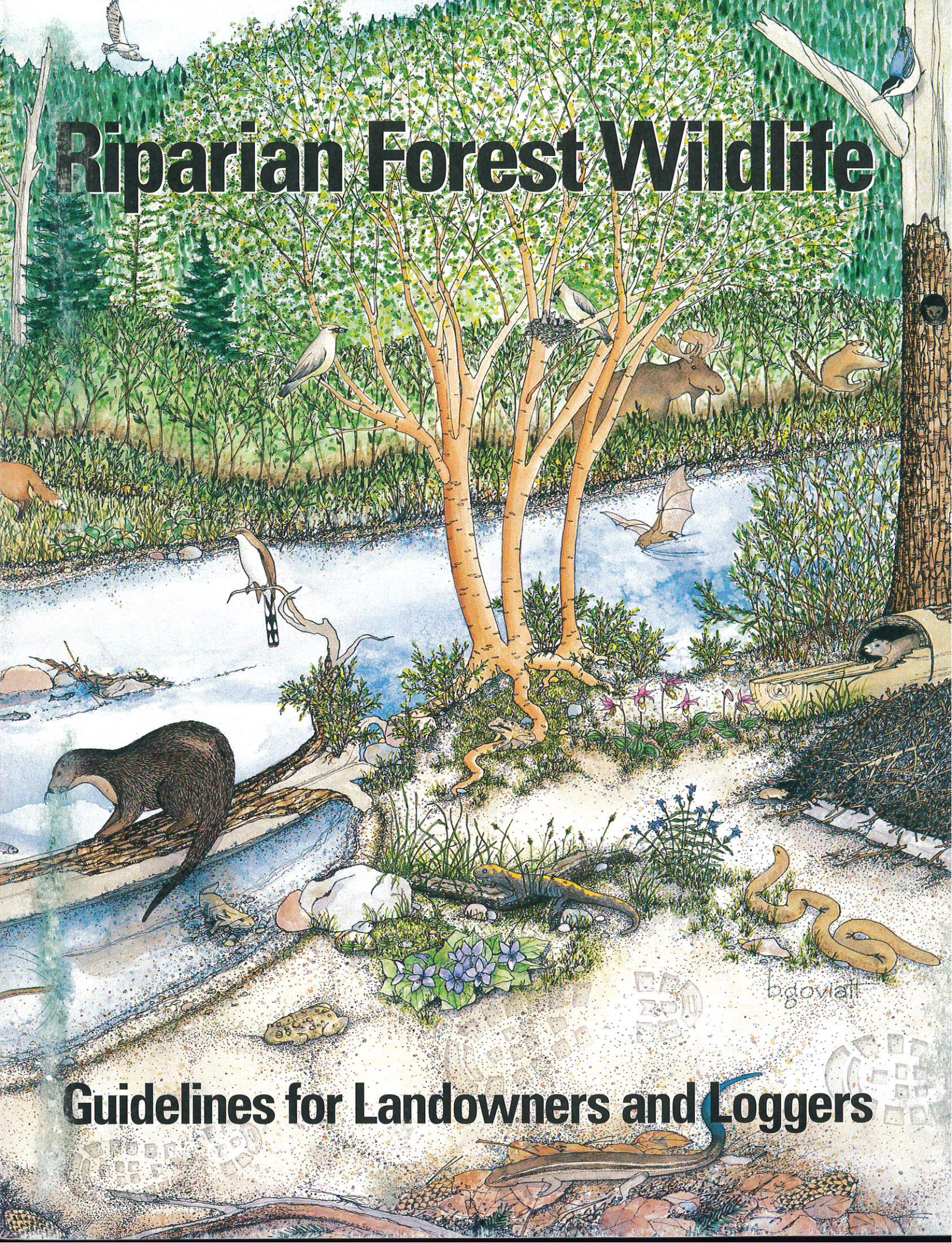
Riparian Forest Wildlife
bgoviatt
Guidelines for Landowners and Loggers

The Riparian Forest *is not just a place where a few favorite birds and animals collect. Instead, this part of the forest, located along streams, rivers and lakes, is an attraction for countless wildlife species. Many species, like trout, beaver, dipper and tailed frog must have riparian forests to survive. Others, like white-tailed deer, grizzly bear, yellow warbler and garter snake use this place seasonally. Species like fox, chickadee, flying squirrel and brown creeper use the riparian forest but also thrive in upland forests. Deer, elk and bear are as dependent on the riparian forest as aquatic insects and fish. The attraction for all these animals is the diversity of plants found in the riparian forest, how those plants are arranged and the many food sources they provide. The working riparian forest requires large growing trees, logs falling into streams and a never ending supply of decomposing plants.*

About This Publication

The 1993 Montana Legislature, in Senate Joint Resolution #24, asked MSU Extension Forestry to develop voluntary wildlife habitat management guidelines to be considered during the conduct of all Montana forestry practices. This publication is the start of that process. Its goal is to introduce to the reader the riparian forest, a place different from the upland forest, describe some of the wildlife that use this unique place and offer guidelines for consideration when operating in and around it. This publication is not intended to provide information on "how to manage" the riparian forest—that subject will have to wait for future research results. Because the Joint Resolution was unfunded, Extension Forestry turned to the private, non-profit Montana Forest Stewardship Foundation and several other organizations and individuals for help. The final result was the Foundation collecting funds to meet printing costs and Extension Forestry contributing development costs. Special thanks are extended to the Forest Stewardship Foundation Board of Directors for their help.

Among the contributors to the Stewardship Foundation were:

Mary Ann Mott
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Table of Contents

Introduction to Riparian Forests 2
- *What Makes Riparian Forests Unique?*
- *Are Riparian Forests the same as Streamside Management Zones (SMZs)?*
- *More About Edges*
- *Riparian Forest Plants*
- *How Riparian Forests Change*

Dead Wood is Good in Riparian Forests 8
- *Instream Wood*
- *What Good is Instream Wood?*
- *How Much is Enough?*
- *What's the Effect of Timber Harvesting on Instream Wood?*
- *Down Wood on the Riparian Forest Floor*
- *What's Happening Inside Down Woody Debris?*
- *How Long Does Down Wood Last?*
- *Adding Down Wood to Riparian Forests*
- *Standing Dead Wood (Snags) in Riparian Forests*
- *Snag Deterioration and Wildlife Use*

Riparian Forest Streams Are Not Alike 14
- *Identifying Streams*
- *Energy Soup*

Riparian Forest Birds 16
- *Neotropical Migrant Birds*
- *Neotropical Migrant Songbirds*
- *The Secret to Riparian Forest Songbird Diversity*
- *The Aquatic Songbird*
- *The Nest Parasite*
- *Accipiters - Neotropical Migrant Predators*
- *River Waterfowl*

Riparian Forest Cold-Water Fish 20
- *Connections Between Riparian Forests and Fish*
- *Focus on Bull Trout*

Riparian Forest Mammals 22
- *Bats*
- *Beaver*
- *Grizzly Bear*
- *Fisher*
- *River Otter*
- *White-tailed deer*
- *Moose*
- *Elk*

Amphibians and Reptiles on the Floor of the Riparian Forest 26
- *Amphibians Use the Riparian Forest*
- *Reptiles*

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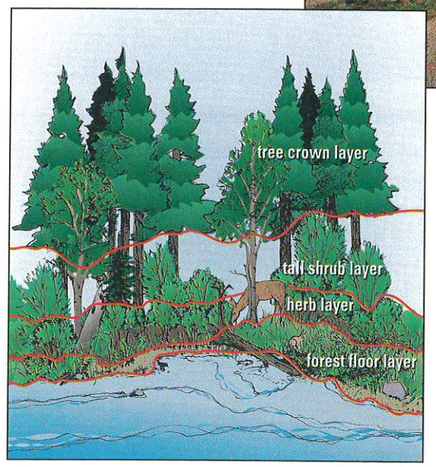
Introduction to Riparian Forests

Riparian forests occur along the shoreline of streams, lakes, reservoirs, springs, marshes, bogs, ponds and seeps. Their moist, often wet soils and high water table create a place for water-loving plants such as alder, willow, cottonwood and cedar. Shrubs and herbaceous plants often grow thick, almost impenetrable. The riparian forest provides necessities of life for wildlife—food, water, protection from weather and enemies, and a place to rear young. It's often referred to as the "green zone" because it forms a necklace of vegetation that stays green longer during summer months, a marked contrast to upland forests. While usually less than five percent of a watershed, riparian forests provide a disproportionately large number of benefits. The riparian plants serve as a filter and sponge. Sediment, pollutants and other debris are trapped, reducing the amount that enters streams, lakes or other water bodies. Its soils also act like a sponge, collecting and holding water. Gradually the water leaks out, replenishing streams and lakes during dry summer months. For years riparian areas have been known to be important for fish and wildlife, but recently scientists have found they are also important for clean water.

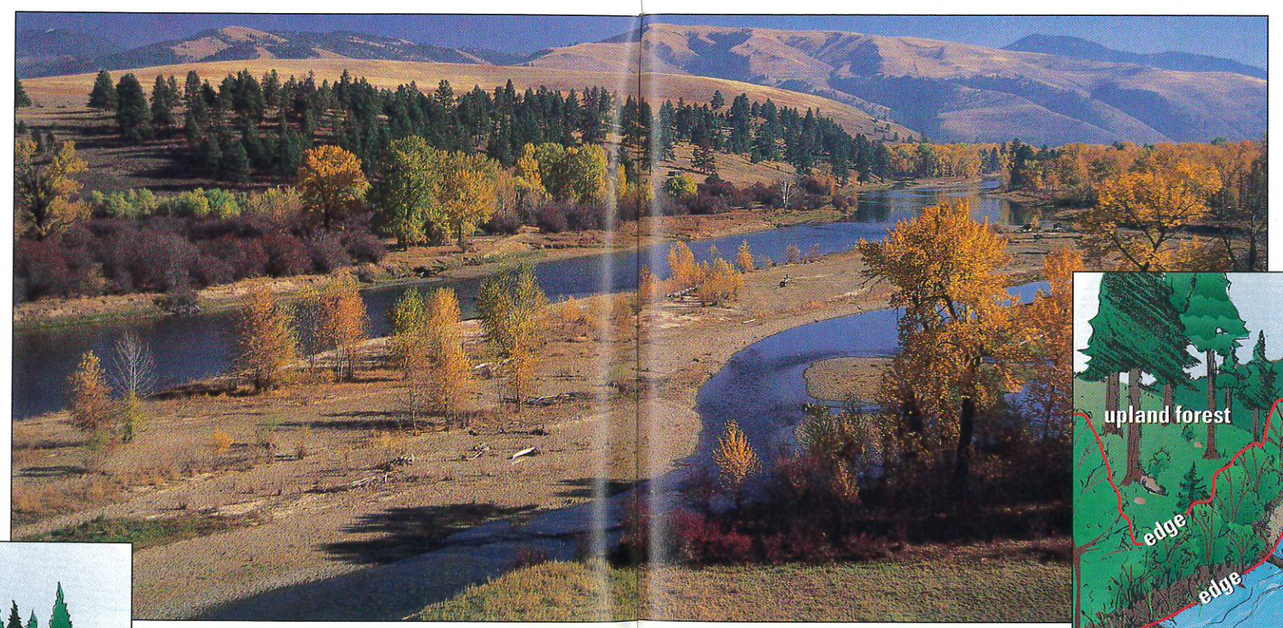
What Makes Riparian Forests Unique?

Some riparian forests are narrow bands hugging the edge of a high mountain stream. Others stretch thousands of feet beyond the waters edge reaching out across broad flood plains. Regardless of extent, recognizing their importance for both terrestrial and aquatic wildlife is the goal of this publication. While not every riparian forest includes all of these characteristics, here are some of the reasons riparian forests are unique.

- They are a mix of water, cover and food, rarely found in other parts of the forest.
- For some animals the presence of water makes it their preferred, or even sole, habitat. Most amphibians, like the long-toed salamander, live on land and return to water to breed, spending much of their lives in riparian forests.
- Open water and a high water table combine to produce a distinctly different microclimate than upland forests—often higher humidity, more shade and unique air movement.
- The long narrow shape provides "edges" attractive to wildlife, where water meets land or where water-loving plants mesh with upland forests.
- The multilayered, vertical and horizontal plant canopy offers a variety of nesting, resting, feeding and wildlife reproduction areas.
- Generally, their use by wildlife is greater than other forested habitats. They frequently support a greater number of individuals as well as a greater number of species. They are the most important wildlife habitats of intermountain west forests.



▲ From forest floor to tree crowns, each vertical and horizontal plant layer contributes a unique combination of cover and food. This vegetation diversity results in a variety of animals and uses.

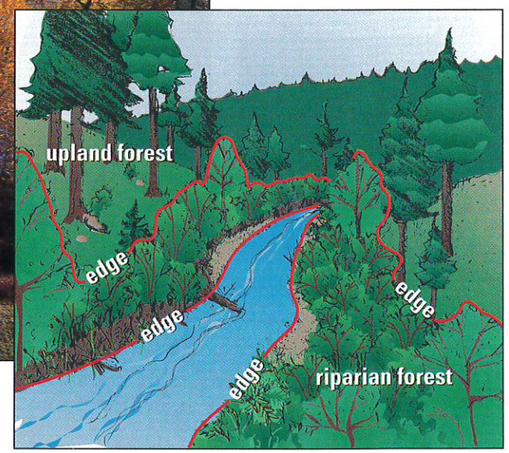


▲ A 50-foot-wide strip on both sides of the stream is the mandated minimum for a streamside management zone (SMZ). The riparian forest may be narrower or wider than the SMZ.

▲ This red fox, like other predators, hunts along "edges." The chance of finding prey is often higher there.

Are Riparian Forests the same as Streamside Management Zones (SMZs)?

An SMZ is a legally agreed-upon definition. In Montana, a SMZ is a protected area at least 50 and up to 100 feet wide, along one side of a stream, lake or other water body. Definitions like this make it convenient for individuals to describe certain forestry practices acceptable in the SMZ. However, since wildlife don't recognize SMZ borders, it makes more sense to think in terms of riparian zones for wildlife habitat. In some places the riparian zone may be less than 50 feet wide, in others it could reach out much farther. Riparian zones are different than SMZs. At first look, most people would agree that the riparian zone includes the water's edge, where a number of specialized plants and animals live. As they learn more, people also realize that the banks and floodplain, those areas periodically flooded by high water, is also the riparian zone. But when seen in its entirety, the riparian zone really includes the band of forest along the stream that has a significant influence on the stream ecosystem, and is likewise influenced by the stream. While this may seem nebulous at first, riparian forest zones or boundaries become more obvious as one learns more about them. The important thing is to understand what purpose they serve for the stream, for wildlife and for humans, and do what's necessary to protect or enhance them.



Two obvious edges occur in the riparian forest. ▶

More About Edges

An "edge" is the place where two different plant groups or communities come together. In riparian forests there are at least two obvious edges. One occurs at the point where aquatic plants end at the water's edge and riparian plants begin growing. The other edge occurs where riparian forest plants end and upland forest plants begin. Edges frequently support a greater number of individuals and species.

The reason is that edges provide animals with simultaneous access to more than one environment, a greater variety of vegetative cover and more abundant food sources. However, edges can be traps, where animals venture into to feed or rest and are picked off by waiting predators, especially when the edge is not wide enough or has insufficient cover for protection. Certain animals adapted to large, undisturbed blocks of habitat suffer from the creation of edges by human activities that convert these habitats to other uses *(see page 18)*.

Remember:
Riparian forests can occur next to streams, lakes, reservoirs, springs, marshes, bogs, ponds and seeps.

Remember:
In Montana, there are laws and rules that govern forest management activities in SMZs.

Remember:
Riparian forests can extend beyond SMZ boundaries.

Remember:
Edges provide opportunities and problems for wildlife.

Remember:
Wildlife is the result of habitat. Where there is food, cover, and water, there is wildlife habitat. If you own riparian forestland, or are a logger who operates around riparian forests, you are a wildlife manager.

Remember:
Riparian forests are key to the health of streams, wildlife and humans.

Riparian Forest Plants

The life support system of the riparian forest originates with the water and variety of plants that grow there. Some plants require the presence of open water and grow along its shoreline. Others thrive in the higher humidity and moist soils created by both open water and ground water near the soil surface. Generally, vegetation in a riparian forest is more diverse, dense and productive than surrounding uplands. The identity of certain "indicator" plants can immediately help to locate riparian areas. Pictured here are some of the common types of riparian forest surrounded by indicator plants common to Northern Rocky Mountain riparian forests. Rushes, cattails, most willows and sedges occur in very wet areas or where soils are saturated for most of the year. Alder, cottonwood, red-osier dogwood, redtop grass and arrowleaf groundsel are also riparian indicators. The multilayered plant canopy provided by this rich mix of plants offers nesting, resting, feeding and wildlife reproduction areas.

▲ Bulrush is used by waterfowl for nesting cover. A variety of birds eat its seeds.

▲ Field horsetail (horsetail rush) is not commonly eaten by elk or deer. It grows primarily in moist areas with a high water table and sandy or gravelly soils. It contains large amounts of silica. It's reported to be poisonous to livestock if fed in large quantities in dry hay.

◀ Reed canarygrass provides streambank stabilization along with food, cover and nesting value to wildlife.

▲ Water birch leaves, twigs and fruit provide food for small mammals, game birds and songbirds, and thermal cover for deer and waterfowl.

▲ Cattails provide erosion control, hiding and nesting cover for waterfowl and deer, and building material for muskrat huts.

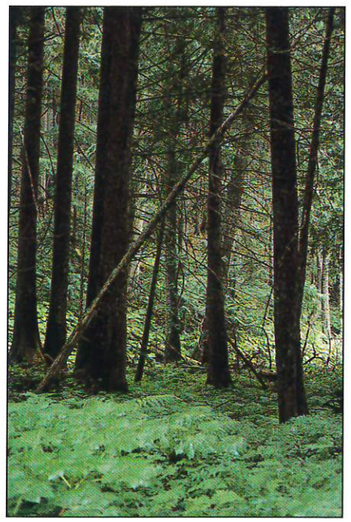
◀ Bebb willow is valuable browse and cover for moose and elk, and also nesting and food for songbirds.

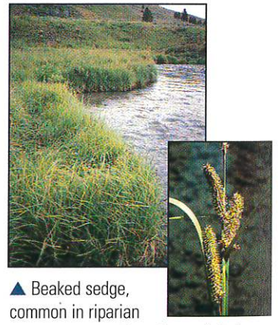
▲ Drummond willow receives heavy winter use by deer, elk and moose. Beaver use its shoots for food and building material. It sprouts quickly after wildfire and is an effective stabilizer of streambanks.

▲ Sandbar willow is a shrub with good food value for upland game birds, song birds and small mammals. It also provides cover and nest sites.

▲ **Drummond willow/beaked sedge**

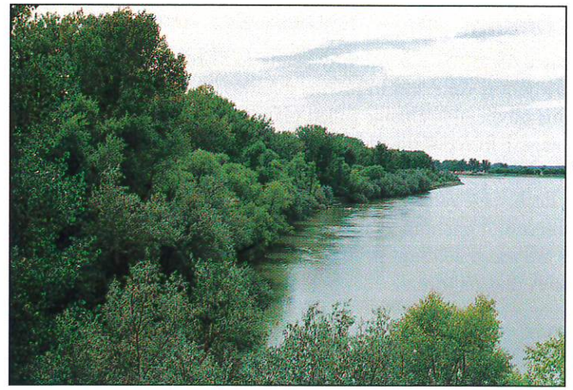
▼ **Subalpine fir/devil's club**





▲ Beaked sedge, common in riparian areas, grows to three feet tall. It is used sparingly by elk and moose because its razor sharp leaves can cut their tongues. It forms a dense erosion-resistant sod. Along streams, this undercut sod sags, providing fish cover and bank protection.

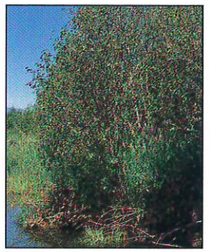
▲ Black hawthorn, often found in riparian areas, is forage for elk and deer. Its persistent fruit is eaten by birds, small mammals and bears. Deer, rabbits and a variety of birds use its thickets as cover. Its branching characteristics provide good nesting sites. Its root system will sprout and sucker if the stem is cut.



▲ **Great Plains cottonwood/red-osier dogwood**

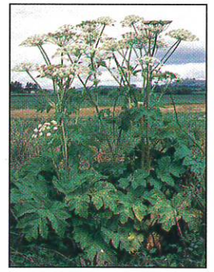
▲ **Black cottonwood/red osier dogwood**

▲ Red-osier dogwood is preferred forage for deer, elk and moose. Its berries are eaten by birds in winter. The root system also provides streambank stabilization.



▲ Mountain alder is rarely browsed by livestock or wildlife but provides good hiding cover for deer and elk along with nesting habitat for game birds and songbirds. Nitrogen fixing bacteria on its roots helps improve soil fertility.

▲ **Western redcedar/devil's club**



▲ Cow-parsnip, often found in riparian areas is a food plant for bears, deer and elk. It's been documented that elk in Yellowstone Park select cow-parsnip even in summer when other forage is abundant.

Arrowleaf groundsel is a forb with good food value for both small birds and mammals. ▶

Listed below are some of the most common types of riparian forest.

Northwest Montana

Drummond willow/
beaked sedge
Black cottonwood/
red-osier dogwood
Spruce/red-osier dogwood
Spruce/field horsetail
Western redcedar/devil's club
Western redcedar/ladyfern
Subalpine fir/devil's club
Subalpine fir/
bluejoint reedgrass

Southwest Montana

Quaking aspen/
red-osier dogwood
Douglas-fir/red osier dogwood
Ponderosa pine/
common chokecherry

Central Montana

Great Plains cottonwood/
red-osier dogwood

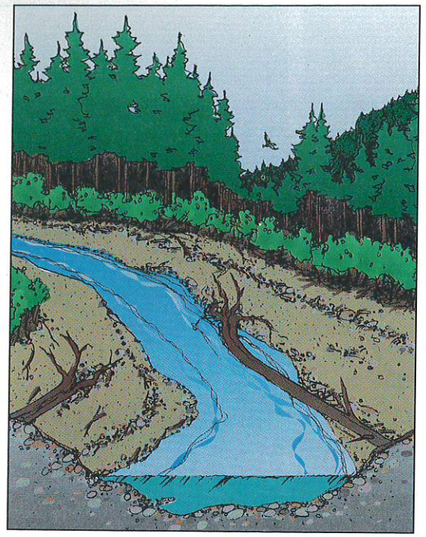
Remember:

Combinations of certain plants like those pictured provide clues to the identity and extent of riparian forest boundaries.

How Riparian Forests Change

Riparian forests, like all forests, are dynamic and constantly changing. Except for catastrophic disturbances like wildfires or floods, riparian forests change slowly over time and in predictable ways. One group of plants becomes dominant and is gradually replaced by another. This predictable change called plant succession is pictured in stages 2, 3 and 4. In this example, a flood disturbance in stage 1 initiates the change and the riparian forest moves from early-, to mid-, to late-succession stages over a period of 100+ years. These stages illustrate a common riparian forest successional pathway, typical of the intermountain forest region. Each stage reflects changes in forest structure which in turn causes some wildlife species to reduce their use of the riparian forest and encourages use by others. Biologists often refer to wildlife generalists and specialists in the riparian forest. Generalists are those wildlife species able to meet their survival needs in a wide variety of habitats. In contrast, specialists are those species that require distinct habitats.

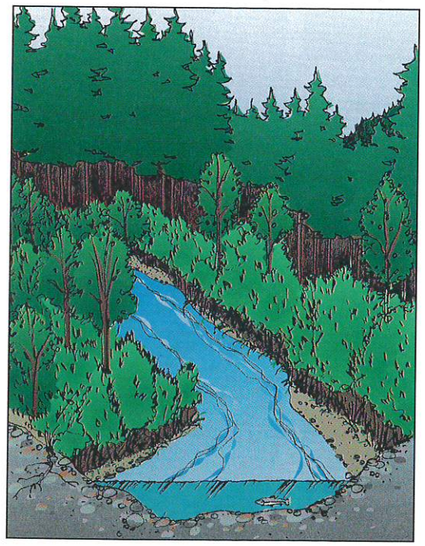
Stage 1: ***Disturbance and Initiation.***



After a major flood, like the one pictured, streambanks are scoured of previous vegetation and a fresh layer of soil is left. If severe enough, flood events create a disturbance that initiates the start of plant succession from bare ground. A 100+ year cycle from willow and cottonwood seedlings to early-, mid- and late-succession forest begins again. In stage 1, pioneer plants like sandbar willow and cottonwood are the first to colonize the disturbed area. These plants are adapted to quickly invade flood plains after surging water washes away previous vegetation. Their seeds are viable for only a short time and require constantly moist, but not flooded soil for germination, and full sunlight for seedling survival. Wildlife use this initiation stage, but they may be limited due to the loss of prior plant structure. For example, elk are attracted to the browse of emerging cottonwood shoots. The robin, a generalist found in many habitats, is commonly seen in stage 1 riparian areas. As plant structure develops and stage 1 moves into stage 2, plant cover is available for more wildlife species.

1964—the year of the flood. Bridges were breached and riparian forest succession was put back to stage 1.

Stage 2: ***Early-succession riparian forest (10-40 years after flood).***



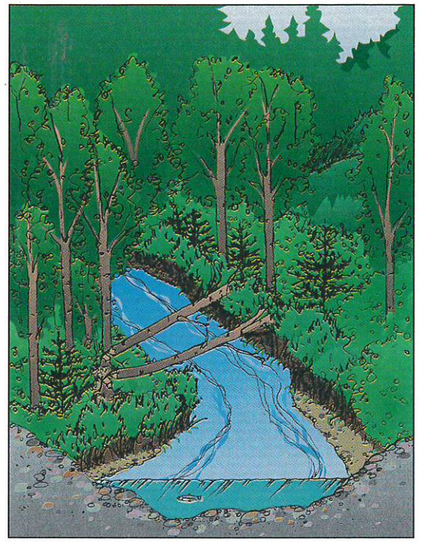
The forest in this stage is developing into dense stands of shrubs and small trees, sometimes dominated by sandbar willow. In time, cottonwood trees overtop the willow, shading it out, except for where it survives along the edges of the stream. Wildlife generalists are attracted to this early-succession riparian forest. Among the generalists are Brewer's blackbird, robin, western wood-pewee, white-tailed deer, bear, red fox and riparian forest snakes.

Early-succession riparian forests attract generalists like this western wood-pewee. The variety of wildlife and their abundance is relatively low at this stage of development.

White-tailed deer, another generalist, is attracted to the abundant browse and security provided by the early-succession riparian forest.

Stage 3: ***Mid-succession riparian forest (40-80 years after flood).***

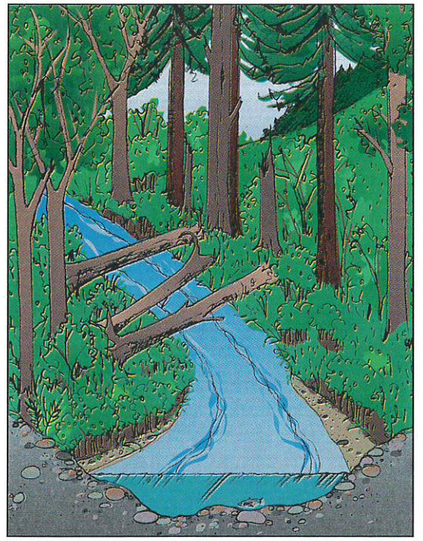
Cottonwoods continue to dominate but other species such as red-osier dogwood, alder, water birch, Douglas-fir, ponderosa pine, lodgepole pine, Englemann spruce and Rocky Mountain juniper may occupy the understory, along with numerous herbaceous plants. The developing multilayered plant canopy offers a variety of nesting, resting, feeding and wildlife reproduction areas. Animals use the lower, mid or upper layers of plants depending upon their needs. Again, generalists are attracted to this riparian forest, but as tree structure matures and adequate sunlight allows for shrubby undergrowth, specialists like the common yellowthroat, solitary vireo and ruby-crowned kinglet begin to appear.



As mid-succession forests mature, specialists like this common yellowthroat appear.

Stage 4: ***Late-succession riparian forest (100+ years after flood).***

In this stage ponderosa pine, Englemann spruce and Rocky Mountain juniper invade the cottonwood overstory and eventually become more dominant. Accompanying them is an intermediate layer of tall shrubs, low shrubs and openings with grasses and forbs. Broken tops and hollow trunks of cottonwood indicate their natural aging process. Dead and dying trees, snags and down logs are readily available. Canopy openings allow for development of multilayered understory vegetation. Along with generalists like elk, there are many specialists, like the northern goshawk, yellow-rumped warbler, pileated woodpecker and northern flying squirrel.



Late-succession riparian forests attract wildlife variety and abundance, with both generalists and specialists such as this northern flying squirrel.

The older, multilayered vegetation of the late-succession riparian forest with abundant snags attracts specialists like this pileated woodpecker.

Remember:

Stage 2 does not occur without a stage 1 flood disturbance. Cottonwood forests require land-clearing floods, full sunlight and moist soils to regenerate naturally. Without repeated floods, conifer forests slowly replace cottonwood forests in the Intermountain West.

Remember:

Older riparian forests like stage 4 have more complex forest structures, with greater accumulations of dead wood. Often lasting for decades, this dead wood is used and reused by many wildlife species, and finally recycled into soil.

Guideline:

Because of the difficulty of regenerating cottonwood trees, consider leaving them to help maintain the variety of riparian forest structure and wildlife.

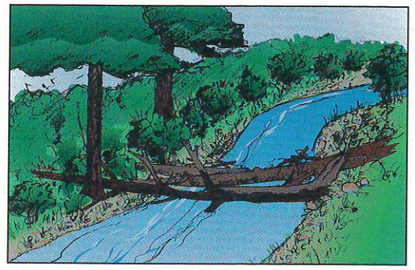
Dead Wood is Good in Riparian Forests

The riparian forest contains three kinds of dead wood or "coarse woody debris" (CWD)—instream wood, down wood and standing wood (snags). Each is described separately in the next six pages. CWD can range in size from 3 to 30 or more inches in diameter and of varying lengths. In contrast, fine woody debris consists of twigs and smaller branches. Whatever its form, dead wood is crucial to the life activities and service provided by riparian forests. As a tree dies, each phase of decomposition serves a role in feeding and housing wildlife. Scientific knowledge about the role of CWD is increasing. But even where it has been studied the most, scientists still are not sure how much dead wood should be left after logging. That's why careful management of CWD in riparian forests is important.

Instream Wood

Scientific understanding of the interconnections between the riparian forest and stream is relatively recent. Previously, no one realized that the riparian forest was a link between the upland forest and the stream. For example, as recently as the 1970s, CWD that fell into streams was considered a problem in the Northwest. Fish experts saw it as an impediment to fish passage and damaging to stream channels. During the 60s and 70s many forest streams were routinely cleared of CWD.

By the early 1980s riparian forests were seen to do more than just supply shade and keep streams cool. We now understand that both large logs in the stream and large trees growing in the riparian forest are directly connected to healthy fish populations. When trees are removed, conditions for many fish species are dramatically affected. All those needles and leaves that fall into the stream are the fuel that drive the streams' food chain *(see Energy Soup, page 14).* A cutthroat trout's caddisfly lunch is only available if leaves and needles fall into the water, because many aquatic insects live on such debris. So fish and caddisflies are as dependent on riparian vegetation as deer, elk and bear. CWD in streams is now considered an essential habitat component required by many wildlife species.



CWD slows stream flow and helps create pools and riffles.

Fish rest and feed in pools created by CWD.

Trees that fall into streams can last for decades, but ultimately need to be replaced. Pieces of conifer trees have been in Pacific Northwest stream channels for 200 years or more. Old growth conifer wood is estimated to decay at a rate of one percent per year, but the rate varies among tree species. Conifer CWD generally outlasts hardwoods in the Northwest.

What Good is Instream Wood?

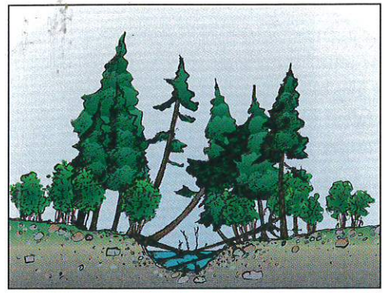
Instream wood acts as a control agent, slowing streamflow and creating riffles and pools. By holding back water, instream wood allows the force of the current to scour pools and rebuild gravel beds. Pools are depressions in the streambed where water slows. Riffles are shallow areas where the streambed is flat, water flows faster and gravels are common. These are important habitats for fish. Fish spawn in the gravel of riffles. Where water spills over and around instream wood, pools are formed by the water's erosive action. Fish depend on the small, slow-water locations provided by instream wood. In these wood-created pools, fish rest and feed. Because fish are territorial, instream wood can keep fish visually isolated from one another, provide hiding cover and reduce competition. More fish can survive with hiding places created by instream wood. Without instream wood, gravel can be flushed downstream by fast-flowing water, streambeds can be degraded to bedrock, and fish spawning habitat can be lost *(more about cold-water fish, pages 20-21).*

In addition to their value for fish, suspended logs can be bridges for bobcats and other terrestrial wildlife species.

Because fish are more visually isolated, more CWD often means more fish.

How Much is Enough?

It is not known how much CWD is too much for a stream. However, in experiments where woody debris is artificially placed in the stream, fish populations have increased. Recent studies in Oregon indicate that the addition of wood has positive effects on aquatic habitat in small headwater streams. In 1989, logs of three different sizes (8,16, 24 inches in diameter), were placed into each of two streams. Prior to placement, pools and riffles were inventoried. Four years later, in 1993, the streams were again inventoried. The new logs created an additional 43 percent pool volume in one stream and 71 percent in the other. Of the different sizes, the most effective for creating pools was the large, 24-inch log spanning the stream from one side to the other. Pool volume, 90 percent in one stream and 84 percent in the other, was directly related to the placement of 24-inch spanners. Cutthroat trout of 1 year + were attracted to the new pool locations, especially during low flows in summer.



As much as 75 percent of the coarse woody debris (CWD) in streams comes from trees within the first 50 feet of the streambank. About 90 percent comes from within 80 feet of the stream. So in some riparian forests CWD comes from the upland forest.

There are special advantages from whole dead trees that fall into streams. Tree stems with branches and roots attached remain in place longer because their branches and roots become snagged on stream obstructions. Trees without branches and roots often float downstream during high water. Short pieces can be stable in narrow streams, but longer pieces are necessary in wider channels where they are caught against standing trees during high water.

What's the Effect of Timber Harvesting on Instream Wood?

Early investigations, before the importance of CWD was fully realized, and before the use of Best Management Practices (BMPs), showed interesting differences. One study that compared the same stream, flowing through both managed and unmanaged forests, indicated the following differences. The average length of wood pieces in the managed stream was half the length of unmanaged (26 feet vs 48 feet). Stumps made up 60 percent of the wood in the managed compared with 6 percent in the unmanaged forest stream. Total wood volume was no different, but the pieces were more prone to float and move downstream in the managed portions of the stream. The trend was smaller and fewer pieces of wood in streams of managed forests.

Timber harvesting has changed as a result of those early studies. The use of BMPs have helped loggers and landowners realize the difference between "logging slash" and the leaves, needles and branches that fall naturally into streams. Slash is residue left after logging or thinning. It includes tree tops, branches, uprooted stumps, defective logs and bark. BMPs prohibit depositing this material in streams, lakes and other bodies of water. Heavy concentrations of logging slash rotting in a stream consumes oxygen in stream water, leaving unhealthy conditions for fish and other aquatic life.

However, during stream and riparian area restoration activities, CWD is often used to improve fish and wildlife habitat. Planned placement of logs in streams or riparian areas is not the same as logging slash. It can restore stream health but should always be done with the guidance of biologists and in compliance with proper permits.

Some landowners take the conservative approach and eliminate all timber management practices from riparian forests with the intent of letting them become old stands *(stage 4, page 7).* Others feel that because riparian forests are often productive timber growing sites, a no-cut policy is impractical, and they can and should be managed according to BMPs and the SMZ law.

Remember:

Dead trees are not wasted in the riparian forest. Dead trees are valuable, either at the location where they once lived or after entering the instream world.

Remember:

CWD maintains pools, riffles and streambed spawning gravels. Pools and hiding cover created by CWD are important for fish.

Remember:

Manage riparian forests with moderation. Montana's SMZ law governs all timber harvesting activity.

Remember:

CWD should never be placed in a stream without professional advice.

Guideline:

Retain some dead trees with branches and roots attached. They provide special advantage as instream CWD.

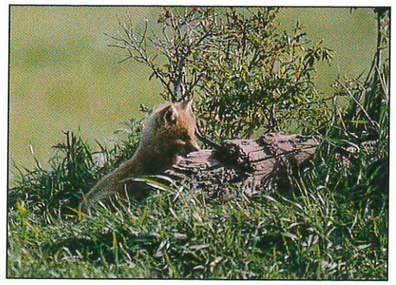
Guideline:

Leave trees already leaning toward the stream within landing distance. They have the highest probability to contribute to future instream wood. These trees may be outside the riparian area and in the upland forest.

Down Wood on the Riparian Forest Floor

For years, CWD has been harvested from the forest if saleable. In other cases, it has been piled and burned to reduce fire hazard. And because it is home for small mammals (hares, mice and gophers), it has also been removed during site preparation to reduce damage to newly planted tree seedlings. But down wood on the riparian forest floor has a number of valuable functions.

Down wood is home to small mammals. A 4-inch diameter limb can provide security for a shrew, a 10-inch diameter log can house deer mice and a 30-inch diameter log can be home to a fisher, bobcat or lynx. Some animals use logs as feeding sites. Others carry food to logs where it is either eaten or stored. Certain reptiles, birds and mammals like black bears reproduce alongside, under or within logs. Soil and other debris that accumulates along the upslope side of a fallen tree allows small vertebrates to tunnel alongside. The downhill side provides cover for larger vertebrates. Spaces created under snow are valuable too.



A red fox hunts for rodents and other prey living in coarse woody debris.

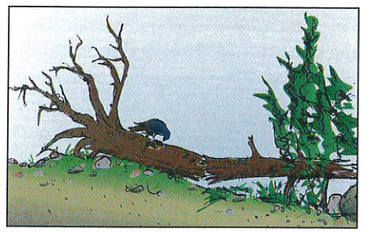
While lizards use logs for sunning, grouse use them as drumming sites. Drumming is thought to be a means of attracting or communicating with a mate or to announce territories and keep competitors away.

CWD lying along riparian slopes reduces erosion by forming a barrier to downhill soil movement. Over time these logs provide protective sites for new tree seedlings. In addition, fallen trees are a source of soil organic material. The nutrients they contain are released during decomposition by microorganisms, fungi and animals, such as termites. This decaying wood contributes nitrogen for tree growth as lignin and humus are decomposed. Nitrogen is often the most limited forest nutrient, so decaying fallen trees become important nitrogen sources.

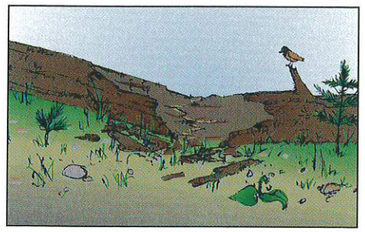
What's Happening Inside Down Woody Debris?

Fallen trees often take considerable time before they become habitat for plants or animals. But cracks and splits that occur during falling, become entry points for microbes and small invertebrates. These animals have specific jobs. They normally only invade dead trees. Once inside, they consume and break down wood cells and fibers. Wood-boring beetle larvae and termites tunnel through the bark and wood, opening the tree to others. Boring and tunneling ants and termites have been known to excavate up to 20 percent of fallen trees. In addition to excavating, termites carry nitrogen-fixing microorganisms in their intestines. Wood-boring beetle larvae and termites tunnel through the bark and wood, not only inoculating it with microbes but also opening the tree to colonization by other small invertebrates. Mites, spiders, millipedes, centipedes, amphibians and small mammals enter as space becomes available. As rotting progresses, roots from plants growing nearby penetrate the decayed wood, often splitting it as they grow.

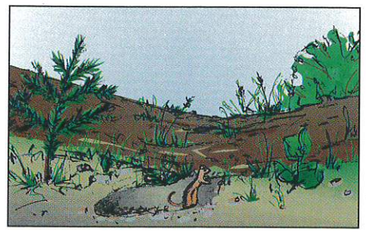
The decomposition of down wood is systematically carried out by a host of microbes and invertebrates.



A log supported off the ground by intact branches provides snowshoe hares a place to raise young. Goshawks and other raptors use logs to pluck feathers or fur from their prey.



Once the bark loosens there is hiding cover for tree frogs. Western skinks *(page 28)* and shrews hunt for insects between bark and wood. As grass and other vegetation become established alongside the log, juncos may use the area for nesting.



Shrews, voles and weasels burrow into the interior as it softens, and toads, skinks and snakes may take up residency when burrows become available.

Once weakened and sagging, logs provide cover for snakes, shrews, chipmunks and voles. Decayed limbs leave hollows used by wrens and bluebirds. As the log sinks to the ground, mice nest under the bark.

Reptiles like this western terrestrial garter snake sun themselves on down wood.

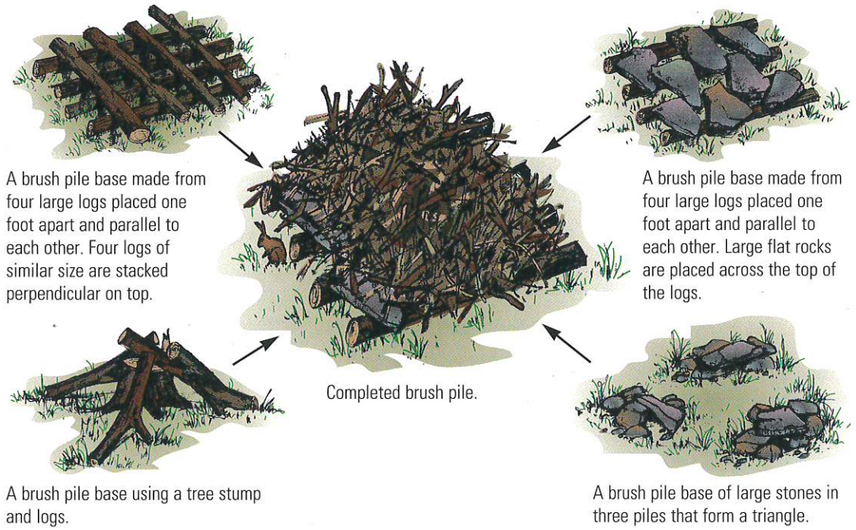
How Long Does Down Wood Last?

Decomposition of woody debris on the forest floor varies with climate, wood species, size of material and the frequency of wildfire. In cedar-hemlock forests with wildfire intervals of more than 200 years, CWD lasts a long time. In drier riparian forests with more frequent fire, CWD will disappear more rapidly. Studies show that Douglas-fir branches, one inch in diameter, can take 36-50 years to decompose. Needles take only 10 to 14 years to decompose. After 150 years on the ground, the logs in one Oregon study had lost only 75 percent of their original density. How many wildlife species might use a log over its decomposition lifetime?

Adding Down Wood to Riparian Forests

Nesting cover for birds and small mammals can be enhanced in riparian forests, or when CWD amounts are inadequate. Brush piles can be built *(see below)*. A properly constructed brush pile can provide escape habitat for many wildlife (rabbits, rodents, grouse, etc). Brush piles are not just heaps of logs and branches. They must have space inside for movement while at the same time keep predators out. The brush pile base is the most important feature for long-term use.

Locate brush piles on the edge of the riparian forest and within 100-200 feet of feeding and watering areas. Be aware that brush piles attract mice and woodrats. While prey for raptors, these wildlife species can also do considerable damage to newly planted tree seedlings.



A brush pile base made from four large logs placed one foot apart and parallel to each other. Four logs of similar size are stacked perpendicular on top.

A brush pile base made from four large logs placed one foot apart and parallel to each other. Large flat rocks are placed across the top of the logs.

Completed brush pile.

A brush pile base using a tree stump and logs.

A brush pile base of large stones in three piles that form a triangle.

Brush pile construction begins with a base of logs or stones or a combination as pictured. Complete brush piles by adding brush to the top and sides of the base. Start with large limbs, adding smaller pieces until the pile is about six feet high and six feet wide.

Remember:

Insects that live and feed in dead wood do not generally infect live trees. Leave dead wood in the riparian forest.

Guideline:

Protect down logs by working around them and avoid pushing them into burn piles. Do not remove down logs.

Guideline:

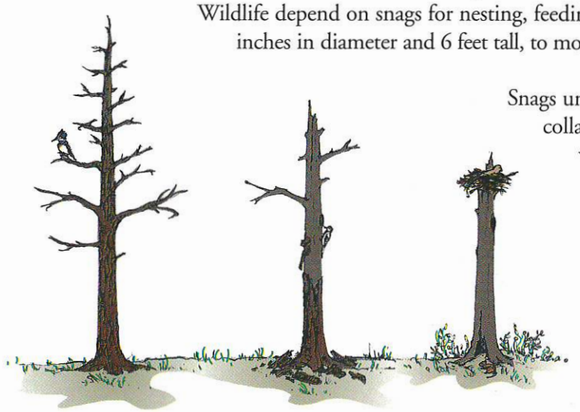
Larger, rather than smaller diameter down logs are more useful to wildlife and should be retained.

Guideline:

Consider adding man-made brush piles and large logs that can enhance wildlife use in riparian forests.

Standing Dead Wood (Snags) in Riparian Forests

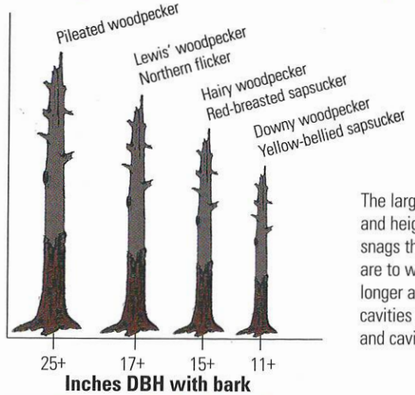
Wildlife depend on snags for nesting, feeding, shelter and perching. Snags come in all sizes, as small as 4 inches in diameter and 6 feet tall, to more than 24 inches in diameter and over 100 feet tall.



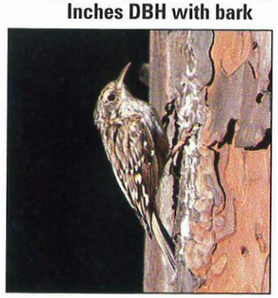
Snags undergo predictable change from the time a tree dies until final collapse. Deterioration varies depending on tree species, weather, wildfire and decay organisms within the snag. Some remain standing for 200 to 300 years.

Carpenter ants are prey for woodpeckers like this downy.

Snag diameters most often used by woodpeckers



The larger the diameter and height of standing snags the more useful they are to wildlife. They stand longer and provide more cavities for both excavators and cavity users.



In early stages of snag decay, the bark slowly loosens, providing nest sites for the brown creeper. Small and difficult to see because it blends with bark, the bird moves up and down searching for insects. Its nest is a hammock of moss and twigs suspended between bark and tree. The bark acts like a shingle, keeping rain off the nest. Since snags eventually lose their bark, creepers need a continuous supply of new snags.

Snag Deterioration and Wildlife Use

Limbs of snags in early decay are ideal perch sites. Red-tailed hawks, bald eagles, eastern kingbirds, and others perch where they can easily see their prey. Overhanging branches along streams become diving boards for kingfishers hunting minnows. If broken-topped, snags can serve as nest platforms for osprey.

At a later stage, old snags lose their bark and most of their limbs. Often the top breaks off due to advanced decay or wind. Snags with broken tops are used much more that those with tops intact. The trunk becomes pockmarked with woodpecker feeding holes and nests.

Finally, in the latest stages of decay the snag may be only 10 feet tall. Carpenter ants tunnel into its base building their home. Unlike termites, carpenter ants do not eat wood but burrow into it and hide their eggs. Other ant species like the western thatching ants feed on eggs and larvae of other insects including the western spruce budworm, a very serious conifer foliage feeder. In turn carpenter ants make up a major part of the woodpecker's diet. While the woodpecker pounds on the snag, worker ants rush to defend their colony and become an easy meal. Skunks, mice and shrews also search snags for carpenter ant colonies. Bears easily tear into the wood of old snags to feast on ants. Bats roost in the hollow center, and the snag's flat top becomes a nest site for a great gray owl.

In each stage of decay, snags provide shelter, nest sites and a unique food chain. In the end, they revert back to the soil to provide nutrients for the next riparian forest.

Hard snags have mostly sound wood, especially on the outside, are often commercially valuable and are frequently cut for firewood. They usually have dead branches and an intact top. Snags can be a safety hazard. Tops and branches can be dislodged from snags without warning, so precautions should be taken. However, it is likely more people are killed or injured while cutting down snags than by snags unpredictably falling. In a wildfire, burning snags do shed embers, spreading fire in some cases, so occasionally snags need to be cut for fire prevention reasons. However, this is less of a problem for riparian snags than upland forest snags.

Hard snags become soft snags over time. Soft snags are in an advanced stage of decay and have no marketable value. They often have broken tops and few limbs.

Mammals that use cavities:

- Bats
  - California myotis
  - Little brown myotis
  - Long-eared myotis
  - Long-legged myotis
  - Silver-haired
- Fisher
- Marten
- Porcupine
- Raccoon
- Squirrel, Northern flying
- Squirrel, Red
- Weasel, Long-tailed
- Weasel, Short-tailed

Woodpecker cavities become homes for mammals. The northern flying squirrel chooses abandoned pileated woodpecker nests for its den. These nocturnal squirrels make good use of older riparian forest living conditions.

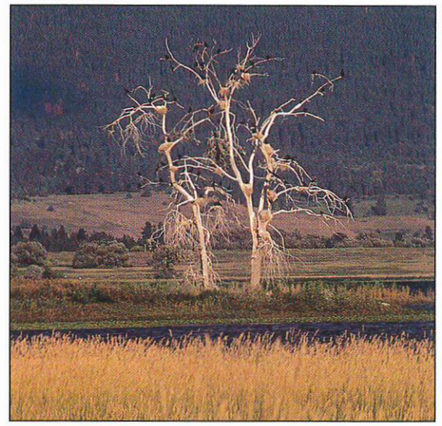
Birds that use existing cavities:

- Bluebird, Mountain
- Duck, Wood
- Goldeneye, Barrow's
- Kestrel, American
- Merganser, Hooded
- Nuthatch, White-breasted
- Owl, Barred
- Owl, Pygmy
- Owl, Saw-whet
- Swallow, Tree
- Swift, Vaux's

Two kinds of birds use snags for nesting or shelter—excavators and secondary or existing cavity users. Excavators make their own nest cavity. The other group uses existing cavities. Most excavators are woodpeckers (pileated, downy, yellow-bellied sapsucker and Lewis'), but this group also includes nonwoodpeckers like the red-breasted nuthatch and black-capped chickadee. Woodpeckers primarily use hard snags and prefer certain tree species. Of the conifers, ponderosa pine, larch and fir are used most often. But excavators also use deciduous trees (aspen, cottonwood and willow) where they occur.

Most woodpeckers create a new nest cavity each year as part of their mating ritual. Woodpeckers seem to test hard snags for heart rot by listening for a certain sound as they peck. After removing excess wood chips from the excavated hole, eggs are laid on the remaining chips. The Lewis' woodpecker, a robin-sized bird, prefers soft snags and returns to the same nest cavity year after year.

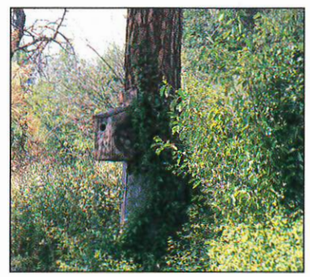
Chickadees often use woodpecker cavities but may excavate in soft snags. After digging out the rotten wood, they fill the opening with moss or feathers. The male feeds the female during incubation. Other birds that use existing cavities are listed in the box *(below, left)*.



Cottonwood snags make great roosting sites.

Nest boxes can attract wildlife but are no substitute for snags.

As a temporary substitute for snags, nest boxes can be used in early and mid-succession riparian forests. Nest boxes work for owls, wood ducks, certain songbirds, squirrels and raccoons but are rarely used by woodpeckers, except flickers. Woodpeckers must excavate cavities as a part of their mating ritual.



The major drawbacks to artificial nest boxes:

1. The need for many types and sizes at different heights and spaced throughout the riparian forest.
2. Unlike snags, boxes only serve as nest sites, they cannot be used for perching, drumming and feeding.
3. Boxes must be cleaned and replaced periodically. Clearly, continued development of snags is the only long-term solution for the wildlife that depend on them.

Remember:

Cavity nesting birds are primarily insect consumers. They do not stop insect epidemics but they help regulate low, non-outbreak levels.

Guideline:

Maintain a steady supply of future snags. Leave some live trees with nests, cavities, broken tops, spike tops, or signs of rot.

Guideline:

The bigger the snag, the better. Leave all snags in the riparian forest unless they are a clear safety hazard.

Guideline:

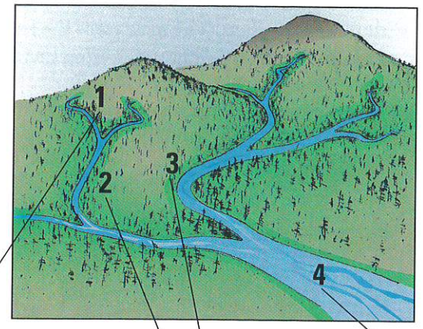
Maintain a continual supply of hard snags that will eventually become soft snags.

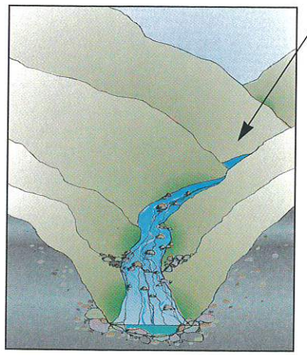
Riparian Forest Streams Are Not Alike

Identifying Streams

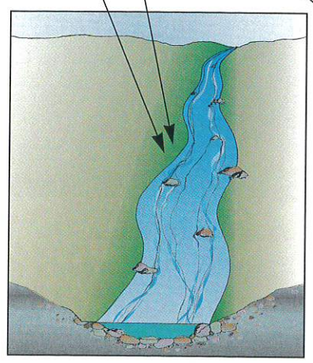
While there's no hard and fast rule, most would agree that creeks are smallest, streams intermediate and rivers largest. Regardless of how they are defined, what's most important about riparian forest waterways is how interconnected they are with the landscape. Creeks, streams and rivers are all connected in a watershed drainage. Distinguishing them is easy if you know the numbering system *(illustrated below)*. 1st order streams are the origin of all river systems. They are located at the headwaters of a watershed. When two 1st order streams join, they become a 2nd order stream. When two 2nd order streams join, they become a 3rd order stream, and so on. 1st to 3rd order streams are considered small, 4th to 6th are medium, 7th and higher are large rivers. The Mississippi River is a 12th order stream at its mouth. Worldwide, 88 percent of streams are small, 12 percent medium and three percent large.

1st and 2nd order streams feed higher order streams with cold, clear water and food energy. How does this happen? What's the connection between the network of headwater streams and the downstream river into which they drain? 1st and 2nd order streams are influenced most by the riparian vegetation along their banks, which commonly covers their entire, often narrow, width. Forest canopies not only keep water cool but drop tons of organic material (leaves, needles, woody debris and insects) into the stream. The result is an ***energy soup***, feeding both 1st and 2nd order streams and ultimately the downstream river system. At higher elevations, where riparian vegetation may be sparse, 1st order streams, usually shaded by steep side slopes, continue to make their cold water contribution to higher stream orders. Cold water, especially during late spring and summer, provides the optimum environment for many fish and other aquatic life in higher order streams and rivers.

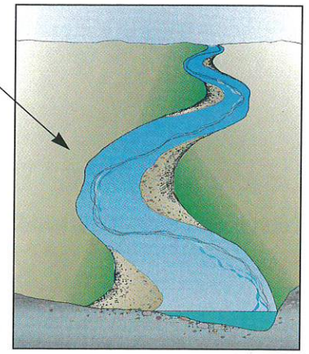




Typical 1st Order Stream:
- High mountain headwater stream
- Often confined by V-shaped canyons
- Narrow riparian area hugging the banks
- Staircase of pools formed by abrupt drops over logs and boulders



Typical 2nd and 3rd Order Streams:
- Less steep than 1st order streams
- More steep than 4th order streams
- Wider riparian area influence
- Riparian vegetation often covers entire width



Typical 4th Order Stream:
- Broad flood plains and riparian areas that extend for considerable distances
- Alternating riffles, pools, gravel bars
- Sinuous, shallow channels

Energy Soup

A literal army of invertebrates live in small streams—ready and waiting for the smorgasbord of falling organic debris. Among this invertebrate army are shredders, collectors, grazers and scrapers. The shredders (stoneflies, caddisflies and craneflies), reduce the dropping leaves, needles and twigs into tiny particles (less than 1 mm in diameter). Actually, the shredders are feeding on fungi, living on leaf and needle surfaces, but in the process of dining on their favorite food they provide this initial decomposition service. In addition, there's a group of wood-eating shredders who specialize on twigs, branches and logs that take more than one year to decompose. Shredders have their job perfectly timed. For example, certain caddisflies emerge in early autumn, just in time to help shred autumn leaf fall.

The collectors take over from the shredders, filtering the shredded particles from the passing water or vacuuming it from the bottom of the stream. Collectors depend on flowing water to bring them the shredded food particles. This part of the instream army include net spinning caddisflies, blackflies, clams and certain midges.

Another group of small stream feeders are the grazers and scrapers (tortoiseshell-case caddisflies). Their streamlined and often flattened bodies, with claws for holding, make them perfectly equipped for dining on algae and diatoms (slippery, crusty masses) attached to rock surfaces.

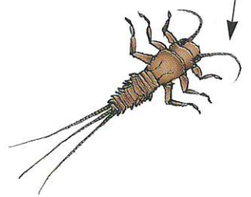
This instream army of shredders, collectors, grazers and scrapers then become meals for fish (trout, sculpins and mud-minnows) and a variety of other predators. Cutthroat trout feed primarily on these invertebrates as they drift downstream to colonize new locations.

Falling from overhanging vegetation above the stream are great numbers of grasshoppers, beetles and ants. They in turn become fish, frog and turtle food. Brown trout, for example, feed voraciously on insects that drop or enter the stream from outside.

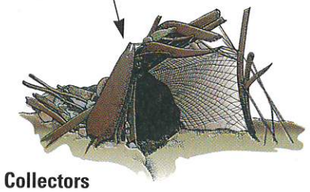
The food chain of 1st and 2nd order streams provide just the right ingredients for higher stream orders. The ***energy soup*** that begins in small streams is carried into larger streams and contributes to their food chain. In these wider streams, no longer covered over with trees, higher water temperatures and lower stream gradients allow for the growth of in-stream plants (algae and rooted plants). They become the primary source of raw material for instream life, and substitute for leaves, insects and twigs of 1st and 2nd order streams. In higher order streams, collectors become more dominant than shredders because stream canopy cover is often reduced. Scrapers and grazers are also more abundant because sunlight allows the growth of more algae on streambed rock surfaces. Fish populations change. Larger 3rd and 4th order streams have larger fish which feed on smaller fish and the great abundance of collector invertebrates.

Shredders
Shredders attach their cases to the upper surfaces of rocks. They shred away the soft parts of leaves and needles until only a skeleton of veins remain.

Grazers
Grazers feed on the slippery layer of diatoms and algae like cattle on a hillside. They are well protected from predators under their domed cases.



Scrapers
Scrapers gather their food from the surfaces of leaves and rocks.



Collectors
Collectors build a shelter from bits of sand, gravel and twigs, held together with silk. The insect comes out from the depths of the net to feed on the food particles strained from the water.

Remember:

Creeks, streams and rivers are interconnected. Land management practices that occur around 1st, 2nd and 3rd order streams can have direct impact on higher order streams in the drainage.

Guideline:

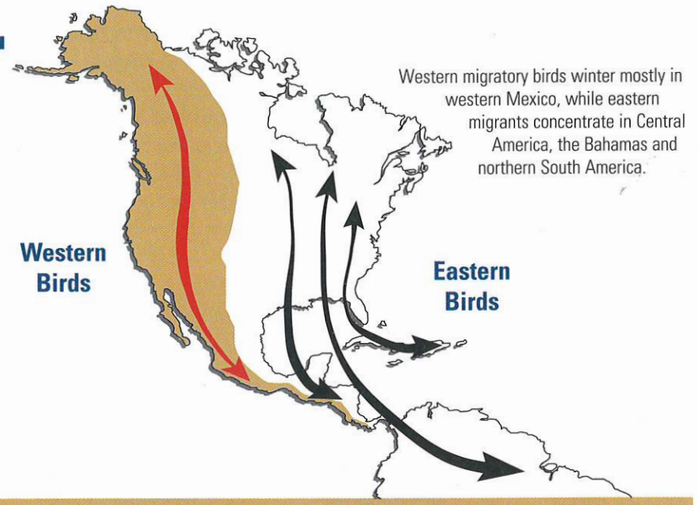
Streamside riparian vegetation contributes to the entire watershed food chain, and helps minimize disturbance.

Riparian Forest Birds

Hundreds of bird species use riparian forests. In western Montana alone, 59 percent of all land birds use riparian forests for breeding. Of that 59 percent, almost half are totally dependent on riparian areas and are unable to reproduce in other habitats. In addition to breeding, many birds feed in the riparian forest.

Neotropical Migrant Birds

In Montana, over half of the breeding land birds (some 144 species) are neotropical migrants. Neotropical migrant is the term applied to birds that fly south of the U.S. border each winter in search of food. Neotropical migrant birds include tiny songbirds, hummingbirds, predatory birds and even scavengers like the turkey vulture. Riparian forest habitats are home for many of the Northwest's neotropical migrants. Some use riparian forests for breeding grounds in the spring and summer, and others use them as migration corridors. In the fall, before insects disappear with the first frost, the birds travel thousands of miles into western Mexico and points further south.



Some of the Neotropical Migrant Land Birds of Montana Riparian Forests

Species	Abundance	Species	Abundance	Species	Abundance
Blackbird, Brewer's	Common	Junco, Dark-eyed	Common	Swallow, Violet-green	Common
Blackbird, Red-winged	Common	Kingbird, Eastern	Common	Swift, Black	Rare
Blackbird, Yellow-headed	Common	Kingbird, Western	Common	Swift, Vaux's	Rare
Bluebird, Mountain	Common	Kingfisher, Belted	Common	Swift, White-throated	Common
Bluebird, Western	Uncommon	Mockingbird, Northern	Common	Tanager, Western	Common
Bunting, Indigo	Common	Oriole, Northern	Common	Thrush, Hermit	Common
Bunting, Lazuli	Uncommon	Osprey	Uncommon	Thrush, Swainson's	Uncommon
Catbird, Gray	Common	Ovenbird	Common	Towhee, Green-tailed	Common
Chat, Yellow-breasted	Common	Owl, Long-eared	Uncommon	Veery	Common
Cowbird, Brown-headed	Common	Pewee, Western wood-	Common	Vireo, Red-eyed	Common
Creeper, Brown	Common	Pipit, Water	Common	Vireo, Solitary	Common
Cuckoo, Black-billed	Uncommon	Redstart, American	Common	Vireo, Warbling	Common
Cuckoo, Yellow-billed	Rare	Robin, American	Common	Warbler, MacGillivray's	Uncommon
Dove, Mourning	Common	Sapsucker, Red-naped	Common	Warbler, Orange-crowned	Common
Finch, Cassin's	Common	Shrike, Loggerhead	Uncommon	Warbler, Nashville	Common
Flycatcher, Cordilleran	Uncommon	Siskin, Pine	Common	Warbler, Townsend's	Common
Flycatcher, Dusky	Common	Solitaire, Townsend's	Common	Warbler, Yellow	Common
Flycatcher, Hammond's	Common	Sparrow, Chipping	Common	Warbler, Yellow-rumped	Common
Flycatcher, Olive-sided	Common	Sparrow, Fox	Common	Warbler, Wilson's	Common
Flycatcher, Willow	Common	Sparrow, Lincoln's	Common	Waterthrush, Northern	Common
Goshawk, Northern	Uncommon	Sparrow, Song	Common	Waxwing, Cedar	Common
Grosbeak, Black-headed	Common	Sparrow, Swamp	Common	Woodpecker, Lewis'	Uncommon
Grosbeak, Rose-breasted	Common	Sparrow, White-crowned	Common	Woodpecker, Red-naped	Common
Hawk, Cooper's	Uncommon	Swallow, Bank	Common	Wren, House	Common
Hawk, Sharp-shinned	Uncommon	Swallow, Barn	Common	Wren, Marsh	Common
Hummingbird, Black-chinned	Common	Swallow, Cliff	Common	Yellowthroat, Common	Common
Hummingbird, Calliope	Uncommon	Swallow, N. rough-winged	Common		
Hummingbird, Rufous	Uncommon	Swallow, Tree	Common		

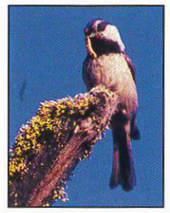
Neotropical Migrant Songbirds

The western tanager, a tussock moth and budworm feeder.

Some pine siskins fly south, others are year around residents. Regardless, all search out spruce budworms during the summer.

Most forest landowners who are familiar with birds consider songbirds desirable. Songbirds add color, movement, and sound to the forest environment. Because most songbirds are migratory, the mix of birds found in the riparian forest changes with the seasons.

In addition to being desirable, neotropical migrant songbirds are beneficial. Scientific evidence shows that several species have an influence over the Douglas-fir tussock moth and the western spruce budworm, two of the Northwest's most significant tree foliage feeders. We now know that without these birds there could be 10 times as many tussock moths on a single tree. In all, a total of 30 bird species are high-potential predators of tussock moths. Two dozen different species of birds prey on western spruce budworm. Scientists caution, however, that birds do not normally control tussock moth or budworm outbreaks. Instead, they regulate low, non-outbreak levels, acting as control agents and lengthening stable periods between outbreaks.* The success of their performance is only as good as their habitat, and riparian forests contribute significantly to their habitat.

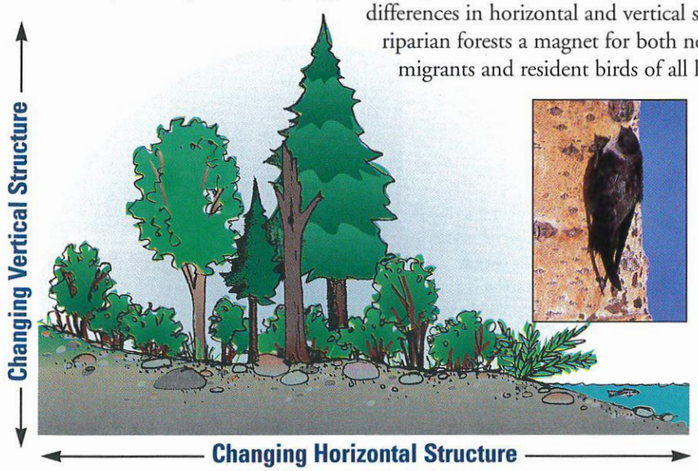


The mountain chickadee is a resident bird that feeds on budworm larvae.

The Secret to Riparian Forest Songbird Diversity

The secret to a diverse songbird community is habitat variety, made available by an abundance of both vertical and horizontal foliage. And that's exactly what a healthy riparian forest has to offer. Vertical structure includes the litter layer on the forest floor, the small shrub and tall herb layer, the layer of larger shrubs and finally the topmost layer of tree crowns. Each layer supports a collection of songbird species adapted to exploit that layer's resources. Some glean insects from the trunks of trees and others pick up insects from the litter. Still others capture insects while flying high in the canopy.

The riparian forest also offers horizontal structure changes, like brushy thickets, patches of grasses and forbes interspersed with shrubs, and areas with few, if any, trees. Each of these different vegetation patches may support a unique collection of songbirds. Collectively, these differences in horizontal and vertical structure make riparian forests a magnet for both neotropical migrants and resident birds of all kinds.



The Vaux's swift, an existing cavity user, returns to Montana each spring after wintering in Mexico. A pair of Vaux's swifts feed their nestlings thousands of insects every day, including western spruce budworm larvae.

* For more information on songbirds as control agents see *Forest Ecosystem Stewardship,* MSU Extension Service publication EB141.

Remember:
Certain neotropical migrants along with resident birds are control agents for the Douglas-fir tussock moth and the western spruce budworm.

Remember:
The secret to healthy songbird habitat is vertical and horizontal plant structure.

Guideline:
Timber harvesting in riparian forests should be done with the objective of maintaining both vertical and horizontal habitat, used by many neotropical migrants and resident birds.

The Aquatic Songbird

The robin-sized water ouzel has earned the name "American dipper" because of its nervous dipping and bobbing motion. It walks underwater, harvesting aquatic insects among the rocks and logs of rushing mountain streams. It feeds on stoneflies, caddisflies and other aquatic life such as snails and minnows. Among its special adaptations are flaps that close over its nostrils during underwater foraging and an enlarged preen gland to supply oil for waterproofing its plumage. It also has goggle-like eyelids which protect its eyes from water-borne particles.

The ouzel does not migrate to warmer climates, but is a permanent resident. If part of the stream freezes over, the bird flies downstream to find running water. Their nests are shaped like a hut with an arched entrance and are built near streams, among twisted roots of uprooted conifers, sometimes even supported by a ledge, or hidden behind a waterfall.

Male and female dippers are an identical gray with stub tails. They and their food—stoneflies and caddisflies—depend on sediment free streams.

The Nest Parasite

Decline in the number of certain migrant songbirds is thought to be due to loss of winter habitat and forest fragmentation in summer grounds. Forest fragmentation is the break up of forests into ever-smaller patches on animal breeding grounds, along migration routes or wintering grounds. The result of fragmentation is more "edge" *(page 3)*, good for some birds but a big problem for others. Increased fragmentation results in forests becoming more isolated, with less and less "interior" forest habitat. Sometimes the only connection between isolated forest patches is the riparian forest. But due to their typical narrow shape, riparian forests can't provide the "interior habitat" needed by neotropical birds like the yellow-rumped warbler, Swainson's thrush, orange-crowned warbler, hermit thrush, song sparrow and varied thrush. These birds are adapted to the seclusion and safety of forest interiors.

Interior forest birds, forced to nest near edges, often are victim of the brown-headed cowbird. This bird never builds its own nest. Instead, the female cowbird lays her eggs in the nests of other birds, as many as 40-50 eggs in one breeding season. Since cowbird eggs often hatch first, and young cowbirds grow faster, they often push other eggs or young out of the nest, and are raised by the adoptive parents who subsequently raise no young of their own. Where once cowbirds had a limited number of adoptive parent hosts, they now have the nests of more interior forest birds available because of increased amount of forest edge. Unable to deal with cowbirds, these interior species raise cowbird young at the expense of their own.

In contrast, birds like the yellow warbler, adapted to life at the edge of the riparian forest, has developed a means to deal with the cowbird. Too small to push a cowbird egg out of her nest, the warbler buries the cowbird egg under a newly constructed nest. Sometimes this is even done at the expense of her own eggs. Once reconstructed, she tries again. One warbler was observed building a six-story nest.

The brown-headed cowbird thrives with more edge *(male pictured)*.

A cowbird egg with chipping sparrow egg and baby sparrow.

This young cowbird has emptied the nest of all other competition.

The yellow warbler is adapted to life in edges.

Accipiters—Neotropical Migrant Predators

Neotropical migrants include hawks, eagles and osprey. Among the hawks are a group called "accipiters." Accipiters hunt forest birds including songbirds in the riparian forest. These secretive hawks include the goshawk, Cooper's and sharp-shinned hawks. They are recognized by their rapid, darting flight through the forest. Accipiters eat songbirds and songbirds eat forest insects. These are just two of the predator/prey relationships occurring in the riparian forest. Relationships like these are reasons for maintaining the vertical and horizontal structure of the riparian forest. Insects, songbirds and their predators are all dependent on plant structure.

Sharp-shinned hawks feed primarily on small birds. They nest in dense thickets and young-growth conifers in proximity to a pond or stream with open meadows. They prefer habitat where ground-nesting birds are abundant. They fly rapidly around bushes and trees, surprising small birds and snatching them.

Cooper's hawks concentrate on small to medium-sized birds, often chasing them into brushy thickets and pursuing them on foot. They nest in deciduous riparian forests, close to meadows where songbirds are abundant. While slightly larger than the Sharp-shinned hawk, the Cooper's hawk has a more rounded tail in flight.

The largest of the three accipiters, the goshawk is identified by a broad, white stripe above the eyes. The goshawk hunts medium to large birds along with occasional red squirrels, rabbits and snowshoe hares. It nests primarily in mature forests and is listed as a species of special concern in Montana *(definition, page 21)*.

River Waterfowl

Among the waterfowl that rely on riparian forest streams is a rarely seen but regular visitor, the harlequin duck. It's described here because of its unusual life cycle and dependence on riparian forest streams. The harlequin duck is actually a sea duck that spends most of its time in coastal waters. It flies inland from the Pacific coast during March and April to nest in mountain streams of Oregon, Washington, Idaho, Wyoming and Montana. After traveling 600 miles up the Columbia River Basin from the Pacific Coast, mated pairs breed exclusively in turbulent whitewater streams. Studies indicate that streams with 1 to 2 percent gradients and a combination of whitewater and beaver impoundments are common breeding sites. The quiet waters of beaver ponds are important for growing ducklings.

In early May the female settles on a nest site. It can be a rock crevice, a tree cavity, on the ground within protective brush, or even in river log jams, but is always close to water. After breeding, the males leave on their return flight to the coast, leaving the hens to incubate the eggs and rear the young. Hens and young feed all summer on the same insects as trout—stoneflies, mayflies and blackflies. Harlequins are able to both fly and walk underwater, foraging for insects among the spaces between river rocks. The hens depart mountain streams in August, leaving the young to find their way back to the coast sometime later.

Some riparian forest waterfowl:

- Bufflehead
- Duck, Wood
- Goldeneye, Barrow's
- Goldeneye, Common
- Merganser, Common
- Merganser, Hooded

Its name, "harlequin," comes from the clown of the 17th century Italian comedy, know for his similarly colored and gaudy costumes. The only waterfowl species that exclusively uses whitewater during the breeding season, the harlequin duck can be found in the rapids of mountain streams and waterfalls. They return year after year to the same stretch of stream to nest and raise their young.

Remember:

Accipiters hunting songbirds and songbirds hunting forest insects are just two of the predator/prey relationships occurring in the riparian forest that are dependent on forest structure.

Remember:

During the spring, birds use riparian forests and streams for breeding. Human disturbances can force birds to leave nest sites, making eggs and young more vulnerable to predators.

Guideline:

Try to avoid timber harvesting in and around riparian forests during the nesting season (March through June).

Guideline:

Maintain shrubby understories.

Guideline:

Construct and maintain brush piles in openings (see page 11).

Riparian Forest Cold-Water Fish

The most common fish in cold-water streams:

Native Fish
- Sculpin, Mottled
- Sculpin, Slimy
- Sucker, Longnose
- *Trout, Bull
- *Trout, Westslope cutthroat
- *Trout, Yellowstone cutthroat
- Whitefish, Mountain

Non Native Fish
- Trout, Brown
- Trout, Eastern brook
- Trout, Rainbow

**Fish of special concern (see page 21)*

Most of the trout that swim in Montana's cold-water streams—brown, rainbow and eastern brook trout—were introduced to the state and are not native. Rainbow and brook trout were introduced from other parts of North America. One exception is the few native rainbow trout in the Kootenai River drainage of Northwest Montana. Brown trout were introduced from Germany and Scotland. Montana's native trout include the westslope cutthroat, Yellowstone cutthroat, bull trout and the mountain whitefish which is a member of the trout family.

Cutthroat, rainbow, brown and bull trout can either be resident fish which live and die within about a mile from where they hatched, or migratory. Brook trout are generally resident. Migratory trout hatch in small streams, then migrate to larger streams, rivers or lakes as juveniles where they spend their adult life, and return annually to their home stream to spawn.

Cutthroat trout do well in 48-52°F water. If they cannot migrate out of streams with higher temperatures or low water flows, they become lethargic and prone to predation and disease.

The sucker's flattened body and lowered mouth makes it possible to sit on a stream bottom and feed. While they can tolerate higher water temperatures, their presence does not indicate poor water quality.

Sculpin have flattened bodies and special fins to help hold them on the bottom of fast flowing streams.

Connections Between Riparian Forests and Fish

Many people consider riparian forests irrelevant to the cold-water fish that inhabit their streams, but an interesting relationship exists between the two. Food, cover and water, the same habitat ingredients important for terrestrial wildlife, are necessary for fish. The kind of vegetative cover along the banks of a stream is as important for the variety and numbers of fish present in a stream as it is for birds and mammals that occupy the riparian forest. Without trees and overhanging shrubs, stream temperatures would be higher in the summer and colder in the winter. Overhanging stream vegetation also provides a rich and plentiful source of food *(see energy soup, page 14)*. In fact, 90 percent of the food energy in forested streams comes from bordering vegetation.

Cover is crucial to fish survival and takes several forms. There is over-water cover which includes trees, shrubs and logs above the water surface. Underwater cover includes roots, submerged logs, boulders and debris jams. Water depth or enough water for fish to hide in and the screening effect of white-water are other kinds of cover. And then there is bank cover, created by stream flows that undercut the stream bank. Undercut banks give fish a place to rest and hide from predators, while still being close enough to the stream current for feeding and escape. When it comes to fish hiding cover, there is a special need for coarse woody debris (CWD) in streams, just like on the forest floor *(page 10)*. It is important that CWD be available and in close proximity so fish can travel from one accumulation of CWD to the other without exposure to predators. Large old trees from riparian forests are the major source of large CWD.

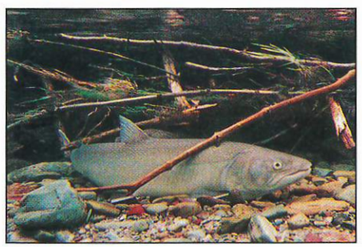
Fish are insectivores, carnivores, cannibals, herbivores or a combination. Aquatic insects in cold-water streams depend on streamside plants for food, while many trout depend upon aquatic insects. Cutthroat trout lean toward a diet of insects and other invertebrates. Rainbow and bull trout like insects and small fish. Browns prefer fish and other vertebrates that include small ducks, frogs and mice. Suckers and sculpins forage for their food on the stream bottom, gathering plant material along with small animals such as snails, clams, worms, insects and water fleas. Another member of the trout family, the mountain whitefish, feeds mostly on aquatic insects living among streambed rocks, while other trout feed mainly in the middle, upper level and surface of stream waters. All of these fish foods are dependent upon the riparian forest to provide leaves, needles and wood. If that primary food source diminishes, fish grow slowly, reproduce less and are more prone to prey on their young.

Mountain whitefish are distinguished from suckers by a tiny adipose fin, located on their back just before the tail fin. Surveys indicate there are four or more whitefish for each trout.

Trout reproduce by external fertilization of the eggs. Some bury their eggs in gravel pits that are scoured out by the adults. The eggs are laid in these nests or "redds," fertilized by the males and then covered with gravel by the adults. It is at this life stage that fish are vulnerable to sediment. When too much sediment settles into the gravel and over the redd, the developing eggs can suffocate. Sediment also kills aquatic insects and fills in fish resting spaces. When kept free of sediment, the eggs develop in the gravel and emerge from the gravel as young fish. The successful reproduction of fish is dependent upon a healthy riparian forest, capable of blocking sediment from entering the stream.

Focus on Bull Trout

Bull trout are only found west of the Continental Divide. Along with westslope and Yellowstone cutthroat, they are ***fish of special concern,*** meaning that there are limited numbers and/or limited habitats both in Montana and elsewhere in North America. Bull trout are the largest fish native to the Flathead, Kootenai and Clark Fork River systems. Most bull trout are migratory, growing to maturity in lakes such as Flathead Lake, Pend Orielle Lake and Swan Lake then migrating up through the river systems and into mountain tributaries to spawn. However, many never make it to lakes and remain in large rivers. The life cycle of this fish provides an excellent example of the connection between healthy riparian forests and fish.



Bull trout have a broad, flat head, no spots on their dorsal fin and a white leading edge on their fins. Similar looking brook trout have a white edge set off with a black line. In prime habitat bull trout can grow to 30 pounds.

Bull trout spawn in the fall in the same location where they were born. They move many miles upstream to cold clean water and clean gravel beds, hiding among cover supplied by instream logs and undercut banks. After laying their eggs, the adults return to downstream lakes. The eggs remain in spawning gravels until spring, when they hatch and fry emerge.

The winter-long egg incubation and multi-year juvenile growth period make bull trout sensitive to riparian forest conditions and good indicators of stream health. Young bull trout remain in high mountain streams, feeding among streambed rocks for one to four years before migrating downstream. When mature, young bull trout migrate out of small streams into larger rivers to feed, ultimately making their way to larger rivers and lakes. When mature the cycle begins again and they return to the spawning tributaries where they were born. They do not spawn every year.

Bull trout populations are declining in western Montana. The reasons are complex, but include sedimentation, dewatering, dams, culverts, introduced fish species, other predatory fish, interbreeding with brook trout, and poaching. For example, culverts that are too high for fish to enter or too long and steep with severe water velocity can be a barrier to migration.

Remember:

There is a connection between riparian forest vegetation and fish populations.

Remember:

Trout eat aquatic insects. Riparian forest vegetation supplies food energy for aquatic insect populations.

Remember:

Trout require cold-water streams. They grow faster in cold water than warm. Riparian forest shade ensures cold water.

Remember:

Trout need sediment-free stream gravels for spawning. Healthy riparian forests filter sediment from timber harvest areas and forest road surfaces.

Remember:

Trout need hiding cover supplied by instream logs and wood. Properly managed riparian forests can supply CWD now and in the future.

Guideline:

Migrating trout must be able to access mountain streams. Watch for and correct culverts that block access to spawning streams.

Riparian Forest Mammals

Bats

Montana's Bats	Occurrence in MT
Bat, Big brown	Widespread
*Bat, Hoary	Common
Bat, Pallid	Restricted small range
*Bat, Silver-haired	Common
Bat, Spotted	Restricted small range
Bat, Townsend's big-eared	Rare
*[1]Myotis, California	Restricted small range
*Myotis, Fringed	Uncommon
*Myotis, Little brown	Widespread
*Myotis, Long-legged	Common
Myotis, Northern long-eared	Restricted small range
*Myotis, Western long-eared	Common
Myotis, Western small-footed	Uncommon
*Myotis, Yuma	Uncommon

Migratory species

[1]Myotis is the name of a group of bats that are all relatively small and brown colored.

All Montana bats feed on insects, consuming moths, plant borers, beetles, gnats and mosquitoes. A single bat, like this big brown bat catching a moth in flight, consumes hundreds of insects each night.

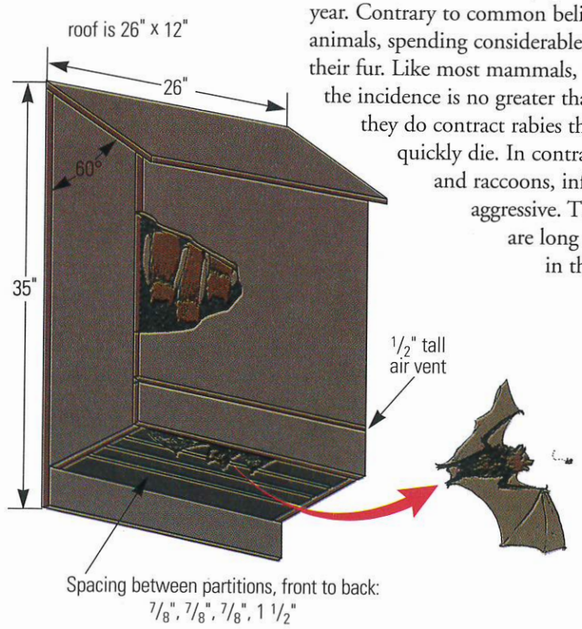
Some, like this silver-haired bat migrate to southwestern states or northern Mexico in the fall when insects disappear. They return to Montana in May or June to raise their young. Others species remain year-round and hibernate through the winter.

Fourteen bat species, some migratory, others yearlong residents, use riparian forests. Bats use space above open water in riparian forests to feed on abundant insects. These unusual mammals can outmaneuver most birds, fly long distances at night, fly at high speeds, and skim over water and drink as they fly. Bats feed throughout the night, but many species have two major feedings that correspond to insect abundance, one during the first few hours after sunset, and the second during the last few hours before sunrise. After feeding, they retire to a night roost to rest and digest food. They spend daylight hours at a different day roost.

Old forests with large trees and snags provide higher quality roost sites than young forests. Bats use old forests for daytime roosting rather than feeding. Cracks and crevices in and under thick bark, and holes in the trunk are common locations for bat roosts. Recent studies in Oregon indicate that bat activity in logged riparian areas was 4 to 8 times lower than in adjacent wooded riparian areas.

Bats have several predators. They are occasionally taken by snakes, owls, weasels or skunks while roosting or hibernating.

Bats have hair, give birth to live young (do not lay eggs) and feed their young milk. They make no nest. Instead, the females gather in groups to give birth and raise their young. Interestingly, bats have the lowest reproductive rate of all small mammals. Females usually give birth to only one offspring per year. Contrary to common beliefs, they are unusually clean animals, spending considerable time grooming and cleaning their fur. Like most mammals, they can contract rabies, but the incidence is no greater than other wild animals. When they do contract rabies they become paralyzed and quickly die. In contrast to rabid dogs, cats, skunks and raccoons, infected bats rarely become aggressive. They tend to avoid people. Bats are long lived, frequently 10 to 20 years in the wild.



Bat Boxes

Where crevices, snags and caves are lacking, bat boxes can be attached to trees. Mount them 12-15 feet above the ground, preferably near water. In Montana's northern latitudes, bat houses should face south or southwest and be painted black or dark brown to maintain warm temperatures. Use untreated, rough-sided lumber and galvanized nails for construction.

Other Mammals that use the Riparian Forest

	Snag User	Log User		Snag User	Log User
Beaver		x	Rabbit, Mountain cottontail		x
Deer, White-tailed			Raccoon	x	x
Elk			Shrew, Masked		
Fisher	x	x	Shrew, Northern water		x
Fox, Red		x	Shrew, Vagrant		x
Grizzly			Skunk, Striped		x
Hare, Snowshoe		x	Squirrel, Northern flying	x	
Mink		x	Squirrel, Red	x	
Moose			Vole, Boreal red-backed		x
Mouse, Western jumping		x	Vole, Long-tailed		x
Muskrat			Weasel, Long-tailed	x	x
Otter, River			Weasel, Short-tailed	x	x

Beaver

Beavers are considered by some to be a nuisance because they frequently dam irrigation ditches, road ditches and other facilities. However, the positive contributions of beavers to riparian areas far outweigh negative impacts. Beavers actually create and maintain riparian areas, and by doing so, provide habitat critical for other wildlife. A typical creek without beavers in the Northern Rockies has only 2 to 4 acres of riparian habitat per mile, but with beaver activity that area can be expanded to 24 acres per mile. Beaver dams impound water and trap sediment, which raises the water table and allows riparian plants to grow and provide wildlife habitat. Beavers are nature's water control engineers. Their dam building activities help regulate stream flow by storing water, reducing flood flow and supplementing summer low flows.

In cold-water streams, beaver ponds enhance fish production by helping to produce more aquatic insects, a common fish food. However, spawning habitat in some stream reaches can temporarily be lost during beaver dam construction and also when dams fail, releasing sediment into downstream gravels.

Beavers depend upon plants commonly associated with riparian forests including willow, alder, cottonwood, birch and aspen. They are capable of felling trees a foot or more in diameter. But even with all their wood gnawing, their teeth are not reduced in size. In fact, they grow about one inch each month.

While some beavers build large mounds, others build their dens in the streambank. Entry to the den is underwater and their dam is designed to stabilize the water level to keep the entrance below the surface for safety. Beavers do not hibernate, but continue to feed all winter as weather conditions permit. During unfavorable weather, they resort to caches of branches anchored to the bottom of their pond.

On large rivers and streams, beavers cannot maintain a permanent structure because dams, made of sticks, mud and rocks are easily washed out by high water. On smaller streams, beaver dams allow sediment to accumulate. This eventually forces the beaver colony to move because the pond becomes a bog without adequate water for security. As more and more vegetation grows, the former pond may eventually become a meadow.

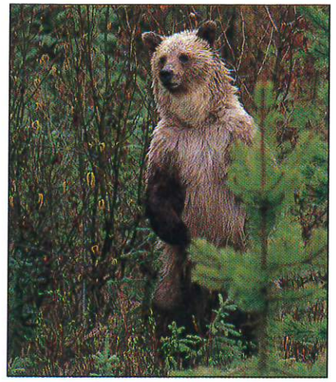
Remember:

Bats depend on large green trees and snags for roosting habitat, nocturnal insects for food and streams for water.

Remember:

Beavers can be used to restore damaged riparian areas. Beavers create and maintain riparian areas that are critical to other wildlife. River otter and mink use abandoned beaver dams for rearing young and protection.

Grizzly Bear



Riparian areas provide important habitat for grizzly bears. After 4-5 months of hibernation at elevations above 6,000 feet, grizzlies leave their dens and move to lower elevations. They travel along riparian corridors and snow chutes, often under cover of darkness. During April, May and June they graze on succulent forbes and grasses of the riparian forest, while shrubs and trees provide concealment. Grizzlies seldom use food sources far from cover, and when available, bears on the Rocky Mountain East Front prefer low-elevation willow and aspen riparian areas for security and cover. In contrast, Yellowstone Park grizzly bears seldom use low-elevation riparian areas because elk browsing has reduced the security and cover value. These bears now depend on whitebark pine nuts.

As forbes become less palatable during June and July, grasses remain an important food, along with the tubers of biscuitroot, springbeauty and glacier lilies that grizzlies dig from the soil. During late summer and autumn they search riparian areas for ripening serviceberries, chokecherries, huckleberries and buffaloberries in an effort to gain the fat needed for hibernation. Feeding on as much as 80 pounds of berries a day, grizzlies can gain over 100 pounds in less than one month. Grizzlies also eat insect larvae, ants, ground squirrels and marmots. Food sources such as livestock carrion, human refuse and domestic beehives can be a problem where people and bears live together.

Fisher

Before 1960 fishers were thought to be eliminated from Montana. However, since that time increased sightings and trapping records indicate that a transplant program started in 1959-60, using animals from British Columbia, appears successful. Fishers are low-elevation animals that inhabit older, moist coniferous forests and riparian areas, mostly located within 350 feet of water. They are cavity-dwelling mammals that use large, old trees for denning and birthing. They prefer areas of mature timber with relatively closed canopy, and wetlands. Fishers are highly secretive and their population numbers, while thought to be low, should increase with riparian habitat improvement.

Wherever abundant, snowshoe hares are common fisher prey along with squirrels, mice and shrews. They are exceptional climbers and hunters, pursuing their prey on the ground or in the tops of trees, making long leaps from tree to tree in pursuit. Fishers are efficient predators of porcupines, able to neatly flip one and get at its quill-less underbelly. Many forest landowners want fishers on their property to control porcupine damage to trees.

River Otter

A surprise to first-time observers is a river otter's size–over 20 pounds and four feet long. These dimensions distinguish them from mink and muskrat.

Few people know much about the river otter and even fewer have ever seen one, but river otters are fairly tame and curious. They are found in alpine lakes, mountain streams and lakeshores, but mostly in larger rivers and their adjacent wetlands. Their torpedo shape, webbed feet and powerful tail make them particularly agile in water, but even on land, an otter can outrun a human. Otters are known to travel across miles of forested terrain to reach another drainage. They have been documented crossing mountain passes in the Rockies.

Otters seldom excavate their own dens. Instead, they depend on beavers for housing. They can be seen resting in logjams, streamside vegetation and natural rock piles. While capable of catching fast-swimming trout, trout make up only a small part of an otter's diet. Instead, more abundant and relatively slow suckers make up the majority of their prey along with sculpins, crayfish and mountain whitefish.

Mink

In contrast to the river otter, mink are primarily nocturnal and secretive. Weighing 2 pounds and about 2 feet long, mink feed mostly on fish, bird eggs, frogs and small mammals. Mink give birth and raise young underneath brush piles, driftwood, rocks, in hollow logs, and abandoned beaver and muskrat dens. Logs are home for most of the animals that mink prey upon.

White-tailed deer

The white-tailed deer needs cover, and riparian forests provide much of that cover. Some western Montana white-tailed deer follow migration patterns. During winter they move into valleys and bottomlands along streams because high elevation areas are buried in snow and are inaccessible. White-tails react to cold temperatures by searching for overhead cover. Dense riparian forests act like an umbrella, maintaining a warmer, more comfortable environment beneath the canopy by reducing heat loss back to the sky. The metabolic rate of white-tails changes at about 20 degrees above zero. They begin to burn more calories to produce body heat. Their winter survival depends on accumulating body fat in summer and autumn and conserving energy reserves. Their energy gain from winter foraging is less than what they expend so they draw on their fat reserves. White-tailed deer remain close to open water of riparian forest streams to keep from taxing their limited energy reserves.

Moose

Moose use riparian vegetation differently depending on location and season of the year. Winter habitat for moose in northwest Montana differs from southwest Montana where they use river bottoms, willow flats and aspen habitats. Radio collared moose in the northwest use south slopes and clearcut areas during winter. During the summer, they move between high elevation forests and adjacent clearcut areas to lowland aquatic swamps and river backwater areas. There they feed for a few days on waterweed and aquatic buttercup and then move back to higher elevations. Evidence shows that these riparian feeding sites may be used by many different moose, each moving down from high elevations to feed for a few days. In the southwest part of the state, moose summer range includes subalpine meadows and lodgepole pine forests.

Elk

Elk and deer obtain water, at least in part, from the forage they consume, but both species require occasional free water. This is one of the reasons they are drawn to riparian areas. In the summer and fall, elk activity in riparian areas increases. It occurs especially in moist areas near first order streams in high elevation subalpine fir forests. Riparian forests also act as travel corridors for elk as they move from winter to summer range. In addition to water, elk are attracted to riparian areas to feed on willow, especially Drummond and Bebb willow when available. Elk also eat less palatable shrubs such as wild rose and river birch.

Wallows are important for elk. They are shallow pools used by bull elk during the rutting season. Wallows are depressions formed in moist seeps. While there is no evidence that wallows are essential to successful breeding, bull elk urinate and roll in the scented wallow mud as part of breeding with cows. Wallows used year after year are found both adjacent to, and at a distance from, mountain streams or wetlands. If timber harvesting occurs in the vicinity of an elk wallow, its value can be protected by leaving surrounding trees and hiding cover.

Remember:

Fisher prey on tree-damaging porcupines but require large, old trees for denning and birthing.

Guideline:

Limit motorized activities in and around grizzly bear riparian habitat from April 1 to June 15. Harvest trees in winter when bears are denning.

Guideline:

Landowners and residents should be aware of problems with grizzly bear attractants including garbage, livestock and pet foods, and vulnerable livestock such as pigs, chickens, sheep and bees.

Guideline:

Maintenance of hiding, thermal cover and plant food sources are important to white-tailed deer, grizzly bear, moose and elk.

Guideline:

Retain trees and shrubs around elk wallows to provide cover.

Amphibians and Reptiles on the Floor of the Riparian Forest

Montana's Riparian Forest Amphibians

Bullfrog (non-native)
Frog, Pacific chorus
Frog, Spotted
* Frog, Tailed
Frog, Western chorus
Salamander, Coeur d'Alene
* Salamander, Idaho giant
Salamander, Long-toed
* Toad, Western (Boreal toad)

** Log users*

Often overlooked are two groups of animals that occupy the floor of the riparian forest: amphibians and reptiles. They are important because they serve key positions in both aquatic and terrestrial food chains. As adults, some are voracious carnivores. As juveniles, many are food sources of birds, mammals, fish and insects. Amphibians include salamanders, frogs and toads *(see box at left)*. They are unique animals that use lungs, gills and their skin for breathing. The word amphibian means "dual life." Their young are aquatic and breathe with gills. As adults, they leave the water and breathe with lungs. With no covering of scales, feathers or fur they have to maintain moist skin to prevent drying and over-heating. Their survival depends on the humid, moist, shaded environment of the riparian forest. The non-native bullfrog is thought to be implicated in the decline of native amphibians and native turtles in some areas. The Western toad is the most common toad in the riparian forest.

A recent two-year study of forest amphibians in Oregon points to the importance of tree cover in riparian forests. Scientists examined 1st, 2nd and 3rd order streams in Douglas-fir forests. They found twice as many amphibians within in the first 30 feet of the stream than at 30 to 130 feet away from the stream. Then they compared the abundance and variety of amphibians in three different kinds of riparian forests: clearcut riparian forests, those harvested with an intact streamside management zone (SMZ) and unharvested riparian forests. Unharvested riparian forests had between 2 and 10 times more amphibians than recently clearcut riparian forests. Interestingly, the riparian forest harvested with an intact SMZ, when compared to the unharvested, showed no difference in total amphibians. Scientists attribute the difference in amphibian abundance to the removal of canopy cover in the clearcut riparian forest.

Amphibians Use the Riparian Forest

Idaho giant salamander

The Idaho giant salamander hides its eggs under water in nest chambers attached under coarse woody debris, stream cut banks and rocks. As larvae, giant salamanders feed on fish and tadpoles. As adults they become nocturnal and secretive, eating snakes, water shrews and other giant salamanders. In turn, they become the prey of snakes, especially the western terrestrial garter snake. During the day they can be found under bark, logs and rocks, and occasionally wandering about on the forest floor. During the breeding season they are in or near streams.

Just how important is the riparian forest for salamanders? Scientists compared high and low gradient streams where the riparian forest had been both logged and not logged. They found high densities of giant salamanders in logged riparian forests but only in the high gradient and fast-flowing streams. In unlogged stream reaches giant salamanders were found in both high and low-gradient areas. The difference was sediment found in the low-gradient logged areas, which filled stream bottom cracks and crevices used by these animals. Protecting riparian forests and their ability to block sediment from reaching the stream is important to the survival of all salamanders.

Coeur d'Alene salamander
Small, only 4 inches in length. They have no lungs and require moist environments to breathe through their skin. Such environments include waterfall spray zones or seeps running over rock outcrops. To avoid desiccation and predation, they are active only at night or on rainy days.

Long-toed salamander
Named for their long fourth toe. As adults they visit water, but are otherwise underground most of the year. Their well-developed lungs allow them to live in damp riparian habitat away from water. They are often found in fallen trees and beneath logs and rocks.

Bullfrog
Biologists note that the bullfrog is an introduced, non-native frog species in Montana's riparian forest. It was introduced around 1920. During breeding season, males return night after night to croaking stations. Wary by day, bullfrogs are easily found at night. When first caught, a bullfrog may "play possum", hanging limp and motionless, but be alert for sudden recovery.

Tailed frog

The tailed frog is well adapted to riparian forests. It's found more often in mature than young forest stands. Tailed frogs are closely associated with fast-flowing forested streams, usually located in headwaters areas. Their tadpoles have a sucking organ that enables them to cling to stream rocks in swift currents. First-year tadpoles prefer water temperatures below 50°F and are likely to be affected by increased water temperatures that can occur after trees are removed along headwater streams. Biologists encourage the protection of headwater riparian vegetation in order to maintain cold water temperatures. Reducing sedimentation is also important because the larval form of the tailed frog, which lasts three years, feed on diatoms, conifer pollen, algae and small insects among the smooth rocks of cold water streams. Tailed frog tadpoles are prey for giant salamanders. Adult tailed frogs move away from streams into damp Douglas-fir, spruce and pine forests, eating snails, ticks, spiders, mites and many insect species. In Montana, tailed frogs are estimated to live more than 14 years. Development from tadpole to frog occurs at three years of age, while breeding does not occur until age 7 or 8.

Pacific chorus frog

Pacific chorus frogs have distinct toe pads and black or brown eye stripes. Some have green bodies, others are brown, red, gray or black. Individuals are able to blend in with their surroundings by changing from a dark color phase to a light phase within a few minutes. Even with the ability to climb, this frog is mostly found on the ground, hiding in the burrows of other animals, among rocks or the openings of down logs, or in heavy vegetation. It escapes high temperatures by hiding between the loose bark and wood of downed logs. Its diet includes beetles, flies, leafhoppers, ants and spiders. It is preyed upon by garter snakes, bullfrogs, birds and mammals. It is one of the more vocal frogs. Singing males have been observed sitting in very shallow water or floating with limbs extended.

With no internal control over body temperatures, cold-blooded amphibians and reptiles must find suitable places to spend the winter before low temperatures make them too lethargic to move. The chorus frog, for example, hides under leaves for protection. Freezing temperatures stimulate their liver to synthesize glucose, a self-made antifreeze that keeps their vital organs from turning to ice. Some frogs can actually survive being frozen. Unlike other hibernators, they have no warning system that prepares them for hibernation.

Western or Boreal toad

The Western or Boreal toad is found in many habitats including lakes, small ponds, shallow marshes and forests, often some distance from water. Breeding sites are used year after year. Tadpoles form huge schools with millions of individuals. When giant water bugs feed on western toad tadpoles, an alarm substance is emitted, causing tadpoles to increase their activity and avoid the predation area. Adult toads consume flying insects, crayfish, sowbugs and earthworms. Unlike frogs, toad skin feels dry, and the back, sides, and upper legs are covered with glands that can exude toxins. They are preyed upon by birds, garter snakes and aquatic insects. Ravens are careful to eviscerate adult toads, leaving the toxic skin. Toads are most active at night, burying themselves in loose soil or hiding in the burrows of gophers or ground squirrels during the day.

Remember:

Forest management activities in riparian areas can affect amphibian and reptile habitats. A large number of these animals occur near streams.

Guideline:

Maintain healthy riparian amphibian and reptile habitat by providing plenty of coarse woody debris for hiding, feeding and plant cover that helps maintain high humidity.

Reptiles

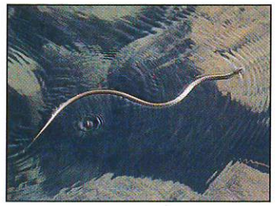
Montana Riparian Forest Reptiles

* Boa, Rubber
* Lizard, Northern alligator
* Skink, Western
  Snake, Common garter
  Snake, Western terrestrial garter
* Turtle, Painted

** Log users*

Three types of reptiles are found in riparian forests: turtles, lizards and snakes. The western painted turtle is the only turtle found west of the Continental Divide. Two lizards, the western skink and the northern alligator lizard, are found in riparian forests. The snakes of riparian forests include the rubber boa, the western terrestrial garter and the common garter snake.

In contrast to birds and mammals which consume food in order to stay warm, reptiles need the sun to warm them before they can be active. Once warm enough, they can hunt or hide from predators. Throughout the day they stop in the sun to boost their temperatures, or lay in the shade and release excess heat to the ground. Lizards have dry skin covered with scales, claws on their toes, and ear openings, all lacking in salamanders. While reptiles have not been studied thoroughly, their use of logs and their dependency on plant cover suggest that riparian forest land management activities that impact amphibian populations can also impact reptile populations.



Garter snake

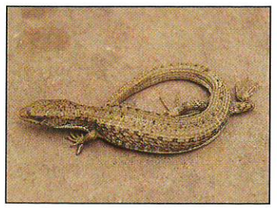
Garter snakes are most commonly found at lower elevations around water. Being good swimmers, they hunt a variety of animals including tadpoles, salamanders and juvenile frogs. Potential garter snake predators are river otters, great blue herons, hawks and ospreys.

Rubber boa

The rubber boa looks and feels like rubber, is approximately two feet long and slow moving. It is sometimes called the "two-headed snake" because the tail is shaped like the head. It rarely bites, but when in danger, rubber boas coil up in a protective ball, often waving their false head at the predator. If attacked, the boa loses its tail. It is found beneath rotting logs, rocks and bark. It eats small mammals (especially young mice and shrews), birds, salamanders and other snakes. It seizes its prey with its mouth, coiling its body around the prey and kills by suffocation. It swallows the prey headfirst by unlocking its jaws, engulfing its meal bit by bit. They are mostly active at night, but can be seen on cloudy days. They can survive higher elevation cool temperatures that would immobilize other snakes.

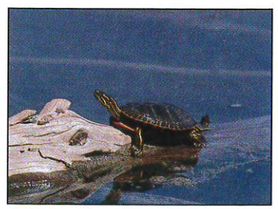
Western skink

This fast moving lizard is almost impossible to catch by hand. While other lizards pause for a moment when surprised, skinks immediately disappear beneath a rock or log. Their blue tail breaks off when attacked by predators. Once broken, the tail thrashes wildly, keeping the predator occupied while the skink slips away. A new tail grows back but without the fracture points that allow it to break off again. Western skinks are found in habitats with moisture nearby—damp soil, springs or streams. They are more dependent on moisture than other lizards and prefer rocky habitats near streams with plant cover. They eat insects, spiders and sowbugs. Skinks are active in the daytime but usually keep out of sight. Their nest is a burrow dug by the female. Eggs are laid during June and July, and tended by the female. She urinates on the eggs to keep them from drying out. Egg tending is unique to skinks. Most other lizards simply bury their eggs and leave them.



Northern alligator lizard

The northern alligator lizard is found in or near conifer riparian forests, under logs, and in areas where dense plant growth offers hunting cover. This is a larger lizard than the skink, as much as 10 to 13 inches in length. It is active during the day, feeding on millipedes, ticks, insects, spiders and snails. Little is known about its life cycle in Montana.



Painted turtle

Named for the colorful red and yellow markings on its belly plate. Painted turtles are found in streams but more commonly in lakes or ponds with sluggish water, shady or muddy bottoms and aquatic plants. Young turtles are eaten by great blue herons, cormorants and mammals able to crack the juvenile's shells. It is not uncommon to find tooth holes in shells of adult turtles that have escaped predation attempts. They require above water basking sites such as partially submerged logs, vegetation mats, rocks or mud banks for morning sunning, in order to become active after a night in the water. They bask in groups, listening for ground or water vibrations that signal danger. Turtles feed on both dead and living material including aquatic plants, insects, spiders, earthworms, crayfish, fish, frogs and tadpoles. In winter they burrow into muddy stream or lake bottoms. Their metabolism slows, requiring little oxygen and allowing them to survive for weeks without surfacing.

Some things to look for on the cover:

- ❑ bat
- ❑ bear, black
- ❑ boa, rubber
- ❑ bobcat
- ❑ cabbage, skunk
- ❑ caddisfly cases (shredders)
- ❑ caddisfly capture net (collector)
- ❑ cuckoo, yellow-billed
- ❑ dipper, American
- ❑ dragonfly
- ❑ ferns
- ❑ fisher
- ❑ fox, red
- ❑ frog, pacific chorus
- ❑ gentian
- ❑ horsetail
- ❑ man's tracks
- ❑ marmot, yellow-bellied
- ❑ monkeyflower
- ❑ moose
- ❑ mouse
- ❑ nuthatch, red-breasted
- ❑ orchid, fairy-slipper
- ❑ osprey
- ❑ otter, river
- ❑ owl
- ❑ rabbit, cottontail
- ❑ salamander larvae
- ❑ salamander, long-toed
- ❑ sculpin, mottled
- ❑ skink, western
- ❑ snails
- ❑ snake, terrestrial garter
- ❑ solitaire, Townsend's
- ❑ squirrel, northern flying
- ❑ squirrel, red
- ❑ stoneflies
- ❑ toads, western
- ❑ trillium
- ❑ trout, rainbow
- ❑ violet
- ❑ vireos, red-eyed
- ❑ waxwings, cedar
- ❑ weasel
- ❑ woodpecker, downy

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