

Tips for Streamside Landowners in Multnomah County



West Multnomah
Soil & Water
Conservation
District



Tips for Streamside Landowners in Multnomah County

- Protecting Your Watershed
- Protecting Your Land From Erosion
- Protecting Streambanks from Erosion
- Managing Streamside Areas with Buffers
- Before You Buy: Wells, Septic Systems, and a Healthy Homesite
- After You Buy: Wells, Septic Systems, and a Healthy Homesite
- Filling Out a Project Permit
- Enhancing Wildlife Habitat

For more information, contact:

Multnomah County Environmental Compliance (503) 988-5050

East Multnomah Soil & Water Conservation District (503) 222-7645

West Multnomah Soil & Water Conservation District (503) 238-4775

Discovering a Watershed

What is a watershed? Wherever you go, there you are, in a watershed. A watershed is simply all the land area that drains to a specific point. Browse a map and you can find your watershed by finding the closest stream. Trace up the stream to its furthest point upland and you reach the headwaters; trace down and you reach the mouth at a larger stream, a lake, or the Pacific Ocean. The surrounding ridgetops define the watershed boundaries.

And there you are. The land drains into tributaries and tributaries flow into the river. As the water flows downhill, it moves over the land or drains through the soil. Along the way, water picks up woody debris, leaves, and needles that provide the foundation of food and shelter for aquatic life in streams. Water can also carry motor oil, fertilizer, pesticides, and eroded soil. Small actions like driving the car, fertilizing pasture, or even walking the dog can inadvertently pollute the watershed you live in. As the tributaries flow into the river, so do the pollutants. It all adds up.

Stewardship/ (stu-erd-ship)

1. A personal commitment to care for the land.
2. To sustain or enhance the land for enjoyment of future generations.

Watershed Functions: How We Change Them

A watershed does three things, but our activities can disrupt its usual cycle:

1) Captures water.

Rain naturally enters the earth through soil, roots, and animal tunnels. When buildings, pavement, and other hard surfaces cover the ground, infiltration is hindered. Instead of being absorbed, water runs off into road ditches and into the nearest stream, causing severe stream erosion and floods.

2) Stores water.

After rain enters the soil, it fills the spaces between rocks and soil particles and becomes groundwater. Shallow groundwater enters the plant root zone where roots and soil organisms help to break down pollutants. Deep groundwater enters an area like a refrigerator: dark and cold, where little biological breakdown occurs. Septic system effluents, spilled motor oil, and excess fertilizers and pesticides can reach deep groundwater, polluting public and private wells. In Oregon, about 5 percent of private wells are polluted.

King County Dept. of Natural Resources

3) Releases water.

Springs, wetlands, and floodplains slowly release groundwater into lakes and streams. When these areas are filled or drained, water storage is reduced, and water runs quickly into the stream. Floods can be more frequent and damaging, while summer flows may be low or nonexistent.

Land use changes can disrupt the natural functions of a watershed. As a result, streams can erode and flood more often, water quality may decline, treatment costs may rise, and fish communities may collapse. Read on to identify problems in your watershed and find out what you can do to restore your watershed to better health...

"I want to be able to see my feet."

– Bernie Fowler, former Maryland senator, standing chest high in a river and talking about watershed goals

How Healthy Is Your Stream?

More than 17,000 small acreage farms cover 298,000 acres in Oregon. Singly, one farm may cause little pollution. But added together, small acreages can significantly impact a watershed. A stream reflects your management of the land and water. Proper upland and instream measures can result in clean water for fish, drinking, and swimming. You can check the health of your stream by using your eyes and legs.

Water color.

Clear water is often found during low flows. Muddy color occurs during high flows and when upstream activities send sediment downstream. Tea-colored water often comes from the brown tannin of decaying leaves. Colored sheen may indicate an oil spill.

Foam.

Froth on a stream can be natural or human-caused. Natural foam has an earthy or fishy smell. Soap or detergent foam will have a perfume smell.

Streambed sediment.

If gravel and cobbles are present, less than 25 percent of the gravel, cobble, and boulder spaces should be filled with sediment. A marginal to poor condition exists if more than 50 percent of the spaces are filled.

Algae color.

Algae thrive on nutrients from commercial fertilizers, leaf waste, and manure. Light or dark green algae scattered in spots indicates a healthy stream. Matted or hairy algae mean poor stream quality. Brown algae point to sediment deposits. An algae bloom indicates excess nutrients.

Streambank erosion.

Bare spots on streambanks may indicate an unhealthy stream. Wooded streambanks seldom erode, even in high floods. Steep banks, frequent tree fall, and more than 10 percent bank erosion along a stretch of stream may indicate erosion problems.

Riffles.

Riffles occur when water runs over rocky or rough streambeds. A mix of riffles and quiet pools provide good fish habitat. The ideal habitat for many aquatic animals is a streambed with cobbles from 2 to 10 inches in diameter.

Fish shelter.

Submerged logs and dead trees provide good fish habitat.

Stream shade.

Trees overhanging more than 50 percent of the streambank provide good fish habitat. Less than 50 percent indicates fair to poor habitat.

Stream temperature.

If you have a thermometer handy, measuring a temperature less than 50 degrees is good, 50 to 64 degrees is fair, and more than 64 degrees is poor. Warm water threatens salmon, trout, and steelhead. Temperature is an important water standard in Oregon.



USDA Natural Resources Conservation Service

Adapted from: *Save Our Streams*, Izaak Walton League; *Rangeland Watershed Management Program Stream/Watercourse Site Evaluation*, Oregon State University; *Vermont Streambank Conservation Manual*, Agency of Environmental Conservation.

Pollutants at Large in Your Watershed

Point source pollution is pollution that comes from one source, such as a factory pipe outlet. Nonpoint source pollution is pollution that comes from many different sources, such as overfertilized lawns, trampled streambanks, or eroding pastures. Test your nonpoint knowledge:



Montana Stream Management Guide

Pollutant	Nonpoint Source	Impact
Bacteria	<ul style="list-style-type: none"> ▪ Septic tanks poorly sited or maintained. ▪ Livestock and pet waste. 	<ul style="list-style-type: none"> ▪ Bacteria contaminate drinking water and swimming areas. ▪ People eating contaminated fish/shellfish can contract hepatitis, stomach and intestinal problems, etc.
High Temperature,	<ul style="list-style-type: none"> ▪ Straightened streams. ▪ Dikes and dams. 	<ul style="list-style-type: none"> ▪ High temperature reduces oxygen. ▪ Plant decay process uses up oxygen.
Low Dissolved Oxygen,	<ul style="list-style-type: none"> ▪ Upland practices, e.g. stream shade removed, poor grazing practices, drained wetlands. ▪ Plant litter, e.g., leaves and lawn trimmings dumped into ditches. 	<ul style="list-style-type: none"> ▪ Low oxygen and high salinity stunt reproduction, increase diseases, and kill fish.
Salinity	<ul style="list-style-type: none"> ▪ Irrigation leaching. 	
Phosphorus, Nitrogen	<ul style="list-style-type: none"> ▪ Crop fertilizers, livestock manure. ▪ Landscape, lawn, and garden fertilizers. ▪ Pet excrement. ▪ Septic tanks poorly sited or maintained. 	<ul style="list-style-type: none"> ▪ Nutrients cause algae blooms that die and lower oxygen levels. ▪ Noxious algae blooms and discolored water limit recreation. ▪ Nitrates in groundwater kill livestock and sicken infants.
Sediment	<ul style="list-style-type: none"> ▪ Erosion from poor grazing practices, tilling ground, logging roads. ▪ Sheet, rill, and gully erosion. ▪ Dredging, streambank erosion. ▪ Bed scour from straightened streams. ▪ Construction, land clearing. ▪ Natural erosion. 	<ul style="list-style-type: none"> ▪ Sediment fills wetlands, destroys habitat, and smothers feeding and spawning areas. ▪ Sediment carries nutrients. ▪ Ports are dredged more often. ▪ Cities have increased costs to filter drinking water.
Heavy Metals	<ul style="list-style-type: none"> ▪ Motor fuel, exhaust. ▪ Consumer products, e.g. batteries. ▪ Construction materials. ▪ Naturally present in soil. 	<ul style="list-style-type: none"> ▪ Heavy metals disrupt fish/shellfish reproduction and can be passed up the food chain. ▪ People eating contaminated fish/shellfish can develop brain damage and fetal defects.
Car Pollutants	<ul style="list-style-type: none"> ▪ Fuel, antifreeze, grease, brake-lining particles, and exhaust from cars. ▪ Runoff from roads, parking lots, and driveways. ▪ Dumping oil down stormdrains. 	<ul style="list-style-type: none"> ▪ Petroleum products accumulate in sediment, resist breakdown, and are toxic to fish in low amounts. ▪ Potential carcinogen in people.
Human-made Chemicals	<ul style="list-style-type: none"> ▪ Batteries, pesticides, household cleaners, and paints. ▪ Poor storage, handling, and disposal of hazardous chemicals. 	<ul style="list-style-type: none"> ▪ Pesticides kill aquatic insects and reduce fish food supply. ▪ Some pesticides cause bone defects and reproductive problems in fish. ▪ Unknown effects in people.

Adapted from *Guidance Specifying Measures for Sources of Nonpoint Pollution in Coastal Waters*, US Environmental Protection Agency.

Your Property: What You Can Do

We are all powerful because every action matters in a watershed. Consider developing a conservation plan and using conservation measures to protect, care for, and enhance your property values and watershed health. To get started, browse the other fact sheets in this series which describe conservation tips for small acreage landowners. For copies of fact sheets, contact the East Multnomah Soil & Water Conservation District at (503) 222-7645

Small Acreage Stewardship Fact Sheets

- 1) Protecting Your Watershed: Eastern Oregon
- 2) Protecting Your Watershed: Northwestern Oregon
- 3) Protecting Your Watershed: Southwestern Oregon
- 4) Protecting Streambanks from Erosion
- 5) Installing a Streamside Buffer
- 6) Managing Pastures: Eastern Oregon
- 7) Managing Pastures: Western Oregon
- 8) Managing Pasture Weeds
- 9) Providing Stockwater in Pastures and Near Streams
- 10) Planning and Installing a Fence
- 11) Managing Mud and Manure
- 12) Fertilizing for Profit
- 13) Protecting Your Land from Erosion
- 14) Planning and Managing Irrigation
- 15) Managing a Sustainable Forest: Western Oregon
- 16) Enhancing Wildlife Habitat
- 17) Planning and Installing a Pond
- 18) Before You Buy: Wells, Septic Systems, and a Healthy Homesite
- 19) After You Buy: Wells, Septic Systems, and a Healthy Homesite
- 20) Filling Out a Project Permit



USDA Natural Resources Conservation Service

Watershed Councils: The Way to Have a Say

Watershed councils offer a trustworthy link between government, community groups, businesses, and local residents. Councils solve natural resource issues in your watershed by a locally led effort rather than a top-down, regulatory one.

Watershed councils:

- Bring local people with diverse natural resource concerns to the same table.
- Develop watershed approaches that include natural resource concerns and community development priorities.
- Address hot topics like water quality and endangered species listings.
- Do not prevent change, but rather direct change towards informed choices.

Watershed councils are the cornerstone to the Oregon Plan for Salmon and Watersheds. Begun in 1995, the plan seeks a voluntary, locally led approach to address listed fish species concerns. For more information, contact the Governor's Watershed Enhancement Board at (503) 986-0178 for a watershed council near you.

- Soil and water conservation districts and the USDA Natural Resources Conservation Service may provide on-site technical advice on conservation measures. Look up your local office in the phone book's blue pages under federal government, Department of Agriculture.
- Oregon State University Extension Service offers publications, workshops, and over-the-phone assistance on conservation measures. Contact your local office by looking in the blue pages under state Government in the phone book.
- Governor's Watershed Enhancement Board (GWEB) has implementation funds available for watershed projects. Contact GWEB, soil and water conservation districts, watershed councils, and other state agencies for more information.



Protecting Your Land from Erosion

Tips for Small Acreages in Oregon

The Soil Is Alive

Every cubic inch of topsoil may contain over a billion creatures – mostly bacteria, microbes, and fungi. This tiny ecosystem recycles dead plant matter back into nutrients that support plant growth. When the upper 8 inches of soil stays put, this living layer produces:

Nutrients.

Studies show a healthy soil has up to 200 percent more nitrogen and phosphorus and 20 percent more potassium than an eroded soil.

High plant yields.

In general, healthy, protected soils have 25 percent higher yields than severely eroded soils. Studies have shown 31 percent higher alfalfa yields and 86 percent higher barley yields on protected soils versus eroded soils.

Clean waterways and fish habitat.

Studies show that we can save \$1 for each ton of soil that stays on the land. With erosion control, clean gravel beds produce healthy fish populations, cities reduce filtration costs for drinking water, and harbors can lower their dredging costs.

Some soil erosion is natural, but accelerated erosion is not. A canopy of trees and shrubs, a thick leaf layer, or dense stand of grass protects soil in its natural state when raindrops fall or winds blow. **We speed up erosion** by removing this protective blanket when we use poor management during tillage, grazing, timber harvest, or construction. Wind and water erosion create sterile soils, fill the air with dust, plug road ditches, carry pollutants, and clog fish habitat. It pays economically and environmentally to keep soil in place.

Dirt Alert: Signs of Erosion

A raindrop is like a miniature water bomb: it hits the ground at 20 miles per hour. When raindrops hit bare soil, water can splash soil up to 6 feet away, carry particles off the field, and drop sediment into drainageways. Wind also dislodges, moves, and transports soil particles, especially in dry, windy climates.

Most Oregon soils begin to lose their ability to support plants when they erode more than 5 tons of soil per acre each year. This usually occurs through a process called sheet erosion, the gradual wearing away of a thin layer or “sheet” of soil. Since 10 tons of soil lost per acre equals the thickness of a dime, sheet erosion can be very hard to see! Look for these clues of sheet, gully, and streambank erosion:

- Cloudy or muddy water flows down the field, road, or driveway.
- Pebbles and plant pieces are supported on “pedestals” of soil because the surrounding soil has been eroded away.
- Small rills or gullies begin to show.
- Dust clouds appear.
- Soil collects along fences or snowbanks.
- Soil splashes on windows, walls, and plants.
- Sediment builds up on pavement or at low spots in the field.
- Streams and rivers run cloudy after a rain.
- Streambanks crumble and fall into stream. (See *Protecting Streambanks from Erosion* in this fact sheet series for more information.)

“It can take 1,000 years to form an inch of soil.”



USDA Agricultural Research Service



USDA Agricultural Research Service

Keeping Soil on Your Land

Here's how conservation measures reduce erosion:

- **Create a protective cover.**

Plant cover, more than anything else, keeps soil erosion in check. Leaves cushion the impact of wind and rain while roots anchor the soil. Other covers like mulch, bark dust, rock, and concrete also protect soils.

- **Erect barriers to wind and water.**

Barriers slow wind and water and trap eroded soils. If you cut water speed in half, you will have four times less erosion! Barriers can be as simple as grass strips in a field crop, silt fences around a construction site, or a windbreak.

- **Reduce slope length and steepness.**

In general, plants can protect slopes that are less than 50 percent (2:1 gradient or 2 foot run for every 1 foot drop), mulches protect slopes less than 33 percent (3:1 gradient), and erosion control structures like terraces may be needed for slopes more than 50 percent. Cropland terraces are usually used on slopes less than 12 percent. The low dams formed by terraces shorten the distance where water can gain speed. Metal or concrete erosion control structures safely drop water to a lower elevation and reduce the steepness of the remaining slope.

One conservation practice does not fit every erosion problem. Your soils, climate, topography, and land use will require a unique set of measures. Here's a sampling of conservation measures that can be used whether you have a large garden or a field crop. They are often more effective in combination than alone:

- **Buffers** of trees, shrubs, and/or grass slow water speed, filter pollutants, and trap sediment. They are used to protect streams, lakes, ponds, and ditches, and to stop sediment at the lower edge of field crops. **Grass filter strips** are effective on slopes less than 10 percent. **Contour buffer strips** combine contour farming with strips of permanent grass. A ratio of cultivated to buffer strip width between 4:1 to 9:1 is best. **Riparian**

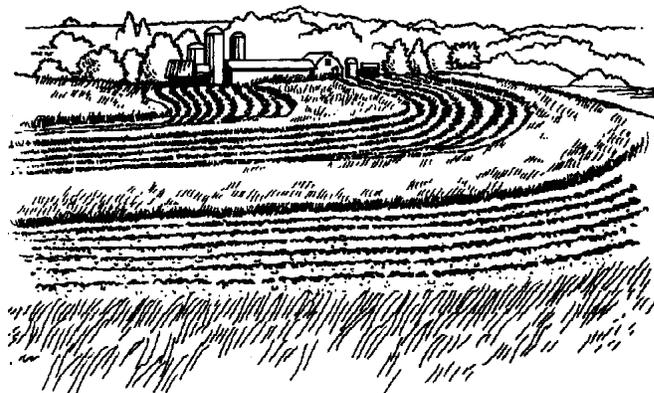
buffers are tree, shrub, and/or grass strips that protect streams, ditches, lakes, and ponds and may be 35 to 300 feet wide, based on site conditions and your goals. For more information on riparian buffers see *Installing a Streamside Buffer* in this fact sheet series. Fact sheets are available from East Multnomah Soil and Water Conservation District (503) 222-7645.

- **Conservation tillage** reduces the amount of tillage and leaves at least 30 percent cover from crop residue after harvest and during winter months. Soil loss is reduced by 50 percent compared to bare soil. (Stretch a 100-foot tape across the field and count how many times a stem, leaf, or root touches the 1-foot marks. The total equals the percent cover.)



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- **Contour farming** runs rows "on the level" around the hill rather than up and down the slope. Crop rows form hundreds of small dams that slow water and reduce soil loss up to 50 percent compared to farming up and down a slope. **Cover crops** temporarily protect the soil until the main crop is planted. Cover crops also add organic matter, hold nitrogen, and reduce weed growth. Plant cereal grains and legumes for winter cover crops. Buckwheat is a good summer cover crop.
- **Crop rotation** changes crops each year in a certain order. A rotation that includes grasses, legumes, or small grains will break pest cycles and



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reduce erosion compared to continuous row crops that may build up pest populations and leave soil open to erosion.

- **Erosion control structure** drops water safely to a lower elevation. Rock, metal, or concrete structures permanently protect the soil from forming gullies. The structure takes the erosive force of the water and can reduce the remaining slope. Use this practice as a last resort because of the design and construction expense.
- **Grassed waterway** is a flat-bottomed channel with grass that slows water and prevents gullies. Farm equipment can drive over gentle side slopes and wildlife can use grasses for nesting and cover. Waterways may need to be combined with rock linings or drop structures on steep slopes.
- **Pasture management** balances livestock numbers, forage, and water for a healthy farm income and



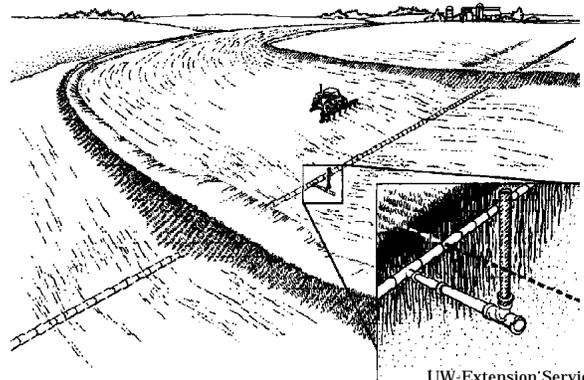
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environment. Pastures with at least 70 percent plant cover have little erosion and produce more forage. Set aside a “sacrifice area” where animals are held to protect pastures when soils are wet or plants are recovering from grazing. For more information, see the fact sheet *Managing Pastures* available from East Multnomah SWCD at (503) 222-7645.

- **Special plantings in critical areas** protect especially erosive areas with special plantings. This erosion measure combines plants, fertilizer, and mulch to protect areas such as construction sites, road banks, and steep slopes. Here’s a typical recommendation:
 1. **Plants** - Use plants native to your area whenever possible. **Native plants** are adapted to local conditions and are more drought-tolerant, pest-resistant, and lower maintenance than nonnative plants. **Grasses** usually provide the most erosion control and are planted in a mix with 10 to 50

percent **legumes, forbs, and/or shrubby species**. A mix of 6 to 10 species can fill voids and adapt to varying conditions. **Trees** reinforce slopes at greater depths, but don’t work as well for surface erosion. Combine trees with slow-growing grasses or add trees after area is stabilized. Plant shrubs 2 to 5 feet apart and trees at 6 to 10 feet apart.

2. **Site preparation** - This can make or break a planting. If possible, spread **4 to 6 inches of topsoil** over site. A smooth surface is needed if the area is for a grassed waterway or to be mowed. Otherwise, a rough surface will work for broadcast or hydroseeding. **Fertilize** according to a soil test or apply 10 pounds of 10-10-10 per 1,000 square feet. **Mulch** grass plantings with 2 bales of straw per 1,000 square feet. Water as needed until grass is 2 inches tall. Mulch shrub and tree plantings with leaves, bark dust, or compost.
- **Terraces** are long, low dikes of earth that follow the contour of the hill. They break long slopes into shorter runs, slow runoff, and trap sediment. If terraces aren’t practical, consider planting 1-foot strips of stiff, perennial plants that are perpendicular to the slope of the land with the same spacing as terraces.
- **Wind barriers** are strips of grass, shrubs, or trees that slow wind. **Grass barriers** are 1 to

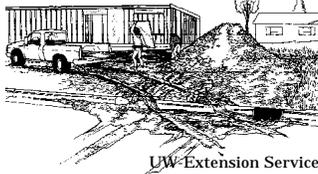


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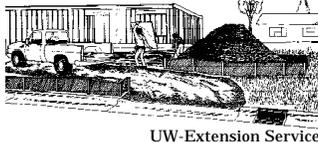
2 rows of tall grass planted perpendicular to the wind to protect crops, provide wildlife food and cover, and trap snow. The strips should be planted no more than 10 to 12 times the grass height for maximum effectiveness.

Windbreaks are tree or shrub rows that slow wind, manage snow, protect livestock, and provide wildlife habitat. Windbreaks are spaced at intervals of 5 to 20 times the height of each windbreak and perpendicular to the prevailing winds.

Construction site before erosion control



Construction site after erosion control



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- Soil and water conservation districts (SWCD's) and the USDA Natural Resources Conservation Service may provide technical advice on soil erosion measures on cropland, pasture, and forest. Contact East Multnomah SWCD at (503) 222-7645 or West Multnomah SWCD at (503) 238-4775 or Portland USDA office at (503) 326-3941.
- Local building departments may provide specifications for erosion control on construction sites. Before construction, contact Multnomah County Land Use at (503) 988-3043. For building issues in East Multnomah County, contact City of Gresham Building Department at (503) 618-2832. In West Multnomah County, contact Portland Building Bureau at (503) 823-7310.

Construction Sites That Are Watershed-Friendly

Sediment is the number one pollutant in surface water. The average homesite construction can lose from 100 to 500 tons of soil per acre per year. This is a rate 100 times more than cropland erosion and 2,000 times more than woodland erosion! You will have healthy plants and happy neighbors, if you keep topsoil on site. Here are seven steps to control erosion on construction sites:

Step 1. Schedule construction activities during the dry season.

Dry soils keep soil compaction, mud, and water runoff to a minimum. Septic systems installed in uncompacted soils will function properly. However, you may need to control wind erosion and irrigate plantings.

Step 2. Flag or fence off areas to be protected.

Protect areas such as:

- *Septic system locations.* Avoid parking or running heavy equipment over this area. Compaction can ruin a septic site.
- *Steep slopes.* Avoid disturbing steep slopes that can be extremely erosive. Use dikes or ditches to divert water away from steep slopes and disturbed areas. Protect diversion channels with grass, rock rip rap or check dams.
- *Trees and their dripline areas.* Trees increase property values. Protect tree roots by fencing off an area 2 to 3 times the width of the branches. Equipment can tear tree roots and earth fill suffocates roots. For details, see *Preventing Construction Damage to Trees* (G6885), University of Missouri Extension Service at website muextension.missouri.edu/xplor/agguides/hort/g06885.htm.

Step 3. Use erosion measures around the site perimeter.

Before construction begins, identify and install erosion controls where eroded soils could leave the site. Check

with your local land development department for requirements in your area. Examples of measures to install are:

- *Plant buffers.* On slopes less than 6 percent, preserve a 20- to 30-foot wide buffer of vegetation around the perimeter of the property. This will slow sediment from leaving the site.
- *Silt fences.* Use silt fencing on the downslope perimeter of the site.
- *Gravel drive.* Restrict traffic to a gravel entry. This will keep soil from sticking to tires and washing into the street.
- *Storm sewer inlets (if present).* Protect storm drains with gravel-filled, geotextile bags, straw bales, or other materials that trap sediment while allowing water to pass through.

Step 4. Prepare site for construction.

Disturb as little vegetation as possible. Remove topsoil (typically top 6 to 8 inches) and stockpile separate from the subsoil. Plant grass on soil stockpiles or place a silt fence around stockpiles to prevent erosion. Locate stockpiles away from drainage areas.

Step 5. Maintain erosion control.

Inspect installed measures at least twice a week and after storm events. Make needed repairs and clean up soil tracked or washed off-site. When gutters and downspouts are installed, consider using downspout extenders to safely carry roof water past disturbed ground.

Step 6. Replant construction site.

Redistribute topsoil 4 to 6 inches over the site. Final grading should slope water away from buildings and into drainage swales. Seed, fertilize, and mulch or sod bare areas. Water until grass is 2 inches tall.

Step 7. Remove temporary erosion control measures when the vegetation is established.



Protecting Streambanks from Erosion

Tips for Small Acreages in Oregon

How Streams Behave — or Misbehave

Streambank erosion is natural. Some erosion is needed to supply gravel beds and inside point bars on river curves. But too much erosion can pollute water supplies, cover fish habitat, and threaten property.

When a stream is healthy, it balances water flow, the sediment it can carry, and its shape and energy (the same energy used in hydroelectric dams). Flowing water tends to move from side to side as seen in meandering streams. Stream meanders and plants growing along the banks reduce the erosive energy of a stream and trap sediment.

Any change in the watershed feeding the stream, in the floodplain, or in the stream itself can upset this delicate balance. The three major causes for increased streambank erosion are:

- **Land use change.** When we build houses, sidewalks, and roads over soil, we reduce the amount of water that can enter the ground. Consequently, water runs off faster, at higher temperatures, and with more erosive energy into streams. Streams become “flashy,” erosive, and flood-prone. When we remove trees and vegetation next to a stream and allow livestock to trample banks, this exposes the soil. As a result, streambanks may erode more rapidly and slump into the water.
- **Dams.** When we build dams, the dams trap sediment and change the amount of sediment and energy in the stream below. Streams must move sediment, so the stream looks for a new source—the banks!
- **Straightening streams.** When we straighten a winding stream, we remove the meanders that reduce the erosive power of water. In the past,

streams were channeled to move water quickly through flood-prone or erosive areas. But instead of solving a problem, it only moved the problem downstream with even greater force.

Streams are complex. In most situations, you should work with a professional to repair your streambank, so you don't throw money down the “drain.” Read on for some guidelines to get you started.

Identifying Your Streambank Erosion Problem

The first step is to discover the cause of streambank erosion on your property. Here are three common causes:

Force of the stream.

Occurs at high water and is the major cause of bank erosion. Solutions for this situation are addressed in the fact sheet.

Ground water seepage.

Occurs at low water. Groundwater leaves the bank face and causes bank failure at the seepage point. Can also occur when floodwaters recede and the saturated bank collapses. This is a common problem in banks with fine soils. (This situation is not addressed here; consult a professional.)

Surface runoff.

Occurs during high runoff periods from rain, snowmelt, or flooding. Concentrated water flowing over the bank causes gullies. Often found next to roads, sidewalks, and parking lots. Can also occur when floodwaters re-enter a stream channel and cause failure in riprap structures. (This situation is not addressed here; consult a professional.)

“Mankind's strength and ultimate survival depends not upon an ability to manipulate and control, but on an ability to harmonize with nature.”

– Rolling Thunder



USDA Natural Resources Conservation Service

Degraded streambank.



USDA Natural Resources Conservation Service

Streambank with vegetative buffer.

A Natural Solution: Soil Bioengineering

Soil bioengineering is a practice that uses plants alone or in combination with hard structures to stabilize streambanks. Hard structures armor the bank, but have hard surfaces that may increase erosion downstream and provide little wildlife habitat. When **rock, roots, or log** structures are combined with shrubs and trees, the plants hold the soil, slow water, filter pollutants, and provide food and cover for fish and wildlife.

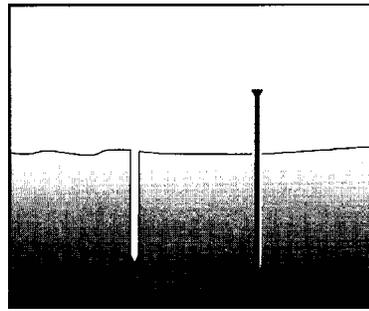
Bioengineering requires hand labor, planting during the growing season, and protection from animals, disease, and insects. Plants may take several years to become fully effective and cannot correct landslides. Soil bioengineering practices include brush mattresses, livestaking, log-wing deflectors, and planting shrubs with half-bank riprap.

Plant Materials for Bioengineering

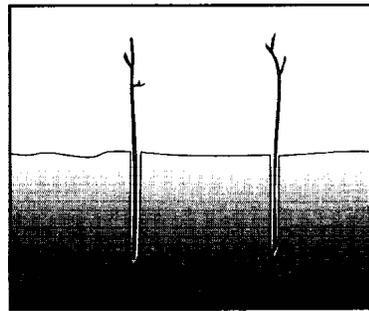
To select the right plants for your bioengineering project, note what native plant communities grow in your area. Avoid planting noxious or invasive grasses such as reed canary grass or ryegrass. Remove invasive plants such as yellow starthistle, English ivy, deadly nightshade, field morning glory, scotch broom, cheatgrass, and purple loosestrife. Use more of the same native plants in your bioengineering design, as these plants are most likely adapted to conditions to the area. Plants like **willow, red osier dogwood, alder, ash, and cottonwood** have the right stuff for bioengineering. They establish easily, grow quickly, and have thick root systems.

You can buy willow and dogwood cuttings from native plant nurseries. Or collect cuttings next to the project site, if the area is well vegetated. Other prime collection areas include ditches, abandoned fields, or utility right-of-ways. Do not take rooted native plants from the wild. This practice is unethical and survival is very low. One exception to this is rescuing rooted plants from construction sites. Be sure to get collection permission from property owners.

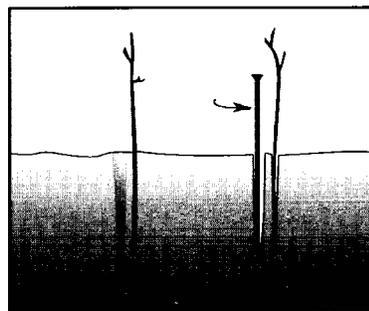
An example of how to plant willow cuttings is shown here. For information on planting and establishing native plants, see the agencies listed under "For Help." For information specific to the Willamette Valley, see the *Guide for Using Willamette Valley Native Plants Along Your Stream*, Linn Soil and Water Conservation District publication, (541) 926-2483.



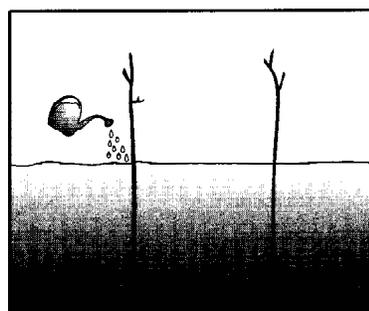
1. If soil is too hard for direct cutting placement, use a planting bar to create a hole. Make hole half the length of the cutting.



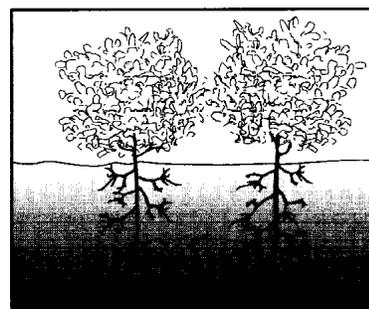
2. Insert willow cutting to the bottom of the hole.



3. Re-insert the planting bar adjacent to first hole and move bar toward willow cutting to close hole.



4. Water thoroughly.



5. Watch your willows grow and flourish.

Protect Your Streambank “Toes”

Severe bank erosion almost always requires protecting the “toe” of the streambank. The toe lies at the bottom of slope and supports the weight of the bank. When water undermines the toe, the bank collapses. You can protect the streambank toe by using rock riprap, logs, and rock barbs combined with plants. One soil bioengineering example is shown here using rock riprap at the toe and live stakes on the slope. Protect the bare soil between structures with native grasses, sedges, and rushes. **Sprig plantings, grass seedings, or erosion blankets** may be needed to prevent erosion until shrubs and trees establish themselves. For more information on soil bioengineering, see your permitting agency or look up the following:

- *Streambank and Shoreline Protection, Chapter 16, Engineering Field Handbook*, USDA Natural Resources Conservation Service, <http://www.info.usda.gov/CED>

Stream-friendly Project Tips

Before Construction

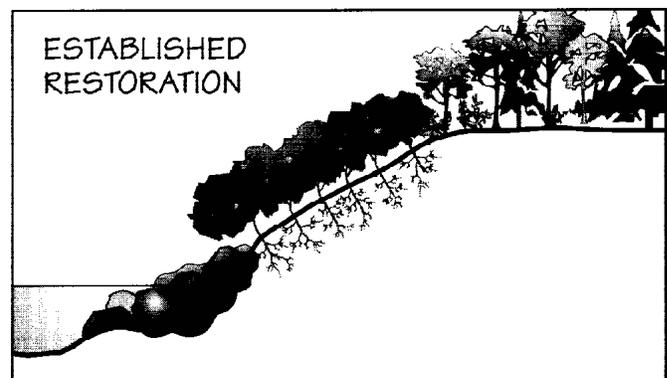
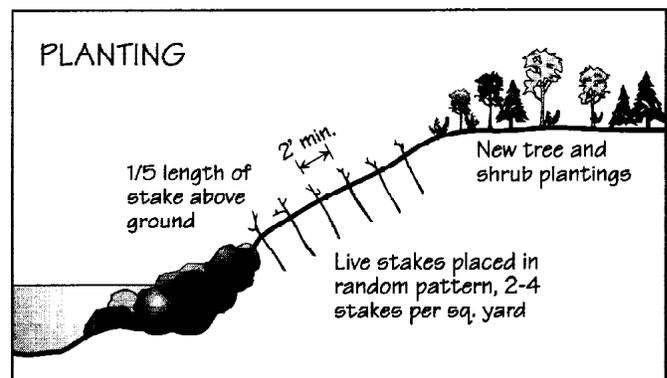
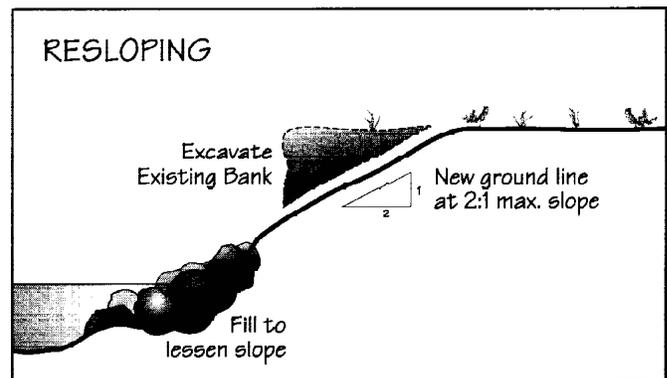
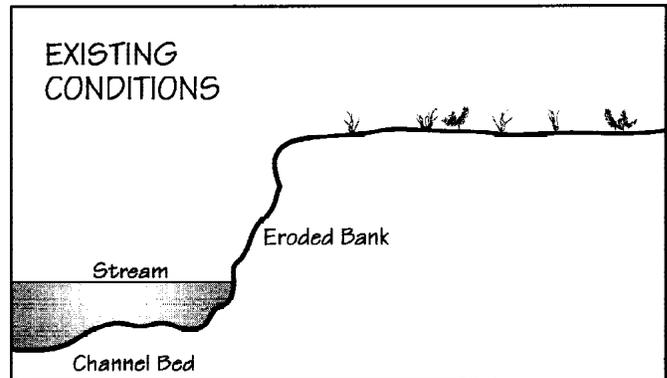
- Involve your neighbors to increase project success
- Get the necessary permits
- Flag and avoid disturbing wetlands
- Preserve existing native trees and shrubs
- Cut trees and shrubs rather than ripping them out of the ground (many may resprout)
- Make a plan to replant disturbed areas and use native plants
- Install sediment-control practices (e.g., coffer dams)

During Construction

- Stockpile fertile topsoil for later use for plants
- Use hand equipment rather than heavy equipment
- If using heavy equipment, use wide-tracks or rubberized tires
- Work from the streambank, preferably on the higher, non-wetland side
- Avoid instream work except as authorized by the Oregon Department of Fisheries and Wildlife
- Stay 100 feet away from water when refueling or adding oil
- Avoid using wood treated with creosote or copper compounds

After Construction

- Keep out people and livestock during plant establishment
- Check project after high flows
- Water plants during droughts
- Control grass until trees and shrubs overtop grass, usually two to three years

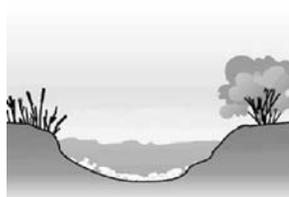
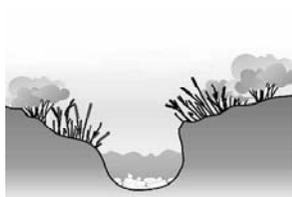


Streambank Stabilization Practices: Pros, Cons, and Costs

Practice	Advantages	Disadvantages	Cost
Change Management Make grazing and cropping changes that allow streamside plants to recover (e.g., fence out livestock or install a buffer that produces income).	Easiest to implement; natural recovery; diverse opportunities.	Results take time; may need long-term change in land use.	Low to moderate cost.
Replant Streamside Area Plant native shrubs and trees; reintroduce native grasses, rushes, and sedges.	Can be done with hand labor; has a natural, attractive look; increases wildlife habitat.	High labor needs; results take time; need streamside expertise; may require long-term change in land use.	Low to moderate cost (if labor is volunteered), \$0.50-\$10/foot.
Reshape Streamside Slope For slope stability, cut slope back to a minimum of 1 foot fall for every 2 foot in length (a 5:1 sideslope is best), reseed or cover with erosion blankets, replant with native shrubs and trees.	High chance of success; recovery of streamside habitat.	Requires design and installation expertise, heavy equipment, and labor; loss of existing vegetation.	Moderate to high cost, \$10-\$100/foot.
Install Soil Bioengineering Use bundles of brush, roots, or trees to cover banks. May include rock or other hard structures.	Uses natural materials; easy to install; may increase property values.	High labor costs; may not be adequate in streams with high flows; results take time.	Moderate cost, \$5-\$25/foot.
Install Jetties or Barbs Redirect water from banks with jetties or barbs.	When well designed, provides long-term stability; uses less rock than riprap; provides pool habitat for fish.	Difficult to design and install; may cause new problems across stream or downstream.	Moderate to high cost, \$100-\$1000 per structure.
Use Riprap or Gabions Cover banks with rocks and boulders alone (riprap) or with filled rock cages (gabions). Gabions are used on steep streambanks that can't be sloped back.	Very stable banks; may enhance habitat by adding logs and/or live plants.	Loss of streamside habitat; may increase erosion downstream; unnatural appearance.	Moderate to high cost, \$40-\$60/foot.
Move Stream to Original Channel Relocate to restore natural functions of stream. Extreme measure that requires careful planning.	Quickest recovery to full potential; replaces all functions.	High cost; must use professional consultants.	Moderate to high cost, \$10-\$70/foot.

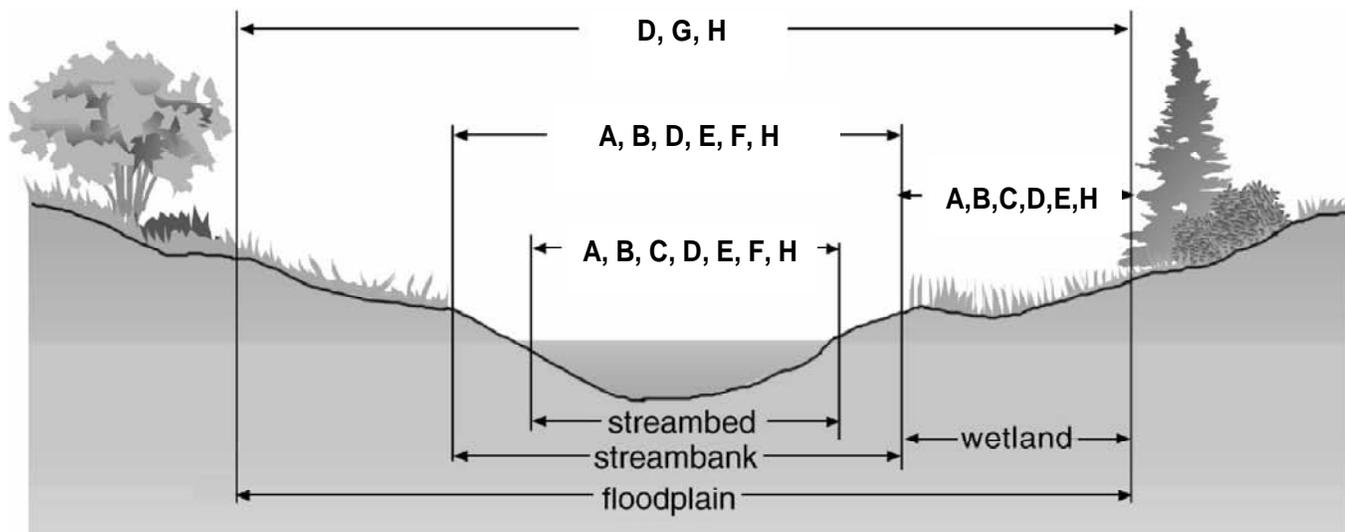
*Costs are for comparison only and will vary depending on the situation. Adapted from the *Montana Stream Management Guide*, Montana Department of Environmental Quality.

Common Channel Shapes



The Permits You'll Need

If you are working in or around water, you will probably need a permit from a local, state, and/or federal agency. Use this diagram to find out where your project will take place and what permits you may need. The State of Oregon and other permitting agencies prefer bioengineering practices to those that are solely rock or other hard structures. Since every situation is different, you may need to contact more agencies than those listed. Hint: to avoid migrating fish, the construction period for most stream work is permitted from July 1 to September 15 (or September 30 depending on the stream). Begin the permit process well ahead of construction time since the process can take a year or longer. See *Filling Out a Project Permit*, for more information.



Montana Association of Conservation Districts

Using this diagram, determine where your activity will occur. The letters refer to the permits listed below.

Permit	Government Agency	Phone
A. Removal or Fill Law.....	Or. Dept. of State Lands*	503-378-3805
(For projects that dredge or fill more than 50 cubic yards in state waters)		
B. Water Quality Certification.....	Or. Dept. of Environmental Quality.....	503-229-5263
(For projects regulated under the Federal Clean Water Act 404)		
C. Water Rights.....	Or. Water Resources Dept.....	503-986-0900
(For projects that take or use surface water or groundwater)		
D. Coastal Zone Certification.....	Or. Dept. of Land Cons. And Dev.....	503-373-0096
(For projects that are west of the crest of the Oregon coast range)		
E. Fed. Clean Water Act (404).....	U.S. Army Corps of Engineers*	503-808-4373
(For projects that dredge or fill more than 50 cubic yards in state waters)		
F. Fed. Rivers & Harbors Act (10).....	U.S. Army Corps of Engineers*	503-808-4373
(For projects in navigable waters of the U.S.)		
G. Floodplain Corridor Designation .	Multnomah County Land Use Planning...	503-988-3043
(For projects in the floodplain)		
H. Other laws may apply.....	Various agencies.....	Various numbers
(For projects that depend on specific activities and locations)		

* The Oregon Dept. of State Lands (DSL) and U.S. Army Corps of Engineers (COE) have a joint application to avoid duplication. Send in a signed copy to DSL and a signed copy to the COE.



Montana Stream Management Guide

Logjams: Wood is Good

In the past, woody debris was removed from streams to drain floodplains, float timber, and allow boat traffic. Now we recognize some logjams are “good” and should be left alone because they have the following benefits:

- Provide cover for fish
- Stabilize channels by trapping sediment
- Redirect flow to create scour pools and open gravel
- Increase groundwater levels

However, woody debris can float downstream, collect, and create “bad” logjams.

Hazardous logjams that are

causing or could cause severe flooding or severe erosion should be removed. When removing woody debris, consider these stream-friendly tips:

- Work from the streambank and keep equipment out of the stream
- Anchor log debris to side for bank protection and aquatic habitat
- Salvage log debris for stream restoration projects
- Leave stump and roots behind when cutting down trees that may rip out banks

Remember! Removing woody debris from streams requires approval from the Oregon Department of State Lands. Other regulations may apply.

A Buffer is the Best Long-term Protection

A streamside buffer of trees, shrubs, and grass protects land and water in the following ways:

- Slows floodwaters
- Blocks flood debris from entering fields
- Protects banks
- Filters overland pollutants
- Provides wildlife habitat

Buffers work! Studies show that a dense tree stand at the top of the bank can cut down meander erosion in half. Consider preserving or planting trees and shrubs near your stream. See *Managing Near Stream Buffers*, Fact Sheet 4 in this series, for information on designing buffers.

Do Not Install Used Construction Materials

Broken pavement, car bodies, asphalt slabs, concrete blocks, bricks, rotting lumber, and scrap metal are impractical to sort by type and impossible to anchor to streambanks. These materials can float downstream, leach pollutants, and lower property values with their presence. They have flat, hard surfaces that do little to dampen the erosive power of water. Dumping many of these items near or in water may be illegal and result in fines.



- The soil and water conservation district (SWCD) and USDA Natural Resources Conservation Service (NCRS) may provide on-site advice and cost-share funding to plant, fence, and repair eroding streambanks. Contact East Multnomah SWCD at (503) 222-7645, West Multnomah SWCD at (503) 238-4775 or local NCRS office at (503) 326-3941.
- Private consulting engineers may obtain permits on your behalf, design projects, and help you meet your streambank protection goals. Check the yellow pages in the phone book for consultants.



Managing Streamside Areas with Buffers

Tips for Small Acreages in Oregon

The Good Life at Water's Edge

Sparkling water and lush plants draw us to fish, swim, and live near streams and lakes. But the choice to live and play near water comes with the responsibility to take care of what attracted us there in the first place. Before anyone knew better, people "tidied up" their properties. They removed native plants and planted pastures, crops, or lawns up to the water's edge. Now we know that a good mix of trees, shrubs, and grasses next to the water bring a wealth of benefits to the landowner and all who live downstream. Near stream areas can provide flood and erosion control, wildlife habitat, and higher property values. Read on to learn how to protect your environmental and real estate investment.

*"What we needed,
the fish needed."*

—Alistair Bleifuss,
describing a buffer
that protects his
streambank and
improves fish habitat

Is Your Riparian Area Healthy?

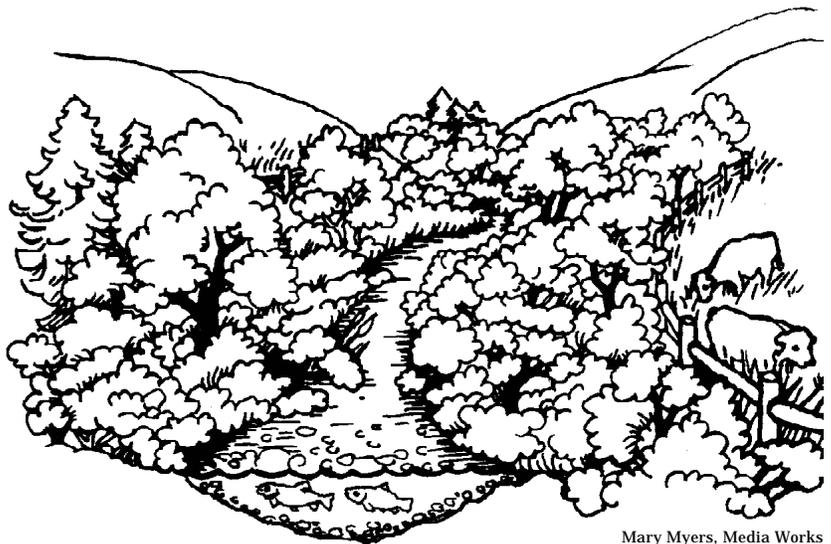
A *riparian area* is the land next to lakes, streams, and wetlands. It has a high water table, occasional flooding, and many valuable benefits (see next page). Signs of an unhealthy riparian area include:

- Raw banks erode and fall into the stream.
- Water is not shaded and heats up in sun.
- Streambanks are wide and shallow from livestock trampling.
- Severe grazing leaves few desirable trees, shrubs or grasses.
- Stream gravel is covered with sediment.
- Noxious weeds invade area and leave no habitat for fish and wildlife.
- Groomed landscape adds runoff with fertilizers, pesticides, and soil to the stream.

A *riparian buffer* is an area next to water that cushions the negative impacts that land and water may have on each other. It is often made up of trees, shrubs, and grasses. Examples of a healthy riparian buffer include (levels for good fish habitat are in parenthesis):

- Trees, shrubs, grasses, sedges, and rushes stabilize banks (80 percent or more of bank area).

- Overhanging trees and shrubs shade water (50 percent or more of bank area).
- Animals are fenced off fragile banks.
- Livestock graze forage and drink clean water in upland pasture.
- Stream gravel is free of sediment (85 percent or more of bottom).
- Native plants and non-invasive exotic plants provide a diverse habitat for wildlife.
- Buffer with trees, shrubs, and grass filters upland runoff.



Mary Myers, Media Works

Benefits of Riparian Buffers

A riparian buffer works for you in a lot of ways you can't immediately see. The following list describe the benefits of a buffer in detail:

Traps eroded soils.

USDA reports that up to 64 percent of the sediment found in streams comes from cropland, pasture, and range. Eroded soils cloud the water, suffocate fish eggs, and scratch the delicate gills

of fish. Sediment fills streams and pushes floodwaters out of banks. A grass buffer can stop up to 70 percent of the soil from entering a stream.

Treats land runoff.

Overland runoff and drainage tile can carry fertilizers and pesticides directly into streams and lakes. Buffers are "last chance stops" where these pollutants are broken down by plants and soil microbes before pollutants can enter streams. Tree and grass buffers remove up to 50 percent of the nitrate and phosphorus in water that might otherwise pollute a stream.

Holds down flood damage.

Trees and shrubs block floating debris from washing onto upland areas. Forest and shrub buffers have stems that slow water and roots that hold soil in place. Grasses, sedges, and rushes reduce soil erosion and increase the amount of water entering soil. Riparian areas with trees generally experience less damage than those planted to grass or crops.

Increases stream flows in summer.

Forest buffer soils take in water up to 15 times faster than pasture or cropland soils. This "buffer sponge" has tremendous water storage capacity and slowly releases water to add to summer flows.

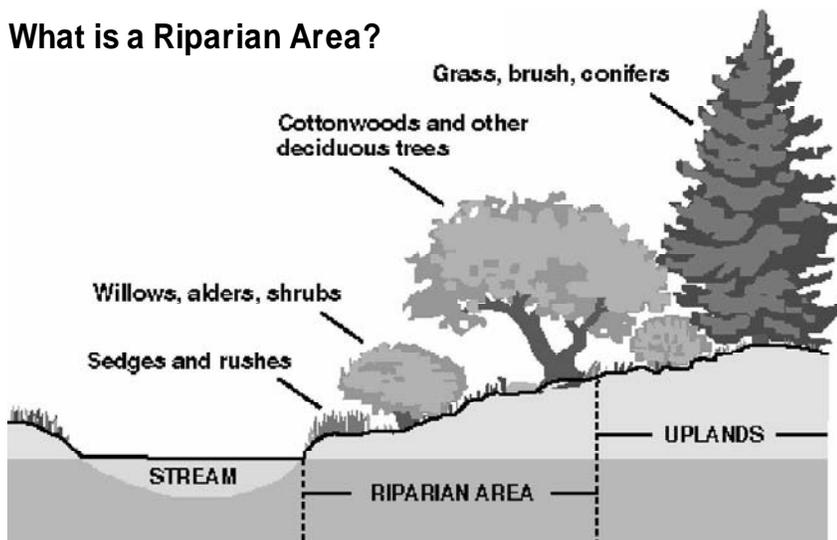
Provides food for the biggest fish.

Overhanging trees and shrubs drop leaves, twigs, and insects into the water and become food sources for aquatic insects. The aquatic insects are eaten by small fish, which are eaten by bigger fish, and so on up the food chain. Trees fall into the stream and provide log shelters for fish. Small, well-shaded streams can supply up to 75 percent of the food base for an entire river system from the headwaters to an ocean estuary.

Creates habitat for wildlife.

Small animals come down to drink, eat, shelter, and hide in the green curves next to water. Larger animals travel the cool corridors that connect one habitat area to another. In eastern and western Oregon, 74 percent and 94 percent of the land animals depend on riparian zones, respectively.

What is a Riparian Area?



Montana Dept. of Natural Resources and Conservation

Relative Advantages of Different Riparian Plant Types

Benefit	Grass	Shrub	Tree
Stabilizes bank erosion	Low	High	High
Traps sediment	High	Low	Low
Filters nutrients, pesticides, and bacteria			
Attached to sediment	High	Low	Low
Dissolved in water	Medium	Low	Medium
Provides in-stream habitat	Low	Medium	High
Provides wildlife habitat			
Grassland wildlife	High	Medium	Low
Forest wildlife	Low	Medium	High
Economic products	Medium	Low	Medium
Attractive landscape	Low	Medium	High
Flood protection	Low	Medium	High

Adapted from *How to Design a Riparian Buffer for Agricultural Land* (AFN-4), USDA National Agroforestry Center.

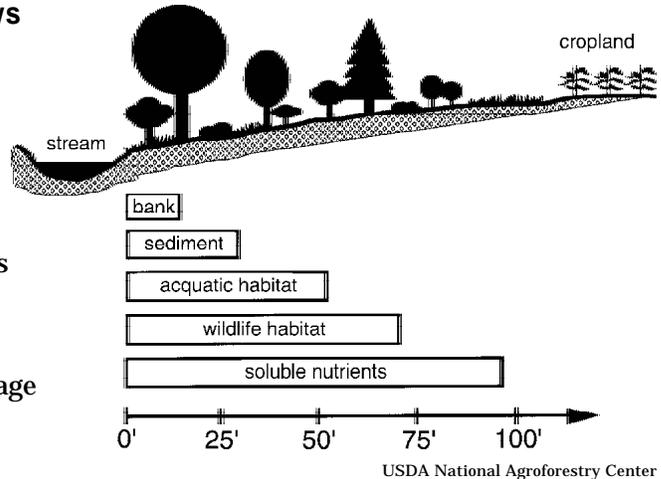
How to Design a Riparian Buffer

One example of a buffer design that provides many benefits follows. It combines 50 feet of trees, shrubs, and grasses planted next to the stream. This design requires 6 acres of land per stream mile (or 12 acres per stream mile, if installed on both sides of the stream).

Estimated buffer widths for desired benefits.

1) Streamside zone - 20 feet / 2 to 3 tree or shrub rows

(measured from the top of streambank). Trees protect the streambank, slow floodwaters, and take up nutrients. A mature riparian forest is best left undisturbed. If a fast-growing tree buffer is needed, plant trees such as cottonwood, alder, and willow. These trees and shrubs will form quick roots for bank stability. Add conifers that will provide durable wood for fish shelters. If you are concerned about trees tearing out banks as they fall, plant shrubs in the streamside zone and trees in the middle zone. Include sedges and rushes in wet areas to increase the plant diversity. Limit activities to recreation and flood damage control. Fence livestock out.



2) Middle zone - 10 feet / 1 to 2 tree or shrub rows.

Trees and shrubs slow floodwaters, take up nutrients, and provide wildlife habitat. Here, buffer width can be increased to include the 100-year-floodplain, steep slopes, or adjacent wetlands. Limited activities are possible to produce forest products or increase recreation.

3) Near-field grass zone - 20 feet / grass strip.

Grasses are the best at trapping eroded soils in runoff. This zone can include the most activities. On farmed ground, this area may be pasture or hay with proper management. Near homes, this area may be lawn or garden with careful management of fertilizers and pesticides. New structures or septic systems should be excluded from this area.

Buffer widths will depend on landowner objectives, site conditions, and local rules. Here are some examples where:

Buffer width is adjusted down.

If a stable streambank is your only concern, a narrow strip of trees and shrubs is better than no buffer at all. Engineered structures may need to be added to protect the bank. If the stream meanders, width may vary to straighten out field borders. For creeks that dry up in the summer, buffer trees and shrubs won't be needed to shade water. However, a grass buffer that filters overland flow may be useful.

Buffer width is adjusted up.

If the slope above the stream is steep, a wider buffer is needed to adequately treat runoff. For maximum flood protection, a buffer extending the width of the 100-year floodplain may be desirable. If you are installing a buffer with cost-share, most programs require greater widths. The USDA Natural Resources Conservation Service recommends widths from 35 to 300 feet, based on site conditions and landowner goals.



Montana Stream Management Guide

Do Small Streams Matter?

You bet. Even streams that dry up in the summer, because the next hard rain will flush pollutants in the creek bed down the river. Small streams are sensitive and react quickly to changes in riparian areas. When added together, these feeder streams can deliver cool, clean water or a polluted punch to larger rivers. All the benefits of riparian buffers on large rivers apply to small streams, only more so.

Installing and Keeping a Buffer in Top Shape



Replanting may be needed to improve a degraded riparian area. To decide what to plant, look at what's already growing at your site:

- Keep existing native plants.
- Plant more of the same. These plants are most likely adapted to conditions from your area.
- Add different native plants that are adapted to your conditions and increase diversity.
- Remove invasive plants such as yellow starthistle, English ivy, deadly nightshade, field morning glory, scotch broom, cheatgrass, and purple loosestrife.
- Maintain the buffers. Harvest grass buffers for livestock feed to remove nutrients trapped by

the buffer. Level eroded soils that have been trapped by the buffer. This will provide an even water flow for good filtration. Control grass that overtops tree and shrub seedlings for at least 3 years. Protect woody seedlings from mice, rabbits, nutria, or beaver.

- Grow native plants from seed or cuttings (willows and dogwood) or buy plants from nurseries. Do not take *rooted* native plants from the wild. This practice destroys wild plant communities and survival is very low. One exception to this is rescuing plants from construction sites with landowner permission. For information specific to the Willamette Valley, see the *Guide for Using Willamette Valley Native Plants Along Your Stream*, Linn Soil and Water Conservation District, (541) 926-2483.

Meeting Buffer Costs, Making Buffers Pay

Some landowners worry about the cost of installing buffers and losing productive land. It's a reasonable concern. To defray costs, some landowners produce saleable products from their buffers. These products include hay, saw timber, chip material for pulp, nuts, berries, and hunting rights. Others have found that greenbelts and wildlife areas increase the property sale values by 10 to 20 percent. Landowners have also used cost-share programs and reduced property taxes when installing buffers. For more information, see the listed agencies under For Help.

**For
Help**

- Your local soil and water conservation district (East Multnomah SWCD at (503) 222-7645 or West Multnomah SWCD at (503) 238-4775) or USDA Natural Resources Conservation Service at (503) 326-3941 can provide on-site technical advice to create, enhance, and protect riparian areas through several cost-share programs.
- The U.S. Fish and Wildlife Service's Partners For Wildlife Private Lands and Jobs in the Woods Programs fund projects that create, enhance, or restore riparian areas and wetlands.
- The Oregon Department of Fish and Wildlife administers the Riparian Lands Tax Exemption program that provides tax incentives to preserve riparian areas.
- Commercial nurseries, the Oregon Department of Forestry, and your local soil and water conservation district may sell native trees, shrubs, and grasses.
- The local Extension Service office or the Oregon Department of Agriculture Noxious Weed Program at (503) 986-4621 may provide recommendations on removing weeds



Fact Sheet

Before You Buy: Wells, Septic Systems, and a Healthy Homesite

Tips for Small Acreages in Oregon

To Buy or Not to Buy

The ideal country home provides fresh air, productive soils, and clean water. Many people look for homes based on location, view, and house style. Rural home seekers must do more. In the absence of city utilities, buyers must choose a property that can provide the basic needs: drinking water, sewage treatment, and other considerations.

Soil Survey Savvy

A soil survey is a good place to start in choosing the right property. You can use a soil survey to find out whether land has the right soils for **house foundations, septic systems, crops, or wildlife ponds**. Soil surveys are only accurate to a 5-acre area, so it's important to get a professional to conduct an **on-site investigation** for building and septic system suitability.

You can do a **preliminary investigation**, just by looking at **soil color**. Dig a hole and look at each soil layer. Bright brown, red, and yellow colors indicate **well-drained soils** that may be suitable for septic systems or building sites. Gray soils or gray soils with mottled "rust spots" indicate **poorly drained soils** that may be good for ponds. Gray or mottled soils may be dry during the summer, but are often saturated during the winter. Vegetation may also indicate soil drainage.

Assessing Steep Slopes

A soil survey has information on **land slope** and its suitability for buildings and septic systems. Avoid building on steep slopes. Building and placing fill at the top of a slope, making road cuts, removing vegetation, and changing water drainage may cause **erosion or landslides** on steep slopes. If you see "**J-shaped**" trunks on trees on a site, beware. This indicates that trees are slowly adjusting to a slumping slope. Look elsewhere for a stable home site.

Floodplains and Wetlands

Floodplains provide "relief valves" that reduce flood damage. Wetlands filter pollutants, provide wildlife habitat, and recharge groundwater. So it's not surprising that these valuable areas are protected from most building activities. In many situations you will not be able to drain or fill a wetland or build in the floodplain. Look for the location of wetlands on a **National Wetlands Resource Inventory Map** published by the U.S. Fish and Wildlife Service. Floodplain locations may be found on a **Federal Emergency Management Agency (FEMA) Floodplain Map**. Cost-share funds and tax benefits are available to enhance wetlands and streamside areas for wildlife habitat. Maps and funding information are available at your local soil and water conservation district and USDA Natural Resources Conservation Service office.

The Right to Farm

It's peaceful and quiet in the country. That is, until your neighbor fires up the tractor and needs to harvest at night. You may live next to farmers whose livelihoods depend on growing crops and livestock. Don't be surprised if farm activities bring noise, chemical sprays, dust, and odors. Use this as an opportunity to understand what it takes to produce food and fiber. Many counties have "right to farm" laws that protect the farmer's right to use normal farming activities.

"Your best place (to live) is one that suits your clothes, encourages your lifestyle, and makes you smile a lot."

– Gene GeRue, *How to Find Your Ideal Country Home*

Construction limitations are based on soil properties and site features:

Slight:
Soil limitations are minor and easily overcome.

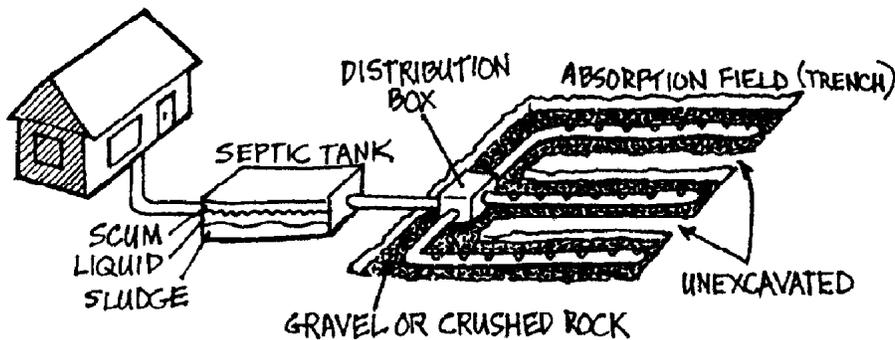
Moderate:
Special planning, design, or maintenance is needed to overcome or minimize limitations.

Severe:
Special design, significant increase in construction costs, and possibly increased maintenance are required.



USDA Natural Resources Conservation Service

Septic Systems: Installing a New One



Oregon Dept. of Agriculture

*Before buying undeveloped property, you should contact the local official for septic system permits. Don't overlook this essential step! The septic system site will determine the location of the house, well, and other installations. The septic system permitting official may be found at your local department of planning, building, community development, or public health, or at the regional Oregon Department of Environmental Quality. **Work with the septic system-permitting official to:***

- **Select a good location.**
Septic systems need gently sloping, moderately well-drained ground. Avoid areas with seasonally high water tables, floodplains, slopes steeper than 15 percent, and fractured bedrock. Locate the septic system downslope from existing or planned wells.
- **Find the right soils.**
A soil survey may indicate a promising site. However, you will need to have a percolation test done to determine how fast soils can absorb septic liquids.
- **Determine the proper setbacks.**
Decide whether a house, well, septic system, and the appropriate setbacks will fit on the property. Is there room for two septic systems—one for immediate use and the other for replacement in the future? A well must be located at least 50 feet from a septic system and 100 feet from a drainfield. Work with your permitting official to determine the setbacks needed from septic systems, buildings, property lines, cliffs, streams, and water lines.
- **Decide on the type of septic system needed.**
If the site investigation indicates poor soils for a conventional septic system, you may be able to use an alternative system. Alternative systems are usually more expensive and may require special maintenance and approval.
- **Include a contingency clause in the contract of sale.**
If possible, make the purchase dependent upon finding suitable soils for a septic system.

Septic Systems: Checking an Existing One

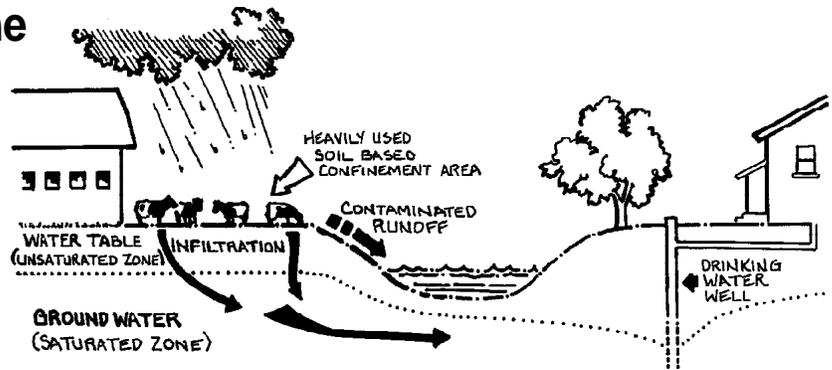
- **Ask when the septic tank was last pumped.**
Tanks should be pumped every 1 to 5 years depending on the household and soils. Check the age of the septic system. Up to 50 percent of all septic systems fail within 25 years. However, some systems that were installed in the 1930's have been well maintained and are still working.
- **Check how fast toilets and sinks drain.**
Toilets and sinks that drain slowly may indicate a waterlogged or clogged septic system. Such systems often need to be pumped or replaced.
- **Find the location of the septic tank and drainfield.**
The areas should not be unusually lush, smelly, green, or wet with seeping sewage. These are signs of a failing septic system that may need to be replaced.

Wells: Installing a New One

If you are looking at property without a well, get a drilling estimate from a licensed well driller. Also, consider the following to protect your future well:

- **Locate the well upslope and away from pollution sources.**

When a well is polluted, the cause is usually located at or very near the well. Avoid placing a well in a depression, drainage, or flood-prone area that may add polluted runoff to the well. The well should be located at least 50 feet from the septic tank and 100 feet from the drainfield. The well should also have minimum setbacks from fertilizer and pesticide storage, livestock yards and buildings, and manure piles.



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- **Install a proper well.**

A well is a direct pipeline from the soil surface to the groundwater. Pollutants most often enter wells through a poor seal at the top of the casing, inadequate casing grout, or a failure to disinfect the well after construction. Get a reputable driller and follow Oregon guidelines for well installation.

- **Prevent backflow into the well.**

During a power failure, most wells have a single check valve to stop the water column from falling back into the well. If the valve leaks (and many do), water flows back into the well and creates suction. Avoid sucking pollutants into your well by installing simple vacuum breakers on faucets and heavy-duty valves on lawn-sprinkling and irrigation systems.

Wells: Checking an Existing One

More than 500,000 Oregonians get their drinking water from private wells. If you are considering a home with an existing well, here are some things to ask about:

- **Recent well test.**

When a home is sold or transferred, Oregon regulations require homeowners to test domestic well water for nitrate and coliform bacteria. If the test results are satisfactory, taste the water. The water will likely taste different because wells are not chlorinated and have different mineral contents. If you notice an "off" taste, stained fixtures, or lead or copper pipes in the home, you may want to request additional tests.

- **Well report and pumping rate.**

Your local watermaster may have a record of the well depth and the conditions at installation. A domestic well should produce a minimum of 5 gallons per minute (gpm) for a three-bedroom home, but 10 gpm is better. Lower flow rates may be acceptable if water can be stored (e.g., in a pressure tank). Note any changes in water pressure when you run a faucet and flush the toilet at the same time.

- **Well house inspection.**

Check the well house and note cleanliness, the casing condition, and proximity to potential pollution sources. The well should be located at least 50 feet from the septic tank and 100 feet from the drainfield. Fertilizers, pesticides, fuel storage tanks, and animals should be located away from the well house.

- **Abandoned wells.**

Determine whether there are any abandoned or unused wells on the property. Abandoned wells that are susceptible to pollution need to be properly sealed.



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USDA Natural Resources Conservation Service



- The City of Portland provides septic system or sanitation permits for Multnomah County residents. Contact City of Portland at (503) 823-7790.
- Oregon Water Resources Department (WRD) and Oregon Health Division (OHD) have well information and installation guidelines. Contact WRD at (503) 986-0900 and OHD at (971) 673-0400.
- The soil and water conservation district (SWCD) and USDA Natural Resources Conservation Service have soil surveys, the National Wetlands Inventory, and floodplain information. Contact East Multnomah SWCD at (503) 222-7645 or West Multnomah SWCD at (503) 238-4775.

What You Need to Know as a Rural Landowner

Who to Contact

Building Codes and Permits – Before building, contact your city or county planning department for zoning requirements and permits.

Buried Utilities - Oregon law requires that you notify utility companies no less than 2 days and no more than 10 days before you start to dig.

Floodplain Protection - Permits may be required for work within a 100-year floodplain. Insurance and financing may be restricted.

Forest Practices - Oregon regulations require that you notify ODF at least 15 days before you begin any forest activities. After harvest, trees must be replanted.

Open Burning - Permits may be required in sensitive airsheds. Bans occur during fire hazard or air pollution periods.

Streambank and Wetland Protection - Permits are required to fill, drain, or dredge water areas (including wetlands) and to modify stream channels, streambanks, or wetlands. A water right is needed to construct a pond.

Trash Recycling and Disposal - Locate licensed landfills, private trash disposal companies, and recycling centers. Burning or burying household trash on private land is not allowed.

Water Quality - You are responsible for managing manure, erosion, pesticides, fertilizers, irrigation, and near stream areas to protect surface water and groundwater quality. Rules for your watershed are either in effect or will be developed under Oregon Senate Bill 1010.

Water Rights - A permit is needed for commercial or industrial uses of more than 5,000 gallons of water per day, more than 1 acre irrigated, and ponds.

Weed Control - You may need an applicator's license for some pesticides. Eradicate noxious weeds that crowd out forage and destroy wildlife habitat.

Wells - Wells need to be registered with the local watermaster and constructed to Oregon Water Well Construction Standards.

Wildlife Protection and Endangered Species - The law protects threatened and endangered species. Your land management may be affected if these species are present.

- In East Multnomah County, contact City of Gresham Building Dept. at (503) 618-2832.
- In West Multnomah County, contact Portland Building Bureau at (503) 823-7310.

- Oregon Utility Notification Center (800) 332-2344

- Multnomah County Land Use Planning (503) 988-3043

- Oregon Dept. of Forestry (503) 945-7470

- Local fire district
- Oregon Dept. of Forestry (timber slash) (503) 945-7470
- East of Sandy River (503) 695-2225
- West of Sandy River (503) 618-3084

- Local soil and water conservation district
- USDA Natural Resources Conservation Service (503) 414-3200
- Oregon Division of State Lands (503) 378-3805
- U.S. Army Corps of Engineers (503) 808-4373

- Recycling centers
- Local garbage disposal companies
- Licensed landfills
- Oregon Dept. of Environmental Quality (800) 452-4011

- Local soil and water conservation districts: East Multnomah SWCD at (503) 222-7645 or West Multnomah SWCD at (503) 238-4775
- USDA Natural Resource Conservation Service (503) 414-3200
- OSU Extension Service
- Local watershed council
- Multnomah County Environmental Compliance (503) 988-5050
- ODA Natural Resources Division (503) 986-4700
- Oregon Dept. of Environmental Quality (503) 229-5279

- Oregon Water Resources Dept. (503) 986-0900

- Oregon Dept. of Agriculture Noxious Weed Control (503) 986-4621

- Local watermaster (503) 722-1410
- Oregon Water Resources Department (503) 986-0900
- Oregon Dept. of Human Services, Drinking Water Program, (971) 673-0405

- Local Audubon Society Chapter
- Oregon Dept. of Fish and Wildlife (503) 657-2000 Ext. 231
- U.S. Fish and Wildlife Service (503) 231-6179
- National Marine Fisheries Service (503) 230-5425

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To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326W, Whitten Building, 14th and Independence Avenue, SW, Washington, D.C., 20250-9410, or call (202) 720-5964 (voice or TDD). USDA is an equal opportunity employer.



Fact Sheet

Filling Out a Project Permit

Tips for Small Acreages in Oregon

What Is a Permit?

A permit gives you formal permission to begin construction on a project. It means the permitting agency has found that the project plan meets the agency's regulations. This fact sheet focuses on permits required for projects that involve Oregon's waters.

Why Do I Need a Permit?

In the past, people were unaware that some construction projects did more harm than good. For example, entire streambanks were armored with rock to protect them from erosion. However, since rock does not reduce the erosive power of water, the rock only passed the erosion problem downstream and provided little fish habitat. More landowners are installing projects that protect the many values of the land. By law, many water projects require a permit. A permit protects you, your community, and the environment from unintended conflicts with watershed health goals.

When Do I Need a Permit?

Chances are you will need approval or a permit if the project involves water. Most projects that involve construction, excavation, or fill in streams, rivers, lakes, wetlands, or the ocean require a permit. Activities that may require a permit include:

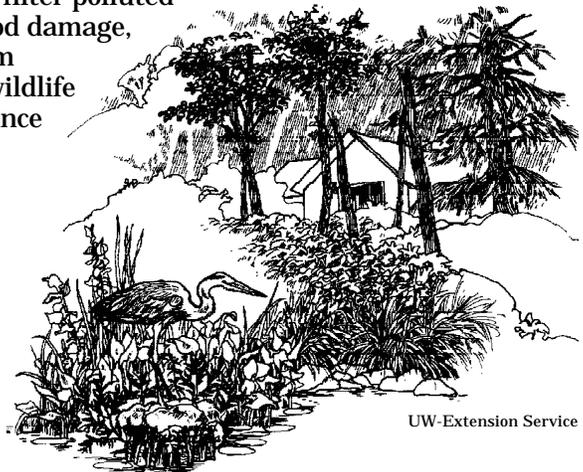
- Dredging or excavating
- Relocating a waterway
- Draining, clearing, or leveling wetlands
- Removing woody debris or gravel
- Placing fill, riprap, or other material
- Constructing bank or shore protection
- Placing fill to construct a dam, dike, roadway, or bridge
- Constructing a dock, pier, wharf, seawall, boat ramp, beach, intake, or outfall pipe

What Is a Wetland?

Most people recognize that swamps, marshes, and bottomland forests are wetlands. However, some wetlands can be hard to spot. A wet pasture full of "tules" could be a wetland. When in doubt, check it out with a wetland specialist. The USDA Natural Resources Conservation Service makes wetland determinations on farmland. Wetlands are areas that have these three conditions:

1. **Water** either covers or saturates the soil during the growing season. (Caution! Many wetlands do not have standing water or waterlogged soils during at least part of the growing season.)
2. **Plants** that can grow in saturated soils for at least part of the growing season. Examples of such plants are rushes, sedges, cattails, and willows.
3. **Soils** that have developed under waterlogged conditions. Signs of waterlogged soils include peat or muck layers, a bluish-gray or gray color, sandy layers with dark streaks, or a rotten-egg odor.

Wetlands can filter polluted runoff, reduce flood damage, protect banks from erosion, provide wildlife habitat, and enhance our quality of life. Agencies and landowners give wetlands special attention because of these values.



UW-Extension Service

"The long fight to save wild beauty represents democracy at its best. It requires citizens to practice the hardest of virtues—self restraint."

– Edwin Way Teale



USDA Natural Resources Conservation Service

A Checklist for Getting and Using Permits

The permitting process begins with you. Remember to contact all of the appropriate local, state, and federal agencies that may have an interest in your project. On some projects, a consultant may obtain permits on your behalf. However, you are ultimately responsible for getting the necessary permits and making sure that the permit requirements are met. *Tips to help you save time and money are in italics.*

Step 1 - Find Out What Permits May Apply

- A. Determine if the project involves adjoining landowners. If it does, ask your neighbors if they share similar goals and support the project. A streambank project may include several landowners.
- B. Ask local, state, and federal agencies to help you determine what permits apply to your project. Some agencies have their own checklists for getting a permit. (See the last page for a list of agencies.)
- C. Decide whether the project is regulated by the agencies. Confirm your conclusions with the agencies. Ask for written confirmation, if the project does not need a permit. Remember that local laws may differ from state and federal regulations. The project will need to meet the most stringent regulations.
- D. *If the project requires agency approval, set up a pre-application conference with the appropriate agencies. Present your project ideas and follow the agency recommendations.*

Step 2 - Plan the Project

- A. Ask the agencies if they think a resource professional is needed to design the project. For example, the correct slope, rock size, and plant materials may be needed for a successful stream bank project.
- B. *Budget time in your project schedule to get permit approvals.* The permit process may take 6 months or longer. Keep in mind that projects in fish-bearing streams must be constructed between July 1 and September 15 or 30, to avoid harming migrating fish.
- C. Consider environment-friendly designs. For example, the Oregon Department of State Lands prefers stream bank stabilization projects that combine native plants with hard structures. Plants protect the banks, slow erosive waters, and provide habitat for fish and wildlife.

Step 3 - Fill Out and Send in the Application

- A. *Read the application carefully and make sure the project meets the agency standards.*
- B. *Enter information that is accurate and complete.* Incomplete information is the most common reason for permit delays. Complete information is necessary to properly evaluate and approve the project. If you have questions about the needed information, contact the permitting agency.
- C. Include the scale drawings, property descriptions, proposed design, maps, and other materials as needed. Sign your signature in ink. *Drawings and maps on 8.5" by 11" paper are easier for agencies to handle.*
- D. Send the application with the permit fees. *Respond quickly to agency requests for more information. Ask the agency for clarification if you don't understand the request.*
- E. Once the permit is approved, read the conditions of approval carefully. *Ask the agency for help if you don't understand or don't think you can carry out the conditions.*
- F. The application may be rejected if the project does not comply with the agency regulations. Consider changing the design, moving the location, or finding an alternative use of the property.

Step 4 - Construct the Project

- A. Remember that you may need a permit from more than one agency to begin construction. If you begin construction without the necessary permits, the authorities may impose fines and require you to restore the area.
- B. *While the work is underway, you must follow all the conditions of approval, plans, and regulations exactly. Any changes to the project plan must be approved.*
- C. Once the project is done, check the site annually to see if it meets your project goals. Determine if modifications or maintenance is needed. Share your observations with resource professionals so that we all learn how to manage our resources successfully.

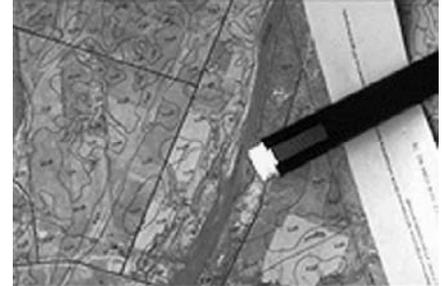


Agencies require certain documents and information to complete the permit application. You may be asked to provide the following information:

- **Aerial photos.**

These photos can be used to show the project location and the surrounding area. You may purchase aerial photos of the project area at your local USDA Farm Services Agency or by phoning the U.S. Geological Survey (USGS) at (888) ASK-USGS. You can also download a low-resolution digital photo from the Microsoft Terra Server online at http://terraserver.microsoft.com/terra_how.htm or order a high-resolution digital photo from USGS at the same website. Availability may vary.

Soil Survey



USDA Natural Resources Conservation Service

- **Floodplain maps.**

The Federal Emergency Management Agency (FEMA) publishes maps that show the location of the 100-year floodplain. You can order these maps by calling (800) 358-9616 or writing to the Map Service Center, PO Box 1038, Jessup, MD 20794-1038.

- **Map and tax lot number.**

This number is found on tax assessor maps. Call the Multnomah County assessor at (503) 988-3326 to find out the tax lot number for your property.

- **National Wetland Inventory maps (NWI).**

The U.S. Fish and Wildlife Service publishes maps that show the general location of wetlands. You can purchase these maps through the USGS at (888) ASK-USGS.

- **Property legal description.**

The metes and bounds for your property may be found on the deed, land sales contract, or title insurance policy.

- **Property ownership.**

If the project involves roads, right-of-ways, or other properties that do not belong to you, then you need to list the name and addresses of the other landowners. This information is often needed for water right permits. Proof of easements or written authorization is required.

- **Stream name and river mile.**

This information is often available on topography maps.

- **Soils maps.**

To get a general soil map of your property, contact your local soil and water conservation district and USDA Natural Resources Conservation Service office. You may need to hire a consultant for site-specific soil investigations.

- **Topography maps.**

U.S. Geological Survey topography maps are useful for showing the project location, elevation, distance, longitude, and latitude. You can purchase a topography map at the Nature of the Northwest Information Center, Suite 177, 800 NE Oregon St., Portland, Oregon 97232, (503) 872-2750. Or you may buy maps directly from the USGS writing to USGS Information Services, Box 25286, Denver, CO 80225, or ordering online at www.usgs.gov/pubprod/.

- **Township, Range, and Section.**

If the project is on your property, the township, range, and section number is coded in your tax lot number. You can also find this designation on the borders of a topography map, soil map, or Oregon Department of Forestry map.

- **Well logs.**

Water right applications may require the well log of your well or surrounding wells. This information is available from your local watermaster.

Check Out Your Permit Concerns with Us

If you are unsure whether your project needs a permit or would like to talk about specific concerns with an agency, you can call or write to the following agencies:



USDA Natural Resources Conservation Service



UW-Extension Service

Local

- Multnomah County
Land Use Planning (503) 988-3043
- Gresham Building Division (503) 618-2845
- Portland Development Services (503) 823-7300

State

- Oregon Department of State Lands
775 Summer Street NE
Salem, OR 97301
Phone: (503) 378-3805
Fax: (503) 378-4844
- Oregon Department of Environmental Quality
Water Quality Division
2020 SW 4th Ave., Suite 400
Portland, OR 97201
Phone: (503) 229-5263
- Oregon Department of Land Conservation & Development
1175 Court Street NE
Salem, OR 97310-0590
Phone: (503) 373-0096
Fax: (503) 362-6705
(For projects that are west of the crest of the Oregon coast range)

Federal

- U.S. Army Corps of Engineers, District Engineer
ATTN: CENWP-OP-G
P.O. Box 2946
Portland, OR 97208-2946
Phone: (503) 808-4373
Fax: (503) 808-4375
- Oregon Water Resources Department has watermasters that can assist you with water rights and well log records. Contact your local watermaster for more information.
- Your local soil and water conservation district (SWCD) and the USDA Natural Resources Conservation Service (NRCS) may provide site visits for projects that stabilize stream banks, drain agricultural land, or restore shallow water areas for wildlife. The office may also have aerial photos, floodplain maps, topography maps, and National Wetland Inventory maps that may be photocopied for a small fee. Contact East Multnomah SWCD at (503) 222-7645 or West Multnomah SWCD at (503) 238-4775 or NRCS at (503) 326-3941.
- Oregon Department of Fisheries and Wildlife and the U.S. Fish and Wildlife Service may provide site visits for projects that restore wetlands and wildlife habitat. Look in the phone book blue pages under State and Federal Government for the offices nearest you.
- Oregon Department of Forestry issues approvals for all forest management activities, except planting. Look in the phone book blue pages under State Government for the office nearest you.



Fact Sheet

After You Buy: Wells, Septic Systems, and a Healthy Homesite

Tips for Small Acreages in Oregon

Be Good to Yourself and Your Neighbors

The wide, open spaces of the country are truly something to care for. You can do many things to maintain the quality of life you desire. Take responsibility to sustain the land, water, and other natural resources in your watershed. Get started by properly caring for your well, septic system, and other things in your own backyard.

"This land is the house we have always lived in."

– Linda Hogan

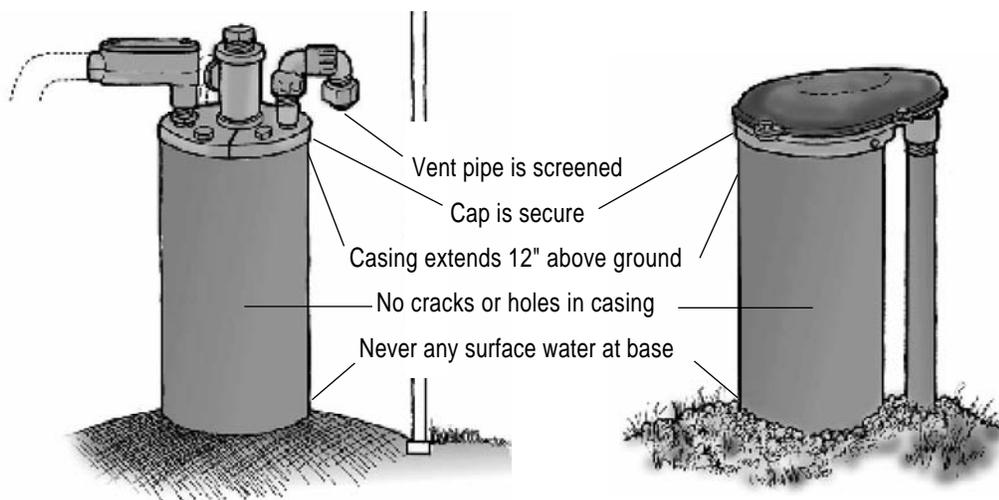
How Well is Your Well?

Overall, Oregon has excellent groundwater quality. However, pollutants such as nitrate have been found in many areas such as Grants Pass, Prineville, Hermiston, Ontario, and Junction City. These towns and cities test and purify drinking water in their municipalities. If you are one of the 500,000 Oregonians with a household well, it is up to you to protect, test, and purify the water for your family's health. Prevention is the best protection for your well. When wells are polluted, the source is often near or at the well itself. Protect your well and groundwater by the following:

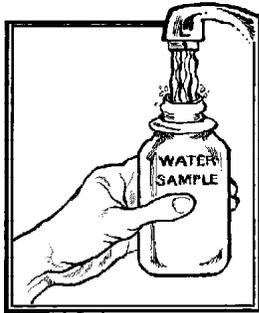
- Maintain your septic system.
- Divert drainage away from the well.

- Never store fertilizers, pesticides, or other chemicals in the well house.
- Mix fertilizers and pesticides and fill tanks and spreaders at least 100 feet from the well.
- Locate new livestock buildings, manure piles, and animal yards at least 100 feet from the well. The well must be 50 feet from septic tanks and 100 feet from drainfields.
- Properly cap old, unused wells on the property. Consult a professional for advice.
- Get a Home*A*Syst evaluation to find out how to protect your drinking water supply. Contact your local Extension Service agent for more information.

Inspect Your Well Every Year



Oregon State University Extension Service



UW-Extension Service

What's in the Water?

No water is 100% pure. Most substances are harmless, but some are nuisances or harmful. Test well water as a precaution or if you suspect a problem. Check results against the drinking water standards set by Oregon. A list of state-approved testing laboratories is available from your local extension office, Oregon Health Division, or at website <http://wellwater.orst.edu/watertests.htm>. Here are some of the more common water quality problems in well water:

What to Test for	When to Test	Cause of Problems	Health Concerns
Coliform bacteria <i>Signs:</i> Musty, septic, or earthy odor. Not always evident. <i>Standard:</i> Absence	Each year.	Poor well installation, manure, septic systems.	If bacteria reach the well, other disease organisms may follow the same pathway. Do not drink the water until it is purified.
Nitrate <i>Signs:</i> Not always evident. <i>Standard:</i> 10 mg/L	Each year if in high nitrate area. If not, every 3 years.	Fertilizers, manure, and septic systems. May also naturally occur in soil.	If nitrate reaches the well, other pollutants can follow. Nitrate can harm infants and kill livestock.
Lead <i>Signs:</i> Metallic taste, corroded pipes, lead pipes, copper pipes with lead solder. <i>Standard:</i> 0.015 mg/L in first draw sample	Only if suspected or when lead or copper pipes are present.	Lead pipes and copper pipes with lead solder.	Brain and blood disorders in children.
Iron <i>Signs:</i> Rust stains on laundry and fixtures <i>Unregulated:</i> 0.3 mg/L	Only if suspected.	Dissolved iron in surrounding soils.	Nuisance.
Hardness <i>Signs:</i> Scaly deposits and scum. <i>Unregulated:</i> 100 ppm	Only if suspected.	Dissolved minerals in surrounding soils.	Nuisance.
Hydrogen sulfide <i>Signs:</i> Rotten egg odor. <i>Unregulated:</i> 250 mg/L sulfate	Only if suspected.	Dissolved sulfate in surrounding soils.	Nuisance.

Adapted from *Water Testing* (AEX-314), Ohio State University Extension, the *National Primary Drinking Water Standards*, Federal Register, and Gail Glick Andrews, pers. comm.

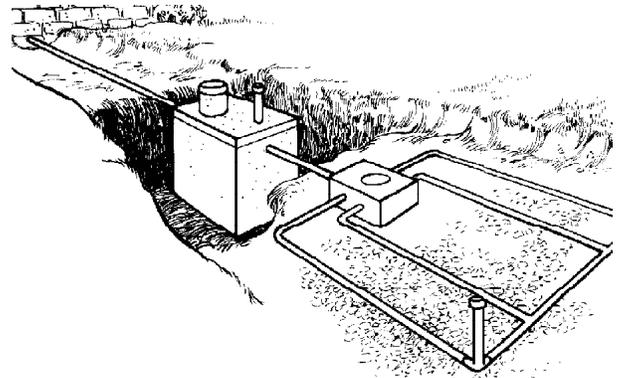
The Solution to Well Water Pollution

If tests show that water treatment is needed, do your homework before buying expensive water treatment equipment. Identify and stop the source of pollution. If a second test from a state-approved lab still shows contamination, compare water treatment options offered by different dealers. When water treatment companies give you conflicting recommendations, contact the Extension Service or Oregon Division of Health for an unbiased opinion.

Septic Tanks: the Basics

Nobody wants to flush a toilet into a drinking water supply. It's important to install and maintain septic systems properly to avoid polluting groundwater. Typical septic systems have three parts:

1. **Septic tank.** Household wastewater is collected and stored in a concrete, metal, plastic, or fiberglass tank just outside the house. The tank stores solids that float to the top or settle to the bottom. The remaining liquid flows into the drainfield. If tanks are not pumped periodically, floating solids may overflow into the drainfield and clog pipes and soil.
2. **Drainfield.** The drainfield is made up of a grid of pipes that spread the liquid over a wide area. Holes in the pipe allow liquid to leach into the soil.
3. **Proper soil.** The soil is the single most important purifying step in a septic system. Soil microorganisms and plant roots need air and time to break down bacteria, viruses, and nutrients and purify liquid waste. Septic systems fail when soils are too wet, clogged, or compacted to absorb the liquids or too well-drained to have enough time to purify liquids.



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Septic System Etiquette

Contrary to popular belief (or wishful thinking), septic systems are not maintenance-free. Half of all septic system failures are due to poor maintenance. Signs of neglect include backed-up plumbing, lush grass over the drainage field, and smelly seepage. Long before you see these signs, the system may discharge untreated sewage into the groundwater and into your well! Extend the life of your septic system by the following:

- **Inspect the solids in septic tank annually.**

Insert a probe into the inspection port in the tank lid. If solids (usually black specks) cover the probe more than one-third of the tank depth, it's time to pump.

- **Pump the tank every 1 to 5 years.**

Decide the pumping frequency based on the solids inspection or use the Tank Pumping Frequency chart as a guide.

Tank Pumping Frequency in Years

Tank Size (Gal)	Number of People in Household			
	1	3	5	7
500	6	2	1	1
1,000	13	4	2	1
1,500	19	6	3	2
2,000	25	8	5	3

Adapted from *Septic Tank Maintenance* (EC 1343), Oregon State University Extension Service.

- **Avoid garbage disposals.**

A garbage disposal can add up to 25 percent of the solids in a tank.

- **Keep slow-to-decompose items out of the tank.**

This includes coffee grounds, facial tissues, cigarette butts, disposable diapers, sanitary napkins, and wet-strength towels. Use toilet paper that breaks down easily when wet (color doesn't matter).

- **Keep harsh cleaners, solvents, and paints out of the tank.**

Normal amounts of bleach, detergent, drain cleaners, and toilet bowl deodorizers will not stop the natural breakdown of solids in the tank. Excessive amounts will. The system is not designed to purify these contaminants. Follow label directions for proper disposal. Take advantage of "household chemical days" at a local landfill.

- **Avoid products that claim to clean septic systems.**

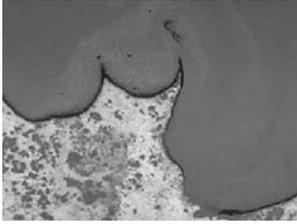
There's little evidence that these products work. What's more, some may be carcinogenic and move into your groundwater.

- **Use less water.**

Give time for solids to settle in the tank and avoid flooding the drainfield. Install showerheads, faucets, and toilets that use less than 3 gallons of water per minute or per flush.

- **Keep vehicles, trees, and roof water away from the drainfield.**

Vehicles may compact soils and damage drainfield pipes. Tree roots clog pipes and roof water saturates soils.



Environmental Protection Agency

Fuel Oil and Water Don't Mix

Most people wouldn't dream of dumping a quart of oil over the side of a boat. But the results may be the same when landowners ignore leaks from fuel oil tanks. Leaks can reach a well, a stream, or a bay. One quart of oil can contaminate 2 million gallons of water or form an oil slick 2 acres in size. Avoid fuel oil spills by the following:

Monitor the fuel tank in summer.

Use a dipstick to detect unwarranted leaks.

Watch fuel oil deliveries.

Spills often occur from overfilling or filling vents at the house without the tank attached. If you remove your tank, remove the fill cap and contact the oil company to cancel future deliveries.

Replace buried tanks with aboveground ones.

Aboveground leaks are easier to detect. Consider adding a concrete apron to contain accidental spills. Locate the tank more than 100 feet from watercourses.

Stormwater Runoff: Get Soaked

When sidewalks, patios, and roads cover the soils of a watershed, these watertight surfaces increase the pollutants that may reach a stream. Rainwater picks up fertilizers, pesticides, and pet waste along the way and runs directly into streams. Polluted water hurts fish and drinking supplies. Slow down water, filter runoff, and turn your yard into a "sponge" by:

Creating swales in the yard.

Low areas in the yard can temporarily hold water and grow moisture-loving plants.

Replacing lawn with native plants.

Turf has fast runoff rates. Reduce lawn maintenance and plant native vegetation that is usually more drought- and pest-tolerant.

Replacing asphalt and concrete.

Use permeable materials of brick, paving grids, stone dust, or gravel.

Reduce, Reuse, and Recycle Hazardous Chemicals

Household, lawn, and garden chemicals can be hazardous to your health and the environment. Take care of the health of yourself and your watershed by practicing the following:

Use healthy home recipes.

Many alternatives for household cleaners and pesticides exist and can be mixed from what's on hand. For cheaper and safer alternatives, contact the Oregon Department of Environmental Quality at 800-452-4011 or check www.metro-region.org/article.cfm?ArticleID=1400

Buy only what you need and give the rest away.

Give leftovers to others for their use. Make sure the products are in their original containers with labels.

Don't burn, bury, or flush hazardous products.

Look for signal words on the label that indicate how hazardous a product is. "Warning," "Danger," or "Poison" indicate that the product is moderately hazardous to highly toxic. Dispose of the product according to the label directions.

Take hazardous items to special recycling centers.

Hazardous items include all types of batteries, ionization smoke detectors, paints, stains, fuel oil, motor oil, kerosene, automatic transmission fluid, brake fluid, and antifreeze. Call the city or county to ask about collection locations.



USDA Natural Resources Conservation Service



- Oregon State University Extension Service offers Home*A*Syst evaluations, publications, workshops, and over-the-phone assistance on wells, septic systems, and other home water quality issues. Contact your local Extension Service office for more information.
- Oregon Department of Environmental Quality (DEQ) provides information on maintaining septic systems. Contact DEQ at (503) 229-5279.
- Oregon Dept. of Human Services Drinking Water Program in Portland (971) 673-0405 provides information on wells and drinking water.

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Fact Sheet

Enhancing Wildlife Habitat

Tips for Small Acreages in Oregon

Living the Good Life with Wildlife

We often choose to live in the country because of the wildlife found there. Some wildlife benefits are:

Natural pest control.

Bats can eat more than 500 insects an hour, including mosquitoes and agricultural pests. Hawks and owls eat rodents.

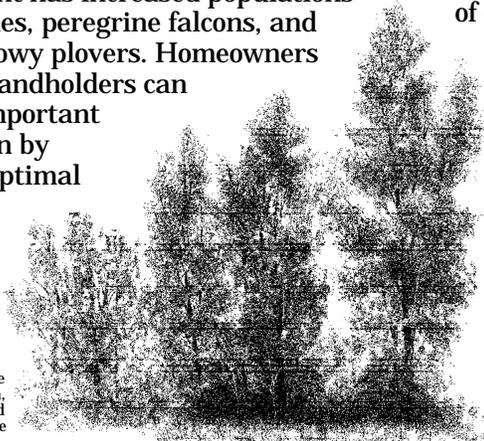
Healthy wildlife population means a healthy environment for people.

Our declining fish populations are like "canaries in a coal mine," warning us that our watersheds are not as healthy as they could be. Clean water for salmon means clean water for drinking, fishing, and swimming.

Moments of beauty.

Seeing wildlife relieves stress and gives us an opportunity to teach our children about nature and the importance of stewardship.

Unfortunately, more than a quarter of the 626 native fish and wildlife species in Oregon are threatened, endangered, or are headed in that direction. More than a third of our migratory birds have declining populations. We know that careful management has increased populations of bald eagles, peregrine falcons, and western snowy plovers. Homeowners and small landholders can make an important contribution by providing optimal refuge, water, and food for wildlife.



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Wildlife Needs: the Basics

Wildlife includes insects, spiders, mammals, birds, fish, amphibians, and reptiles. Each animal lives in a habitat or habitats that provide food, water, cover, and the right placement of each. Small farms and ranches can provide habitat for many of these needs:

Food

Animals need food year-round. Crops and plants provide forage, berries, nuts, and fruits. Plants with fruits that dry on the stem and are slow to fall are important winter foods. Plants attract animals that are prey for others in the food chain.

Water

Wildlife species need water to drink, to bathe in, and as a source of food. Streams, ponds, birdbaths, and watering tanks can provide water.

Cover

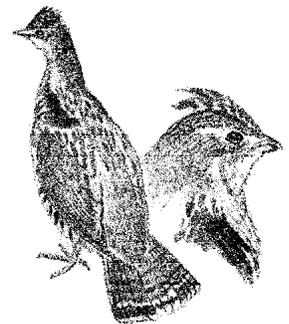
Wildlife need places to nest, rest, escape from predators, and take shelter from harsh weather. Brush piles, fence rows, rock piles, and dense shrubs provide cover. Many wildlife species use different habitats to meet their needs. For small animals, these habitats must be close together. For example, quail and rabbits need forage and shrubs within a few hundred feet of each other. Other wildlife can travel greater distances between needed cover and habitat types.

Oregon has an exceptionally diverse number of landscapes and habitats. Improving your property for wildlife will depend on the conditions in your area. Become familiar with the local wildlife and their habitats. Get advice from informed people with local experience.

"We live in a world of complex, intertwined relationships. The loss of one, small species may not touch us, but it can set in motion a chain of events that ultimately damages our existence. By giving back to wildlife, you give to the future."

– Rebecca MacLeod,
NRCS District
Conservationist

Ruffed Grouse



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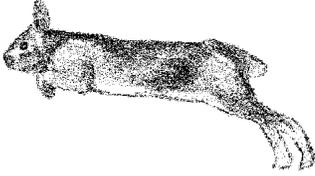
Tree Frog



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Where Do I Start?

Rabbit



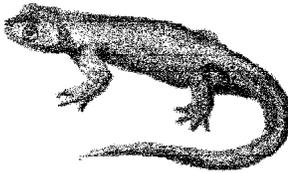
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Junco



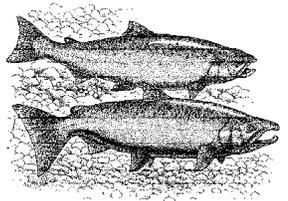
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Salamander



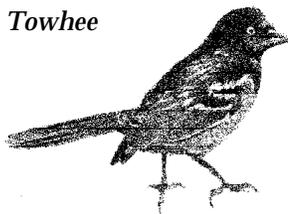
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Salmon



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Towhee



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Small farms and ranches can be rich wildlife havens and serve as buffers from urban areas. To enhance wildlife opportunities on your land:

1. Draw a map of your property.
2. Inventory your existing habitat types (trees, shrubs, or grasses).
3. Decide what wildlife you would like to encourage.
4. Make a plan to meet your goals for protecting, restoring, or improving wildlife habitat.
5. Follow parts or the entire plan over a period of years.

You can improve wildlife habitat on your land in six basic areas: pasture, windbreaks, cropland, woodland, wetland, and farmstead. One study showed that cropland supported up to 88 birds per acre, grassland supported up to 386 birds per acre, and wetland supported up to 702 birds per acre. Read on to learn how to enjoy the company of more wildlife...

How Much Wildlife Can My Land Support?

Just as the acreage and productivity of a pasture can only support a limited number of livestock, so it is with wildlife. A 5-acre farm may support a bevy of songbirds, but it will be difficult to supply all of the requirements for deer. If you would like to attract wildlife requiring large acreages, work with your neighbors to provide habitat on adjoining properties. Wildlife won't recognize property lines. Here's a sampling of wildlife species and their habitat requirements:

Habitat and Wildlife	Required Acreages
Riparian Salamanders, frogs, snakes	1/4 to 2 acres - moist, streamside vegetation with closed canopy; flowing streams.
Meadow Quail, rabbit, meadowlark	15 acres - open areas with grasses and forbs; some shrubs. Rabbits need 1-2 brush piles/acre.
Mixed meadow/forest Deer, elk	50 acres - openings, closed canopy (15-year-old+ trees). Must be close to extensive forested areas of 100 to 1,000 acres.
Young forest Ruffed grouse	15 acres - 50:50 ratio of conifers to alder. Need moist streamside.

Adapted from *Enhancing Wildlife on Private Woodlands* (EC 1122), Oregon State University.



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The Farmstead as Wildlife Habitat

Enhancing wildlife at the farmstead and surrounding landscape offers the opportunity to see wildlife up close. Consider the following to invite wildlife near your home:

Tolerate some leaf litter and weeds in your yard.

Allow leaves to accumulate under shrubs. You'll encourage towhees and fox sparrows, get rid of insects, and do less raking. Some "weeds" are actually valuable wildlife foods. Dandelions, pigweed, knotweed, chickweed, miner's lettuce, and wild grasses produce seeds prized by wildlife. If you are concerned about the looks of a weedy patch, put up a sign that says, "It's for the birds." In dry areas, you will need to balance the wildlife benefits of plant litter with the fire hazards.

Manage roadsides for wildlife.

Mow in August to avoid the nesting season and leave some cover for winter. Mow grass in blocks to leave some undisturbed cover at any one time. Convert bluegrass or fescue areas to native grasses. Consider a prescribed burn every 3 to 5 years to maintain grass and forb cover.

Preserve abandoned buildings.

Abandoned house and barn buildings provide shelter for barn owls, barn swallows, rabbits, and raccoons. If it is necessary to remove the buildings, consider keeping the surrounding trees and shrubs. Plant mast and berry-producing trees in the area.

Install birdbaths, birdhouses, and bat boxes.

Birdbath water will attract insect- and fruit-eating birds that ignore birdfeeder seed. More than 24 North American bird species will nest in birdhouses that provide nesting cavities in the absence of snags. Do not put birdhouses built for the same bird species next to each other, unless you like to see bird fights. For more information, see the US Fish and Wildlife Service publication "Homes for Birds" at the following website: <http://www.bcpl.lib.md.us/~tross/by/attract.html>. Also, the Bat Conservation Trust has advice on bat houses at <http://www.bats.org.uk/>.

Control pets.

Domestic cats are among the most serious predators of songbirds and quail. Unleashed dogs often disturb nesting birds, run deer, and chase livestock. While it is tempting to let pets roam free in the country, it is safer to confine pets to your yard.

Discourage scavenging wildlife.

It is not healthy for wildlife to depend on processed foods. Store garbage and animal feed in aluminum cans with secure lids. Put away cat food, dog chow, and water dishes at night. Plug holes to prevent unwanted access to outbuildings.

Plant native trees, shrubs, and forbs.

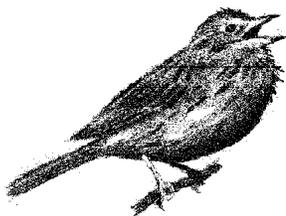
You can double the number of birds in your yard through diverse plantings that provide food year-round. Preserve existing native plants and add others. Native plants are adapted to local conditions and can be more drought-tolerant and resistant to pests than ornamental plants. See the list below for things to plant.

Wildlife Food Source Plants (native and acceptable non-native species)

Trees	Shrubs	Ground Covers	Flowers
Big leaf maple	Blueberry	Bunchberry	Balsamroot
birch	butterfly bush	Kinnickinnick	black-eyed susan
Brewer's spruce	Douglas spirea	salal	bleeding heart
cascara	evergreen huckleberry	violets	cardinal flower
Douglas-fir	lilac	wild strawberry	columbine
filbert	mockorange	wood sorrel	coneflower
grand fir	Oregon grape		daisy
hawthorn	pyracantha		foxglove
incense cedar	red flowering currant		fuscia
Kousa dogwood	red-osier dogwood		iris
noble fir	serviceberry		lupine
Oregon white oak	snowberry		milkweed
Pacific crabapple	wild roses (bald hip, Nootka, and Wood's)		penstemon
red alder			poppy
red and blue elderberry			sweet alyssum
shore pine			sunflower
vine maple			yarrow
western hemlock			
western red cedar			
western white pine			

Pastures as Wildlife Habitat

Savannah Sparrow



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More than 99 percent of grasslands native to Columbia Basin or the Willamette Valley have disappeared. Old fields and pastures on private land can make up for some of this habitat loss. More wildlife is found on farms with pastures than those with cropland only.

In eastern Oregon, grasslands are important to migratory birds, lizards, and rare mammals including the Swainson's hawk, sagebrush lizard, burrowing owl, and the Washington ground squirrel. In western Oregon, meadows are important to songbirds and butterflies, including the Western meadowlark, Fender's blue butterfly, grasshopper sparrow, horned lark, and western bluebird.

To increase wildlife habitat on pasture, consider the following:

Delay spring mowing or increase the time intervals between grazing.

April 1 to August 1 is prime nesting season. Grazing or mowing at this time can kill adults and their nestlings or cause adults to abandon nests. Since this time also produces the most forage, some farmers set aside one "refuge" field for wildlife. This field can be grazed before April 1 and mowed after August 1 to accommodate nesting.

Increase the time intervals between grazing.

Rotationally grazed pastures have twice as many songbirds as those that are continuously grazed. Livestock is moved between paddocks to provide grass a recovery period and to increase yield. Manure droppings increase grass growth and insects, which in turn provide cover and food for wildlife.

Plant warm-season grasses.

Paddocks planted to big bluestem, little bluestem, or switchgrass will produce forage in the summer. These areas may be left undisturbed in the spring and harvested for forage in late July or August. This forage is provided when cool-season grasses are dormant and after the peak nesting season.

Add legumes to pasture and hayland.

Legumes add nitrogen to the soil and reduce fertilizer requirements for forage. Grasses and legumes attract insects that support insect-eating animals, supply browse, and provide nesting cover.

Limit pesticide use.

Insecticides such as organophosphate and carbofuran are extremely harmful to wildlife. For example, carbofuran will kill burrowing owls upon contact. Give nests and burrows wide berth when spraying. Find alternatives to pesticides when possible and use pesticides only when the cost of pesticides is outweighed by the damage to the crop. Select pesticides that are the least toxic to wildlife, follow the label, and keep chemicals away from water.

Install fences that are safe for wildlife.

Smooth wire is safer for wildlife than barbed or woven wire. Space wire at 16, 22, 28, and 40 inches from the ground to allow antelope, deer, and elk to pass the fence with reduced damage to themselves and the fence. The 12-inch gap between the two top wires keeps animals from getting tangled in the fence. Some livestock may need different wire spacing. See your fence dealer for details.

Preserve or plant a windbreak of trees, shrubs, and forbs.

One report estimates that birds consume up to 260 pounds of insects per half-mile windbreak each year. Windbreaks also protect livestock from harsh weather, control wind erosion, increase field moisture, trap snowdrifts, and provide travel corridors for wildlife. See the next page for details.



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The Windbreak as Wildlife Habitat

Fifty-seven bird species use windbreaks in the United States. Studies show that you will attract more birds per fencerow if it has a mix of trees, shrubs, and grass than one with only grass. Trees attract hawks and owls, while short trees and shrubs attract ground nesters. Decaying trees provide food and nest sites for some animals. Most wildlife will begin to populate a new windbreak after 5 years.

A typical windbreak has four to six rows of trees and shrubs. However, the more windbreak rows, the better for wildlife. Plant rows perpendicular to the prevailing winds. In areas with snow, make sure the most windward row is at least 100-200 feet from buildings, driveways, and feed bunks to provide for snowdrifts. Or plant one or two shrub rows 50 feet windward of the main windbreak to trap snow.

Typical Windbreak

Plant type	No. of Rows	Spacing Within Rows*
Conifer tree (windward row)	2-3	6-20 feet
Deciduous tree (middle row)	1-2	6-15 feet
Shrub (leeward row)	1	3-6 feet

*Spacing between rows is typically 12-16 feet.

Create a "wildlife windbreak" by providing the following:

Perch poles, snags and birdhouses.

Add birdhouses or at least three snags (standing dead trees) per fence row mile to encourage cavity nesters. Rock and brush piles within the windbreak will add cover.

Food plots or fruit-bearing shrubs on the lee side.

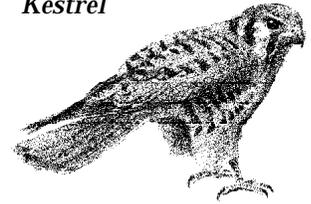
Windbreaks provide shelter from the wind. Food plots may also get a chance to warm up in the sun, especially during the cold months.

Windbreaks between different habitats.

Wildlife prefer using a travel corridor between food and cover sites, e.g. a windbreak connecting a woodlot and wetland.

However, windbreaks are not the answer for every situation. Do not plant windbreaks in wide expanses of grassland. Some grassland species will be at higher risk from predators and cowbird parasitism. Overgrown fencerows may also support noxious weeds which should be pulled, clipped or spot-sprayed for removal.

Kestrel



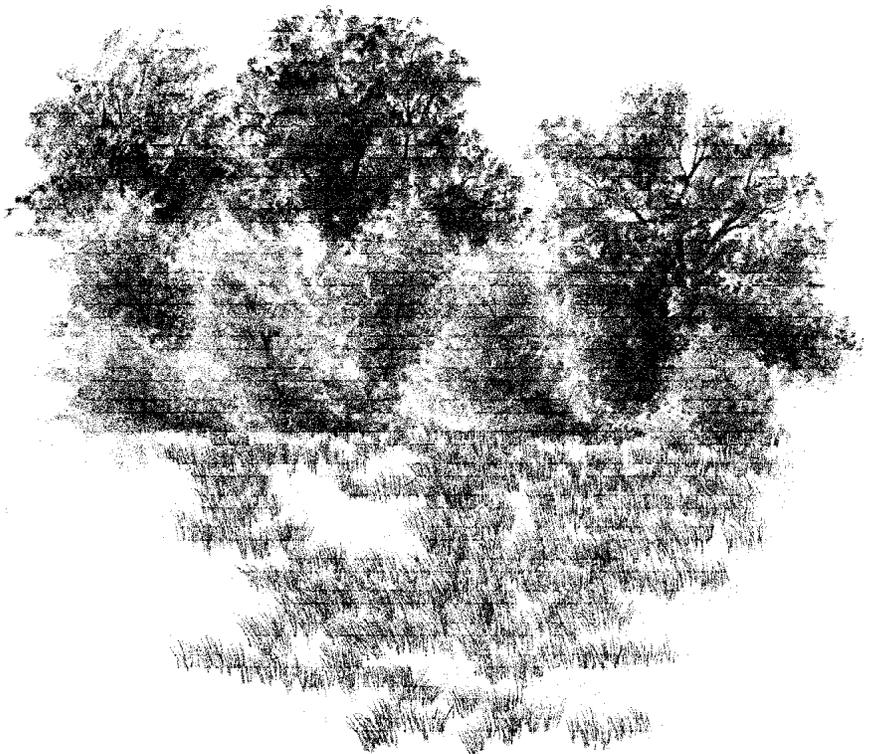
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A Native Plant Windbreak

Consider these plants, which are native cover and food sources, for your windbreak:

Conifers	Deciduous Trees	Shrubs
Douglas-fir western hemlock western red cedar	Oregon white oak big leaf maple vine maple red alder birch	Mockorange red and blue elderberry red flowering current serviceberry snowberry wild roses (bald hip, Nootka)

Native trees and shrubs are available at nurseries, the Oregon Department of Forestry, and some soil and water conservation districts.



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Forest as Wildlife Habitat

Squirrel



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Forests grow in stages, starting with an event that opens up a stand such as fire, insect and disease attacks, or timber harvest. These areas then naturally progress to grasses, shrubs, seedling trees, saplings, mature trees, and finally to old-growth trees. Most forests on private lands have been recently cleared and are in the young forest stages. Young forest wildlife includes deer, elk, chipmunks, juncos, western bluebirds, red squirrels, ruffed grouse, and MacGillivray's warbler. To encourage more wildlife in your forest, consider the following:

Preserve or create snags and down logs.

Almost 30 percent of the amphibians, reptiles, birds, and mammals in a forest use snags or down logs at some time. Private woodlands in Oregon have the potential of increasing cavity nesters by 60 to 94 percent. Avoid disturbing existing large down logs, stumps and uprooted stumps. Increase the number of large-diameter snags to 10 or more per acre. Girdle non-marketable trees that must be cut from a stand and leave for a snag. This can reduce removal costs and damage from felling culled trees.

Make brush piles from slash.

Woody debris provides food and cover for salamanders, snakes, small mammals, and birds that in turn become food for forest carnivores and raptors. Stack limbs from felled trees into piles and place piles near forest edges. A pipe laid under the pile will provide space for hiding. Leaving slash saves time and labor for removal and returns nutrients to the soil. In dry areas, you will need to balance the wildlife benefits with fire hazards. For more information on fire protection, contact a USDA Forest Service office or Oregon Department of Forestry office for the publication "Home Protection Guide."

Favor mast-producing trees like oak, maple, and ash.

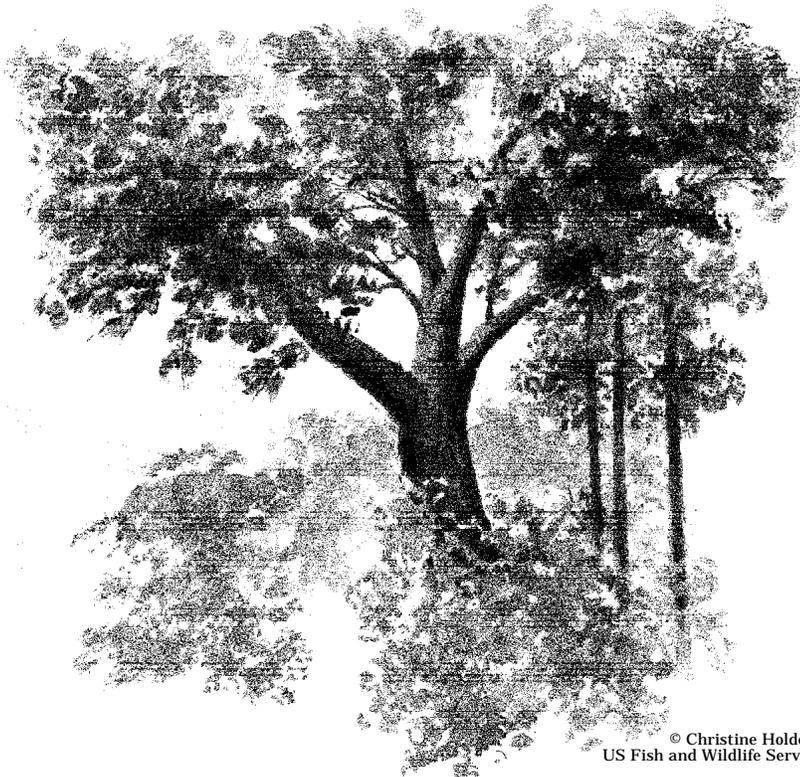
Mast is the berries, nuts, and seeds of trees that provide food for wildlife. Oak woodlands, a rare habitat in the Willamette Valley, supports more than 150 different kinds of wildlife, including the acorn woodpecker, the sharptail snake, and western gray squirrel. Mast trees can also provide timber, seed sources, and diversity against insect and disease infestations.

Seed trails, logging roads, and forest openings to grasses and legumes.

Grasses and legumes control erosion and increase insects, nesting cover, and forage for wildlife. Allow shrubs, vines, and native blackberries to develop on the forest edge where they can protect the woodland from drying winds and where timber quality is usually poorer.

Increase woodlot diversity.

As the number of different plants increase in a woodlot, the more wildlife can find the food and shelter they need. Uneven-aged forest stands have more diversity than even-aged stands that result from clearcuts. During thinning operations, consider keeping patches of unthinned or overtopped trees. Protect rare tree populations of Oregon white oak forests, Willamette Valley ponderosa pine, and Columbia Basin shrub-steppe.



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The Wetland as Wildlife Habitat

Less than 15 to 62 percent of the historic wetlands remain in Oregon. A wetland is an area with wet soils or standing water that can support water-tolerant plants, be it a marsh, a wet streamside, or seasonal pond. These valuable areas filter pollutants, provide flood control, recharge groundwater, and enhance wildlife habitat. Wetlands support mammals, waterbirds, turtles, amphibians, and songbirds, including the yellow rail, great blue heron, western pond turtle, Oregon spotted frog, red-legged frog, marsh wren, and many ducks and geese. Here are some ways to protect wetland habitats:

Do nothing.

Wetland "enhancement" often means changing wetlands to meet people's desires. This is not always best for the wetland or the wildlife it supports. A healthy wetland has a thriving native plant and wildlife community. A degraded wetland has noxious weeds and no longer provides many of the wetland benefits. For example, a degraded wetland that is choked with invasive reed canarygrass and filled with sediment may be improved with weed control and excavation. Seek the help of a professional if considering major wetland changes. Otherwise, consider the small-scale improvements that follow...

Fence and buffer the wetland.

Fencing is one of the easiest ways to protect a wetland from livestock and people pressure. Consider replacing pasture or lawn with native trees, shrubs, and plants. Native plants require less maintenance, as they are usually more drought-tolerant and pest-resistant than cultivated areas. See other fact sheets in this series for more information on fencing and riparian areas.

Plant native vegetation.

Although exotic plants may be attractive to you, wildlife are more likely to use native plants. Use caution when planting near open water. Too many plants or the wrong kind can choke a pond. If the wetland is not degraded, avoid planting.

Remove noxious or exotic plants.

Noxious weeds are not native to the area and grow unchecked by their natural enemies. Their biology allows them to spread rapidly and they quickly take over natural communities. Contact your county weed control board, Extension Service office, or Oregon Department of Agriculture Noxious Weed Program at (503) 986-4621, to get a list of noxious weeds and the best ways to control them

Designate trails.

Trails can increase your enjoyment and appreciation of wetlands. Trails also keep disturbances to a minimum and provide wildlife with unbroken stretches of habitat. Paths may be natural, lined with wood chips (make sure chips are not treated with pesticides), or a boardwalk. Avoid gravel as it is noisy and may reduce your wildlife sightings.

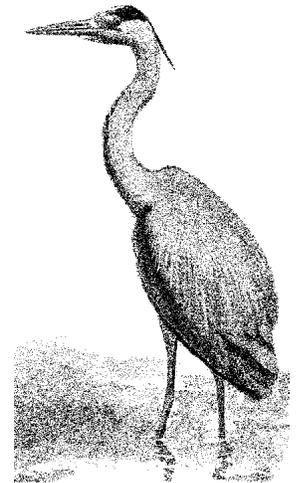
Identify and preserve seasonal ponds.

Seasonal ponds are often little more than large depressions in the ground that hold water until the dry months. The combination of water, insects, and lack of fish or other predators makes these areas prime breeding habitat for amphibians. Frog calls in the spring and wetland plants will help you locate the ponds. Retain woody debris, litter depth, and plant cover in these areas.

Avoid stocking fish.

Fish stocking may be appealing, but it is rarely beneficial to a wetland and may be illegal. Non-native fish or fish not found in adjacent waterways may escape into local waters and throw the natural community out of balance. This often happens during a flood. Consult a professional before stocking fish.

Great Blue Heron



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Cropland as Wildlife Habitat

Raccoon



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Service

Leave unharvested rows on field edges.

Leave unharvested grain, legume, and grass strips along fencerows, at fence corner, and in forest borders to provide food, nesting, and travel lanes next to cover.

Avoid mowing grassed waterways and grass strips during the nesting season.

Grassy areas like waterways, grass strips along fence lines, and odd areas in field corners can be left undisturbed from April 1 to August 1 to protect nests. Waterways can also provide food, cover, and travel lanes through cropland.

Practice conservation tillage.

This type of tillage leaves at least 30 percent plant residue on the soil. Migratory birds will stop to eat waste grain and weed seeds on their flight south. Canada geese and northern flickers may use these fields during the winter.

Limit pesticide use.

Use buffer zones to guard against drift and runoff into important or unique habitats, such as wetlands. Where practical, eliminate use of pesticides around field edges, corners, fencerows, nesting sites, streams, and wetlands. Find alternatives to pesticides when possible and use pesticides only when the cost of pesticides is outweighed by the damage to the crop. Select pesticides that are the least toxic to wildlife, spray in the evening when bees are less active, and follow the label directions.

The Buzz About Bees

About 30 percent of our diet is the result of a bee pollinating the flower of a fruit tree or a vegetable plant. Surprisingly, most of the 5,000 native bee species in the United States are solitary and nest in holes in the ground or in twigs. Since these bees do not have to defend a hive, they are not aggressive and rarely sting. You can encourage these friendly bees by building a bee box. Follow these easy steps:

1. Use a block of untreated lumber (3 to 5 inches thick).
2. Drill 1/8-inch to 5/16-inch diameter holes about 90 percent of the way into the block. The 5/16-inch holes work best for orchard bees that are good pollinators of fruit trees.
3. Space the holes about 1/2-inch to 3/4-inch apart.
4. Hang your bee blocks under roof eaves or a thick tree branch for protection from sun and rain.



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For
Help

- USDA Natural Resources Conservation Service and soil and water conservation districts provide on-site advice to create, restore, or protect stream corridors, wildlife habitat, and wetlands through several cost-share programs. Cost-share programs include the Conservation Reserve Enhancement Program, Environmental Quality Incentives Program, Wetland Reserve Program, and the Wildlife Habitat Incentive Program. Look up your local office in the phone book's blue pages under federal government, Department of Agriculture.
- The US Fish and Wildlife's Partners for Fish and Wildlife Program funds projects that create, enhance, or restore wetlands and stream corridors on private lands. Look up your local office in the phone book's blue pages under federal government.
- The Oregon Department of Fish and Wildlife's Wildlife Habitat Conservation and Management, and Riparian Tax Incentive programs provide technical help, wildlife plans, and tax incentives for projects that create, improve or protect wildlife habitat. Look up your local office in the phone book's blue pages under state government.

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