

The following 23 pages are examples of interpretive signs from two trails on the Wenatchee National Forest.

Since the dimensions of the first 16 pages are 16 x 12" you will need to print them at 70% to fit letter size paper.

These signs are for examples of what can be done, and are not to be used as clip art.

Permission to use the art in any form should be obtained from the artist:

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DEAD TREES BRING NEW LIFE TO THE FOREST

Standing dead trees are called snags. Worn and weathered, snags are rich with life. Forest plants and animals use many parts of a snag for food, shelter, courtship and nesting.

When a tree dies, it is no longer protected from the forces which cause decay. A dead tree, whether standing or fallen, becomes sort of a mall for insects and animals. Wood boring beetles chew tunnels into the wood, thereby creating paths for fungi to enter the tree.

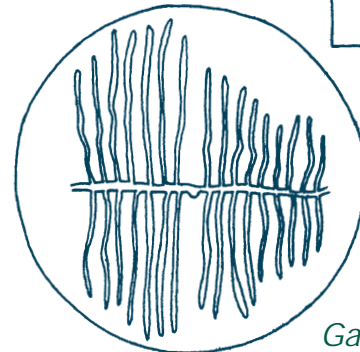
As the wood decays it attracts more insect life, which in turn attracts insect-eating birds. These birds will often excavate cavities in search of food. The process continues when still other species use these cavities for nests. Rodents and bats often find shelter under loose slabs of bark clinging to dead trees.

After a snag falls it becomes an even greater target for decay as moisture from the ground hastens the rotting process. The forest floor likes the taste of downed snags. Down wood sucks up moisture like an enormous sponge and holds it through the dry summer months. This reservoir of moisture attracts insects and fungi, which again draws larger animals in search of food, such as mice and voles.

Big Brown Bat



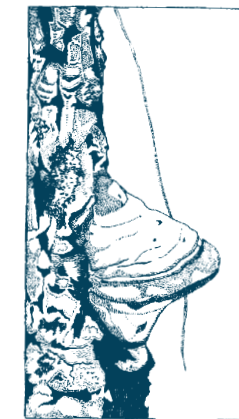
Pine Bark Beetle



Gallery of Fir Engraver



Pileated Woodpecker

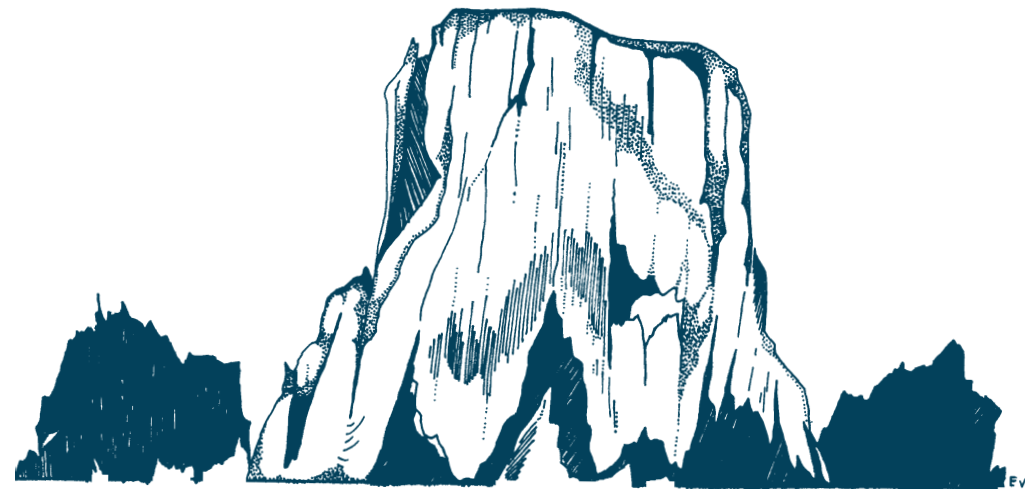


Red Belt fungus

Deer Mouse



Dead trees eventually end up as soil. Through the processes of decay, the nutrients they absorbed from the sun's energy centuries ago becomes the food for tomorrow's forest.

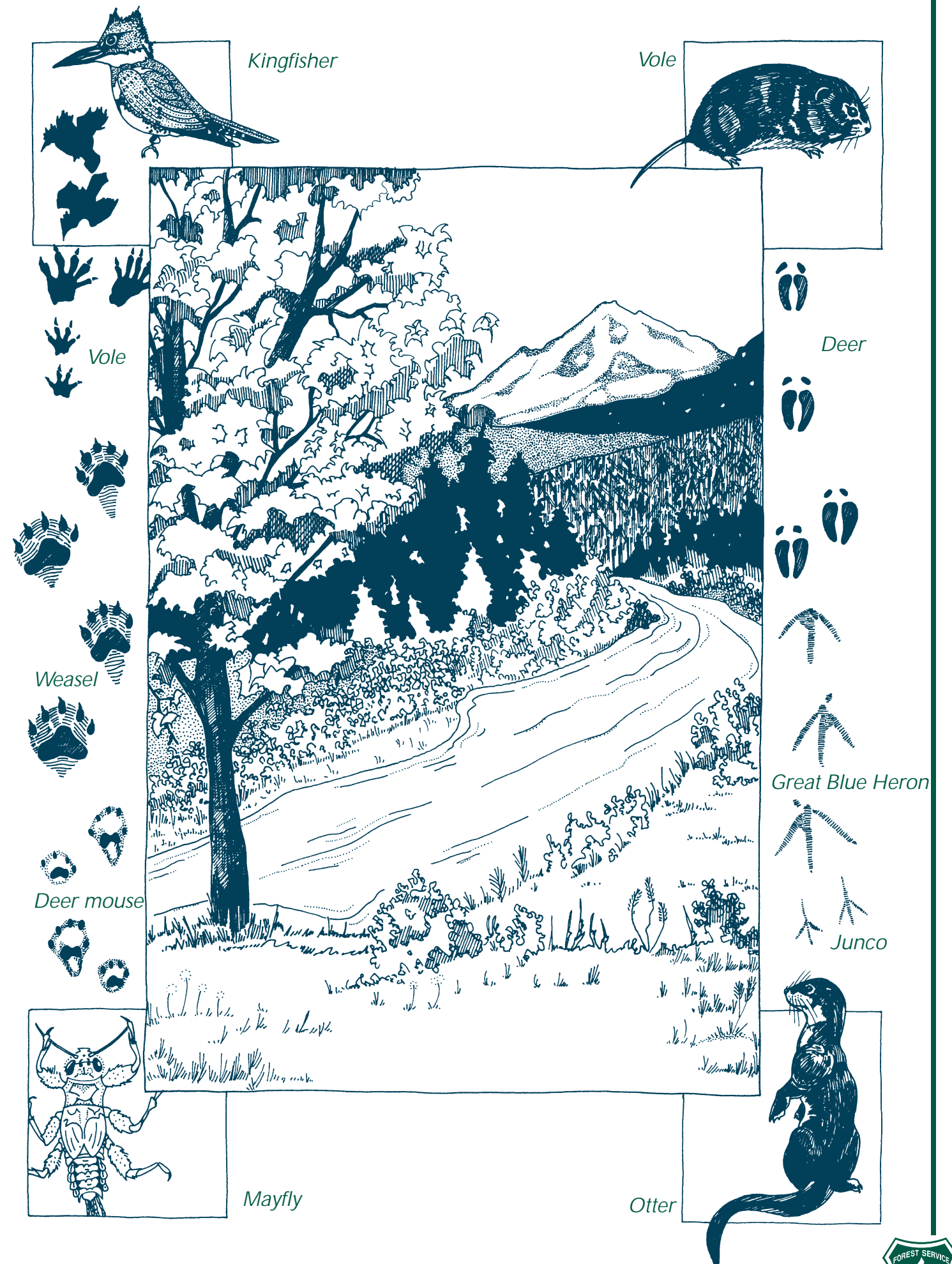


THE RIVER AS A TRAVELWAY

Look at the river flowing in front of you. Imagine yourself floating downstream. It's easy to visualize the river as a travelway, a corridor for transport. The ecosystem is dependent on the transport functions of the river. The first thing that comes to mind is the movement of fishes. The juvenile salmon and steelhead that spent their early lives here used the river corridor to travel 470 miles from this point to the Pacific Ocean. They will retrace those same 470 miles when they return as adults to spawn here.

While many aquatic birds (mergansers, dippers, ospreys, herons) travel the river in search of food and cover, many more birds travel the wooded riparian zone that lines the river. Small perching birds (warblers, thrushes, woodpeckers, etc.) search the riparian zone for food and nesting sites. Larger predatory birds (raptors such as hawks, eagles and owls) search the riparian woods for prey—smaller birds and mammals.

Mammals from the smallest mice and voles to the largest deer, elk and bear follow the river in search of food and cover. Deer and elk follow seasonal migration routes along the river. Beaver, otter, and weasels use the river and its banks as travelways in their search for food and cover. As you travel the bank of the river on this trail, be watchful for signs of wildlife that have traveled here before you.



NOT ALL PLANTS GROW IN SOIL

Dwarf mistletoe is a seed-bearing parasite plant which grows in trees. The "roots" of the dwarf mistletoe plant invade the cambium (inner bark) layer of the host tree and drain off water and nutrients needed by the host. Over time, this will stress and eventually kill the host.

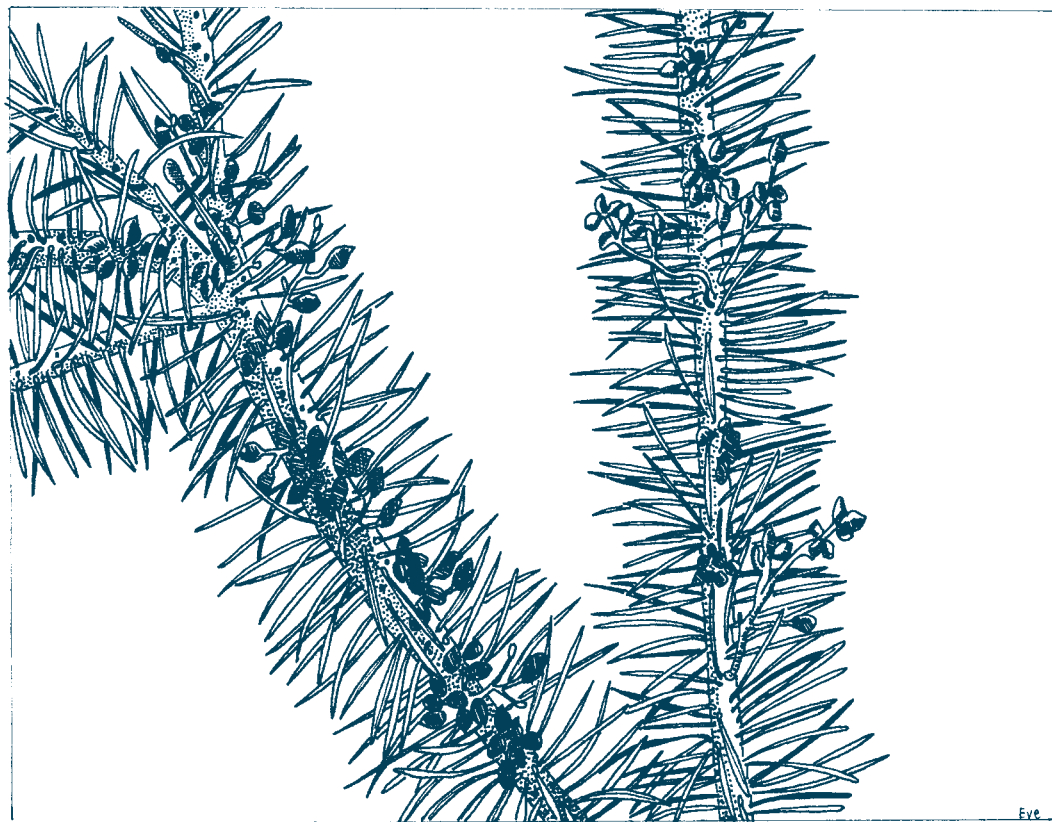
Although it's a parasite, dwarf mistletoe can play a beneficial role in its ecosystem.

Nature has found several beneficial uses for this slow killer. The large masses of foliage characteristic of dwarf mistletoe infestations, called "witches brooms," provide excellent hiding and nesting habitat for a variety of creatures, including grouse, owls and squirrels.

Dwarf mistletoe spreads by ejecting sticky "seeds" in the autumn. These seeds will either stick to the trunk or branches of the next host, or they can be unwittingly spread by wildlife. Dwarf mistletoe has adapted into distinct subspecies which grow in a particular host tree species. Dwarf mistletoe growing in Douglas-fir, for example, can only spread to other Douglas-fir trees rather than into grand fir. This parasite spreads 30 to 100 feet per year.

In an undisturbed ecosystem, fire, which kills dwarf mistletoe, will control its spread.

Dwarf Mistletoe on Douglas-fir branch



"Witches broom" in Douglas-fir

THE RIVER: the most dynamic agent of change in this ecosystem

Many people enjoy spending time beside a placid river, strolling the bank or fishing. However, if the river is flooding it's a different story. Although floods appear terribly destructive, they are normal geologic events which shape and mold the surface of the Earth.

The most obvious effect of a flood is the dangerous spread of water over the landscape. But floods also carve new channels and fill in old ones. They topple and transport trees downstream. They redistribute rocks and boulders in the riverbed. They scour sediments from upstream areas and deposit them where the water calms down. They build new islands and wash away the old ones.

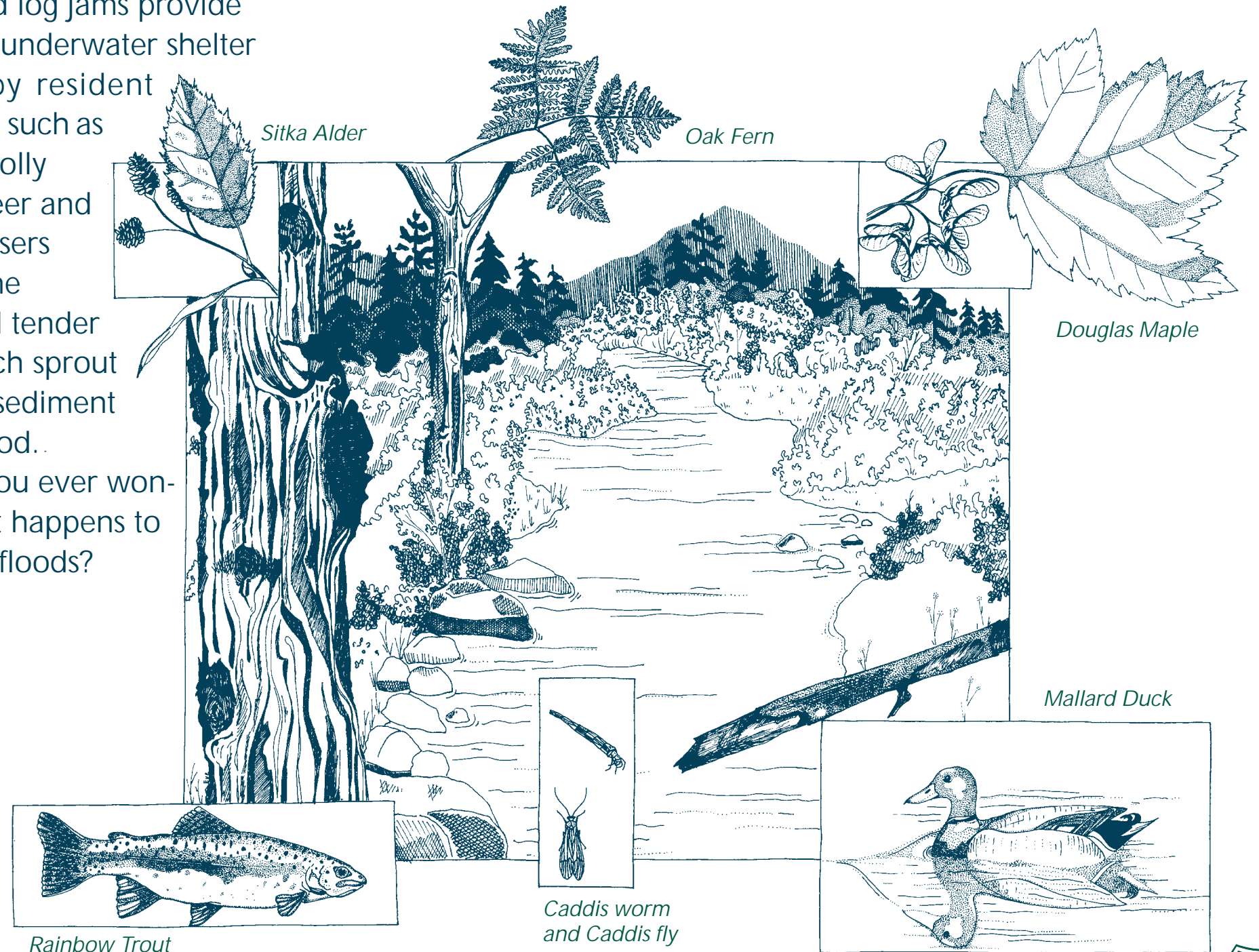
These changes, though, are not necessarily bad or good. Many of these changes act to reinvigorate the riverbottom ecosystem.

Fresh gravel beds in new channels make excellent spawning grounds for salmon. The presence of these fish attract both flying and walking predators. Jumbles of boulders and tangled log jams provide the kind of underwater shelter required by resident fish species, such as trout and dolly varden. Deer and other browsers thrive on the grasses and tender shoots which sprout in the rich sediment left by a flood.

Have you ever wondered what happens to fish during floods?

Some fish inevitably get swept downstream. Other fish, though, will flee to protected areas, like side channels or backwaters, to escape a violent and muddy trip downstream.

If you want to imagine what it's like for a fish caught in a flood, just imagine yourself in a dust-storm.



OLD GROWTH FORESTS

What is an old-growth forest? Massive trees filtering light down to the needle-carpeted ground. Silvered snags guarding their fallen forbearers. Rough bark, gnarled and fractured with crevices. Arthritic branches jutting from lower trunks, whiskered with moss and lichen. Silent giants standing in the dark, moist ground.

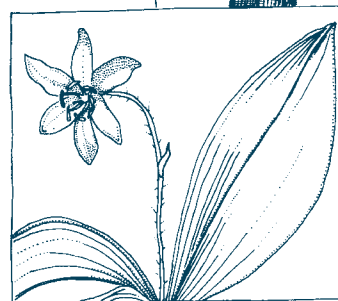
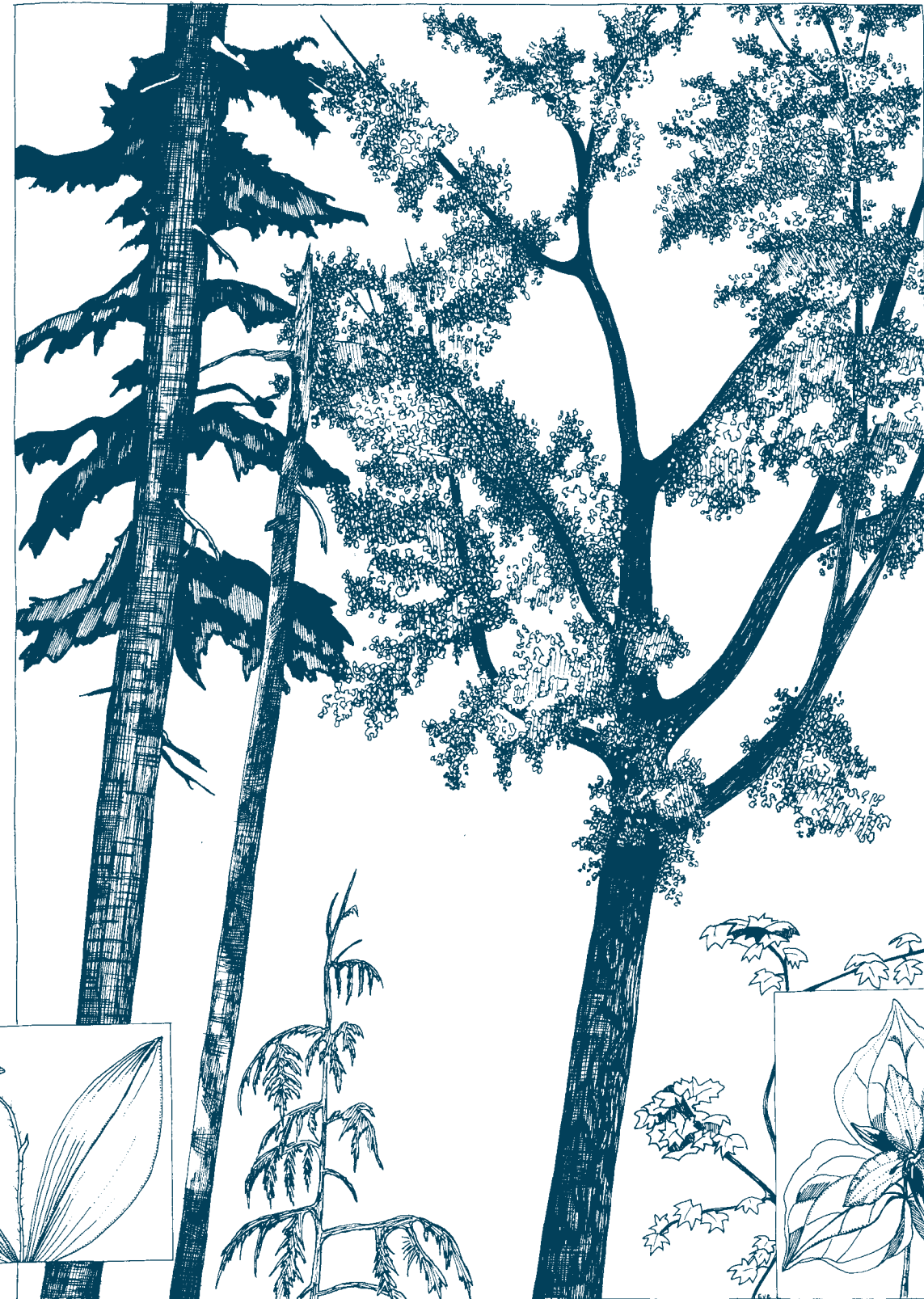
Perhaps this is what many of us may think of when we ponder an old-growth forest, but in reality old-growth may not look this way at all.

“Old-growth” is a stage a forest reaches if it is left undisturbed and allowed to reach its maximum growth condition. What this condition finally looks like depends on a number of factors.

For example, coastal old-growth typically has trees much larger and taller than old-growth in an inland arid climate. The difference? Water. Annual rainfall on the Olympic Peninsula is 15 to 20 times the annual rainfall in the upper Entiat Valley. Plus, the species of trees found in old-growth will vary by elevation, the direction the slope is facing, moisture and soil type.

Other factors distinguishing old-growth are the accumulation of dead material, disease and decay evident in the stand of trees, multiple canopy layers, a wide variation in tree size and spacing, and gaps in the canopy and understory.

The trees you see in the grove beyond this sign are around 250-300 years old.



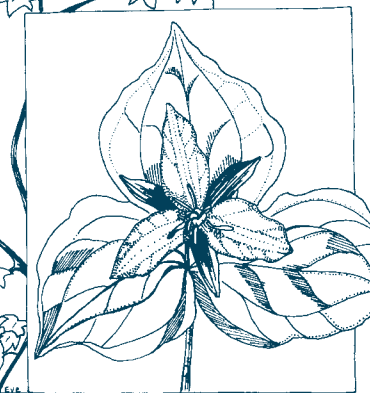
Bead Lily



Cedar



Cottonwood



Trillium

HEALTHY FORESTS HAVE LOTS OF VARIETY

What is the difference between a forest and an orchard? Most people would quickly answer that an orchard is a tightly managed group of trees growing for a specific purpose—to provide food.

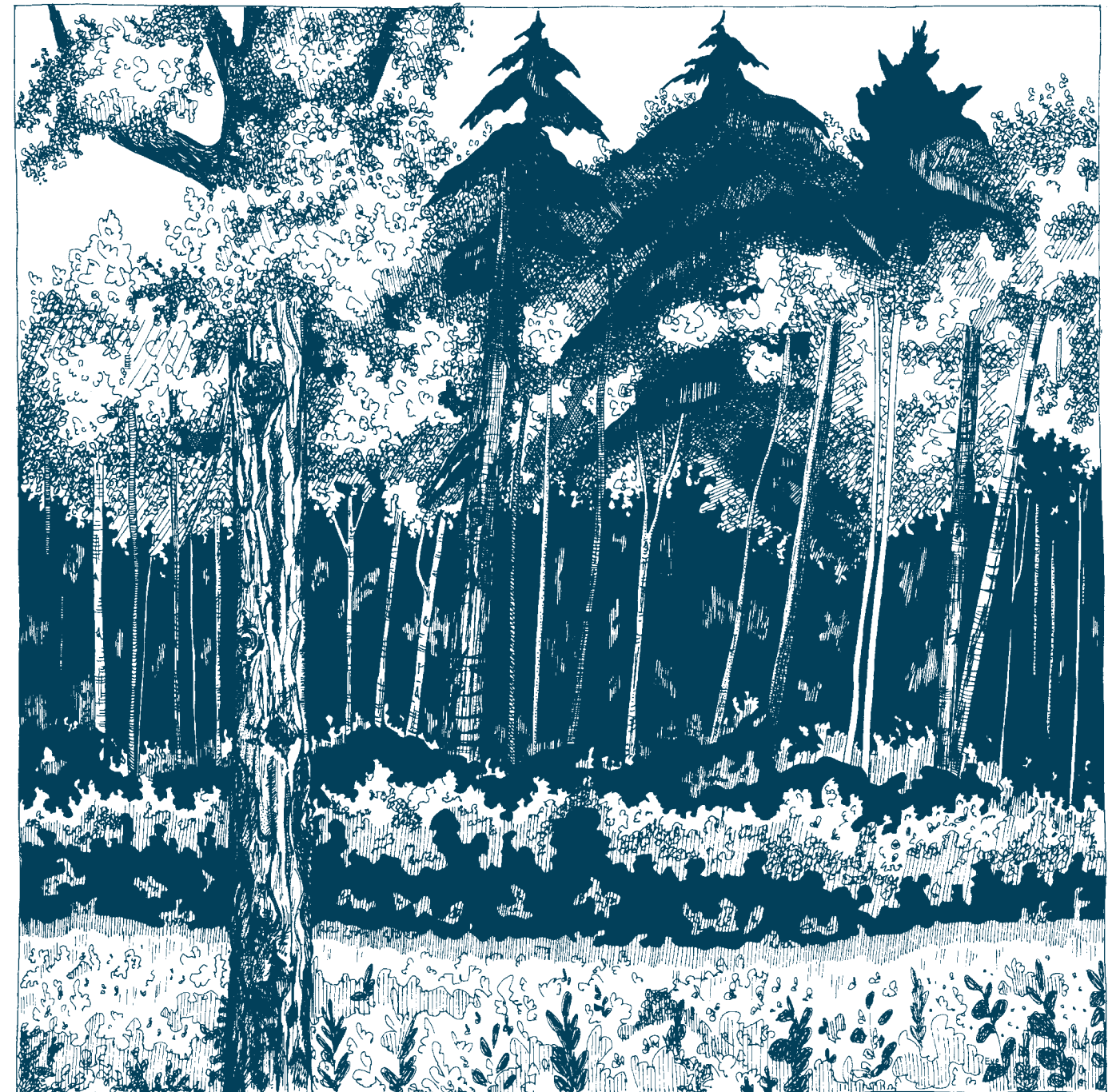
Even though both an orchard and a forest can loosely be considered groups of trees, there are significant differences.

For one thing, a healthy forest needs a mix of tree types, sizes and conditions to be vigorous. Such a forest has trees both live and dead, trees both tall and short, bushy trees and thin trees, trees with leaves and trees with needles.

A healthy forest has all stages of a tree's life represented. This variety produces the diversity that marks a healthy forest by providing a spectrum of niches—places for plants and animals to live, eat and sleep. Plus, in order to provide the ingredients which make up the food chain, a forest must comprise a variety of plants and growing spaces.

As foresters have learned more about the science of forestry they have discovered that we can't treat a forest like an orchard. Forests must be managed so as to produce and promote biodiversity—which literally means a variety of life.

Look around this spot closely. What kind of variety do you see?



Spruce

Cottonwood

Cedar

FIRE ECOLOGY

Fire is as natural a part of the forest as water. Just like a flood or an avalanche, fire is a dramatic agent of change in an ecosystem—one which we don't always like or understand.

Such a change occurred across the river from where you are standing in 1970. That summer was a particularly hot and dry one. In the middle of the night on August 24, 1970, a huge dry lightning storm hit the northern end of the Wenatchee National Forest. Dozens of fires were ignited, and many of the fires spread rapidly beyond control.

Even though these fires were started by a natural force, conditions were such that they had an awesome effect on the forest. Due to the hot and dry conditions, and because of the heavy load of fuels sitting on the forest floor, the '70 Fires ended up charring some 65,000 acres on the Entiat

Ranger District, plus many thousands of acres on adjoining ranger districts.

Natural fire is important in maintaining the health of a forest. For one thing, a naturally-occurring low intensity fire will not destroy a forest. A low intensity fire is one which doesn't burn with huge flames or searing heat; it burns close to the ground with small flames, slowly creeping and smoldering. This kind of fire protects the forest from disastrous fires by preventing heavier fuels—things like logs, stumps and thick limbs—from building up over the years. When accumulated large fuels catch on fire, they cause high intensity fires, which is what happened in 1970.

Fire also returns needed minerals to the soil and clears the way for missing plants to reappear where the fire burned. The growth spurt after a fire tends to benefit wildlife by providing a greater variety

and abundance of food for several years.

Even though fire effects can be destructive, fire is a natural part of a healthy forest ecosystem.



BEAVERS USED TO LIVE HERE

Have you seen any evidence that beavers used to live in this area? You can still find the peculiar pointed stumps from trees felled by beavers along this part of the Entiat River.

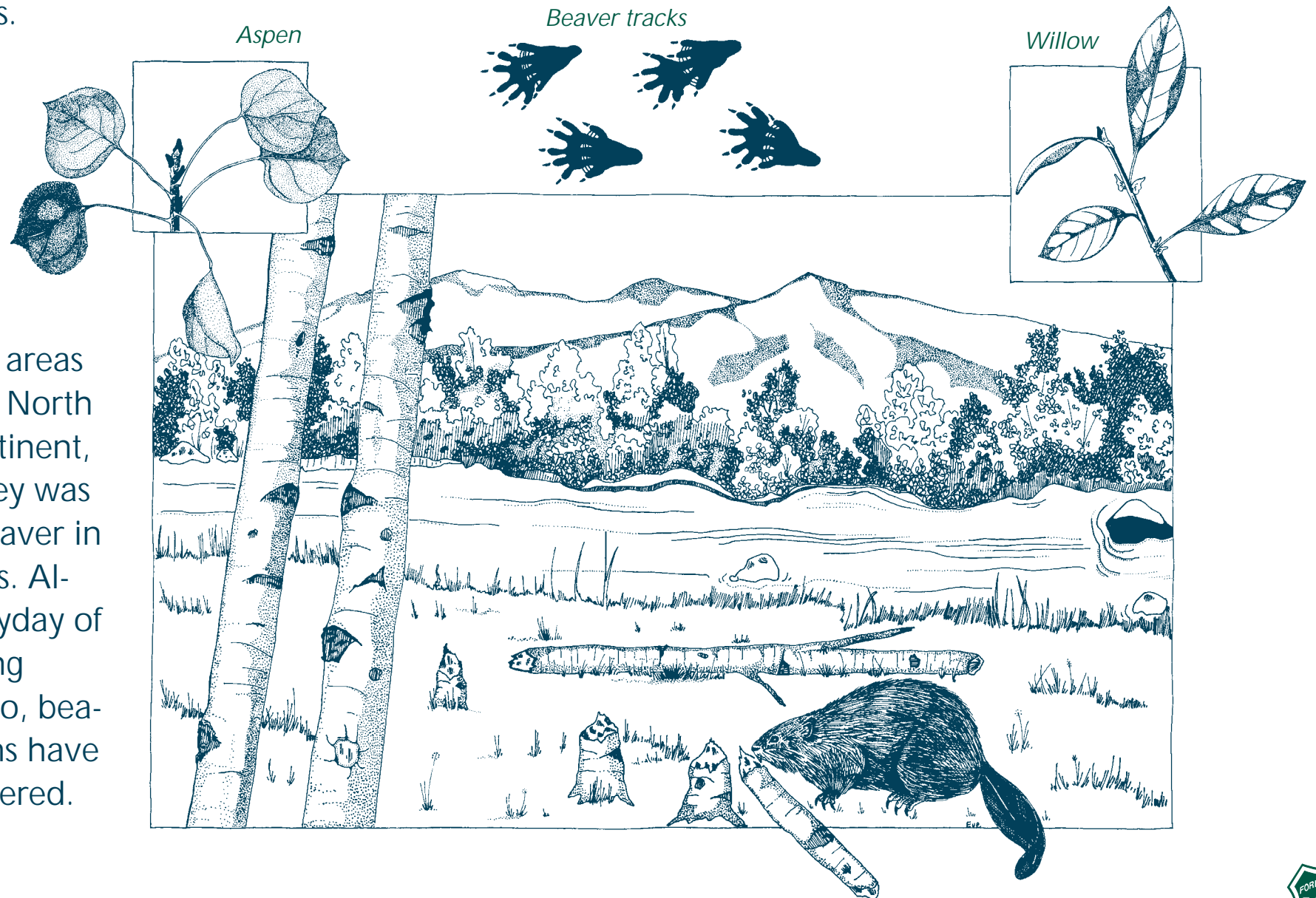
Beavers are a valuable member of the riparian ecosystem. Their tree-cutting activity puts woody material into the river which helps provide nutrients for aquatic insects, cover for fish, and feeding stations for other animals and birds. The ponds created by beaver dams reduce flooding by balancing and stabilizing year-round streamflow. The backwater created by ponds produces new wetland habitat and provides a safe place for fish to grow.

Although the Entiat River is too wide and swift to be dammed, beavers can still thrive here. They can dam side channels and creeks flowing into the river, and they will tunnel into the riverbank to make lodges. Beavers eat the inner bark of water-dependent plants such as aspen, willow and alder trees.

Like many areas in the western North American continent, the Entiat Valley was trapped for beaver in the early 1800s. Although the heyday of beaver trapping ended long ago, beaver populations have not fully recovered.

Scientists estimate that there may have been up to 400 million beavers distributed from the Arctic Circle to Mexico in prehistoric times; their population today stands at less than 10 million.

Hopefully, beavers will one day return to this reach of the Entiat River, with or without man's help. We'll know they are back when we see freshly chewed stumps!



CEDAR FISSURE: Scars may mar a tree, but they aren't necessarily bad

This cedar tree has a very noticeable scar in its trunk. Chances are this scar was caused by a fire, but it could have been caused by a chunk of ice from the river, a lightning strike, or damage from a human. Fire is the most common cause of scars like these. Usually, fire will burn into a tree trunk on either the uphill or downwind side of the tree.

Although this kind of damage can weaken or kill a tree, it can be overcome by a healthy tree. The tree slowly seals the wound with sap and eventually grows over the site.

During the years it takes for a tree to heal a scar, though, animals will often use the fissure for shelter or food storage. In some cases, honey bees will build their nests in fissures like these.

Imagine how much pioneers enjoyed finding a golden treasure of honey in a fire-scarred tree.



Honey Bee



New fire scar...

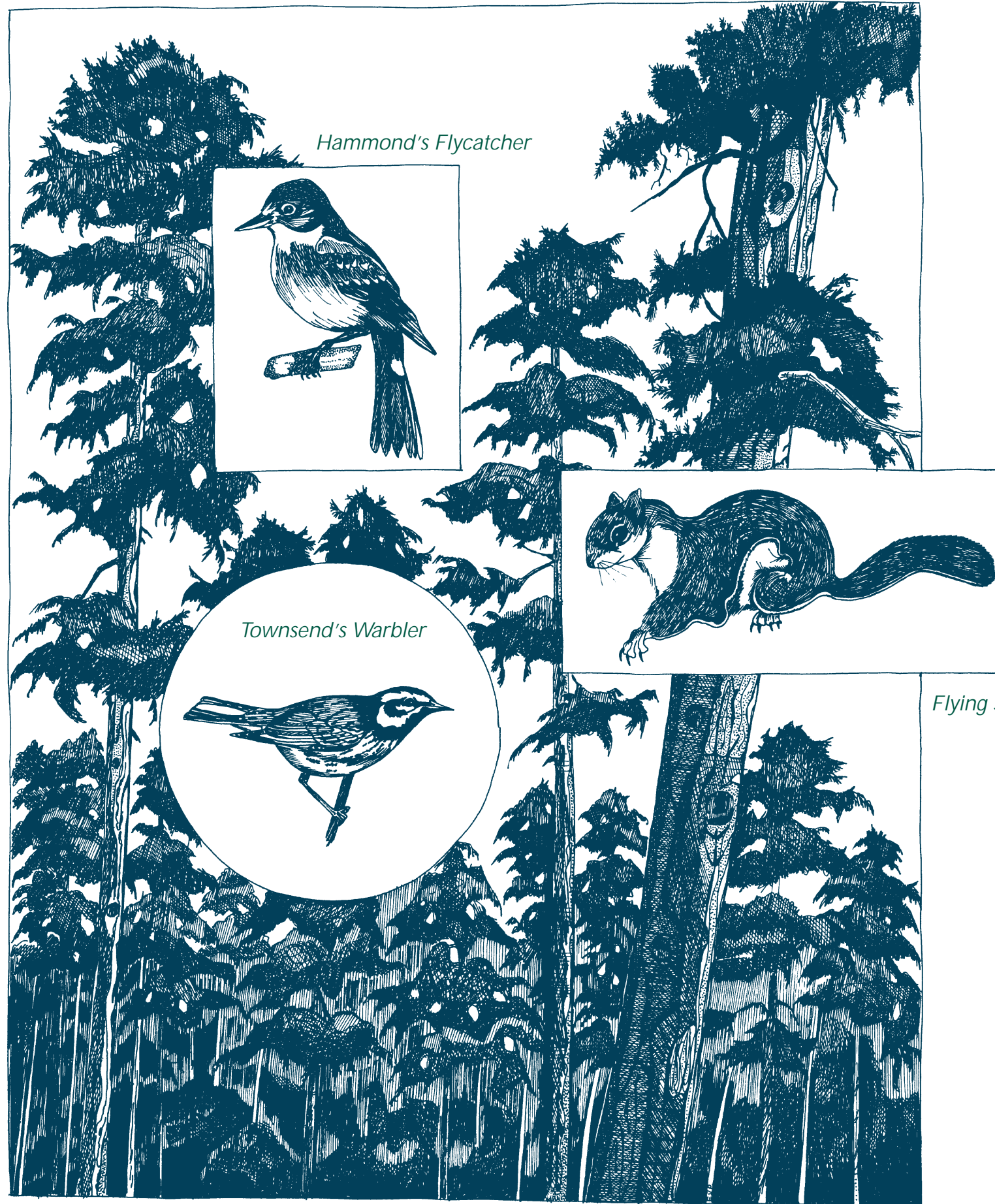
after 3 years...

after 10 years...

after 20 years

ECOLOGY OF THE UPPER CANOPY

High above you, in the upper canopy of the tree tops, is another world where several life forms exist, often unknown and unseen by those who spend most of their time on the ground. Several varieties of birds, animals and insects spend most of their lives in that habitat, eating, sleeping, mating and reproducing.



Hammond's Flycatcher



Townsend's Warbler



Flying Squirrel

WATER BELOW DICTATES THE PLANTS ABOVE

Do you notice a difference in the vegetation found in this area as opposed to other areas along the trail?

For one thing, the tall, straight trees you see growing in the openings are lodgepole pine. Look at the open character of the pine stand. Notice how the ground has more grasses here than at other spots. Some of the shrubs growing close to the ground are dwarf huckleberries which don't normally grow in a riverbottom ecosystem. What accounts for these differences?

You are standing in a transition zone between wet, moist soils and drier land. The abundance or lack of water in the soils dictates what plant life will thrive on the surface. Plants like fir trees and devil's club grow best where they have ample moisture.

On the other hand, plants like lodgepole pine and huckleberry require a well-drained site. Too much water will kill these plants.

The presence of water has everything to do with the character and type of vegetation growing in a particular spot.

Because of lack of moisture, dry-site plants are better adapted to fire. Pines, for example, survive fires better than fir trees as a rule.

Lodgepole pines propagate more readily after a fire because their cones usually need heat to be opened and because they need a nice bed of soil to sprout in.



Strawberry

Huckleberry

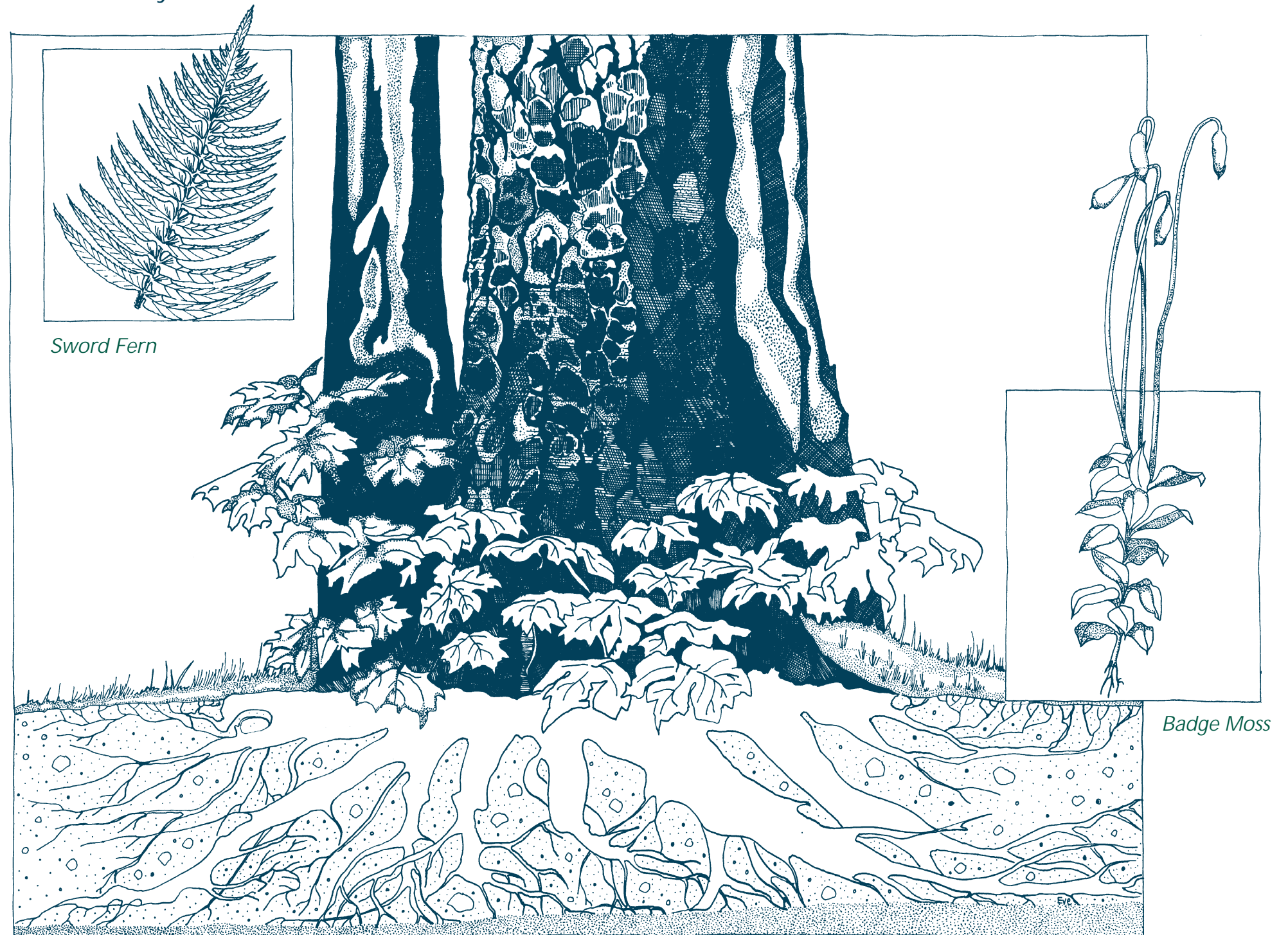
Elk Sedge

THERE'S MORE WATER HERE THAN MEETS THE EYE

What does the lush plant life around this sign tell you? Usually, the presence of thick, lush plants is a reliable indicator that you are close to water. However, there doesn't seem to be any water here, does there?

The truth is, there *is* water here. It is just below the ground surface. Just 12 to 18 inches below the forest floor lies a cemented mud flow. This slab of hard material inhibits water drainage into lower soil layers. The effect is that water is held near the surface longer, thereby allowing plant roots to reach and drink deeply of this source of life-giving moisture. These soils remain wetter longer into dry summers, and give plants a longer growing season.

So, even though the surface looks dry, the presence of water-dependent plants, like devil's club, shows that there really is more water here than meets the eye.



Sword Fern

Badge Moss

BIRD HABITAT

Birds, like humans, look for certain requirements when choosing a home. If you were a bird looking to set up housekeeping in this area what kind of "habitat" or "real estate" would you be interested in? Of course, each bird species has different requirements for home sites (just as humans do), but they all require these certain things in their habitat: food, water, shelter, and safe places to nest.

One type of bird might look for ideal habitat on or near the forest floor, while others require "high-rise" habitats in the uppermost reaches of the tree tops. Some birds enjoy the "inner city" crowding of thick brush, and others seek the solitude of the open rangeland.

The Pileated woodpecker sets his sights on the "fixer-upper" home, pecking his nest cavity out of old, partially decayed snags. The Wood Duck prefers a natural tree cavity or man-made nest box often located high above the ground and in the vicinity of water. The Dipper (or Water Ouzel) prefers a home under roots, in a rock crevice, or bank side area along a stream; and the blue Steller's Jay builds a nest in well hidden shady conifers.

The birds that you might see along this trail utilize all of these types of habitats. As you move along the trail try to guess which birds might live in each different habitat type you encounter.

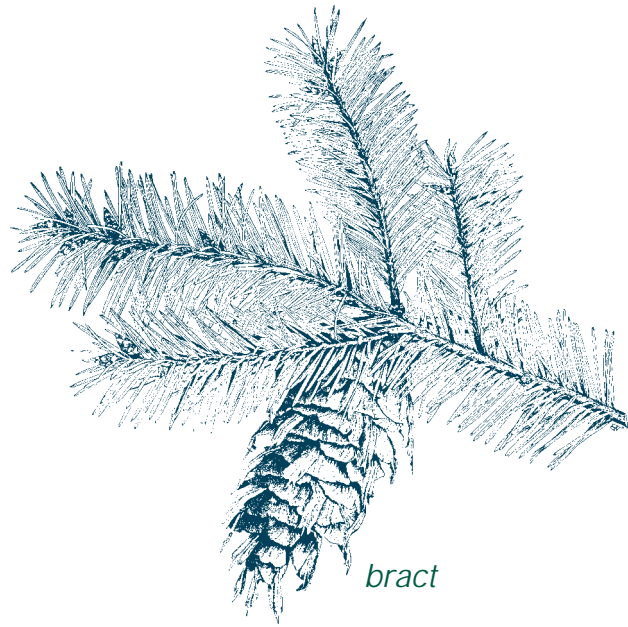


Pileated Woodpecker

Steller's Jay

Varied Thrush

LARGE OLD TREES AND HOW TO IDENTIFY THEM



GRAND FIR

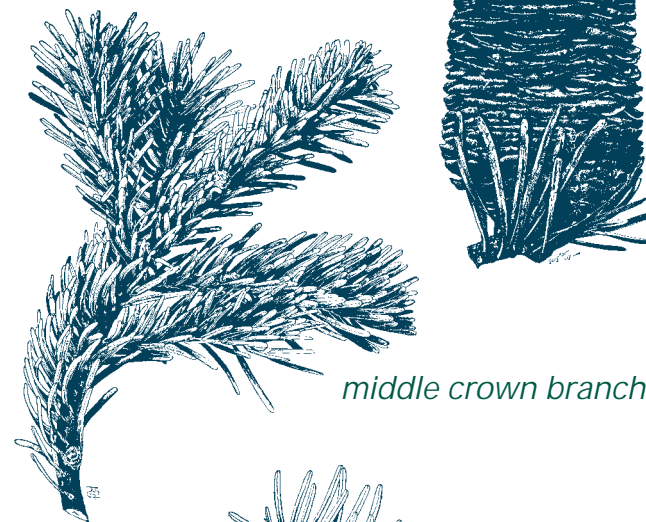
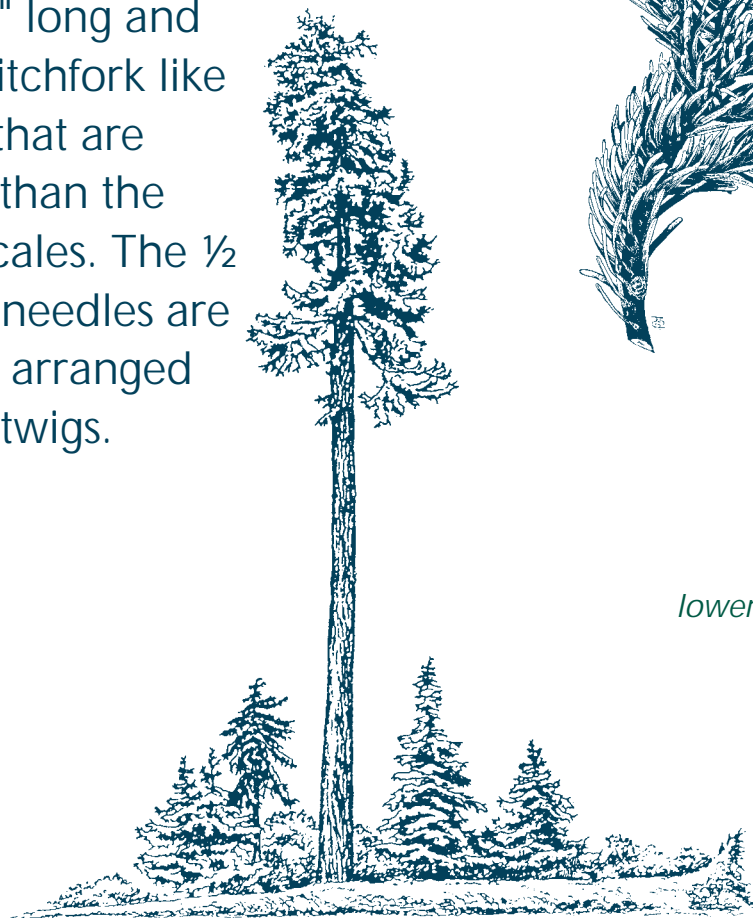
Abies grandis

A large, shade-tolerant conifer (125-180'). The needles are about 1"-2" long and grow along opposite sides of the twig. Cones are 2-4" long, growing upright and are high on the crown where they disintegrate in place.

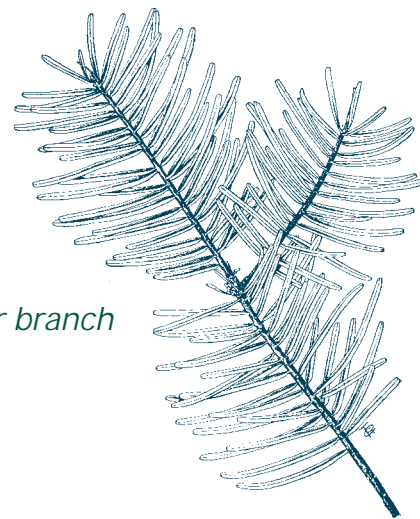
DOUGLAS-FIR

Pseudotsuga menziesii

Large (150-180'). Cones are 2-4" long and have pitchfork like bracts that are longer than the cone scales. The 1/2 to 1 1/2" needles are spirally arranged on the twigs.



middle crown branch

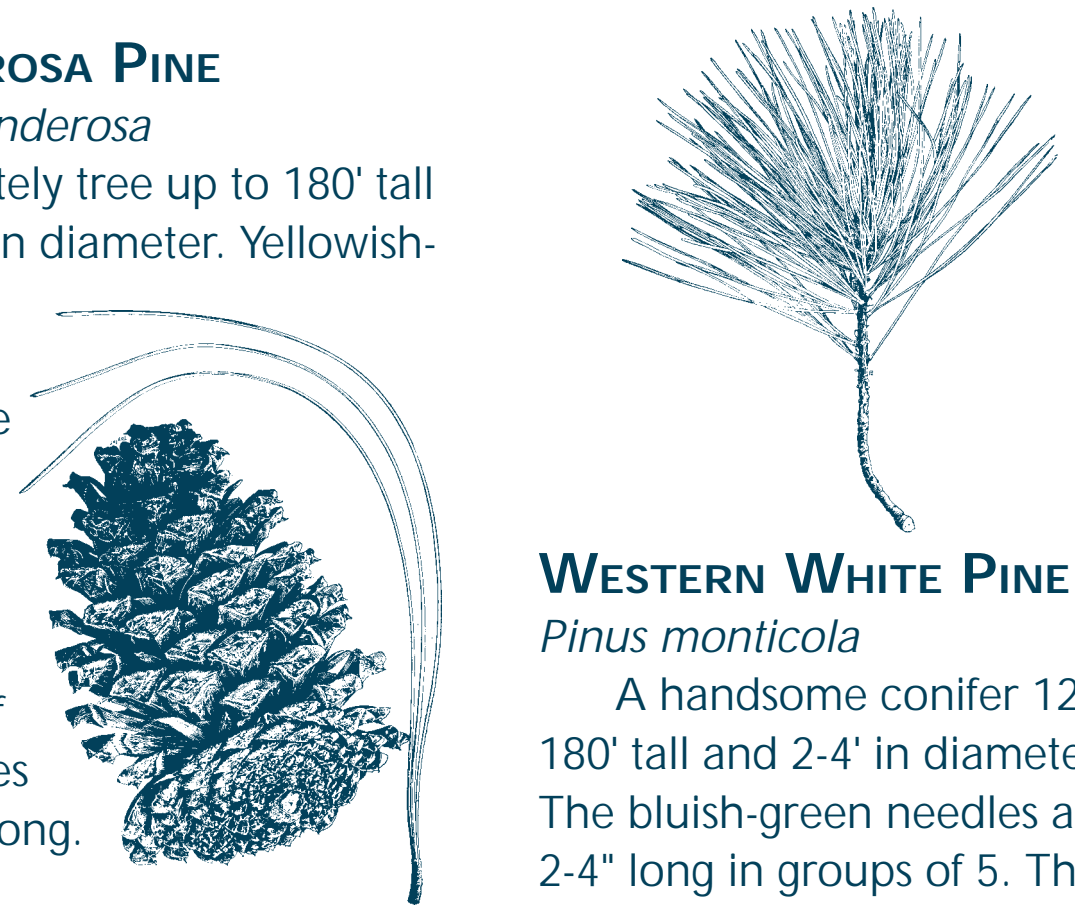


lower branch

PONDEROSA PINE

Pinus ponderosa

A stately tree up to 180' tall and 3-6' in diameter. Yellowish-red bark on trunk of mature trees. Needles are long (5-8"), in groups of 2-3. Cones are 3-6" long.



ENGELMANN SPRUCE

Picea engelmannii

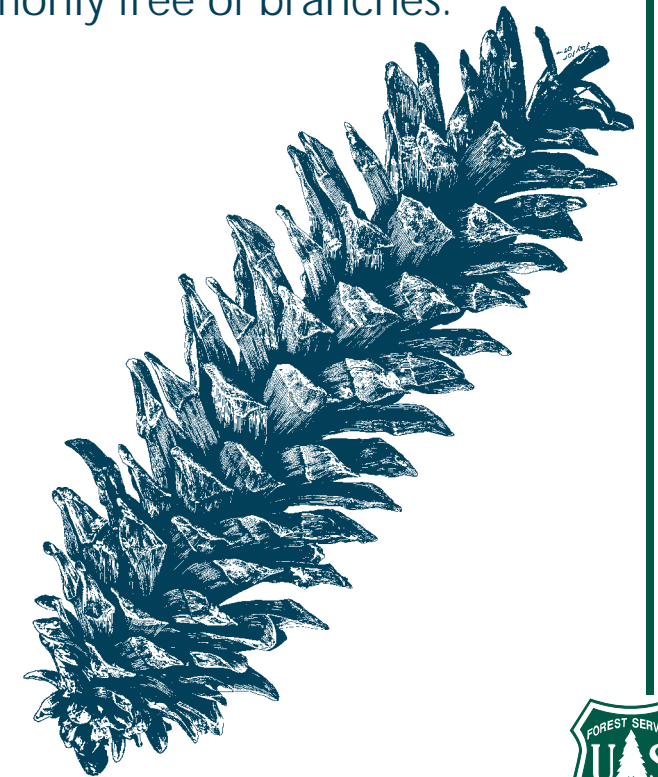
Tall (up to 180'), shade-tolerant, and grow in cold, wet-bottomed sites. Needles grow on small stems, are four-sided and have sharp pointed ends. This is the only spruce found in the Wenatchee Forest.



WESTERN WHITE PINE

Pinus monticola

A handsome conifer 120-180' tall and 2-4' in diameter. The bluish-green needles are 2-4" long in groups of 5. The cones are large (5-12" long). The lower third to half of the trunk of mature trees is commonly free of branches.



WOODPECKERS CHISEL HOMES IN FOREST TREES

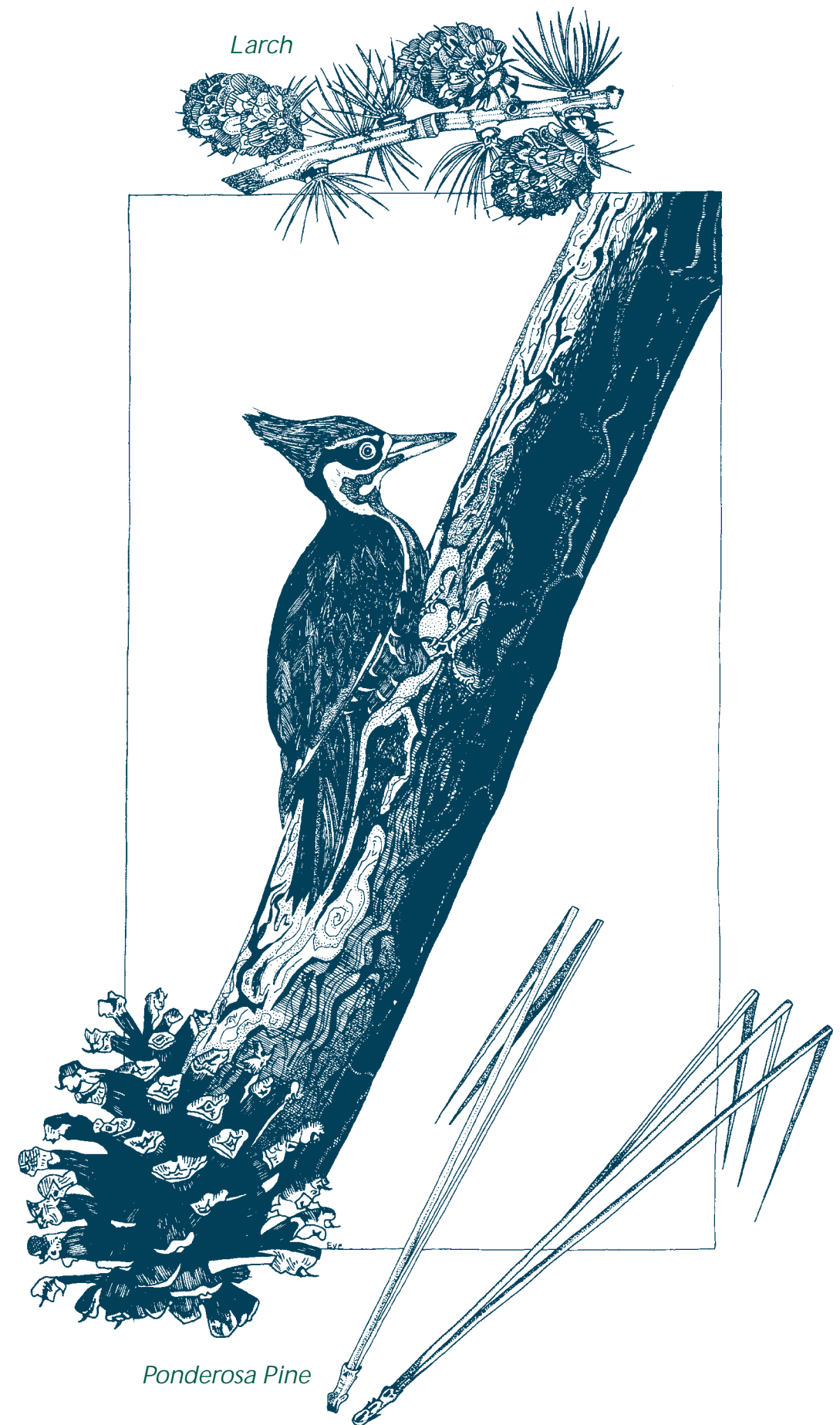
Can you find evidence of an elusive forest character? The holes in the trunks of dead trees are the calling card of the pileated woodpecker.

There are several ways to recognize this bird. Usually, it gives its presence away by creating a loud drumming sound as it searches for insects in tree trunks. To identify a flying pileated woodpecker, look for a black and white bird with a red cap.

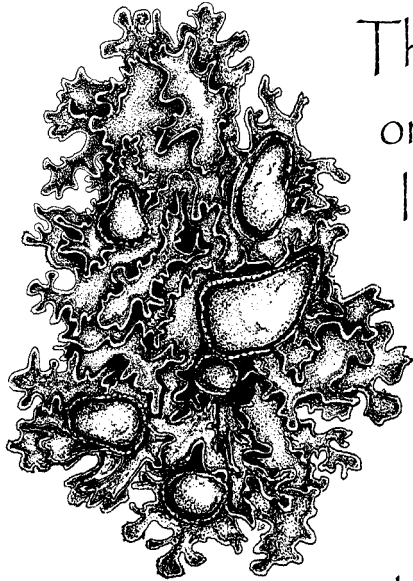
Woodpeckers have a special fluid cushion surrounding their brains which protects them from the shock of constantly pecking and drilling for food. What are they looking for? Woodpeckers feed primarily on carpenter ants and beetle grubs. They will also eat berries and nuts.

Pileated woodpecker pairs will usually excavate a nest cavity each year, typically in large dead trees. They normally choose ponderosa pine or western larch for nest trees on the east side of the Cascade Range.

Many other species of animals use the roomy cavities the pileated woodpecker constructs in its search for food. Bluebirds and chickadees nest in smaller holes, while larger birds such as owls may use larger holes. The seldom-seen pine marten and commonly-seen raccoons will den in the roomiest woodpecker holes.



NATURAL WONDERS



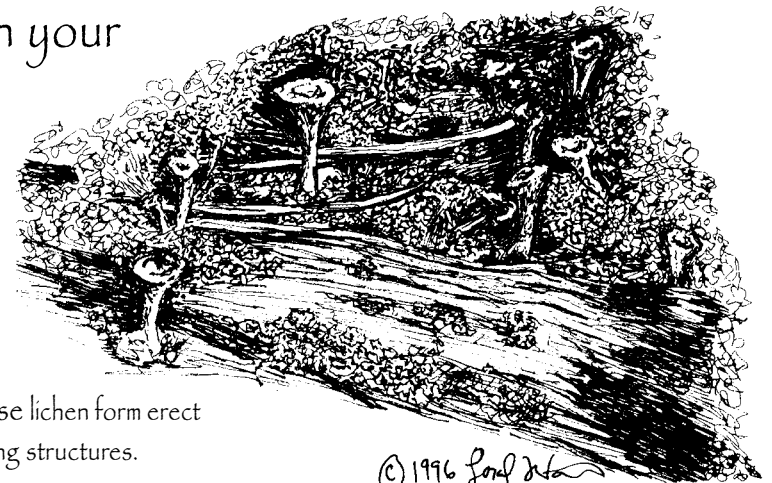
Foliose lichen are leaf-like.

The colorful patches on this boulder are remarkable organisms called lichens. Tenacious survivors, lichens are able to colonize bare rock, withstand long periods of drought and gather nutrients from the air. Look around the Icicle Gorge; you'll see many lichens clinging to stone or hanging from trees. Many specimens, though no bigger than your hand, are hundreds of years old.



Crustose lichen adhere closely to the surface.

A lichen is actually two organisms (an alga and a fungus) living together for mutual benefit.



Fruticose lichen form erect or hanging structures.



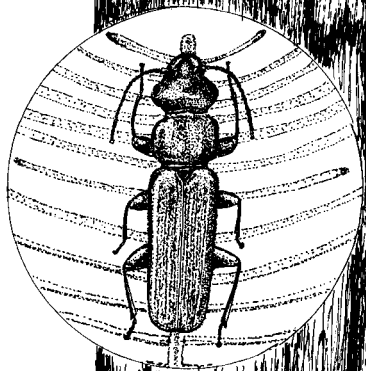
PART OF THE PLAN

See the variety of holes and channels in this dead tree? The large hole is a squirrel's nest. Insects or woodpeckers foraging for insects bored the small, round holes. Bark beetles carved out the meandering paths above you.



Nest cavities abandoned by woodpeckers are often occupied by other animals like the tiny red-breasted nuthatch.

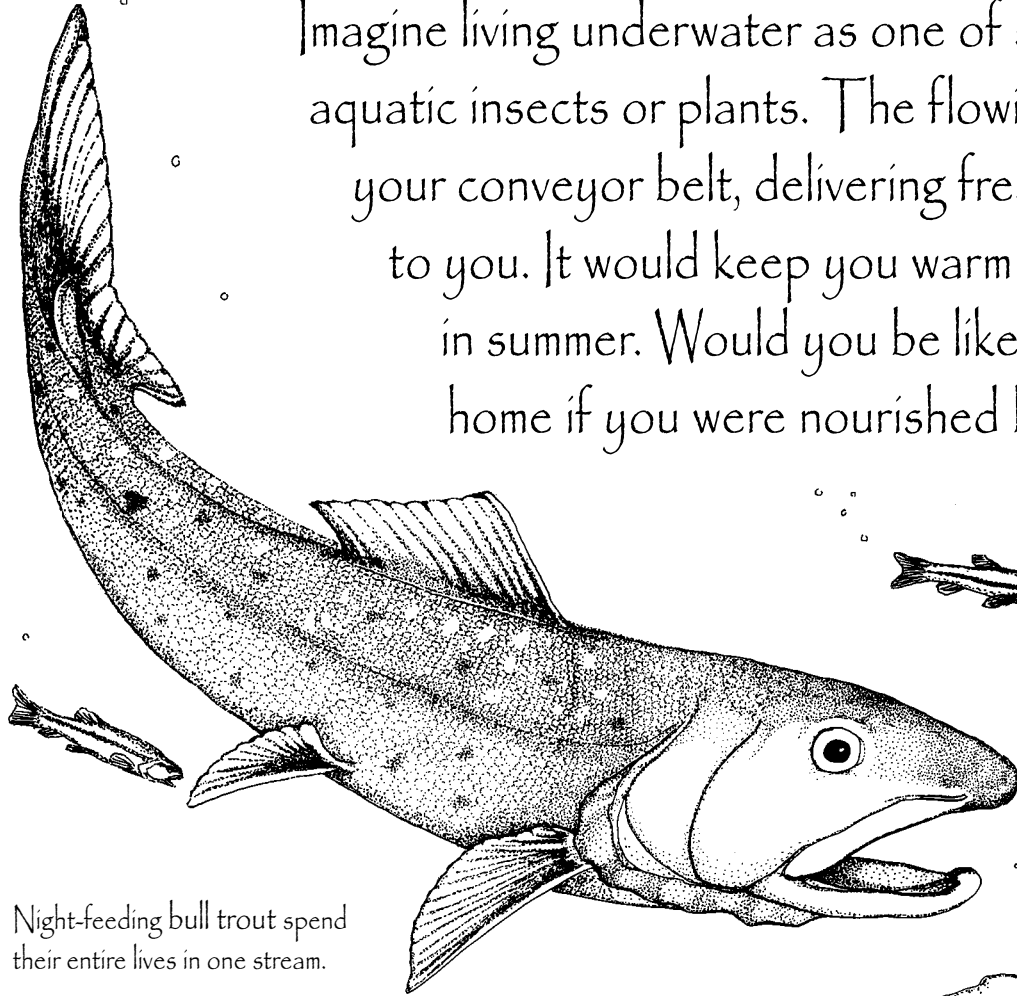
All these residents aid in the decomposition of the tree, but none are more essential than the microscopic bacteria and fungi present in all "snags." By breaking molecular bonds, these tiny denizens crumble the tough bole of a tree. Without them, a tree (minus its leaves) would stand unchanged for many years.



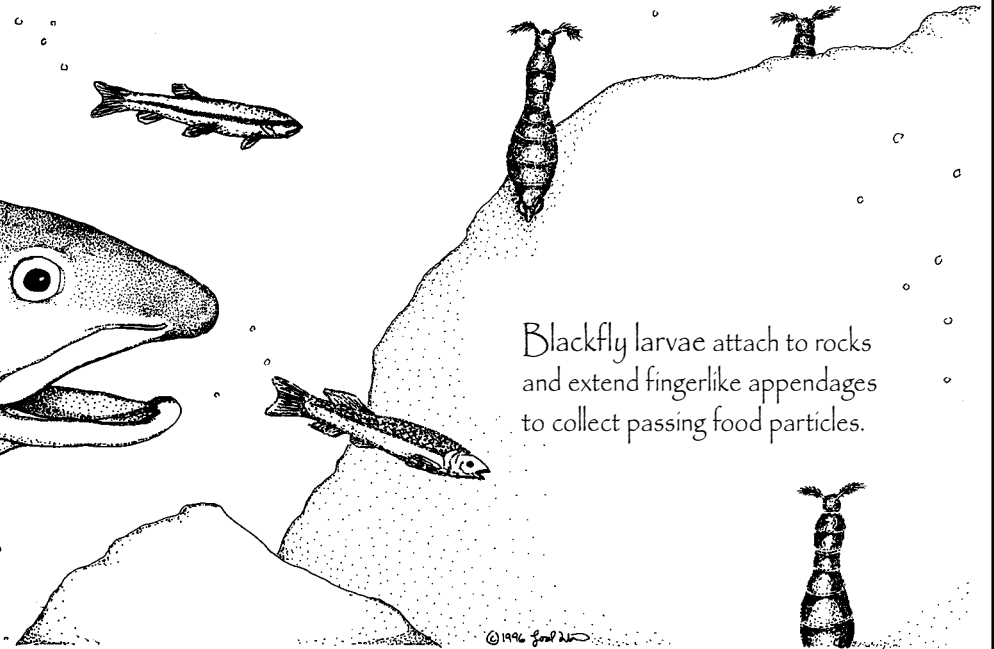
Bark beetles tunnel into living bark to feed and lay eggs.

LIFE UNDERWATER

Imagine living underwater as one of several species of fish, aquatic insects or plants. The flowing water would act as your conveyor belt, delivering fresh food and oxygen to you. It would keep you warm in winter and cool in summer. Would you be likely to stray from home if you were nourished by the current?



Night-feeding bull trout spend their entire lives in one stream.



Blackfly larvae attach to rocks and extend fingerlike appendages to collect passing food particles.

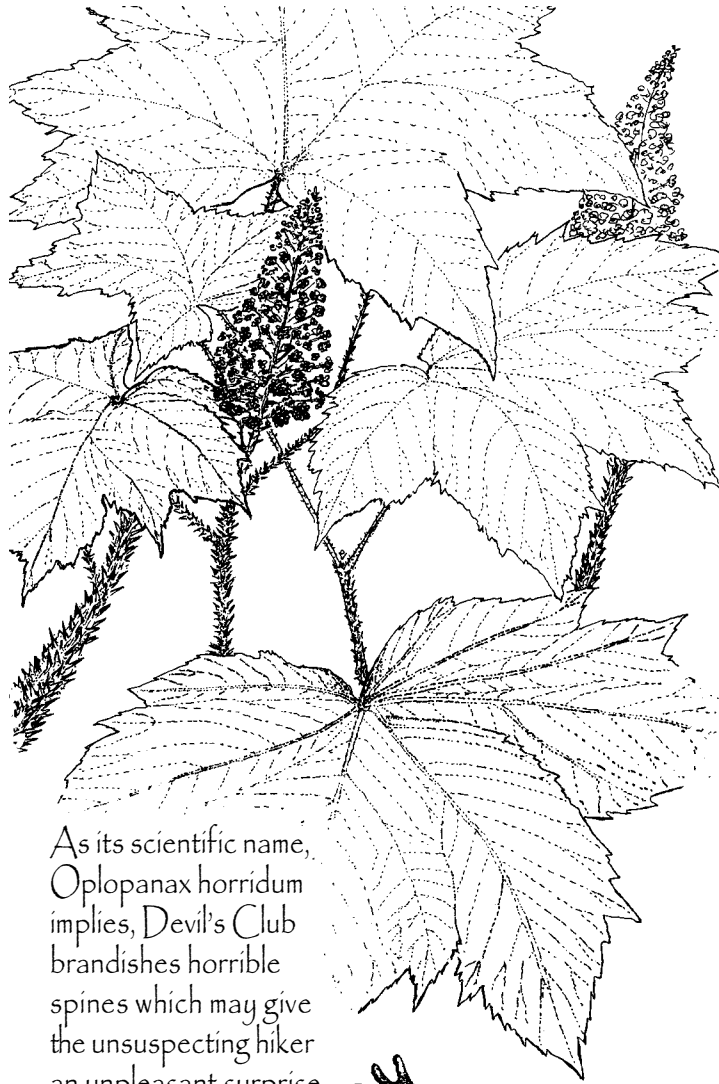


CEDAR SWAMP

Smell the pungent vegetation, notice the lush green foliage and huge cedar trees, and listen to the water trickling through this hillside.

A continuous supply of moisture makes this cedar swamp one of the most fertile stops along the trail.

Several kinds of plants not usually found on the dry, east Cascade slopes grow here. Can you identify the heart-shaped leaves of wild ginger or the delicate curve of maidenhair fern?



As its scientific name, *Oplopanax horridum* implies, Devil's Club brandishes horrible spines which may give the unsuspecting hiker an unpleasant surprise.



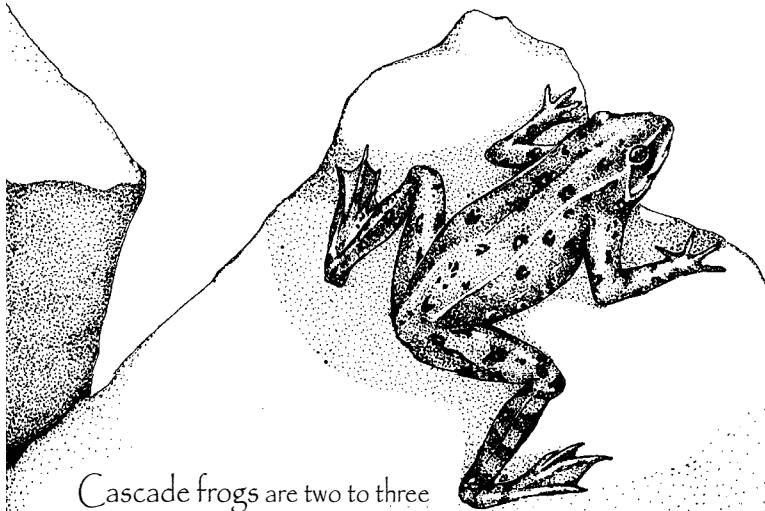
The long-toed salamander prefers to remain hidden in rotting logs.



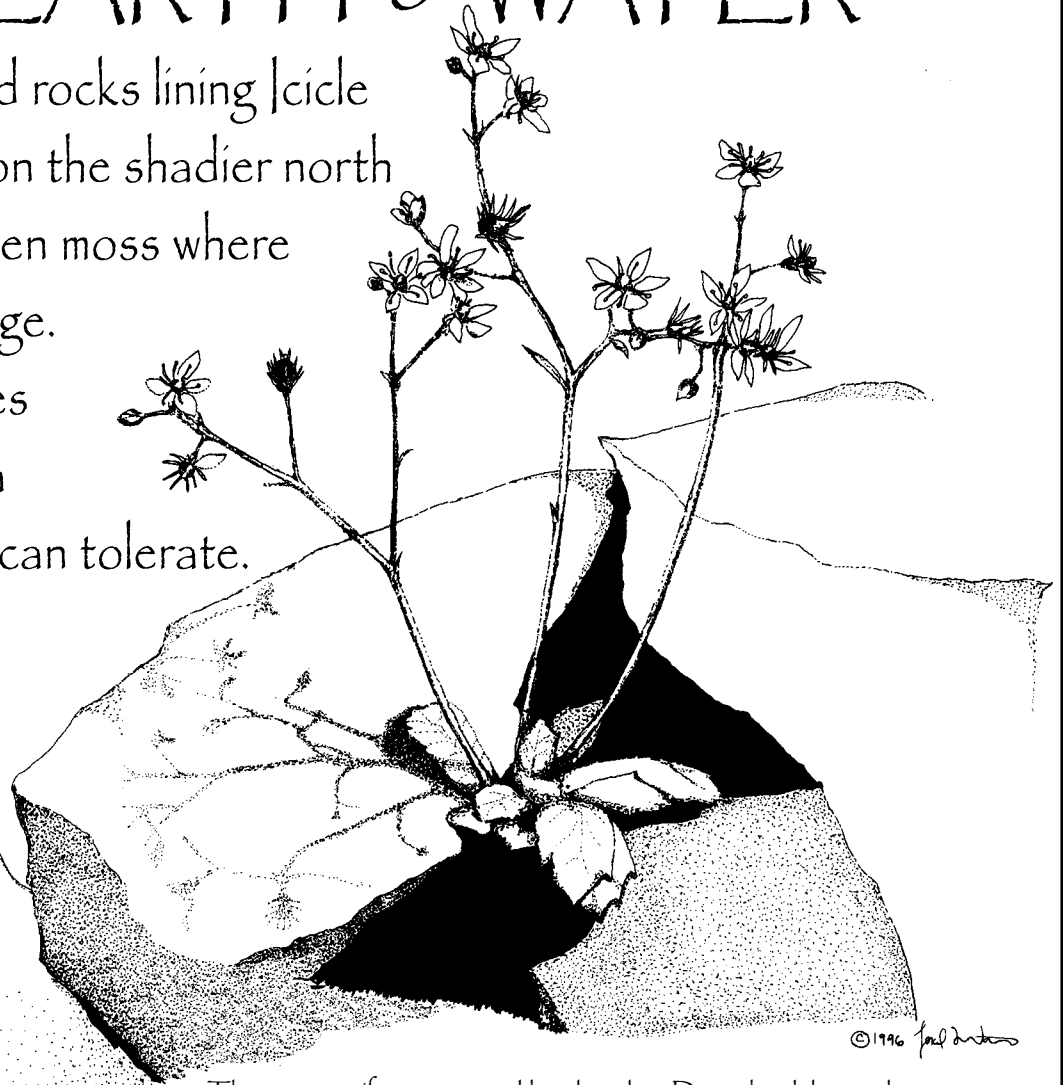
BETWEEN EARTH & WATER

Look upstream at the water-carved rocks lining Ice Gorge. In the hollows, especially on the shadier north side, you'll see pockets of soft green moss where amphibians and birds rest and forage.

Constantly sprayed and sometimes awash, these inhabitants thrive in a transition zone few forest dwellers can tolerate.



Cascade frogs are two to three inches long and are never far from water.

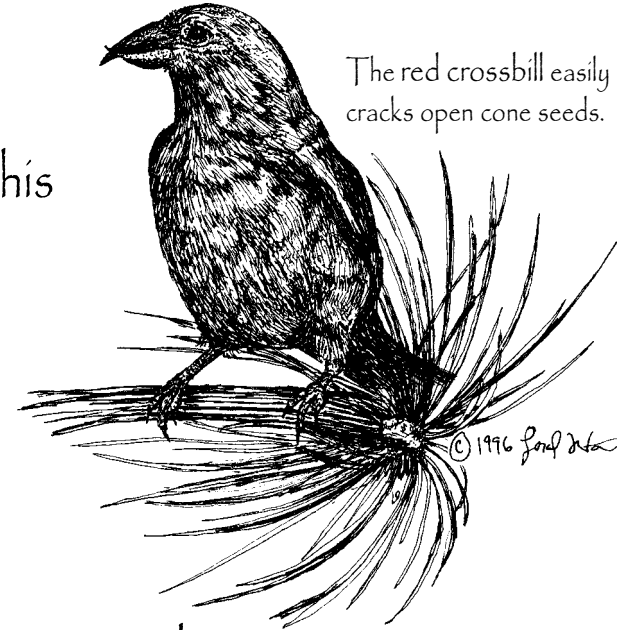


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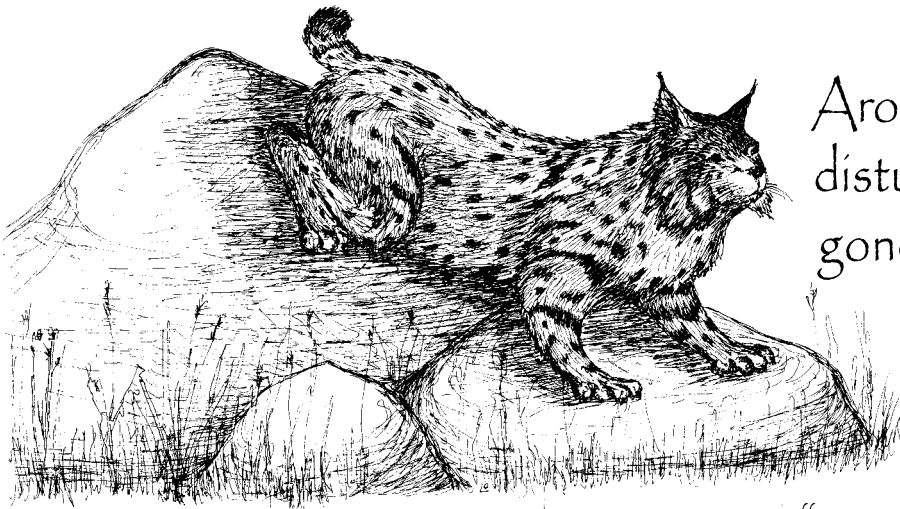
The name saxifrage means "I break rocks." Does this delicate plant growing near turbulent water really have the ability to crack rock?

PAST, PRESENT & FUTURE

About two feet tall in 1920, these lodgepole pine trees were part of a community of plants and animals that included the snowshoe hare and bobcat. Today this stand is nearing maturity, and some of the plants and animals associated with it have changed. Now the branches provide habitat for birds like the red crossbill and mammals such as the flying squirrel.



The red crossbill easily cracks open cone seeds.



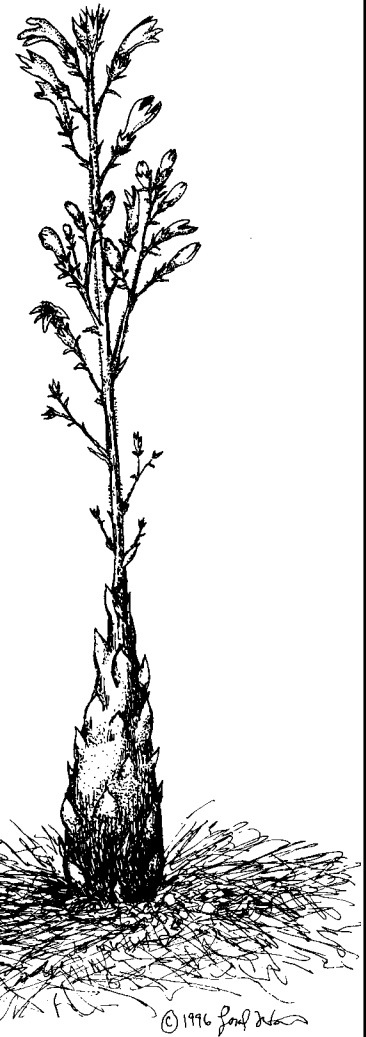
Around the year 2050, barring major disturbance, the lodgepole pine will be gone and a cedar understory will have grown to dominate this site. The cedar trees will attract yet another set of plants and animals. Through a process called “succession,” the forest is constantly changing.

Solitary and nocturnal, bobcats are rarely seen by humans.

FRIENDS & NEIGHBORS

Orange-barked ponderosa pine are common on the east side of the Cascades. About fifty species of plants live in association with them. One of the rarest is a parasitic plant called pine broomrape. The broomrape derives all its water and nutrients from the roots of its host, a shrub called ocean spray. Like the broomrape, most residents of Icicle Gorge are mutually dependent upon their neighbors.

Little brown bats roost in bark crevices of large trees.



Pine broomrape sends up a stem of purplish flowers resembling snapdragons.

