



Trees in the Riparian Zone

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Editor: Dr. James R. Fazio • \$3.00

Whether it is a creek small enough to jump across or the shore of a major river, America's waterways and the land that surrounds them are valuable, finite resources. Action by individuals and communities is needed now to protect or restore the trees that complete the wholeness of riparian habitat.

The human attraction to water borders on the mysterious. Some claim this affinity has evolutionary roots. Others believe it is simply due to fond memories. Playing in a creek during childhood would be an example. Still others take a more practical view — one that recognizes water as the foundation of our nation's richness. From the first grist mills to today's faucets, water provides uncountable benefits.

Whatever the reason, most people place a value on the silver threads of life that course through the forests, farms and communities of America. But it has not always been this way. Rather, we are emerging from a shameful period of treating waterways like flowing dumps, drainage ditches, or some mythical beast to be hurried away or contained in a cage. In the 1950s and 60s, for example, the U.S. Army Corps of Engineers spent over \$30 million to convert Florida's 98-mile, meandering Kissimmee River into a 56-mile canal. The resulting damage to adjacent lands and resources was so great that the Corps is now taking the straitjacket off portions of the river — at a cost more than double the original amount!

Fortunately, a new philosophy is replacing the mentality of finding "efficient" ways to move water through the land. Still, even today, there are communities, developers, and individual property owners that have not realized the potential of the river bank or the tiny brook in their midst. This is especially true when the waterway serves as a property line or jurisdictional border. In all cases, however, we will never have more waterways than we have today. What we do to protect the quality of these waters and to maximize their contributions to the land and the people along their banks depends on what is called riparian management. The care of riparian trees — or their restoration on denuded sites — is an essential part of that management and a key to the future quality of our silver threads of life.

Two ways to treat a waterway. In one community, a creek is rendered ugly and useless by a straitjacket of expensive concrete. In another, a meandering creek is enhanced by careful engineering to become a valuable part of a housing tract.



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Benefits of Riparian Management

The riparian zone of a waterway is defined as an area of ecological transition between the aquatic zone and upland zone. Within this usually narrow band of land, subsurface water (the “water table”) is high because of its proximity to the stream, and conditions favor the growth of water-loving vegetation. But these water/land corridors are much more. John Simonds, writing in Earthscape, calls them “natural gardens, self-sustaining, and refreshing.” When prized and given care, they are ribbons of nature, winding through the landscape providing trees, wildlife, clean water, and places of refuge for renewing the human spirit.

1. STORMWATER MANAGEMENT

In some cases, developers can design broad, gentle slopes of lawn or parking areas that direct water toward an adjoining riparian woodland. This spreads runoff and reduces the cost for expensive drain pipe systems. Where stormwater detention ponds are required, instead of cutting trees and scouring out ugly basins to occasionally catch storm runoff, steel sheet piles can be driven perpendicular to a drainage to create a temporary dam during storms. These techniques aside, riparian zones provide natural floodwater storage and an earthen sponge to retain massive quantities of water for slow, steady release.

4. POLLUTION PREVENTION — FILTERS, SINKS, AND TRANSFORMERS

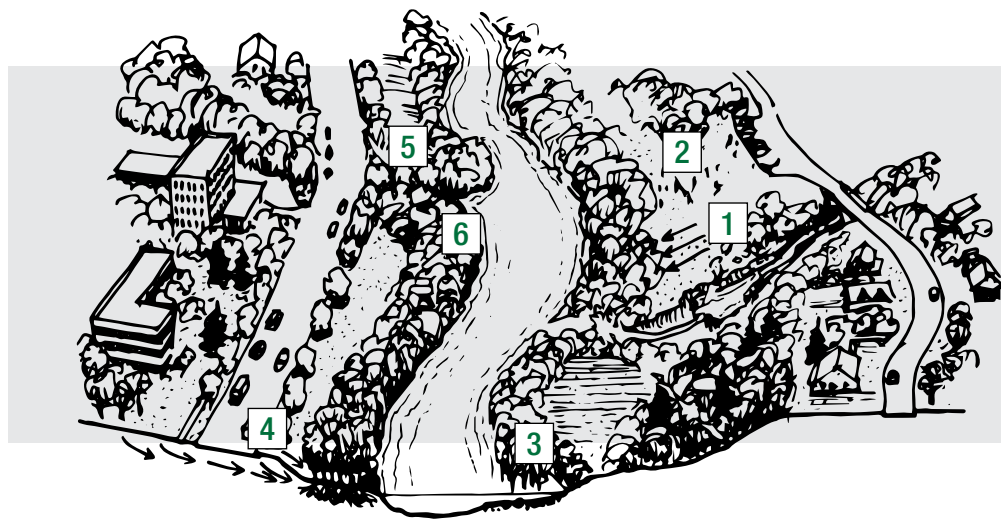
Riparian zones with trees and other vegetation filter excessive chemicals that wash from lawns, gardens, and fields. In some cases, the soft soil and leaf litter of the riparian zone act as a trap for the particles and associated chemicals. The phosphates stay on site, absorbed into the soil from which they are taken up by tree roots. Nitrates move either on the surface or in groundwater. These chemicals, too, can be intercepted and used by tree roots rather than being allowed to enter the waterway as pollution. Even pesticides are transformed into non-toxic compounds in a riparian woodland.

2. RECREATION

In a study near Indianapolis, “the presence of trees and shade, natural areas, wildlife and birds” were attributes selected as being most important to riverside park users. Whether it is a meandering creek through a county park or a highly developed river walk, riparian parks are popular. With careful planning, they can serve the needs of wildlife and watershed management while at the same time providing a myriad of recreational opportunities.

3. SLOWER FLOOD WATERS, LESS SEDIMENT

When trees, shrubs and other plants cover a stream’s floodplain, they slow the rush of high water. Since fast-moving water can carry a higher amount of soil particles than slower water, sediments are dropped by the flood waters in the riparian zone rather than ending up downstream in reservoirs, channels, and harbors. Slowing the water also helps to reduce streambank erosion.



Urban Area

Riparian
Zone

Aquatic
Zone

Riparian
Zone

Upland Zone

Urban Area

5. WILDLIFE HABITAT

Wooded riparian zones are a boon to some species of wildlife as they struggle to survive in an urbanizing land. In New Mexico, for example, the vast majority of rare and endangered species are found in or near riparian ecosystems. In all areas of the country, riparian forests serve as corridors, or wildlife “highways” between remaining blocks of fragmented habitat.

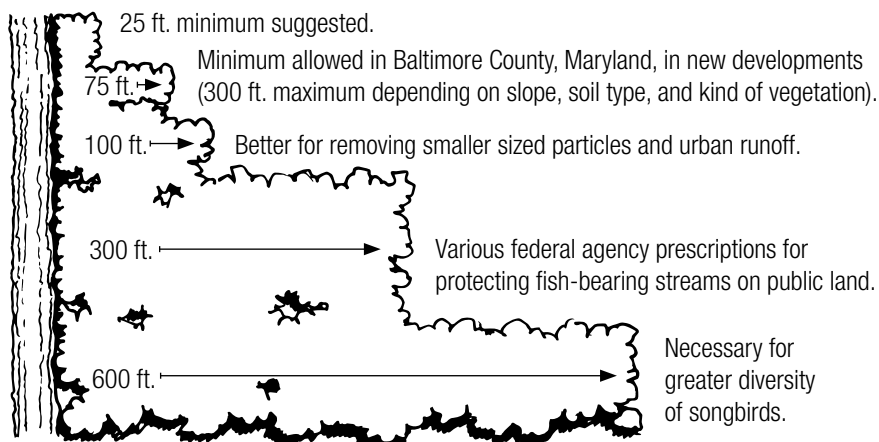
6. WATER TEMPERATURE CONTROL

Shading creeks and rivers helps keep the water cool. Cool water carries more oxygen and provides a more livable environment for many species of wildlife including game fish such as trout. The warmer water of denuded creeks also slightly increases the release rate of certain pollutants from sediment particles.

Treating Waterways With Tender Care

HOW WIDE TO MAKE THE BUFFER?

Expert opinion differs on how wide a riparian forest should be. Recommendations vary from 25 feet to over 1,000 feet. The best rule of thumb is — the wider the better.



TREES FOR RIPARIAN SITES

It is not easy being a tree in an area prone to flooding. Water and sedimentation cut off oxygen to the roots, soil pH is altered, trunks are scoured and bent, and chemicals are washed over the soil from upstream properties. For these reasons, it is important to select species carefully for planting in floodplains. There is abundant, research-based information available online by searching for “flood-tolerant trees.” Here are how a few common trees were rated by the U.S. Forest Service:

FLOOD TOLERANT

Baldcypress
Cottonwood
Elm (American)
Hickory (Water, Pecan, Shagbark)
Honeylocust
Linden (Littleleaf)
Maple (Red, Silver, Boxelder)
Mulberry
Oak (Overcup, Pin, Bur, Swamp White)
Pecan
Persimmon
Redbud
Sweetgum
Sycamore
Tupelo (Water)
Willows

FLOOD INTOLERANT

Apple
Birch (Gray and Paper)
Cherry (Black and Weeping)
Flowering Dogwood
Hawthorn (Washington and Lavalley)
Hemlock
Hickory (Bitternut)
Kentucky Coffeetree
Locust (Black)
Maple (Sugar)
Mulberry (Red)
Oak (White, Red, Black, Blackjack)
Pines
Sassafras
Spruces
Yew

Note: Flood tolerance varies with local factors such as soil, and with characteristics of the flood — time of year, temperature of the water, depth, and sediment levels.

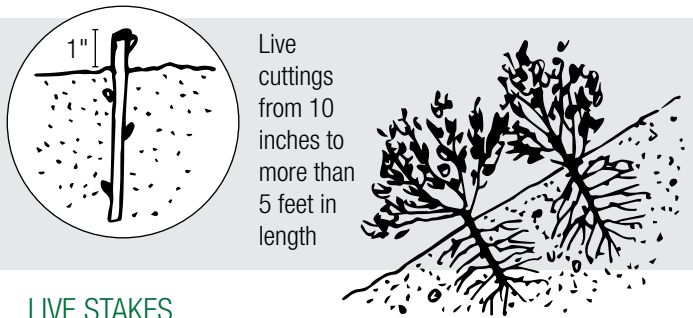
For anyone who wants better stewardship of their waterways, many techniques are available to do the job. Here are some general suggestions adapted from Ecology of Greenways.

- ✓ Provide green corridors on both sides of the waterway.
- ✓ Avoid mowing and clearing of streambank vegetation. Instead, maintain or plant a band of trees and other vegetation that is capable of filtering runoff and cooling the water.
- ✓ Plant and manage for native species to prevent the spread of invasive-type exotic vegetation along riparian corridors.
- ✓ Supplement sediment trapping with retention basins and vegetated berms. Do not fill in oxbows or marshy areas.
- ✓ Consider a regular tree harvesting plan to maximize nutrient uptake. Vigorous, actively growing trees take up more nutrients from the soil.
- ✓ Keep cars and grazing animals away from the edges of water and focus human activities at specific points rather than along the entire length of the waterway.
- ✓ To prevent erosion gullies, build steps or a ramp between the top and bottom of a bank at access points.
- ✓ Prevent stream channel degradation, or restore natural flows and processes if alteration has occurred.
- ✓ Limit facilities and paved areas that prevent infiltration of rain and runoff. Use porous material when surface hardening is necessary.

Treating Waterways With Tender Care (continued)

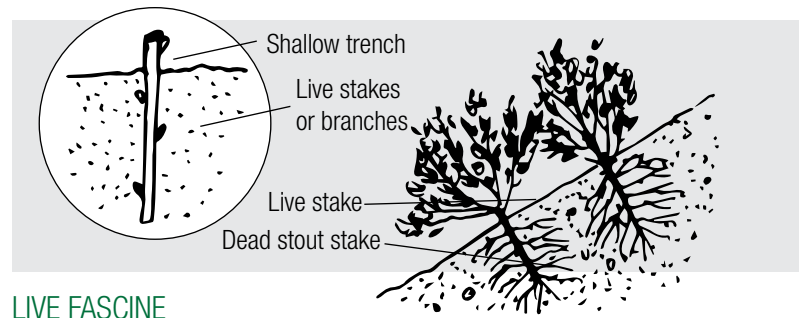
ESTABLISHING RIPARIAN TREES

The first step in restoring a neglected or altered riparian area is to seek the help of experts. A good place to start is the county office of the Natural Resources Conservation Service (formerly Soil Conservation Service). NRCS professionals can suggest methods, funding sources and plant materials, and guide you to consultants who can handle major jobs. "Soil bioengineering" is a term sometimes applied to the art and science of combining biological, structural and ecological concepts to restore riparian areas. Here are a few of these techniques for stopping streambank erosion, trapping sediments, and controlling floods by natural means.



LIVE STAKES

Planting cuttings of willows or poplars is a fast and inexpensive method of establishing riparian tree growth (See Bulletin No. 39). Within a year or two, the roots in dense plantings anchor the soil while interlocking branches slow flood waters and reduce their scouring effect. The live stakes can also be used to anchor geotextile or other blanket surface materials that are sometimes needed to cover soil while vegetation gets started.



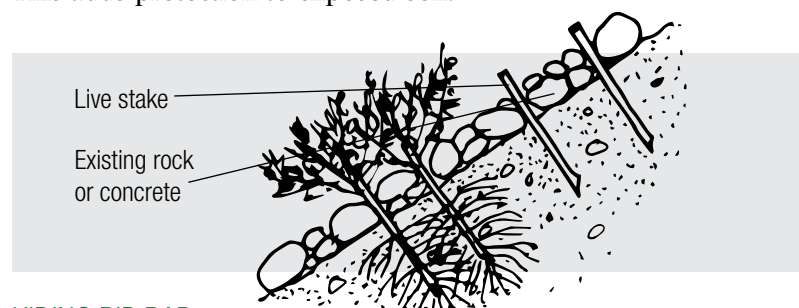
LIVE FASCINE

Fascine is an old word dating back to 16th century Europe where this technique probably arose. This method can be used on steep slopes in need of immediate erosion control. Cut branches of species like willows or dogwood that root easily are tied into bundles or mats and placed in shallow trenches dug along the contour of the slope. The bundles can be secured with live stakes, adding to the profusion of sprouts that result. A brushmattress of limbs is often staked in place over the soil upslope from the bundle. This adds protection to exposed soil.



LIVE CRIBWALL

This is a more expensive measure. However, it can be very effective where strong currents, steep banks, or limited space make other erosion remedies impossible. In this method, a rectangular framework of logs or old timbers are anchored by rocks or scrap concrete. Live stakes or cut branches are laid into the structure. Roots provide additional anchorage, especially as the cribwall timbers eventually decay. At the same time, new tree growth improves appearance and provides wildlife habitat.



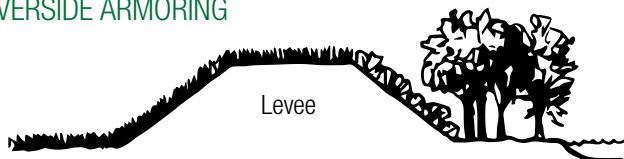
HIDING RIP RAP

In the past, well-meaning landowners or managers dumped rock and scrap concrete on streambanks for stabilization. Although this is effective in some ways, it does little for recreation, aesthetics, or some kinds of wildlife. One solution is to insert willow or other appropriate cuttings into soil between the rip rap material, or into the finer rock material that may form a base. The resulting roots function as a soil stabilizer, and the stems will slow flood waters. In turn, this will let silt settle out to begin forming a soil layer. While the site slowly becomes more ecologically friendly, the trees provide the added service of improving aesthetics.

A NEW LOOK AT TREES ON LEVEES

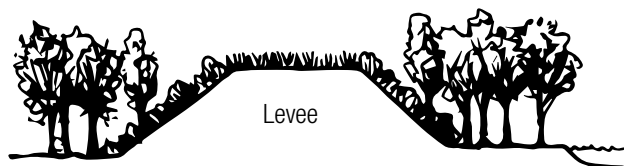
Historically, trees have not been a part of levee systems, but it is time to reconsider the role of trees. As policy toward trees is reviewed, several levee system designs have been suggested for consideration by U.S. Forest Service researchers. The techniques are based on a concept that is appropriately called armoring — with trees acting as the armor, or shield, to protect the human-made flood barriers.

RIVERSIDE ARMORING



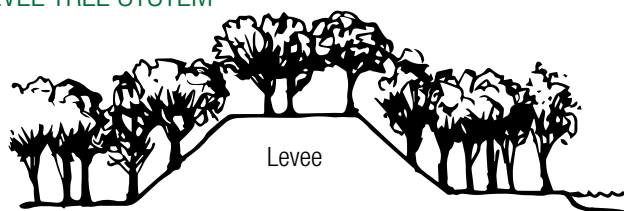
In this system, trees are planted on the river side to help protect the levee against wave wash. The levee itself is planted with shrubs on one side. Wildlife habitat and aesthetics are enhanced and there is easy access to the top and inland side of the levee. A variation on this method is to extend the shrub zone to the second side of the levee for expanded wildlife habitat.

DOUBLE ARMORING



In what might be thought of as double armoring, a corridor of trees is provided on both sides of the levee. The trees can extend midway up the levee where they are replaced by an upper zone of shrubs. The levee crest remains in grass to provide an access route. This method adds several benefits: increased lower levee slope protection, an opportunity for the periodic sale of wood products, and increased wildlife habitat diversity, debris trapping, and filtering action.

LEVEE TREE SYSTEM



Trees dominate in this scenario. In addition to providing all the benefits described above, this method comes closest to restoring a complete riparian ecosystem while at the same time having a levee to control floods. The greatest disadvantage is loss of easy inspection access.

Should trees be planted on the levees that protect towns, fields, and other low-lying areas from floods?

NO...SAY SOME ENGINEERS

- Seepage might occur due to tree roots.
- Trees uprooted by wind may lead to reduced stability and levee failure.
- Trees can hinder inspection and flood fighting.
- Woody material on levees is not currently an accepted policy by federal agencies.

YES...SAY SOME RESEARCHERS

- Tree-related levee failures are based on speculation, not documented occurrences. In fact, some evidence shows a dramatic increase in levee failures as woody corridor width decreased.
- Access for inspection and flood fighting can be safeguarded by designing for trees and travel.
- Trees and other woody vegetation slow flood velocity, protect streambanks, reduce slope failure, and offer important benefits year-round.

Source: Flooding and its Effect on Trees (U.S. Forest Service).

AFTER THE FLOOD

Most people breathe a sigh of relief when flood waters subside, but if you are responsible for trees, the trouble may be just beginning. A flood causes stress on trees, and stress renders trees less able to ward off insect and disease attacks. Stress often reveals itself through symptoms such as leaf yellowing, defoliation, reduced leaf and shoot size, early fall coloration and leaf drop, heavy sprouting, large seed crops, and crown dieback.

Riparian trees need to be inspected immediately after a flood and regularly in the coming months. Post-flood treatment should include:

- ✓ Removing debris from the trunk down to soil level.
- ✓ Pruning damaged limbs.
- ✓ Removing trees made hazardous by the flood.
- ✓ Inspecting regularly for disease and insect outbreaks, and treating as necessary.
- ✓ Making extra efforts to enhance tree vigor — aerating, mulching, and watering if drought follows.

Communities in Action

Some developers view waterways as a nuisance; others see them as valuable attributes that will enhance sales and make life more pleasant for the residents. Some communities treat their creeks and rivers like unwelcome guests, something to be tolerated and hurried out of town; other municipalities welcome the presence of flowing water and make it the centerpiece of community life. The difference is up to you. Throughout the nation there are good examples to follow. Here are just a few.

TREES AND TABLE CREEK AT ARBOR DAY FARM

When flood waters washed out a county road in Nebraska City, Nebraska, the banks of historic Table Creek were scoured and washed away by the resulting debris and rampaging waters. Following the flood, local officials and the Arbor Day Foundation immediately began planning to replace the road and restore the streambanks while at the same time demonstrating the use of bioengineering techniques recommended by the Natural Resources Conservation Service. Live fascine and live cribwall methods described on page 4 were used to stabilize Table Creek below the road. The project, like others demonstrating trees in action, can be seen while visiting Lied Lodge & Conference Center at Arbor Day Farm.

The storm caused a wash-out (above), but careful planning brought back a stable creekbed anchored with vegetation (below).



PLANNING AHEAD FOR DEVELOPMENT

Not far from Moscow, Idaho, is the developing bedroom community of Troy. Just outside town a small creek flows through 86 acres of forested, city-owned property. When forestry consultant Cliff Todd noticed this parcel on a map, he proposed a far-sighted management plan that could work not only in Troy, but many places where city and country are meeting head on. The concept, called the Dutch Flat Stewardship Plan, calls for both riparian restoration and active forest management.

Riparian activities include engineering a fish passage through an abandoned dam spillway, creating pools for improved aquatic habitat, eliminating grazing, and planting trees close to the creek to provide shade. Timber management on the nearby slopes can thin dense stands of low grade lodgepole pine and favor valuable species such as spruce, Douglasfir and ponderosa pine. Selection cutting, a tightly-written logging contract, and “skidding” logs without building new roads, has been used for crop tree removal without damaging riparian resources. The first improvement cut alone provided over \$65,000 used by the community to clean up a dump by the creek, build a hiking trail, and pay for the planting of riparian trees.

A rural setting today, a community park tomorrow, and an important role for trees.



PUTTING THE PARADISE BACK IN PARADISE CREEK

Paradise Creek flows out of the gentle farmland of the Palouse Prairie in northern Idaho and into the community of Moscow. Once the delight of pioneer children for fishing and playing, and before them the Nez Perce Indians who camped on its banks, the creek had become little more than a murky ditch. Modern agriculture, urbanization, and a philosophy of “stream straightening” combined to transform the once-beautiful Paradise Creek. Today, thanks to local activists, a grant from the Clean Water Act, and the dedication of 3 acres of public school property, part of the creek has been restored and other sections are being added. The project provides riparian habitat, demonstrates natural flood control, serves as an outdoor study area, and showcases what is possible elsewhere along the banks.

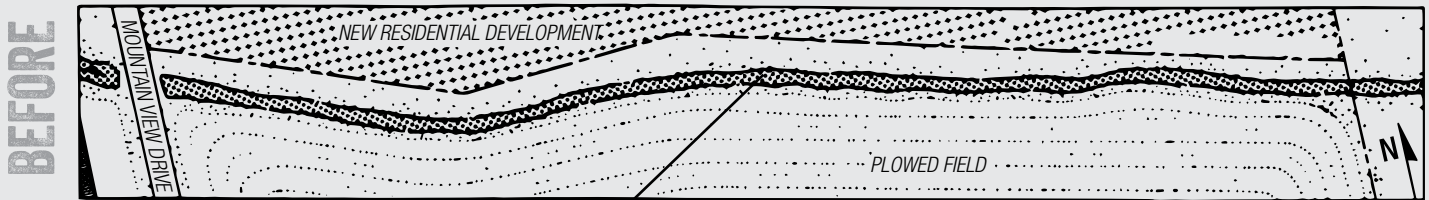
Techniques used in the restoration include:

- Restoring a meandering channel to reduce the erosive power of the creek and improve bank stability.
- Changing the straightened channel from one maintained to accommodate occasional large flows to one that offers a “two-stage” method of flood protection. As seen in the cross section, this essentially restores the flood plain, giving occasional flood waters a place to safely spread out.
- Providing safe access to the creek by “laying back” the existing steep banks.
- Installing bioengineered structures to stabilize streambanks.
- Planting trees and other riparian vegetation that has long been missing from the ecosystem.



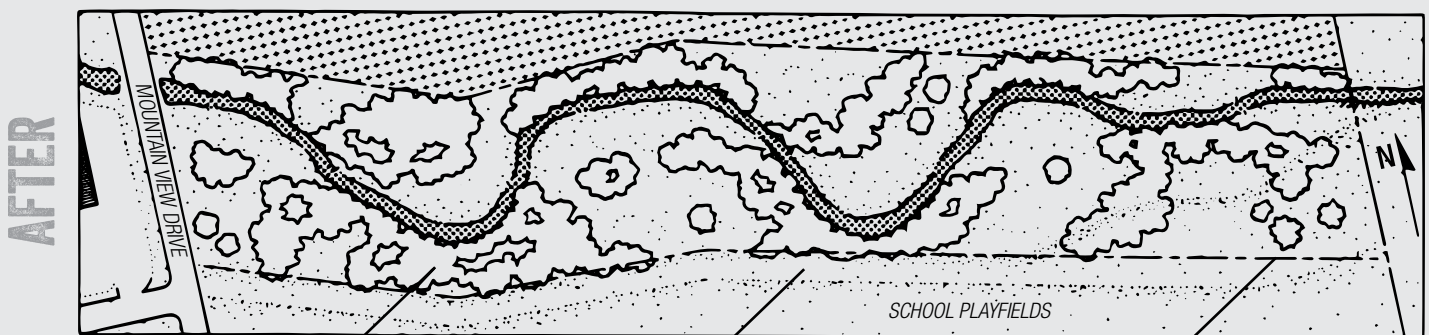
The restoration of Paradise Creek in Moscow, Idaho, provides riparian habitat, demonstrates natural flood control, and serves as an outdoor study area.

PREVIOUS CONDITIONS



Narrow, reed canarygrass-covered riparian fringe

REHABILITATION



Woody vegetation (canopy)

Low bern (future trail)

Approx. limit of stream corridor rehabilitation

The Importance of Water

Here is a philosopher's question. Which is most important – soil, air or water? In reality, we need all three if life is to continue on earth. Trees play an essential role protecting all three. Roots hold the soil in place to prevent erosion while fallen leaves recycle nutrients and improve structure. Living leaves provide oxygen in the air, soak up carbon dioxide and trap dust and other pollutants, and water quality is protected as roots keep soil and harmful chemicals from becoming contaminants. When trees and shrubs shade water, they help cool water temperature, making it more livable for desirable species of fish and other aquatic life forms.

Although water covers more than 70 percent of Earth's surface, only about one percent of it is available as a source for drinking. The amount of this precious commodity remains constant while our population and industrial demands keep growing. More than ever, communities need to appreciate and protect their water supply – and the trees that are so important to it. Tree boards play an important role in bringing this awareness to residents. As the chief of the Forest Service once told a

convention of foresters, "We need to help urban people understand the connection between forests and the water that comes out of their tap." And those forests begin right in our own backyards and along our streets.

The Cedar River Watershed Education Center near North Bend, Washington, helps visitors better understand the role between trees and water quality.



FOR MORE INFORMATION ...

For more sources of information about the topics in this bulletin, please visit arborday.org/bulletins.

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