



## Porcupines in Managed Woodlands: Tools for Family Forestland Owners

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### Introduction

The North American porcupine (*Erethizon dorsatum*) is a giant of the rodent order. They tower over mice and squirrels, and weigh in at an average of about 15 pounds when fully grown, taking the title of second-most-massive rodent in North America, after the American beaver (*Castor canadensis*). Porcupines are highly intelligent animals with excellent memories, and produce a variety of noises, some of which can be heard over great distances. They are herbivores that consume a broad, seasonal variety of plant materials and possess special adaptations to survive on foods of low nutritional quality. Because of their tendency to forage on trees, porcupines may be considered by some to be a nuisance. Although they can be a challenge for orchards, managed forests, and back-yard trees, they contribute greatly to ecological stability in our Northwestern forests by creating dead wood habitat, increasing plant species diversity by opening up canopy space, and providing food for predators. They occur throughout much of Oregon, Washington, and the rest of the western and southwestern U.S. They also occur in the northeast and much of Canada and Alaska. Across their transcontinental range, they inhabit biomes from desert scrub and grasslands to tundra and forests. When it comes to woodlands in the Pacific Northwest, the porcupine can be found

among conifers, hardwoods, and mixed forests with their highest numbers east of the Cascade Mountain. There, in the east, they also occur throughout shrub steppe habitats dominated by sagebrush.

Porcupine populations in the Pacific Northwest are poorly studied, but recent research and analysis of historical records suggests that they may be declining and/or shifting away from forestlands due

to the cumulative impacts of several stressors, including long-standing human persecution (Appel et al., 2021). This publication will help small woodland owners understand porcupines in Oregon and Washington forests, the dual role they play as both an important part of the ecosystem and potential agricultural pest, and how to manage forests with porcupines in mind as they face an uncertain future largely due to human action.

### The porcupine is a giant among rodents



Photo: Flickr, Silk Knoll

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## The road is a dangerous place for this mother porcupine and her porcupette



Photo: Flickr, NPS Alex Vanderstuyf

### Biology

#### Anatomy

The North American porcupine is a large rodent with woolly fur that ranges in color from blonde to black, and quills covering the top of its body and tail. Females are generally smaller than males with the largest males weighing 30 pounds or more. They have small eyes, small ears, and big teeth. Like other rodents, their incisors are capable of impressive feats of gnawing, and are reddish-orange due to the strengthening presence of iron in their tooth enamel. They can range in length from 2 to 4 feet snout to tail, and the tops of their bodies are covered in as many as 30,000 quills. Being a rather slow moving and docile creature, these quills are the porcupine's main defense. The use of such quills makes the porcupine unique among North American mammals.

When the quills come into contact with a potential predator they pierce skin, attach to the attacker with barbed points, and easily detach from the porcupine. Once embedded, the quills are very difficult to remove. They can work their way in deeper and even expand. The strong tail of the porcupine is dense with quills and can be vigorously swung

with potent effect when the animal is defending itself. Contrary to what some believe, quills cannot be shot out as projectiles. The porcupine's tail, long claws, and powerful legs make it an outstanding tree climber. They can be clumsy, however, and have been known to fall out of trees and even quill themselves. This is likely due at least in part to the fact that unlike other tree-climbing porcupine species, such as the Coendu porcupines of Central and South America, the North American porcupine lacks a proper prehensile tail.

#### Diet and Foraging

Porcupines are herbivores and what they eat varies widely based on what is available locally and seasonally. Their broad diet includes grasses and other non-woody plants, twigs, buds, roots, stems, leaves and conifer needles, nuts, berries and other fruits, and inner tree bark. During winter months when other food sources are scarce, porcupines will chew and rip through a tree's outer bark to eat the inner bark and cambium, typically towards the tops of trees. This activity can be very hard on the tree, potentially leading to deformity or death, especially when girdling occurs. Winters west of the Cascades are relatively mild and green, allowing

porcupines to forage on herbaceous plants year-round, but they are known to feed on Douglas-fir (*Pseudotsuga menziesii*) and western hemlock (*Tsuga heterophylla*) cambium.

Porcupines eat more bark in the colder, semi-arid regions east of the Cascades where they prefer ponderosa pine

### Porcupines are herbivores

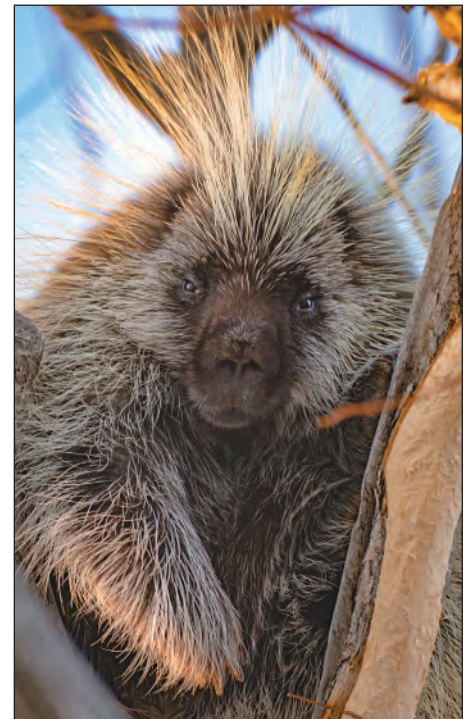


Photo: Flickr, NPS / Patrick Meyers



## Porcupines are active year-round, mainly at night



Photo: Flickr, NPS / Adams

(*Pinus ponderosa*) (Eglitis & Hennon, 1997). Surviving on needles and bark isn't easy, and would likely be impossible if not for the cecum, an adaptation to the digestive tracts of porcupines and some other plant-eaters, like rabbits and horses. This special sac in the intestines makes use of symbiotic microorganisms to break down and convert otherwise unpalatable, woody material into more useable calories, a process known as hindgut fermentation.

Subsisting on these low-quality plant foods also tends to lead to a deficiency in sodium, an element which porcupines and other creatures require to remain healthy. This means porcupines will seek out salt, occasionally from where they are not considered welcome. Wood glues, like those in plywood, contain salt, as does human sweat, which can collect on gloves, boots, and tools. The saltiness of these and other manmade items can make them appealing targets to a sodium-deficient porcupine. They have been known to

gnaw on human structures, including outhouses, to obtain needed sodium. Considering their generalist vegetarian feeding habits, it is not surprising that porcupines forage both on the ground and up in trees. They are active year-round, mainly at night but they do also forage in daytime.

### Reproduction

The North American porcupine maintains a long, solitary life, 18 years or possibly more in the wild, with a few exceptions; mating, rearing, and occasional communal winter denning and foraging. They are not prolific reproducers. Adults take 1 - 3 years to become sexually mature and females will almost always have just one offspring per year. A breeding session occurs just once a year between late summer and early winter, beginning with females advertising ahead of their very short estrus period, which sometimes only lasts a matter of hours. Males must work hard if they are to mate successfully. They

may have to travel exceptionally long distances as they home in on auditory and olfactory cues given off by a female. Several males may be attracted to the same female and they will fight for the chance to mate, biting and even quilling each other. Males will defend a soon-to-be ovulating female for up to several days. Mating only occurs when the female is receptive. When she is ready, the female and her chosen partner may carefully mate several times, and after a gestation period of 7 months, the female gives birth typically to a single young called a porcupette. Porcupettes are precocial, capable of climbing trees and using their quills as defense very soon after being born. The mother provides all care for her offspring and usually by fall the two will separate.

## Porcupines eat a wide variety of plants



Photo: iNaturalist, John Krampfl



## The main predators of porcupines are the cougar and fisher



Photo: Flickr, BLM

### Predators

Porcupines are stout and formidably armed, which makes them tricky prey, but nature is ever adaptive, and there are a number of co-adapted predators capable of killing and eating them. Bobcats, lynx, bears, wolverines, wolves, coyotes, and large raptors have all been documented to at least occasionally prey on porcupine. The porcupine's most effective natural predators however are thought to be the cougar (*Puma concolor*) and fisher (*Pekania pennanti*). Cougars are among North America's most powerful and capable hunters, but dispatching a fighting porcupine is no simple task. Even successful attacks can leave the cougar pierced by many quills, and these encounters can be deadly for the big cat. Fishers are perhaps the most famous of the porcupine's predators. These large, tenacious mustelids are skilled at wearing down their spiny victim with repeated bites to the face and may make regular meals of the porcupine where the two species co-occur. Recent efforts to recover populations of cougar and fisher, as well as the gray wolf, have undoubtedly put some additional pressure on porcupines as these predators rebound where they were previously extirpated.



Photo: iNaturalist, John Krampl

### Ecologically speaking, "Why Porcupines"?

Porcupines play numerous important roles within their respective ecosystems and affect many plants and animals that coexist with them. In fact, they are unassuming ecosystem engineers! Their bark-eating activities can lead to tree death and deformity, and while this may

not be beneficial to the tree, it is a creation of habitat. Dead and dying trees, as standing snags or down wood, are vital to a healthy forest ecosystem and are important to many wildlife taxa from woodpeckers to salamanders to bats. Fallen logs and branches are shelter to a multitude of terrestrial organisms that need a safe place to hide from predators or avoid desiccation. Mammals, amphibians, and invertebrates will all readily make use of down wood.

Snags are equally important, and are especially needed by birds and mammals that require cavities for nesting and denning. Dead wood will often become host to scores of insects, like beetle larvae and termite colonies, which are in turn eaten by bears, woodpeckers, and many others. Trees that are partially girdled may not die but grow in atypical shapes with platforms, cavities, and complex crowns. Again, these heterogeneous forest features provide essential habitat for many species.

### Porcupine Den



Photo: iNaturalist, Nate Martineau



As porcupines forage in the crowns of trees they will drop twigs, buds, and bits of other food items to the ground below. This can provide deer and other non-climbing animals with a food source that is normally out of their reach, which is especially valuable when vegetation is sparse or covered by snow (Schemnitz, 1994). This arboreal foraging behavior, sometimes called “nip-twigging,” is also thought to be beneficial to ecosystem health by allowing more sunlight to reach below the canopy. In an article by Holland (2019), the author describes work by porcupine researcher Dr. Uldis Roze, who states that additional light penetration facilitated by nip-twigging promotes a more diverse plant and animal community. Roze refers to porcupines as “Enrichers of the forest.” Finally, as discussed in the previous section, porcupines may serve as regular prey to some predator species, including the rare fisher. Being prey is yet another important part played by these spiky critters.

### Porcupines are adapted to be excellent tree climbers

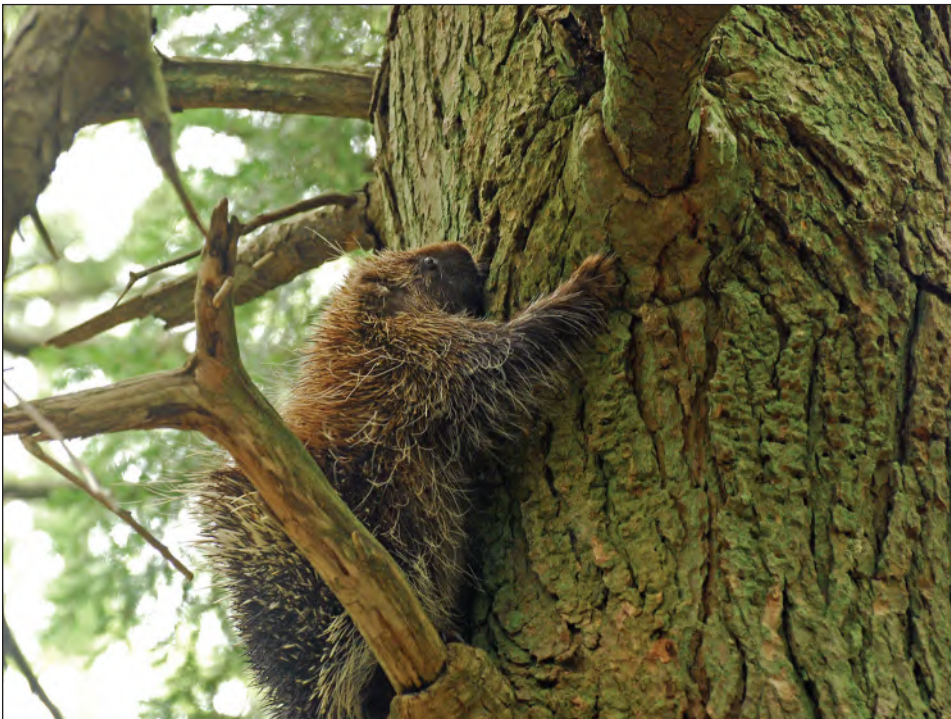


Photo: Flickr, Joshua Mayer

### Threats to Porcupines

The recent likely declines and shifts in porcupine populations in the Pacific Northwest are thought to be linked to several compounding threats. North American porcupines have faced extensive persecution due to their ability to injure pets and damage trees and property. Considered nothing but a pest for many decades, they have been actively killed by hunting, trapping, and poisoning, activities which were often sponsored by bounty programs in the past (Appel et al., 2021). Porcupine numbers in many areas were likely significantly reduced during the 20th century due to eradication efforts. The North American porcupine is still persecuted today, though to a lesser extent.

Road mortality is a substantial danger to porcupines throughout their range. Being slow-moving and attracted to salt makes them prone to being hit by vehicles (Appel et al., 2017). Since there is a lack of proper monitoring of porcupines in Washington,

### Porcupine foraging in the crown.



Photo: Kenneth King USFWS

Oregon, and California, most occurrence records from recent times in fact come from documented cases of road-kill. In some parts of the U.S., such as Alaska, the porcupine is thought to be among the animals most often killed by vehicles (ADFG 2017).

With the exceptions of human threat and low reproductive rates, porcupines are more adaptable than many species. They are able to survive in a broad spectrum of habitats and local climates, with a great defense against predators and an impressive ability to survive off of poorer quality foods. They are still likely to suffer from impacts brought on by our changing climate. Intensifying drought, wildfire, and storm regimes pose both near and long-term dangers to all wildlife, porcupines included.

The indirect effects of climate change on particular species are often complex.

Holland (2019) discusses one such indirect impact as described by porcupine researcher Jonathan Pauli. In an area of



## Porcupine Den



Photo: iNaturalist, noskcaj55

Wisconsin where porcupines, snowshoe hares, and fishers coexist, winters are becoming milder. Shorter, less snowy winters means the snow-white winter coat of the snowshoe hare no longer works as effective camouflage, so hares are more easily found by predators, and surviving hares are shifting their range north. As hare numbers decreased in the area, the fisher and other predators increasingly fed on porcupines, and a decline in their local population has been observed. It's not hard to imagine alterations to predator-prey dynamics, facilitated by climate change, taking place here in the Pacific Northwest.

Regardless of the specific causes for decline, given the animal's relatively slow maturation and low reproductive rates, especially compared to other rodents, recovery after major reductions in population numbers is a long and difficult process.

### Managing for Porcupines

Small woodland owners have an important role to play in ensuring porcupines persist into the future. Maintaining preferred, natural food sources for porcupines may benefit them as well as help keep them away from more valuable tree plantings.

A mix of hardwoods and conifers, fruit and nut trees, and a diverse understory with access to herbaceous plants would probably keep them well-fed. Skunk cabbage (*Lysichiton americanus*) is thought to be a favorite food, as well as ponderosa

pine and black cottonwood (*Populus trichocarpa*). Ideally, landowners would plan for some amount of loss due to porcupines and other wildlife.

In addition to food, porcupines require suitable sites to safely rest when not foraging and to shelter from particularly harsh weather. Dens and resting sites can be tree cavities, underground burrows, hollow logs, wood or rock piles, caves, brooms of dwarf mistletoe, or any safe spot. Porcupine dens are often marked by large accumulations of feces near the entrance. Retention of snags, logs, and wood and rock piles would likely benefit porcupines in the area by providing them with refuge for resting and bearing young. It is possible that constructed habitat piles, or biodens, could be used by porcupines as well.

Limiting or avoiding the outdoor use of rodenticides would likely benefit porcupines. Instructions for proper use should always be followed closely for any toxicant. Porcupines may not be the intended target but they have a good nose and could potentially ingest any unsecured poisons.

### Porcupine Bark Damage #1



Photo: iNaturalist, Benoit Renaud

### Porcupine Bark Damage #2



Photo: iNaturalist, Mary Krieger



## Porcupine Bark Damage #3



Photo: iNaturalist, Alexis Godin

### Diagnosing and Preventing Porcupine Damage

A general tip to reduce the presence of wildlife is to maintain a property free of things that may attract them, like unsecured garbage, pet food, and large compost piles (Ziegenhagen & Tuck, 2005). In the case of porcupines, this also includes properly storing tools, boat oars, and other items that may have sweat on them, since the animals will seek out anything salty.

Porcupines are just one of many animals that may feed on or otherwise cause damage to trees. Low densities of porcupines will cause limited, if any, noticeable damage. However, managing for porcupine activity may become necessary for landowners. Identifying the source of damage is the first step. Porcupines, bears, and mountain beavers can all cause similar harm to trees, but with a little effort and knowledge, the culprit can usually be determined. The work of Appel et al. (2021) suggests that sodium-soaked woodblocks deployed in tandem with a camera may work as an inexpensive and less invasive means of detecting porcupine presence. The salt-soaked wood attracts the porcupine and elicits chewing while the camera

confirms species identification, avoiding the significant possibility of mis-identifying chew marks.

If porcupine damage is diagnosed, there are several options available to landowners

to prevent or mitigate additional damage. Natural predators help keep porcupines in check. Fisher, where they occur, may limit porcupine numbers. Cougars, coyotes, and other carnivores may also limit them to some extent. Porcupines are expert climbers, and would likely have no problem getting under or over a standard fence, but buried fences that are angled outward and electrified at the top are likely the best bet at excluding the animal from certain areas. Metal flashing and wire mesh may be used to protect individual trees (Kuhns et al, 2019). Live-trapping and relocation may be an option, but is not always recommended by wildlife officials. Relocating wild animals is often not as humane of a solution as one might think. Survival rates of relocated wildlife are generally low and moving an animal from one location to another may increase the spread of disease. Always check with your state fish and wildlife agency to determine if the trap and relocate option is appropriate before any attempt is made (Ziegenhagen & Tuck, 2005). In Oregon, a permit is required to relocate

Porcupine's dietary preferences for tasty cambium leads them to girdle trees, many of which are of commercial value to people. Because of this, for many years, porcupines have been considered forest pests. Varying degrees of control have been instituted, and continue to be.

A long standing, respected forester (who requested to remain unnamed) tells of a bounty program many years ago in Klickitat County, Washington, paid for by a timber company. Every porcupine nose delivered was worth \$0.25! Some areas had poisoning programs as well. (WA Dept Fish and Wildlife, J. Bernatowicz, pers comm.).

Anecdotal accounts today, consistently suggest that porcupines are rare in forested environments across large areas of Washington and Oregon. A recent article with population analyses of historic data suggests that populations of porcupines in forested environments may be depleted, with greater abundance in shrub steppe, and less forested landscapes. (Appell et al, NW Naturalist, March 2021). This could be the outcome of these long standing control efforts on this relatively slow moving and reproducing species.

Today, porcupines are listed as "Unclassified Wildlife" in Washington and "Unprotected Mammal" in Oregon, and may be taken at any time, with no limit. However, a hunting license may be required.

wildlife and release locations must be approved by ODFW.

North American porcupines are not currently a protected species in Oregon or Washington, thus lethal control is at the landowner's discretion, but generally not recommended as it is usually deemed unnecessary. In Washington state, for example, porcupines are "Unclassified Wildlife" and may be hunted or trapped year around, with no bag limits. In Oregon, the species is classified as an "Unprotected Mammal" with no limits or closed season. State wildlife agencies can provide the required license to hunt porcupine, if there is one. Preventative measures and non-lethal options, coupled with an attitude of tolerance, are preferred. It is important to note that there are no poisons registered or recommended for porcupines.

## Damage Descriptions

Porcupine damage to trees is typically characterized by the tooth marks left behind. About 5 millimeters wide and an inch long, there can be hundreds of these distinct scrapes made against the bare tree where the outer bark is removed. These relatively large tooth marks help identify the porcupine as the one that did the

gnawing when compared to the relatively small marks left behind by mountain beavers or squirrels. Accurate identification by tooth mark alone can be challenging, so it is always good to look for additional signs such as dens or scat. Porcupines do much of their foraging up in the crowns of trees, where the choice edibles like nuts and fruits are, but will feast on the inner bark anywhere on the tree, including the base. Black bears can cause damage that looks similar to that of a porcupine. When food options are limited, they will strip bark from trees and chew at the new wood beneath. This type of foraging usually occurs near the base of the tree and can lead to girdling. Usually there are piles of torn bark left lying around the tree or strips of bark left dangling. Bears also mark trees with their claws and teeth, leaving deep, vertical scars.

Mountain beavers can girdle larger saplings of up to about 6 inches in diameter, but mainly damage trees by clipping off small saplings at a 45° angle. Girdling by mountain beaver can look a lot like porcupine damage, however, the tooth marks are smaller, and there is usually a distinct lack of bark chips littering the base of the tree. The presence of numerous small burrows near damaged trees can also give away

## Porcupine Bark Damage #4



Photo: iNaturalist, Bobcat Brad

the mountain beaver. Burrow entrances will often have piles of clipped ferns and saplings nearby.

## Summary

Porcupines have a prickly reputation, but as the multi-faceted roles which they play in their ecosystem become better understood, they may prove more endearing than many might have imagined. Their presence may not always be welcome in orchards and managed timber stands, or appreciated when they take to chewing on outhouses or quilling pets, but their absence in forestlands can have negative consequences for overall ecosystem health. They are ecosystem engineers, creating habitat for numerous other species, and serve as a food source for predators such as the cougar, fisher, gray wolf, and some large raptors like the great-horned owl. Porcupine populations in the Pacific Northwest are not well understood, but recent research suggests they may be in decline, and almost certainly reduced compared to historical levels. We are only just beginning to quantify the impacts that

### Damage

**Porcupine:** Usually there will be numerous, large (for a rodent) tooth marks left against the bare tree where the outer bark was removed. Look for tooth marks about five millimeters wide and one inch long. There may be hundreds of scrapes. They feed anywhere from the base to the crown, and may girdle the tree. There may be a den nearby.

**Black Bear:** Outer bark is ripped or stripped off and the inner bark is chewed. Often there are large pieces left dangling or lying on the ground. The tree may be marked by the bear's large claws and teeth. Bears usually feed at the base of the tree and may cause girdling.

**Mountain Beaver:** Damage can look similar to porcupine, but tooth marks will generally be much smaller. Saplings are the preferred target. Girdling may occur but typical damage will typically be observed as clipping, at a 45° angle. Look for numerous small burrows, often with piles of clipped ferns and saplings at the entrance.



decades of treating porcupines solely as pests have had on their numbers, distribution, and the woodland ecosystems that they have historically been a part of, but are now becoming absent in. In the meantime, private forestland owners have an important part to play in ensuring the species persists into the future as one of nature's very unique ecosystem engineers.

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### Porcupine Climbing a Tree



Photo by iNaturalist, Blake M Ross

### Porcupine Climbing a Tree



Photo by iNaturalist, Blake M Ross

### Porcupine Den



Photo: iNaturalist, Actually Axley

### Porcupine Den



Photo: Flickr, Cataloging Nature



For questions about regulations for small mammals and other information contact your local Fish and Wildlife Office. . . Also contact your forestry agency about use of chemicals (e.g., rodenticides) for purposes of forest management.

Oregon Department of Fish and Wildlife: [myodfw.com](http://myodfw.com)

Washington Department of Fish and Wildlife: [wdfw.wa.gov](http://wdfw.wa.gov)

Oregon Department of Forestry: [www.oregon.gov/ODF](http://www.oregon.gov/ODF)

Washington Department of Natural Resources: [www.dnr.wa.gov](http://www.dnr.wa.gov)

### Porcupine and Porcupine Damage



Photo: Flickr Porcupine Root and Bole Damage. Photo by Paul Hennon

Flickr, Porcupine wound teeth-marks.  
Photo by Robin Mulvey



Photo: iNaturalist, John Krampl



### About the Woodland Fish and Wildlife Group

The Woodland Fish and Wildlife Group is a consortium of public agencies, universities, and private organizations which collaborates to produce educational publications about fish and wildlife species, and habitat management, for use by family forest owners in the Pacific Northwest. Currently available publications can be viewed and downloaded, free of charge, at the organization's website:

[www.woodlandfishandwildlife.com](http://www.woodlandfishandwildlife.com)

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The Woodland Fish and Wildlife Group gratefully acknowledge funding support provided by USDA Forest Service, Pacific Northwest Region, State and Private Forestry.

### Project Partners

