11 Salmon-Trout Enhancement Program

"The times of a river are measured by the salmon,
and the stages in a salmon's life are measured by its color."
— Kathleen Dean Moore

What is STEP?

Recognizing that volunteers could play an important role in the restoration of native stocks of salmon, steelhead and trout, the Oregon Legislature created the Oregon Department of Fish and Wildlife's (ODFW) Salmon-Trout Enhancement Program (STEP) in 1981.

Since that time thousands of volunteers have assisted Oregon's fisheries through their involvement in STEP. They have donated money, materials, equipment, and countless hours of time and labor. STEP volunteers have completed stream habitat restoration work, conducted surveys, helped with education projects, and hatched and reared several million salmon and trout eggs—all because they care about fish and fish habitat.

What can a STEP volunteer do?

Interested citizens can help out in a variety of ways, from data collection and management to habitat restoration or education. Volunteer projects and opportunities are defined by the diversity of fish resource management needs found throughout Oregon.

Each of Oregon's watersheds has its own fish management priorities. Local biologists determine what must be done and are always on the lookout for ways volunteers can help.

Many fish projects simply *could not happen* without volunteers. Volunteers provide the extra effort needed to get the job done. Volunteer participation also frees up ODFW staff time and dollars for other important work.

Surveys

Volunteers help determine the status of fish populations and the condition of stream and lake habitats through a variety of survey projects. *Aquatic Habitat Inventories* provide information about the quality of fish habitat in streams. *Fish Population Surveys* determine the species present, their abundance, and distribution within a given stream. *Spawning Surveys* document the amount of spawning activity in a stream system. Some surveys are part of annual efforts to track a population trend within a basin. Others determine the potential impacts of proposed land use activities.

Another survey might document migration barriers caused by poorly functioning culverts. Others measure streamflows or monitor water temperatures to develop stream temperature profiles, and photographic surveys follow habitat changes over time.

Habitat restoration

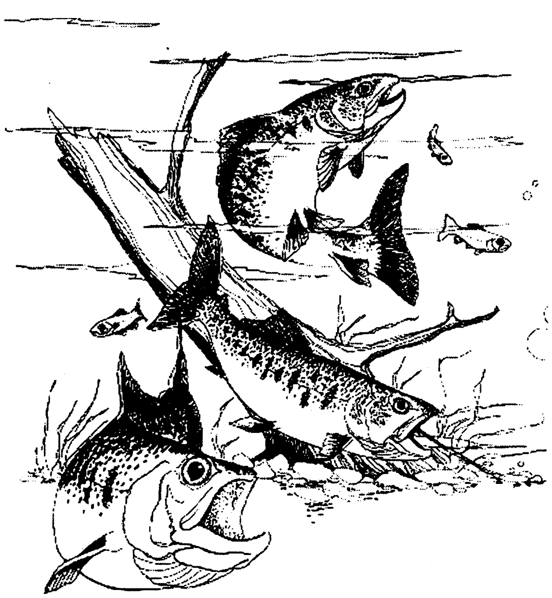
Biologists use the information gathered during surveys to identify factors that may limit fish production. For example, a stream survey might show few pools or a lack of spawning gravel, barriers to fish passage, or summer monitoring might reveal extreme water temperatures. Once needs are identified, habitat restoration projects can be designed to address those needs. Volunteers can assist with all phases of habitat restoration. These include help with funding, site selection, project design, construction and placement, equipment donation and operation, photo monitoring and report writing.

Fish culture

In those waters where natural production does not meet fish management needs, STEP volunteers may be asked to help with fish culture efforts. Volunteers can assist ODFW personnel with broodstock collection, egg incubation, and fish rearing activities. The work may take place at an ODFW facility or at a volunteer-operated site that complements public hatcheries.

Education

Education and information materials are essential to promote public awareness and understanding of fish and wildlife habitat needs. The STEP program distributes a number of publications to meet this need and to show how citizen volunteers can participate in STEP activities. *Stream Scene* is a curriculum package about watersheds, upland and riparian areas, streams, and aquatic organisms. *Storm Drain Marking* is a program to educate citizens about the ecological hazards of dumping household chemicals into storm drains. *From Fish Eggs To Fry* is a tool for setting up and maintaining a classroom aquarium to hatch fish eggs; *Why Wild?* is a supplement to help students understand how fish are adapted to their native streams. *Stream Care* is a landowner's guide for protecting and enhancing stream habitat. Related materials are also available through ODFW's Aquatic Education Program.



Other projects

Many fish management tasks provide opportunities for volunteer involvement. Some volunteers may snorkel a clear mountain stream in search of an endangered native trout or perhaps others enjoy entering data at a computer terminal. Still other volunteers might try fish salvage, fin clipping, fish stocking, or equipment maintenance. Volunteers also suggest projects like streamside plantings, identifying fish passage barriers, and acquiring access for anglers.

What's in it for me?

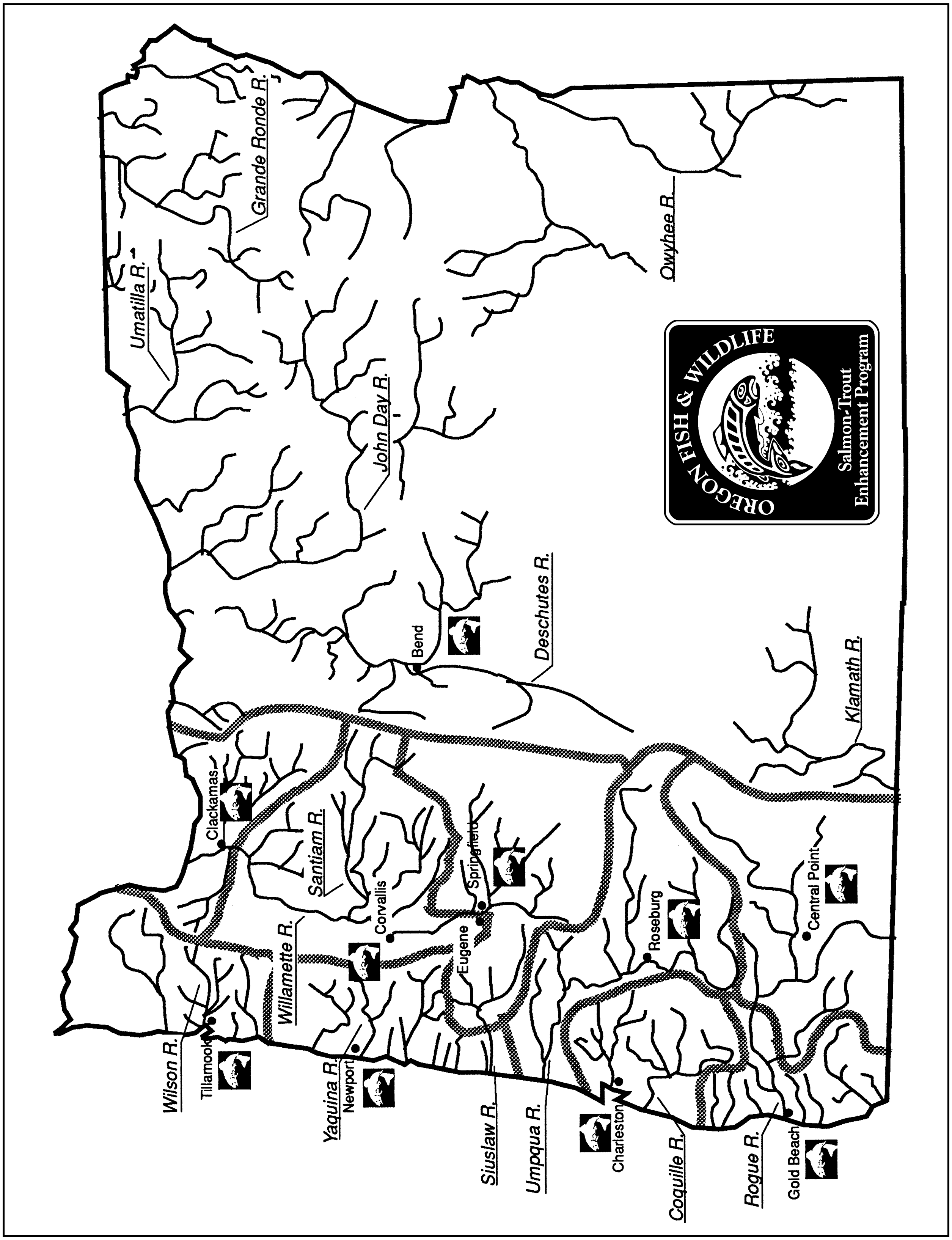
STEP is a growing program and Oregonians are eager to contribute time, muscle, money, and perseverance. The combined effort of all STEP volunteers has made an important and measurable impact toward conservation of Oregon's valuable fish resources. Participants also benefit. Volunteers come away with a better understanding of fish and the systems upon which they depend. And, they achieve a strong sense of personal accomplishment through their hard work. Do you want the satisfaction of knowing your stewardship helps fish? Come join us. You'll be glad you did.

How can I get involved?

Contact the nearest ODFW office or STEP Biologist to learn more about the needs in your area. Sign up today as a STEP volunteer—Oregon's fish need your help now!

Author's suggestion: Use a classroom incubator project as part of a lesson on fish

STEP Biologist Districts



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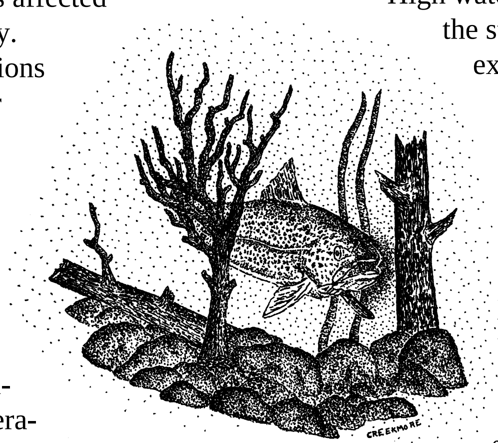
Fish habitat restoration

Aquatic habitat restoration activities are one of the key issues in the Oregon Plan for Salmon and Watersheds. The concept of "habitat restoration" covers a multitude of ways to improve watershed function—water quality, water quantity, increased channel complexity, flood plain interaction, and the quality of riparian vegetation. Reintroducing wood to stream channels, repairing culverts, planting trees and shrubs, and opening up historical stream channels are all examples of habitat restoration projects.

A stream's or estuary's ability to support fish and other forms of aquatic life is affected by its ability to function properly. Stream or estuary habitat conditions are dependent on land and water management actions including road building, development, grazing, agricultural practices, forestry practices, controlled fires, and other human and natural activities within a watershed.



Fish survival in aquatic habitats is dependent on water temperature, water quality and quantity, cover, and food supply. Fish have different requirements at various stages of their lives and different species use different habitats for spawning and rearing. Understanding the different life cycle requirements and interactions among species plays an important role in sound habitat restoration.

Successful spawning and development from egg to fry require:

- absence of barriers at all flows to upstream migration of adult fish;
- spawning areas with sediment-free substrate and adequate water flows;
- a balance of pools and riffles to provide spawning and holding areas, especially deep, cool pools for species like spring chinook salmon;
- instream and streamside cover to protect adult fish from predators and to provide shaded resting areas; and
- an adequate flow of cool, well-oxygenated water through the spawning gravel.

Development from eggs to fry is a delicate process. Many things can happen to limit the number of fish that survive this stage of the life cycle. High water flows may scour eggs from the streambed. Low water can expose the redd and allow the eggs to die from temperature extremes. High sediments loads may smother the eggs in the redds and large numbers of adults spawning in a limited area may uncover eggs in one redd while building another.

Young emergent fry require quiet, slow stream flows, backwaters, or stream margins. Juvenile migratory fish live and grow in the stream for one to three years, while resident fish need suitable habitat throughout their lives. Rearing fish also need clear access to move up and down the stream, including access to the ocean for migratory fish.

Productive fish rearing habitat requires:

- low to moderate slope and streamflow velocity;
- a balance of pool and riffle habitat to provide food and cover appropriate to the species;
- a variety of substrate types to provide hiding cover for young fish and places for aquatic insects to live;

- undercut banks, stable natural debris such as fallen trees, and overhanging plants to provide cooling shade, protection for young fish and leaf litter for aquatic insect food;
- nutrients, particularly from salmon and lamprey carcasses in areas where these species were historically found, to promote growth of naturally occurring plants and other organisms beneficial to the stream;
- barrier-free migration for upstream and downstream movement;
- a stream channel that interacts with the floodplain during high water periods; and
- meandering streambanks and backwater channels to slow streamflow, add diversity, and increase the amount of habitat available to fish.

What is fish habitat restoration?

Habitat restoration is the repair of altered streams or creation of productive habitat in streams, riparian areas, uplands, and estuaries. In a properly functioning natural system, habitat restoration can help watersheds produce and support increased numbers of salmon, trout, and other wildlife.

Why are fish habitat restoration projects needed?

Many of Oregon's watersheds have suffered from the effects of human activities and support fish populations well below their historic levels. Loss of wetland and estuary habitat, spawning areas, rearing areas, streamside vegetation, instream woody debris, beaver ponds, and access to former fish production areas are all results of our treatment of the land, aquatic environment, and aquatic wildlife

To understand the need for habitat restoration, we must first recognize how land use activi-

ties affect a stream's character and how fish populations respond to reduced habitat quality within a stream. Certain aquatic and riparian habitat conditions, or limiting factors, establish the number of fish a stream can support — its carrying capacity. Limiting factors are considered for all phases of a salmon or trout's life cycle. For example, the amount and quality of gravel-rich areas are limiting factors for spawning habitat. The amount and quality of deep pools, backwater pools, or beaver dam areas limit rearing habitat for young fish.

Varying environmental factors cause fish populations to fluctuate from year to year within the limits of their habitat. Extremes in streamflow can cause wide variations in survival and production. Extended low flows may keep adults from reaching spawning areas. High winter flows can destroy eggs by scouring spawning beds or depositing sediments. Stream temperatures also affect survival. Variable ocean conditions affect smolt and adult survival. Fish populations in healthy habitats generally recover quickly from these natural events. But when habitat quality is degraded, serious reductions in fish numbers occur.

Many fish habitat problems are overcome with changes in land and water management practices, but habitat restoration activities may get the stream system on a fast track to recovery. Restoration projects are not an alternative to improvements in land and water management, but can bridge the time between past disturbances and a return of natural functions that will maintain productive fish habitat.

It is important to understand which management activities or habitat conditions are limiting fish populations so efforts to improve the situation are not misdirected, harmful, or wasted. Once limiting factors are identified by surveys or other evaluation processes, habitat restoration projects can address specific habitat needs in a given stream. Restoration practices should target the most limiting factors first.

What are some fish habitat problems?

✔ Water quality and quantity

Most aquatic organisms rely on a relatively narrow temperature range for survival. Shade plays an important role in determining water temperature. Air temperature, adjacent land forms, upslope vegetation, and land and water use also affect water temperatures. Various types of pollution negatively affect fish and aquatic insect production. Minimum streamflows are necessary to maintain good fish habitat, especially during natural low flow periods of the year. Lack of beneficial nutrients, such as those from salmon and lamprey carcasses in areas where these species were historically found, also affects water quality.

✔ Abused riparian areas

Healthy streambank conditions are important to fish production. Good riparian plant growth along a stream helps the soil store water for late summer flows, provides shade to keep water cool, holds the soil together to reduce sediment input to the stream, and contributes insects to the fish food menu.

✔ Barriers to migration

Roadway culverts, dams, dikes, and other man-made structures may artificially block spawning, rearing, and smolting migrations of fish.

✔ Lack of natural instream structure

Large and small woody debris accumulations create resting areas, scour deep pools, provide cover for fish, collect gravel for spawning beds, and are homes for aquatic insects.

✔ Lack of spawning or rearing areas

Salmon and trout species have different habitat requirements during the various stages of their life cycles. They need a balance of spawning and rearing areas with both riffles and pools in a given stream section. Suitable spawning areas have clean, porous, proper-sized gravels with an adequate flow of cool well-oxygenated water. Rearing areas with undercut streambanks, side channels, beaver ponds and other pools, instream cobble and boulders, and large woody structures, such as fallen trees, provide young fish with an environment suitable for survival and growth.

Does a fish habitat problem exist?

Before starting a habitat restoration project, find out if a habitat problem exists. Volunteers can help determine the status of fish populations and the condition of aquatic habitats through a variety of survey projects. Aquatic Habitat Inventories provide information about the quality of fish habitat in streams. Fish Population Surveys determine the species present and their abundance and distribution within a given stream. Spawning Surveys document the amount of spawning activity in a stream system. Another survey might document migration barriers caused by poorly functioning culverts. Others measure streamflows or monitor water temperatures to develop stream temperature profiles. Biologists train volunteers to conduct the surveys and help evaluate the results.

Information gathered during the surveys helps biologists identify and assess factors limiting fish production. If habitat restoration is appropriate, proceed with the following steps.

✔ Identify the problem

What is missing and what are associated limiting factors? What are the "most limiting" among the limiting factors?

✔ Develop a plan

What actions can correct the problem? Identify the best approach and develop an organized plan with clear objectives and measurable outcomes. Consider the cost/benefit factors of your actions. Use a Habitat Restoration Project Planning Worksheet provided by your local Oregon Department of Fish and Wildlife STEP biologist or habitat biologist to guide your thought process. ODFW staff can also provide a copy of the *Oregon Aquatic Habitat Restoration and Enhancement Guide*, which includes information about permits, approvals needed, and who to contact.

✔ Implement the plan

Carry out the selected action under the supervision of the STEP Biologist or other experienced habitat biologist.

✔ Evaluate the project

Include time and dollars in your plan to evaluate both the short and long term success of the project. Is it accomplishing the desired results? Are more fish present in the stream following the project? What are the measurable outcomes of the project?

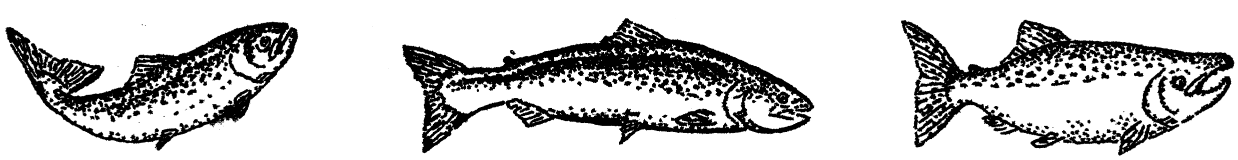
✔ Maintain the project

Some projects require periodic inspection and maintenance to assure the project or structure functions properly. Include time and funding to cover maintenance costs in your plan.

Remember, stream habitat is dynamic over time. Collections of gravel, large wood, and stream meanders will change seasonally and over the years. Large wood or other instream structures often work best if allowed some movement with natural flow events. In less heavily degraded watersheds nature can place the wood and other structures in arrangements that work best for fish.

What next?

Each project requires individual consideration to tailor the action to the need and the site. There are many techniques for accomplishing the various actions. Consult the *Oregon Aquatic Habitat Restoration and Enhancement Guide* for suggestions and ask your local ODFW fish biologist, STEP biologist, or habitat biologist for assistance in planning a restoration project.



Habitat restoration techniques

Remember one very important thing when considering habitat restoration work: Mother Nature has taken care of her watersheds and streams for a long time. Only when human interaction began affecting the picture did the function go awry.

If the problem with the stream is one of human management, that is, convincing people to change their actions or management strategies (such as limiting livestock access or restricting timber harvest), then the best form of habitat restoration is to follow nature's lead and allow the stream to recover naturally. There is no reason to place structures in the stream, just because it seems like the thing to do.

A "light touch" is best and all work done in a stream should blend into the natural pattern.

If the stream has time to recover on its own, any remaining problem areas will be evident. Those areas should be evaluated and receive appropriate attention. A "light touch" is best and all work done in the stream should blend into the natural pattern. Never underestimate the power of flowing water when planning your habitat work.

Habitat restoration is the repair of damaged streams so they may produce and support increased numbers of salmon and trout. Habitat enhancement is the creation of better or more suitable habitat within a stream. Habitat enhancement may not mean more fish, but may mean an increase in other values related to overall watershed health.

Various techniques exist for restoring and enhancing fish habitat. For any habitat rehabilitation or enhancement work to be successful, it must meet two criteria. It should be placed where it will best aid creation of the desired habitat condition and it should be designed to last for a relatively long period of time.

Restoration techniques

Following are a few examples of habitat restoration techniques. Many other techniques exist for specific problem areas in streams. If you and your students want to get involved with habitat restoration work, contact the local STEP biologist or district fish biologist for assistance.

Boulders

Very large irregular boulders create "pockets" or hiding and resting places for fish. Boulders also change the flow pattern of the water, creating greater habitat diversity. They are most often used when there is too much riffle and limited pool and hiding areas. Depth is increased by scouring, a result of the faster water velocities around the rock.

Generally, boulders are placed in clusters or along the edges of streams to create small backwater areas. Streambanks should be stable or well protected in areas where boulder placement is considered.

Rock weirs (or boulder berms)

Rock weirs are constructed in areas where long shallow riffle areas exist and sufficient spawning gravel is limited.

A rock weir consists of a collection of rocks and cobble used in combination with large boulders (which may already be found in the stream) to form a dam-like arrangement. Rocks are piled across the stream using already present boulders as a base. The rock weir is constructed with a somewhat vertical, downstream face and a gradually sloping upstream side. This design spreads the water's force over the entire structure, lessening the chance of wash out. The height of the weir varies depending upon the channel.

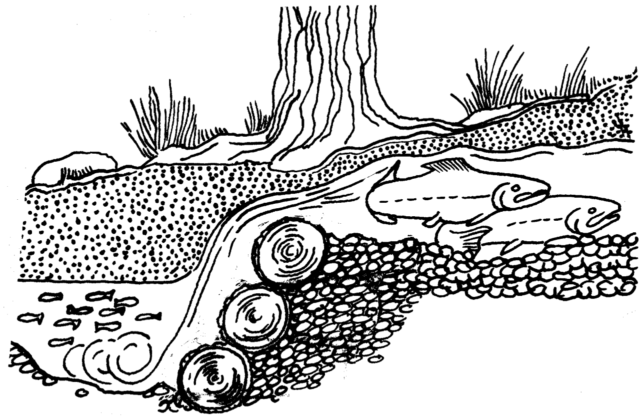
A rock weir reduces a stream's velocity, collects spawning gravels, and help restore the water table. Downstream, water plunging over a weir scours a pool and recruits gravel that is sent downstream by the flow to the next collection site.

Rock weirs are best used in series to create habitat diversity (increased pool-to-riffle ratios). Streambanks must be stable or well-protected in rock weir placement areas.

Log sills (or log weirs)

Log sills are placed across or at an angle to the stream flow, unless flow or bank stability are controlling factors. They are anchored to the stream bottom, to stable boulders, or to tree trunks along the edge of the stream.

To be most effective, the logs should be at least 12" to 16" in diameter, well placed in the stream bottom to reduce washouts under the logs and keyed into the banks at

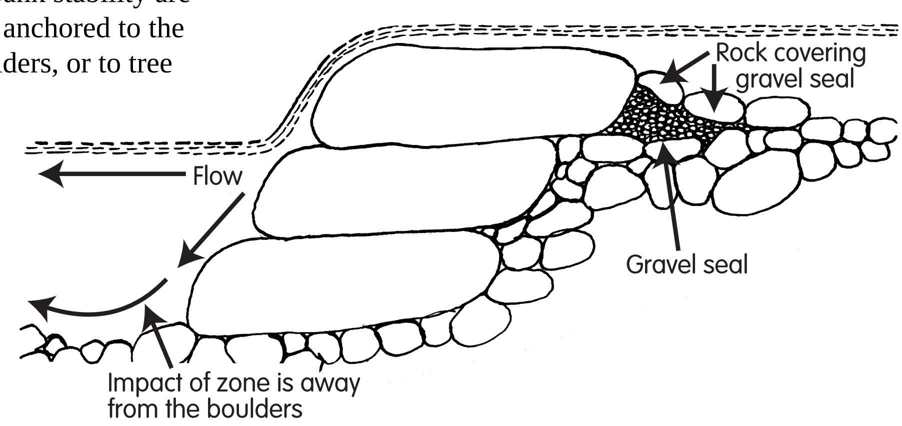


least a third of their length. Often, a layer of heavy wire and erosion fabric is anchored to the log. This is placed on the streambed on the upstream side of the log sill to help complete the seal, reducing washouts under the log. Gravel collects behind the log, providing spawning area above the structure and a rearing pool on the downstream side.

Plantings

Stabilizing stream banks with tree plantings or reseeding with other vegetation can help restore streamside vegetation. Consult with local professionals, like the Natural Resources Conservation Service, to select the right species for the site.

The condition of the streambanks is related to water quality and fish production. Shade provided by the vegetation helps keep streams cool. Root systems help control erosion that would add sediments to the stream. Silt can clog gravel, smother eggs and reduce aquatic insect production.



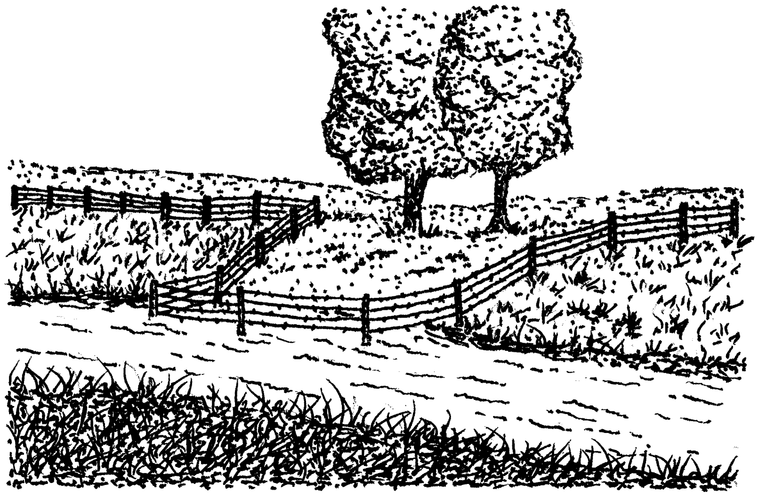
Cover logs

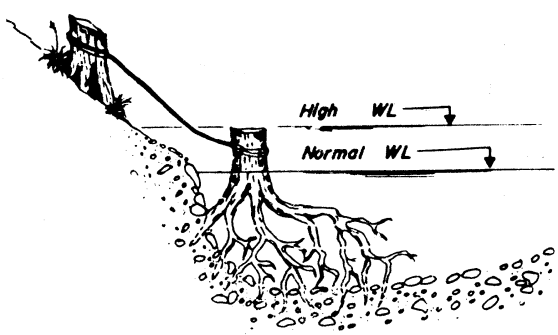
Cover logs provide overhead cover in sections of a stream where the water depth is adequate but cover is lacking.

Cover logs can be any shape, length or size, but the best results are obtained by using large crooked logs with limb stubs extending several inches. Root wads are also used. Both provide an irregular surface resulting in maximum turbulence and spot scouring along the edge of the structure.

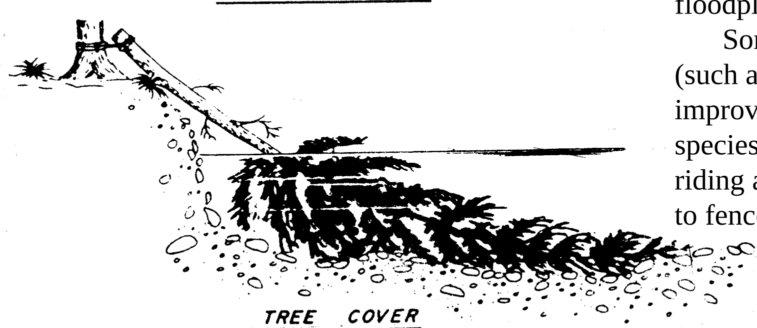
Logs are anchored to the stream bottom or the bank. Ideal locations are open pools or glides at least 6" to 8" in depth. Logs are placed parallel or at slight angles to the flow. Cover logs have the added advantage of presenting a natural appearance in the stream.

Cut trees (juniper) that are placed against and anchored to the banks are beneficial in bank stabilization. Green trees with a bushy crown work best.





ROOT WAD COVER



TREE COVER

Source: *Stream Enhancement Guide,* Government of Canada, Province of British Columbia, Vancouver, B.C., 1980.

The trees and their branches reduce water velocities, allowing sediments to collect. Native plants then colonize these new seed beds, improving banks, narrowing and deepening the channel, and enhancing salmonid habitat.

Streambank fencing

Fencing, or otherwise limiting usage of disturbed streamside areas, can help restore deteriorated streambanks, reduce excessive or unnatural nutrient and sediment loads, and protect riparian vegetation. Healthy riparian vegetation shades the stream, reduces bank erosion, and provides other benefits to fish. Fencing may be necessary to reduce impacts from agricultural or other human activities on streambanks, but it is most often used to control livestock grazing in terms of numbers of animals, season, and timing of use.

Location of riparian fences should take into account potential damage from ice, high flows, floodplain levels, and debris.

Some grazing systems and/or techniques (such as alternative water developments, upland improvements, planting of nutritious, palatable species well away from riparian areas, and/or riding and herding practices) can reduce the need to fence.