FireWorks for Missouri River Country--Teacher Guide

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The Teacher Guide included here, in *FireWorks for Missouri River Country,* contains excerpts from the Teacher Guide for *FireWorks for the Pikunii Nation.* These excerpts describe items used traditionally by the Pikunii people of the northern Great Plains. This knowledge was provided through a collaboration with Marvin Weatherwax, Blackfeet Community College, Browning, MT. The knowledge belongs to the Pikunii people and, while the materials described here demonstrate the traditional ways of one Native people, they are unlikely to be identical to the ways of others. Please honor the information provided and the unique culture of each Native people.

Cover photos:
Top: Wind Cave National Park (NPS photo)
Bottom: Courtesy of Rick Trembath

Introduction

Welcome to *FireWorks for Missouri River Country*. This adaptation of the *FireWorks* Program (Smith and McMurray 2000), features the ecology of the Missouri River drainage, reaching from the spine of the Rocky Mountains east into the tallgrass prairie. *FireWorks* aims to increase the science literacy and fire literacy of students in grades K-12. The curriculum is structured so it can be complemented by activities and materials developed by Native American nations, thus perhaps increasing cultural literacy as well.

The original version of *FireWorks* focused on the ecology of forests in the northern Rocky Mountains and Cascade Range. In creating this version, we changed only the activities of Chapter 7, "Communities in Action." Where other chapters in the curriculum refer to specific plants, animals, and plant communities, they use the organisms featured in the original curriculum (e.g., pileated woodpecker and western larch) rather than prairie organisms. This choice was partly due to time constraints and partly to the authors' location, where it is not possible to collect specimens of the most important prairie plants for inclusion in the trunk. We hope you will not find this too great a challenge. We encourage you to collect your own specimens and thus fine-tune activities and materials to better fit your local ecosystems. We know that most teachers are remarkably resourceful; you not only can, but usually do, fine-tune materials to fit your students and to meet your educational objectives. To make *FireWorks* fit your local ecosystems better, consider making your own collection of species for the "Mystery Trees" and "Buried Treasures" activities (4-3, 4-4, 6-2, and 6-3), and developing an alternative to the activities on fire history in Chapter 5.

The lesson plans here are adapted from the original *FireWorks* curriculum. If they refer to appendices or other information that you cannot find in this volume, please consult the original curriculum—available in the trunk (Box C) and online. The original curriculum and all electronic materials produced for this project are available online at http://www.firelab.org/con-ed/92-fireworks.

Development of *FireWorks for Missouri River Country* was made possible through a grant from the US Department of Interior, Bureau of Indian Affairs, Great Plains and Rocky Mountain Regions. We are grateful for their support.

Jane Kapler Smith
Nancy E. McMurray
June 8, 2012

Activity 7-1. In the Web

Grade level:
X Elementary

What's the Point?

Forest communities survive and thrive because energy flows into and through them, beginning with sunlight and eventually reaching every inhabitant, and also because every organism finds shelter somewhere in the environment. Sometimes shelter is found inside another organism!

In this activity, students individually research 30 kinds of living things that occur in the broad expanse of the Missouri River drainage. Each student "adopts" an organism or a group of organisms from the *FireWorks Notebook*, learns about its life history and fire ecology, and uses what is learned to build a living model of a *resource web*.

Teacher's Map:

Objective: Given information about a plant or animal, students can explain and dramatize its role in a resource web to other members of the class.

Subjects: Science, Mathematics, Reading, Speaking and Listening, Social Studies, Library Media, Arts, Workplace Competencies

Duration: 1-2 hours of student preparation, 20 minutes for activity

Links to Standards[1]:

National Science Teachers' Association—Grades K-4:

C1) Identify needs of various organisms
C2) Identify structures of various organisms and the needs they serve
D3) Understand that the sun provides light and heat to earth
F2) Understand source of resources

National Science Teachers' Association—Grades 5-8:

B3) Understand that energy is transferred in many ways
B4) Identify ways in which energy moves in and out of a system
C1) Describe structure and function in a living system
C4) Recognize that ability to obtain and use resources, grow, reproduce… are essential for life
C7) Recognize nature of energy and food webs

North American Association for Environmental Education—Grades K-4:

0A) Identify basic kinds of habitat and plants and animals living there
0C) Describe aspects that change on temporal basis
1C) Collect information about environment

[1] See Appendix 4 of Smith and McMurray (2000) for links to Montana educational standards, grades K-4, 5-8.

2.2A) Understand similarities and differences among variety of organisms. Understand habitat
2.2B) Understand that plants and animals have different characteristics and many are inherited
2.2C) Understand basic ways organisms are related to environment and other organisms
2.2D) Know that living things need energy to live and grow

North American Association for Environmental Education—Grades 5-8:

0A) Classify local ecosystems. Create food webs
1C) Collect and locate reliable information about environment
2.1C) Understand energy transfer
2.2A) Understand biotic communities and adaptations
2.2C) Understand interactions among organisms and populations
2.2D) Understand how energy and matter flow in environment

Vocabulary: animal, food web, resource web, fungus, parasite, plant, succession

Materials

In this trunk…	***… where?***	***You must supply***
FireWorks Notebook for the Missouri River Country (pages are removable)	MO River Box	Art supplies for masks or puppets, or costumes
cotton string	Box A-- *Hardware Box*	Scissors
		Lightweight, large, flat tray of cookies or other treats
		Copy of Class Page 13 (*Assignment List*)
		Copy of Student Page 20 (*Getting to Know You*) for each student
Optional: If you wish to incorporate names for plants & animals in a Native language, find the "Plant and Animal Names for Missouri River Country" poster in Box B <u>or</u> use the Excel file Names_spreadsheet.xlsx, in Tables_of_Names on the CD in the Missouri River Box.		

Preparation

Assign each student to research one of the organisms listed on the *Assignment List*, Class Page 13. Each of these is described in an essay in the *FireWorks Notebook for the Missouri River Country*. Assign the Prairie Grasses to a highly capable student or a team of 2-3 students.

If you wish to use Native American names for the plants and animals featured in the *Notebook,* the trunk contains two resources that may help:

1. a laminated poster listing a few names in the languages of the Lakota and Pikunii people, with plenty of space to add names and explanations in other languages. Find this in Box B.
2. a file in Microsoft Excel that lists the organism names and has space for names in another language and explanations. Find this file on the CD in the Missouri River Box. The file is called Names_spreadsheet.xlsx, and it is in the folder Tables_of_Names.

Work with someone who can provide and explain the words for various organisms; if possible, have that person meet with your class to teach them about the language and culture.

Pages of the *FireWorks Notebook* are removable, so students can borrow the page for their organisms to study and make their masks or costumes. Or they can read the same material from the CD-ROM included in the trunk or online (refer to www.firelab.org/con-ed/92-fireworks). Record assignments on your copy of class Page 13. Students can supplement the *Notebook* information with references in the *FireWorks Library* and other resources. Students with advanced reading skills can consult the Fire Effects Information System at www.fs.fed.us/database/feis.

In their research, students should think of themselves as becoming the local experts on their assigned organisms. Student Page 20 (*Getting to Know You*) is a worksheet to help them look for particular information and take notes on it.

Ask students to depict what they have learned about their forest inhabitant in a costume, puppet, or mask. A student may need to talk about his or her organism at several times during its lifetime—perhaps as an egg and as an adult, perhaps right after a fire and then a hundred years later. To do this, students may want to make two items or create a changeable or reversible costume.

Explain the materials available and the time frame for the assignment.

Find a volunteer from outside the class or play the role of "sunlight" or take this role yourself. Place your tray of cookies nearby.

Figure 23—Sixth grader prepares her pileated woodpecker puppet for

Procedure

When all preparation is done.....

1. Explain: Plants capture the sun's energy and store it in the chemicals that make up their tissues. Later, plants break these energy-storing chemicals apart and use that energy to grow, change, and reproduce. We have learned from experiments (Chapter 3 of the *FireWorks* curriculum) that fire releases some of the energy in plant tissues as heat and light. Other living things can release that energy too, using it for their own growth, change, and reproduction. That's how animals, including ourselves, obtain energy.

   > **INFO SPARK**: Introduce or review concepts from your curriculum about the carbon cycle—photosynthesis and respiration (both cellular and pulmonary). Introduce or review concepts from your curriculum about resource webs, food webs and trophic levels.

2. Ask students to introduce their organisms to the class. It may be best to feature a few organisms at a time over a few days rather than schedule them all at once.
3. After all presentations have been done, explain that you're going to do an activity that will bring all that knowledge together and show how interconnected the plants and animals are in Missouri River Country. Then ask student actors and actresses to stand in a circle wearing their masks/costumes. Have them stand pretty close, shoulder-to-shoulder.
4. Have each student name the organism he or she represents.
5. Give the string to the Sun.
6. Have the Sun hold one end of the string and pass the ball to an organism that uses sunlight (a plant).
7. Have the "plant" hold on to the string and pass the ball on to something that it's related to, either as its energy source, a consumer of its energy, or in a shelter relationship. The bur oak, for instance, could pass the yarn to the wild turkey (which might eat its acorns) or the flicker (which might nest in its trunk). Each time someone claims the string, the ball becomes available for another to claim, either as a resource or as a consumer. Don't treat the activity as a test with right/wrong answers; instead, encourage students to help each other by identifying their food and shelter relationships. **Note that, if students always pass the ball under the web, sort of rolling it along the floor, the string will not be tangled and can be reused.**
8. Continue the activity until the person holding the string has no one to pass it to. Explain that other organisms, not included in this limited "cast of characters," will use that organism's energy. Worms and vultures are great examples! But don't let the ball of string be stuck there; just pass it from the last organism back under the web to the sun, and keep going.
9. When every organism in the ecosystem is connected to one or two others, you can stop passing the ball of string. But don't let students drop it yet!
10. Ask them to hold the string firmly. This will make the web look a lot like a (somewhat disorganized) spider web. Now place your tray of "real" energy (cookies or other treats) on top of the string web, in a place where the string is criss-crossed enough to support it. Explain that this shows that the students themselves are part of the resource web that they are depicting.

11. Ask students to slowly, carefully ("on the count of three") bring their string web to the floor so they set the treats down without spilling. (This really gets them focused on cooperation, and it is usually successful. The uncertainty keeps it exciting.) Then let them share the treats.

Evaluation: Write down the name of your organism. Write one sentence explaining where your organism gets energy. If it requires other organisms for energy, name one or two of them. Write another sentence explaining how your organism might be useful to the people of Missouri River Country.

Closure: Remind students that energy is constantly being transferred from one living thing to another and that people are part of the web, capturing some of the energy for their own needs.

Extensions

1. Play the *Wildfire Prevention Team Interactive ZIP game* in the *Teacher Box.* This game discusses fire ecology in relationship to many species not mentioned in *FireWorks* materials.
2. Soils are a crucial part of the earth's energy webs. Explore the riches of soil using Activity 9 in the *Woodsy Owl Activity Guide,* "A Great Recipe for Garbage."
3. Make tree and owl puppets. Directions are in *Exploring Wood* (in the *Teacher Box*), pp. 32 and 62.

Class Page 13

Plant or Animal	Student's name
ANTS	
ARROWLEAF BALSAMROOT	
BALD EAGLE	
BISON	
BLACK BEAR	
BLACK-EYED SUSAN	
BUR OAK	
CHOKECHERRY	
CLARK'S NUTCRACKER	
COTTONWOOD	
COYOTE	
DEER MOUSE	
LIMBER PINE	
LODGEPOLE PINE	
MOUNTAIN PINE BEETLE	
NORTHERN FLICKER	
PLAINS PRICKLY-PEAR	
PONDEROSA PINE	
PRAIRIE DOG	
PRAIRIE GRASSES	
PRAIRIE TURNIP, BREADROOT	
PRONGHORN	
QUAKING ASPEN	
SASKATOON SERVICEBERRY	
SHARP-TAILED GROUSE	
WESTERN SNOWBERRY	
WESTERN YARROW	
WILD ONION	
WILD TURKEY	
WILLOWS	

Student Page 20

Getting to Know You

My name _____

My organism _____

Answer these questions about your plant or animal.

1. What is your organism—plant or animal? _____

1. How does your organism get energy? If it gets energy from other organisms, list a few of them.

   _____

4. What other organisms gets energy from yours?

   _____

5. What kinds of plants usually live in your organism's neighborhood?

   _____

6. Does your organism live best in places that are burned by surface fire, crown fire, or no fire at all?

   _____

7. Does it matter to your organism how long ago a fire occurred? Explain.

   _____

Activity 7-2. Always Changing

Grade levels:
X Middle
X High

What's the Point?

Missouri River Country is a vast, complex land containing many different kinds of plant and animal communities. Most of the area is covered by one kind of prairie or another. These are usually classified in a general way as shortgrass, tallgrass, and mixed-grass prairie. In moist draws and river bottoms you will find woodlands and wetlands. In the west are hills and mountainsides covered by pine forest.

All of these plant communities change over time, and the animals that use them may change as well, in a process called *succession*. Plant communities are tremendous storehouses of carbon compounds with high-energy chemical bonds, so other organisms—fungi, insects, mammals, birds, people—have developed ways to tap that resource. People rely on plants and plant consumers (animals) for food, clothing, housing, medicines, and many other needs, including nourishment of the spirit.

Thus fungi and animals reuse and recycle the carbon accumulated the plants, but fire is the most dramatic recycler in Missouri River Country.

This *FireWorks* activity asks students to use information in *Story Time* (Activity 7-3) and in *Prairie, a Natural History* (in the Missouri River Box) to create and present a play showing 100 years of change in the plant communities of Missouri River Country.

ALTERNATIVE OR SUPPLEMENTAL ACTIVITY: You can cover the information in this activity in a more structured way and provide a service to younger students in your school as well: Assign a group of students to prepare *Story Time* (Activity 7-3) and present it to your class or a younger class.

Teacher's Map:

Objectives: Given reference materials on biology, ecology, and succession, students can prepare and produce a drama showing succession in Missouri River ecosystems

Subjects: Science, Reading, Writing, Speaking and Listening, Social Studies, Technology, Library Media, Arts, Workplace Competencies

Duration: 1-2 hours or more for student preparation, 20 minutes for presentation

Links to Standards[2]:

National Science Teachers' Association—Grades 5-8:

C4) Recognize that ability to obtain and use resources, grow, reproduce… are essential for life

C7) Recognize nature of energy and food webs

[2] See Appendix 4 in Smith and McMurray (2000) for links to Montana educational standards, grades 5-8, 9-12.

C8) Recognize that population size depends on resources
F3) Recognize sources and challenges of natural and human-induced hazards

National Science Teachers' Association—Grades 9-12:

C1) Understand basis for theory of evolution and natural selection
C4) Recognize that energy flow underlies resource webs
C6) Recognize behavior as a form of adaptation to environment
F3) Recognize extent, sources and challenges of natural and human-induced hazards

North American Association for Environmental Education—Grades 5-8:

0A) Classify local ecosystems. Create food webs
0B) Describe habitat needs of species that are locally declining
1C) Locate and collect reliable information about environment
2.2A) Understand biotic communities and adaptations
2.2C) Understand interactions among organisms and populations

North American Association for Environmental Education—Grades 9-12:

0A) Identify several plants and animals common to local ecosystems. Describe concepts
(succession, competition, parasitism)
0B) Investigate short- and long-term environmental changes
2.2A) Understand basic population dynamics and importance of biodiversity
2.2B) Understand basic ideas behind biological evolution
2.2C) Understand the living environment is comprised of interrelated, dynamic systems
2.2D) Use interaction of matter and energy to explain environmental characteristics

Vocabulary: plant community, ecosystem, succession

Materials

In this trunk...	***...where?***	***You must supply***
Map of Missouri River Country	B (with posters)	
Prairie, a Natural History	MO River Box	Art supplies for masks or costumes
FireWorks Notebook for the Missouri River Country	Teacher/C	Copy of Class Page 13, *Assignment List*, used in Activity 7-1
Feltboard Background for *Dancing Prairie Fires in Missouri River Country*		
Giant Looseleaf Notebooks: *Dancing Prairie Fires in Missouri River Country* (Parts 1 & 2)		

Preparation

Use this activity right after Activity 7-1, in which students adopt an organism and explain its fire ecology to the class. In this activity, students will learn about the different kinds of plant communities that comprise Missouri River Country. Then they will prepare and produce a play in which they depict inhabitants of these communities using masks or costumes. In the play, a reporter or narrator interviews plants and animals about changes in their homeland, especially due to fire.

Use the *Assignment List* from Activity 7-1 for planning.

Display the map of Missouri River Country in the classroom.

Procedure

1. Explain: The map shows the enormous size of the Missouri River drainage, where water originates at the Continental Divide in the Rocky Mountains and runs or creeps or seeps downhill through the northern Great Plains toward the Mississippi. (This curriculum does not cover the ecology of the lower Missouri River drainage, which reaches through the tallgrass prairie and into the hardwood forests of the central states.) Our class will develop a play that shows how some of the plants and animals in this vast area relate to each other, how they change over time, and how they interact with fire. Students will work together, using their adopted organisms from Activity 7-1, to create this play.
2. Find one student who will be the "director" of the production. That student doesn't have to "just" be a reporter; he or she can retain the identity of the organism adopted earlier. (A mouse can interview a tree—why not?)
3. Provide the *Story Time* narrative—at the start of Part 1 of *Dancing Prairie Fires in Missouri River Country*—for students to consult.
4. Have students plan the play by discussing the relationships among their organisms what happens to them over time, how fire influences them, and what happens to them after fire. Then have them develop a script, write it if necessary, and rehearse.
5. Have students produce their play for other classes or a parent group.

Evaluation:

Middle School level: Describe two organisms that live in Missouri River Country. Compare the ways they obtain energy and the ways they respond to fire.

High School level: How well could a tree from high in the mountains cope with life in the prairies? What traits might make it difficult for the tree to survive or reproduce in its new habitat? Would its relationship with fire have to change? Now select an organism that lives in the prairies and describe how it might respond to life in the high mountains.

Closure: Explain that students have investigated the story of fire in ecosystems of the Missouri River country three kinds of forest, but hundreds of other kinds of ecosystems in North America are shaped by fire. Fire's story is different in each of these ecosystems, and the plants and animals in each have developed traits that enable them to survive fire or reproduce well after fire.

Extensions

1. Report to the class on fire ecology in a different ecosystem than the ones explored in *FireWorks for Missouri River Country* by searching online or by studying the *Fire Ecology Resource Management Education Unit* (in the Teacher Box). Interesting ecosystems to study might include the longleaf pine forests of the South, sagebrush steppe in the Great Basin, giant sequoias in California, jack pine forests in the Great Lakes states, and pine barrens in New Jersey and New York.
2. Learn about current research in whitebark pine ecosystems from the Internet site of the Whitebark Pine Ecosystem Foundation, a group dedicated to protecting this unique ecosystem:

   www.whitebarkfound.org

Activity 7-3. Story Time

Grade levels:
X Primary
X Elementary

What's the Point?

Missouri River Country is a vast, complex land containing many different kinds of plant and animal communities. Most of the area is covered by one kind of prairie or another. These are usually classified in a general way as shortgrass, tallgrass, and mixed-grass prairie. In moist draws and river bottoms, you will find woodlands and wetlands. In the west are hills and mountainsides covered by pine forest.

Figure 24—Fire approaches a cluster of whitebark pine trees in a feltboard story in *FireWorks featuring Ponderosa, Lodgepole, and Whitebark Pine Forests.*

All of these plant communities change over time, and the animals that use them may change as well, in a process called *succession*. Fire is a dramatic force of change, but change occurs even without fire. Some plants need sunny openings to grow well, and some animals thrive on the plants that live there. These organisms often live in places recently burned. Other plants reproduce almost anywhere, even in deep shade. They may thrive in places not burned for a long time. Some plants and animals can live almost anywhere, regardless of when a fire occurred or how the forest changes.

This activity introduces a map of Missouri River Country and then uses feltboard materials (fig. 24) to tell the story of fire and succession in Missouri River Country. You may want to spread this activity out over several days, presenting one chapter of the 3-chapter feltboard story each day. **Primary** students help assemble the feltboard as the teacher or other adult reads the story. **Elementary** students may be able to read the narrative themselves; then they can practice working with the feltboard materials and present the story to their class or other students. If *FireWorks* is being used in the upper grades of your school, use it to have older students present the story to younger classes.

This activity can stand alone, but the learning will be richer if you combine it with Activity 7-1, in which each student adopts an organism, learns about it, and explains it to the class.

At some time during the week you're doing this activity, use Smokeygram #2 in your class (fig. 25).

Teacher's Map:

Objective: Given materials and a narrative for storytelling, students can describe fire ecology and succession in a forest ecosystem.

Subjects: Science, Reading, Speaking and Listening, Workplace Competencies

Duration: 15 minutes to prepare, 15 minutes to present, 15 minutes to put away

Links to Standards[3]:

National Science Teachers' Association—Grades K-4:

C1) Identify needs of various organisms
C2) Identify structures of various organisms and the needs they serve
F4) Understand that changes in environments can be natural or influenced by people
F5) Understand that changes in environments can be slow or rapid; rate has consequences

National Science Teachers' Association—Grades 5-8:

C4) Recognize abilities to obtain and use resources, grow, reproduce are essential for life
C7) Recognize nature of energy and food webs
C8) Recognize that population size depends on resources
F3) Recognize sources and challenges of natural and human-induced hazards

North American Association for Environmental Education—Grades K-4:

0A) Identify basic kinds of habitat and plants and animals living there
0B) Produce images of the area at the beginning of European settlement
0C) Describe aspects that change on temporal basis
2.1A) Identify changes in physical environment
2.2A) Understand similarities and differences among variety of organisms, habitat
2.2C) Understand basic ways organisms are related to environment and other organisms

North American Association for Environmental Education—Grades 5-8:

0A) Classify local ecosystems. Create food webs
0B) Describe habitat needs of species that are locally declining
2.2A) Understand biotic communities and adaptations
2.2C) Understand interactions among organisms and populations
2.2D) Understand how energy and matter flow in environment

Vocabulary: riparian, succession, plant community, ecosystem

[3] See Appendix 4 of Smith and McMurray (2000) for links to Montana educational standards, grades K-4, 5-8.

----------Smokeygram #2

Dear Class,

I'm glad you are learning about my homeland. I'm glad you are learning about how fires work, and how plants and animals live in wildlands that burn. As you get smarter about fire, I hope you learn to be even more careful about preventing wildland fires!

Sincerely yours,

Figure 25--"Smokeygram" to be used in Activity 7-3.

C2) Identify structures of various organisms and the needs they serve
F4) Understand that changes in environments can be natural or influenced by people
F5) Understand that changes in environments can be slow or rapid; rate has consequences

National Science Teachers' Association—Grades 5-8:
C4) Recognize abilities to obtain and use resources, grow, reproduce are essential for life
C7) Recognize nature of energy and food webs
C8) Recognize that population size depends on resources
F3) Recognize sources and challenges of natural and human-induced hazards

North American Association for Environmental Education—Grades K-4:
0A) Identify basic kinds of habitat and plants and animals living there
0B) Produce images of the area at the beginning of European settlement
0C) Describe aspects that change on temporal basis
2.1A) Identify changes in physical environment
2.2A) Understand similarities and differences among variety of organisms, habitat
2.2C) Understand basic ways organisms are related to environment and other organisms

North American Association for Environmental Education—Grades 5-8:
0A) Classify local ecosystems. Create food webs
0B) Describe habitat needs of species that are locally declining
2.2A) Understand biotic communities and adaptations
2.2C) Understand interactions among organisms and populations
2.2D) Understand how energy and matter flow in environment

Vocabulary: riparian, succession, plant community, ecosystem

Materials

In this trunk...	***... where?***
Map of Missouri River Country	B (with posters)
Feltboard Background for *Dancing Prairie Fires in Missouri River Country*	Teacher/C
Two large looseleaf Notebooks for *Dancing Prairie Fires in Missouri River Country* (Parts 1 & 2)	Teacher/C
Straight pins in small container You may also find 2-sided tape helpful.	*Hardware Box,* A
Optional: If you wish to incorporate names for plants & animals in a Native language, find the "Plant and Animal Names for Missouri River Country" poster in Box B or use the Excel file Names_spreadsheet.xlsx, in Tables_of_Names on the CD in the Missouri River Box.	

Preparation

Display the map in the classroom. Set up your storytelling area. Take the narrative pages out of the feltboard book for the reader (yourself?). Hang up the large blue felt background in a location where students can reach it. Read the Foreword and Introduction to *Dancing Prairie Fires in Missouri River Country* before starting the activity, paying special attention to the "Hints" on the first page.

Have pins and/or tape handy to attach pieces if they fail to "stick" to the background. This is especially helpful for the pink "buried treasures", which need to stay on the feltboard even when nearby pieces are removed… and for the wide strips of prairie plants, which may be too heavy to stay in place.

If you wish to use Native American names for the plants and animals featured in this activity, the trunk contains two resources that may help:

1. a laminated poster listing a few names in the languages of the Lakota and Pikunii people, with plenty of space to add names and explanations in other languages. Find this in Box B.
2. a file in Microsoft Excel that lists the organism names and has space for names in another language and explanations. Find this file on the CD in the Missouri River Box. The file is called Names_spreadsheet.xlsx, and it is in the folder Tables_of_Names.

Work with someone who can provide and explain the words for various organisms; if possible, have that person meet with your class to teach them about the language and culture.

Procedure

1. Explain: The map shows the enormous size of the Missouri River drainage, where water originates at the Continental Divide in the Rocky Mountains and runs or creeps or seeps downhill through the northern Great Plains toward the Mississippi. (This curriculum does not cover the ecology of the lower Missouri River drainage, which reaches through the tallgrass prairie and into the hardwood forests of the central states.) Now we will listen to a story about the plants and animals in this region. The class will provide dramatic sound effects for the story and illustrate it with felt pieces on this background.
2. If you intend to spread the story out over several days, explain how that will work—and that the feltboard will remain on display throughout that time.
3. Read the story, directing student helpers to illustrate it with felt pieces according to the directions in the narrative. Have the student helpers pat the felt pieces onto the board firmly so they'll stick. If they won't stick anyway, attach with pins or tape. It may be especially helpful to attach the pink "buried treasures" with tape, because they stay up while neighboring pieces are removed.
4. When it is time to disassemble the display, remove all pins and tape. Then replace the pieces in appropriate place in the looseleaf notebooks, using the scanned copies of pieces to get them in the right place.

Evaluation: Use any or all of the "Closure" questions below.

Closure: After reading the feltboard story with the students, have the class compare different kinds of ecosystems that are illustrated. Leading questions:

1. Which plant communities have conifer trees? (ponderosa and lodgepole pine)
2. Which communities are probably the driest, and which the wettest? (Shortgrass prairie is driest; willow-covered wetlands and riparian cottonwoods are wettest.)
3. Which communities are likely to have fires that move very fast but don't heat the soil much? (prairie)
4. How do prairie dogs fit into the prairie story?
5. Clark's nutcrackers fit into the whitebark pine story?
6. How do mountain pine beetles fit into the lodgepole pine story?

Extensions

1. Read *Fire in the Forest* (in the *FireWorks Library*) aloud to students. This book uses beautiful graphics to describe the story of fire in lodgepole pine forests. Work in teams to plan and paint such a book for another kind of plant community.
2. Set up an activity station where students can try "Puzzling It Out" (Activity 7-4). If students cannot read the clues on the puzzle pieces, see if older students in your school can help. For Primary-level students, sort the puzzles in one of the envelope kits into four groups—ponderosa pine, lodgepole pine, whitebark pine, and prairie—and have students assemble these puzzles separately.
3. To improve your skill in critical reading, use the "Reporting the Blazes," an activity in the *Fire Ecology Resource Management Education Unit* (U.S. Department of the Interior curriculum) in the *Teacher Box.*
4. Make up verses for the songs "Do you know who lives in my tree?" and "Trees for Lunch" (in *Exploring Wood*, pp. 38 and 81) and sing them for the class.
5. Fire suppression is one of several careers that arise from North America's complicated relationship with wildland fire. Read *Fire—a Force of Nature* (pp. 44-47) and *Yellowstone on Fire* (pp. 57-85), both in the *FireWorks Library*, to learn more about the work and frustrations of fire suppression.

Activity 7-4. Puzzling It Out

Grade level:
X Middle

What's the Point?

Discovering how the inhabitants of ecosystems interact is a little like assembling a complicated jigsaw puzzle. In this activity, students use what they have learned about fire, plants, animals, and succession to assemble jigsaw puzzles about some of the plant and animal communities in Missouri River Country: prairie (this activity doesn't distinguish the different types of prairie), ponderosa pine forests, lodgepole pine forests, and whitebark pine forests. Students need to use information about many species—either from their previous study or from reading the clues on the puzzle pieces—to complete the puzzles correctly.

This is a quiet activity that can be done alone or in small groups. *FireWorks* contains four puzzle sets. If you want to set up only 1 station for the activity, put out only 1 set; if you want to set up multiple stations, put them in separate places so the pieces from different sets don't get mixed up. This project can be assigned as seat work to fit in with other classroom activities, or set up at activity stations that one or a few students visit at a time.

Teacher's Map:

Objective: Given photographs and text as clues, students can identify components of 4 different ecosystems and see how they interact.

Subjects: Science, Reading, Social Studies

Duration: 20 minutes

Links to Standards[4]:

National Science Teachers' Association—Grades 5-8:

C4) Recognize ability to obtain and use resources, grow, reproduce… are essential for life
C6) Understand nature of populations and classification
C7) Recognize nature of energy and food webs
F3) Recognize sources and challenges of natural and human-induced hazards

North American Association for Environmental Education—Grades 5-8:

0A) Classify local ecosystems. Create food webs
0B) Describe habitat needs of species that are locally declining
2.2A) Understand biotic communities and adaptations
2.2C) Understand interactions among organisms and populations
2.2D) Understand how energy and matter flow in environment

[4] See Appendix 4 of Smith and McMurray (2000) for links to Montana educational standards, grades 5-8.

Vocabulary: cavity nester, crown fire, fire scar, fungus, succession, surface fire

Materials

In this trunk…	***… where?***
Puzzling It Out Kit (4 manila envelopes, each with a complete puzzle set of 44 pieces)	Teacher/C

Procedure

1. Explain: Each team uses one envelope of puzzle pieces to assemble four puzzles simultaneously, all on the same template. One of these puzzles describes the prairies of the Great Plains, another describes ponderosa pine forests, another lodgepole pine forests, and another whitebark pine forests. **Each puzzle contains**
   - a picture of the main kind of plant life—prairie or pine tree— in the center
   - across the top, typical fires and change in that kind of ecosystem over time
   - across the bottom, photos and information about other plants and animals that live in that ecosystem and how they interact with one another
2. Since the puzzles are all cut from the same pattern, they can't be assembled correctly based on shape alone; many pieces are interchangeable. To assemble them correctly, students need to use what they already know and use new clues in the captions on the puzzle pieces.
3. **OPTIONAL:** Review these key concepts that students will need to know:
   - Prairies are dominated by grasses but also have a lot of variety, including trees and shrubs
   - Ponderosa pines grow best at low elevations, on dry sites. In the past, most fires here were surface fires and did not kill the large trees. Trees could grow very old and very big.
   - Lodgepole pines grow well at middle elevations. They do not get very old or very large. Fires are not frequent, but they often crown and kill most of the trees.
   - Whitebark pines grow best at high elevations, on dry sites. In the past, some fires were surface fires and some were crown fires. Some burned in surface fuels most of the time, then—when the wind got strong and flames reached a cluster of trees with lots of ladder fuels—reached into the crowns. (*FireWorks for Missouri River Country* does not contain much information on whitebark pine communities, so this puzzle may be especially challenging and could be left out of the exercise.)
3. When students have completed puzzles, check them against the puzzle-master illustrations included in the *Puzzling It Out* Kit and shown (reduced in size, with text omitted) in fig. 26.

Evaluation: Name one kind of mammal, bird, or insect that lives in each ecosystem.

Closure: Repack the puzzles in the correct envelopes, 44 pieces per envelope. If the pieces get scrambled, just turn them over and place all those with matching colors and symbols (for example, red X or black O) in the same envelope.

Extensions

1. Make a flip book[5] illustrating succession in one of the ecosystems included in this curriculum or in another ecosystem.
2. Read and report to the class about information in *Made for Each Other* (about whitebark pine ecosystems) or *Graced by Pines* (about ponderosa pine forests), both in the *FireWorks Library.*

[5] Thanks for *Fire in Florida's Ecosystems* Educator's Guide for this activity.

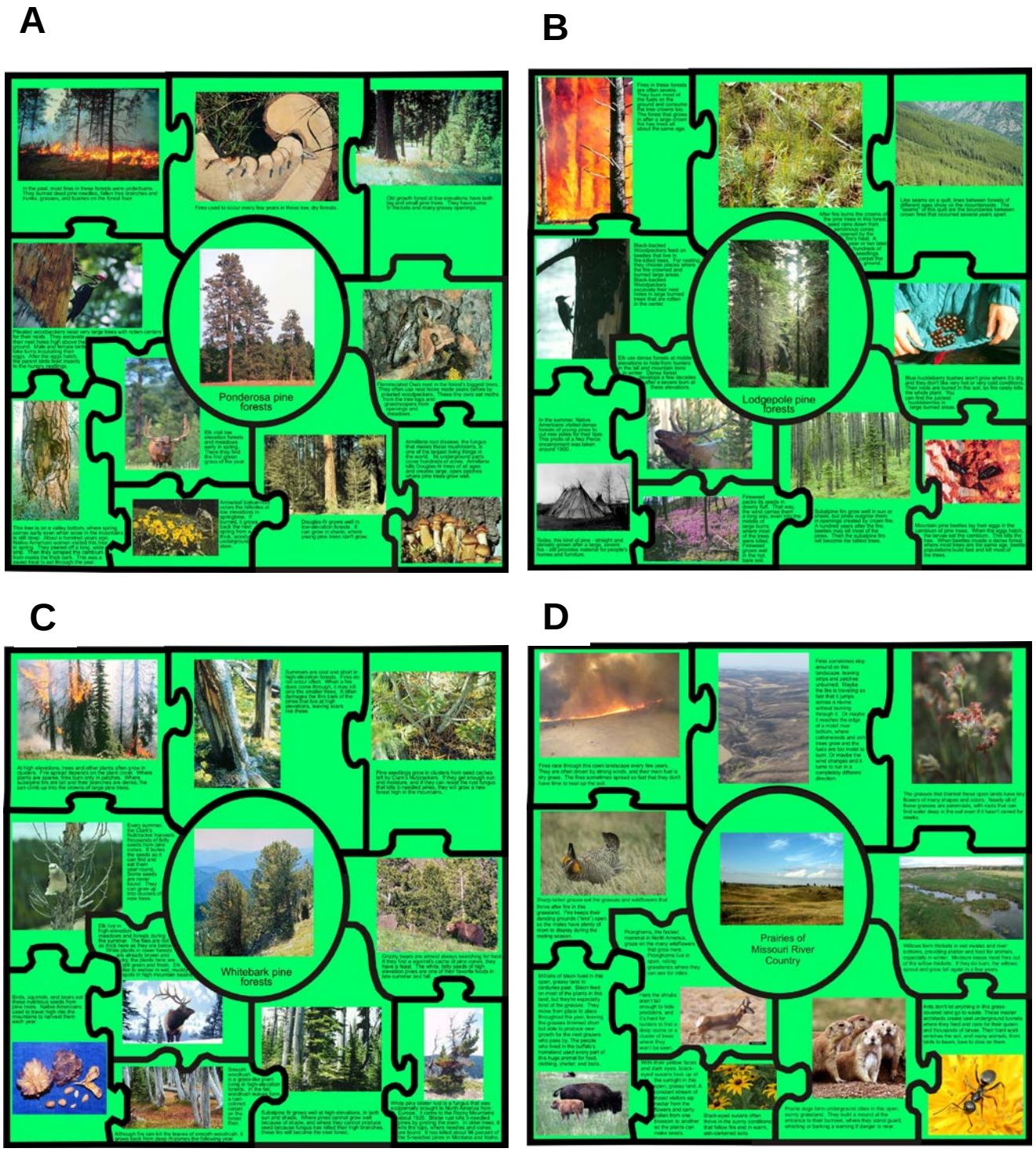

Figure 26—Correctly completed jigsaw puzzles for Activity 7-4. Size is reduced so text has been left out. **A—**Puzzle depicting ponderosa pine/Douglas-fir forest. **B—**Puzzle depicting lodgepole pine/subalpine fir forest. **C—**Puzzle depicting whitebark pine/subalpine fir forest. **D—**Puzzle depicting prairies of Missouri River Country.

Checklist:
FireWorks Materials Specific to the **Missouri River Country** trunk

For use in inventorying box

Item		No.	Checked in?
FireWorks for Missouri River Country—Teacher Guide		1	
"Beaver Steals Fire: A Salish Coyote Story" (2005) by Confederated Salish and Kootenai Tribes. Published by University of Nebraska Press, Lincoln, NE.		1	
Copy of this checklist		1	
Fire Carrier Box		1	
Complete fire carrier model			
Cross-sectioned fire carrier model			
CD containing documentation for this project		1	
"Fire: Friend or Foe" (1998) by Dorothy Hinshaw Patten. Published by Clarion Press, New York.		1	
"Fire on the Land" (2005) by Confederated Salish and Kootenai Tribes, Pablo, MT (a 2 DVD set).		1	
"Jackrabbit and the Prairie Fire: The Story of a Black-tailed Jackrabbit" (1991) by Susan Saunders. Published by Trudy Corporation, Norwalk, CT.		1	
Posters for ***Missouri River Country (*** in main *FireWorks* trunk Box B)	Map of Missouri River Country	1	
	Plant and Animal Names	1	
"Prairie, a Natural History" (2004) by Candace Savage. Published by Greystone Books, Berkeley, CA.		1	
"The Charcoal Forest: How Fire Helps Animals and Plants" (2007) by Beth Peluso. Published by Mountain Press Publishing, Missoula, MT.		1	

Literature Cited

Smith, Jane Kapler; McMurray, Nancy E. 2000. *FireWorks* curriculum featuring ponderosa, lodgepole, and whitebark pine forests. Gen. Tech. Rep. RMRS-GTR-65. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 270 p.