4.1
Visual Memory and Knowledge

Standard is: Develop a basic mental storehouse of images.

Students give examples of events in their lives that relate to emotions and share examples of safe and dangerous situations.

VISUAL ARTS I.4.1
Personal and Social Development

Standard is: Use art to understand how they feel.

Students indicate their feelings with emotion cards as they look at the pictures of safe and dangerous fire situations.

VISUAL ARTS I.4.3
Personal and Social Development

Standard is: Talk or write about feelings in a work of art.

Students discuss their feelings related to pictures of safe and dangerous fire situations.

2ND-3RD GRADE LESSON: SMOKEYTOONS: A LOOK AT FIRE AND HUMAN BEHAVIOR

SCIENCE D.4.4
Properties of Earth Materials

Standard is: Observe and describe changes in form, temperature, color, speed, and directions of objects and construct explanations for the changes.

Students examine ashes made from burning paper and describe how fire changed the paper to ash.

VISUAL ARTS E.4.3
Visual Communication and Expression

Standard is: Communicate basic ideas by producing popular images and objects such as folk art, traditional arts and crafts, popular arts, mass media, and consumer products.

Students produce comic strips to convey a fire prevention message.

VISUAL ARTS K.4.3
Making Connections

Standard is: Use what they are learning about life, nature, the physical world, and people to create art.

Students use the information they have learned about to create comic strips that convey a fire prevention message.

4TH GRADE LESSON: THE PESHTIGO THEATER COMPANY PRESENTS: THE LIFE OF FIRE

ENGLISH LANGUAGE ARTS A.4.1
Reading and Literature

Standard is: Use effective reading strategies to achieve their purposes in reading.

- Read aloud with age-appropriate fluency, accuracy, and expression
- Discern how written texts and accompanying illustrations connect to convey meaning

Students design a play set from a script and picture and act out the play by reading a script.

ENGLISH LANGUAGE ARTS C.4.2
Oral Language

Standard is: Listen to and comprehend oral communications.

- Recall the content of stories after hearing them, relate the content to prior knowledge, and answer various types of factual and interpretive questions about the stories

Students answer questions after each scene in a play and discuss the answers.

ENGLISH LANGUAGE ARTS C.4.3
Oral Language

Standard is: Participate effectively in discussion.

- Volunteer relevant information, ask relevant questions, and answer questions directly
- Reflect on the ideas and opinions of others and respond thoughtfully
- Ask for clarification and explanation of unfamiliar words and ideas

Students answer and discuss questions after each scene in a play.

SOCIAL STUDIES A.4.4
Geography: People, Places, and Environments

Standard is: Describe and give examples of ways in which people interact with the physical environment including use of land, locations of communities, methods of construction, and design of shelters.

Students participate in a play and discussion that explores the role humans have played in wildland fire and how it has altered our environment.

SOCIAL STUDIES A.4.8
Geography: People, Places, and Environments

Standard is: Identify major changes in the local community that have been caused by human beings, such as a construction project, a new highway, a building torn down, or a fire; discuss reasons for these changes; and explain their probable effects on the community and the environment.

Students participate in a play and discussion that explores how human communities have been altered by wildland fire.

5TH-6TH GRADE LESSON: IN THE HOT SEAT: THE PROCESS AND SCIENCE OF DECISION-MAKING

ENVIRONMENTAL EDUCATION B.8.10
Energy and Ecosystems

Standard is: Explain and cite examples of how humans shape the environment.

Students are faced with a series of dilemmas about human actions and fire and must make decisions on how best to respond.

ENVIRONMENTAL EDUCATION D.8.1
Decision and Action Skills

Standard is: Identify options for addressing an environmental issue and evaluate the consequences of each option.

Students are faced with a series of dilemmas about human actions and fire and must make decisions on how best to respond.

ENVIRONMENTAL EDUCATION D.8.4
Decision and Action Skills

Standard is: Explain the political, legal, and budgetary options for resolving local, state, and national environmental issues.

Students participate in mock town council meeting and lobby for and determine the consequences of the passage of certain legislation.

ENVIRONMENTAL EDUCATION D.8.5
Decision and Action Skills

Standard is: Explain how personal actions can impact an environmental issue.

Students are faced with a series of dilemmas about human actions and fire and must make decisions on how best to respond. Discussion that follows helps students understand the impact of each action.

SCIENCE A.8.6
Science Connections

Standard is: Use models and explanations to predict actions and events in the natural world.

Students use system diagrams to represent how events and outcomes are related.

SOCIAL STUDIES D.8.4
Economics: Production, Distribution, Exchange, Consumption

Standard is: Describe how investments in human and physical capital, including new technology, affect standard of living and quality of life.

Students participate in a mock town meeting where they try to pass legislation that will cost their community money, but will provide for increased safety and quality of life.

SOCIAL STUDIES E.8.5
The Behavioral Sciences: Individuals, Institutions, and Society

Standard is: Describe and explain the means by which groups and institutions meet the needs of individuals and societies.

Students participate in a mock town meeting and learn how the government provides for the needs of citizens and the betterment of society.

7TH-8TH GRADE LESSON: NATURAL PHENOMENA INVESTIGATORS (NPI)

ENGLISH LANGUAGE ARTS A.8.1
Reading and Literature

Standard is: Use effective reading strategies to achieve their purpose in reading including using texts to find information, make decisions, and to select, summarize, and analyze orally and in writing.

Student groups read a variety of textual information to find pertinent information, draw conclusions, and report their findings orally to their investigation group and class.

ENGLISH LANGUAGE ARTS A.8.4
Reading and Literature

Standard is: Read to acquire information including the use of technical resources such as charts, tables, travel schedules, timelines, and manuals.

Students interpret data from a variety of sources including tables, written logs, maps, and background information.

ENGLISH LANGUAGE ARTS B.8.1
Writing

Standard is: Create or produce writing to communicate with different audiences for a variety of purposes including writing a clear and pertinent response to verbal or visual materials that communicate, explain, and interpret the reading.

Student investigation groups review a variety of materials to develop a statement that reflects the circumstances leading to a fire. They are given additional materials and must adjust their statement based on additional knowledge.

ENGLISH LANGUAGE ARTS C.8.1
Oral Language

Standard is: Orally communicate information, opinions, and ideas effectively to different audiences for a variety of purposes.

Student investigation groups are asked to make a statement to the class about their findings.

ENGLISH LANGUAGE ARTS C.8.3
Oral Language

Standard is: Participate effectively in discussion including explaining and advancing opinions by citing evidence and referring to sources.

Students in investigation groups participate in discussions to debate findings and come to a consensus on what to report to the class.

ENGLISH LANGUAGE ARTS F.8.1
Research and Inquiry

Standard is: Conduct research and inquiry of self-selected or assigned topics, issues, or problems and use an appropriate form to communicate the findings, including using multiple sources.

Students research several topics related to wildland fire using a variety of resources provided and work in teams to develop position statements on each.

ENVIRONMENTAL EDUCATION A.8.4
Questioning and Analysis

Standard is: Use critical thinking strategies to interpret and analyze gathered information.

Students use critical thinking to analyze data, primary sources, maps, and definitions to investigate the spread and control of a wildland fire.

ENVIRONMENTAL EDUCATION A.8.5
Questioning and Analysis

Standard is: Use the results of their investigations to develop answers, draw conclusions, and revise their personal understanding.

Students make predictions about the spread of a wildland fire and then use data, primary sources, maps, and definitions to investigate the wildland fire and postulate why their predictions may not have been correct.

MATHEMATICS A.8.1
Mathematical Processes

Standard is: Use reasoning abilities to evaluate information, perceive patterns, identify relationships, evaluate strategies, and justify statements.

Students work in investigation teams to identify relationships, evaluate strategies, and justify statements using primary source documents.

MATHEMATICS D.8.2
Measurement

Standard is: Demonstrate an understanding of basic measurement facts, principles, and techniques.

Students measure the rate of the spread of the fire using locations on a map and the map scale of miles. They compute the rate in feet per minute.

MATHEMATICS E.8.4
Statistics and Probability

Standard is: Use the results of data analysis to make predictions, develop convincing arguments, and draw conclusions.

Student investigation groups use a variety of data, maps, primary sources, and definitions to predict, draw conclusions, and develop convincing arguments to be shared with the class.

SCIENCE C.8.6
Science Inquiry

Standard is: State what they have learned from investigations, relating their inference to scientific knowledge and to data they have collected.

Students discuss information in investigation teams and present their findings to the class.

SCIENCE H.8.3
Science in Social and Personal Perspectives

Standard is: Understand the consequences of decisions affecting personal health and safety.

Students discuss post-fire dilemmas and examine the pros and cons of each action.

9TH-12TH GRADE LESSON: WILDLAND FIRE ISSUES AND EDUCATION

ENGLISH LANGUAGE ARTS F.12.1
Research and Inquiry

Standard is: Conduct research and inquiry on self-selected or assigned topics, issues, or problems and use an appropriate form to communicate their findings.

- Formulate questions addressing issues or problems that can be answered through a well-defined and focused investigation.
- Develop research strategies appropriate to the investigation, considering methods such as questionnaires, experiments, and field studies.
- Evaluate the usefulness and credibility of data and sources by applying tests of evidence including bias, position, expertise, adequacy, validity, reliability, and date.

Students develop, conduct, and analyze the results of a survey to test hypotheses they have written.

ENVIRONMENTAL EDUCATION A.12.3
Questioning and Analysis

Standard is: Evaluate personal investigations and those of others, critiquing procedures, results, and sources of data and suggest improvements to the investigation.

Students conduct a survey and analyze the results. They discuss bias in surveys and how that could be eliminated.

ENVIRONMENTAL EDUCATION A.12.4
Questioning and Analysis

Standard is: State and interpret their results accurately and consider other explanations for their results.

Students analyze data collected from a survey and interpret the findings of the study.

SCIENCE C.12.1
Science Inquiry

Standard is: When studying science content, ask questions suggested by current social issues, scientific literature, and observations of phenomena; build hypotheses that might answer some of these questions; design possible investigations; and describe results that might emerge from such investigations.

Students use the scientific method to generate a hypothesis about a wildfire social phenomena and generate questions as part of a survey to test their hypothesis.

SCIENCE C.12.3
Science Inquiry

Standard is: Evaluate the data collected during an investigation, critique the data-collection procedures and results, and suggest ways to make any needed improvements.

Students conduct a survey and analyze the results. They discuss bias in surveys and how that could be eliminated.

WISCONSIN MODEL ACADEMIC STANDARDS

Standard	K-1st Grade Lesson	2nd-3rd Grade Lesson	4th Grade Lesson	5th-6th Grade Lesson	7th-8th Grade Lesson	9th-12th Grade Lesson
ENGLISH LANGUAGE ARTS						
A.4.1						
A.8.1						
A.8.4						
B.8.1						
C.4.2						
C.4.3						
C.8.1						
C.8.3						
F.8.1						
F.12.1						
ENVIRONMENTAL EDUCATION						
A.8.4						
A.8.5						
A.12.3						
A.12.4						
B.8.10						
D.8.1						
D.8.4						
D.8.5						

(Continued on page 174.)

WISCONSIN MODEL ACADEMIC STANDARDS

Standard	K-1st Grade Lesson	2nd-3rd Grade Lesson	4th Grade Lesson	5th-6th Grade Lesson	7th-8th Grade Lesson	9th-12th Grade Lesson
MATHEMATICS						
A.8.1					✓	
D.8.2					✓	
E.8.4					✓	
SCIENCE						
A.8.6				✓		
C.8.6					✓	
C.12.1						✓
C.12.3						✓
D.4.4		✓				
H.8.3					✓	
SOCIAL STUDIES						
A.4.4			✓			
A.4.8			✓			
D.8.4				✓		
E.8.5				✓		
VISUAL ARTS						
A.4.1	✓					
E.4.3		✓				
I.4.1	✓					
I.4.3	✓					
K.4.3		✓				

SUBJECT AREAS

	ENGLISH LANGUAGE ARTS	GEOGRAPHY	HEALTH	MATHE-MATICS	SCIENCE	SOCIAL STUDIES	VISUAL ARTS
K-1ST GRADE LESSON My Feelings About Fire							
2ND-3RD GRADE LESSON SmokeyToons: A Look at Fire and Human Behavior							
4TH GRADE LESSON The Peshtigo Theater Company Presents: The Life of Fire							
5TH-6TH GRADE LESSON In the Hot Seat: The Process and Science of Decision-making							
7TH-8TH GRADE LESSON Natural Phenomena Investigators (NPI)							
9TH-12TH GRADE LESSON Wildland Fire Issues and Education							

MULTIPLE INTELLIGENCES

Multiple Intelligences can be thought of as different modes of learning and retaining information. Generally, everyone has all the multiple intelligences, but in varying strengths. Students excel when they have an opportunity to express themselves in their preferred intelligences, but also need to have opportunities to strengthen other areas. The table below lists each of the Wildland Fire lessons and the multiple intelligences that are addressed.

V-L: VERBAL-LINGUISTIC
Using language to express ideas and concepts, thinking symbolically and reasoning abstractly, and the ability to create conceptual verbal patterns.

L-M: LOGICAL-MATHEMATICAL
Skillfully able to think logically, inductively, categorically; recognize patterns; and work with abstract concepts.

V-S: VISUAL-SPATIAL
Perceiving images and spatial elements and representing those expressions effectively.

B-K: BODILY-KINESTHETIC
Creatively using the whole body to illustrate ideas and concepts.

M-R: MUSICAL-RHYTHMIC
Discriminating among musical components and using instruments or the voice to express understanding.

INTER: INTERPERSONAL
Demonstrating empathy toward or appreciating the thoughts and feelings of others.

INTRA: INTRAPERSONAL
Analyzing one's own thoughts and motivations and expressing understanding of those thoughts and feelings through behavior.

NAT: NATURALISTIC
Sensing patterns in and making connections with nature and the environment.

	V-L	L-M	V-S	B-K	M-R	Inter	Intra	Nat
K-1st Grade Lesson - My Feelings About Fire	✓	✓	✓			✓		✓
2nd-3rd Grade Lesson - SmokeyToons: A Look at Fire and Human Behavior	✓	✓	✓			✓	✓	✓
4th Grade Lesson - The Peshtigo Theater Company Presents: The Life of Fire	✓	✓		✓		✓	✓	
5th-6th Grade Lesson - In the Hot Seat: The Process and Science of Decision-making	✓	✓	✓			✓	✓	
7th-8th Grade Lesson - Natural Phenomena Investigators (NPI)	✓	✓	✓			✓	✓	
9th-12th Grade Lesson - Wildland Fire Issues and Education	✓	✓				✓		

LESSON CONNECTIONS TO THE *LEAF WILDLAND FIRE CONCEPTUAL GUIDE*

The objectives of each lesson in the ***LEAF Wisconsin K-12 Wildland Fire Lesson Guide*** are based on subconcepts outlined in the ***LEAF Conceptual Guide to K-12 Wildland Fire Education in Wisconsin***. This chart identifies the subconcepts covered by each lesson.

	Theme 1: What Is Wildland Fire?												Theme 2: Why Is Wildland Fire Important?							Theme 3: How Do We Manage Wildland Fire?						Theme 4: What Is the Future?											
Sub-concept	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
K-1st		✓																								✓										
2nd-3rd	✓	✓	✓																							✓										
4th	✓	✓	✓				✓							✓	✓											✓										
5th-6th	✓	✓											✓									✓				✓	✓			✓		✓				
7th-8th	✓	✓	✓		✓											✓																✓				
9th-12th		✓											✓					✓									✓					✓	✓			

LEAF WISCONSIN K-12 FORESTRY EDUCATION LESSON GUIDE OVERVIEWS

This ***LEAF Wisconsin K-12 Wildland Fire Lesson Guide*** is a supplement to the ***LEAF Wisconsin K-12 Forestry Education Lesson Guide*** (LEAF Guide). The LEAF Guide is comprised of six grade specific units: K-1, 2-3, 4, 5-6, 7-8, and 9-12. The LEAF Guide is obtained by participating in a LEAF workshop. Workshop participants receive forestry background information and practical experience using the LEAF Guide. Workshops vary in length and format, sometimes including an option for graduate credit and/or hands-on field experiences.

K-1 UNIT

5 CLASSROOM LESSONS, 1 CAREERS LESSON, 3 FIELD ENHANCEMENTS

The K-1 Unit is an introduction to trees and forests. Students learn about the parts of a tree, what forests are, and why they are important.

LESSON 1 - TREE HARDWARE
Students are introduced to the parts of a tree and its life stages through songs, games, and role playing.

LESSON 2 - WHAT'S IN A FOREST?
Students learn about living and nonliving parts of a forest by playing a game and creating artwork.

LESSON 3 - MY FAVORITE FOREST USE
Students discover the value of forests by studying *Tree Spy* collages and singing a song.

LESSON 4 - FOREST PRODUCT TIME MACHINE
Students explore historical uses of forest resources and compare them to present-day goods by surveying pictures and creating drawings.

LESSON 5 - ANIMALS NEED FORESTS, TOO
Students find out what forests do for animals and play a game to search for basic needs.

CAREERS EXPLORATION
Students learn about forestry-related careers, participate in a matching exercise, and draw their favorite career.

FIELD ENHANCEMENT 1 - ALL ABOUT MY TREE
Students adopt a tree and record their observations to create a class scrapbook.

FIELD ENHANCEMENT 2 - SENSING THE FOREST
Students use all their senses to discover the living and nonliving parts of a forest.

FIELD ENHANCEMENT 3 - SEARCHING FOR BASIC NEEDS
Students examine the needs of animals and evaluate if their playground can support various critters.

2-3 UNIT

6 CLASSROOM LESSONS, 1 CAREERS LESSON, 3 FIELD ENHANCEMENTS

The 2-3 Unit expands on basic ideas about forests and helps students understand their connection to forests. Students learn about energy flow, basic tree identification skills, forest products, and what it means to be a forest steward.

LESSON 1 - TO BE A TREE
Students use their knowledge of tree parts to learn basic tree identification skills. Basic needs and life stages of a tree are also emphasized through a game and drawing activity.

LEAF WISCONSIN K-12 FORESTRY EDUCATION LESSON GUIDE OVERVIEWS

LESSON 2 - WHAT MAKES A FOREST?
Students discover how living things are influenced by nonliving things through a matching activity, song or skit, and creating a class mural of Wisconsin forests.

LESSON 3 - FOREST ENERGY FLOW
Students learn about energy flow in the forest by role-playing producers, consumers, and decomposers.

LESSON 4 - FORESTS ARE IMPORTANT TO ME!
Students explore forest values and discover what forest products come from Wisconsin using a checklist. Creative writing and an art project help students examine why they value forests.

LESSON 5 - DECISIONS, DECISIONS
Students are introduced to the concept of forest management by creating a plan for their schoolyard. A card game and song highlight some of the people involved in forest management.

LESSON 6 - I CAN BE A FOREST STEWARD
Students find out what it means to be a forest steward and make decisions about good stewardship activities through an *I Spy*-like picture and board game.

CAREERS EXPLORATION
Students learn about professionals in Wisconsin with forestry-related careers, match jobs and duties, and draw themselves in a career that interests them.

FIELD ENHANCEMENT 1 - I CAN BE A FORESTER
Students get a taste of what foresters do by collecting and discussing data.

FIELD ENHANCEMENT 2 - OBSERVING FOREST INTERACTIONS
Students explore living and nonliving forest features on a hike and spend time observing and drawing parts of a forest.

FIELD ENHANCEMENT 3 - FOREST ENERGY SCAVENGER HUNT
Students follow the flow of energy in a forest by going on a scavenger hunt.

4 UNIT
7 CLASSROOM LESSONS, 1 CAREERS LESSON, 3 FIELD ENHANCEMENTS

The 4 Unit focuses on Wisconsin forest history. Students learn about the logging days, farming the Cutover, events that led to modern forestry, and why forests are important today.

LESSON 1 - NATIVE AMERICANS AND THE FOREST
Students read the journal of an early explorer to learn what Wisconsin forests were like before European settlement and how Native Americans used the forests.

LESSON 2 - FORESTS BUILT OUR STATE
Students explore the importance of forests to early settlers and learn how forests played a role in settling Wisconsin through a mapping activity.

LESSON 3 - HELP WANTED – LUMBERJACKS
Students examine the steps and people involved in an 1800s logging process by following a tree from northern Wisconsin to a house in Iowa.

LESSON 4 - BROKEN DREAMS
Students experience what it was like to farm in Wisconsin during the "Cutover" by role-playing and studying letters, photographs, and documents.

LESSON 5 - I SAW IT ON THE 6 O'CLOCK NEWS
Students learn about 150 years of events in Wisconsin that have led to the forests of today by participating in a live newscast.

LEAF WISCONSIN K-12 FORESTRY EDUCATION LESSON GUIDE OVERVIEWS

LESSON 6 - FORESTS ARE IMPORTANT TO YOU AND ME
Students discover reasons why Wisconsin forests are important to our quality of life through guided imagery, brainstorming, and an interactive media presentation.

LESSON 7 - SUSTAINING OUR FORESTS
Students are introduced to the sustainability and stewardship of forests by listening to a fable, brainstorming, reading situation cards, and creating an art project.

CAREERS EXPLORATION
Students learn about professionals in Wisconsin with forestry-related careers, play career bingo to learn about skills used in each profession, and describe and draw themselves in a career.

FIELD ENHANCEMENT 1 - UNLOCKING A FOREST'S PAST
Students uncover a forest's history by becoming detectives, collecting data, and making predictions about a forest.

FIELD ENHANCEMENT 2 - ARE FORESTS IMPORTANT TODAY?
Students find out why forests are ecologically, economically, and socially valuable by searching in a forest and playing scavenger hunt bingo.

FIELD ENHANCEMENT 3 - CARING FOR THE FUTURE OF FORESTS
Students learn what a tree needs to grow, how to choose an appropriate site, and how to properly plant a tree by putting one in their schoolyard.

5-6 UNIT
8 CLASSROOM LESSONS, 1 CAREERS LESSON, 3 FIELD ENHANCEMENTS

The 5-6 Unit connects the science of forests with human aspects. Students learn about forest layers, ecosystems, and energy flow. This information is related to the value of trees, forest ownership, and management.

LESSON 1 - ME AS A TREE
Students learn about a tree's functions, basic needs, life stages, and role in the forest community by comparing trees and humans.

LESSON 2 - WHAT MAKES A FOREST?
Students explore parts of forest ecosystems and forest layers through an interactive game and discussion.

LESSON 3 - FORESTS ARE ALWAYS CHANGING
Students examine forest succession, disturbances, and renewability by completing a sustainability worksheet and role-playing.

LESSON 4 - ECOSYSTEM EXTRAVAGANZA
Students are introduced to forest functions such as photosynthesis, energy flow, and the cycling of matter through reading and creating a diagram. The roles of producers, consumers, and decomposers in forests are also examined.

LESSON 5 - WE ALL NEED TREES
Students learn about the values of forests and their impact on the environment by categorizing values and writing and producing a commercial.

LESSON 6 - WHAT IS MANAGEMENT?
Students discover what's happened in Wisconsin's history that led us to modern forestry and about management techniques by creating a timeline and reading a "choose your own adventure" type story.

LESSON 7 - WHO OWNS IT?
Students observe how management goals of landowners impact forest ecosystems by studying a plat map and answering questions. They also learn about the roles individuals and groups play that affect forest management.

LEAF WISCONSIN K-12 FORESTRY EDUCATION LESSON GUIDE OVERVIEWS

LESSON 8 - WHOSE JOB IS IT?
Students learn about stewardship and how their choices affect the future of forests by participating in a mock school board meeting.

CAREERS EXPLORATION
Students become aware of careers that are forestry-related by listening to descriptions of them and playing charades.

FIELD ENHANCEMENT 1 - WOOD'S WORTH
Students make their own tree scale stick and use it to calculate the number of products that can be made from individual trees. They also go on a scavenger hunt to explore many ways that forests are valuable.

FIELD ENHANCEMENT 2 - STUDYING FOREST LAYERS
Students observe the structural layers of a forest and draw a color-coded picture. They also embark on two exploration activities to discover which animals can be found in each of the forest layers.

FIELD ENHANCEMENT 3 - COMPETITION IN A FOREST
Students learn how trees compete for their basic needs through observation and a simulation.

7-8 UNIT

8 CLASSROOM LESSONS, 1 CAREERS LESSON, 3 FIELD ENHANCEMENTS

The 7-8 Unit highlights a wide variety of topics related to Wisconsin's forests. Students learn about forest biomes, types of forests, biodiversity, forest management, forest trends, forest issues, forest products, and sustaining forests.

LESSON 1 - DISCOVERING WISCONSIN'S FORESTS
Students are introduced to the types of forests in Wisconsin and factors that affect their distribution through data comparison, a mapping activity, and video research.

LESSON 2 - BIODIVERSITY AND THE FOREST CONNECTION
Students analyze three ecosystems to determine their interconnections and create a Venn diagram. They also discuss the value of Wisconsin's forests in terms of biodiversity.

LESSON 3 - HOW FORESTS ARE MANAGED
Students explore forest management plans, multiple use, and sustainability through a simulation, video, and game.

LESSON 4 - FOREST MANAGEMENT ISSUES
Students examine forest management, factors that influence decisions, effects, and conflicts through brainstorming, discussion, and issue analysis.

LESSON 5 - MANY FORESTS, MANY VALUES, MANY REASONS
Students assess forest values and discover how forests shape the economy, environment, and society using games, story analysis, and brainstorming.

LESSON 6 - MAKING BROADER CONNECTIONS
Students make connections between forests of Wisconsin and forests worldwide and discuss challenges to Wisconsin's forests by tracing the life cycle of a product and playing Forest Jeopardy. They also participate in a sustainability simulation to learn about demand.

LESSON 7 - KEY STRATEGIES FOR OUR FUTURE
Students learn how science, technology, and collaboration are keys to sustaining Wisconsin's forests by analyzing articles. They then make predictions about the future by creating a *Fantasy Future Forest*.

LEAF WISCONSIN K-12 FORESTRY EDUCATION LESSON GUIDE OVERVIEWS

LESSON 8 - SUSTAINING OUR FORESTS: CITIZENS' ROLES
Students discover how people in Wisconsin practice good forest stewardship and debate their own choices through jigsaw readings and dilemma cards.

CAREERS EXPLORATION
Students learn about professionals in Wisconsin with forestry-related careers and examine the skills, education, and experience necessary for each type of job.

FIELD ENHANCEMENT 1 - TREE IDENTIFICATION
Students are introduced to dichotomous keys and tree identification vocabulary to identify common Wisconsin trees.

FIELD ENHANCEMENT 2 - FOREST MAPPING
Students work in groups to map features of a forest plot using data collection, tree identification, measurement, and ageing.

FIELD ENHANCEMENT 3 - FOREST DIVERSITY
Students study and collect data on three components of diversity that can be found in Wisconsin forests.

9-12 UNIT

5 CLASSROOM LESSONS, 1 CAREERS LESSON

The 9-12 Unit has an environmental science focus. Students learn about forest ecosystem processes, succession, the economics of forest products, and science and technology.

LESSON 1 - THE FOREST ODYSSEY
Students learn about forest ecosystem functions and processes by reading an Aldo Leopold essay, doing research, and creating an original science-based essay as a class.

LESSON 2 - A HISTORY OF SUCCESSION
Students explore how Wisconsin's forests have changed due to human and natural influences through a teacher presentation, readings, and a video. Current changes in Wisconsin's forests are discussed using a Wisconsin Land Cover Map.

LESSON 3 - FOREST BIODIVERSITY: TREE CASE STUDIES
Students study how Wisconsin's climate and natural history influence forest biodiversity. They use case studies to develop insights into the question, "What is a healthy level of forest biodiversity?" In groups, they create an original poster and presentation.

LESSON 4 - THE FOREST MARKETPLACE
Students identify factors that influence the supply of and demand for forest resources using basic economic principles. Using veneer as an example, students use graphs to describe markets in different geographic regions and examine the relationship between Wisconsin's forest resources and those of the rest of the world.

LESSON 5 - FOREST SCIENCE AND TECHNOLOGY
Students analyze the environmental impacts associated with wood, concrete, and steel by creating life cycle analyses. They study the roles that forest management, technology, and consumption play in sustaining forests and develop proposals to reduce the environmental impacts of wood use.

CAREERS EXPLORATION
Students learn about job opportunities in natural resource fields by creating a resume from the education and experiences of college students in Wisconsin.

LESSON FEEDBACK FORM (WILDLAND FIRE LESSON GUIDE)

We want to hear from you! Your comments and suggestions will contribute to the effectiveness of the *LEAF Wisconsin K-12 Wildland Fire Lesson Guide*.

Subject Areas and/or Grade Levels Taught _____

Name (optional) _____

School Name (optional) _____

School Address (optional) _____

School Phone (optional) _____

School Email (optional) _____

What recommendations do you have to improve the guide/lesson? **If comments relate to a specific part of a particular lesson, please list page numbers for reference.**

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Please send comments to: LEAF, WCEE/CNR UWSP, Stevens Point, WI 54481, leaf@uwsp.edu