FireWorks Encyclopedia

Featuring Species from the Northern Rocky Mountains and North Cascades

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American Black Bear

(Ursus americanus)

Image by Terry Spivey, USDA Forest Service.

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 hollow tree. When she finally found a spot that would fit all three of us (Mother, Brother, and me), she cleared a 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 she 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: I was about the size of a rat when I was born— much smaller than you were. I was totally helpless. 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, 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 where 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, I follow creeks and streams, eating the succulent plants that grow along their edge. Have you seen torn-up logs in the woods? 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 the 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. I could scramble up and get the nuts right out of the cones, but I find it easier to let squirrels climb the trees for me. Then I eat from the cones that they collect and stockpile on the ground. These piles are called middens. Most 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!

Squirrel midden with whitebark pine cones. Photo by Ilana Abrahamson.

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. While I sleep, 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 hardly move at all during this time, so I use very little energy. When spring comes, I might have lost a quarter of my weight, but my muscles are still strong.

Fast food. From spring through fall, bears have to put on as much fat as possible. Finding lots of high-energy food in one spot is much more efficient than moving around between snacks, so I have to know exactly when and where to look for large concentrations of food. Another lesson from 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 eat mostly at night and sleep most of 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. I bet you didn't weight that much 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 is 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.

Black bear cubs. Image by Joy Viola, Northeastern University.

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

Fires create some of the black bear's favorite feeding spots—berry patches. Burned areas grow within a few years into brush fields 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 openings with tree cover close by – food and safe shelter all close together.

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Citation: Kurzel, Brian. 2016. American black bear. In: FireWorks encyclopedia. Fort Collins, CO: U.S. Department of Agriculture, U.S.D.A. Forest Service, Rocky Mountain Research Station. 2 p.

American Marten

(Martes Americana)

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.

Photo by Erwin and Peggy Bauer.

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. That means that I'm a good hunter—very quick and agile.

Catching and eating small rodents is a snap for me. I usually hunt by 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. It's no problem for me to chase tasty squirrels through the treetops.

During the summer, lots of migratory birds nest in my forest. I eat their eggs and nestlings to get more variety in my diet. And I'm extremely fond of ripe huckleberries. Aren't you?

Hideouts everywhere: Although I eat many kinds of food, I'm very picky about where I live. I choose only places where the forest is moist and there are many big, old trees. The spruce and fir branches sweep the ground, creating convenient hiding places. Younger trees are growing in beneath the old giants, creating even more shelter. I feel safe here.

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

When I'm not hunting, I find safe places to take a breather. I have many resting places in my square-kilometer home range. I will use a hole in just about anything—live trees, dead trees, rotten logs, or hollows under large rocks. Sometimes I climb up into trees infested with dwarf mistletoe and rest in the tangled masses of a witches'-broom. What a view!

Snow caves: When winter comes, deep snow covers the ground. Then I struggle to survive. I concentrate on hunting red-backed voles. They're not particularly delicious, but there are lots of them around. They spend the winter huddled beneath the snow in hollows along the undersides of old logs. These spaces are like miniature snow caves. Here the voles keep warm and feed on whatever plants are available.

How can I find a way down through the snow to catch the voles? Luckily, some logs and stumps poke up out of the deep snow. Where the snow has settled and melted away from this dead wood, I find passageways that connect me with my food supply! I just follow the space down along the log or stump until I find a meal.

It's usually a lot warmer beneath the snow than on top of it, so I rest there during cold snaps. I 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, and 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 hunt red squirrels and snowshoe hares above the snow.

Photo by Cody Connor.

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 in my home range. After my young are born, I'll move them to another den site where they'll grow up under my constant care. They will be born helpless – blind and naked. But in only 50 days they will be strong enough and smart enough to leave my second den and take care of themselves.

I'll probably live 12 years or so if everything goes well. Very few humans will see me during that time because I'm so secretive. 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 North Cascades. These forests don't burn often. Three of four centuries may go by without fire. But dead logs and branches are plentiful and duff is deep on the floor of these old forests. When these fuels get dry enough to burn, the fire may be severe. It may even crown, killing most of the trees and burning a lot of the duff and logs on the forest floor.

Martens are fast, so they can easily escape a fire, but it will destroy their prey and their shelter. They will move out, seeking another valley or hillside with old, moist forest.

Fires leave many dead trees standing. As the new forest grows in, the dead trees will fall and become the rotting logs of the new forest – perfect habitat for small rodents and eventually for American martens. After another century or so, another marten can call the burned site home.

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American Three-Toed Woodpecker

(Picoides dorsalis)

Photo by Pierre Bonenfant.

I'm the American three-toed woodpecker. My 3-toed feet make me special, because most woodpeckers have 4 toes on each foot. Two of my toes point forward and one points backward to help me stay firmly in place while I work on the trunks of just-burned trees. My cousins the black-backed woodpeckers have 3 toes too, but they have a completely black back. Mine has a beautiful ladder of black and white stripes!

Home on the burn. When I find hundreds of blackened tree trunks covering a mountainside, it is a dream come true. This is the perfect place for me to live and raise a family. Is that hard to believe? Let me explain.

You may not think that all of those dying trees probably are very important, but to me they represent lots of food. I'm not interested in the trees themselves. I'm interested in what's living underneath the bark. These burned trees are crammed with my favorite food—the larvae of bark beetles. These small, white, worm-like creatures— also known as grubs— are delicious!

How did so many larvae get here? Not long after a fire burned across the mountain, hundreds of "fire bugs" began showing up, seemingly out of nowhere. More than 40 kinds of insects, mostly beetles, are attracted to recently burned forests. The beetles compete fiercely for space in burned trees. Early arrivals get the best spots and deposit the most eggs. Because of this, some beetles have developed ways to locate forest fires while they're still burning. Some of them can sense smoke and follow it to a fire. Others use special heat detectors on their antennae or abdomens to sense the radiation that we feel, close up, as heat –infrared radiation. The black fire beetle has both smoke- and heat-sensing equipment! It helps them take a direct route to a fire, beating the rest of the "fire bug" crowd.

Mountain pine beetles and other bark beetles home in on burns too, perhaps responding to the 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. It's very convenient for them, and it's great and for me too!

Grubs, anyone? Most beetle larvae grow up just under the bark of burned tree trunks. Here they are quite safe from snow and rain and 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, sticky tongue. Yum-m-m! Would you care for some?

Woodpeckers only! The burn has also attracted some black-backed woodpeckers. You might wonder if we compete with each other for food. Black-backed woodpeckers are a bit larger than me and sport a much stronger bill, so they concentrate on wood-boring beetles for food. Like their name says, the larvae of wood-boring beetles burrow deep into the wood of burned trees. A black-backed woodpecker actually has to chisel through the hard 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, I can find a lot of them without working

as hard as my black-backed relatives!

A newly burned area will provide food for 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 near plenty of food trees. 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 the last fire, and it 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 because the cavity has to be big 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, 4 nestlings have hatched. They may look naked and awkward to you, but to me they're beautiful. My mate and I work hard at caring for them. We make hundreds of trips to the nest with food. Our nestlings will eat lots of beetle larvae and also insects picked off the bark of trees. The nestlings will fledge in about 25 days, but they'll follow us for awhile afterward to learn 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. Next year, we'll excavate a new nest cavity.

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

FIRE FACTS: Three-toed woodpeckers usually find the best habitat in lightly-burned patches and along the edges of severe burns. Food is abundant in the trees damaged and killed by fire, and rotten trees for nest sites may be found either inside the burn or along its unburned edge. Only rotten trees are soft enough for these woodpeckers to excavate their nest cavities.

Three-toed woodpeckers must take advantage of this great habitat quickly because it will only last a few years. After that time there will be fewer beetles feeding on the dead trees. Once the woodpeckers' food supply is gone, the woodpeckers will be gone too! They will look for another recently burned forest that offers more beetle larvae.

Photo by Dave Powell, USDA Forest Service, Bugwood.org.

Citation: U.S. Department of Agriculture, Forest Service. [n.d.]. American three-toed woodpecker. In: FireWorks encyclopedia. Fort Collins, CO: U.S. Department of Agriculture, U.S.D.A. Forest Service, Rocky Mountain Research Station. 2 p.

Armillaria Root Fungus

(Armillaria ostoyae)

Mushrooms. Photo by John W. Schwandt, USDA Forest Service, Bugwood.org.

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 trees for nutrition.

Armillaria species are busy in nearly every forest in the world. We break down living wood and recycle dead wood for our nutrition. The most important Armillaria species in the northern Rocky Mountains and the North Cascades is called Armillaria ostoyae.

<u>What do I look like</u>? 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 called hyphae.

Usually my hyphae are only about a millimeter across, but in a few places they get organized into something larger. At the base of a tree, under the bark, you may find me looking like a flat white cobweb glued onto the wood. Underground and under the bark, you may find me looking 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. These mushrooms produce my tiny spores, which are a lot like a plant's seeds.

Mat of hyphae. Joseph O'Brien, USDA Forest Service, Bugwood.org.

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 complex, enormous network of hyphae can weave its way through the soil of a whole hillside, like a giant underground cobweb. This is called a root disease center.

The humongous fungus: The world's largest living organism may be a disease center of Armillaria ostoyae that lives in Oregon. Scientists have estimated that it weighs about 35,000 tons. That is like the combined weight of 175 blue whales! Some parts of this root disease center are more than 8,000 years old!

<u>Growing up</u>: I start life either from spores or from hyphae that break off from a root disease center. I use spores to spread over long distances just as plants use seeds. And I make a **lot** of spores! When my mushrooms are ripe, they can drop more than a thousand spores onto an area as big as a cereal bowl **every single minute**.

"Rhizomorphs" are networks of hyphae that look like plant roots. Joseph O'Brien, USDA Forest Service, Bugwood.org.

I 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. 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 penetrate than the bark of pine and larch trees.

Scientists are not sure what makes me produce mushrooms and spores. Moisture, light, and warm weather all help. I can live for hundreds of years and get very big without making any spores. Then in just one year, I might sprout hundreds of mushrooms. Even more mysterious, they might all grow in a giant ring formation. People call this a “fairy ring.”

Am I useful?

Insects and worms eat my hyphae. Squirrels, deer, elk, bears, and people harvest my mushrooms. Some people call my mushrooms "honey mushrooms" because they're so sweet. Squirrels sometimes hang my mushrooms on a tree branch to dry out. If no one else finds them, the squirrels 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 and less. They make fewer needles. The wood at their bases gets weak, so a strong wind can blow them over. Then they will become homes for voles and other small mammals. That will make them into favorite hunting places for predators like American martens.

When my host tree dies, I won’t run out of food. By that time, I have infected many others nearby. But the firs and Douglas-firs may find it hard to grow back because I will wait right here for them to return. If pines and larches grow here instead, I may not survive. They 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! After Armillaria begins the process, fungi known as "brown rotters" follow. They break wood down into really rich soil.

Fire and me:

Fire sometimes kills my host trees. But I can live for many decades on dead roots and stumps and underground, so I can stay around even after fire.

If a fire changes the tree species in the forest, my life changes too. If a low-severity fire kills most of the Douglas-firs and leaves the pines alive, I'll have less nutrition and my life will be harder. I'm patient though. I can wait in one spot for 50 years or more for a good fir root to grow nearby. When firs become plentiful again, I'll spread my network of hyphae very slowly among them, expanding 20 or 30 centimeters a year. Slowly but surely, I’ll become

the biggest!!

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Arrowleaf Balsamroot

(Balsamorhiza sagittata)

I am a plant with big, showy yellow flowers. But my name has nothing to do with my flowers. Instead, it describes what I grow underground – a huge, woody stem that smells like **balsam** wood.

Photo copyright © by Lee Dittmann, used with permission.

Where do I live? I am native to the western part of the United States. I live in dry prairies and low-elevation forests. I grow with sagebrush, too. Ponderosa pine forests are some of my favorites. I grow with Douglas-fir and lodgepole pine, too.

You can't always identify me by my flowers. If the forest is thick and shady, I will grow new leaves every year, but I won't grow many flowers. For flowering, I need to be in open, sunny places.

What do I look like? I have big, fuzzy, arrow-shaped leaves. They are green, but thick hairs make them look grayish.

I produce my bright yellow, daisy-like flowers in the spring. They grow on a stem that gets about half a meter tall. My flowers are actually a composite of 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 here?

I am a perennial plant, so I grow for many years. If my habitat is just right, I might live as long as 50 years!

Photo by Dave Powell, USDA Forest Service, Bugwood.org.

Growing up: I start growing from seed. Then 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. I sprout new leaves from my caudex every spring.

How do I reproduce? By the time I am 4 or 5 years old, I can produce seeds. When I'm younger than that, I'm too busy growing my caudex and roots to make seeds too.

By the middle of 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. I hope many of them fall in sunny, open places where they can sprout new plants the next year.

After winter, I grow back from buds on my caudex. I can do that after fire too, and I can do it after animals eat my top off.

BOTANICAL FACT: Above ground, I look like a medium-sized plant. Underground, I'm often much bigger. My taproot may get thicker than your wrist, like a gigantic carrot. 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. My flower stalk comes up within a week. I am in full bloom a month after that. My seeds are ripe by early July, and then 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 eat me too. Mice eat my seeds.

My leaves are so big that they provide hiding places for grouse and smaller birds.

People have found that I am a plant with many talents. They can eat my stems, roots, and seeds. They can also use me as medicine for burns, wounds, colds, sore throats, stomachaches, headaches, fevers, insect bites, and swelling. Wow!

What does fire do to me? Fires burn up my stems and leaves, especially because fires usually visit in summer or fall when my leaves are brown and dry. But fires can hardly ever kill my underground stem, so I can resprout easily. My roots are even tougher than my underground stem, so 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.

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Beargrass

(Xerophyllum tenax)

Photo by Chris Schnepf, University of Idaho, Bugwood.org

What a strange name I have! I'm not really a grass, and bears don't eat me. Maybe I got this name because bears sometimes use my leaves to cushion their winter dens.

Where do I live? I am native to the western mountains of North America. I like cold places and high elevations. I grow well where winters are cold and the soil is dry. I grow best in open places, where the trees are far apart – or there are no trees at all. That's where I produce my best flowers. I also grow under lodgepole pines, whitebark pines, and subalpine firs.

What do I look like? I am a perennial plant. This means I grow for many years. My skinny leaves grow in a thick clump that looks like a bunch of grass. My leaves stay green all winter, even under heavy snow. They are long and strong, so they can be used to make beautiful baskets.

BOTANICAL FACT: A beargrass plant may be 5 years old or older before it blooms. The blossoms are spectacular.
Hundreds of small, cream-colored flowers grow in a big cluster at the end of a stem more than a meter tall. A meadow of blooming beargrass looks like it has hundreds of snowballs floating above the ground.

Each beargrass plant blooms only once, then dies.

Photo by Chris Schnepf, University of Idaho, Bugwood.org

Growing up: Every spring, I grow new leaves from my woody stems that lie on top of the ground or in the top layer of soil. These stems are called rhizomes. My new leaves just add to the old ones that stayed green through the winter.

My rhizomes are thick and rope-like. Leaves and flowers grow up from them, and stringy, golden-colored roots grow down.

Year after year, my rhizomes branch out and sprout new clusters of leaves. Each cluster is a new plant. Even though individual beargrass plants die after flowering, the clump continues to spread out, so I can live on and on.

My rhizomes have another talent. They are tough and thick to survive harsh weather, grazing, and trampling. This is useful because lots of animals feed on me, and little animals use me for shelter. It is very hard to kill me once I get established!

My calendar: Since my leaves are evergreen, I begin to grow as soon as the snow cover and the ice in the soil have

melted. I form flower buds in late spring. I blossom in early summer and form my seeds right after flowering. My seeds are ripe by late summer or early fall.

Am I useful? Deer and elk eat my flower tops. Pocket gophers hide and feed in places where I grow thick. Ground squirrels bite off my stems at the base like loggers with tiny saws. When the stems fall down, the ground squirrels can harvest my nutrition-rich seeds. Elk eat my leaves during early summer, and bears may use them as a bedding for their winter dens.

My roots can be used 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. Sometimes people burn beargrass meadows on purpose to get the best leaves for weaving.

What does fire do to me? I can survive a fire if it just burns off my leaves. Fires that burn my rhizomes usually kill me. Luckily, fires are often patchy. One spot might burn severely and kill my rhizomes, but a spot right next to it might only singe my leaves. That leaves my rhizomes ready to sprout.

I grow well from seed in burned places, but it takes many years before I develop thick clumps that cover the ground.

Life after fire: After fires, I grow from seed and sprout from my rhizomes. My sprouts grow really fast. In fact, I might grow several centimeters from the time of the fire to the time when snow covers me for the winter. If you see me then, you can recognize me because I look like I just got a flat-top haircut.

I sometimes put on a big flower show in the years after fire, because I grow very well in sunny openings.

After the forest grows tall and shades my leaves, I continue to grow but I don't flower much. You can find me in forests that haven't burned for a hundred years. I am just waiting for the next one to help me thrive and flower.

Beargrass sprouting around the edge of a clump that was top-killed by fire the previous year. Photo by Garon Smith.

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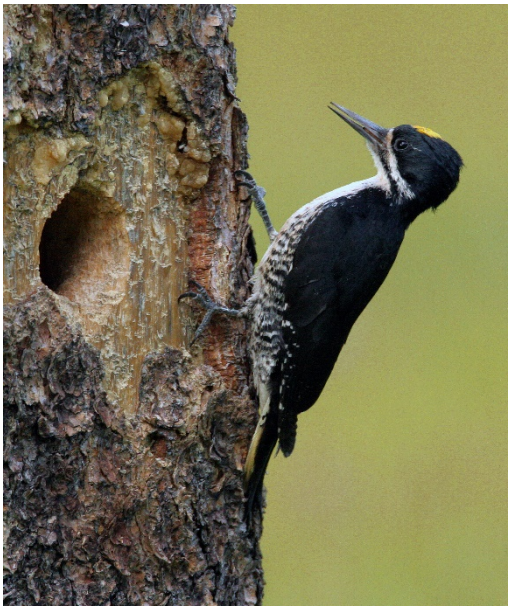
Black-Backed Woodpecker

(Picoides arcticus)

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.



Male black-backed woodpecker at nest hole
Photo by Ron Wolf.

Smoke detectors: All of those standing dead trees probably don't mean much to you. But to me they represent lots of food. I'm not particularly interested in the trees themselves. It's what lives inside the wood that gets me excited. The burned trees are crammed with my favorite food – the larvae of wood-boring beetles. Plump and juicy, these white, worm-like creatures— also known as grubs— are delicious!

How did the larvae get here? Let me explain. Right after a crown fire roared across the mountain, hundreds of "fire bugs" began appearing, seemingly out of nowhere. Some came while the trees were still smoldering. More than 40 kinds of insects, mostly beetles, are attracted to recently burned forests. The insects mate, then lay their eggs under the charred bark of freshly killed and dying trees. When the larvae come out, they have an unlimited supply of wood to feast on.

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 to find burns. Some use smoke detectors on their antennae. Others use 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. The beetles that are best at finding fires are called Melanophila, a Latin word meaning “dark lovers.” Their name refers to the fire-charred trees where they mate and lay eggs. They are such expert fire finders that they can zero in on a fire from 100 kilometers away!

Grubs, anyone? Wood-boring beetle larvae generally tunnel into a tree only a few centimeters. They stay here for a year or so before they develop into adults. 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 looking 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. This burn will provide me with a year-round supply of food for a few years. And it's all reserved for woodpeckers. Other kinds of birds can't get grubs out of these trees.

Perfect combination: The burn has attracted several black-backed woodpeckers. 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 with 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 across. It is a warm, safe place to raise our young.

While we work on the nest hole, we also remove the bark from around the entrance hole. The smooth, slippery surface of this "door frame" will make it hard for squirrels and other predators to get in!

Room available: Everything is finally ready. I lay 3 white eggs in the bottom of the nest cavity. We incubate them for 12 days, and then 3 lovely nestlings hatch out. My mate and I work hard to care for them, making many trips to the nest with food. Besides eating lots of beetle larvae, the nestlings eat insects that we pick 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 to learn 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 among the many kinds of animals that raise their young in old woodpecker cavities. One of them will surely move in next spring.

Now you know why a recent burn of is my kind of place. Next time you see one, listen for my busy hammering and look carefully for me on the blackened bark. I'll be there!

Male black-backed woodpecker at a nest after fire in California. Photo courtesy of Martin Meyers.

FIRE FACTS: Stand-replacing fires in lodgepole pine forests create perfect habitat for black-backed woodpeckers. In fact, the habitat is so good that many pairs can nest within a single burn. Why not? A great supply of grubs is available right under the bark of the dead and dying trees.

The woodpecker must also find a good nest tree near these food-rich trees. Only rotten trees are soft enough to excavate, so they usually nest in rotten trees in the middle of a dense clump of burned trees.

The black-backed woodpecker must make its home and raise young quickly because this great arrangement will only last 5 or 6 years. After that, there will be fewer beetles feeding on the dead trees. And once their food supply is gone, so are the woodpeckers! They will look for a more recently burned forest that offers more beetle larvae.

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Black Cottonwood

(Populus balsamifera subsp. *trichocarpa)*

Cottonwood seeds ready to "fly". Photo by Bill Cook, Michigan State University, Bugwood.org.

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 a long way on the surfaces 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 you find me 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. They are about 10 centimeters long and almost as wide. In spring, 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.

Mature black cottonwood. Photo by Dave Powell, USDA Forest Service, Bugwood.org.

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, so we are 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 to eat. It helps to keep me from becoming someone's dinner!

Growing points: I have growing points all over the place: at the tips of my branches, in buds that produce leaves and

flowers, at the base of my trunk, 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 grow into seeds). I don't have to reproduce from seed though. I can sprout new plants from my roots and the base of my trunk. I can also grow from broken-off branches. A cottonwood branch stuck in the wet sand on a river bank may really be a brand-new tree.

My calendar: My flowers appear in March and April. My leaves unfold soon afterward. After a couple of months, I release my cotton-borne seeds. In August or September, my leaves turn yellow, so a stand of cottonwoods looks like it has 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 cool enough for fish. I provide high branches where song birds build nests, and my soft inner wood is the perfect place for woodpeckers' nest holes. Beavers use my branches to build their lodges.

Large and small mammals eat my buds and twigs. Rabbits eat my cambium. The tiny animals living in the river bed eat my leaves. I protect the river itself by holding tight to the 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, and furniture. Because I grow so fast, I'm used to make paper products. People can also use the sticky, sweet-smelling resin from my buds to treat sore throats and coughs.

Cottonwood seedling (left) growing in a hole left by a burned tree root. Photo by Jane Kapler Smith, U.S.D.A. Forest Service.

What does fire do to me? My buds and cambium are sensitive to heat, so fires often kill my above-ground parts. But fires don't usually kill all of my roots. After a fire, dozens of stems may sprout from my scorched trunk.

Life is good for me after fire. My new sprouts have plenty of sunlight, and my root system provides them with lots of water so they grow fast. To take advantage of all the sunlight, I might grow huge, plate-sized leaves in the first few years after fire.

BOTANICAL FACT: Floods are very good for a cottonwood tree's health. When floods sweep through a riverbed, they clear out the old brush and deposit fresh, moist gravel bars—the perfect place for new cottonwood trees to grow.

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Black fire beetle

(*Melanophila acuminata*)

Fire seeker. When most other animals run from a forest fire, I head straight for it. That is because I love fires, especially crown fires! There are many other fire-loving insects. Unfortunately for me, some of these insects follow fires so they can eat me!

Many of the beetles in my family are spectacularly dressed in a rainbow of glossy, iridescent colors, which is why our family is called the "jewel beetles". But I am just plain black. My scientific name, Melanophila, means "black-loving" not because I am black, but because I lay my eggs in the freshly burned, blackened wood found in burns.

Black fire beetle. Courtesy of AG Prof. Schmitz, http://idw-online.de/pages/de/image73525

Smoldering nurseries. As soon as I detect a fire, I rush there. I especially like fires that burn a lot of trees, like crown fires. I mate near the glowing wood and hot ashes, and then I lay my eggs under the bark of the freshly burned trees. The trees may still be smoldering when I find my way in! I am not fussy about the kind of tree in which I lay my eggs. I lay them in many kinds of conifers, including pines, firs, and spruces.

Black fire beetles may use many kinds of burned conifer trees to lay their eggs. Image by Glacier National Park Fire Management.

My eggs need to cool through the winter before my larvae can develop. These short, thick, white, wormlike babies begin to grow in spring. They eat the phloem of recently killed or weakened trees. They cannot eat the phloem of healthy trees because the trees are protected by special chemicals.

Most of my offspring emerge from under the bark during the first year after the fire. However, they may emerge over several years even though I laid all

of my eggs at the same time. If larvae do not emerge the first year after fire, they hibernate until they are ready to emerge.

Not all of my larvae grow to be adults. Woodpeckers arrive at a burned area soon after we do. When they pry the bark away from the burned trees, they uncover millions of eggs and larvae. It is enough food for breakfast, lunch, and supper every day for two or three years! Black-backed woodpeckers are so fond of beetle larvae that they move in right after a fire, stay for a few years until our populations go down, and then move to another, more recent burn.

Built-in smoke and heat detectors. I can be found everywhere in the Northern Hemisphere where forest fires occur. Even though I am just the size of a bean, I can fly long distances. This helps me find forest fires from far away. I also have two body parts that help me find fires. First, I have antennae that are very sensitive to smoke. I can detect just a few parts per billion of smoke particles in the air. This is like sensing a single drop of orange juice in a backyard swimming pool! Second, I have sensors in little pits on each side of my thorax that detect heat. These features can help me find forest fires from up to 12 kilometers away! It was not until the 1960s that scientists figured out how I find fires. Once they realized how impressive I am, the U.S. Air Force began studying me to improve their heat-sensing technology.

Fire Facts: Black fire beetles swarm by the thousands toward fires. The bigger and hotter the fire, the more likely they are to find it. They are a nuisance to firefighters throughout the fire season, latching onto their clothes and biting them. Perhaps the firefighters should have pet woodpeckers to keep them company!

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Blue Huckleberry

(Vaccinium membranaceum)

Photo by Keir Morse.

I am a shrub native to the United States. I live mostly in the northwestern United States and western Canada. I like places with moisture in the soil, but I don't like my habitat to be actually wet. I am a perennial plant, which means I grow for many years.

You can find me in many kinds of forest. In the northern Rocky Mountains and the North Cascades, I am especially common in forests with lodgepole pine, subalpine fir, and Engelmann spruce. I love big, sunny openings in these forests. That's where I produce my best berry crops.

What do I look like? I can get to be more than a meter tall, but often I'm much shorter. I have woody stems with bark that gets flaky as I get older. Eventually it begins to peel off in shreds.

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

Growing up: I can grow from seed, but that is not the way most blue huckleberry plants get started. Most of us sprout from underground stems called rhizomes. Rhizomes are very important to our survival, because that is how we start new plants if our tops are killed off by browsing animals or fire or other causes. When my seedlings are very young, they don't grow rhizomes because they are too busy establishing strong roots and stems. When they are about 3 years old, they finally begin to grow rhizomes. These usually grow in the top 15 centimeters of soil, but some grow more than 20 centimeters underground.

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 of the buds that produce leaves and flowers, in my rhizomes, and in my roots.

My calendar: My leaves unfold from their buds in spring. My flower buds emerge at the same time, because I am in a hurry to blossom as soon as possible in the summer.

By early summer, my leaves are full-sized and my flowers are already open, welcoming pollinators. Bumblebees and honeybees drink my nectar and then pollinate my flowers as they fly from one blossom to another. Elk and mule deer stop by to eat my leaves. I also provide hiding places and shelter from storms for grouse, small birds, and small mammals.

Six weeks after flowering, I have ripe berries to share with my

Photo used with permission.

neighbors. It seems like everyone in the forest wants to harvest my berry crop. Here are a few: grizzly bears, 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.

I welcome all of these visitors because they will distribute my seeds for miles around. You see, they can digest the sweet, juicy part of my berries, but they cannot digest my seeds. These will pass right on through and be deposited wherever the animals stop to poop. In late summer, bears leave piles of purple poop everywhere they go. The seeds may germinate and begin growing right away, before the snow flies.

My leaves turn red in late summer. From far away they make the mountainsides look like they're carpeted with scarlet. Through the fall and winter, elk and mule deer eat my twigs.

People food: People harvest my berries too. They have done so for thousands of years. You can eat the berries right off the bush, of course, but you can also dry and store them. Many people freeze huckleberries, can them, or make them into jams and jellies. That way, they can enjoy little tastes of summer all winter long!

Photo by Keir Morse.

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 just a few weeks after a surface fire. But where severe fires burn heavy fuels or smolder for a long time, my rhizomes are likely to be killed.

Life after fire: After a low-severity surface fire, I might be able to sprout and produce berries in just a year or two. But after a severe fire, I may need to grow for 20 years or more before I am strong enough to produce a lot of berries. Once I get started, I will produce good berry crops every few years until the trees grow tall enough to shade me.

When I'm living in shade, I can survive for many years and continue to sprout new plants, but I won't produce many berries. I will welcome the next fire because it will give me more sunlight, just as I welcome the animals that eat my berries every year because they distribute my seeds.

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Clark's Nutcracker

(Nucifraga Columbiana)

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. It is amazing that he witnessed the one activity that is essential to my way of life!

Photo by Nadine Hergenrider.

Every year in late summer and fall, I spend nearly all my time harvesting whitebark pine seeds (also called pine nuts). Only when most of the cones are harvested and the nuts carefully buried underground do I finally take a break.

This nutcracker's sublingual pouch is bulging with whitebark pine seeds. Photo by Nadine Hergenrider.

Nuts about nuts. Why am I so nuts about whitebark pine nuts? They are my main food through most of the year, but they are on the trees for only a short time. I have to work really hard to collect and hide a whole year's supply of pine nuts in just 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 rather than falling off when they're ripe. Second, the pine nuts stay inside the cones 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 to get the nuts out.

It is easy to hammer off the thick scales on the cone, thanks to my long, chisel-shaped bill. Once the scales are broken, I use my bill like a pair of tweezers to pluck out the pine nuts. One by one, I collect them in my mouth.

Here is the tricky part: I don't eat them! Instead, I send them on a detour. I place them into a specially designed pocket under my tongue. It is called a sublingual pouch. Only nutcracker species have these special storage places, and mine is bigger than that of any other species!

My sublingual 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 shall I put all of them? This is important. 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 high-elevation forests work best. Ridge tops are great because they may stay free of snow for much of the winter. Recent burns are great because snow melts off quickly in the spring. I might fly 30 kilometers or more to find the best places for burying my treasures. A full pouch is a very heavy load, but I'm a very strong flyer.

When I reach my cache site, I use my bill to make a small hole in the soil. Then I push pine nuts up from under my tongue and poke them into the hole, one by one. Once I've stuffed in 3 to 15 seeds, I cover them up and move a little way to make another cache. I repeat this until my pouch is empty. Then I'm off to get more seeds.

When I'm done harvesting for the year, I have created thousands of seed caches containing maybe 20,000 to 100,000 seeds. That should be enough to feed me 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 each 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 be able to support a family. In February, when my mate and I start nesting, our forest is still a winter wonderland. But we depend on buried seeds to feed our young from birth until the new nut crop ripens in late summer. Don't worry! Our young will have plenty to eat. Even where deep snow covers the caches, I can tunnel through the snow and be right on target. My search-and-find talents are simply amazing!

Most of my caches are safe from animal burglars because they're in big openings. Hungry red squirrels and other animals know better than to rob a cache buried out in the open. A golden eagle might have that squirrel for lunch!

Tough old bird. 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 was already difficult in the high subalpine forests. But now my tough life has become even tougher!

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

When fires at high elevations are severe, they kill most of the whitebark pines and eliminate part of the nutcracker's food supply. When the fires are patchy, some trees are likely to survive, but the food supply for the nutcrackers may still be limited because of white pine blister rust. The birds may fly to lower elevations and feed on limber pine or ponderosa pine seeds in order to survive.

Large burns reduce the nutcrackers' food supply, but they provide great cache sites. Nutcrackers plant thousands of whitebark pine seeds in the middle of large burns. This technique works much better than relying on wind to deliver seeds, which is what other tree species do. Someday the caches that nutcrackers leave behind will grow into trees that produce pine nuts for future generations of nutcrackers.

Aundant whitebark pine seedlings grow from nutcracker caches in a stand of dead trees. Photo by Ilana Abrahamson.

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Douglas-Fir

(Pseudotsuga menziesii var. *glauca)*

Two kinds of Douglas-fir trees live in the United States. I am the "Rocky Mountain" kind of Douglas-fir. The other kind, "coast Douglas-fir," lives closer to the Pacific Ocean.

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 scientific name (menziesii) comes from one of these scientists, and its common name (Douglas-) 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 my range.

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 one of the biggest evergreen trees in the northern Rocky Mountains. I can grow to be more than 30 meters tall, and my trunk can be more than a meter thick. My needles are flat and short, 2 to 3 centimeters long. The buds at the tips of my twigs are pointed and rusty-brown in color. My pointy buds can help you tell the difference between me – Douglas-fir – and "true" firs like subalpine fir. The buds at the tips of their twigs are rounded, not pointy like mine.

Douglas-fir buds: Paul Wray, Iowa State University, Bugwood.org.

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.

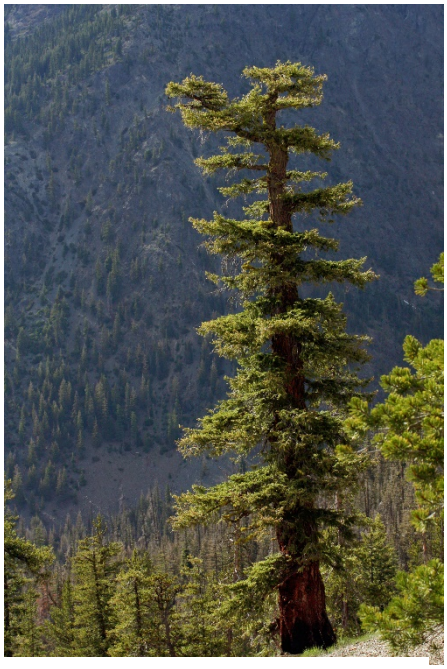

Photo by Walter Siegmund.

Some of my roots grow close to the soil surface, sometimes in the duff layer. Other roots grow deep into the soil.

Growing Up: I begin life as a seed. My seedlings can become established in bare soil and also in soil covered by litter and duff. I grow best where there's a little shade overhead.

If I am living under a lot of shade, I grow slowly. My trunk is thin, and my branches don't have many needles. Dense patches of such spindly trees are called thickets. I don't look great when I grow like this, but I'm stubborn, so I can live a long time even in deep shade.

Thicket of Douglas-fir seedlings. Dave Powell, USDA Forest Service, Bugwood.org.

How do I reproduce? I'm a conifer, which means I put my seeds in cones. My light

Douglas-fir cone. Mary Ellen (Mel) Harte, Bugwood.org.

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 out of the cone. My seeds can travel 100 meters or more before they land.

The wings on my seeds peek out from under the cone scales. They look like tiny mouse feet and tails, where the mouse is trying to hide but can't quite fit inside.

My calendar: My new leaves begin to unfurl from my buds in spring. Within a few weeks, they are full grown. I will keep these leaves for a few years and add more next spring. By early August, next year's leaves are already stored in the buds at the tips of my branches.

While my leaves are emerging in spring, new cones are also beginning to grow. By the end of August, they have grown to full size and are filled with ripe seeds. I can grow more than 1,000 cones every year, and each cone could hold 20 seeds or more. Can you figure out how many seeds I have produced in your lifetime?

My seeds fall to the ground in autumn, 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 feed 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 of the Douglas-firs in the forest have died. We haven't, though. Many of us will survive and grow a whole new crop of needles the next year.

Fungi use the nutrients stored in my roots. Armillaria root fungus can slow my growth and even kill me. A tiny plant called "dwarf mistletoe" grows on my branches. This shrub sinks its roots into my branches to get water and nutrients, so it never has to come to the ground. I provide hiding places and shelter from storms for bighorn sheep, elk, and deer, especially during winter. Deer, elk, and moose eat my leaves in winter, when other food is scarce.

People use my long, straight trunks to build their homes. They use small trees for plywood, fences, and firewood.

What does fire do to me? My branches grow close to the ground, especially when I am young. Sometimes the low branches act like ladders that let surface fires climb into the crowns of the tallest trees in the forest.

When I am young, my thin bark cannot protect my cambium from fires. But as I get older, my bark thickens. After I turn 40 or 50 years old, my bark is thick enough to help me survive surface fires. Surface fires can still kill me though, if I have grown my roots in the duff on the forest floor. If the duff burns, those shallow roots will burn too. I may die right away, or I may become so weak that bark beetles can kill me. Or I may fall over because I don't have enough roots to hold me up straight.

I can begin growing from seed right after fire, but pines grow faster than I do for the first 20 to 30 years after fire. After that, I can take off and zoom upward unless I'm too crowded by other plants. I will grow taller every year until I'm more than a hundred years old. I can live to the ripe old age of 400!

Reference: Steinberg, Peter D. 2002. Pseudotsuga menziesii var. glauca. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: https://www.fs.fed.us /database/feis/plants/tree/psemeng/all.html.

Citation: Smith, Jane Kapler. 2000. Douglas-fir. In: FireWorks encyclopedia. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p.

Douglas-Fir Dwarf Mistletoe

(Arceuthobium douglasii)

When you hear "mistletoe," you may think that I am 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.

Witches'-brooms formed by Douglas-fir dwarf mistletoe. Photo by Oscar Dooling, USDA Forest Service, Bugwood.org.

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

What do I look like? I'm very small, and I grow on tree branches – sometimes high in the crowns. You have to look carefully at a Douglas-fir to see me.

First, 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 tree branches. All together, they 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 the witches'-brooms in this photo?

Once you've found my home branch, you can look for me. Scientists say I'm 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 cannot 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."

Douglas-fir dwarf mistletoe shrub growing on Douglas-fir branch. Photo by Oscar Dooling, USDA Forest Service, Bugwood.org.

Growing Up: Mistletoe plants have a spectacular start in life. When our seeds are ripe, we can't just drop them to the ground, because they can't live there – and they certainly can't

climb up into the treetops by themselves! We have to get them to another Douglas-fir branch. Here's how we do that:

As our seeds ripen, we pump water into the ends of the stems that hold them. When the seeds are ready, this little water tank pops open and launches the seeds, like tiny rockets, out among 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.

Our 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, they start growing. They make roots that form little bulges on the twig. Then they send smaller, thread-like strands right through the twig's bark into its cambium. That's where they can finally get water and nutrients.

Flowers of Douglas-fir dwarf mistletoe. USDA Forest Service - Ogden Archive, USDA Forest Service, Bugwood.org.

When I was young, I grew inside a twig for two years before I began to poke my little stems out into the air. I was four years old before I made my first flowers and seeds.

After I got a good start on my host tree, I stole a lot of nutrients that the tree could have used. Leaves on the branches above my witches'-brooms thinned out, and the branches slowly died. The tree's growth slowed down. It is weak enough now that it might be killed easily by drought or insects. Eventually, of course, it will die from starvation, since I'm taking all of its nutrients. I will die then too, but I'll leave thousands of young mistletoe plants on nearby Douglas-fir trees.

My calendar: My flowers come out in spring. More than a year later, in mid-summer, my seeds are ripe and ready to be launched from my little water-rocket stems.

Am I useful? Many kinds of insects eat my stems and flowers. So do blue grouse and chickadees. 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 can carry my sticky seeds much farther than I can launch them on my water rockets.

What does fire do to me? Surface fires and ground fires don't affect me much unless they kill my host tree. Then I die, of course. Crown fires are very bad for all of the mistletoe plants in the neighborhood. They kill all of us and our host trees in one fell swoop. It will be decades before we can grow there again, but we'll do it. Here's how:

Even if all of the mistletoe plants in a burn are dead, there are probably many growing on Douglas-firs nearby, outside the burn. In super-slow motion, they will "invade" from the edges. They will launch thousands of seeds every year. The seeds will only travel a few meters, and they can't begin to grow until there are Douglas-firs in the burn to be their host trees. Once they get established on a good host tree, they must grow for a few years before they can make seeds, and then they must launch their seeds further into the burn in hopes that they'll land on another Douglas-fir instead of a pine or a tall shrub, or even bare soil. Scientists say that I move into the new forest at a rate of about half a meter per year. It takes a lot of patience to take over a forest, but if our host trees are there, we can do it!

Citation: Smith, Jane Kapler. 2000. Douglas-fir dwarf mistletoe. In: FireWorks encyclopedia. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p.

Elk

(Cervus elaphus)

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! My all-time favorite name 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 they weigh almost 20 kilograms. Even with this big, heavy rack on top of my head, I'm amazingly quiet and swift as I move through the trees.

I shed my antlers each fall after the mating season. Each spring I grow a new set. 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 more than 300 kilograms, and I stand a meter and a half tall at the shoulder.

It takes lots of food to fuel a huge animal like me. I'm an herbivore. That means that I eat mainly plants – especially grass. During the early morning and late evening hours, you can find me eating in meadows and other openings in the mountain forests.

The more, the merrier: Feeding out in the open is a very risky business because of predators, 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 bands of 3 to 6. Large bulls like me spend most of the year alone, except during mating season.

Being in a herd is a safe way for elk to live, because its many pairs of eyes and ears are constantly checking for danger. If a predator is lurking nearby, someone in the herd will probably notice and alert everyone else. An elk herd even stays together when it's running away from danger. A disappearing rump patch tells everyone which way to go!

I'm so big that the only predators I worry about these days are mountain lions. Bears, coyotes and wolves can mean trouble for young calves, but not for me.

Bull elk in fall. Photo by Terry L. Spivey, Terry Spivey Photography, Bugwood.org.

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, but 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 gets crowded too. Many elk gather here, so it's hard to get enough food to survive.

When I arrived last fall, I ate the yellow aspen and cottonwood leaves that were still on the trees, and I grazed on the dried grasses and forbs. They were plentiful then.

By early winter, the herd had eaten the most nutritious food. Then we 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 shrubs were soon eaten. I found shelter from the storms at the base of a big tree, where the branches kept the snow from piling up. But I was hungry much of the time.

Then we moved back down to the grasslands. We went over every square meter for a second time. We looked for tidbits that we had missed the first time. We ate plants that didn't seem very appetizing earlier in the winter, but we found that any food was better than no food at all!

Follow the melting snow: When spring came, I followed the melting snow up into the mountains. My first stop was 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, green food is

a welcome change. I love to eat the new leaves of bunchgrasses and arrowleaf balsamroot. They're tasty and nutritious, and they're very abundant after a fire has gone through!

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.

Elk band grazing. Note burned snags in background. Photo by Terry Spivey, USDA Forest Service, Bugwood.org.

Summertime, and the livin' is easy: I really look forward to summer. I'm up in the subalpine forests and meadows then. I spend a lot of time alone. The rest of the herd spreads out through the mountain meadows and openings. Nutritious bunchgrasses grow everywhere. I enjoy nipping off the tops of beargrass flowers to eat. All of our food is lush and green and delicious.

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

Where have all the green plants gone? The abundant green plants don't last long in the high country. By early autumn, plants in the open meadows have frozen or dried out. I head for forest patches because some of the plants are still green there.

Heavy snows in the high country soon push me toward winter range again. I'll hide out in the dense lodgepole pines during hunting season. Then I'll move to the ponderosa pine forest and grasslands, completing my annual circle of migration.

Bull elk browsing in late winter. USDA Forest Service, Northern and Intermountain Region, USDA Forest Service, Bugwood.org.

FIRE FACTS: Elk cover great distances and use many kinds of habitat in their yearly migration. A landscape with lots of variety is ideal. Fires are good at creating this kind of habitat. Where fuels are heavy, fires burn hot and create openings — some big, some small. Where fuels are sparse, fires spread slowly and leave patches of forest and meadow unburned.

Sunlight is plentiful in recently-burned areas. 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 prefer recent burns to other kinds of habitat as long as they can find shelter in trees nearby.

Reference: Innes, Robin J. 2011. Cervus elaphus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: www.fs.fed.us/database/feis/mammal/ceel/all.html.

Citation: McMurray, Nancy E. [n.d.]. Elk. In: FireWorks encyclopedia. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p.

Engelmann Spruce

(Picea engelmannii)

I am one of the largest conifers living at high elevations in the Rocky Mountains and the North Cascades.

My size depends a lot on moisture. The wetter my home is, the bigger I can get. When I am full grown, I may be 30 or 40 meters tall, 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 bluish-green and my bark is purplish-brown. It is thin and flakes off in rounded scales as I grow up.

You'll be sorry if you grab one of my branches! My needles are short and strong, and they have sharp, pointy tips. That's why people call me "sticky spruce."

Photo by Dave Powell, USDA Forest Service, Bugwood.org.

Photo by Dave Powell, USDA Forest Service, Bugwood.org.

Where do I live? I am native to the western mountains of North America. I grow 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.

BOTANICAL FACT: At high elevations, severe winds and winter ice cause many kinds of trees—including Engelmann spruce—to grow in a strange form. They are short because icy winds shear off their tops. Their low branches form a floor-length skirt along the ground, where snow flattens them each winter. Their crowns are one-sided because winter storms kill the branches on their windward sides. This kind of forest is called krummholz, meaning "crooked wood" or "twisted wood."

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 about 7 centimeters tall. Five-year-old pines nearby were nearly a meter tall by then, and aspens the same age towered over me. 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! But I was persistent and continued to grow. After a couple hundred years, I reached a

grand height of 40 meters.

My calendar: I usually produce pollen in June. My cones grow all summer, then open and release seeds my in the fall. My seeds have long, papery wings that help them float away on the wind. They might go 100 meters before they land. If they fall on some early-winter snow, they might be able to skate 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.

Trunk of fire-killed Engelmann spruce. Photo by Dave Powell, USDA Forest Service, Bugwood.org.

Am I useful? Small mammals and birds find my seeds delicious. Deer, elk, moose, bighorn sheep, and bears all like me – but not necessarily for food. They like the shade I provide in summer and the protection I offer during storms. They also like to hide from predators behind the dense, low branches in a stand of spruces.

My bark can be used to make canoes, baskets, and roofing. Sometimes my roots are used to make rope. My needles and boughs provide fresh-smelling incense, and they can be made into perfume 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, the heat from a fire will probably kill my shallow roots or climb from the ground through my dense, lichen-covered branches into my crown. If one spruce tree is ignited, its neighbors are likely to burn because our little patch of moist ground is crowded with trees.

Even if I manage to survive a fire, I'll never be the same. I'm likely to catch some fungus spores in places damaged by fire. These will rot my wood 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.

Reference: Uchytil, Ronald J. 1991. Picea engelmannii. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: https://www.fs.fed.us/database/feis/plants/tree/picengl/all.html.

Citation: Smith, Jane Kapler. 2000. Engelmann spruce. In: FireWorks encyclopedia. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p.

Fireweed

(Chamerion angustifolium)

I am a perennial flowering plant, which means I can live for many years. I live in cool forests in North America. In the western United States, I live in every state except Texas. I like forests with lodgepole pine and subalpine fir because they are cool and sometimes moist. You can often find me growing in "disturbed" areas like recent burns or roadside gravel.

What do I look like? I grow 1 to 2 meters tall. I have a single stem with many narrow leaves. My bright pink flowers grow at the top of my stem in tall 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.

Growing Up: I begin life as a seed. In my first year or two, I grow a rosette of leaves, so I'm shaped like a small dandelion plant with no flower. At the same time, I grow my hair-like roots and my very important underground stems called rhizomes. Rhizomes help me get water and minerals from the ground, and they can also sprout brand-new plants. This means that, after a few years, I develop into a big patch of fireweed,

Fireweed seeds. Photo by Snežana Trifunović.

Fireweed flowering. Photo by Terry Spivey, USDA Forest Service, Bugwood.org.

with every plant identical to me!

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

My calendar: When the soil has thawed, my roots begin to grow. They start growing when it is still very cold out, before my leaves can survive above ground! My stem comes up in early spring, and a month later my leaves are full grown. That's when my flowers come out. In another month, I will 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

Photo courtesy of Wknight94.

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.

People can use 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 deep 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 right away. 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.

Reddish-green "rosettes" are seedling fireweed plants 1 year after fire. Photo by Garon Smith.

The year after a fire, you might find hundreds of little seedling rosettes carpeting the blackened soil.

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.

Reference: Pavek, Diane S. 1992. Chamerion angustifolium. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: https://www.fs.fed.us/database/feis/plants/forb/chaang/all.html.

Citation: Smith, Jane Kapler. 2000. Fireweed. In: FireWorks encyclopedia. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p.

Flammulated Owl

(Psiloscops flammeolus)

I'm pretty unusual for an owl. Most owls are meat eaters – that is, carnivores. After eating, they cough up pellets that are full of the undigested bones of small mammals and birds.

But I'm not a carnivore. No old bones for me, because I'm an insectivore! I eat insects and nothing else. Since I'm awake and hunting for food at night, I only eat the insects that are active at night. I have excellent night vision, so I can find insects when it's too dark for you to see much at all.

Photo by Michael Woodruff.

My favorite foods are those fuzzy moths that flap around lighted windows in the spring and early summer. Yum-m! Grasshoppers are good too, especially in the late summer, when there are so many of them.

Here's another thing about me that's different. Most owls live in the same place all year d. But I can't stay in the northern Rocky Mountains or the North Cascades all year. Where would I find enough insects to keep me alive in January? I have to fly south to find food in winter. I need places where the weather stays warm and the insects are active all year. My favorite wintering areas are in Mexico and Guatemala.

Tree scout. When spring begins in the northern Rocky Mountains and the North Cascades, the snow melts and the insects begin to hatch. That's when I fly back north to my summer habitat, which is dry forests with ponderosa pine and Douglas-fir trees. These forests supply everything I need for nesting and raising my young.

I like to nest in a hole in the trunk of a big tree. Giant old ponderosa pines are perfect. They are strong and tall, so my nest can be out of reach from any ground-based predators. Also, they are likely to already have some rot in their heartwood, which means they may already have holes that I could nest in. My small bill isn't designed for excavating wood, so I need a hole that someone else has already made. When I spot one, I hope no one else has gotten there first!

My favorite nest holes are the cavities made by pileated woodpeckers. With their strong, chisel-like bills, these large woodpeckers chip out roomy nest cavities – usually in large, soft-centered tree snags. But they only use their nest cavities for one nesting season. After that, it's up for grabs, and it's a perfect fit for my mate and me. Thank you, pileated woodpeckers!

Young mouths to feed. My mate lays a clutch of 2 to 4 creamy white eggs in early May. She incubates them for 27 days, keeping them warm day and night. I bring her all the food she needs. After the babies hatch, both of us take care of them.

Photo by Michael Woodruff.

It's a full-time job for both of us to deliver enough food to feed those hungry mouths. I'm glad that our nest tree is surrounded by an open forest of large, old ponderosa

Photo by Dave Menke.

pines and Douglas-firs, because lots of insects live in this kind of forest and its grassy openings.

The old trees that we like best are widely spaced, with lots of room between their crowns. We like to fly between their branches, swooping on moths and other flying insects. We catch these foods right out of the air.

As our babies grow, they learn to fly and find their own food. This takes a lot of practice. Remember, all of our hunting happens in the dark! First, our young learn to hunt grasshoppers in the openings between patches of trees. They perch on low branches and pounce on the grasshoppers from there. That is much easier than catching insects in the air. As they become better fliers, they learn to hunt moths and other insects "on the wing."

During the day my mate and I – and our babies when they are big enough to fly – like to rest huddled up against the trunks of big trees. This is called roosting. Our brownish-orange feathers blend nicely with the bark of ponderosa pines. We also roost in thickets of young Douglas-fir trees. If we're lucky, predators won't spot us there.

By autumn, our babies are on their own. It is very hard for them to survive until their first birthday. Many will die during the migration south or on the way back north in spring. The ones that survive this first year are likely to live several years more. Many of us get to our 7th or 8th birthday.

FIRE FACTS: For hundreds of years before 1900, surface fires burned through dry ponderosa pine/Douglas-fir forests quite frequently— sometimes every 5 years or so. These fires killed many of the small trees, so the forests had lots of grassy openings. The large trees survived easily because of their thick bark and high branches.

The trees that survived fires had ideal growing conditions: plenty of water, soil nutrients, and space to grow even bigger. They often lived for hundreds of years. By that time, many had broken tops and rotten heartwood, which made them easy for woodpeckers to excavate. There were also many dead snags. The combination of big trees, snags, grassy openings, and occasional thickets of young trees formed perfect habitat for flammulated owls.

Reference: Wright, Vita. 1996. Multi-scale analysis of flammulated owl habitat use: Owl distribution, habitat management, and conservation. Missoula, MT: The University of Montana. 91 p. Thesis.

Citation: McMurray, Nancy E. 2000. Flammulated owl. In: FireWorks encyclopedia. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p.

Glacier Lily

(Erythronium grandiflorum)

I am a flowering plant in the lily family. My scientific name means "red-tinged, big-flowered plant". "Red" actually refers to one of my relatives, which makes deep red flowers. As you can see, my flowers are sunny yellow. If you look closely, though, you might find red pollen at the tips of my stamens.

My two long, wide, smooth leaves sprout right up from the ground in spring. Then my flowers come out, with their 6 soft petals. You can tell I'm in the lily family because all lilies have 3 or 6 petals. I grow to be about 20 to 40 centimeters tall.

Photo by Vernon Smith.

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, but I don't produce many flowers there. I grow much better – and produce lots of flowers – in open, wet meadows.

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

Growing up: I start growing from seed, but soon I grow a roundish underground stem called a corm. The corm stores nutrients for me through the long winter. That way, 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, so it's not easily killed by winter's cold, summer's heat, grazers that bite off my tops, or forest fires.

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 can reproduce from seeds and also from sprouts that grow out of my corm.

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

Am I useful? Bees and hummingbirds eat my pollen and drink my nectar. Grizzly bears dig up my corms and eat them in the spring and fall. It takes a lot of corms to feed a hungry bear, so the meadows where bears have 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. People can also crush my roots and use them to treat wounds.

What does fire do to me? When fires come to the mountainsides where I live, it is usually late summer. By that time, my leaves are brown and dry, and I don't need them anymore. The leaves burn, of course, 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 the nutrients left in the ashes. I thrive in the new forests that develop after severe fires, and I persist in old forests too. Come to the mountains in springtime to see my bright yellow flower show!

Reference: Williams, T. Y. 1990. Erythronium grandiflorum. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: https://www.fs.fed.us/database/feis/plants/forb/erygra/all.html.

Citation: Smith, Jane Kapler. 2000. Glacier lily. In: FireWorks encyclopedia. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p.

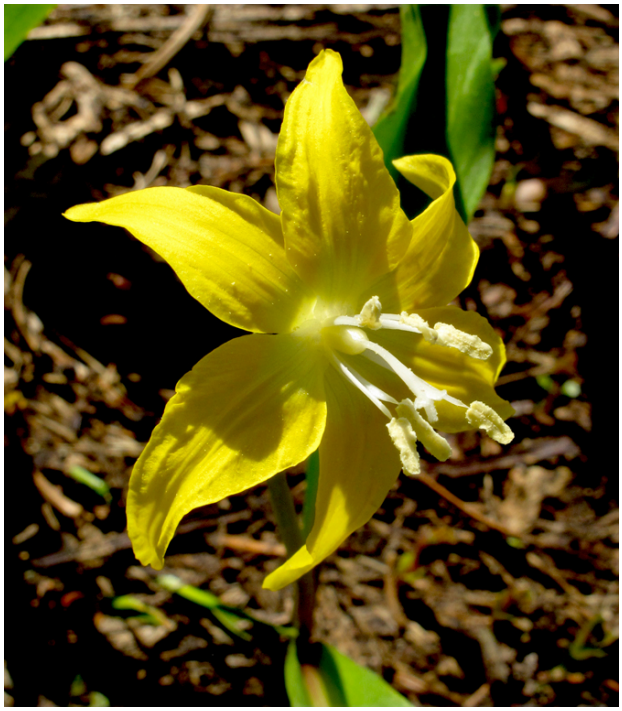

Photo by Vernon Smith.

Grand Fir

(Abies grandis)

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 United States, 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, moist 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 scales that could be green, yellowish, or purple. They are very, VERY sticky. They grow only in the tree crown. 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.

Photo by Chris Schnepf, University of Idaho, Bugwood.org.

Animal Facts: Moose are about the only large animal that prefers forests of big, old grand fir to other habitat. Two rare birds of the Pacific Northwest, the Northern spotted owl and the Marbled murrelet, also like to live in this kind of forest. 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.

Cones of grand fir. Photo by Dave Powell, USDA Forest Service, Bugwood.org.

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! Can you grow that fast?

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 are so dry that they fall apart on the tree. This frees the seeds so they float to the ground.

My cones never fall to the ground. When winter begins, you can see the woody spine at the center of each cone sticking up from its branch. It looks a little 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 yellow-green and very tender.

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

Grand fir foliage. ©2008 Timothy D. Ives. Used with permission.

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

People can collect pitch from my branches to use in medicines. They 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 a wimp. 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 for us. But give us the right growing conditions, and soon we'll be producing shade for other forest inhabitants—squirrels, chipmunks, moose, and deer.

Reference: Howard, Janet L.; Aleksoff, Keith C. 2000. Abies grandis. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: https://www.fs.fed.us /database/feis/plants/tree/abigra/all.html.

Citation: Smith, Jane Kapler. 2000. Grand fir. In: FireWorks encyclopedia. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p.

Grizzly Bear

(Ursus arctos horribilis)

Photo by Terry L. Spivey, Terry Spivey Photography, Bugwood.org.

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 she went in to stay. The new snow buried the entrance, so it was completely hidden. Inside the den it was dark, but it was also warm and snug. What a comfortable, safe place for my brother and me to be born!

A small start: I was about the size of a rat when I was born— much smaller than most human babies. 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. Then it was time for my family and me to head out of the snowy high country and see what food the melting snow might uncover.

Grizzly sow and cubs.Courtesy of Glacier National Park.

I'm an omnivore. That means 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. Here are some of her lessons:

Low-elevation meadows are wet in the spring, so they provide juicy new grasses and horsetails when we first come out of the den. As the weather warms and the snow melts, wildflowers cover the mountainsides. Glacier lilies are some of my favorites. 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 farmer's plow 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. Eating 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.

Grizzly bear resting. Photo by Terry Spivey, USDA Forest Service, Bugwood.org.

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 hardly move at all during this time, 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. We sometimes roam over hundreds of square kilometers searching for food. We learned where to look from Mom, of course!

Openings in the forest are rich in bear foods. These areas include shrub fields, ridge tops, avalanche chutes, wet mountain meadows, and hillsides. We just hang out and eat until all the food is gone. Most of the time we forage at night, out in the open. After the sun rises, we rest and sleep in a "daybed" in the nearby forest, avoiding the hottest part of the day.

Big three year-old. I'm into my third year of life now, and 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 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. What a family that would be!

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 good berry patch, and 30 or 40 years later it might 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 rest in during the day.

Reference: Snyder, S. A. 1991. Ursus arctos horribilis. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: www.fs.fed.us/database/feis/animals/mammal/urach/all.html.

Citation: McMurray, Nancy E. 2000. Grizzly bear. In: FireWorks encyclopedia. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p.

Grouse Whortleberry

(Vaccinium scoparium)

I am a shrub, but I'm so short that you might not even notice me, standing about 20 centimeters "tall" on the forest floor.

My English name mentions the grouse, because that is one of the many animals that eats my berries. The scoparium part of my scientific name means "like a broom". That is because my thin, woody twigs branch out right from my base, so I look a little like an upside-down broom.

Grouse whortleberry flowers. Photo by Dave Powell, USDA Forest Service, Bugwood.org.

Where do I live? I am native to the high-elevation forests of the western 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'm not a showy plant, so you'll have to look carefully for me. Watch for a short shrub with small, emerald-green leaves. When I'm young, my branches are bright green, almost the same color as my leaves. When I get older, they turn brown.

My flowers are hard to see because they are very small, less than half a centimeter long. They hang from my stems like pinkish-white, oval bells.

My only features that show off a little bit are my berries. They are bright red. But, just like the rest of me, they are very small. It could take you a long time to pick a handful of my berries, but the result would be worth the effort. When my berries are ripe, they are 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? Once in awhile I grow from seed, but most new plants of grouse whortleberry are sprouts from rhizomes. My little red berries are like bus and plane tickets for my seeds. Birds and mammals eat my berries and digest the soft, sweet part. 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 and ready for hungry animals to eat.

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

If my seeds are deposited in a good spot, they don't wait for spring to start growing. Seedlings may come up a month after they fall.

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.

Lots of mammals and birds find my berries delicious—chipmunks, red squirrels, foxes, skunks, grouse, bluebirds, thrushes, and people to name a few! 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, a kind of grouse that changes its plumage to match the seasons – brown in summer, white in winter. To help it survive the long winters, it grows feathers on its feet!

What does fire do to me? Fires top-kill my leaves and stems, but that doesn't mean they kill my underground parts. My rhizomes can survive most surface fires, because they don't burn all of the duff. Then I can sprout new plants. I can also grow back from seeds in these places, but that takes a long time. Crown fires are more severe, so they might kill more of my rhizomes. But most crown fires are patchy in the high mountain forests where I live. They leave many spots unburned or just lightly scorched, so I can sprout in these places too.

Life after fire: All plants grow slowly in the high forests where I live—including me. I can usually grow back from rhizomes and produce sweet berries in 10 or 20 years after fire. I continue to grow and produce sprouts for many years, even as the new forest grows up around me.

Berries. Photo by Dave Powell, USDA Forest Service, Bugwood.org.

Reference: Johnson, Kathleen A. 2001. Vaccinium scoparium. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: https://www.fs.fed.us/database/feis/plants/shrub/vacsco/all.html.

Citation: McMurray, Nancy E. 2000. Grouse whortleberry. In: FireWorks encyclopedia. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p.

Heartleaf Arnica

(Arnica cordifolia)

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 means the same thing as my common name, that is, a plant whose leaves look like hearts!

Heartleaf arnica. Photo by Dave Powell, USDA Forest Service, Bugwood.org.

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 began life by growing from a seed that was blown here by the wind. My paired leaves grow every spring from a slender stem that can get to be half a meter tall. This above-ground stem grows from another stem called a rhizome. My rhizomes either lie on top of the ground or grow in the soil. They are very tough. Sometimes they grow as deep as half a meter underground!

Rhizomes make new plants by sending roots down into the ground and sprouting new above-ground stems and leaves. A single plant can eventually grow into a big clump with dozens of plants. They carpet the ground with green leaves and yellow flowers every spring.

Large clump of heartleaf arnica flowers. Photo by Mary Ellen (Mel) Harte, Bugwood.org.

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 I might continue to flower until September. My seeds form right after flowering, but I usually wait to disperse them until late summer or early fall. My seed's white, feathery hairs help them fly off in the wind.

Seed head of heartleaf arnica flower. Photo by Keir Morse.

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 can use my flowers and roots for medicines. My leaves can be used to heal bruises and reduce swelling. A lotion made from my flowers can be used 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. But remember that some of my rhizomes grow very deep underground.

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 big, old trees. Whether I'm growing from seed or sprouting from rhizomes, I'm a permanent resident of the forest.

Heartleaf arnica 1 year after fire. Photo by Garon Smith.

Reference: Reed, William R. 1993. Arnica cordifolia. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: https://www.fs.fed.us/database/feis/plants/forb/arncor/all.html.

Citation: Smith, Jane Kapler. 2000. Heartleaf arnica. In: FireWorks encyclopedia. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p.

Lodgepole Pine

(Pinus contorta var. *latifolia)*

I am a tree. Four varieties of lodgepole pine live in the United States. I am the variety that lives in the Rocky Mountains, the North Cascades, and other forests in the "interior" United States.

Where do I live? I like it COLD. I can grow in dry, frosty places where most other trees can't survive. I can live with a variety of neighbors, including ponderosa pine, subalpine fir, Engelmann spruce, western larch, Douglas-fir, quaking aspen, and whitebark pine. Of all these species, the only one that handles cold better than me is the whitebark pine.

What do I look like? I am an evergreen tree. My needles are about 5 centimeters long and grow in bundles of two. 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. Then I have needles only on my top branches, so I'm shaped a little like a lollipop.

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

Needles and immature cones that will produce pollen. Photo by Dave Powell, USDA Forest Service (retired), Bugwood.org.

Growing Up: I grow very fast in sunlight. I can start from seed right after a big crown fire and be 6 meters tall by the time I'm 20 years old. That's way taller than you will ever get. I begin making seeds when I'm only 5 or 10 years old.

BOTANICAL FACT: Lodgepole pines

Dave Powell, USDA Forest Service, Bugwood.org.

grow much faster in sunny places than many of their neighboring species. Thousands grow from seed after a big crown fire, so it may look like lodgepole pine is the only kind of tree growing on a whole mountainside. But other, slower-growing species, such as subalpine fir and Engelmann spruce, are probably hiding underneath.

How do I reproduce? I am a conifer, which means I put my seeds in cones. My cones are brown, small, and woody. Each cone scale is decorated with a tiny, sharp prickle, so be careful if you grab one! 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, which then start a new forest.

Dense lodgepole pine regeneration after stand-replacing fire. Photo by Dave Powell, USDA Forest Service (retired), Bugwood.org

My calendar: It takes 2 years for me to make a cone. In spring, I grow tiny new cones

that catch pollen from special, pollen-producing cones. More than a year later, in summer, my seed-bearing cones are finally ripe. Some are not serotinous, so they open right away and drop their seeds. My serotinous cones store my seeds just like you might store money in the bank. These cones stay on my branches, with their seeds sealed up tight, until heat from a fire opens them and the seeds fall out on the ash-covered soil.

Am I useful? Many kinds of insects eat my cambium. Mistletoe plants grow on me and sink their roots into my branches and trunk to get nutrients. 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.

I am very useful when I'm dead! Crown fires kill me, of course, but they create great habitat for many kinds of animals. The heat-sensing black fire beetles find me while the fires are still burning. They lay their eggs in my burned wood. Wasps follow right away, laying THEIR eggs in the beetles! And woodpeckers follow to eat ALL of the insects that live under my burned bark. Black-backed woodpeckers and northern three-toed woodpeckers almost always nest near a forest burned recently by crown fire so they can take advantage of this insect feast.

People have used my wood for their homes for thousands of years. The slender trunks of lodgepole pines in young forests make perfect tipi poles. My wood is great for furniture, fenceposts, plywood, and paper. Large logs are used for homes. People can also use my cambium layer for food and my sap for medicine.

What does fire do to me? I can survive some surface fires, but my bark is not very thick, so surface fires may kill me or make me more vulnerable to insects and fungi. If my roots are shallow, fires might damage them and make me vulnerable to strong winds.

If crown fires kill me, I reproduce right away from the seed bank in my serotinous cones. My seedlings grow especially well where fire has cleared the duff from the ground.

My seedlings do not grow well in shade. Firs and spruces do grow in my shade, so they gradually take over in forests where I live. I may be only 100 years old when I die. That may be a long life for a person, but it's short for a tree.

ECOLOGICAL FACT: When pine trees get old and their growth slows down, mountain pine beetles are likely to tunnel through their bark and lay eggs in their cambium. When the eggs hatch, the larvae find themselves surrounded by cambium – which is all the food they need!

Mountain pine beetles especially love lodgepole pine forests that grew in after fire. In these forests, most of the trees become old and vulnerable to beetle attack at about the same time. Then millions of female beetles find them and lay their eggs under the bark, and the larvae may kill nearly all of the trees in just a year or two. Then the forest looks like it's full of red trees, like those in this picture.

Lodgepole pine forest after epidemic of mountain pine beetle. Photo by William M. Ciesla, Forest Health Management International, Bugwood.org.

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Mountain Pine Beetle

(Dendroctonus ponderosae)

Pine beetle larva. Photo by Scott Tunnock, USDA Forest Service, Bugwood.org.

I am an insect native to western North America. I love to live in pine trees, especially lodgepole pines. But I will also happily live in ponderosa pines and whitebark pines.

For most of my life, I am a larva living 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 am 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, so most of the trees are about the same age and size. The trees all reach the perfect size for mountain pine beetles to use at about the same time— towards the end of their life. What a treasure trove of food and shelter!

Gallery shows where a female mountain pine beetle tunneled upward and larvae are tunneling sideways. Photo by USDA Forest Service - Ogden Archive, USDA Forest Service, Bugwood.org.

Growing up: I began life as an egg. Like most insects, I have changed dramatically through my lifetime. Let's start with the egg:

It was the middle of summer, just last year. My mother found an old lodgepole pine. It wasn't producing much pitch or growing much anymore. She decided it was the perfect place to mate and lay her eggs. She bored a hole in the tree's thin bark. The tree pumped some pitch out of the hole, and she almost drowned in it. But she finally got through the bark into the tree's phloem, where she produced a special scent, like perfume, to attract other bark beetles. This scent is called a pheromone. My father caught a whiff of it and found it irresistible. He flew over and bored into the tree. There he found my mother, mated, and fertilized a bunch of eggs, including mine!

Mother began tunneling up toward the treetop in an almost straight line. She left a trail of ground-up bark and poop along the way. Every so often, she stopped to lay a tiny, pearl-white egg along the side of her 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. I was all white except for my little brown head. I spent the whole fall and the next spring under the tree's bark, eating the tree's phloem. I didn't do much at all during the cold winter weather. I was lucky that the temperatures didn't stay VERY cold for long, because that would have killed me.

While I ate, I made a tunnel going cross-wise in the phloem and cambium. 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.

Adult mountain pine beetle is about as big as a grain of rice. Photo by Ron Long, Simon Fraser University, Bugwood.org.

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 to find a mate and a perfect pine tree for my own eggs.

Never alone: The number of pine beetles in a forest depends on how many vulnerable trees that forest has. Wherever there are pine trees, there are always a few beetles around. When we settle into a large forest with lots of old trees that can nurture our larvae, our numbers increase year after year. Then we can attack thousands of trees all at once. We call this a feast, but — if we kill most of the big trees of our host species — you might call it 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. After our eggs hatch, millions of larvae begin to tunnel sideways under the bark. During a pine beetle epidemic, you can actually stand in the forest and hear the larvae feeding inside the trees!

Even if a mountain pine beetle looks like it's by itself, it really isn't alone. We always carry the spores of a fungus along with us. When we bore through a tree's bark, we 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 our larvae to thrive.

Beetle galleries and blue-stain fungus are great for us, but they're not good for lodgepole pine trees. Our galleries crisscross the tree's phloem and cambium, and fungi grow throughout the tree. All of these things 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 even hatch. Some wasps lay their eggs in my larvae, so **their** larvae will have me for lunch after **they** hatch! Woodpeckers think that a tree full of beetle larvae is a feast just for them. Nuthatches and other birds eat me when I'm out in the daylight. 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 us completely. Instead, they mark the beginning of a new pine forest that will be ready for us to live in after a few decades.

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

Surface fires kill some trees too. That makes the surviving trees a little farther apart and makes sunny openings for seedlings to grow in. Mountain pine beetles can live and reproduce well in this kind of forest, but we're not likely to cause an epidemic there because the forest has so many trees of different ages and sizes.

We may be small, but we can actually change the way fire burns in a forest. If we have killed thousands of trees in an epidemic, the dry, red needles that stay on the trees provide a huge, flammable fuel supply. Fires in forest recently killed by pine beetles often spread fast and burn very hot. Scientists are still learning about how fires burn in beetle-killed forests after all of the needles have fallen and only tree skeletons are left. Maybe you will help figure this out!

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Northern Flicker

(Colaptes auratus)

I am a woodpecker about 30 cm long. I live in forests, woodlands, and riparian areas. I also live in many cities and towns. I love to eat the suet that people put out in their birdfeeders.

Some people think I look fancy, with my black-spotted belly, red "moustache," and bright salmon-colored 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.

The "Colaptes" part of my scientific name means "chisel." That is a great description of my powerful bill, and chiseling is what I do for a living.

Male northern flicker. Photo by Dave Herr.

Rotten to the core: I hang out in all types of forests, but I particularly like ponderosa pine forests and cottonwood groves. These places often have very large trees, and some of them are rotten inside. That makes them perfect nest trees for me.

BIRD FACT: Flickers get their name because their calls sound like "flick, flick, flick" or "flick-errr." You might also think they call "quick-quick-quick-quick," as if they're in a big hurry.

Dead tree fan: 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 inside. The rot makes it easy for me to excavate a nest cavity. I use my large neck muscles and chisel-shaped beak to pull the rotten wood apart. The cavity will be a safe place for me to raise my family.

While I'm working to loosen chips of wood, I use my hard tail feathers just like you might use a kick-stand on your bike. It lets me stay firmly in place on the tree trunk while I'm working on my nest cavity or hunting for my insect food.

My mate and I can build a nest cavity in 12 days. This is a lot of work, so if we find a natural tree cavity, we will probably use it instead. Don't think I'm lazy if I do that. 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, we will catch food to feed our nestlings. After that, our young flickers are ready to fly from the nest and find their own food.

The food search: Although I like to nest and roost in trees, I also feed on the ground. I am one of the few woodpeckers in

North America that does this. Most of them find everything they need in the trees.

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, and it has a flattened tip that can maneuver eggs, pupae, and adult ants out of the soil.

I am not fussy about my diet though. I also eat termites, beetle larvae, and caterpillars. Sometimes I perch on bushes and eat berries. I can digest the sweet, pulpy part of the berries but not the seeds. So I distribute seeds throughout the forest, in every place where I perch and poop!

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, and the old, dead branches have fallen off. 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.

Photo by Dave Menke.

We have used this tree before. Rot is gradually moving from the top down through its heartwood. Each year we make our nest hole a little lower, where the wood is soft but still protects us from the cold and rain. Someday we'll decide that the best wood for a nest hole is too close to the ground to be safe. Then we'll have to find another snag for raising our family.

After our young leave the nest, we'll move out of this snag, but our hard work to excavate this hole 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 in different kinds of forest. For example, on north-facing hillsides, there are often many trees growing close together. These forests stay moist through most of the summer. But when they dry out and a fire reaches them, they are likely to burn in crown fires. This might happen every hundred years or so. As long as the fire-killed trees remain standing, flickers might be able to nest in them.

Other forests and woodlands have had frequent surface fires. These fires thinned out the small trees that grew in after the last fire. Ponderosa pines survived because of their thick bark and high branches, so they grew bigger and bigger. Cottonwood trees often live in moist places, so surface fires often burned around them and left them to grow very large too. So forests that have had surface fires often have large, old trees, and many of these trees have rotten centers. They provide ideal nest sites for northern flickers.

Citation: McMurray, Nancy E. 2005. Northern flicker. In: FireWorks encyclopedia. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p.

Pileated Woodpecker

(Dryocopus pileatus)

Male pileated woodpecker. Steven Katovich, USDA Forest Service, Bugwood.org.

I'm unforgettable once you see me. I look like a modern-day pterosaur— you know, those prehistoric bird-like reptiles that flew around above the dinosaurs. My bright red crest and loud, eerie call definitely give me an ancient flare. Even the trees I live in are often hundreds of years old. I am the largest woodpecker in the western United States, nearly 50 centimeters long.

Rotten to the core: I hang out in low-elevation ponderosa pine and western larch forests. I also like moist forests with aspens and big old cottonwoods. I like places where most of the trees are very large and very old. Many of them are also very rotten inside. Because of that, they make wonderful nest trees. After I excavate a hole in the hard outer wood, I can easily pull the rotten insides out to make a soft, safe shelter for my eggs and young.

I use rotten trees after they fall to the ground, too. That is because rotten wood is often filled with big, black carpenter ants. These are my favorite food.

Hunting with my head: Carpenter ants will build their colonies in any rotten wood. They use live trees, especially ones with broken tops. They also use standing dead trees called snags, and they use decaying logs on the ground. Dead trees are just as important to my habitat as live ones!

I have a tricky method for finding an ant colony in a rotten log. First I give the log a few swift taps with my strong, chisel-shaped beak. Knock, knock... anybody home? Be quiet now! I'm listening for ants moving around inside the log. You'd be surprised how much noise hundreds of frightened ants can make. If I hear them moving through their wooden tunnels, it's time for some serious wood pecking.

It is hard work to pound wood over and over again with my beak, but I am well equipped to do it. 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.

Finally I can see ants! I'll have to work fast before they escape deep 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 feeding, my tongue is coiled up inside my head. To feed, I quickly unwind it and stick it out way past the end of my beak. Then I can slurp up ants and other insects. On a good day I can devour lots of food. Once I

Feeding holes excavated by pileated woodpecker. Photo by Mark Musselman.

had 2,600 ants in my stomach. Wow, was I full!

Bigger is better: This year my mate and I are nesting in an aspen snag. Usually we pick a big, broken-topped western larch or ponderosa pine. But this tree had so much rot and so many ants nearby that we couldn't resist.

Our nest tree doesn't actually look much like a tree anymore. The top and most of the branches broke off long ago. All that's left is the tree's trunk stretching to the sky. It is very rotten inside, but it still has an outer shell of sound wood.

Nest holes excavated by pileated woodpeckers. Photo by Joseph OBrien, USDA Forest Service, Bugwood.org.

We used the same tree last year – and the year before that. Our first nest hole was about 17 meters off the ground. Last year, we nested about a meter lower, following the rot as it spread down through the trunk. This year we'll go still lower. Soon we'll need to find a new tree because the rotten wood will be too close to the ground for safety.

It is exhausting to excavate a new nest cavity every year. 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. Our young hatched out 2 weeks later, and they will leave the nest in about another month.

After our young have fledged, we'll move out of this high-rise apartment, but it won't stay empty for long. Northern flying squirrels, flammulated owls, and northern pygmy owls are some of the species that 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 stands every few years. These fires killed most of the small trees, but the big trees survived because of their thick bark and high branches. Surface fires also burned into stands of aspen and cottonwood, but they often stopped at the edges because these stands stayed moist through most of the summer. The big trees grew older and even bigger.

Old trees are very likely to have rotten centers. This makes them perfect nest sites and feeding sites for pileated woodpeckers. Thanks to surface fires and patchy fire spread, pileated woodpeckers can have plenty of old trees for both food and shelter—the perfect habitat.

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Pinegrass

(Calamagrostis rubescens)

Just as my name says, I am a grass. The "rubescens" part of my scientific name means "reddish," which probably doesn't make any sense to you. But if you get down on the ground and look at the base of my leaves, you'll see my reddish-purple color.

Pinegrass with seed heads. Photo by Dave Powell, USDA Forest Service, Bugwood.org.

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.

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.

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. My flowers are pale green at first, and then they get purplish. When they dry out and my seeds are ripe, they turn golden-brown.

Clumps ("bunches") of pinegrass without flowers. Photo by Dave Powell, USDA Forest Service, Bugwood.org.

Growing up:

I begin life as a seed. My seeds are ready to grow as soon as they drop to the soil, so they will begin to grow 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.* Most of my rhizomes grow in the top 10 centimeters of soil.

You won't often see me produce flowers and seed in a closed forest. I can grow there,

but I need lots of sunlight to blossom.

Pinegrass bunches with seeds heads. Photo by Dave Powell, USDA Forest Service, Bugwood.org.

My calendar: I am a *perennial* plant. This means I grow for many years. Every spring, I sprout new leaves in late April or May. I may begin to grow earlier if I'm getting lots of sunshine.

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

Am I useful? Lots of animals eat my leaves, flowers, and seeds. These include small mammals and birds, and also big mammals, including bears, deer, mountain goats, and elk. Cattle and sheep like to graze on me, too.

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?

Most fires just burn off my leaves. I can survive that easily, because I can sprout from my rhizomes. If a fire is so hot that it kills my rhizomes, I will have to start over from seed. I will have to depend on the wind to bring some seeds to the burned spot.

After fires, I grow fast and lush. I produce my biggest crops of flowers and seeds in the first few years after fire. I stay in the new forest as it grows up. But as the forest gets more dense and shady, I produce fewer and fewer flowers and seeds.

If many decades go by without fire, I may gradually die out. Sometimes land managers use prescribed fires to make sure I will stay healthy and continue to produce food for the many animals that need me.

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Ponderosa pine

(Pinus ponderosa var. *scopulorum)*

I am a tree. I am native to the Rocky Mountain West. The “ponderosa” part of my scientific name is a Spanish word meaning "large” or “heavy.” I can grow old and huge, becoming a truly “ponderous" tree.

There are three varieties of ponderosa pine. I’m the kind called “interior” ponderosa pine because I live in the interior part of the western United States rather than along the west coast.

I like warm, dry forests – but not deserts. In the southwestern United States, I am a high-elevation species because the valley bottoms are too hot and dry for me. In the northern United States, I am a low-elevatioin species, growing where it is too hot and dry for other conifers. I can grow in cooler, moister places too. You can find me with Douglas-fir, western larch, and lodgepole pine.

What do I look like? I am an evergreen tree. I grow to be 25 to 35 meters tall, with a trunk 2 meters thick. I have long needles that grow in clusters of three.

My bark gets very thick as I age. On old trees, my bark is 8 centimeters thick. It is yellowish and has deep, dark furrows. It flakes off in pieces that look like they belong in a jigsaw puzzle.

I grow many thick roots. Some of them grow 2 meters into the soil. Some branch out from my trunk to support my huge weight. They may reach out 30 meters or more from my trunk.

Growing up: I grow from seed. In sunlight, I grow very fast. I can be a meter tall when I'm 7 or 8 years old. By that time, my bark is thick enough to protect me from surface fires. 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. It was 1,047 years old when it died.

Photo by Scott Roberts, Mississippi State University, Bugwood.org.

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. Be careful when you pick one up!

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 float 50 meters before they land.

My calendar: I begin to grow new wood in spring. At the same time, the buds at the tips of my branches begin to unfurl new leaves. I prepared those the summer before. My roots and trunk will continue to grow all summer. At the same time, my branches will make new buds to hold next year's fresh needles.

In late spring, my tiny new cones get pollinated. More than a year later, in the fall, the seeds in these cones will finally be ripe. The cones will open. Wind will shake the seeds loose, and they’ll fall to the ground.

Am I useful? Many kinds of insects eat my cambium. The most pesky one is the mountain pine beetle. These tiny insects

tunnel into my phloem and cambium to lay their eggs. When the larvae hatch, they feast on my cambium, growing as they go. Sometimes there are so many larvae that they kill me.

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.

Fungi use the nutrients stored in my trunk. When my heartwood gets rotten, woodpeckers excavate their nest holes in me. A family of woodpeckers uses a hole for only one year. Then other birds and small mammals move in.

Photo by Jane Kapler Smith.

People use my long, thick, straight trunks to build their homes. Sometimes, people peel the bark from big, old trees in the spring to get the cambium and phloem layers for food. See the scar made by peeling this tree?

What does fire do to me?

I can survive 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.

Fire scars at base of a ponderosa pine. USDA FS photo by

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. That made it hard for the flames to reach my crown. Surface fires also burned the fuels on the ground before they got deep. This protected my roots from the heat of fires.

I survived many fires, with only a few scars on my trunk to show when they occurred.

Life after fire:

My seeds grow well in the sunny openings created by fire, especially if the fire also killed off some of my moisture-hogging neighbors.

If my homeland does not burn for many years, it becomes hard to produce healthy young ponderosa pine trees. Too many small trees are growing in my shade, taking up moisture. 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. In those forests, almost any fire can climb into the tree crowns and kill even the biggest, oldest trees. Land managers sometimes use prescribed fires to clear out the undergrowth and get me growing again.

Photo by Ilana Abrahamson.

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Quaking Aspen

(Populus tremuloides)

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.

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. This means I shed my leaves in the fall and grow 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 eyes.

My leaves are about 5 centimeters long. They are almost round, but they have a pointy tip that looks 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 live at low elevations. On the prairies, I live in moist spots and on north-facing hillsides. In the mountains, I form bright-green patches between dark-green patches of pine forest.

I like cool summers and snowy winters. I live best in places where the soil is moist.

Aspen leaves. Photo by Paul Wray, Iowa State University, Bugwood.org.

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 into Mexico. In Utah, Minnesota, and Wisconsin, quaking aspen covers more land than any other kind of forest.

Growing up: You'll hardly ever see a single aspen tree in a forest. We are almost all connected to other aspens through our huge root system. In fact, aspens seldom grow from seed. We usually sprout from the root of another aspen tree. A new aspen growing from roots is called a sucker. If a fire or avalanche comes by, our trunks may break off or 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." A group of identical trees like this is called a clone.

Photo by Terry Spivey, USDA Forest Service, Bugwood.org.

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 and grow seeds, I release them in cottony packages that can travel many miles on the wind.

The seeds must hurry if they are going to grow new trees. They will live less than a month. That's a very short time to settle into a moist, warm location free from other trees so they 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 species of bluebirds in North America use me for nesting. Aspens are so important to wildlife that managers sometimes use prescribed fires to get more of us to grow.

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 store water from rain and snow. I filter the water, so it is fresh and clean when it leaves my aspen clone.

Quaking aspen wood makes good, clean fuel for heating and cooking because it makes few sparks.

Aspens in fall. Photo by Terry Spivey, USDA Forest Service, Bugwood.org.

Aspens sprouting after fire. Photo by Robert F. Wittwer, Oklahoma State University, Bugwood.org.

People use quaking aspen for medicines to treat fever and infections. The inner bark can be used as winter feed for livestock.

What does fire do to me? Most fires pass me by because I live in places that stay moist most of the year. When I do burn, fire top-kills me but rarely harms my roots. They can sprout new suckers right afterwards.

While severe fires usually kill most of the conifer trees in a forest, and they have to grow back from seed. I get a head start because I am ready to sprout right away. My root system quickly grabs the moisture in the soil and the nutrients in the ash. That is all we need to grow new suckers. A year after fire, my home is filled with slender new aspens that may be taller than you already!

Reference: Howard, Janet L. 1996. Populus tremuloides. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: https://www.fs.fed.us/database/feis/plants/tree/poptre/all.html.

Citation: Smith, Jane Kapler. 2000. Quaking aspen. In: FireWorks encyclopedia. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p.

Red-Backed Vole

(Myodes rutilus)

You have 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. Look more closely and you will see that I'm different: My stocky body is blunt on both ends. My fur usually hides my legs, my short tail, and my little round ears. 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 reddish-brown streak down my back.

Photo by Zbyszek Boratynski.

Never stops ticking. If I am awake, I cannot sit still. I'm always on the go, day and night, year-round. It doesn't matter whether the sun is shining or the moon is out. It doesn't matter whether the sky is clear or cloudy. The rhythm of my life is forever the same. I wake up, eat, and then go back to sleep. Then I wake up, eat, and go back to sleep. I do that many times every single day.

Rotten fan: I can be a meal for nearly every meat eater in the forest, so I'm constantly watching and listening for trouble. Small carnivores, particularly American martens and weasels, are constantly hunting for me.

So far, I've outsmarted my predators. I try to be invisible even while I'm on the move. How do I do that? I usually travel along the underside of decaying logs. 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 being seen by predators.

A single log would not give me much protection, but my forest is so old that lots of trees have died and fallen over. The rotting logs create a maze of safe travel routes for me. These make it almost safe for me to search for food over my half-hectare home range.

Engelmann spruce – subalpine fir forest with many fallen logs. Photo by Dave Powell, USDA Forest Service (retired), Bugwood.org.

A rotten log is also an excellent spot for digging my tunnels and burrows. I find it easy to scratch and dig into the soft soil beneath a rotten log. And when a log is rotten clear through, it is easy for me to dig burrows and nest sites underneath. So you see, I simply could not survive without rotten logs!

Short but sweet: I probably won't live more than a year or two, but there will always be plenty of red-backed voles in this old forest. Lots more voles 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 about 4 to 6 babies every three weeks. Can you

estimate how many that will be? There are always a few of us around in old forests, even during hard years when our food is hard to find.

Got mushrooms? Speaking of food, I need a lot of It, so I will eat almost anything. That makes me an omnivore. I dine on the leaves, seeds, and berries of plants. I eat insects too. And I eat fungi. You know what those are— mushrooms!

I like all kinds of fungi, but I specialize in those that grow underground. They're called truffles. Maybe you have 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. They make a perfect vole-sized meal.

I can find truffles underground because they are smelly when they're ripe. I can count on this food supply year-round. Since truffles grow underground, they don't vanish when there's a drought or a frost the way surface fungi do.

Truffles reproduce from spores, just as plants reproduce from seeds. Mushrooms that grow above the ground use the wind to spread their spores around. Truffles can't use the wind, so they use me!

I eat a lot of truffles, but I cannot digest their spores. Right away, I pass them through my digestive system. I leave thousands of spores beneath the rotten logs where I travel, and rotten logs are the perfect places for truffles to grow. You might say that I plant my own truffles when I poop and then go back to harvest the truffles when they grow up!

Healthy forest: Just as roots and stems and leaves are the main parts of a plant, hyphae are the main parts of a fungus. These thread-like filaments grow underground throughout the forest. Hyphae often intertwine with the tiniest roots of a tree. This partnership between fungus and tree benefits both of them. The fungus gathers water and nutrients from the soil and shares them with the tree. Then the tree makes sugars and transfers them back 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, especially in winter. During winter, I stay in my usual space - along the undersides of rotten logs. These spaces stay much warmer than the snow surface. They are just like miniature snow caves.

I can't spend all of my time beneath the snow though. Sometimes my underground food supply runs low. When I get really hungry, I make a mad dash into the trees to eat lichens. I hope no hungry predators are watching.

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 get away from the heat. If their burrows are deep enough, they will survive. But the large, decaying logs that voles need might be burned up by a fire. Then the surviving voles would have nowhere to hide. They also would have little food, since truffles don't grow well in young forest stands.

It will be a long time 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.

Reference: Tesky, Julie L. 1994. Myodes rutilus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: www.fs.fed.us/database/feis/animals/mammal/muni/all.html.

Citation: McMurray, Nancy E. 2000. Red-backed vole. In: FireWorks encyclopedia. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p.

Red Squirrel

(Tamiasciurus hudsonicus)

Photo by Michael Mengak, University of Georgia, Bugwood.org.

Have you ever seen a big patch of the forest floor covered with pine-cone parts? That was probably a midden made by a red squirrel – like me.

Maybe the midden was small, the size of a hula hoop… or maybe it was as big as your classroom floor! Maybe it was a few centimeters deep… or maybe it was a meter deep. Whatever its size, the midden was filled with cones, scales pulled from cones, little twigs, and cone "cobs." It was the kitchen, dining room, and landfill for a red squirrel.

Midden time: I am the smallest kind of squirrel living in the northern Rocky Mountains and the North Cascades. Although I'm small, I create huge middens. I have several of them scattered through my one-hectare territory. You might wonder how it got so big.

My midden is the heart of my food supply. It is essential for my survival in winter, when wildflowers and berries and birds' eggs are scarce. In late summer and fall, I spend all day, every day collecting cones and burying them in my midden. Last fall, I collected about 15,000 cones in all. My favorites come from whitebark pines, because their seeds are very nutritious and very big.

Red squirrel midden. Photo by Velma Hudson, via Eileen Schuh's website.

During the long winter, I spend almost every day sitting in my midden or on a tree branch above. I am busy tearing my stored cones apart and eating the seeds. But I never clean up when I've finished eating! I just leave my leftovers and garbage on top of the midden. It piles up day after day, year after year. Over the seven years of my life I'll make it even bigger than it is now

I could never have created such a big midden all by myself. My ancestors from several generations did a wonderful job of not taking out the trash!

Forest fridge: It's good thing that red squirrels don't clean up after themselves, because a midden makes a wonderful refrigerator. The loose twigs, cone cobs, and scales create a nearly perfect temperature for storing cones. They insulate fresh seeds and cones from the heat of summer and the cold of winter.

My middens also hide cones from the searching eyes and noses of most hungry animals. Sadly for me, the middens do **not** hide my food from hungry bears. They'll raid my refrigerator any chance they get, and there's nothing I can do but sit in the branches above and scold them. I can't come down and fight, because they might 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. The forest has to have a lot of fairly big trees to produce enough seeds for me to survive. I have to grab every cone I can get, and I also have to defend my territory from other squirrels. I can't afford to share!

Whitebark pines produce my favorite cones. I watch the pines carefully so I'll know when their cones are ripe. During late summer and fall, I spend most of my time in these trees. I clip the cones from the tree, drop them to the ground, and carry them to a midden. Of course, I also eat a lot while I'm working!

Cones are a very important food for me, but they aren't my only food. I'm an omnivore. That means that I eat both plants and animals – pretty much anything I can find. In the summer I eat lichens, mushrooms, and berries. I also eat birds' eggs, young birds, small mammals, and insects. 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?

Evidence of squirrel feeding around canker. Photo by William Jacobi, Colorado State University, Bugwood.org.

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 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 live alone. That is the price I have to pay to make sure I get the biggest cone harvest possible.

I am not alone during mating season though. That is in late winter. At that time, you might see many male squirrels chasing a female, running and jumping through the trees, hoping to mate with her.

FIRE FACTS: Red squirrels get their food from trees that are big and strong and old enough to produce a lot of cones. Since the squirrels don't need young forests, you might think they don't really need fire. But remember that their favorite food is the seeds of whitebark pines.

Most whitebark pine forests burned every few decades to every few centuries in the past. Patchy, mixed-severity fires cleared out some of the firs underneath the pines, so the big trees thrived. Severe fires killed the pines but also provided good spots for Clark's nutcrackers to cache whitebark seeds and for the seedlings to grow. If whitebark pines need fire, then don't red squirrels need fire too?

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Saskatoon Serviceberry

(Amelanchier alnifolia)

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 North Cascades. I grow very well in sunny places, so I also really like the open prairies too.

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.

Photo by Mary Ellen (Mel) Harte, Bugwood.org.

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 my underground stems. These are called rhizomes.

BOTANICAL FACT: I am strongly attached to the ground! The place where my stems meet my roots is called my "root crown," and it can be more than 10 centimeters thick. My rhizomes can grow more than 70 centimeters underground, and my roots can grow 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 slowly die 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.

Serviceberry flowers. Photo by Terry Spivey, USDA Forest Service, Bugwood.org

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.

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

You might like my berries, too. People harvest them for a sweet treat. People make tea

from my branches. People can also make arrows, spears, and digging sticks from my branches.

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

Serviceberry fruit. Photo by Chris Evans, River to River CWMA, Bugwood.org.

What does fire do to me? Fires usually kill the buds on my branches, but I 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 stems.

Life after fire: For many years after a fire, I thrive in the sunny conditions and warm, ash-covered soil. 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!

Reference: Fryer, Janet L. 1997. Amelanchier alnifolia. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: https://www.fs.fed.us/database/feis/plants/shrub/amealn/all.html.

Soups, pemmican, and arrows: Saskatoon serviceberry may be the most important vegetable food in the traditional way of life for the Blackfeet people.

In early summer, when the serviceberries are fresh and ripe, the people visit their favorite locations for picking. The people use the berries in soups and jams and jellies. When the Blackfeet were a migratory people, they used great quantities of serviceberries in pemmican. They also dried the fruit in the hot summer sun, then used it to trade for other supplies.

The wood of serviceberry shoots is hard, dense, and flexible, so it makes good arrows. Skilled arrow makers peel the shoots, tie them in bundles, and hang them to dry. Later, they smooth the shoots and sand them to the right thickness. Finally, they pull the dried shoots through a circular hole to smooth and straighten them. The hole might be drilled through a buffalo rib or the horn of a bighorn sheep.

For hundreds of years, serviceberries have been an essential part of traditional life for the Blackfeet Nation, and they remain that way today.

Citation: Smith, Jane Kapler. 2000. Saskatoon serviceberry. In: FireWorks encyclopedia. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p.

Smooth Woodrush

(Luzula glabrata var. *hitchcockii)*

I am a special kind of grass-like plant called a rush. I make tiny brown flowers—only 2 or 3 millimeters across – and my flowers make tiny dark seeds.

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.

Photo by Keir Morse.

Where do I live?

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

What do I look like?

I grow 20 to 40 centimeters tall. My shiny leaves are 4 to 6 centimeters long, with rusty-brown tips. By the end of summer, my leaves turn rusty-brown all over. They cover the ground like a shaggy red carpet.

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

Growing up:

I begin life as a 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 my growing points are underground. That protects them from the deep winter cold and from the animals that eat my leaves and stems.

How do I reproduce?

I reproduce from seeds and by sprouting from my rhizomes.

It is hard for me to spread my seeds around and start new plants. When my seeds are ripe, the little capsules holding them flare open. The seeds look like they are sitting in little teacups at the top of my stem. They are too heavy for the wind to carry away, although sometimes a gust will shake them out onto the ground. They are not sticky enough to travel on animals' paws or fur, although sometimes they travel that way too. But usually they just sit still until a raindrops hit their little cups and splash them out! As you can imagine, they don't go very far.

My calendar: I begin to grow as soon as the snow melts. In the high country where I live, that could be June or even July. I get busy making flowers and seeds right away, because the summer is short in the high, cold mountains that I call home.

Am I useful? Bears eat my flowers, leaves, and stems. Grizzly bears sometimes even dig up my roots to eat. During summer and fall, elk feed and rest in the cool places where I grow. They like the high country because there are fewer biting flies here than in the low country.

What does fire do to me? The cool, moist places where I live do not burn often. When they do burn, the fires are often patchy and leave many spots unburned.

When a fire comes by, it top-kills me. It burns my leaves and stems, and it burns any seeds that are lying on top of the soil. But it usually doesn't kill my rhizomes, because they are buried underground. The soil provides great insulation!

The summer after fire, I sprout from my rhizomes. I continue to sprout a lot of new plants for two or three years after fire.

I like to live in sunny places if there's enough moisture, so I grow well after fires have removed some of the trees. I can also produce new plants in the shade of tall trees. So you can find me recent burns and also in forests that haven't burned for hundreds of years.

Reference: Habeck, R. J. 1992. Luzula glabrata var. hitchcockii. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: https://www.fs.fed.us/database/feis/plants/graminoid/luzglah/all.html.

Citation: Smith, Jane Kapler. 2000. Smooth woodrush. In: FireWorks encyclopedia. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p.

Snowbrush *Ceanothus*

(Ceanothus velutinus)

Photo by Dave Powell, USDA Forest Service, Bugwood.org.

I am a very thick, bushy shrub. I'm not especially tall. You can probably see over me, but you can't walk between my branches!

Where do I live? I am native to western 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 hillsides, but you won't find me on the very tops of mountains. Brrrrrr! It's too cold up there, and summer is 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 are a great combination for me. You can find me growing under ponderosa pines, Douglas-firs and lodgepole pines, but their shade is not good for me. I won't produce many flowers there, and I won't live long if I am shaded from the sun.

Photo by Dave Powell, USDA Forest Service, Bugwood.org.

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

My tiny flowers grow in greenish-white clusters at the ends of my branches. In spring, I look like someone dropped handfuls of snow all over me. These flower clusters give me my common name, "snowbrush."

If you're hiking through the mountain hillsides in spring and smell something wonderfully sweet, it's probably me. My flowers contain so much perfume that they're sticky with it. My leaves are sometimes a little sticky too.

BOTANICAL FACT: My roots are covered with little woody bumps called nodules. These are very important for keeping me healthy. Every nodule is like an apartment house for bacteria. These bacteria are not the kind that make you sick. No, they are very welcome guests, because they capture nitrogen right out of the air.

I can't live without nitrogen, but I can't find enough without some help. My guest bacteria break molecules of nitrogen apart and store the pieces in a way that I can use later 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 begin life as a seed. The soil on my hillsides may hold millions of snowbrush seeds, but their outside "coats" are hard and waterproof, so the seeds cannot germinate just any old time. First, they have to be heated up so their coats will crack open. Forest fires are the perfect heaters for this. They open my seeds so water can get in. After a fire, the baby plants have to chill out through the winter, and then they are ready to start growing.

Fires also create the perfect habitat for my seedlings. The spring after fire, they emerge from

the ground into a warm, sunny place with lots of nutrition in the ashes. This environment gives them a healthy start in life.

Since my seeds are very fussy about when and where they will germinate, they may have to wait a long time before they can germinate. Some people have been able to grow snowbrush from seeds that were stored in the ground for more than 100 years!

Snowbrush sprouting 1 year after fire. Photo by Garon Smith.

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 also sprout new plants 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. This gives me a head start on growing each year. While grasses and wildflowers and other shrubs have to produce a whole new crop of leaves every spring, I can use my old leaves to photosynthesize while I am unfurling my new ones. About a month later, I open my flowers.

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 eat my leaves and branches in winter. Even moose feed on me. During hunting season, these big animals may hide and rest 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.

People don't eat any parts of me, but they use my flowers and leaves to make soap.

What does fire do to me?

I love fire! Fires top-kill my branches and scorch my leaves, but they usually do not kill my root crown, and they hardly ever kill my roots. Besides, fires open my seeds so thousands of new plants can grow.

Life after fire: I can sprout from my root crown in late summer or fall, right after a fire. New plants start from seed the summer after fire. It takes 8 or 9 years after a fire for us to get strong strong enough to produce seeds. But after that, look out! Every year, we will provide thousands of seeds 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!

Snowbrush seedling 1 year after fire. Leaves are 1-2 centimeters long. Photo by Garon Smith.

Reference: Anderson, Michelle D. 2001. Ceanothus velutinus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: https://www.fs.fed.us/database/feis/plants/shrub/ceavel/all.html.

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Subalpine Fir

(Abies lasiocarpa)

I am an evergreen tree, and I am native to the western mountains of North America. I like cold forests at high elevations. My neighbors include lodgepole pines and whitebark pines.

I am not too fussy about the soil and moisture conditions where I live. I can grow where it is either dry or moist, but I don't like to have my roots really wet. One of my neighbors – Engelmann spruce – grows much better than I do in wet places.

What do I look like? 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. This helps me shed snow through the long winter months without breaking my branches.

My roots grow in the top layers of the soil. They do not go down very deep,

My needles are short, 2 to 3 centimeters long. They grow singly, right out of the twig. Spruce needles look a lot like mine, but mine have rounded tips. The needles of spruce trees are stiff and pointy. When you grab a spruce branch, you are likely to say "Ouch!" When you grab one of my branches, the needles will feel soft and flexible.

Growing up: I can grow in sun or in shade. My seeds can germinate in sunny openings after a crown fire and also in the shade of an old forest.

I grow slowly. When I'm 15 years old, I may be only 30 centimeters tall. When I'm 50 years old, I may not be any taller than you – which is really short for a tree.

Sometimes I grow in places where it's very hard to survive, and that makes me grow even more slowly. If I'm living on a dry ridge way up high, I might be less than a meter tall when I'm 200 years old!

I can begin producing seed when I am about 20 years old. After that, I will probably produce a good seed crop every few years until

Photo by Mary Ellen (Mel) Harte, Bugwood.org.

I'm more than 200 years old.

I have growing points 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. I grow my cones on my top branches. They point straight up from the branches, so they look a little like a circle of fat candles forming a crown around my head.

I begin to grow new cones in the middle of summer. Nearly a year later, they will open and get pollinated. The seeds will form through the second summer and be ripe by September or October.

As my cones grow, they become dark purple, and they drip with sap. If you touch them, you'll have a hard time getting your hands clean; everything will stick to them!

As my cones get more and more ripe, they

become purplish-brown. They dry out and get kind of furry. That is how I got the "lasiocarpa" part of my scientific name. It means "woolly fruit."

By the end of their second summer, my seeds have ripened and my cones have dried out completely. The cones don't fall off. Instead, they fall apart right in the treetop, letting the seeds float down to the ground. Each seed is attached to a paper-like wing about a centimeter long. The wing helps it float a little way from me before it lands. Sometimes my seeds travel 60 or 80 meters away from me before they get to the ground.

Subalpine fir cones in late summer. Photo by Dave Powell, USDA Forest Service, Bugwood.org.

I can live on high ridges where the winter is cold and windy, but life is hard there. If my top branches stick up out of the snow, the icy winter winds shear them off. But even if my top is broken, my bottom branches continue to grow. 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.

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 the 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 forests of subalpine fir mixed with other species.

People sometimes use my wood for homes and furniture. People also use my sap in a special kind of glue for glass lenses and microscopes. My sap can be used to make a medicinal tea for colds, and my needles can be ground up for a salve to heal cuts.

BOTANICAL FACTS: Many birds live in subalpine firs. Flycatchers, thrushes, and owls might nest there. Blue grouse hide in fir branches and eat the needles and buds on the twigs. Red squirrels, chipmunks, chickadees, crossbills, and Clark's nutcrackers all 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 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 tower over them for many years. However, I am patient. After a hundred years or so, the lodgepole pines die off, but I am still growing strong. I am also producing seedlings that can grow in my shade. That's when I'm sure to take over the forest— until there's another fire!

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Western Larch

(Larix occidentalis)

I am one of the most unusual trees in the western United States. I bear cones just like pines, spruces, and firs do. But I shed my leaves in the fall, just like cottonwoods and aspens do. I am a deciduous conifer.

Where do I live? I am native to the northwestern United States and southwestern Canada. I live west of the Continental Divide. You'll find me growing in moist places but not wet places, because my roots hate to be soaking wet. My favorite places are north- and east-facing slopes. These places are a little cooler and moister than west- and south-facing hillsides.

What do I look like? My leaves are needles. They are 3 to 5 centimeters long. They grow out from my branches in little tufts. Each tuft contains about 20 needles. In summer, I look a lot like other conifers in the western forests. But in fall, I stand out from everyone else because my needles turn golden before they fall. In winter, my branches are bare—unless fog covers them with glistening crystals of frost.

Leaves and cones of western larch. Photo by Chris Schnepf, University of Idaho, Bugwood.org.

As I grow taller, I let my lower branches break off. They don't get much sunlight in the shade of my crown, so I don't need them. And losing my low branches keeps fires from climbing from the forest floor into my crown.

BOTANICAL FACT: The world has many kinds of larch trees, but western larch is one of the biggest. It can grow more than 60 meters tall, with a trunk more than 2 meters in diameter. Many western larches live to be 500 or 600 years old!

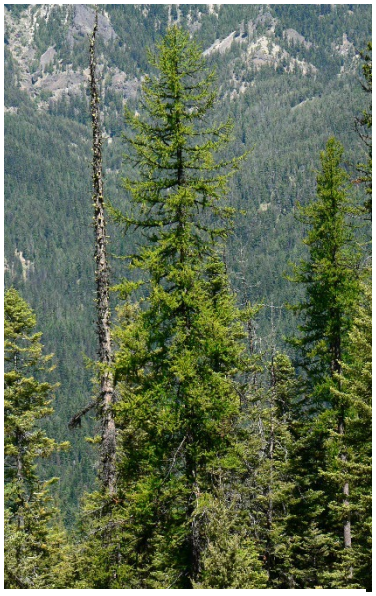

Photo by Walter Siegmund.

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

I can grow very fast – more than 30 centimeters in one year. I grow faster than any 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 years old?

My roots need plenty of room, and my needles need a lot of light. So I don't grow well in the middle of a dense forest. I grow best where fire has killed most of the trees, leaving lots of sunlight and open space for me.

How do I reproduce? I produce a few cones every year. Some years I produce thousands of cones, and each of them holds 30 to 40 seeds.

My calendar: I the fall, I develop tiny buds all along my branches. These contain next year's needles. At the same time, I begin growing next year's cones. When spring comes, tufts of new, tender, light-green needles will unfurl from my branches. At the same time, my cones will be pollinated. They'll grow all summer. In the fall, they'll open and release my seeds.

Western larch foliage in fall. Photo by Garon Smith.

When the weather gets cold and the days get short, I pull nutrients from my leaves back into my trunk. That makes my needles turn yellow. If you walk through a larch forest in autumn, it will be like walking through a gallery with a golden c eiling. 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.

Am I useful? Many animals of the western forests depend on me. Small mammals eat my seeds and seedlings. Squirrels store my cones in middens, where they can feed all winter. Bears 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, I will tower above most of the trees in the forest. Then my top is likely to break off in a wind storm or be shattered by a lightning strike. Then rain will get into my wood and it will begin to rot. That is when I provide nest sites for woodpeckers and hiding places for many other animals.

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, hard, and beautiful. 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 help 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 a few western larches towering above a young forest. Look for fire scars at their bases. The scars show that the larches have survived fires 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 in the burn. As seedlings, they will quickly outgrow the other trees. By the time they are 20 years old, they will begin producing seed. We'll be ready for the next fire!

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Western redcedar

(Thuja plicata)

I am a tall evergreen tree. I live in moist forests west of the Continental Divide. I can live near sea level and also at elevations as high as 1,800 meters. I cannot live at high elevations. The winter weather is too cold there, so I live in moist drainages that do not get too frosty at night.

I can grow to be very old. Some western redcedars are more than 1,000 years old. When I am grown up, I can be more than 60 meters tall, and my trunk can be more than 2 meters thick.

Lots of roots grow out in every direction from my trunk. They grow in the duff and in the top layer of soil. They crisscross each other, forming a thick mat all around me. Although my roots spread far out from my trunk, they do not always grow deep. That is because I live in places where the soil can be nearly filled with water.

I am an evergreen, but my leaves are not needles like those of pine and fir trees. Instead, they are tiny overlapping scales. Flat "sprays" of leaves hang from my branches.

My small brown cones grow at the tips of my twigs. When the cones dry out and open at the end of summer, they look like stiff brown flowers.

When I am young, my bark is thin, but it grows thick as I get older. By the time I am grown up, my bark can be as thick as your wrist. It is reddish-gray. It has deep furrows, and narrow strips of bark hang loose from my trunk.

The flared brown shapes at the tips of the twigs are cones that have opened and released seeds. Richard Webb, Bugwood.org.

Reproducing:

I began making seeds when I was about 30 years old. Now that I am grown up, I make a big crop of seeds every few years. I rely on the wind to carry my seeds away, although they do not travel very far from me.

Seeds are not my only way to reproduce. I can also grow new trees wherever my lower branches touch the ground. I can grow new trees from fallen branches, too. And if my roots lose their grip on the soil and I fall over, I can sprout new trees from my trunk where it lies on the ground.

Some trees are fussy about where their offspring grow, but I am not. My seeds can germinate on bare soil or in duff, in sunlight or in shade. They can even grow on stumps and rotten logs that lie on the forest floor.

My offspring grow very slowly, but they are very patient. They can wait for many years until some of their tall neighbors fall down, creating a sunny opening in the forest. Then they will grow quickly into the tree canopy.

Fire smoldering in a grove of western redcedar trees. Photo courtesy of Rick Trembath.

Am I useful? Let me tell you how important I am. Many insects eat my leaves, and more than 200 fungi live in my branches and trunk. Deer and elk eat my leaves too, especially in winter. Bears sometimes strip off my bark to eat the sapwood underneath. Large animals find shelter from storms under my thick crown. Birds nest in my branches and trunk. Small birds and mammals hide and feed in the small trees and shrubs that grow in my shade.

My wood lasts a very long time, so people have found many ways to use it. For more than a thousand years, people of the Pacific Northwest have made their homes and canoes from my wood. People also use my wood for furniture, fences, and storage containers. The fibers in my bark can be softened and made into padding materials and cloth.

Fire Facts: Even though western redcedars grow in moist valleys and wet canyons, their habitat can burn. Fires in this kind of forest usually burn slowly and patchily. The fires smolder in rotten logs and spread slowly through the duff. Because these fires are patchy, they do not kill many trees. Some forests containing western redcedar have not experienced fire for hundreds of years.

In the past, some forests containing western redcedar experienced surface fires every 10 or 20 years. Surface fires killed most of the small trees, but many of the big, old trees survived because of their thick bark. You can find these survivors in the woods by looking for their fire scars.

Big crown fires are unusual in this kind of forest, but they can occur during very hot weather, when the wind is very strong. It may take hundreds of years to establish a new western redcedar forest after a severe fire.

Fire scar on western redcedar. Photo by Chris Schnepf, University of Idaho, Bugwood.org.

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Citation: Smith, Jane Kapler. 2015. Western redcedar. In: FireWorks encyclopedia. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p.

Whitebark Pine

(Pinus albicaulis)

I am a tree. The “albicaulis” part of my scientific name means "white-stemmed pine." Yes, my trunk is white… sort of. As I get older, it looks more gray and scaly. When I’m young, I have a pointy shape like most other conifers. But when I get old, my crown becomes full and round. The branches bend upward as if they’re reaching for the sky.

Where do I live? I am native to the northern Rocky Mountains, the North Cascades, and the Sierra Nevada. I often form the highest-elevation forests in rocky, dry places. I often grow with subalpine fir and lodgepole pine.

What do I look like? I am an evergreen tree. When I grow up, I'm about 15 or 20 meters tall—unless I live in a very windy place. On ridges and mountaintops, the wind and ice trim my branches every winter so I may only grow 1 meter tall.

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

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

Growing up: My seedlings grow well in open, sunny places with bare ground. I am often the first tree to show up in a big burned area.

It is easy for me to get seedlings started in the middle of a burn, because Clark's nutcrackers plant them for me. These birds harvest my seeds right out of the cones, then bury the seeds so they’ll have a winter food supply. Sometimes the nutcrackers travel 10 kilometers or more to find the perfect spot for a seed cache.

Summers are very short in the high mountains where I live, so I grow slowly. I may be

Photo by Paul Bolstad, University of Minnesota, Bugwood.org.

80 years old before I can produce seeds. I have plenty of years ahead of me, though. I might live to be more than 700!

How do I reproduce? I am a conifer, which means I place my seeds in cones. My cones are purplish-red, 5 to 10 centimeters long.

In late summer, Clark's nutcrackers break off the scales of my cones, pry the seeds out, and cache them in the ground. The birds don’t retrieve all of their buried seeds, though. Some will grow into new pines.

You usually find whitebark pines growing in groups of three to five trees. That is because they all grew from the same seed cache

On cold, windy ridges, the icy wind shears off my top branches every

Clump of whitebark pine seedlings. Photo by Anna Schoettle, U.S. Department of Agriculture, Forest Service.

winter. My low branches grow along the ground at my base, like a flared-out skirt. Sometimes I sprout new roots and stems from these branches.

My calendar: My new cones are pollinated in early summer. More than a year later, in late summer, my seeds are ripe. That is when nutcrackers harvest the seeds and red squirrels harvest the cones to put in their middens.

Because my seeds are large and rich in energy, lots of animals want to eat them. Black bears and grizzly bears raid the middens of squirrels to feed. Ground squirrels and chipmunks harvest and store my cones, too. Sapsuckers, chickadees, nuthatches, finches, crossbills, grosbeaks, and grouse harvest my seeds. Deer don't climb into my crown to harvest the seeds, but they feed on any they can find on the ground. People eat my seeds too. They're very nutritious and tasty!

Squirrel midden filled with whitebark pine cones. Photo by Ilana Abrahamson.

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, which is **not** good for me at all. Sometimes pine beetles kill nearly all of the whitebark pines on a mountainside!

Life is getting more difficult for whitebark pines because the climate is getting warmer. Summers are hotter and drier. This stresses the pines and helps trees from lower elevations thrive. Winters are milder now, so the deep cold that used to kill off mountain pine beetles does not last as long.

SAD BOTANICAL FACT: White pine blister rust is a fungus that is very damaging to whitebark pines and other trees that grow their needles in bundles of five.

White pine blister rust was accidentally brought to North America from Europe. Its thread-like hyphae grow from the needles and twigs into the tree's phloem and cambium. They mess up the tree's ability to get water to its needles and nutrition to its roots. Eventually, blister rust kills the tree – and it has killed thousands of whitebark pines in the northern Rocky Mountains and the North Cascades.

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. Sometimes I do survive surface 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.

Life after fire: If I am killed by a crown fire, Clark's nutcrackers will bury the seeds of other whitebarks in the burn. I hope they can find enough seeds now that blister rust has killed so many trees.

If seeds are planted here, new clusters of whitebark pine trees will be able to grow and take advantage of the sunlight and moisture in the burned area. It could take awhile, though. In a cold place like this, perfect conditions for seed germination and seedling growth don't happen every year.

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. Then the and dozens of animals that eat my seeds will have to rely on other foods to survive.

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White Pine Blister Rust

(Cronartium ribicola)

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.

Some of the branches in this whitebark pine's crown are dead or dying. Perhaps they are infected with white pine blister rust. Photo by Dave Powell, USDA Forest Service, Bugwood.org.

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, but I have been very busy. I've been infecting a special group of pine trees called the "five-needled pines." They have this name because they grow their needles in bundles of five. Whitebark pine is one of these species.

So far, my infections have killed five-needled pines over thousands of square kilometers in the northern United States and Canada.

Where do I grow? A fungus like me has to reach inside a plant for nutrition. I use two different kinds of "host" plants to complete my life cycle. First, I use a five-needled pine, like whitebark. Then, second, I use a shrub or wildflower, like a gooseberry bush.

You should suspect that I've infected a whitebark pine if the tree has many dead branches in its crown. Still, you'll have to look very close to actually see me.

Yellowish spots on the needles or twigs of a pine signal the beginning of my infection. Later, I make blisters. Eventually, I make 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.

While I need my second host plants to reproduce, I don't kill them. You can find me on a gooseberry bush just by turning its leaves upside-down. If the leaf is infected, you will see tiny yellow blisters and brown, thread-like growths on its underside.

Spores of white pine blister rust on leaves of host plant. Photo by Robert L. Anderson, USDA Forest Service, Bugwood.org.

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." It's complicated, but I'll tell you the main points:

In late summer, I produce spores from the brown, thread-like growths on the leaves of my second host. The wind carries these spores to the needles of nearby pines.

The spores develop thread-like strands called "hyphae" that dissolve the needle's protective covering. Then the hyphae grow down into the needle and steal the nutrients between the needle's cells.

The hyphae keep on growing – very slowly – from the needle into 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 yellowish bulges and then develops small blisters. After many years, these blisters grow together into large cankers on my host tree's trunk.

But I'm not quite finished reproducing yet. In the spring, my cankers produce more kinds of spores. Wind carries the new spores throughout the forest. When they land on a gooseberry bush or other host species, they infect it.

Those are the highlights of my spory. There are more kinds of spores, but I don't want to wear you out with the details.

Blister rust infection on whitebark pine branches. Photo by H. J. Larsen, Bugwood.org.

Am I useful? Many insects eat me. Red squirrels love the sweet liquid that infected wood produces. Sometimes the 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 evolved ways to survive my infections over the past thousands of years. But I've only been living with whitebark pines for a hundred years or so. So far, only a few of them have been able to survive.

Life is getting more difficult all the time for whitebark pines. With the climate getting warmer and drier, mountain pine beetle epidemics, and my constant, sneaky attacks, the trees find it harder and harder to survive and reproduce.

Fire and me: If a fire kills my host plant, it kills me— but it can't keep me down for long. Most of my "second hosts" sprout back right after fire, so I'll soon have plenty of them.

I hope I can find plenty of whitebark pines too. Clark's nutcrackers plant lots of whitebark seeds in burns – if they can find them. But a lot of beautiful whitebark pines have died. I sure hope I haven't killed too many with my infections!

WHAT'S TO BE DONE? Scientists, managers, and volunteers are working hard to help the five-needled pines.

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

Then they try to provide the best possible growing conditions for seedlings from the "rust resistant" pines. People might clear away the firs that would take moisture away from pine seedlings. They might use fire to create a space that has plenty of light. They might burn off the litter and duff, so the frail roots of brand-new pine seedlings can find moisture before they dry out and die. Fire could give the pines a head start on growing before other trees start using most of the water in the soil.

People are looking for more ways to help whitebark pines thrive in the mountains where they have lived for thousands of years. Perhaps you can help!

Citation: Smith, Jane Kapler. 2000. White pine blister rust. In: FireWorks encyclopedia. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p.

Wild Onion

(Allium species*)*

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. The scientific name of my genus, *Allium*, means "garlic." That is a good name for me, since the garlic used in cooking is a close relative of mine.

Photo by Mrs. W. D. Bransford.

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 the prairies and forests. We can be found in light-filled openings and dark, closed forests. Some of us that even live near running streams and in 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, roots do. But a bulb is not really a root. It's a cluster of leaves—**very special** leaves. Bulb leaves are very thick and moist.

Also, bulb leaves are white, not green. They don't need to be green because they live underground and do not photosynthesize. That is, they do not capture sunlight and turn it into nutrients. Instead, bulb leaves **store** nutrients, especially through the winter.

With all that stored energy, onions can begin growing early in spring. They can also sprout from underground even after a hungry animal has eaten all of their leaves. They can sprout even after a fire has burned off the top of 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 tiny new bulbs, called "bulblets," at its base. Those new little bulbs will grow into whole new onion plants!

Photo by Andy and Sally Wasowski.

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 again.

Am I useful? Everyone likes to cook with me! The people of North America have used onions in preparing food for thousands of years. Lewis and Clark cooked with wild onions as they traveled through the West 200 years ago.

Other animals eat me too. 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 is hot enough to roast my bulbs. But most fires are not that severe. I can easily survive if a fire just burns my stems and leaves. Don't let the soil wash away after the fire, though. If erosion uncovers my bulb, I'll have no place to grow, and I will die.

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

Citation: Smith, Jane Kapler. 2000. Wild onion. In: FireWorks encyclopedia. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p.