



The
FireWorks
Notebook

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*PP=ponderosa pine/Douglas/fir, LP=lodgepole pine/subalpine fir, WB=whitebark pine/subalpine fir.

American Black Bear

Den mother. I began life in my mother's winter den in the mountains. My mother started preparing for my arrival several months before I showed up. She searched for a good place for a den. This could be a cave, a place with thick shrubs and soft earth, a sheltered spot under fallen trees, or a hollowed out tree. When she finally found a spot that would fit all three of us (Mother, Brother, and me), she cleared enough space and lined the den with grass and rotten wood so it would be cozy all winter.



Mother entered the den late in the fall and went to sleep for a long time. She woke up when we were born, in the middle of winter, but went right back to sleep after cleaning us up. She must have been tired! Inside the den it was dark, but it was also warm and snug despite the harsh winter weather. What a comfortable, safe place for my brother and me to be born!

A small start: This may be hard to believe, but I was about the size of a rat when I was born—much smaller than you were. I was totally helpless, too. I was blind and didn't have any teeth. My brother and I stayed inside the den for the rest of the winter, nursing and growing. By the time I was strong enough to walk and keep up with Mother it was spring, and time for us to see what food the melting snow might uncover.

Mother taught me all about food. My brother and I followed her everywhere, carefully watching what she ate.

Did I tell you I'm an *omnivore*? I love to eat grass, flowers, and seeds, but I'm not at all picky. I'll also eat insects, mushrooms, and small animals—dead or alive. If I find garbage lying around outside, I'll eat that too. In fact, I'm a master burglar when it comes to garbage cans, coolers, and backpacks. Don't leave them

anywhere I might find them!

What Mother taught

us: Wet meadows provide juicy new grasses and horsetails in the spring, when most other plants haven't started growing. As the weather warms and the snow melts in the mountains, foothills, and forests, I follow creeks and streams, eating the *succulent* plants that grow along their edge. Have you seen torn up logs when you are hiking? Perhaps that was me making a mess. My sharp, short claws help me uncover ants, grubs,

and beetles that make their home in decaying logs. Short, sharp claws also come in handy for climbing trees—something adult grizzly bears have a hard time doing!

Throughout the summer, all sorts of berries ripen—bearberries, Saskatoon serviceberries, and rose hips to name a few. I like them all, but I'm especially fond of sugar-filled huckleberries. In places where oak trees grow, I gorge on acorns.

In the fall, I sometimes move to places where the limber pines and whitebark pines grow. Their cones are full of high-energy pine nuts. Since I'm a good climber, I could scramble up and get the nuts right out of the cones. But it's easier to let squirrels climb the trees for me, and then eat from the cones they collect. They stockpile cones on the ground in *caches* called *middens*. Most of



these middens are in dense forests where pines are mixed with spruce and fir trees, so that is where I go. When I find a midden, I just help myself...finders keepers!

I can find a meal almost anywhere. An ant colony in a decaying log, a boulder swarming with mating ladybugs, honey in a bee tree, even the rotting carcass of an elk that didn't live through the winter—they're all food for me!

Fat is where it's at! Why am I constantly eating? For a bear, storing up lots of fat makes the difference between life and death. By eating as much as possible when there's plenty of food around, I'm well prepared to make it through the winter when all my food has vanished beneath the snow. You could say I store my winter's food supply right on my body.

If I have enough fat stored, I can go for nearly six months without eating or drinking. How? I go into a deep sleep. This sleep is similar to hibernation, but I am able to wake up at any time to take advantage of warm winter days. This kind of sleep is called *torpor*. During this time, my body changes stored fat into the energy I need to stay alive. Nothing leaves my body because my wastes are recycled. Amazing, isn't it? I'm totally inactive during this time; I don't move much except to get more comfortable. When spring comes, I might have lost a quarter of my weight, but my muscles are still strong.

Fast food. Bears have a challenge from spring through fall: to quickly put on as much fat as possible. Moving around between little snacks uses too much energy for the amount of fat gained. Finding lots of high-energy food in one spot is much more efficient. The tricky part is knowing exactly when and where to look for large concentrations of food. Another lesson from... guess who? Mom, of course!

When you're willing to eat anything, many places provide good food: shrub patches, avalanche chutes, wet meadows, hillsides, and river bottoms. I'm *nocturnal*, so I like to do most of my moving and eating during the night and sleep during the day. But if there's lots of food around, eating is a full-time job and you might see me at any time of day or night.

My family and I cover lots of ground to check out our traditional feeding areas. Sometimes we roam over one hundred square kilometers searching for food.

Big two year-old. I'm into my second year of life now, and look at me! I weigh almost 100 kilograms. How much did you weigh when you were two? My brother and I take care of ourselves now. Our mother will find a mate when summer begins and have more cubs, so this will be our last spring together. My brother and I might stay together for a few years. When I'm 4 years old I'll be ready to mate and start my own family. If things go well, I'll have a pair of cubs every three years or so. Over my 20-year life span I might have 15 cubs if I'm lucky.

FIRE FACTS: A wildland fire is no problem for a black bear. It usually just moves away from the fire and wanders somewhere else to find food. Within its large home range, there are always unburned areas to explore.

Fires create one of the black bear's favorite feeding spots—a berry patch. It doesn't take long for a burned area to grow into a brush field loaded with berries. Decades later, the same spot is likely to be a dense forest.

Forests with a patchwork of burned and unburned spots are ideal black bear habitat. A bear can feed in the openings but has the cover of trees nearby, providing a safe spot for rest and sleep.

American Marten

At first you might think I'm a small house cat that's lost in the forest. The size is right, but look more closely. You can't see it in this picture, but I have a long, bushy tail and a flashy orange throat patch. Look closer still to see my pointed nose. It makes me look more like a fox than a cat. I'm an American marten. Maybe you've never even heard of me! I don't mind. I'm shy and often overlooked in the old forests where I make my home.



places. My forest home has plenty of large, decaying logs and stumps lying around. All the wood on the ground hides my scurrying food supply. It also hides me from bigger predators—like great horned owls, red foxes, and coyotes to name a few. Places to hide are always just a step away and that's exactly how I like it!

When I'm not hunting, there are lots of safe places for me to take a breather. I have many resting places in my square kilometer home range. A hole in just about anything—live trees, snags, rotten logs, or hollows under large rocks—will

do nicely. Sometimes I climb up into trees infested with dwarf mistletoe and use the tangled masses of a *witches'-broom* for resting. What a view!

Cunning

carnivore: I'm a member of the weasel family. My long, slender body and rather short legs are clues to that. I'm a well-designed small carnivore, meaning that I'm a good hunter—very quick and agile.

Catching and eating small rodents is a snap for me. I usually spend my time bounding along the ground, checking out rotten logs and decaying stumps, hoping to find voles, mice or shrews hiding there. I'm always on the prowl for an easy meal. My superb tree climbing abilities come in handy too. Chasing tasty squirrels through the treetops is no problem for me.

During the summer there are lots of migratory birds nesting in my forest. Eating their eggs and nestlings makes a nice change of pace. And I'm extremely fond of huckleberries when they are ripe. Aren't you?

Hideouts everywhere: I eat many kinds of food, but I'm very picky about where I spend my time. I only live where the forest is moist and there are many big, old trees. Beneath these giants, younger trees are growing in. Here I feel safe. The spruces and firs have branches that sweep the ground, creating convenient hiding

Snow caves: Once winter comes, deep snow covers the ground and I struggle to survive. Now I concentrate all my hunting efforts on red-backed voles. Although they're not particularly delicious, there are lots of them around. Red-backed voles spend the winter huddled beneath the snow in hollows along the undersides of old logs. These spaces are a lot like miniature snow caves. Here the voles keep warm and feed on whatever plants are available. But how am I going to find a way down through the snow to catch them?

Lucky for me, some large old logs and rotting stumps poke up out of the deep snow. The snow has settled and melted away from this dead wood, creating a passageway that will connect me with my hunting grounds below! All I have to do is follow the space down along the log or stump until I find a meal.

I spend a lot of the winter hunting beneath the surface of the snow. It's usually a lot warmer beneath the snow than on top of it. During cold

snaps I often use marten-sized snow caves to keep warm, sometimes for days at a time. Some winters the snow gets so deep that the ground is white for as far as I can see. Even the largest logs are totally buried in snow. There's no way to enter my under-the-snow hunting grounds then. But don't worry. When this happens I start hunting red squirrels and snowshoe hares above the snow.



New nursery: I mated last summer. I'll give birth in the spring. By that time, most of the snow will be gone and I can easily catch small mammals to feed my young. I've carefully selected my *natal den*, the place where I'll give birth. It's a cavity in the largest, sturdiest log I could find within my home range. Once my young are born, I'll move them to another den site where they'll grow up under my constant care. Although born blind and naked, it will be only 50 days until they leave my second den for good, sometime during late summer.

I'll probably live 12 or so years if everything goes well. Not many humans will have seen me during that time. Maybe you'll be one of the lucky ones.

FIRE FACTS: American martens choose only moist, old forests for their homes in the northern Rocky Mountains and Intermountain area. Such forests don't burn often, perhaps every couple of centuries or so, during an especially hot, dry summer. Dead branches and twigs are deep on the floor of this kind of forest,

and there are many dead logs. When these fuels get dry enough to burn, the fire may crown, killing most of the trees and burning up many of the logs and stumps on the forest floor.

Martens can easily escape the flames, but their prey and their shelter are gone. They move out, seeking another valley or hillside with old, moist forest. The fire has left many standing dead trees, though. These will eventually fall and become the rotting logs of the new forest. It may be many decades before another marten can call the burned site home.

American Three-Toed Woodpecker



I'm the American three-toed woodpecker. Can you guess how many toes I have? I'm special for having only 3 toes on each foot instead of 4 like most other woodpeckers in North America. Two of my toes point forward and one points backward. Cool, huh? My cousin the black-backed woodpecker has 3 toes too, but he is more famous for having an entirely black back than having 3 toes. Look for the beautiful ladder of black and white stripes on the center of my back to identify me!

Home on the burn. Hundreds of blackened tree trunks covering a mountainside is a dream come true for an American three-toed woodpecker like me. A recent burn creates the perfect place for me to live and raise a family. Hard to believe? Let me explain.

All those dying trees probably don't mean much to you, but to me they represent lots of food. I'm not interested in the trees themselves. It's what's living underneath the bark that gets me excited. The burned trees are crammed full of my favorite food—the larvae of bark beetles. These small, white, worm-like creatures—also known as grubs—are so delicious! But how did the larvae get there?

Not long after a fire burned across the mountain, hundreds of "fire bugs" began appearing, seemingly out of nowhere. More than 40 kinds of insects, mostly beetles, are attracted to recently burned forests. Among beetles,

competition for space in burned trees is fierce. Early arrivals get the best spots and deposit the most eggs. Because of this, many beetles have developed ways of locating recently burned areas. Some are alerted by smoke and use it to find their way to a fire. Others have special heat detectors on their antennae or abdomen that sense the radiation that we might feel, close up, as heat. It's called *infrared* radiation. Their special heat-sensing equipment allows them to take a direct route to a fire, often beating the rest of the "fire bug" crowd.

Bark beetles home in on burns too, perhaps responding to the unique chemicals given off by fire-weakened trees. Bark beetles usually select lightly burned trees where most of the *cambium* hasn't been damaged. They burrow through the bark, mate, and then lay their eggs under the scorched bark. Once the eggs hatch the larvae have an unlimited supply of cambium to feast on. Very convenient for them and for me!

Grubs, anyone? Bark beetle larvae grow up just under the bark of burned tree trunks. Here they are quite safe from most predators, but they are not safe from me. I use my strong woodpecker bill like a pry bar to loosen and chip off large flakes of bark. Beneath the bark are countless *galleries* of beetle larvae just waiting to be devoured. I slurp them up with my barbed and sticky tongue. Yum-m-m! Would you care for some?

Woodpeckers only! The burn has also attracted my cousin the black-backed woodpecker. You might wonder if we compete with each other for food. A bit larger than me and sporting a much stronger bill, the black-backed woodpecker concentrates on wood boring beetles for food. Like their name says, the larvae of these beetles burrow into the wood of burned trees. A black-backed woodpecker actually chisels into wood to get its dinner. That's a whole lot of work! Chipping off the bark is so much easier. Even though my grubs might be smaller, there's a lot more of them to eat!

A newly burned area will provide food through several years, and it's all reserved for woodpeckers. Other kinds of birds can't get grubs out of these trees.

Perfect combination. When spring arrives, I find a mate and we pick out a nest tree in the burn. A recent burn offers the ideal combination: a nest tree and plenty of food trees within easy reach. We'll be able to feed our young without a hitch. Our nest tree is a lodgepole pine with a broken top. It died decades ago, long before this last fire, and has decayed nicely over the years. A sturdy outer shell of wood surrounds a totally rotten center. Perfect!!

My mate and I work together to excavate a cavity for our nest. Chipping out an entrance hole in the hard outer wood is tough going. Hollowing out the inside is much easier, but it takes a while since the cavity needs to be large enough to hold our nestlings until they're strong enough to fly. We spread wood chips around the nest cavity to make sure the eggs have a soft place to rest. The door to the completed nest cavity is about 4 centimeters in diameter, and the pear-shaped cavity is about 27 centimeters deep. Such a warm, safe place to raise our young!



Room available. Finally, everything is ready. I lay 4 white eggs in the bottom of the nest cavity. After 12 days of *incubating*, we have 4 nestlings. They may look naked and awkward to you, but to me they're beautiful. My mate and I work hard at caring for them, making many trips to the nest with food. Our nestlings will eat lots of beetle larvae and also insects picked off the bark of trees. They will be able to fly in about 25 days, but they'll follow us for awhile, learning our tricks

for finding food.

My mate and I will use our nest cavity only once and then abandon it, but it won't be empty for long. After we leave someone else will move in. Mountain bluebirds and tree swallows are two kinds of birds that raise their young in old woodpecker cavities. There are many others.

Now you know why a recent burn is my kind of place. Next time you see a recently burned area, think of me. I'll be there!

FIRE FACTS: Lightly burned patches or the edges of stand-replacement burns within lodgepole pine or spruce-fir forests can create perfect habitat for three-toed woodpeckers. Here, three-toed woodpeckers are sure to find a great supply of grubs living right under the bark of the dying trees.

The three-toed woodpecker must also find a good nest tree amid these food-rich trees. Only rotten trees are soft enough for them to excavate a nest cavity, so three-toed woodpeckers usually nest in rotten trees within a burn.

The three-toed woodpecker must quickly make its home because this great arrangement will only last a few years. After that time there are fewer beetles feeding on the dead trees. Once the woodpeckers' food supply is gone, so are the woodpeckers! Then the three-toed will look for another recently burned forest that offers more beetle larvae.

Armillaria Root Fungus

I am a *fungus*. I'm like a plant in many ways, but I don't get my energy directly from the sun like plants do. Instead, I tap into tree roots and the bases of their trunks to get nutrition.

Where do I live? In nearly every forest in the world, some species of *Armillaria* is busy. We break down living wood and recycle dead wood for our nutrition. My most important "host" species in the northern Rocky Mountains and the Intermountain area is called *Armillaria ostoyae*.



What do I look like? Scientists say that I'm the largest living thing on earth— bigger than the tallest tree and heavier than the Great Blue Whale! But even though I'm large, I'm hard to see. That's because most of me is hidden underground or in the bases of tree trunks. There I form long, delicate chains of cells; these chains are called "hyphae."

Usually my hyphae are only about a millimeter across, but there are a few places where they get organized into something larger that you can actually see. At the base of a tree, under the bark, I look like a flattened white cobweb glued onto the wood. Underground and under the bark, I sometimes look like a brown plant root. If you see a clump of brown mushrooms right at the base of a tree, they might also belong to me. Mushrooms produce my "spores," which are a lot like a plant's seeds, but very tiny.

If I'm just a web of hyphae, you might wonder how I can be the biggest living thing in the world. Good question! A network of hyphae, called a "root disease center," can weave its way through the soil of a whole

hillside, like a giant underground cobweb.

The humongous fungus: The world's largest living organism is an *Armillaria ostoyae* living in Oregon. It is estimated to weigh up to 35,000 tons—that is like the combined weight of 175 blue whales! This root disease center is not only large, it is really, really old. The oldest part of it is about 8650 year old!

Growing up: I usually start from spores or from hyphae that break off from a root disease center. Fungi use spores to spread over long distances just as plants use seeds. We make a lot of spores! When my mushrooms were ripe, more than a thousand spores can fall **every minute** onto an area about as big as a cereal bowl.



I grow and spread by making new hyphae. When they reach a tree root or stump, they dissolve its bark and grow right into the tree's cells to absorb nutrients. I can't last very long without nutrition from some part of a tree. Scientists call this my "host tree," making it

sound like I'm their guest for dinner. I guess I am— but my host **is** my dinner! My favorite trees are Douglas-fir, grand fir, and subalpine fir. Their bark is easier for me to get through than the bark of pine and larch trees.

Eventually some of my hyphae form that white, cobwebby shape, called a "mycelium." Other hyphae form the brown, root-like shape. It not only looks like a root; it acts like one too, growing long distances underground in search of nutrients.

Scientists are not exactly sure what I need to produce mushrooms and make spores. Moisture, light, and warm weather all seem to help. I can live for hundreds of years and spread through a large area without making any spores at all.

Am I useful? Insects and worms eat my hyphae. Squirrels, deer, elk, and bears harvest my mushrooms. So do people. Some people call my mushrooms "honey mushrooms" because they're really sweet. Squirrels sometimes hang my mushrooms on a tree branch to dry out. Then they can eat these delicious treats all winter long!

I suppose Douglas-fir trees would tell you I'm the opposite of useful. As I take more and more nutrients from their roots, they grow less. They make fewer needles. The wood at their bases gets weak. A strong wind might blow them over or a fire may burn the dead and dried out trees. Bark beetles might find it easier to feed on their cambium. After many years, an infected tree dies. I don't worry about killing off my food supply, though. By the time one host tree dies, I have infected many others nearby.

In forests where I have infected most of the Douglas-firs, Douglas-firs may have to wait a long time to grow back because I am still here waiting. Ponderosa pines and larch may grow here instead. Phooey! Pines and larches are much harder for me to infect.

If you ever notice a glowing white light in the woods at night, it could be aliens... or it could be me! My mycelia glow in the dark, making a light some people call "foxfire."



FUNGUS FACT: *Armillaria's* arrival in a fir tree begins the noble and glorious process of **ROT**. Rotting a tree is a tough job, but someone really does have to do it, or the forest would fill up with dead wood!

Right after *Armillaria's* invasion, fungi known as the "brown rotters" follow. Brown rotting fungi break wood down into really rich soil.

Eventually, trees infected with *Armillaria* die and fall over. Then they become homes for voles and other small mammals. That makes the fallen trees into favorite hunting places for predators like American martens.

Fire and me: Fire sometimes kills my host trees. But I can live for many decades on dead roots and stumps (so that doesn't bother me!). In places where I'm growing close to the surface, fires kill or damage my hyphae. But I almost always have hyphae deep underground, so I can stay around even after fire.

If a fire changes the tree species in the forest, my life becomes a lot harder. If a fire kills most of the Douglas-firs and leaves the pines alive, I'll have less nutrition. Pines are hard for me to infect, so I won't be very busy until the firs grow back. I'm patient though. I can wait in one spot for 50 years or more for a good root to grow near by. If firs become really plentiful, I'll spread my network of hyphae very slowly among them, expanding 20 or 30 centimeters a year. Slowly but surely, I'm becoming

the biggest!!

Arrowleaf Balsamroot

I am a flowering plant. My scientific name is a lot like my English name: *Balsamorhiza sagittata*, meaning "arrow-shaped balsamroot."

Where do I live? I am native to the western part of the United States. I live in dry places in prairies, forests, plains, foothills, and mountains. I grow with sagebrush, too. You can often find me in ponderosa pine forests, or even with Douglas-fir or lodgepole pine. If the forest is thick and shady I can grow new leaves year after year, but I don't produce many flowers. I prefer more open places.



What do I look like? I have big, fuzzy, arrow-shaped leaves. They are green, but thick hairs make them look a bit grayish. My flowers grow on a stem that gets about half a meter tall. My bright yellow daisy-like flowers are actually many tiny flowers all grouped together. In fact, each "petal" is its own flower! Can you see all of the tiny flowers in my close-up picture?

I am a *perennial* plant. This means I grow for many years. Under good

conditions I can sometimes live for 50 years.



Growing up: I start growing from seed, but soon I grow a thick, woody taproot that goes almost straight down into the soil. At the top of this root I have a strong underground stem called a *caudex*. From the caudex I sprout leaves and flowers every spring.

Growing points: I have growing points in my roots and on my underground stem.

How do I reproduce? I can reproduce from seeds. It takes about 4 years before I start to make flowers and seeds because I am so busy growing my caudex and getting bigger. At the end of the summer, my yellow flowers fade and fall to the ground and my seeds begin to ripen. I am very lucky that animals and wind help spread my seeds. The following spring my seeds can sprout and start new plants.

After winter, I grow back from sprouts on my underground stem. I can do that after fire too, and after animals eat my top off. Scientists aren't sure whether or not I can grow a whole new plant from my underground stem.

BOTANICAL FACT: Above ground, I look like a medium-sized plant. Underground, I'm often much bigger. Like a gigantic carrot, my taproot may get thicker than your wrist. It is usually only 20 to 30 centimeters long, but it can reach more than a meter down into the soil!

My calendar: My leaves begin to grow in April or May. Within a week, my flower stalk comes up. I am in full bloom a month after that. My seeds are ripe by early July when they fly off in the wind or catch a ride with an animal passing by. My year's work is about done by the time the hot, dry summer weather comes to the prairies and forests where I live.

Am I useful? It seems like someone is eating me all year-long! Pronghorn, mule deer, and bighorn sheep eat my leaves and flowers, especially during spring and early summer. Elk eat me in winter. Cattle, sheep, and horses like to eat me too. Mice eat my seeds. Small birds may hide under my huge leaves.

Native Americans know how to harvest my stems, roots, and seeds for food. I can also be used as medicine. I have been used to relieve pain and to treat burns, wounds, colds, sore throats, stomachaches, headaches, fevers, insect bites, and swelling. Wow!

What does fire do to me?

My stems and leaves are burned by fire, especially if the fire comes through in summer or fall when my leaves are brown and dry. Fires hardly ever kill my underground stem, so I can easily resprout. My roots are even tougher than my underground stem and fires hardly ever damage them.

Life after fire: I sprout very soon after a fire, ready to use the nutrients in the ashes. I usually grow my best crops of leaves and flowers in places that have burned in the last few years. I don't grow as well when shrubs and trees grow over me and shade my leaves. I come up year after year, though, ready for another fire and another chance to show off my bright yellow blossoms.

Beargrass

What a strange name I have! I'm not really a grass, and bears don't eat me. I am a flowering plant in the lily family. My scientific name is *Xerophyllum tenax*, meaning "dry-leaved and strong."



Where do I

live? I am native to the western mountains of North America. I like cold places and high elevations. I am especially good at growing where the soil is dry. You can find me in the open, in places with few trees. That's where I produce the best flowers. You can also find me growing under lodgepole pines, whitebark pines, and subalpine firs. Although I can grow in shady places, I don't produce many flowers there.

What do I look like? I am a *perennial* plant. This means I grow for many years. My long, skinny leaves grow in a thick clump that looks like a bunch of grass. My leaves stay green all winter, even under heavy snow.

BOTANICAL FACT: A beargrass plant may be 5 years old or older before it blooms. The blossoms are spectacular. Hundreds of cream-colored flowers grow in a big cluster at the end of a stem more than a meter tall. Each plant blooms only once, then dies.

Growing up:

I start growing from seed. My leaves grow from woody stems on top of the ground or in the very top layer of soil. These stems are called "*rhizomes*." They spread by sending down roots and growing new leaves. That is how

a single plant can spread out into a thick clump.

My rhizomes are tough, so it's hard to trample me or kill me once I get established.

Growing points: I have growing points in my rhizomes and in my roots.

How do I reproduce? I grow from seeds and from sprouts on my rhizomes.

My calendar: Since my leaves are evergreen, I can begin to grow early in spring, as soon as the snow cover and the ice in the soil have melted. Flower buds form in late spring. I blossom in early summer and form my seeds right after flowering. By late summer or early fall, my seeds are ripe.

Am I useful? Deer and elk eat my flower tops. Pocket gophers hide and feed in places where I grow thick. Elk eat my leaves during early summer, and grizzly bears may use them as a bed for their winter dens.

Native Americans in the Rocky Mountains used my roots for medicines and my leaves for baskets. My leaves are best for weaving in the first year after fire because then they are strong but not stiff. Nowadays, Native Americans burn some beargrass meadows on purpose to get the best leaves for weaving.

Florists use my evergreen leaves in winter bouquets.

What does fire do to me? I can survive fire if it just burns off my leaves. Fires that burn my rhizomes usually kill me. I grow well from seed in burned places, but it takes many years before I grow thick clumps that cover the ground.

Life after fire: I can grow back right after fire unless my rhizomes are killed. I also start from seed after fire, but my seedlings grow slowly.

I blossom well in open, sunny places, so I sometimes put on quite a flower show in the years right after a fire.

After the forest grows tall and shades my leaves, I continue to grow but I don't flower much. You can find me for a hundred years or more after fire. In very old forests, I may gradually die out.



Black Cottonwood

You have probably noticed tufts of snow-like “cotton” drifting through the air on summer days. These clusters of soft, white fibers come from the pods where I keep my seeds. When the seeds are ripe, I send them off in a little pillow of “cottonwood down” so they can fly long distances on the wind or float far on the surface of rivers and streams. You’ve probably already figured out that this is how I got my name.

Where do I live?

I’m native to western North America. I prefer areas with lots of light and water. No wonder I like to live next to rivers and streams. If I do choose to live in a meadow or on a mountainside, you can bet there is moisture underground. I’m not picky about my neighbors. If there’s water available, I don’t care if I’m in a forest, shrubland, or prairie.

What do I look like? I can grow to be 30 meters tall. My trunk may be 5 meters around—so big that two or three children can’t reach all the way around.

My leaves are wide at the base and pointy at the tips, about 10 centimeters long and almost as wide. The leaves unfurl from thick, sticky buds in spring. In autumn, they turn golden and fall from my branches. That makes me a *deciduous* tree.

When I am young, my bark is smooth and grayish. As I get older, my bark grows thick and develops deep grooves and



wrinkles.

Growing up: I grow best where light and water are plentiful. Because I have such good taste in habitat, I can grow as much as a meter in a single year! Can you do that?

BOTANICAL FACT: Many young cottonwoods have a big problem: We stick up above the snow in winter, easy prey for hungry little animals. But I have a solution to that problem: I produce a chemical that snowshoe hares and other mammals don’t like. It helps to keep me from becoming someone’s dinner!



Growing points: I have growing points at the tips of my branches, in the buds that produce leaves and flowers, in my root crown, and on my roots.

How do I reproduce?

It takes two cottonwood trees to make seeds, because some of us produce only pollen (which contains *sperm*) and some produce only *ova*, which can grow into seeds. I don't have to reproduce from seed though. I can sprout new plants from my roots. If a branch breaks off and gets stuck in the wet sand on a river bank, it can also grow into a new tree.



My calendar:

My flowers appear in March and to April. Soon afterward, my leaves unfold from big, sticky buds. Sometime between May and July, I release my cotton-borne seeds. They will have the rest of the summer to grow. In August or September, my leaves turn yellow, so a stand of cottonwoods seems to have a golden roof. Then the leaves fall, giving the woods a golden floor.

Am I useful?

I provide shelter for many animals: I hide the deer as they come down to the stream to drink. I shade the river, keeping the water temperature low enough for fish. I provide high branches where song birds can build nests, and my soft inner wood is the perfect place for woodpeckers to make nest holes. Beavers use my branches and trunks as building materials for their lodges.

Large and small mammals may eat my buds and twigs; rabbits are especially fond of eating my inner bark. My leaves are an important food for the tiny animals living in the river bed. I even protect the river

itself by holding on to riverbank soil with my roots.

Because my wood is easy to bend, people have used me for thousands of years. I'm used in canoes and cradles, furniture, and paper products. People sometimes use the sticky, sweet-smelling resin from my buds to make a treatment for sore throats and coughs.

What does fire do to me?

My buds and cambium are sensitive to heat, so most fires kill the parts of me that live above-ground. But fires don't often kill my roots, so I usually sprout many new plants after a fire.

After a fire, life is good for me. My new sprouts have plenty of sunlight and my root system provides them with lots of



water, so they grow fast. They often make huge leaves in the first few years after a fire.

BOTANICAL FACT: Floods are very good for my health! When floods sweep through a riverbed, they clear out the old brush and deposit fresh, moist gravel bars—the perfect place for me to grow.

Black-Backed Woodpecker

A mountainside with hundreds of blackened tree skeletons reaching to the sky is a dream come true for a black-backed woodpecker like me. A recent burn is the perfect place for me to live and raise a family. Hard to believe? Let me explain.

Smoke detectors:

All those standing dead trees probably don't mean much to you. Big deal, you're thinking. To me they represent lots of food. I'm not particularly interested in the trees themselves. It's what's living inside the wood that gets me excited. The burned trees are crammed full of my favorite food... wood boring beetle larvae. Plump and juicy, these white, worm-like creatures— also known as grubs— are so delicious! How did the larvae get here?

Not long after a *crown fire* roared across the mountain, hundreds of "fire bugs" began appearing, seemingly out of nowhere. Over 40 kinds of insects, mostly beetles, are attracted to recently burned forests. The beetles mate, then lay their eggs under the charred bark of freshly killed and dying trees. Once their eggs hatch, the larvae have an unlimited supply of good wood to feast on. Very convenient— for them and for me!

Competition for space in burned trees is intense among beetles. Early arrivals get the best sites and deposit the most eggs. Because of this, many beetles have developed ways of homing in on burns. Some are alerted by smoke and use it to find their way to a fire. Others have special heat detectors that sense infrared radiation. This equipment allows them to take a very direct route to a fire, often beating the rest of the "fire bug" crowd. These beetles are called *Melanophila*, a Latin word meaning "dark lovers." Their name refers to the fire-charred trees on which they mate. They are such expert fire finders that they have zeroed in on a fire from as far away as 160



kilometers.

Grubs, anyone?

Wood-boring beetle larvae generally tunnel only two to five centimeters into a tree. Here they stay for a year or so before turning into adult beetles. During this time wood surrounds them on all sides and they are safe from most predators. But they're not safe from me! I use my strong woodpecker bill like a pry bar to loosen and chisel off large chips of bark. Beneath the bark are small holes where larvae have entered the wood.

Now I know exactly where to start hunting for my lunch. Steadily chiseling away the wood, I finally uncover a larva and spear it with my barbed tongue. Yum-m! Would you care for some?

Woodpeckers only! I'm not too worried about predators while I'm busy working. The back of my head and my entire back are black, so I blend in beautifully with the charred sides of burned trees while I hunt for food. This burn will provide me with a year-round supply of food for a few years. Even in winter I'll be able to find food. And it's all reserved for woodpeckers. Other kinds of birds can't get grubs from these trees.

Perfect combination: The burn has attracted other black-backed woodpeckers besides me. When spring arrives I find a mate and we pick out a nest tree in the burn. Only a recent burn offers the ideal combination: a nest tree and plenty of food trees within easy reach. We'll be able to feed our young without a hitch. Our nest tree is a western larch with a broken top. It died decades ago, long before this last fire, and has decayed nicely over the years. A sturdy outer shell of wood surrounds a totally rotten center. Perfect!!

My mate and I work together to

excavate a cavity for our nest. Chipping out an entrance hole in the hard outer wood is tough going. Hollowing out the inside is much easier, but it takes awhile since the cavity needs to be fairly large. It must hold our nestlings until they're old enough to fly. Our completed nest cavity is about 25 centimeters deep and 12 centimeters in diameter. Such a warm, safe place to raise our young! We also remove any tree bark from around the entrance hole to make our home super safe. Predators like tree squirrels will have to deal with a slippery surface if they want to get in!

Room available: Finally, everything is ready. I lay 3 white eggs in the bottom of the nest cavity. After 12 days of incubating, we have 3 lovely nestlings. My mate and I work hard at caring for our nestlings, making many trips to the nest with food. Besides eating lots of beetle larvae, the nestlings eat many insects picked off the bark of trees. Our young will be able to fly in about 25 days, but they will follow us around for several weeks, learning more tricks about finding food.

We only use a cavity for one nesting season. It won't be vacant for long, though. Mountain bluebirds and tree swallows are two kinds of birds that raise their young in old woodpecker cavities. There are many others. After we leave, someone will move in the following spring.

Now you know why a recent burn is my kind of place. Next time you see one, think of me. I'll be there!

FIRE FACTS: Stand-replacing fires in lodgepole pine forests create perfect habitat for black-backed woodpeckers. In fact, it's so good that many pairs may nest within a single burn. Why not? Food is abundant. A great supply of grubs is available right under the bark of the dead and dying trees. The black-backed must also find a good nest tree amid these food-rich trees. Only rotten trees are soft enough for them to excavate a nest cavity in. So black-backed woodpeckers usually nest in rotten trees in the middle of a dense clump of burned snags. The black-backed must quickly make its home because this great arrangement will only last 5 or 6 years. After that time there are fewer beetles feeding on the dead trees. And once the woodpeckers' food supply is gone, so are the woodpeckers! Then the black-backed will look for another recently burned forest that offers more beetle larvae.

Blue Huckleberry

I am a shrub. I have two scientific names: *Vaccinium globulare* (*globulare* means "little ball or seed") and *Vaccinium membranaceum* (*membranaceum* means "with a flaky skin or membrane"). Both names describe me well.



Where do I live? I am native to the Rocky Mountains and other northern forests of the United States and Canada. I like places with some moisture in the soil. You can find me in lodgepole pine, subalpine fir, and Engelmann spruce forests. I grow with many other kinds of trees and shrubs, too. I grow very well on sunny hillsides. That's where I produce the best berries.

What do I look like? I may be short (30 centimeters) or tall (more than a meter). I have woody stems. When my stems get old their flaky bark peels off in shreds.

My flowers are pale pink and shaped like bells. I grow a dark blue or purplish berry that is delicious—even to people, who seem fussier than many animals about what they eat.

I am a *perennial* plant. This means I grow for many years.

Growing up: I can grow from seed, and

my underground stems (called "*rhizomes*") are also able to start new plants. A *seedling* may not have rhizomes until it is about 3 years old. I am most likely to produce new plants from rhizomes if my top is broken off or burned.

I grow best in open, sunny places. That's also where I produce the biggest berry crops. I can grow for many years under forest shade. Then, if a fire burns the trees, I'm ready to sprout up into the sunshine that follows.

BOTANICAL FACT: The rhizomes of a blue huckleberry bush can grow as much as 20 centimeters in just one year!

Growing points: I have growing points at the tips of my branches, in all my buds that produce leaves and flowers, in my rhizomes, and in my roots. Most of my rhizomes are in the top 15 centimeters of soil, but some are 25 centimeters deep.

How do I reproduce? Most new blue huckleberry plants are sprouts from rhizomes. Once in awhile I grow from seed.

My calendar: My leaves unfold from their buds in spring, and flower buds come out at the same time. My flowers open before the leaves are completely grown. By early summer my leaves are full-sized, my flowers are open, and my stems have already completed their year's growth. In about 6 weeks my berries are ripe. My leaves turn red in late summer. From far away they make the mountainsides look like they're carpeted with scarlet.

My seeds don't wait for spring to start growing. A seedling may appear three weeks after a seed lands in the soil.



Life after fire: I resprout and produce berries in just a year or two after some fires. After hot fires I may need 20 years or more to recover. I produce my best berry crops in the years before trees grow tall enough to shade me.

As trees begin growing after crown fires, I live in their shade. I can live many years and continue to sprout in a forest of tall trees, but I don't produce many berries there.

Am I useful? Bumblebees and honeybees drink my nectar. They pollinate my flowers as they fly from one blossom to another seeking nectar.

Elk and mule deer eat my leaves and twigs.

Many mammals and birds like to eat my berries. Here are a few: grizzly and black bears, red squirrels, foxes, chipmunks, skunks, grouse, ptarmigans, bluebirds, and thrushes. Black bears seem to have more cubs after a summer of plentiful huckleberries, and black bear cubs often survive better if they are born in a year with a good berry crop.

People have harvested my berries for thousands of years. Native Americans used to eat my berries fresh and also dried them for winter food and for trading. Native Americans may have burned the places where I grow to get better berry crops.

I also provide hiding places and shelter from storms for grouse, other small birds and mammals.

What does fire do to me? Fires usually kill the buds on my branches, but I can grow back from my rhizomes if the fire doesn't damage them. Whether I survive or not depends on how hot the fire gets and how deep my rhizomes grow. I may grow new sprouts in a few weeks after surface fires. But when fire burns heavy fuels or smolders for a long time, my rhizomes are likely to be killed.

Clark's Nutcracker

I am named for the famous explorer Captain William Clark of the Lewis and Clark Expedition. In late August, 1805, the Expedition traveled through the Bitterroot Mountains in what is now Montana. Clark recorded watching a flock of robin-sized, light brown and black birds. They were cracking open pine cones. Amazing that he witnessed the one activity that is so important to my way of life! You'll find me hoarding whitebark pine nuts—or seeds—every year in late summer and early fall. When the cones are ripe I spend all day, every day, selecting and burying nuts. Only when most of the cones are harvested do I finally take a break. Whew!!



Nuts about nuts. Why am I so nuts about whitebark pine nuts? My life revolves around those small brown seed packages. Whitebark pine nuts are my primary food throughout most of the year. I know it is not wise to be such a picky eater.

Pine nuts are on the trees for only a short time in the summer and fall. How do I manage to eat pine nuts during the rest of the year? Well, if I work real hard, I can collect and hide a whole year's supply of pine nuts in a few short weeks. Here's how it happens:

Made to order. Whitebark pines produce cones that are made to order for nutcrackers. First, the ripe cones stay attached to the tree. Second, the pine nuts stay inside the cone no matter how roughly I handle it. This means I can set up my workshop in the safety of the treetops and just chip away at the ripe cones.

Hammering off the thick outer edges of the cone is easy thanks to my stout,

chisel-shaped bill. Once the scales are broken, I use my long bill like a pair of tweezers to pluck out the waiting pine nuts. One by one I collect them in my mouth. But I don't eat them. Instead, I send them on a detour. The nuts go into a specially designed pocket, called a *sublingual pouch*, under my tongue. Only nutcracker species have

pouches, and the biggest one belongs to me! Having a pouch lets me collect and carry lots of pine nuts at one time. My pouch can stretch until I've stored up to 80 pine nuts. Now where am I going to put all of them? My winter meals depend on how well I hide the nuts.



Hide and seek. The spots where I hide my precious pine nuts are called *caches*. I cache seeds in lots of places, but openings in the forest work best. Ridge tops and recent burns are great spots because snow melts off quickly in the spring. These openings are scattered throughout the forest. I might fly 30 kilometers or more to bury my treasures. A full pouch is a very heavy load. Lucky for me I'm a strong flyer.

When I reach my cache site, I go right to work hiding seeds. I use my bill to make a small hole in the soil. Then I bring up pine nuts from my pouch and poke them into the same hole, one by one. Once I've stuffed in 3 to 15 seeds, I cover them up and move a short distance to make another small cache. I repeat this until my pouch is empty. Then it's off to get more seeds.

When I'm done harvesting for the year, thousands of my seed caches are scattered in

openings throughout the high country. I've buried maybe 20,000 to 100,000 seeds to eat during the long winter. How am I going to find them all? Easy! I have a super memory! By remembering markers like special rocks and trees, I know where to look for a seed cache.

Safe and sound. I won't find all of my seed caches, but I'll remember enough to live year round in the mountains near *treeline*.

I'll even remember enough caches to support a family. In February, when my mate and I start nesting, our forest is still a winter wonderland. We depend completely on buried seeds to feed our young. In fact, buried pine nuts are our nestlings' main food from birth until the new nut crop ripens in late summer. Don't worry! Our young will have plenty to eat. Windy ridge tops are often blown free of snow in the winter, so I can easily find the caches buried there. Even if deep snow covers some caches, I can tunnel through the snow and still be right on target. I'm simply amazing!!!

Most caches are safe from animal burglars and easy for me to get. Red squirrels know better than to rob a cache buried out in the open. A golden eagle might have that squirrel for lunch!

Tough old bird. So I'm all set to live where the whitebark pines grow. But a lot has changed in the two centuries since Captain Clark came through. White pine blister rust is changing the forests where I live. This *fungus* came to North America from Europe in 1910 and is killing many whitebark pine trees. There are not as many whitebark pine nuts as there once were. Survival is difficult in the high subalpine forests. My tough life has become even tougher!

FIRE FACTS: Clark's nutcrackers can easily fly away from fires in the subalpine forests. By the time fire season comes around, they have finished nesting and their young can fly well enough to escape.

High elevation crown fires kill many whitebark pines, so they eliminate part of the nutcracker's food supply, sometimes over large areas. Although patches of unburned whitebark pines sometimes occur within larger burn areas, finding new trees producing seed is stressful for the birds. To survive, nutcrackers often fly to lower elevations looking for limber pine or ponderosa pine seeds.

Even though large burns produce few seeds, they are great cache sites. Nutcrackers transport thousands of seeds into the middle of large burns, faster than other tree seeds can blow in. Someday the forgotten caches will grow into trees that produce pine nuts for future generations of nutcrackers.



Douglas-Fir Dwarf Mistletoe

When you hear "mistletoe," you may think about the plant with white berries that people kiss under during the winter holidays. Well, I don't have *anything* to do with kissing!

I am a plant, but unlike most plants, I don't get all of my energy from sunlight. Instead, I get water and energy from the trees that I live on, so I'm called a *parasite*.

I am a *perennial* plant, which means I can live for many years.

Where do I live? I

almost always live on the branches of Douglas-fir trees. Many other kinds of dwarf mistletoe live in the western United States on other kinds of trees. Each mistletoe species is very particular about what kind of tree it lives on. Some prefer ponderosa pines, some prefer lodgepole pines, others prefer larch. Even though I occasionally make my home on other kinds of fir trees, I really like Douglas-fir.

What do I look like? I'm small, so you have to look carefully at a Douglas-fir branch to see me.

First, you'll have to find a branch that I'm living on. That won't be hard, because any branch I've lived on for a few years is funny-looking. My "home" branch is thick, with lots of bulges on it. It is made up of many little, deformed branches that look like a big, messy tuft instead of a graceful tree branch. People call these tufts *witches'-brooms*, but I would NEVER let a witch live on me! Can you find any witches'-brooms on the photo on the top of the page?

Once you've found my home branch, you



can look for *me*. Scientists call me a "shrub," but my greenish stem is often shorter than the Douglas-fir needles that are my neighbors! I have tiny flowers and no leaves at all. Compare my size to the length of the needles in the photo below.

BOTANICAL FACT:

Dwarf mistletoe can't produce both pollen and seed on the same plant. Some plants are "males." They make pollen, which fertilizes the flowers produced by "female" plants. There's a long word for this kind of plant; it's called *dioecious*, meaning "in two houses."

Growing Up: I grow from seed. My start is spectacular. When my seeds are ripe, I can't just drop them to the ground. I need to get them to another Douglas-fir branch so they'll have a chance to grow. So, as the seeds ripen, I pump water into the ends of the stems that hold them. When the seeds are ripe, this little water tank pops open and launches the seeds, like tiny rockets, out through the tree branches. The seeds travel as fast as 100 kilometers per hour! They don't get far though. Most land within 5 meters



of where they started.

My seeds stick to the needles on the branches where they land. The next rainfall loosens their hold so they slide down the needle to the twig. The next spring, I start growing. My root builds a little bulge on the twig. From there I send smaller, thread-like strands right through the twig's bark into its cambium and wood. Finally I can get water and fresh nutrients!



I grow inside the twig for at least two years before I even begin to poke my little stems out into the air. I have to grow for at least four years before I can flower and produce seed.

After I get a good start on a Douglas-fir tree, I steal a lot of nutrients that the tree could use instead. Leaves on the branches above my witches'-brooms thin out; the branch slowly dies. The tree's growth slows down. It may easily be killed by drought or insects. Even if it survives those things, it will eventually die from starvation. I will die then too, but not without leaving thousands of young mistletoe plants on nearby trees.

How do I reproduce? I reproduce by seed.

My calendar: My flowers come out in spring. More than a year later, in mid-summer, my seeds are ripe and ready for travel.

Am I useful? Many kinds of insects eat my stems and flowers. Blue grouse and chickadees eat them, too. Red squirrels and porcupines eat the bark on my host branches. My witches'-brooms provide good hideouts for birds and squirrels. It isn't always safe there, though. Hawks and owls may nest in witches'-brooms, and American martens use them as resting places. Maybe they're looking for a

snack as well as a nap!

I welcome all of my animal visitors because they carry my sticky seeds much farther than I can get them on their little water rockets.

What does fire do to me? *Surface and ground fires* don't affect me much unless they kill my host tree. *Crown fires* are very bad for my health, though. They clear me out of a forest almost completely. I can't grow back until my host trees start to grow there again and I can get seeds to them.

Life After Fire: If I'm wiped out by a fire, I'm probably still growing on Douglas-firs outside the burn. I'll have to "invade" from the edges. This invasion isn't fast, like a big army marching across the land. It's very slow! Remember, each of my seeds only travels a few meters on its water rocket, and it must land on a Douglas-fir tree to survive.

After fire, young pines grow very fast—much faster than my host Douglas-firs. They grow so fast that they get in the way of my seeds and slow my invasion to a crawl. Scientists say that I move into the new forest at a rate of about half a meter per year.

I don't give up, though. Wherever you find plentiful Douglas-firs, you'll probably find me too.

Douglas-Fir

I am a tree. My scientific name is *Pseudotsuga menziesii*. *Pseudotsuga* means "like a hemlock." Two kinds of Douglas-fir live in the United States. I am the "Rocky Mountain" kind of Douglas-fir.



BOTANICAL FACT:

Douglas-firs were first described in writing in 1791 by Dr. Archibald Menzies. Thirty years later, David Douglas found this tree in Oregon. Now the tree's English name comes from one of these scientists, and its scientific name comes from the other!

Where do I live? I am native to the inland mountains of the western United States. I grow especially well in the northern parts of this area. I can live in many kinds of forest. I like warm places at low elevations, so I often grow with ponderosa pine, other firs, and western larch. I can also grow in cooler places. My neighbors in those forests are lodgepole pine, Engelmann spruce, and quaking aspen.

What do I look like? I am an evergreen tree. I can become 35 meters tall, and my trunk can be more than a meter thick. My needles are short— 2 to 3 centimeters long. They grow right out of the twig. My buds are pointed and rusty brown in color.

When I am young, my bark is gray and smooth, with small blisters filled by resin. As I get older, my bark gets very thick and forms deep, brown furrows.

Some of my roots are close to the soil surface. Others grow deep into the soil.

Growing Up: I grow from seed. I start growing in bare soil and also in soil covered by dead pine needles. I grow best where there's a little shade overhead. Where there's a lot of shade I grow slowly, with a spindly trunk and few needles. I don't look great then, but I'm stubborn, so I can live a long time like this. Dense patches of such spindly trees are called "thickets."

Growing Points: I have growing points inside my bark (in my *cambium*), at my very top, and at the tips of my branches and roots.

How do I reproduce? I'm a "conifer," which means I put my seeds in cones. My light brown cones feel papery. They grow 5 to 10 centimeters long. Each seed is attached to a 3-pointed "wing" that helps it float on the wind when it falls from the cone. Seeds can travel up to 80 meters before they land. The wings on my seeds peek out from under the cone scales. They look like tiny mouse feet sticking out between the scales. Some people think they look like serpent's tongues.



My calendar: New leaves begin to unfurl from my buds in spring. Within a few weeks, they are full grown. At the same time, new cones begin to grow. By early August, next year's leaves are stored already in the tiny buds at the tips of my branches. By the end of

August, my cones have grown to full size and are filled with ripe seeds. The seeds fall to the ground, but they will wait until the next spring to start growing.

Am I useful? Red squirrels cut the cones from my branches, drop them to the ground, and pile them up for winter food. My seeds are an important food for many other animals too. Chipmunks, mice, voles, and shrews eat them. So do Clark's nutcrackers, chickadees, nuthatches, crossbills, juncos, and pine siskins. In some years, insects eat a third of my seeds! Beetles eat my cambium, and the larvae of some moths eat my needles. They may eat so many needles that it looks like all the trees on a hillside have died.

Fungi use the nutrients stored in my roots. *Armillaria* is one of the most important of these fungi. *Armillaria* can slow my growth and even kill me. A plant called "dwarf mistletoe" grows on my branches. It sinks its roots into my branches and trunk to get water and nutrients.

I provide hiding places for bighorn sheep, elk, and deer—especially during winter. Deer, elk, and moose may eat my leaves in late winter when other food is scarce.

People use my long, straight trunks to build their homes. Small trees can be used for plywood, fences, and firewood.

What does fire do to me? My branches grow close to the ground, and I often grow up in the shade of other trees. Sometimes, when I'm still young, my low branches act like a ladder that lets *surface fires* climb into the crowns of the tallest trees in the forest.

When I'm old, my thick bark helps me survive surface fires. I don't have this protection until I'm at least 40 years old, though. Before that, my thin bark can't protect me from fires.

Even when I'm old and tall and have thick bark, surface fires may kill my roots. If I survive, I may be so weak that bark beetles can easily kill me.

Life After Fire: I can begin growing from seed right after fire, but I'm usually not the

fastest-growing tree in a new forest. Pines are usually faster. When I'm about 20, I start to grow faster if there aren't too many other plants or trees nearby. If I'm living in a thicket, I grow very slowly.

I can live a long time. I grow taller every year until I'm more than a hundred. I can live to the ripe old age of 400!

Elk

You might know me by two completely different names. One is “wapiti,” meaning “white rump” in the language of the Shawnee Native Americans. The second is “elk,” which is the European name for moose. No way I am a moose!



Strong headed: I’m called many names, but my all-time favorite is “monarch of the mountains.” I think it’s very appropriate, considering my magnificent crown. Check out my wide set of antlers. Now that I’m grown up, they measure nearly a meter and a half from tip to tip and weigh close to 19 kilograms. How would you like to live with a great big coat rack on top of your head? It might be hard for you, but I’m quite used to it. I’m amazingly quiet and swift as I move through the trees.

Each year I grow a new set of antlers. I shed them sometime after the fall mating season. Now that I’m 13 years old, my antlers are about as big as they’re going to get. My body is full grown too. I weigh over 300 kilograms and stand a meter and a half tall at the shoulder.

The more, the merrier: It takes lots of food to fuel a huge animal like me. I’m an “herbivore.” That means that I eat mainly plants. Grass is the “meat and potatoes” of my diet. During the early morning and late evening hours, you can find me eating in meadows and grassy openings in the mountain forests.

Feeding out in the open is a very risky business, so most elk find safety in numbers. Cows and calves are often in herds of 20 to 30 animals; young bulls usually stay in small groups, called “bands,” of 3 to 6. Large bulls like me spend most of the year alone. I



join the rest of the herd only during mating season.

Being in a herd is a safe way for elk to live. Why? Because a herd has many pairs of eyes and ears constantly checking for danger. If a predator is lurking about, the herd is alerted long before it can attack. An elk herd even stays together when it’s running away from danger.

A disappearing rump patch tells the herd which way to go!

Mountain lions are the only predator I give much thought to these days. Bears, coyotes and wolves can mean trouble for young calves, but not for me.

Winter blues: Each year hundreds of us migrate from the high country down to low elevation grasslands and shrub-covered hillsides. This is our “winter range.” Here the snow is shallow enough for us to find the dried remains of last summer’s grass. I can paw through half a meter of snow to find food. Although I’d much rather not work that hard!

Winter is the hardest time of year for me. Not only is food in short supply, but what little there is may be low in nutrition. Our winter range is such a small part of the forest. Many elk gather here and it’s hard to get enough food to survive.

When I arrived last fall, there were plenty of dried grasses and forbs to eat. I ate the yellow aspen and cottonwood leaves that were still on the trees, too.

In early winter, the herd devoured the most nutritious food. Then it headed uphill along the edge of the pine forest looking for dried bunchgrasses, lichens and chokecherry bushes to eat. But winter was long. The grass was covered by deep snow, and the buds on the bushes were soon eaten.

Sometimes when there is a lot of snow, I seek shelter at the base of a big tree, where the branches keep the snow from piling up.

The herd moved back to the grassland then, going over every square meter for a second time. We looked for tidbits that we missed the first time. We ate plants that didn't seem very appetizing earlier in winter, when grass was plentiful. Any food was better than no food at all! By the end of winter, the place was almost picked clean.

Follow the melting snow: When spring comes, I follow the melting snow up into the mountains. My first stop is the ponderosa pine forest. As the snow melts off the south-facing slopes of these low-elevation forests, dried grasses and forbs are uncovered, and new green plants appear. After a winter of dried plants, anything green is a welcome change. I love to eat the new leaves of bunchgrasses and arrowleaf balsamroot. They're so-o-o tasty.

As the snow melts, I move further up into the mountains. When I reach the lodgepole pine forests at middle elevations, the amount of food depends a lot on how long it's been since a big fire. Recent burns have lots of grass, wildflowers, and shrubs. Old forests have little to eat, but they're great places to hide!

Pregnant cows usually win the race to the high elevation forests and meadows. They need the tender new grasses and forbs for their newborn calves. I get to the high ridges a little later.

Summertime, and the livin' is easy: I really look forward to summer each year. That's when I'm on my summer range. The rest of the herd is spread out over the high mountain meadows and grassy, park-like openings in the subalpine forests.

Life is easy during this time of year. Nutritious bunchgrasses grow everywhere. Everything I eat is lush and green and oh, so delicious! I spend a lot of time in summer nipping off the tops of beargrass flowers.

I can think of only one bad thing about summer: flies! They torment the living daylight out of me. When they're really thick and pesky, I find a cool snowbank to rest, or I hide in the shade of the subalpine firs and spruces. Breezy ridge tops, where the whitebark pines grow in clusters, are good spots too. I'll go any place where the air is cool and those pesky flies aren't so active.

Where have all the green plants

gone? The abundance of green plants doesn't last long in the high country. By early autumn, many plants have dried out and frosty nights have damaged those growing in the meadows. I head for the patches of forest, where many plants are still green and lush. This trick buys me a bit of time, but it isn't long before I go back down toward winter range.

Heavy snows in the high country soon push me to the lower elevations where food is still available. I'll hide out in the dense lodgepole pines during hunting season. Then I'll move to the ponderosa pine forest and grasslands, completing the circle of my annual migration.

FIRE FACTS: Elk cover great distances in their yearly movements between winter and summer ranges. As they travel, they use many different kinds of habitat. Usually they are attracted to openings within a forest, where they find grasses and forbs to eat. A landscape with a combination of openings and trees is ideal for elk.

Fires are good at creating this kind of habitat. Where fuels are heavy, fires burn hot and create openings— some big, some little. Fires barely spread over areas where fuels are light. If the wind changes direction, a fire might totally skip a stand of trees.

More sunlight reaches the ground where fires have opened up the forest. For several years afterward, grasses and forbs flourish in the openings. Fire gives many shrubs a "new lease on life" by burning off the old, woody growth and getting new sprouts to come up from the roots. Elk seek out these tender young shoots. As long as elk can find shelter in trees nearby, they often prefer recent burns to other kinds of habitat.

Engelmann Spruce

I'm a *conifer* and one of the largest trees that can grow high in the mountains. My size depends on temperature and moisture. The warmer and wetter my home is, the bigger I can get.

Where do I live?

I am native to the western mountains of North America, growing from British Columbia in the north to Arizona in the south. I grow well in high-elevation forests and along streams. I get along well with subalpine fir and lodgepole pine, but I can also grow in places too wet for them.



my bark is purplish-brown. It is thin and flakes off in rounded scales as I grow up.

BOTANICAL FACT: At high elevations, severe winds and winter ice make many kinds of trees—including Engelmann spruce—grow in a strange form. They are short, with many branches low to the ground. They have branches only on one side of their trunks, and their tops are dead. This mountain-top forest of miniature trees is called *krummholz*, meaning “crooked wood” or “twisted wood.”

What do I look like? When I am full grown, I may be taller than 40 meters, and my trunk may be a meter across at the base. Many spruces live 400 years or more, and some of us get to our 600th birthday!

My needles are 2 to 3 centimeters long, four-sided, and with sharp, pointy tips. You'll be sorry if you grab one of my branches! My needles are bluish-green and



Growing Points: I am a very patient tree; slow growth is normal for me. During my first 100 years, I'm usually the shortest tree around. When I was 1 year old, I was only a couple of centimeters tall. When I turned 5, I was 7 centimeters tall. Five-year-old pines nearby were nearly a meter tall by then, and aspens the same age towered over me, already 3 meters tall. When I got to be 100, I was finally 2 meters tall. That's ridiculous for a tree—it's almost as short as a human!

My calendar: I usually produce pollen in June. My cones grow all summer, then open and release seeds in the fall. My seeds have long, papery wings, so they might travel 100 meters or more in the wind. If they can skate across some early snow, they might travel even further.

My seeds spend the winter under snow and begin to grow a few weeks after it melts. Bare mineral soil is a good place for my seeds to land, but they can become established even where *litter* and *duff* cover the ground.

Am I useful? Deer, elk, moose, bighorn sheep, and bears all like me because I provide excellent hiding spots. I shield them from the heat of the sun in the summer, protect them from the wind during storms, and provide great cover when they hide from predators. Small mammals and birds find my seeds delicious; spruce seed may be the only food available in deep winter, when most seeds and small plants are covered by snow.

Native Americans know how to use my bark to make canoes, baskets, and roofing. Sometimes my roots are used to make rope. My needles and boughs provide fresh-smelling incense that can be made into body scents and soap.

What does fire do to me? I

rarely live through fires because I have thin bark, often with patches of sticky sap on it. The sap burns easily, heating and killing my *cambium*. Even if my cambium survives, heat from a fire will probably kill my shallow roots or use my dense, lichen-covered branches as *ladder fuels*—climbing from the ground into my crown. If one tree crown is ignited, its neighbors are likely to burn because my neighborhood is often crowded with trees.

Even if I manage to survive fire, I'll probably never be the same. I'm likely

to catch some fungus spores in places damaged by fire. These will start growing in my wood, causing it to rot from the inside out. I can live for many years with decayed heartwood, but it weakens me. I'm more likely to break under a heavy snow load or fall when the mountain winds get too strong for my weakened roots.

Life After Fire: I love what fire does to my habitat. My seedlings grow well in the sunny openings, bare soil, and plentiful moisture in burns. But, as you know, I'm a slow grower. Pines and aspens also like burned areas and grow much faster than I can. That makes the neighborhood crowded, but I don't mind. I'll stick around. When my fast-growing neighbors die out after a century or two, I'll have lots of space for myself. Remember, I'm a very patient tree.



Fireweed

I am a flowering plant. My scientific name is *Epilobium angustifolium*. *Angustifolium* means "narrow-leaved."

Where do I live?

I live in cool forests in North America. In the western United States, I live in every state except Texas. I like lodgepole pine/subalpine fir forests because they are cool and sometimes moist. You can often find me growing in disturbed areas like places that recently burned or along roadsides.

What do I look like? I grow 1 to 2 meters tall. I have a single stem with many narrow leaves. My bright pink or lavender flowers grow at the top of the stem in clusters of 10 to 20 blossoms. Each flower can make hundreds of seeds, and each seed has a tuft of fuzz attached. Some people say my buds look like matches, my flowers look like fire, and my seeds look like smoke.

I am a *perennial* plant. This means I grow for many years.



Growing Up: I grow from seed. Soon I grow many hair-like roots and underground stems called "*rhizomes*." The rhizomes grow new roots and can start new plants.

My roots and rhizomes grow deep in the soil. Sometimes they grow down 40 to 50 centimeters, so they are not easily killed by winter's cold, summer's heat, or forest fires.

Growing Points: I have growing points in my roots and rhizomes.

How do I reproduce? I can grow from seeds and also from sprouts that grow from my rhizomes.

My calendar: When the soil has thawed, my roots begin growing. They start before my leaves do! It is still very cold out. My stem comes up in early spring, and a month later my leaves are full grown. That's when my flowers start to bloom. In another month, I have seeds ready to be carried far on the late summer winds.

BOTANICAL FACT: Fireweed seeds don't wait long to start new plants. They begin growing a few weeks after they land on the ground, forming tiny leaves and roots that get them through the winter.

Am I useful? Moose, elk, deer, muskrats, bighorn sheep, and mountain goats all eat my leaves and stems. Chipmunks and pikas eat my seeds.



Hummingbirds and butterflies drink my nectar, and butterflies eat my pollen.

Because I am not very fussy about what kind of soil I grow in, people plant me to protect the soil in places that have been mined or damaged by oil spills.

Native Americans have used my young stems and roots for food, my petals for jelly, and my leaves for tea.

What does fire do to me?

Since my roots and rhizomes are buried in the soil, fires don't often kill them. My stems and leaves do burn, and so do seeds near the top of the soil. After fire, I sprout from rhizomes. I don't even wait for the following spring; I may show up a month after the fire! Wind can carry my seeds, with their downy parachutes, a long way— right into the middle of even the largest burn.

Life After Fire: A year after fire, my flowers make some burned hillsides look like they're covered by a lavender cloud. I spread and flower for many years after fire. As the bushes and trees crowd in, I flower less. I produce a few stems and leaves every year, though, even in shady forests. That way I'm still around when the next fire comes through.



Flammulated Owl

I'm pretty unusual for an owl. Most owls are *carnivores*, meat eaters. After eating they cough up owl pellets that are full of undigested small mammal and bird bones. Not me—I'm an *insectivore*! Insects are the only things I eat. Since I'm awake and hunting for food at night, I only eat insects that are active after the sun goes down. I have excellent night vision and can find insects when it's too dark for you to see much at all. My favorite snacks are those fuzzy moths that flap around lighted windows in the spring and early summer. Yum-m! Grasshoppers are good too, especially in the summer when there are so many of them.



Here's another thing about me that's different. Most owls live in the same place year round. But I can't stay around here all year. In Montana and Idaho insects aren't active during the cold winter months. To find food I fly south to places where the weather stays warm and the insects are active all year. Mexico and Guatemala are perfect spots for me to spend the winter chowing down on insects. So, unlike most other owls, my summers and winters are spent in very different places.

Tree scout. Once spring begins in the northern Rocky Mountains and Intermountain area, warm temperatures bring melting snow and hatching insects. Now it's time for me to fly back to the dry ponderosa pine forests. These forests, with their big old pine trees, supply everything I need for nesting and raising my young. I like to nest in a hole inside a big tree trunk; it's a cozy, safe place to raise a family. Because my small bill isn't designed for making holes in wood, I scout out a cavity that's already made. When I spot one, I hope it's not being used by other

animals.

Lucky for me pileated woodpeckers also nest in my kind of forest. They are experts at excavating wood. With their strong, chisel-like bills, these large woodpeckers can chip out a roomy *nest cavity*. Pileated woodpeckers often pick large, soft-centered ponderosa pine *snags* for their nest trees; only the largest trees are big enough to hold their families.

When pileated woodpeckers prepare their nest cavity they are also preparing mine. They'll use it for a single nesting season and excavate a new cavity the next year. My mate and I fit perfectly into their

abandoned home. We just move right in. Thank you, pileated woodpeckers!

Young mouths to feed.

In early May my mate lays a clutch: two to four creamy white eggs. She sits on them and keeps them warm for 27 days. I bring her food the whole time she's *incubating*. Both of us take care of the babies after they hatch. Delivering enough food to feed those hungry mouths is a lot of work.



To keep our babies healthy and growing we must feed them as much as possible. It's a good thing our nest tree is surrounded by an open forest of large, old ponderosa pine and Douglas-fir trees. Lots of insects live in this kind of forest and its grassy openings. Snatching food out of the air while we are flying can be tricky. The old trees that we like best are widely spaced with lots of room between their crowns. It's easy

to fly between their branches, swooping down on moths and other flying insects. We find plenty of insects close to our nest and they're a cinch to catch. What more could a parent want?



As our babies grow they learn to fly and find their own food. They hunt for grasshoppers in the openings between patches of old trees. Pouncing down on grasshoppers from low tree branches is much easier than trying to catch insects in the air. Remember, all of our hunting happens in the dark!

During the day my mate and I, and our babies when they are big enough to fly, sometimes roost in thickets of young Douglas-fir trees that grow under some of the bigger pines and firs. If we're lucky predators won't find us here. We also roost right up against the trunk of large ponderosa pine trees. Our orange feathers blend nicely with the orange bark. By autumn the fledglings are on their own. Surviving until their first birthday is very difficult. Many will die during the migration south. The ones that make it will live about 7 years.

FIRE FACTS: For hundreds of years before 1900, surface fires burned through ponderosa pine/Douglas-fir forests quite frequently— sometimes every 5 to 7 years. These fires thinned out the small trees that started growing between fires. The large trees survived easily because of their thick bark and high branches. These surviving trees had ideal growing conditions: plenty of water, soil nutrients, and space to grow even bigger. Since fires kept their competition in check, the surviving big trees grew older and their trunks grew bigger. These forests contained many ponderosa pines and a few Douglas-firs that were 300-400 years old. Some were much older. These old forests had plenty of rotten *snags* nesting birds needed. The combination of big trees, snags, grassy openings, and occasional thickets of young trees was perfect flammulated owl habitat.

Glacier Lily

I am a flowering plant in the lily family. My scientific name is *Erythronium grandiflorum*, meaning "red-tinged, big-leafed plant".

I am a *perennial* plant. This means I grow for many years.

Where do I live?

I am native to western North America. I like cool, moist places, especially where the snow stays late in the spring. You can find me in Douglas-fir, lodgepole pine, subalpine fir, Engelmann spruce, and aspen forests. I can grow under shrubs and trees. I grow even better in open, wet meadows. That's where I produce the best flowers. Although I can grow in shady places, I don't produce many flowers there.

What do I look like? I grow about 20 to 40 centimeters tall. My two long, wide hairless leaves grow right up from the ground. My bright yellow flowers have six petals, each one 3 to 4 centimeters long. Inside the flower, six stamens carry my pollen. Sometimes the stamens are red.

BOTANICAL FACT: Glacier lily flowers grow on a tall stalk in the center of the plant, but they don't look up at the sun. Instead, they nod their heads as the wind blows, as if they're looking for something on the ground.

Growing up: I start growing from seed, but soon I grow a thick underground stem called a *corm*. The corm stores nutrients for me through the long winter so I can begin



growing leaves in the spring even while I'm still covered with snow!

My corm grows deep in the soil. It's covered by 15 to 25 centimeters of soil and is not easily killed by winter's cold, summer's heat, or forest fires.

Growing points:

I have growing points in my corm and in my roots.

BOTANICAL FACT: A glacier lily plant may be 6 or 8 years old before it is large enough and strong enough to produce seeds.

How do I reproduce? I grow from seeds and from sprouts that grow out of my corm.

My calendar: My leaves begin growing while the last snow is melting from the mountain meadows, and I don't waste any time in the short summer. In ten weeks I manage to make flowers, get my seeds ripe, and store nutrition for next spring in my corm. Then my leaves get brown and dry out, and I'm ready for winter.

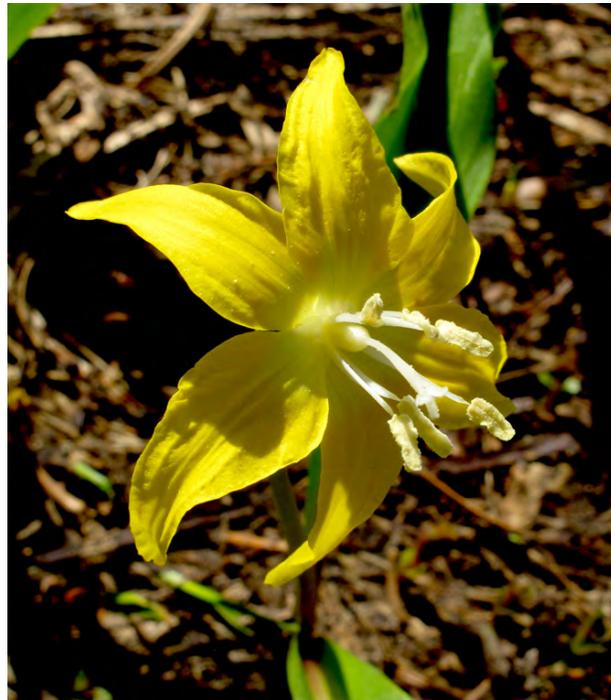
Am I useful? Bees and hummingbirds eat my pollen and drink my nectar. Grizzly bears dig my corms and eat them in the spring and fall. The meadows where they've been eating look like a farmer's plowed field! Ground squirrels eat my corms too. Elk and mule deer eat my leaves.

People can eat every part of me. My flowers are very sweet because of their nectar. Native Americans used to crush my roots and

use them to treat sores.

What does fire do to me? Fires usually burn the mountainsides where I live during late summer, when my leaves are brown and dry. The leaves burn, but fires hardly ever kill my corm because it is so deep underground.

Life After Fire: I sprout from my corm the spring after a fire, ready to use any nutrition left in the ashes. I can live in new forests as they develop after a crown fire, and I can live in old forests, too.



Grand Fir

You won't need to ask why I'm called a "grand" fir once you get a good look at me. In many forests of the northwestern U.S., I am simply the biggest kind of fir that can be found.

Where do I live?

I am native to western North America. I live in forests from the Pacific coast almost all the way to the Continental Divide in Montana. I love the warm air that flows across the West from the ocean.

I'm a very versatile grower: I love moist places, but I can survive droughts better than many other fir trees.

What do I look like? When I'm all grown up, I usually stand 40 to 50 meters tall, and my trunk may be more than 3 meters around. Sometimes I grow to nearly twice that size. My crown is wide and dome-like. My middle branches droop over each other a little, giving me a graceful shape.

My needles are 3 to 5 centimeters long, flat, shiny, and dark green. They are attached to opposite sides of the branch, so my branches lie flat. The tips of my needles are blunt, so they won't poke if you shake hands with me.

My cones



are brightly colored with yellowish-greenish-purplish scales. They are very, very sticky. They grow only in the tree crown, and they do not dangle carelessly from the branches, like cones of many species. Instead, they stand straight up, like the candles on a Christmas tree.

Animal Facts: Moose are about the only large animal that prefers forests of big, old grand fir to other habitat. Two rare birds, the Northern spotted owl and the Marbled murrelet,

also like to live in forests of big, old grand firs. Deer and elk use grand fir forests for hiding when the trees are young and stand close together. Grouse often eat grand fir buds and needles during the winter.

Growing Up: I can begin life only by growing from last year's seeds. If my seeds spend more than one winter on the ground, they die. I grow faster than any other North American fir, sometimes nearly a meter a year!

How do I reproduce? Each of my cones contains about 200 seeds, and in a good year I might produce 40 cones. How many seeds would that be?

After producing that many cones in one year, I rest for awhile, producing only a few cones each summer until I'm ready for another big year.

When my cones first form, they are sticky with sap. As the seeds ripen through

the summer, the cones dry out. By September, they fall apart on the tree, freeing the seeds so they float to the ground. When winter begins, only the woody spine at the cone's center remains, like a popsicle stick after all the goodies are gone.

My calendar: The buds at my branch tips usually begin to open in April or May, unfurling my new needles. Look at one of my branches in spring. You'll see that my old needles are dark green and firm, while my new ones are chartreuse and very tender.

With both new and old needles harvesting energy from sunlight, I spend most of the summer growing taller and wider so I can capture even more energy from the sun.



Am I useful? My wood isn't used much for building, but it makes great paper.

Native Americans used to collect pitch from my branches to use in medicines. They would also heat up the pitch and use it to varnish wooden tools.

What do fires do to me? I can survive wind and drought, but when it comes to fire I'm kind of wimpy. Fires can kill me in many ways—by cooking my *cambium*, burning up through my low branches into my crown, overheating my roots, or just injuring me a little and then

letting *fungi* finish the job. Once in awhile an old grand fir survives a surface fire because of its bark, which grows thicker with age.

Fires aren't good for mature grand firs, but they're great preparation for seedlings. My seeds *germinate* well after fire has burned off the litter and duff. We don't mind a little shade, though. Sometimes a burned area gets too hot and dry. Give us the right growing conditions, and soon we'll be producing shade for other forest inhabitants—squirrels, chipmunks, moose, and deer.

Grizzly Bear

Den mother: I began life in my mother's winter den high in the mountains. My mother started preparing for my arrival several months before I showed up. Using her front claws and powerful shoulder muscles, she dug straight into a rocky hillside. First she dug a short tunnel. Then, at the end of the tunnel, she dug a small sleeping chamber. Next, she made a soft bed of beargrass leaves covering the den's dirt floor.

Even though our den was ready, Mother waited for the first big snow storm before denning up.

The new snow completely buried the den entrance, concealing any trace of its existence. Inside the den it was dark, but it was also warm and snug despite the harsh winter weather. What a comfortable, safe place for my brother and me to be born!

A small start: This may be hard to believe, but I was about the size of a rat when I was born— much smaller than you were I imagine. I was totally helpless, too. I stayed inside the den for three months, nursing and growing. It was springtime down in the river valleys by the time I was strong enough to walk and keep up with my mother. It was now time for my family and me to head out of the snowy high country and see what food the melting snow might uncover.

Did I tell you I'm an *omnivore*? I eat almost everything I come across— insects, plants, and other animals. Most of the time, though, I eat plants— lots and lots of plants. My mother taught me all about which foods to eat. My brother and I followed her everywhere, carefully watching what she ate.

What Mother taught us: Low

elevation wet meadows provide juicy new grasses and horsetails in the spring when most plants haven't started growing. As the weather warms and the snow melts, wildflowers like spring beauties and glacier lilies cover the mountainsides. Even though their little, potato-like corms are buried in the

ground, we can easily smell them. The corms are full of starch— perfect food for a growing bear cub. Since my front claws are very strong and about as long as your fingers (10 centimeters long), it's a snap to dig up bulbs. When I'm done finding dinner, it looks like a rototiller churned up the hillside.

Throughout the summer, all sorts of berries ripen— elderberries, Saskatoon serviceberries, thimbleberries. I like them all, but I'm especially fond of sugar-filled huckleberries.

In the fall, I move up to the high country where the whitebark pines grow. Their cones are full of high-energy pine nuts. Finding lots of pine nuts will help me pack on a good layer of fat. I can't reach them in the treetops, but the red squirrel can. It cuts the cones and stockpiles them on the ground to eat later. Most of these red squirrel *middens* are in dense forests where whitebark pines are mixed with lodgepole pines, spruce, and fir trees. So that is where I go. When I find a midden, I just help myself... finders keepers! I can find a meal almost anywhere. An ant colony in a decaying log, a boulder swarming with mating ladybugs, honey in a bee tree, even the rotting carcass of an elk that didn't live through the winter— they're all food for me!

Fat is where it's at! Why am I constantly eating? For a bear, storing up lots of fat means the difference between life and death. By overeating when there's plenty of food around, I'm well



prepared to make it through the winter when all my food has vanished beneath the snow. You could say I store my winter's food supply right on my body.

If I have enough fat stored, I can go for nearly six months without eating or drinking. How? I hibernate! Scientists call it a “deep sleep.” My hibernating body changes stored fat into the energy I need to stay alive. Nothing leaves my body, because my wastes are recycled. Amazing, isn't it? I'm totally inactive during this time; I don't move much except to get more comfortable. When spring comes, I might have lost half my weight, but my muscles are still strong.

Fast food: Bears have a challenge from spring through fall: to quickly put on as much fat as possible. Moving around between little snacks uses too much energy for the amount of fat gained. Finding lots of high-energy food in one spot is much more efficient. The tricky part is knowing exactly when and where to look for large concentrations of food. Another lesson from... guess who? Mom, of course!

Openings in the forest are rich in bear foods: shrub fields, ridge tops, avalanche chutes, wet mountain meadows, and hillsides. I just hang out and eat until all the food is gone. Most of the time my family forages at night, out in the open. After the sun rises, a “daybed” in the nearby forest is a safe spot to rest and sleep during the heat of the day.

My family and I cover lots of ground to check out our traditional feeding areas. Sometimes we roam over hundreds of square kilometers searching for food.

Big three year-old. I'm into my third year of life now, and look at me! I weigh almost 150 kilograms. How much did you weigh when you were three? My brother and I take care of ourselves now. Our mother will find a mate when summer begins and start a new family, so this will be our last spring together. My brother and I might stay together for a few years. When I'm 6 1/2 years old I'll be ready to mate and start my own family. If things go well, I'll have a pair of cubs every three years or so. Over my 30-year life span I might have 16 cubs if I'm lucky. That would be nice, don't you think?

FIRE FACTS: A wildland fire is no problem for a grizzly bear. It just wanders somewhere else to find food. Within its large home range, there are always unburned areas to explore.

Fires create one of the grizzly's favorite feeding spots— a huckleberry patch. It takes 20 or 30 years for a burned area to grow into a brush field loaded with huckleberries. Thirty or forty years later, the same spot is likely to be a dense forest.

Forests with a patchwork of burned and unburned spots are ideal grizzly habitat. A bear can feed in the openings but has the cover of nearby trees to feel safe and to rest in during the day.

Grouse Whortleberry

I am a short shrub, so short that some people call me a "dwarf" shrub. My English name mentions one of the main animals that eats my berries, the grouse. My scientific name is *Vaccinium scoparium*. *Scoparium* means "like a broom". My thin, woody twigs branch out right from my base, so I look a little like an upside-down broom.

Where do I live? I am native to the high-elevation western forests of the United States and Canada— places that have a short, cool summer. I can live in dry places where few other shrubs survive. You can find me in whitebark pine, lodgepole pine, subalpine fir, and Engelmann spruce forests.

What do I look like? I am short, usually less than half a meter tall. When young, my branches are bright green. They turn brown as I get older.

My flowers are hard to see because they are very small, less than half a centimeter long. They dangle from my stems like pinkish-white, oval bells. I grow a tiny red berry that is very sweet.

I am a *perennial* plant. This means I grow for many years.

Growing up: I can grow from seed, but my underground stems (called *rhizomes*) are also able to grow new plants. Most of my rhizomes are in the top 10 centimeters of the soil. Many even grow in the *duff* on top of the soil.

Growing points: I have growing points at the tips of my branches, in the buds that produce my leaves and flowers, in my rhizomes, and in my roots.

How do I reproduce? Most new plants are sprouts from my rhizomes. Once in awhile I grow from seed. My little, red berries are like bus and plane tickets for my seeds. Animals can digest the soft, sweet part of my



berries, but they can't digest the seeds. They excrete the seeds— along with a little package of fertilizer as they travel.

My calendar: I live at high elevations, where summers are short, so I don't have any time to waste during the summer. My leaves unfold from their buds in spring. Even if my leaves aren't completely open, my flowers will bloom about two weeks later. About ten weeks after I first begin to grow, my fruit is ripe.

Early in August, my leaves start to turn red. A few weeks later, the high mountain hillsides look like they're carpeted with my scarlet leaves.

My seeds don't wait for spring to start growing. A seedling may come up within a month after the seed falls to the ground.

Am I useful? Mountain goats eat me in summer. Elk and moose eat my leaves in late summer and fall. Many animals, including grizzly bears and elk, like to rest on summer days in the high, cool mountain forests and openings where I carpet the ground.

Many mammals and birds find my berries delicious—chipmunks, red squirrels, foxes, skunks, grouse, bluebirds, thrushes, and people to name a few! You have to be **very patient** to gather enough berries for a mouthful. Tea can be made from my leaves. Tea can be made from my leaves.

BOTANICAL FACT: Grouse whortleberry is an important winter food for many species, but especially for one of the very few animals that lives all year in the high mountains without hibernating— the ptarmigan.



What does fire do to me? Fires kill my leaves and stems, but they don't always kill the parts of me that live underground. Most of my rhizomes can survive *surface fires* if they don't burn all of the duff. If a fire burns most of the duff, it usually kills my rhizomes so I can't resprout. I can grow back from seeds in these places, but that takes a long time. *Crown fires* in high-elevation forests often leave many areas unburned, so I can survive there too.

Life after fire: All plants grow slowly in the high forests where I live—including me! Even if fire kills my leaves and stems, I can usually grow back from rhizomes and produce sweet berries by the time you find new trees growing in the burn. That may take ten years or more. I continue to grow and produce sprouts for many years. I can sprout even under some of the oldest trees in the high mountain forests.

Heartleaf Arnica

If there was ever a plant that had heart, that would be me! I am a flowering plant in the daisy family. My scientific name, *Arnica cordifolia*, means the same thing as my common name, that is, a plant whose leaves look like hearts!



Where do I live? I am native to the western mountains of North America. I like cold places and moderate elevations. I am especially good at growing where the soil is a bit dry. I occur in open areas with few trees, but you can also find me growing under pine and fir trees.

I'm a *perennial* plant, meaning that I grow for many years. My heart-shaped leaves always grow in pairs and have tiny white hairs all over them. I have bright yellow flowers. I like growing in crowded patches with others of my kind; you won't often find me growing alone.

BOTANICAL FACT: Heartleaf arnica is capable of *self-pollination*. This means that the flowers can pollinate themselves and do not need insects to deliver pollen from other plants.

Growing up: I grow from seeds that are blown by the wind. My paired leaves grow from a stem that can get to be half a meter tall. These stems grow from other, woody stems called *rhizomes*, which lie on top of the ground or in the very top layer of soil. Rhizomes grow out from a "parent plant" and then make new plants by sending down roots and growing stems and leaves. That is how a single plant can eventually grow into a cluster with dozens of plants that carpet the ground with green leaves and yellow flowers each spring.

My rhizomes are tough and may live deep in the ground, perhaps even half a meter below the surface.



Growing points: I have growing points in my rhizomes and in my roots.

How do I reproduce? I grow from seeds and from sprouts on my rhizomes.

My calendar: I begin to grow as soon as the snow cover and the ice in the soil have melted. I blossom in late spring and can continue to flower until September. My seeds form right after flowering, but I usually wait to disperse them until late summer or early fall. Just like a dandelion, my seed's white, feathery hairs help them fly off in the wind.



Am I useful? Deer and elk spend a lot of time eating my leaves in the summer. Some birds and small mammals eat me, too.

People know how to use my flowers, leaves and roots for medicines. My leaves can be used to heal bruises and reduce swelling. A lotion made from my flowers has been used on cuts to stop bleeding and reduce infections.

What does fire do to me? I can survive fire if it just burns off my leaves.

If a fire is severe enough to burn my rhizomes, it will probably kill me.

I can grow back right after fire unless my rhizomes are killed. I also let the wind scatter my seeds into burned areas.

In the first couple of years after fire, my sprouts grow well because they have plenty of sunlight and nutrients. These "postfire" plants produce lots of seeds, which grow new plants, which produce lots more seeds. One or two years after a fire, the ground may be almost covered with my yellow flowers. For a few years, I can be the showiest plant around!

After the forest grows tall and shades my leaves, I continue to grow but I don't produce as many flowers. Look for my furry, heart-shaped leaves even in the shade of dense trees. Growing from seed or sprouting from rhizomes, I'm a permanent resident of the forest.

Limber pine

I am a tree. My scientific name is *Pinus flexilis*, meaning “flexible pine.”

Where do I live? I am native to the Rocky Mountains and the Great Basin. I am also found in scattered populations as far as California in the west and South Dakota in the east. I like places where the soil is dry and rocky. In some places, I form the highest forests on the mountainsides. My neighbors might be subalpine fir, Engelmann spruce, or lodgepole pine. In other places, I grow at low elevations, mixed with sagebrush and grass at the prairie’s edge.



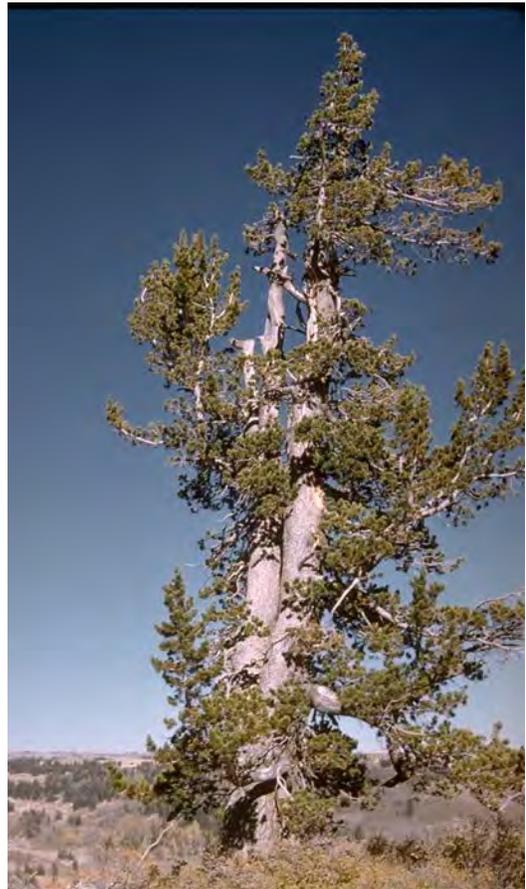
What do I look like? I am an evergreen tree. The bark on my twigs is smooth and light gray, while the bark on my trunk can have dark brown “scales”. I grow to be 10 to 15 meters tall—unless I’m in a very rocky, windy place. On ridges and mountaintops, wind and ice trim my branches every winter so I may only grow 1 m tall. My roots grow deep into the soil. My needles are 3 to 9 centimeters long and grow in bundles of five. I have growing points inside my bark (in my *cambium*), at my very top, and at the tips of my branches and roots.

In places where the wind is very strong, it nearly tears my branches right off the trunk! Luckily, they can bend in the wind without breaking. Remember, I’m the “limber” pine!

BOTANICAL FACT: Limber pines sometimes grow in clusters of three or more trees. They all started from a little pile of seeds buried years earlier by a Clark’s nutcracker.

Growing Up: My seedlings grow well in dry, open places with bare ground, so I may be the first tree to show up in a burned area. Getting seeds from a parent tree to the middle of a burn is no problem for me. The Clark’s nutcracker provides me with a special seed delivery service. Nutcrackers can easily carry my seeds 10 kilometers or more before they bury them, several together, in the ground.

I grow slowly in my dry, rocky habitat. I don’t produce many seeds until I’m 100 years old. I have plenty of years ahead of me, though. I may live to be over 1,000!



How do I reproduce? I am a conifer, so of course I put my seeds in cones. New cones

are pollinated in the middle of summer. More than a year later, in late summer, my seeds are ripe, stored in yellowish-brown cones about 8 to 10 centimeters long. In late summer, Clark's nutcrackers come to harvest them. They break off the cone scales and pry the seeds out, then bury the seeds in caches of food for winter. They don't eat all the seeds, though. Some grow into new pines.

Nutcrackers don't get all of my cones. Some fall to the ground, where red squirrels gather and pile them in huge *middens*, so they can use the seeds as winter food.

Am I useful?

Because my seeds are large and rich in energy, nutcrackers and squirrels aren't the only animals that eat them. Bears pull cones off the trees and feed in squirrel middens. Ground squirrels and chipmunks harvest and store my cones. Jays, nuthatches, finches, crossbills and grosbeaks harvest my seeds. Deer mice don't climb into the trees to harvest seeds, but they feed on any they can find on the ground. People eat my seeds too; they are very tasty!

I provide shelter and hiding places for mule deer and elk. Woodpeckers nest in my trunk, and porcupines like to eat my cambium and live in my upper branches. Mountain pine beetles feed on my cambium too. The female beetles lay their eggs there. When the *larvae* hatch, they feast on cambium, growing bigger as they go.

BOTANICAL FACT: White pine blister rust is a *fungus* that was accidentally brought to North America from Europe and can kill five-needled pines, including limber pine. Blister rust infects a tree's cambium all the way around, or *girdles* it. In older trees, blister rust kills the tops, where needles and cones are found. These dead tops won't produce any new limber pine cones.

What does fire do to me? My bark

is thin, so it doesn't protect my cambium well from the heat of fires. Luckily, I usually grow in places where trees are very scattered, so it's hard for fire to spread from one treetop to another. Fuels are sparse in these rocky sites, so sometimes I survive surface fires too. The fires leave a scar on my trunk that records their visits.

Life after fire: If I am killed by *crown fire*, don't worry—I won't be absent for long. Clark's nutcrackers will collect seeds from limber pines living nearby and bury the seeds in the burn. If they don't eat all of their stores, my seedlings

may emerge when the soil becomes warm and moist. In a cold place, however, it could take many years to get conditions just right for seedlings to start growing.

Subalpine firs and other trees grow near me except where the soil is very dry. My own seedlings can grow in windy, dry openings, but firs need the shelter of my branches to start to grow. If hundreds of years pass without fire, and if beetles or blister rust kills the old trees, I may become a rare sight on the mountaintops and prairie edges.



Lodgepole Pine

I am a tree. My scientific name is *Pinus contorta*, meaning "twisted pine." Four kinds of lodgepole pine live in the United States. I am the kind called "Rocky Mountain" lodgepole pine.



Where do I live? I am native to the Rocky Mountains of North America. I like cold forests. I can grow in dry, frosty places where most other trees can't survive. I also grow with subalpine fir, Engelmann spruce, western larch, and Douglas-fir. You can even find me growing with whitebark pine in high elevation forests.

What do I look like? I am an evergreen tree. When I grow up, I'm about 20 to 30 meters tall. If I grow close to other pines, my lower branches usually drop off and I have needles only on my top branches.

My roots usually grow near the soil surface, but some grow deep into the soil.

My needles are about 5 centimeters long and grow in bundles of two.

Growing Up: I grow very fast in sunlight. I can start from seed right after a big *crown fire* and be 6 meters tall when I'm 20 years old! I begin making seeds well before that though, when I'm only 5 or 10.

Growing Points: I have growing points inside my bark (in my *cambium*), at my very top, and at the tips of my branches and roots.

BOTANICAL FACT: In sunny places, lodgepole pines grow much faster than subalpine fir or Engelmann spruce. Thousands come in after a big crown fire, so it may look like lodgepole pine is the only kind of tree growing on a whole mountainside.

How do I reproduce? I am a *conifer*, which means I put my seeds in cones. My cones are brown, small, and woody, with tiny, sharp prickles on them. My seeds are small and brown, with a paper-like "wing" that helps them float on the wind when they fall out of the cone. They may travel 50 or 60 meters before they land.

Some of my cones are *serotinous*, which means "late." They are sealed tight by resin and won't open unless they're heated. Fires that burn in the tree crowns open these cones and free millions of seeds to start a new forest.



My calendar: It takes 2 years for me to make cones. My new cones are pollinated in spring. More than a year later, in summer, they are finally ripe. Some open immediately and drop their seed. The others, the late, serotinous ones, store their seed until a fire melts the resin that seals them.

Am I useful? Many kinds of insects eat my cambium. Female mountain pine beetles tunnel into my cambium to lay their eggs. They bring *fungi* in, too. When the beetles' eggs hatch, the larvae eat the cambium, growing as they go.

Fungi use the nutrients stored in my trunk. A plant called *mistletoe* grows on me and sinks its roots into my branches and trunk to get nutrients.

Crown fires are deadly to me, but they make me into good habitat for different kinds of animals. Within hours after a crown fire, beetles show up to feed on my burned wood and lay their eggs in it. Wasps follow right away, laying THEIR eggs in the beetles! And woodpeckers follow to eat all the insects living under the burned tree bark. The black-backed woodpecker is one kind that almost always nests near a forest burned recently by crown fire.

I provide hiding cover and shelter from storms for deer, moose, elk, and bears. Red squirrels, chipmunks, and small birds eat my seeds. Grouse eat my needles for winter food.

People have used my wood for their homes for thousands of years. Native Americans cut young lodgepole pines to support their tipis. Lodgepole pine logs are often used to build homes and furniture, and to make plywood and paper.

Sometimes Native Americans used to eat my cambium layer and use my sap for medicine.

What does fire do to me? I can survive some surface fires, but many fires kill me. My bark is thin, so it doesn't protect my cambium well from the heat of fires. Since my roots may grow shallow or deep, some fires damage them and others do not.

Life after fire: If a surface fire burns through light fuels, I may survive, and my seedlings will grow well in the new openings.

Crown fires kill me, but I reproduce right away from seed stored in my serotinous cones. My seedlings grow especially well where fire has cleared the *duff* from the ground.

My seedlings don't grow well in shade.

Firs and spruces *do* grow in my shade, and they gradually "take over" the forest where I live. I may be only 100 years old or so when I quit growing and die. That may be a long life for a person, but it's short for a tree.

ECOLOGICAL FACT: Mountain pine beetles love to find a forest where most of the trees are old lodgepole pines. Millions of female beetles lay their eggs under the tree bark. When the eggs hatch, the larvae feed on the trees' cambium. Helped by a fungus they carry, the beetles may kill nearly all of the trees. Then the forest looks like it's full of red trees, like those in this picture, until the needles fall off.



Mountain Pine Beetle

I am an insect, native to western North America and *Dendroctonus ponderosae* is my scientific name. I love to live in lodgepole pines. I'm also fond of ponderosa and whitebark pine trees.

Where do I live? For almost my whole life, I live under the bark of a pine tree. I come out into the sunlight only at the end of my life, when I'm grown up and ready to mate.

I'm especially fond of forests that have lots of pines growing close together. That's why I like lodgepole pine forests. These forests often grow in after *crown fires*. In a lodgepole pine forest, most of the trees are about the same age and size. The trees all reach the perfect size for me to use at about the same time—towards the end of their life. What a treasure trove of food and shelter!

Growing up: I begin life as an egg but, like most insects, I change dramatically through my lifetime. Let's start with the egg.

It was the middle of summer, just last year. My mother chose this lodgepole pine as the place to mate and lay her eggs. She bored a hole in the tree's thin bark. At first, a lot of pitch came out through the hole—so much that she almost drowned— but she finally got in to the tree's *cambium*. There she began tunneling in an almost straight line toward the treetop, leaving a trail of ground up bark or "*frass*" along the way. Every so often she would stop to lay a tiny, pearl-white egg along the side of the tunnel. By the time she had laid all of her eggs, her tunnel was nearly 60 centimeters long.

It took only two weeks for me to hatch. You probably would have taken one look at me and said, "Gross!" I was short, thick, and soft— a *larva*— all

white except for my little brown head. I spent the whole fall and spring inside the tree bark eating cambium. I didn't do much at all during winter, when the weather was cold. I made a tunnel while I ate, but my tunnel went sideways, unlike my mother's. Between my mother and me and all of my siblings, we created a sculpture inside the tree's bark that was shaped like a tall, wide feather. Scientists call our masterpiece a *gallery*.

When I was about eight months old, I formed a soft white shell. Inside it, I could finally become the kind of beetle you'd



recognize— very dark brown and shiny, with stiff little wings and a small head, about 6 millimeters long. After slipping off my soft shell, I bored through the tree's bark and saw daylight for the first time! Now I'm ready to fly off. I'm looking for a mate and a perfect pine tree for laying my own eggs.

Never alone: The number of pine beetles in a forest depends on how many yummy trees that forest has. Where there are pine trees, a few of us are always around. If there's a large forest with trees big enough to nurture our larvae, our numbers increase year after year until there are millions of us, an *epidemic*.

Lodgepole pine forests are "ripe" for an epidemic about 70 to 100 years after a crown fire. Most of the pines are big enough at that time to nurture our larvae, but they're no longer strong enough to make lots of pitch and keep us out.

Thousands of us attack each tree. Millions of our larvae tunnel across the cambium of each tree.



Even if a mountain pine beetle looks like it's by itself, it really isn't alone. I always carry the spores of a fungus along with me. When I bore through a tree's bark, I carry the fungus in too. The fungus grows from the cambium into the wood, staining it blue! As this *blue-stain fungus* grows, it interrupts the flow of water from roots to leaves. This keeps the tree's moisture just perfect for my larvae to survive in.

Beetle galleries and blue-stain fungus are great for me, but they're not good for lodgepole pine trees. As galleries crisscross the tree's cambium and fungi grow throughout the tree, they interrupt the flow of water and nutrients from roots to leaves and leaves to roots. Together, they often kill the tree.

Am I useful? Life is pretty uncertain for a mountain pine beetle. Some kinds of worms eat my eggs before they can even hatch. Woodpeckers think that a tree full of my larvae is a feast just for them. Some wasps lay their eggs in my larvae, so **their** larvae will have me for lunch after **they** hatch! Nuthatches and other birds eat me when I'm out in the daylight. Flies and other beetles eat me, too. I certainly do my part to support the other living things in the forest!

Fire and me: Crown fires kill me when they kill my *host* trees. But there are so many pine trees and pine beetles in the forest that crown fires don't ever get rid of me completely. Instead, they mark the beginning of a new pine forest that will be ready for me to live in after a few decades.

Surface fires don't kill me, but sometimes they injure my host trees. Any time the tree is weakened and produces less pitch, it's easier for me to get in to lay my eggs. So surface fires sometimes help me reproduce.

Surface fires also kill some trees, making the trees a little farther apart and making sunny openings for seedlings to grow in. I can live and reproduce well in this kind of forest. I'm not likely to cause an epidemic in forests that have trees of various ages and sizes.

I may be small, but I can actually change the way fire burns in a forest. If I have killed thousands of trees in an epidemic, the dead trees and their dry, red needles provide a huge, *flammable* fuel supply for a fire. Fires in beetle-killed forests often spread fast and burn very hot. They may even scorch the soil in some places, making it hard for plants to

return very quickly.



Northern Flicker

I am a woodpecker about 30 cm long, living mainly in forests, woodlands, and *riparian* areas in the prairie. Some people think I look fancy, with my black-spotted belly, red “moustache,” and bright salmon feathers under my wings and tail. But don’t let my good looks fool you! I am a hard worker who helps other animals in the forest find a place to live.



Family matters: My scientific name, *Colaptes auratus*, means “golden chisel.” My cousins who live in the eastern U.S. have yellow under their wings and tail, so scientists call our whole family “golden.” Although I’m not yellow, I sure do like to chisel wood! That part of my scientific name is right on.

Rotten to the core: I hang out in all types of forests, but I particularly like ponderosa pine forests and cottonwood groves, where trees are very large and sometimes rotten inside. Terrific! They make wonderful nest trees while they’re still standing.

BIRD FACT: Flickers get their name because they have cries that sound like “flick, flick, flick” or “flick-errr.” They also call “quick-quick-quick-quick,” as if they’re in a hurry.

Wood pecking: Many people think that dead trees are useless, but I don’t know what I would do without them! My favorite kind of tree is one that is large, dead, and

rotten. I excavate a nest cavity in the rotting wood to create a safe place to raise my family. My large neck muscles and chisel-shaped beak make it easy for me to pull the wood apart. While I’m working to loosen chips of wood, I use my hard tail feathers as a ‘kick-stand’ to give me more balance. With the help of my mate, we can build a nest cavity in 12 days. It’s a lot of work, so if we find a natural tree cavity we will use it as our nest... but don’t think I’m lazy. I’m just smart!

My mate lays 3 to 12 eggs each year. We take turns incubating them. After about two weeks, the eggs hatch. For the next month, I catch food to feed our nestlings. After that, the young flickers are ready to fly from the nest and find their own food.

Finding food: Although I like to nest and roost in trees, I am one of the only North American woodpeckers that comes down to the ground to eat. My favorite food in the whole world is a big mound of ants. In fact, flickers eat more ants than any other bird in the United States! I have a special tongue that helps me catch ants. It is really long with a flattened tip that can maneuver eggs, pupae, and adult insects from the soil.

I spend a lot of time digging into the soil to find ants, but I will also hunt for termites, beetle larvae and caterpillars, and sometimes I perch on bushes to eat berries.

Bigger is better: This year my mate and I are once again nesting in our favorite tree, a huge, dead ponderosa pine. It doesn't actually look much like a tree anymore. The top broke off long ago. All that's left is the tree's trunk stretching to the sky. The bark is completely gone from the top half, leaving the wood weathered and gray. This standing dead tree is called a *snag*.

After our young grow up, we'll move out of this snag, but our hard excavating work won't go unappreciated. Small owls, chickadees, bluebirds, or flying squirrels may use our old nest cavity to raise families of their own.



FIRE FACTS: Fires burn differently throughout the western forests and prairies because these ecosystems have lots of variety. On north-facing hillsides, there are often many small and large trees growing close together. These north-facing forests may burn in *crown fires* every century or so. Other forests and woodlands have had many *surface fires*, which thinned out the small trees that started growing after the last fire. Large ponderosa pines survived easily because of their thick bark and high branches. Cottonwoods were sometimes killed, but they sprouted soon after fire.

Old trees are very likely to have some kind of decay, especially a rotten center. Standing trees with heart rot provide ideal nest sites for northern flickers.

Pileated Woodpecker

I'm unforgettable once you see me. I like to think I look like a modern-day *pterodactyl*— you know, those prehistoric bird-like reptiles that flew around above the dinosaurs! Although I'm much smaller than a pterodactyl, I am the largest woodpecker in the western United States. I'm nearly 50 centimeters long! And my bright red crest and loud, eerie call definitely give me an ancient flare, don't you think? Even the trees I live in are often hundreds of years old. Let me tell you more.

Rotten to the core: I hang out in low elevation ponderosa pine and western larch forests where most of the trees are very large and very old. Many of these trees are also very rotten inside. Terrific! They make wonderful nest trees while they're still standing. And when they fall to the ground and are filled with ants and other insects, they make great feeding sites. Either way is fine with me!



Wood

pecking. Large, rotten trees— standing or fallen— are usually home to big, black carpenter ants, my favorite food! Carpenter ants build their colonies in live trees or standing dead trees called *snags*. Sometimes they use trees that are so rotten, the top has broken off. Carpenter ants are especially fond of building their colonies in



big, decaying *logs*—parts of trees that are lying on the ground. Small logs won't do. So you see, big dead trees are just as important to my kind of forest as big, live ones!

Locating an ant colony in a rotten log can be tricky. Let me tell you about my technique. First I give the log a few swift taps with my strong, chisel-shaped beak. Knock, knock... anybody home? Sh-h-h! I'm listening for ants moving around inside the log. You'd be surprised how much noise hundreds of mad ants can make. This time, I'm in luck! I hear lots of them moving through their wooden tunnels. It's time for some serious wood pecking. Pounding wood over and over again with my beak is hard work, but the constant pecking doesn't give *me* a headache. My skull has special shock absorbers so I don't knock myself silly. If I work steadily, I'll eventually chip away a deep, rectangular opening in the wood.

Yipp-e-e-e! Now I can see ants! I'll have to work fast before they disappear further into the wood. Thank goodness for my amazing tongue. It's long and slithery

like a snake, and it's coated with gooey saliva. When I'm not using it, my tongue is coiled up inside my head. I simply unwind my tongue to capture something yummy to eat. I can stick it out way past the end of my beak. How far can you stick out your tongue?

Exploring nooks and crannies in an ant gallery is easy for me. I chase down ants with my long, sticky tongue and then slurp them up. On a good day I can devour lots of food. Once I had 2,600 ants in my stomach. Boy, was I full!

Bigger is better: This year my mate and I are once again nesting in our favorite tree, a huge, dead ponderosa pine *snag*. This "nest tree" doesn't actually look much like a tree anymore. The top with most of its branches broke off long ago. All that's left is the tree's trunk stretching to the sky. The bark is completely gone on the top half, leaving the wood weathered and gray.

Our nest tree is remarkably large. It's nearly 23 meters tall and more than a meter across at the base. High above the ground, almost 15 meters up, is the entrance to this year's nest cavity. Excavating an entirely new nest cavity every year is an exhausting job. This year it took us 44 days to hollow out a cavity big enough to hold our new family. From early April until mid-May, my mate and I took turns excavating.

We've nested in this same tree for several years now. If you look up and down the trunk, you'll see several rounded, triangular-shaped holes almost in a line. Every one of them is a pileated nest hole. Eventually the tree will fall over or break off. Then we'll be looking for another nest tree. Lucky for us, there are plenty of large, old trees in this forest.

After our young are raised, we'll move out. All our hard excavating work won't go unappreciated though. Flammulated, saw-whet, and pygmy owls, in addition to

northern flying squirrels, will use our old nest cavities to raise families of their own.

FIRE FACTS: For hundreds of years before 1900, surface fires burned through ponderosa pine and western larch quite frequently—in some places every 5 to 7 years, in other places every 30 years or so. These fires thinned out most of the small trees that had started growing between fires. The large trees survived easily because of their thick bark and high branches. Since fires kept the competition in check, the big trees grew older and their trunks grew even bigger. These forests contained many trees that were 300 to 400 years old. Some were even older.

Old trees are very likely to have some kind of rot, especially *heart rot*, a rotten center. Standing trees with heart rot provide ideal pileated woodpecker nest sites. Fallen ones provide food. Thanks to frequent fires, pileated woodpeckers can have plenty of old trees for both food and shelter—the perfect habitat!

Pinegrass

I bet you could guess from my name, that I am a grass. My scientific name is *Calamagrostis rubescens*, meaning "reddish field reed."

Where do I live?

I am native to the western United States. I can grow in many kinds of places—at low and high elevations, in moist and dry soils, in shade and in sunny openings.

BOTANICAL FACT:

Sometimes pinegrass grows so thick in an open forest of ponderosa pine and Douglas-fir that it looks like a cloud of soft grass is floating just above the ground.

What do I look like? I grow 30 to 50 centimeters tall. My shiny green leaves are flat and narrow. My pale flowers grow in a tight cluster at the top of my reddish stem. They are pale green or purplish.

I am a *perennial* plant. This means I grow for many years.

Growing up: I grow from seed. My seeds are ready to grow whenever they hit the soil—they need only moisture to start growing. My seeds will start sprouting in the fall if the weather is rainy. Few of my seeds survive to make new plants, though. Most new plants are sprouts from my tough underground stems. These are called *rhizomes*.



Growing points:

I have growing points in my rhizomes and in my roots. Most of my rhizomes grow in the top 10 centimeters of soil.

How do I reproduce?

Sometimes I reproduce from seeds, but more often I grow new plants as sprouts from my rhizomes. You don't often see me produce flowers and seed in a closed forest; I need lots

of sunlight.



My calendar: I begin to grow in late April or May. I begin growing earlier in sunny spots than where I'm shaded by trees.

My flowers come out in June, and my seeds ripen early in August when the soil dries out. My leaves dry up then too, and I stop growing. I'll grow some more if September brings rainy weather.

Am I useful? Black bear, deer, elk, and pronghorn eat my leaves and flowers. My leaves are more nutritious in spring than in summer or fall. They are best to eat when they grow in sunny openings.

People sometimes plant me to hold the soil in place where they have mined, built roads, or disturbed the soil in other ways.

What does fire do to me? I survive fires that just burn off my leaves. I can sprout from my rhizomes unless they are burned or killed by the heat of a fire. Luckily fires that hot don't happen very often.

Life after fire: I grow fast and lush after most fires. My best crops of flowers and seeds are produced in the first few years after fire. If a forest becomes dense and shady, I stay there, but I don't grow as fast. I may gradually die out if many decades go by without fire.



Ponderosa pine

I am a tree. My scientific name is *Pinus ponderosa*. *Ponderosa* is a Spanish word meaning "large, heavy, ponderous." There are three kinds of ponderosa pine. I'm the kind called an "interior" ponderosa pine because I live in the *interior* part of the western United States, from the Great Plains to the North Cascade Mountains.



30 meters out from my trunk under the soil.

Growing up: I grow from seed, especially in sunny places. I grow very fast in sunlight. I can be a meter tall when I'm 7 or 8 years old. By the time I'm 10 years old, I am able to make cones and seeds.

BOTANICAL FACT: Ponderosa pines can live for many centuries. The oldest known ponderosa pine was found in Colorado and was 1,047 years old when it died.

Ponderosa pine seedlings grow much better in sunlight than in shade. They often grow in openings where large trees have died.

Growing points: I have growing points inside my bark (in my *cambium*), at my very top, and at the tips of my branches and roots.

Where do I live? I am native to the Rocky Mountain West and some of the midwestern states of North America. I like warm, dry forests. I can grow in hot, low-elevation places where few evergreen trees can survive. I often grow with Douglas-fir and western larch. You can also find me growing with lodgepole pine.

What do I look like? I am an evergreen tree. I grow to be 25 to 35 meters tall. My trunk can be more than 2 meters thick. I have the longest needles of any pine growing in the northern Rocky Mountains or Intermountain area— about 20 centimeters long. My needles grow in clusters of three.

My bark gets very thick as I age. On old trees, my bark is yellowish and has deep, dark furrows. Then people call me a "yellow pine."

I grow many thick roots. Some of them grow 2 meters into the soil. Others may reach

How do I reproduce? I am a *conifer*, which means I put my seeds in cones. My cones are big, brown and woody, with large, sharp prickles. My seeds have a paper-like "wing" that helps them float on the wind when they fall out of the cone. Most of my seeds fall close to me, but some may travel 50 meters before they land.

My calendar: I begin to grow new wood in spring. At the same time, the buds that I prepared the summer before begin to grow. In about a month, they will open and my new needles will unfurl. My roots and trunk continue to grow all summer, while my branches make new buds that will hold next year's fresh needles.

My new cones are pollinated in late spring. More than a year later, in the fall, the seeds in these cones are finally ripe. The cones open. Wind shakes the seeds loose, and they fall to the ground.

Am I useful? *Fungi* use the nutrients stored in my trunk. Many kinds of insects eat my *cambium*. Female pine beetles tunnel into my cambium to lay their eggs. When the larvae hatch, they feast on my cambium, growing as they go.

Rabbits and mice eat me when I am very young. Squirrels, juncos, crossbills, and chickadees eat my seeds. Squirrels eat the cambium on my twigs. I provide hiding places for elk and deer. If they are very hungry, they may eat the buds and needles of my seedlings.

When I get large, the wood in my trunk may begin to rot. Then woodpeckers make holes in my trunk and nest there. A family of woodpeckers only uses a hole for one year, but other animals move in after the woodpeckers move out. Flammulated owls are some of my favorite guests.

People use my long, thick, straight trunks to build their homes. Native Americans used to peel the bark from some of my oldest, biggest trees in the spring. They would peel off narrow strips of the cambium from inside the bark and eat them as a sweet treat. See the scar made by peeling year after year?



usually grow faster than the firs that grow near me.

If my homeland does not burn for many years, producing healthy young ponderosa pine trees is difficult. Too many small trees are growing in my shade. Some of the forests where I live now seem odd because the big trees are all ponderosa pines and the small ones are all Douglas-firs. There, almost any fire can climb into the tree crowns and kill even the biggest, oldest trees.



What does fire do to me? I can survive some surface fires when I'm only 6 years old! The older I get, the thicker my bark gets and the easier it is for me to survive a fire.

Surface fires used to burn the places where I lived every few years. They killed my lower branches and the small trees that grew in my shade so it was hard for the flames to reach my leaves and *buds*. Surface fires burned up the dead needles and fallen branches on the ground before these fuels got deep. This kept fires from being so hot that they could kill my roots with their heat.

Life after fire: My seeds grow well in sunny openings created by fire, especially if the fire also killed off some of the other plants— shrubs, grasses, other trees— that use a lot of moisture. I

Pronghorn

I'm the pronghorn. When Europeans first saw me, some thought I was a goat. Others thought I was an antelope. None of them were right! I'm so special, I'm in a category all by myself. My official scientific name is *Antilocapra americana*, which means "American goat antelope". It covers all the possibilities!



Home, home on the range: I'm very much at home on the wide open spaces of grasslands and deserts, especially in the Great Plains. Pronghorns are native to the central parts of North America, ranging from southern Alberta and Saskatchewan, south through the western plains, to northern Mexico. We are found nowhere else on earth!

My fur coat is mostly reddish-brown to tan, but my stomach and rump are white. I have distinctive white markings on my face and neck. Pronghorn males, like me, have black horns that are 25-31 centimeters long; females have much smaller spikes. The shape of my horns is very unique. They are flattened from side to side and point straight up from the top of my head before curving backward. They branch only once, with a little notch on the front that points forward. Some people call this a "prong". Now you know where I got my common name!

You can't catch me! Predators have to be extremely lucky to catch an adult pronghorn like me. Mountain lions, wolves, coyotes and bobcats don't have many places to

hide on the treeless parts of the prairie, and that suits me just fine. I like open, low rolling plains where the shrubs don't grow too tall and predators can't lurk over the side of a hill. Prairies are the perfect place for me!

I have keen eyesight so I can spot predators up to 6 km away. I can also run like the wind, reaching speeds up to 97 km an hour. In fact, I'm the fastest land mammal in the Western Hemisphere, and I'm second only to the cheetah in the entire world. The cheetah can run fast only for short distances, but I can go super fast for a long time. I've been able to run fast practically my whole life—I could run faster than a human when I was just three days old!

Because I'm so fast and can see forever, hunters always have a hard time catching me. Long ago, people would set snares to trap me or try to drive a herd of us over a cliff like they did to the buffalo. They weren't very successful; we can dodge and dart our way out of any trap!

Food from the prairie. I eat a wide variety of prairie plants—mostly *forbs* (herb-like flowering plants), some shrubs and grasses, and even cactus plants. Forbs make up much of my diet during the spring, summer, and fall. Scarlet globemallow is one of my favorites. In the early spring I'll eat the tender young shoots of grasses such as blue grama, Indian ricegrass, and needle-and-thread. Shrubs, like sagebrush and western snowberry, which stick out above the snow, are a good winter food when I can't find other low-growing foods. Many of the plants I find delicious are *toxic* to most other grazing animals. That's fine; it leaves more for me!

You've probably heard about the millions of bison that roamed the prairies long ago. Well, equally large herds of pronghorns traveled behind the bison. People believe these vast buffalo herds helped the pronghorns by eating the prairie grasses, leaving the forbs to

grow thicker and taller after the grass was eaten—creating the perfect salad bar for a herd of pronghorns.

My family and me... My parents mated in the fall, and my twin sister and I were born the following May. My mother was very choosy about where to give birth. She picked a spot where a clump of tall grasses, shrubs, or rocks would hide us. When we were first born we tried hard to be invisible. We had no scent; we would lie perfectly still for hours at a time; and the color of our fur matched the surrounding prairie. Our mother stayed away from our hiding spot for most of the day so she wouldn't give us away. She fed us only a couple of times a day, just for a few minutes. How would you like that?



My twin and I were extremely fortunate that no predators found us during our first month of life. Adult pronghorns have no problem running from predators, but new-born fawns are easy to catch if predators locate them. Our predators, especially coyotes and eagles, kill about half of the pronghorn fawns each year. Yikes!

I stayed with my mother for about a year before I went out on my own. But I didn't move out to be alone. I'm *gregarious*, which means that I hang out in a herd most of the time. You'll usually find me in a loose herd of *bucks* and *does* from the end of breeding season through the winter. On winter range, my herd might reach 100 pronghorns. We break up into smaller bands in the spring and summer. The

does and fawns hang out together, so we call those bands "nursery groups". I'll wander alone or with a few of my guy pals. I migrate about 70 km between my summer and winter ranges, but some pronghorns migrate much further—they travel as far as 300 km, twice a year!

Fire and me. Fires don't bother me much. I can just run away and leave the flames in my dust! Fires do affect my habitat, however. Burns are great places for me to find food. Grasses on new burns usually start growing earlier than on unburned prairie and the new sprouts are tender and delicious.

Even better, prairie fires are hard on the shrubs that like to spread through the prairie, shading out the forbs I like to eat. These forbs grow and reproduce wonderfully for several years after a fire because they have more sunlight, water, and nutrients than before the fire.

Burned areas with lots of prickly pear cactus are especially attractive to me. The flames singe off the spines of prickly pear cacti. Yum! With those pesky spines removed, I can easily chow down on those tasty *succulent* cactus pads!

Pronghorn facts: Although pronghorns may be the fastest land mammal in North America, fences give them big problems. They won't jump over a fence. Instead, they try to go underneath it! Scientists believe that pronghorns have lived so long in the wide open spaces, that they've never learned how to jump over a barrier, even though they are physically able to do it. Some people have started building fences where the bottom wire is smooth instead of barbed. That way, pronghorns can squeeze under without hurting themselves.

Quaking Aspen

How could you possibly **not** notice me? I have found a way to draw attention to myself even in the slightest wind. I simply **never** stop moving. Even when everything around me is quiet—the grass unmoving, the air completely still—my leaves are trembling and making a gentle, rustling sound. I do that with a unique trick. Each leaf has a flat stem that shakes in response to the slightest breath of air.

Special uses: Quaking aspen is good fuel for heating and cooking because it makes few sparks.

Native Americans use quaking aspen to reduce fever and treat urinary infections.

The inner bark of this tree could be eaten in spring and used as winter feed for horses.

Even if you haven't noticed my constant motion, you surely have noticed me in the fall, when my leaves become bright yellow against the dark green background of evergreen trees. I do that because I'm a *deciduous* tree, shedding my leaves in the fall and growing new ones each spring.

My trunk is slender and white. I grow 10 to 15 meters tall.

Where the branches break off from my white



trunk, they leave round, gray scars that look like big eyes.

My leaves are 4 to 7 centimeters long. They are almost round, but they have a pointy tip like a “spade” in a deck of playing cards.



Where do I live? I am a *circumboreal* species. That means I live in northern lands all around the world. In the eastern United States, I am found at low elevations. On the prairies, you can find me in moist spots and north-facing hillsides. In the mountains, I form bright-green patches between dark-green patches of pine forest. I like cool, dry summers and snowy winters. I live best in places where the soil is moist.

BOTANICAL FACT: Quaking aspen is the most widely distributed tree species in North America. It occurs from Newfoundland in the east to Alaska in the west, and all the way south to Mexico. In Utah, Minnesota, and Wisconsin, quaking aspen covers more land than any other kind of forest.

Growing up: A single aspen tree is not really separate from other aspens growing nearby. Underground, I am connected to many of my neighbors. In fact, aspens seldom grow from seed. We simply sprout from the root of another aspen tree.

A new aspen growing from roots, like me, is called a *sucker*. If a fire or avalanche comes by, our trunks may be broken off and

look dead, but the next year our roots will produce thousands of suckers. Every sucker has the same *genes* as the parent tree. No doubt you have heard of identical twins or triplets. The aspen grove where I live is like identical “thousandtuplets.” The special name for our patch of related trees is a *clone*.

Growing points: I have growing points at the tips of my branches, in the buds that produce my leaves and flowers, in my root crown, and on my roots.

Making seeds: Even though I can sprout new trees from my roots, I work hard at seed production each year. In the spring, before my leaves come out, I produce long, slender *catkins* that hold my flowers. After the flowers are pollinated, I release them in cottony packages that can travel many miles on the wind. The seeds will live less than a month. That’s a very short time to get settled in a moist, warm location free from other trees so I can begin growing. No wonder few seedlings survive!

Am I useful? Beaver, deer, elk, and grouse eat my bark, leaves, and buds. Many birds nest in my trunk and branches. I’m especially proud of the fact that all three kinds of bluebirds in the United States use me for nesting.

People use my wood and enjoy my colorful fall leaves, but I am most useful to them in a quiet way. I help the soil



absorb water from rain and snow. I filter the water so it is clean, and store it in the soil.

What does fire do to me?

Most fires pass me by because of the moist locations where I live. When I do burn, fire usually kills my above-ground parts—leaves, branches, and trunk—but it rarely harms my roots. This gives me a chance to grow a new crop of suckers. How invigorating!



Life after fire: Severe fires usually kill most of the conifer trees in a forest. The conifers have to reproduce from seed, but my huge root system gives me a head start in the new forest. My roots easily grab the moisture and nutrients needed to grow new suckers. They will come up by the thousands, and they’ll be 1 to 2 meters tall within a year. I recover so quickly after fire that managers sometimes use prescribed fires to get more aspens on the landscape.

Red Squirrel

Have you ever seen a squirrel *midden*? “What’s that?” you ask! Well, have you ever seen large mounds of woody material piled on the forest floor? I’m not talking about rotting stumps. And I’m not talking about the straight lines of decayed wood that mark the remains of a fallen tree. I’m talking about deep piles of woody stuff, especially parts of pine cones. A small midden is about the size of a hula hoop. A spectacular one might be nearly a meter deep and as big around as a trampoline. If your answer is “yes”, you’ve probably seen a squirrel midden



after all.

Forest Fridge: Maybe it was my midden! I’m a red squirrel. Even though I’m the smallest kind of squirrel living in the northern Rocky Mountains, I create awesome middens. I have several middens scattered across my one-*hectare* territory. Look closely. My midden contains pieces of conifer cones—mostly the scales and cores of whitebark pine cones. How did it get so big?

During the long winter, I spend my days sitting on top of my midden, tearing apart cones and eating the seeds. I never clean up my mess when I’m done. I just let the cone debris pile up and up and up. Day after day, year after year, the midden grows bigger and deeper. Over the seven years of my life I’ll contribute handsomely to its size. I couldn’t have created it all by myself, however. Several generations of

squirrels before me did a wonderful job of not taking out the trash!

It’s actually a good thing that red squirrels are such sloppy eaters. A midden makes a wonderful refrigerator. Seeds and cones buried in the midden stay fresh longer than those sitting on the ground. They’re insulated against both hot summer days and wintertime cold. The loose twigs, cone cobs, and scales create a nearly perfect temperature for storing cones.

Middens are easy to dig into. Burying and retrieving cones is a snap. A midden also hides cones from the searching eyes and noses of most hungry animals, including other red squirrels. It doesn’t work with grizzly bears, though. They’ll raid my refrigerator any chance they get, and there’s nothing I can do but sit by and scold. Sometimes they even try to make me part of the free meal!



Cone crazy: The dense subalpine forest where I live is a mixture of species—whitebark pine, lodgepole pine, spruce, and fir. Only forests with fairly big trees can produce the large quantities of seed cones I need to survive. It pays to be greedy when you’re a red squirrel. Whitebark pine cones are my favorite. I begin to harvest them as soon as they are ripe in late summer.

Although I’m very skilled at harvesting cones, I’m actually an *omnivore*: I take advantage of any feeding opportunity that comes along. In the summer I eat many kinds of food

including lichens, mushrooms, and berries. Birds' eggs, young birds, very small mammals, and insects are all part of my diet too. I even have a bit of a sweet tooth. The *cankers* on tree trunks where white pine blister rust makes its spores are so sweet I just can't help myself. Once I ate so much of the wood around a canker that the infection stopped! How's that for protecting your future food supply?

Greedy to the very end: A large fir tree in the center of my territory serves as my watch tower. From there I guard the rest of my trees closely. I must hoard as many of their cones as possible to survive the winter. This is serious business. I won't tolerate other squirrels trespassing in my part of the forest. If they do, I scold them loudly and run them off. So, for most of the year I lead a solitary life. It's the price I pay to make sure I harvest all the cones from "my" trees. I seek the company of other red squirrels only during the mating season in late winter. During the rest of the year, I'm on alert. It's a full-time job.

FIRE FACTS: Red squirrels get their food from grown trees that are old enough to produce lots of cones. Since they don't need young forests, you might think they don't really need fire. But remember their favorite food is the seeds from whitebark pine cones. Most whitebark pine forests burned occasionally in the past. Whitebark pine seedlings grow best in openings created by fire. If whitebark pines need fire, then don't red squirrels need fire too?



Red-Backed Vole

You've got to be quick to get a glimpse of me! I'm small and very fast. At first glance, you might mistake me for my cousin, the mouse. My stocky body is blunt on both ends. My fur usually hides not only my legs, but my short tail and little round ears as well. I guess you could say I look like a small, plump sausage with fur. It's easy to distinguish me from other voles. I'm the one with a dark red streak down my back!



Never stops ticking. Not moving a muscle is impossible for me. I'm always on the go, day and night, year round. Whether the sun is shining or the moon is out makes no difference to me. The rhythm of my life is forever the same. I wake up and eat and then go back to sleep many times during a twenty-four hour "day". My hectic life-style gives lots of predators the opportunity to eat me. Small carnivores, particularly American martens and weasels, are constantly hunting me down. So far I've outsmarted them!

Look Out! Since I can be a meal for nearly every meat eater in the forest, I'm constantly on the lookout. That's why, when I travel, I scurry along the underside of decaying logs. Big logs are great. Why? Check one out. There's a small space between the curve of the log and the place where the log meets the ground. That space is just my size. I can travel

along the whole length of a log without worrying much about predators. What a relief!

My forest is so old that lots of trees have died and fallen over. The rotting *logs* create a maze of travel routes for me. Searching for food over my half-*hectare* home range is certainly a lot safer with these logs around.

A rotten log is also an excellent spot for building my burrow system. The soil beneath it is easy to tunnel into. And when a log is rotten clear through, it's easy to dig out burrows and nest sites under the rotten wood. So you see, I simply couldn't live without rotten logs!

Short but sweet: I probably won't live long, maybe two years tops. But there are plenty of my species in this forest. While many of us end up as someone's lunch, lots more are being born all the time! I'll have many babies during my short lifetime. I have big litters, and I have them often. From late winter until early fall, I'll give birth to an average of 4 to 6 babies every three weeks. See if you can estimate how many that is! There are always a few of us around, even during hard years when we outgrow our food supply.

Got mushrooms? Speaking of food, guess what I eat! The moist forest where I live is a mixture of spruce and fir trees. These large, old giants tower above the forest floor. Because very little light reaches the ground, only plants that grow in dim light survive. That's okay with me. I won't go hungry, because I eat *fungi*. You know what those are— mushrooms! I like all kinds of fungi, but I specialize in those that grow beneath the ground surface. They're called *truffles*. Maybe you've heard of the large truffles that are considered a delicacy in France. The French people use pigs to sniff them out of the dirt. Well, my truffles are much smaller but still a delight to me. They look like smooth white bonbons with a slimy, chocolate-colored center.

Yum-m-m, a perfect vole-sized meal!

Locating truffles beneath the ground is easy. They're so-o-o smelly when they're ripe. Truffles are a food supply I can count on. Since they grow underground, they don't vanish when there's a drought or a frost the way surface fungi do.

Surface fungi have the wind to spread their spores around. Truffles have me!!! Since truffle spores pass right through my *digestive system*, I sprinkle them throughout the forest as I go about my business. Rotting logs and stumps where I hang out are ideal spots for truffle spores to grow. More truffles is a good deal for me!

Everybody's happy! Spore sprinkling is great for my forest, too. How? Truffles are like the flowers of a fungus. The main part of a fungus is its thousands of thread-like roots. Fungus roots often intertwine with the smallest roots of a tree, forming a partnership that benefits both the tree and the fungus. This is called a *symbiotic* relationship. The fungus gathers water and nutrients from the soil and shares them with the tree; the tree makes sugar and transfers it to the fungus. All the trees in my moist forest have this special partnership— thanks to me, the super spore sprinkler!

Bundle of energy: My small size means I lose body heat rapidly. I have to eat constantly to stay warm. Winter is especially difficult. Most of the winter I stay deep beneath the snow in spaces that form along the sides of rotten logs. These spaces are like miniature snow caves— much warmer than the snow surface. Not many truffles are around when it's cold, so I usually make a mad dash into the trees to eat lichens. I hope no hungry predators are watching. Wish me well!

FIRE FACTS: Once in a great while a crown fire burns through the moist old forests where red-backed voles live. Voles run to their burrows to seek refuge from the heat. Some survive if their burrow is deep enough. The large, decaying logs and stumps that voles depend upon are sometimes nearly burned up by a fire. Surviving voles have nowhere to hide. They also have little food after severe fires, since the fires kill most of the trees *and* their underground fungi and truffles.

A newly burned forest is much drier than before, so fungus spores have a hard time growing. It will be a long time, maybe 20 or 30 years, before the new tree seedlings are big enough, with enough roots, for truffles to grow. Until then, red-backed voles will be waiting nearby in unburned forests.

Saskatoon Serviceberry

I am a tall shrub that is native to western North America. I grow well in low-elevation forests, even where the soil is a bit dry. You can find me in all but the highest, coldest forests of the northern Rocky Mountains and the Intermountain area. I grow very well in sunny places, so I also really like the open prairies too.

My scientific name is *Amelanchier alnifolia*, meaning "with leaves like alders."



What do I look like? I can be waist-high, or I can grow as high as 8 meters tall—that's very large for a shrub. I have woody stems and oval-shaped leaves with little points along the edges. My white flowers grow in small clusters near the ends of my branches. I grow a purplish berry that many animals eat.

I am a *perennial* plant. This means I grow for many years.

Growing up: I can grow from seed, but most new plants begin as sprouts. I have growing points at the top of my roots, a place called my *root crown*. Some new plants come from underground stems called *rhizomes*.

BOTANICAL FACT: My root crown can be 10 centimeters across. I have rhizomes

70 centimeters underground, and my roots go much deeper!

I grow best in open, sunny places. This is also where I produce my best berry crops. I can grow for a while under forest shade, but I will die out if the forest over me grows dense and dark.

My calendar: My leaves unfold from their buds in early spring. Flowers come out at almost the same time. By the end of June or early July, I've done most of my summer's work. My leaves are full-sized, my stems have finished growing for the year, and my berries are getting ripe.



Am I useful? Bears, deer, elk, bighorn sheep, mountain goats, and moose feed on my branches during the winter. Bison eat my twigs. Cattle and sheep eat my twigs and branches, too.

Many kinds of birds eat my berries. So do snowshoe hares. The animals can't digest the seeds inside the berries, so they distribute seeds for me as they travel!

People eat my berries and make tea from my branches. Native Americans know how to make arrows, spears, and digging sticks from my branches.

I provide hiding places and shelter from storms for grouse and many kinds of small birds.



What does fire do to me? Fires usually kill my buds on my branches, but I can almost always grow back from my root crown. If a fire kills my root crown, it's still not likely to kill me. I just sprout from my rhizomes instead.

Deer and elk like the way fire burns away my old, dead outer branches. That makes it easier for them to reach my new, tender shoots.

Life after fire: I can live for twenty years or more after fire. As the forest grows back and covers me with more and more shade, my growth slows down. I produce fewer berries, and I slowly die. I need another fire!

Uses on the Great Plains:

Saskatoon serviceberry was a very important food of native people of the northern prairies. The berries were eaten raw, cooked, and dried.

Serviceberry may be the most important vegetable food in the Blackfoot tribe's way of life. Each summer, when berries were ripe, camp was moved to a good location for picking. Women and girls gathered the fruit in rawhide bags and dried it in the sun. The berries were used in great quantities in soups and pemmican, and dried fruit was often used in trade.

The wood of serviceberry shoots is hard, dense, and flexible, so it makes good arrows. The shoots were peeled, roughly smoothed, tied in bundles, and hung to dry, then smoothed and sanded to the right thickness. As a final step, they were straightened and passed through a circular hole drilled in a buffalo rib or a mountain sheep's horn.

Smooth Woodrush

I am a grass-like plant. My dark brown flowers are very small—only 2 or 3 millimeters across! My scientific name is *Luzula glabrata* var. *hitchcockii*.



BOTANICAL FACT:

Scientists named smooth woodrush after a botanist, Professor C. Leo Hitchcock. Dr. Hitchcock worked at the University of Montana in the 1930s and at the University of Washington for many years after that. He wrote books that help people identify the plants that live in the northwestern United States.

Where do I live? I live in high-elevation, moist forests in the Pacific Northwest and western Canada. Wherever the snow stays late, you can find me growing under subalpine fir, whitebark pine, and Engelmann spruce trees. I also grow in high mountain meadows.

What do I look like? I grow 20 to 40 centimeters tall. My shiny leaves are 4 to 6 centimeters long, with reddish-brown tips. They grow from the base of my stem and from the stem itself. By the end of summer, my leaves turn rusty brown and cover the ground like a shaggy, reddish carpet.

I am a *perennial* plant. This means I grow for many years.

Growing up: I grow from seed, but I

soon grow strong underground stems called *rhizomes*. New plants can grow from my rhizomes.

Growing points: I have growing points in my roots and in my rhizomes, all of them underground and protected from the deep winter cold.

How do I reproduce? I reproduce from seeds and sprouts that grow from my rhizomes.

My calendar: I begin to grow as soon as the snow melts. Of course, that could be June or even July in the high, cold mountains that I call home.

Am I useful? Grizzly bears eat my flowers, leaves, roots, and stems. They're not very fussy about their menu. During summer and fall, elk feed and rest in the cool places where I grow.

What does fire do to me? Fires don't often kill my rhizomes, since they are buried in the soil. My stems and leaves do burn. So do any seeds that are lying near the top of the soil.

Life after fire: The summer after fire, I sprout from rhizomes. I produce many more sprouts in the next two or three years.

I like to grow in sunny places if there's enough moisture, so I grow well after fires remove some trees. I can also produce

new plants in the shade of tall trees. That's why you can find me even in forests that haven't burned for a hundred years!

Snowbrush *Ceanothus*

I'm a shrub. I am very thick and bushy, but I'm not especially tall. You can usually see over me, but you probably can't walk between my branches! My scientific name is *Ceanothus velutinus*.



Where do I live? I am native to western and northwestern North America. I like warm, dry, rocky hillsides. I'm a real fan of sunshine and hot days. I can grow near the valley bottoms and way up high on the ridges, but you won't find me on the very tops of mountains. Brrrrr! It's too cold up there, and summer's way too short.

You can usually find me in open places, where there are few trees. Burned places are my very favorite habitat. Ashes and sunlight—what a great combination! You can find me growing under ponderosa pines, Douglas-firs and lodgepole pines, but I won't last long if they shade me from the sun.

What do I look like? I'm a bright green bush. I'm a little like a pine or fir tree because I'm evergreen. That means I keep my shiny green leaves all winter long. But my leaves aren't shaped anything like the needles on a tree! Instead, they are thick and flat and round, with little "teeth" lining their edges.

My tiny flowers grow in greenish-white clusters at the ends of my branches. They look like handfuls of snow on my leaves in spring.

These flower clusters give me my common name, "snowbrush."

If you're hiking through the forest and smell something wonderfully sweet, it's probably me! My flowers contain so much perfume that they're sticky with it. Sometimes my perfume makes my leaves sticky, too.

BOTANICAL FACT: My roots are covered with little woody bumps called *nodules*. Every nodule is like an apartment house for tiny animals called *bacteria*. These bacteria are not the kind we call *germs*, which can make you sick. No, they are very welcome guests. They can capture a really strong molecule, called nitrogen, right out of the air. Then they break it apart and store the pieces in a way that I can use later on for growing. Instead of asking them for rent every month, I just use some of their nitrogen when I need more nutrition.

Growing up: I grow from seed. The soil on my hillsides may hold millions of snowbrush seeds, but they're very fussy about when to start growing. First, they have to be heated up. Forest fires are the perfect heaters, and they also guarantee that my new plants will come out of the soil into a very warm, sunny place. After heating, my seeds need water, and finally they have to "chill out" in some cold weather before they can start to grow.

If you're going to be fussy about growing conditions, you also have to be patient, and my seeds really are. Some people say they've been able to grow snowbrush seeds that were stored in the ground for 300 years!

Growing points: I have growing points in my stems and roots and also in my *root crown*, which grows at the very top of my roots.

How do I reproduce? Seeds are great, and I grow really well from seed. But that's not my only way to reproduce. I can sprout a new plant from the base of my stem and from my root crown.

My calendar: Being an evergreen doesn't mean that I never make new leaves; it just means I keep my leaves longer than one year. I begin to unfurl new leaves early each spring. My flowers come out about a month later.

After flowering ends, it takes about another month to get my seeds ready for storage in the soil. Seeds fall to the ground as soon as they're ripe. Some rocket a few feet away from me when their covers split open. For the seeds to move really far away from me, they have to hitch a ride on a bird or mouse or rabbit or other animal. Some actually get carried away by hungry ants!

Am I useful? Elk and deer love to eat my leaves and branches in winter. Even moose feed on me. During hunting season, these big animals may even try to hide in the thick patches formed by my branches and leaves.

Chipmunks, birds, and ants feed on my seeds. Some animals hide my seeds in the ground for their winter food supply.

Native Americans and European American settlers used my flowers and seeds for soap.

What does fire do to me? I love fire! Fires may kill my branches and scorch my leaves, but they hardly ever damage my roots. Besides, fires open my seeds so thousands of new plants can grow.

Life after fire: I can sprout right after fire. New plants start from seed the next summer. Eight years later, I'm able to produce seeds again, so there will be a snowbrush seed supply for the next fire to open.

I grow and blossom best in open, sunny places. After the forest grows tall and shady, I die out. Sometimes that takes 50 years or more, but sometimes I don't even last until my 20th birthday!



Subalpine Fir

I am a tree. My scientific name is *Abies lasiocarpa*, meaning "woolly-fruited fir."

Where do I

live? I am native to the western mountains of North America. I like cold forests at high elevations. I can grow where the soil is either dry or moist. You can find me growing with lodgepole pines and whitebark pines. Where I live, you often find Engelmann spruce trees too.

What do I look

like? I am an evergreen tree. When I'm grown up, I'm usually about 20 or 30 meters tall. I grow a very pointy top, and I have branches all the way to the ground. People say this helps me shed snow through the long winter months without breaking my branches.

My roots grow only in the top layers of the soil.

My needles are short, about 2 to 3 centimeters long. They grow singly, right out of the twig. Spruce needles look a lot like mine, but my needles have blunt tips. They don't make you say "Ouch!" when you touch them, the way spruce needles do.

Growing up: I grow in both sun and shade. I can even grow in the deep shade of a forest of old pine, spruce, and fir trees. I can start from seed right after a big *crown fire*. I can also grow under old pine trees.

I grow slowly. When I'm 15 years old, I



may be only 30 centimeters tall. When I'm 50 years old, I may be only 2 meters tall. I can begin producing seed when I am about 20 years old, and I continue to grow and produce seed for 200 years or more.

Growing points: I have growing points inside my bark (in my *cambium*), at my very top, and at the tips of my branches and roots.

How do I

reproduce? I am a *conifer*, which means I put my seeds in cones. My cones are dark purple, fuzzy, and sticky with sap. They grow in the top branches of the tree. They point straight up from the branch, so they look a little like fat purple

candles. At the end of the summer, the cones fall apart right there in the treetop, freeing the seeds. Seeds are about a half-centimeter long. Each seed is attached to a paper-like "wing" 1 centimeter long. This wing helps it travel in the wind. Sometimes my seeds float as far as 80 meters before they land.

My top branches are sometimes sheared off by winter's wind and snow in the high mountains. Although my top is stunted, my bottom branches keep on growing. They fan out along the ground, looking like a floor-length skirt. Where these branches touch the ground, they can form roots and sprout new trees!

My calendar: Cones begin growing on my top branches in the middle of summer. The next May or June, the cones open. They are pollinated, and seeds form. By September or October, the cones fall apart and free the seeds.



Am I useful? Many kinds of insects eat my needles and seeds. *Fungi* use the nutrients stored in my wood and roots. Some kinds of beetles feed on my wood—but only after fungi have softened it.

I provide shelter for deer, moose, mountain goats, and bears. Elk may visit the forests where I live in the spring when their calves are born. Bighorn sheep may have their lambs in my shade. Snowshoe hares, flying squirrels, red squirrels, chipmunks, voles, and many other mammals live in these forests.

People use my wood for homes and furniture, and my sap is used in a special kind of glue for glass lenses and microscopes. Native Americans used to grind up my needles for a salve to heal cuts. They used tea, made from my sap, as a medicine for colds.

BOTANICAL FACTS: Flycatchers, thrushes, and owls live in subalpine firs. Blue grouse are big birds, but they can hide in fir branches and eat the needles and buds. Red squirrels, chipmunks, chickadees, crossbills, and Clark's nutcrackers eat subalpine fir seeds.

What does fire do to me? I don't usually survive fire. Even *surface fires* usually kill me. My bark is very thin, so it doesn't protect my cambium from the heat. My branches grow low to the ground, so they catch fire easily. My roots grow in the top layers of soil, so fires damage them too.

Life after fire: After a fire, my seedlings may begin growing right away, but fast-growing trees like lodgepole pine hide them. A hundred years later, the lodgepole pines have grown up and died, but I am still growing well and producing seedlings that grow in my shade. That's when I'm sure to take over the forest—until there's another fire!

Western Larch

I am one of the most unusual trees in the western forests. I look like an evergreen in the summer, but don't be fooled—I'm not. I am a *deciduous conifer*. I bear cones just like pines, spruces, and firs do. But I shed my leaves (needles) in the fall, as cottonwoods and aspens do. Another name for me is tamarack.

Where do I live?

I am native to the northwestern United States and southwestern Canada.

You'll find me growing in moist places but not wet places. My roots hate to be soaking wet for any length of time. I live west of the Continental Divide, mostly in valleys and on mountainsides up to 2,000 meters in elevation. My favorite places are north- and east-facing slopes, which are a little cooler and moister than south- and west-facing hillsides.

What do I look like? I may look spindly as a sapling, but I am strong. I can grow to be very big and old.

My needles are short, 3 to 5



a lot like other conifers in the western forests. But in fall, I stand out from



centimeters long. They grow out from my branches in little tufts, each one containing about 20 needles. In summer, I look

everyone else because my needles turn golden before they fall. In winter, my branches are bare—unless moist weather covers them with glistening crystals of frost.

As I grow, I gradually let my lower branches break off. I don't need them. There's no point growing needles in a shady spot where they can't get much sunlight. This habit helps me survive fires. When my low branches are gone, fires can't easily climb from the forest floor into my crown.

BOTANICAL FACT: The world has many different kinds of larch trees, but western larch is one of the biggest, often growing more than 50 meters tall. Really big western larches can grow more than 60 meters tall, with a trunk more than 2 meters in *diameter*. Many western larches live to be more than 500 years old!

Growing up: I store my lightweight seeds in delicate cones 5 to 7 centimeters long. Each seed is attached to a long, papery wing that helps the wind carry my seeds across open places to start new trees. I can easily disperse seeds throughout a large burned area.

I can grow 30 centimeters in one year. Can you grow that fast? I can outgrow all of the other western conifers until I'm about 100 years old. After that, like all trees, I will grow a little each year for the rest of my life. Will you keep growing after you turn 100?

I don't grow well in places that already have a lot of trees. My roots need plenty of room and my needles need a lot of

light. I grow best where fire has killed most of the trees. I'm great at starting a new forest!

How do I reproduce? I grow from seed. I can produce seed every year, but some years are better than others. About every five years, I produce thousands of cones and thousands of seeds! Each of my small cones can hold 30 to 40 seeds.

My calendar: Tiny buds containing next year's needles show up on my branches in the fall. They open in the spring, releasing my tender, bright-green needles.

I begin growing next year's cones in the fall, but they're tiny. You probably won't notice them until next spring. They'll be pollinated late in spring. Then they'll grow all summer so they can open in the fall and release seeds.



When the weather gets cold and the days get short, I pull nutrients from my leaves back into my trunk. My needles turn yellow. Walking through a larch forest in autumn is like walking through a gallery with a golden ceiling. If you take the same walk in November or December, the gallery's roof will be missing and you'll be walking on a golden carpet.

I don't understand why other conifers keep their needles all winter. My bare branches can easily shed the snow and then, when spring comes, I get a completely new wardrobe!

Am I useful? Many animals of the

western forests depend on me. Small mammals eat my seeds and seedlings. Squirrels store my cones in caches, where they can feed all winter. Bears like to eat my sap in spring when it is filled with sugars. In winter, when elk, deer, and moose can't find other food, they sometimes eat my buds and small branches.

When I get old and tower above shorter trees in the forest, my top is likely to break off in a wind storm or be shattered by a lightning strike. After that happens, my inner wood begins to rot and I provide perfect nesting habitat for pileated woodpeckers. The woodpeckers move on after a year or two, but their holes will be used by flying squirrels, owls, and other birds.

People use my wood for buildings because it is dense and hard. Here are some other things made from western larch: medicine for colds and coughs, syrup, a kind of chewing gum, paint, ink, and turpentine. Larch wood burns well in a campfire too!

What does fire do to me? I get along well with fire. By the time I'm grown, my bark is 10 to 20 centimeters thick, my roots are deep, and my lower trunk is free of branches. These traits let me survive most fires. If a fire reaches my crown, I am better equipped to re-grow my needles than other conifers because I do that every spring anyway! You'll often see scattered western larches towering above a young forest. Look for fire scars at their bases; they have survived a fire that killed all the other trees.

If a fire kills the trees around me and burns the leaf litter, my seeds have a good chance to establish the new forest. Thousands of my children will germinate after a fire and outgrow the other trees. By the time they are 20 years old, they begin producing seed. We'll be ready for the next fire!

White Pine Blister Rust

I am a *fungus*. I'm like a plant in many ways, but I don't get my energy directly from the sun, like plants do. Instead, I get my nutrition from plants. I'll tell you more about myself and two of my generous "*host*" plants, the whitebark pine and the gooseberry bush.

Where do I live? I am native to Asia. Long ago, I spread into Europe. Then, in 1910, I hitchhiked on pine seedlings from Romania to British Columbia. Less than 100 years have passed since I arrived in North America, and I've been busy. My infections have killed more than 90 percent of the "five-needled pines" in Idaho and Montana. These are the only kind of tree I can live on. Five-needled pines have needles attached to the twig in bunches of five. Whitebark pine, western white pine, and limber pine are the five-needled pines that live in Montana and Idaho.

Where do I grow? A fungus like me has to reach inside a plant for nutrition. I'm pretty special, because I need two different kinds of plants to complete my life cycle—a five-needled pine like the whitebark and a gooseberry bush.

You should suspect that I've infected a whitebark pine if the tree has many dead branches. Still, you'll have to look very close to actually see me. Yellow spots on the needles or twigs of a pine signal the beginning of my infection. Later, I make blisters and—eventually—open wounds on the outside of the tree's branch or trunk. Scientists call these "*cankers*." They are yellowish along the edge, with lots of yellow fluff toward the center. The middle of the canker is dead. As the canker gets larger, it kills more and more of the tree trunk.



When cankers kill the trunk most of the way around, the tree dies.

The other plant I need is a gooseberry bush. Some people call them currant bushes. People seldom notice me on gooseberry bushes because I don't kill the leaves or stems. But you can find me easily enough. Just look on the underside of a leaf. I make tiny yellow blisters and brown, thread-like growths underneath each leaf I infect.

Growing up: If you described an animal's life from birth to death, you might call it a "story." It might be better to call my life's tale a "spory." Here's why:

In late summer, I produce spores from those brown, thread-like growths on gooseberry leaves. The wind carries these spores to the needles of nearby pines. To get nutrition, the spores develop thread-like strands called "hyphae." These dissolve the needle's protective covering, then grow down into the needle and tap the nutrients between cells.



The hyphae keep on growing—very slowly—from the needle into the twig, through the twig to the branch, then from the branch into the trunk of the tree. This usually takes two or three years. Wherever I infect a branch or trunk, it swells with yellow bulges, then develops small blisters. After many years, these blisters form the large cankers on my host tree's trunk.

Finally, in spring, I produce another kind of spore along the edges of the cankers. These spores are the yellow fluff that I told you about. They can infect gooseberry bushes, so my life cycle is finally complete! This may sound complicated, but I've only told you a little of my "spory." I actually make five different kinds of spores to complete my life cycle!

Am I useful? Many insects eat me. Red squirrels love the sweet liquid that infected wood produces. Sometimes squirrels eat so much wood from around a canker that it stops my infection from growing!

Hard to handle: If I were a North American native, whitebark pines would have ways to survive my infections, just as they have ways to survive fires. But I've been living with the whitebark pine for just about a hundred years. So far very few of them have figured out ways to survive.

Fire and me: If a fire kills my host tree or gooseberry bush, it kills me— but it can't keep me down for long. Gooseberry bushes often sprout back right after fire, and fire actually helps their seeds to grow! I'll soon have plenty of gooseberry plants. All I'll need is a good wind or a small animal to carry my spores to their leaves.

I hope I'll find new whitebark pines as I invade burned places, too. Clark's nutcrackers love to plant whitebark pine seeds in recent burns, so the pines will come back soon after fire— if the nutcrackers can find enough seeds to



plant. I sure hope I haven't killed too many with my infections!

WHAT'S TO BE DONE?

People are trying to help the whitebark pines survive even though blister rust has moved in for good. For many years, people tried to protect the five-needled pines by digging up all the gooseberry bushes. But gooseberry plants are tough, and rust spores can travel a long way from plant to plant. Blister rust outwitted their plans and continued to spread.

Here's what people are doing now to help the five-needled pines:

First, they look high and low for pines that **have** survived blister rust infections. Since these trees can survive infection, perhaps their offspring can, too.

Then, people try to provide the best growing conditions possible for seedlings from these "rust resistant" pines. Sometimes people prepare a "seed bed" by clearing away the firs that would take moisture away from pine seedlings. Sometimes land managers use fire to prepare a seed bed. Fire kills many firs, so the pine seedlings will get plenty of light. Fire also removes some of the soil's covering, so the frail roots of pine seedlings can get to the soil's moisture before they dry out and die. Maybe fire can help the pine seedlings get a head start on growing, before other plants start using most of the water in the soil.

People hope that they can help rust resistant trees to grow on the hillsides and mountains where whitebark pines have been for thousands of years.

Whitebark Pine

I am a tree. My scientific name is *Pinus albicaulis*, meaning "white-stemmed pine."

Where do I live?

I am native to the northern Rocky Mountains, the North Cascades, and the Sierra Nevada of the far western states. In many places, especially where the soil is dry and rocky, I form the highest elevation forests on the mountainsides. I often grow with subalpine fir and Engelmann spruce. Sometimes I grow with lodgepole pine.



What do I look like? I am an evergreen tree. My bark is gray and scaly. I'm about 15 or 20 meters tall when I grow up—unless I'm in a very rocky, windy place. On ridges and mountaintops, wind and ice trim my branches every winter so I may only grow 1 meter tall. I sometimes have a bushy look because of the way my branches reach out for the sunlight.

My roots grow deep into the soil. My needles are about 3 or 4 centimeters long and grow in bundles of five.

BOTANICAL FACT: Whitebark pines often grow in clusters of three or more trees. They all started from a little pile of seeds buried years earlier by a Clark's nutcracker.

Growing up: My seedlings grow well in open, sunny places with bare ground. That is one reason why I may be the first tree to show up in a burned area. Getting seeds from a parent tree to the middle of a burn is no problem. Clark's nutcrackers may carry my seeds up to 10 kilometers before they bury them, several

together, in the ground!

Summers are very short in the high mountains where I live, so I grow very slowly. I produce few seeds before I'm 80 years old. I have plenty of years ahead of me, though. I may live to be over 700!

Growing points: I have growing points inside my bark (in my *cambium*), at my very top, and at the tips of my branches and roots.

How do I reproduce?

I am a *conifer*, which means I put my seeds in cones. My cones are purplish-red and 5 to 10

centimeters long. In late summer, Clark's nutcrackers peck out my seeds or break off the scales of my cones and pry the seeds out. Then they bury the seeds in caches that they'll feed from during the winter. They don't eat all the seeds, though. Some grow into new pines. You seldom find whitebark pines alone; we grow in clusters of three to five trees. Can you figure out why?

In the high mountains, where my top branches are sheared off by snow and wind each winter, I sometimes sprout at the places where my



lowest branches touch the ground.

My calendar: New cones are pollinated in early summer. More than a year later, in late summer, my seeds are ripe. Nutcrackers peck many of the seeds out. Red squirrels snip off whole cones with their teeth. After the cones fall to the ground, the squirrels pile them in huge *middens* where they can feed all winter.

Am I useful?

Because my seeds are large and so rich in energy, Clark's nutcrackers and red squirrels aren't the only animals that want to eat them. Black bears and grizzly bears feed at the squirrel middens. Ground squirrels and chipmunks harvest my cones and store them. Sapsuckers, chickadees, nuthatches, finches, crossbills, grosbeaks, and grouse harvest my seeds. Deer mice can't harvest the seeds, but they feed on any they can find on the ground. People eat my seeds too. They're very tasty!

I provide shelter and hiding places for mule deer and elk. Woodpeckers and mountain bluebirds nest in my trunk.

Mountain pine beetles feed on my cambium. The female beetles lay their eggs there. When the *larvae* hatch they eat my cambium, growing bigger as they go.

BOTANICAL FACT: White pine blister rust is a *fungus* that was accidentally brought to North America from Europe. It came to the Rocky Mountains in about 1910. Blister rust infects a tree's cambium. It can kill a tree by infecting the cambium all the way around, or *girdling* it. Blister rust kills the tops of older trees where the needles and cones are found.



Blister rust has killed about 96 percent of the whitebark pines in northern Idaho and northwestern Montana.

What does fire do to me? My bark is medium in thickness so it doesn't protect my cambium well from the heat of fires. Luckily, I usually grow in places where the forest is open and trees are scattered, so it's hard for a *crown fire* to travel through. Sometimes I survive *surface fires*, even if they leave a scar on my trunk.

Life after fire: If I am killed by a crown fire, Clark's nutcrackers will bury seeds from other whitebark pines in the opening created by the fire. I hope they can find enough seeds because blister rust has killed so many trees. If seeds are planted here, new clusters of whitebark pine trees will begin growing when the soil becomes warm and moist. In a cold place like this, it could take many years just to get the conditions right for trees to start growing.

Subalpine firs and other trees grow near me except where the soil is very dry. My own seedlings don't grow well in shade, but subalpine firs grow up just fine under my branches. If hundreds of years pass without fire and blister rust kills my old trees, I may disappear from the forest.

Wild Onion

If you're walking through the woods or across a prairie and suddenly think you've walked into the kitchen and someone is cooking spaghetti, you may be in a patch of wild onions. My whole plant smells just like the onions you use in cooking. My genus name is *Allium*, which really means "garlic." The garlic used in cooking is a close relative of mine.



BOTANICAL FACT: The plant world has many kinds of onions. About 50 species of wild onions grow just in the Rocky Mountains. There are nearly 300 species in the world!

Where do I live? I can grow in lots of different places. Some species of wild onion like shady, moist homes while others like it dry and sunny. Because of this, we can be found in both the prairies and forests. Those of us that like moist places are very happy living near running streams and wet meadows.

Growing points: I have growing points in my *bulb* and in my roots. Some species of wild onions have growing points on underground stems called *rhizomes* too.

BOTANICAL FACT: A bulb grows underground, just like a root. But it's not really a root. It's a cluster of leaves—**very special** leaves. Bulb leaves are thick and moist, and they're white, not green! Green leaves capture sunlight and turn it into nutrients for plants. The white leaves of a bulb **store** nutrients, especially through the long winter. With all that stored energy, bulbs can begin growing early in spring and sprout from under ground even if someone has picked all the flowers and leaves on the plant.

Growing up: I can start growing from seed, but I can also make new onions without using flowers or seeds at all! That's because, at the end of summer, my bulb starts growing little *bulblets* at its base. Those are new bulbs, and they'll grow into new wild onion plants!



My calendar: I start to grow in spring. My flowers open in late spring or summer. I make seeds right away. After the seeds are ripe, my year's work is done. By August, my stem and leaves may dry up and disappear. Like an underground treasure, my bulb will wait underground for spring to come.

Am I useful? Everyone likes to cook with onions. Native Americans have always used them. Lewis and Clark cooked with wild onions as they traveled through the West 200 years ago. Bears and ground squirrels eat my bulbs. In early spring, elk and deer graze on my leaves.

Even though I'm delicious and nutritious, you'd better keep your cows away from me unless you like onion-flavored milk!

What does fire do to me? I can't handle a fire that's so hot it roasts my bulbs! But I can survive fires that just burn my stems and leaves. Don't let the soil wash away after the fire, though. If erosion uncovers my bulb, I'll probably die.

Life after fire: If my top burns off, it's no big deal to me. I can grow new leaves and flowers the next year. I don't go crazy with flowers after fire like show-off fireweed does, though. I just grow slowly and steadily, making a few new plants every year. Come on out to the woods and see if you can find me!