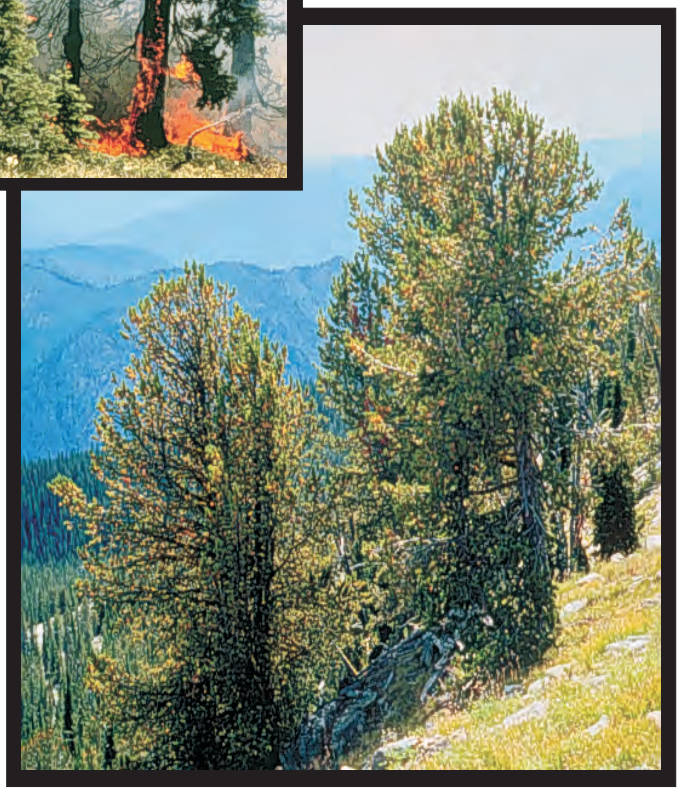
Rollercoaster Fires:

Feltboard Kit for Whitebark Pine/Subalpine Fir Forest

by Nancy E. McMurray and Jane Kapler Smith



FireWorks

Whitebark pine/subalpine fir forest Flannelboard display

Fire patterns...what's natural?
Introduction for the teacher

[This page is at the beginning of all feltboard binders.]

Have you seen pictures of forest fires on the news or in magazines? What did these fires look like? Fires that make the news are usually spectacular. They are huge, roaring, scary-looking fires... tall flames blazing up through the trees... fires gobbling up everything in their path... mushroom-shaped columns of smoke looming high above the mountain tops... animals running for their lives. Some forest fires are like this, but not all of them. Fires burning in open pine forests can be just the opposite. These are creepy, crawly fires. They move through the forest like a spider through the grass, creeping slowly along the surface of the ground, quietly burning up flowers and bushes. Occasionally the flames may run up the side of a tree, blackening the bark, but only rarely do they push into the tree tops.

In the forests of the northern Rocky Mountains and in the prairies of the Missouri River drainage, fire is bound to come visiting sooner or later. Over thousands of years, these ecosystems burned again and again. The pattern of fire, however, was different for each ecosystem. Two important things shaped the natural fire pattern: the waiting time between fires, and how the fire behaved. Grasslands and forests growing in hot, dry places near valley bottoms had only a short wait between fires. Cool, wet forests high in the mountains waited a long time between fires. Each kind of ecosystem developed its own way of living with its special pattern of fire. Plants and animals living in these habitats likewise came to depend on these fire patterns for their well-being.

FireWorks has several feltboard stories that describe fire in different ecosystems.

- *Creepy, Crawly Fires* tells the story of past fires in ponderosa pine/Douglas-fir forests.
- *Roaring Treetop Fires* shows the history of fire in lodgepole pine/subalpine fir forests.
- *Rollercoaster Fires* describes how fire was a part of some of the highest forests in the northern Rocky Mountains and Intermountain area, whitebark pine/subalpine fir forests.
- *Dancing Fires in Missouri River Country* describes the diverse habitats and fire relationships of the Missouri River drainage, from the spine of the Rockies to the tallgrass prairies of the central states.

Rollercoaster Fires

Fire pattern in whitebark pine/subalpine fir forests of the Northern Rockies and Intermountain regions

by Jane Kapler Smith and Nancy McMurray

This feltboard story describes the fire ecology of whitebark pine forests of the northern Rocky Mountains and the Northern Cascades, including the "intermountain" region between these two ranges. The story can be told in a single session or divided into chapters. Breaking it up may keep students more fully engaged and offer them time to absorb the complexity and/or investigate the ecology before moving on.

Narrative format: ***Items in blue ink and bold italics*** identify the first mention of each species incorporated in the story. Most of these species are described in greater detail in the *FireWorks Notebook.* Items in ***black ink and bold italics*** identify the first mention of a feltboard piece that needs to be added to the story. Directions to add or remove items from the feltboard are in ***red in the right-hand column***.

Felt pieces: Moveable feltboard pieces are located after the narrative. They are assembled on numbered "piece pages" in order of their appearance in the story. Most pieces are grouped—all the trees at the beginning, then understory plants, animals, etc. Each "piece page" has 2 parts: On the left is a colored scan identifying each piece and providing a count of duplicate pieces. Facing this on the right is the actual page of moveable felt pieces arranged on a blue felt background. These companion pages should match up. *Keep the scanned (left-hand) pages in the notebook while telling the story* so you can use them as a template for putting the pieces back in the right places after the story is told.

SETUP: Put up the blue felt background for the whitebark pine community. All materials on the background (sun, hillside, creek) are glued in place. If necessary, use pins to attach additional pieces as you tell and illustrate the story.

HINTS:

- The narrative refers repeatedly to "buried treasures" to describe surface and underground plant parts that can generate new growth or new plants. Buried treasures are shown on the feltboard with pink strips or circles. Students will get the most out of the story if they understand this concept. Buried treasures include rhizomes, corms, caudices, bulbs, tubers, seed (if buried or otherwise protected on the ground), roots (if they can generate new plants), and root crowns. After fires are shown on the feltboard, you may be instructed to remove green vegetation and even to replace it with gray or black, but *always leave the pink buried treasures in place.*
- After you remove things from the background, keep track of them; you'll need almost all of those pieces later in the story.
- If felt pieces won't stay in place on background, attach them with a pin. (These can be found in the *FireWorks* Hardware Box.)

CHAPTER 1. Community members

INTRODUCTION

In a whitebark pine forest, large fires don't happen very often—perhaps every 200 or 300 years. Summers are just too short at the high elevations where this forest grows. Snow disappears for only a few weeks before it covers the ground again. When a fire does start, it has a hard time spreading. Usually it just creeps through the dried plants on the forest floor, but once in a while it burns into the tree crowns. Sometimes it moves from bushes to treetops, then back down again, then up, then down, like a rollercoaster. It's a rollercoaster fire!

TREE SPECIES IN THIS FOREST

A ***whitebark pine*** forest grows very high in the mountains, often forming what is called "treeline", the upper edge of the forest. This forest is tough enough to live in cold, windy places. The gnarled whitebark pines are proof of the rough growing conditions. These pines are more than 300 years old and not very tall. A tree in a moist valley bottom would probably be twice as tall at this age!

The whitebarks grow in scattered bunches along the top of the ridge. A few ***subalpine fir*** and ***Engelmann spruce*** trees grow in their shade.

Big fir and spruce trees grow well in moist, seepy areas.

Put up two whitebark pine groves, one on the left side of the blue seep in the middle and one on the right.

Put up 2 medium subalpine firs next to each whitebark pine grove (add 4 trees total).

Put up 2 medium spruce trees next to each whitebark pine grove (add 4 trees total).

Put up 1 large subalpine fir and 1 large spruce near the seep in the foreground. Put up rotten log near them.

PLANT SPECIES GROWING ON THE FOREST FLOOR

It's not just the trees that are short in a whitebark pine forest. The ground beneath the open, scattered groves of whitebarks is a carpet of short plants. It's hard to grow tall here. The soil is dry and rocky, and the growing season is only a few weeks long. ***Smooth woodrush***, a grass-like plant, grows here. So does ***grouse whortleberry***, a shrub so small it's called a "dwarf". These plants grow in clumps between patches of bare, gravelly ground.

Put up 6 smooth woodrush plants with their pink Buried Treasures circles.

These high mountain plants are tough below ground as well as above. They all share an underground secret, a buried treasure that lets them grow back after winter, grazing, or fire. Pink circles mark these buried treasures.

Put up 6 grouse whortleberry plants with their pink Buried Treasures circles.

ANIMAL SPECIES THAT CALL THIS FOREST HOME

Listen! Can you hear soft tapping sounds coming from the tops of the whitebark pine trees? A flock of ***Clark's nutcrackers*** is working over the ripe whitebark cones. These crow-sized birds use their strong beaks to hammer off the edges of the cones. Then they delicately pluck out the prizes hidden inside—delicious pine nuts! With their takeoffs and landings, the nutcrackers make the whitebark pines look like treetop airports. They are taking their load of pine nuts to openings in the forest, where they will quickly bury the precious seeds and then hurry back to collect more.

Ask students for sound effect. Put up a Clark's nutcracker in a whitebark pine crown.

Nutcrackers usually hide pine nuts in little groups of 3 to 5 seeds. These are called seed "caches". When winter comes, it will be extremely important to remember the location of seed caches. Pine nuts are the main nutcracker food during the long subalpine winter.

Other animals depend on pine nuts for food too. Can you hear the ***red squirrels*** chattering in the treetops? Instead of harvesting whitebark pine seeds one by one, they cut off the entire cone! Once cones are on the ground, red squirrels carry them off to storage heaps, called "middens", where they tear the cones apart and eat the pine nuts.

Put up red squirrel at base of a whitebark pine. Ask students for chattering noise.

In the fall, pine nuts are an important food for grizzlies as they prepare for hibernation. Grizzlies can't climb into the treetops to harvest cones, but they can raid a squirrel midden without feeling the least bit guilty! Thanks to the red squirrel, bears often get a high energy meal without having to work for it.

Put up grizzly bear.

Moist, seepy places within the whitebark pine forest attract ***red-backed voles*** and their predator, the ***American marten.*** The voles hide near rotten logs, so that's where martens hang out, looking for dinner!

Put up red-backed vole and American marten near rotten log.

CHAPTER 2. Fire in the Forest

FIRE WEATHER

In late summer, huge ***cumulus clouds*** build up over the mountains during the afternoons. There's lots of lightning but very little rain. A ***lightning bolt*** strikes a high point along the open ridge—a whitebark pine tree. Thunder shakes the forest and echoes in the valley below.

Put up cloud, partially hiding the sun.

Put up lightning bolt reaching from the cloud to a whitebark pine. Ask for sound effect, maybe on a count of three.

FIRE BEHAVIOR

The lightning starts a ***surface fire*** in our whitebark pine forest. Most of the time, fires that start here don't do much. The fuels just aren't dry enough or plentiful enough to keep a fire going.

The fire creeps around for several days, spreading beneath the whitebarks and leaving fire scars on some. Here and there, it climbs up the low branches of a fir or spruce just as if they were rungs on a ladder. From there, the fire might spread into the crown of an old whitebark pine.

Put up small surface fire.

Put more flames next to the surface fire, covering the ladder fuels and reaching into the crown of the whitebark pine.

A tree in this cluster "torches out". All its twigs and branches go up in a fiery blaze that lasts but an instant.

Once the crown fuels are gone, this fire has nowhere to go! The clumps of whitebark pine are so widely spaced that their crowns don't touch each other. The fire drops back down to the ground and creeps along until it finds another fuel ladder to climb.

Eventually another tree crown might torch out. Up and down, up and down! Our fire really does move through the forest like a rollercoaster. On it goes until it stops in sparse fuels along the open, rocky ridge.

Put up crown fire covering the whitebark pine crown.

Put up another small surface fire on the opposite side of tree from the first surface fire.

FIRE AND ANIMALS

What do the animals do while this fire is spreading? They just move out!

Move Clark's nutcracker, grizzly bear and red squirrel to unburned whitebark pine grove or the seepy area.

OUR FOREST AFTER FIRE

Rollercoaster fires create small openings in the forest where groups of trees are killed.

A ***flicker*** hunts for ants in the unburned portions of the forest floor. Woodpeckers may make a nest in one of these ***snags*** and raise their young. After they move out, bluebirds can use the hole for many years to come.

Nutcrackers love to cache their seeds in the openings that fires provide, no matter how big the burned area is. Although nutcrackers have an amazing ability to relocate seed caches, they always leave some behind. Those seeds may eventually grow into big, old trees that produce more pine nuts for the nutcrackers. No wonder whitebarks grow in clusters of trees!

Remove flames, cloud and lightning.
Remove burned pine grove and replace with snags.

Put up flicker on dead snag.

Put nutcracker on the ground in burned opening.

	Remember…pink circles mark

PLANTS AFTER FIRE What do rollercoaster fires do to the forest floor? Wherever a fire comes through, the tops of the plants are burned. Only ash remains of the smooth woodrush plants. A few ***black stick skeletons*** are all that remain where the grouse whorleberry bushes grew.	***the location of Buried Treasures. They stay put after the fire.*** ***Remove woodrush plants wherever fire occurred and replace with gray rectangles.*** ***Remove whortleberry bushes wherever fire occurred and replace with black stick skeletons.***
HOT SUMMERS AND HOT FIRES During hot, dry summer, spectacular fires can roar through a whitebark pine forest in the same way they might burn a lodgepole pine forest. Such fires often start in lodgepole pines and then burn uphill into the whitebark pines.  Only a change in wind, weather or terrain finally stops fires like these. Let's make some rain and stop this crown fire. That was a good soaker! Now let's dry things out.	***Put up wind above unburned whitebarks, blowing at trees.*** ***Put up flames coming from the bottom left-hand corner and moving toward the unburned pine grove.*** ***Ask class to "follow a leader" to make rain sounds—first clicking fingers, then swishing hands together, then tapping knees with hands. Have leader change from tapping knees to swishing hands, the clicking fingers, then quiet.*** ***Take down flames and wind.***

CHAPTER 3. Change over Time

BUSINESS AS USUAL

The spring after a fire, wildflowers and bushes sprout right back because of their secret, buried treasures—those underground growing points. The fire hardly touched them!

Within a few years, something else is growing in the openings made by the fire. What are these little green tufts? Whitebark pine seedlings! These tiny trees grow a little bit each year. They may be 80 years old before they can make seeds, but that doesn't seem to bother the animals that live here.

Replace gray rectangles of ash and black sticks with smooth woodrush and grouse whortleberry plants.

Put up 4 clusters of whitebark pine seedlings.

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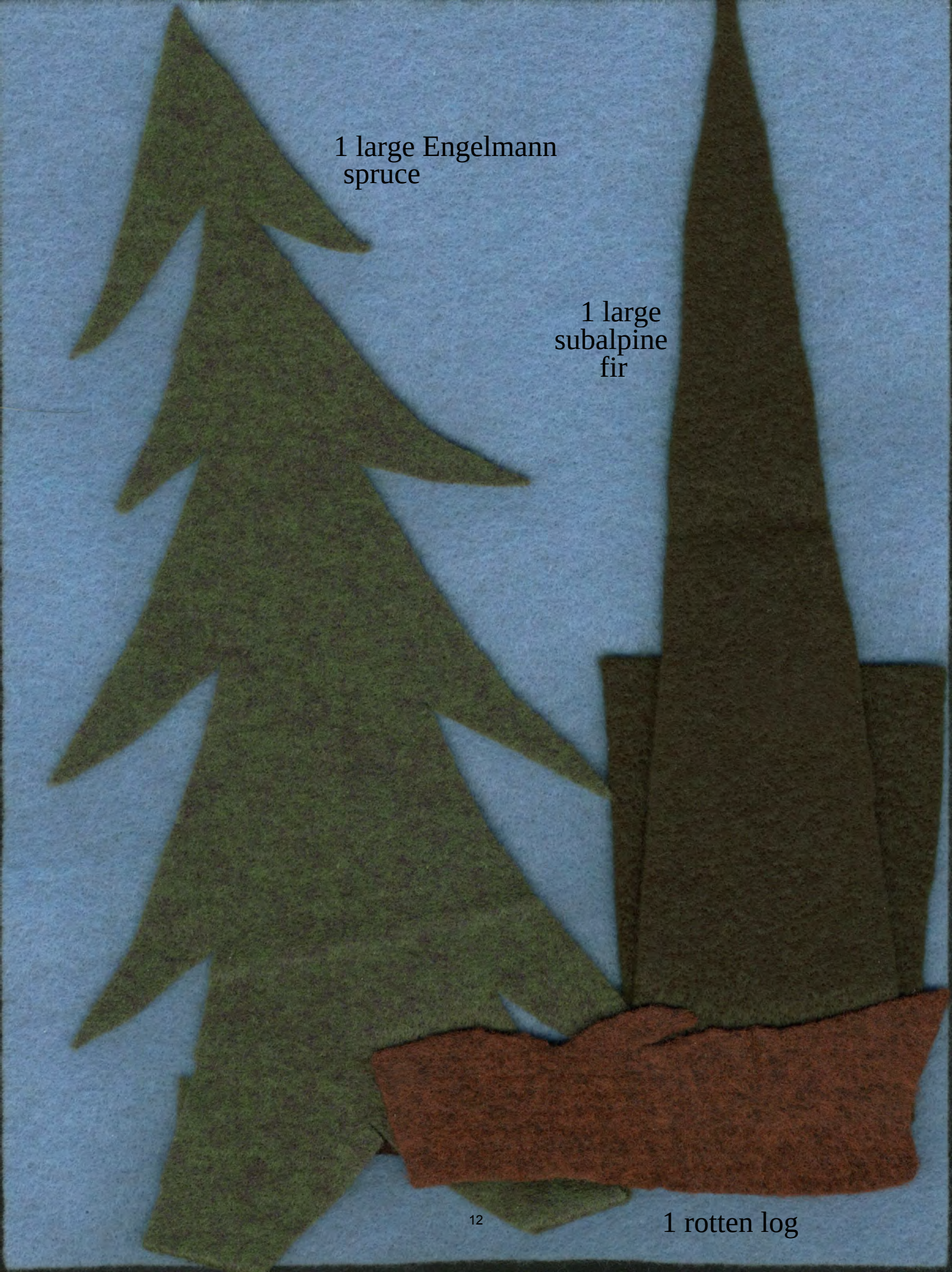
The Clark's nutcracker, red squirrels and grizzly bears—and their descendants—will harvest pine nuts in other whitebark groves until then.  You have to be very patient to see a whitebark pine forest grow up!	***Move Clark's nutcracker, red squirrel and grizzly bear to unburned whitebark pine grove***
BIG CHALLENGES FOR OUR FOREST As if life wasn't already hard enough in the high mountain forests, beetles and a tiny fungus are making it even harder. Mountain pine beetles have always lived with whitebark pines and fed on their cambium, but the long summers and warm winters of recent years now let them produce lots more larvae than usual. To make matters worse, a fungus called white pine blister rust arrived in North America about 100 years ago, and it has killed thousands of whitebark pines. The surviving pines need places for their seed to grow, and fires create some of the best places for seedlings. What do you think the future holds for whitebark pines? **THE END**	

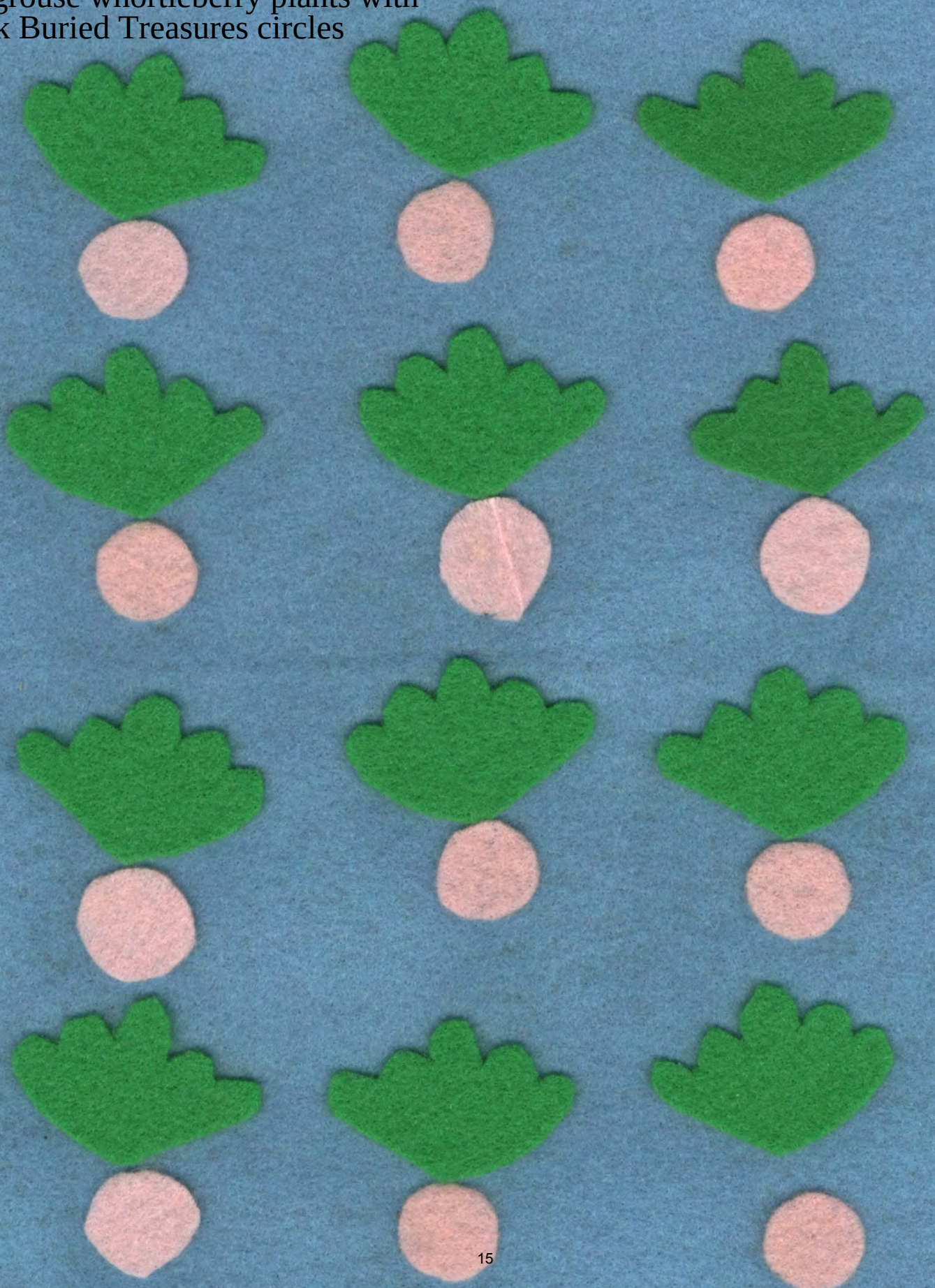
2 whitebark pine groves


1 large Engelmann spruce
1 large subalpine fir
1 rotten log

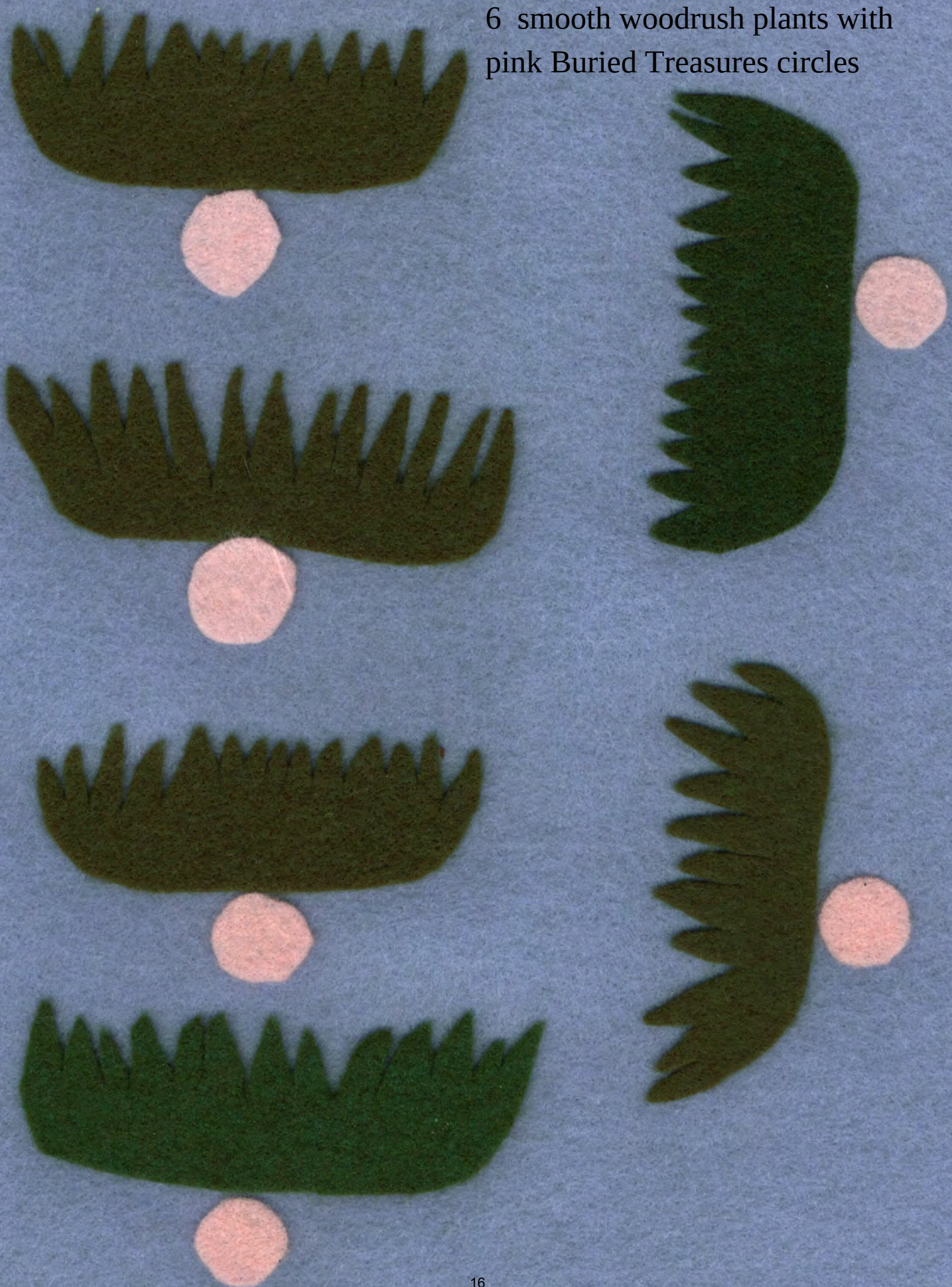
Decaying log


4 medium subalpine fir trees
4 small subalpine fir trees
4 medium Engelmann spruce trees

12 grouse whortleberry plants with pink Buried Treasures circles



6 smooth woodrush plants with pink Buried Treasures circles



1 American marten

1 Clark's nutcracker

1 red-backed vole

1 red squirrel

1 grizzly bear

1 common flicker

1 thundercloud

1 lightning bolt

1 wind


1 surface fire
2 flames moving through ladder fuels into the crowns
1 surface fire

1 crown fire
(place in lower left-hand corner)

1 burned grove of whitebark pine snags

6 grouse whortleberry stick skeletons

4 smooth woodrush ash

4 whitebark pine seedlings