



A guide to planting
riparian buffers for
healthy streams.



ri·par·i·an

ri'pe(ə)rēən, rī'pe(ə)rēən

adjective

of, relating to, or situated on the banks of a river or stream

If you have a stream running through or along your property, this guide is for you.

It is designed to help you keep the stream and the aquatic life in it healthy, keep the water clean, manage stormwater, and keep soil from eroding.

By far the best way to do this is to create and maintain buffers of trees and plants along the banks of the stream. These buffers protect the stream and the life within it.

This guide will tell you *what* riparian buffers are, *why* they are important parts of the ecosystem, and *what* benefits they provide. Most importantly, it will tell you *where* your buffer should go, *how big* it should be, *how* to plan a buffer, *what* trees and plants to choose (and what *not* to plant,) *how* to plant and maintain them, and *where* to get more information.

Most communities now have riparian setback ordinances in their zoning codes that prohibit building or paving within a certain number of feet of a streambank. To find out about your community's riparian setback code, you can contact your municipal building department.

The building code is important, but a setback ordinance only determines distance – how far from the streambank you may build or pave. Most of these ordinances do not require you to plant vegetation, or let your grass grow, within that setback, so they do not go far enough to protect the stream itself.

Whether or not your community has a setback code, it is important to protect the stream with vegetation - trees and plants other than turf grass - and to stop mowing your grass up to the edge of the stream. If you can only do that one thing – stop mowing within the setback – that will help, and you can stop reading this guide. But if you want to create a vibrant, beautiful, healthy stream, read on to learn about the benefits and to find out how to make your property a better streamside neighbor.





What is a riparian forest buffer? (and why you should care about yours)

It doesn't matter what you call the stretch of land along the streambank. Call it the streamside, the riparian zone, or the buffer zone. It's up to you. The important thing is that you make it an area filled with trees and plants.

We'll call it a riparian forest buffer, because those two words describe where it is (riparian: along a river or stream,) what it's made of (forest: trees and woody plants,) and what it does (buffer: separates or prevents one thing from harming another.)

Why is this important?

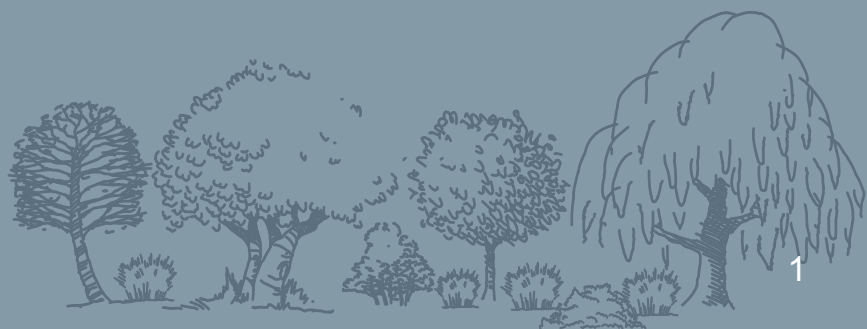
There's a reason why the healthiest streams are those that are surrounded by woods.

The fish that live in our streams, and the smaller creatures that the fish eat, need water that stays within a certain range of temperatures. Trees provide the shade that keeps the water cool. Leaves that fall into the stream feed the insects that live in stream bottom (they're called "macroinvertebrates," by the way,) that feed the fish. No leaves, no bugs. No bugs, no fish. And birds need habitat, too, so a buffer will also provide food and shelter for them.

Riparian buffers keep pollution, like fertilizer used on lawns, farms, or gardens, out of the stream. Anything that washes off the surface gets into streams, and our fresh water sources have too much nutrients, like phosphorous, in them. Buffers help keep what's on the land where it belongs - on the land, not in the water. They block or absorb the pollution before it runs into the stream.

Your stream is part of a larger system. Small streams flow into larger streams, and join even larger rivers, and eventually empty into lakes or oceans. Small backyard streams are the nurseries for living things that will move downstream as they grow.

What happens in your stream doesn't stay in your stream. It affects all the water and aquatic life downstream, so the better the life in and around your stream, the better the whole living system works.



The Benefits of Better Buffers

Riparian forest buffers provide benefits for property owners beyond just good ecological stewardship. They can protect and increase the value of your property, improve your health, manage stormwater, keep your land from eroding, provide greenways for wildlife to move through, and cool and clean the air.

Protecting property

- Areas without roots to hold soil in place let erosion carry land from your property into the stream and can eventually destabilize structures.
- Forest buffers reduce flooding on your property by blocking or absorbing stormwater. Buffers provide floodplain storage for stream overflows.
- Streamside forests provide habitat and passage for deer and wildlife, making it less likely they will eat your tulips.

Economic Benefits

- Restoring degraded streams is quite expensive. Planting trees is much less so.
- Wooded property is significantly more valuable and marketable than unforested land, and the benefits grow as the trees grow.
- Leaves that are used as mulch or compost reduce the cost of maintaining landscaping in other areas of your property.

Improving health

- Humans benefit from the shade, as well as from the cleaner, moister air that trees provide.
- Studies have shown that views of trees improve mental health, speed recovery from illness, support better learning outcomes among children, and provide a general sense of well being.

Community Benefits

- Trees and shrubs interrupt heavy rain, and hold snow in their branches, reducing flooding and stream bank deterioration and reducing the need for costly repairs and built infrastructure.
- Forested buffers reduce litter and debris.
- They reduce the cost of maintaining storm structures.
- Connected riparian areas can provide places for recreation and healthy outdoor exploration.

Good buffers make good neighbors. Consider engaging the neighbors who own the sections of streambank next to you to improve their buffers, too. And if others own the land on the other side of the stream, encourage them to buffer their side of the stream.



Riparian Forest Basics

Bigger is better

Large trees are more effective at riparian restoration than small trees.

- Larger canopies interrupt more rain, give more shade over larger areas, and offer more bird habitat.
- Larger roots and trunks absorb and hold more water to reduce flooding.
- Larger leaf size and more leaves draw in more carbon dioxide, release more fresh air, cover more ground to cool the soil, and create more new soil that feeds the rest of the forest plants.
- Their size allows them to shelter smaller and younger trees.

Think of layers and ages

Although large trees are the basis of a healthy forest, it is important to include trees and plants that fill all the levels from canopy to earth.

- Include smaller understory trees that grow in the shade of larger trees. These add visual interest, provide windbreaks, and develop fruits that feed wildlife. They grow faster than larger trees, so benefits are seen sooner.
- Plant trees of different ages. A forest is like a family, with new generations growing to take the place of older ones.

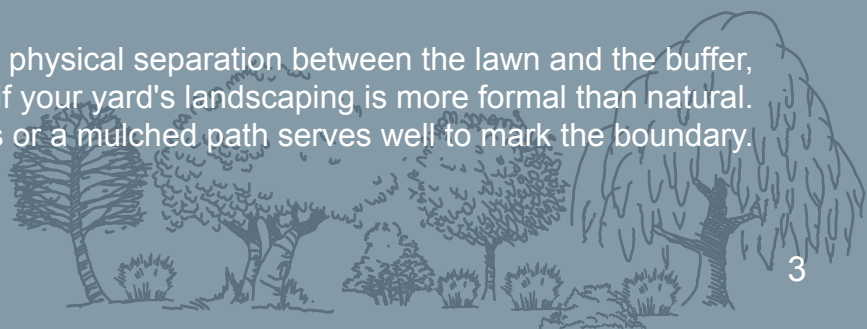
Diversity means longevity

Plant a lot of different species. Pests like Emerald Ash Borer attack specific tree species, and if you plant too many trees of the same species, and they all die at once, you'll lose a major portion of your forest.

Leaves rather than needles

- Deciduous trees (the ones with leaves) are more important to a healthy riparian buffer than conifers (evergreens with needles and cones.) They provide more food and shelter to aquatic life.
- When deciduous trees lose their leaves in winter, they allow sunlight to penetrate to the forest floor and the stream. It's how nature moderates soil and water temperatures.
- You can include conifers if a visual barrier or windbreak is important to you, but know that their needles increase acidity in the water and soil as they break down.
- Fallen leaves cover the ground more completely than needles, and break down more readily to create new soil.

Consider creating a physical separation between the lawn and the buffer, especially if your yard's landscaping is more formal than natural. A row of stones or pavers or a mulched path serves well to mark the boundary.



Where to begin...

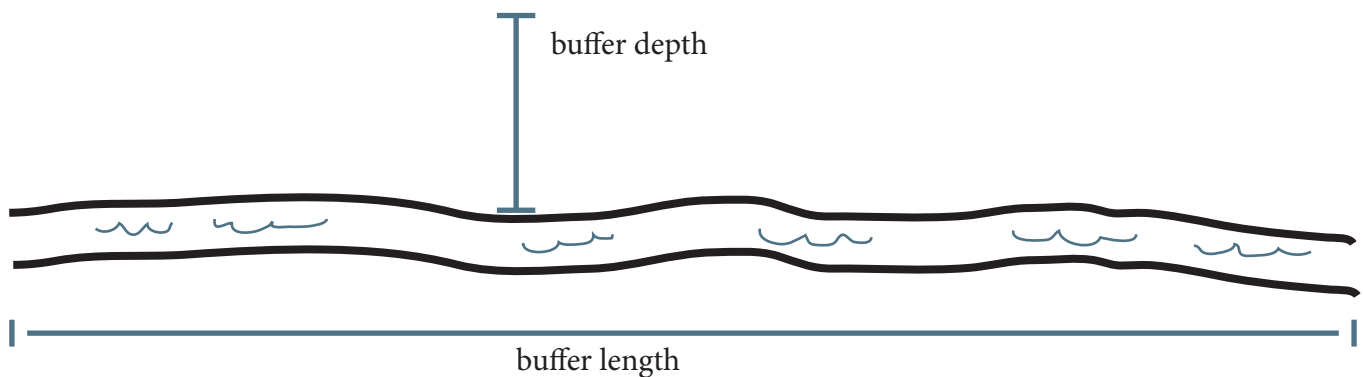
Where to begin?

First, measure and define your buffer area:

1. Measure the depth of your riparian buffer. Start at the point where the water starts when the stream is full, or start at the edge where the bank drops off, and measure the distance back from that point.

Use your community's riparian setback distance, if there is one, as a minimum depth. Larger areas of land that drain to the stream require deeper setbacks. The more water that runs off, the deeper the buffer should be. Figure a minimum depth of 25 feet.

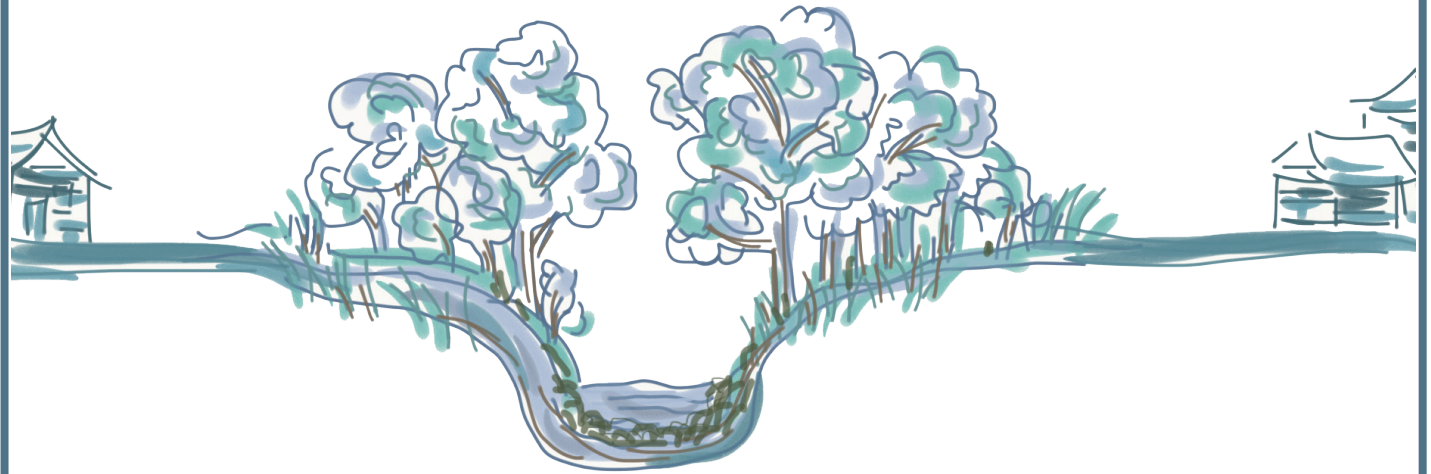
2. Next, measure the length of the stream edge along your property.



The best way to start your project is to walk your property and observe the landform as well as the surroundings. Really look at things you may not have noticed for years.

See where the land rises and falls. Note where water gathers. Mark where floodwaters reach when the stream rises. Identify the plants that are growing there now, and what grows upstream or downstream.

...and what it will look like when you're done



Let the grass grow! - Once your trees and shrubs are established, meaning they have started to grow new leaves the second spring, stop mowing the lawn around them. Tall grasses are a natural buffer. As the trees and shrubs grow, their shade will keep the grass down.

If your community requires that you mow your lawn to no higher than 6", make sure that your building or housing department knows that your stream buffer is separate from your lawn.

Worksheet

Use the planning grid to draw your site, with rectangles representing units that are 50' long and 25' deep.

A. LENGTH OF BUFFER (if your property includes both sides of the stream, enter the total of both sides) : _____ feet.

B. DEPTH OF BUFFER(s) : _____ feet.

C. How many units? Divide "A" by 50. This will tell you how many 50' long and 25' deep units you'll be planting. If your buffer will be 50' deep, double the amount in "C". If it's to be 37' deep, multiply the amount in "C" by 1.5. In this case, you'll have a buffer that is one and a half units deep.

NUMBER OF UNITS: _____

D. How many trees? Each 50'-long unit contains 1 large tree, 6 medium-size trees and 8 seedlings or shrubs.

Large trees (6' tall or larger when planted, largest canopy when mature):

_____ units X 1 = _____ large trees

Additional large trees: Because you'll be planting the largest trees 25' apart, you'll add one large tree between each unit and one on each end of the entire buffer:

_____ units + 1 = _____ additional large trees

Medium trees (container trees when planted, large or understory when mature):

_____ units X 6 = _____ container trees

Shrubs or seedlings (young trees of any size or multi-stemmed shrubs):

_____ units X 8 = _____ shrubs or seedlings

Example: If you have 200 feet of buffer, 25' deep, you'll have:

- 4 units
- 9 large trees (one each unit plus additional trees between units)
- 24 medium container trees
- 24 shrubs or seedlings

Beyond these, you can fill the spaces with shrubs or grasses to the extent your budget allows.

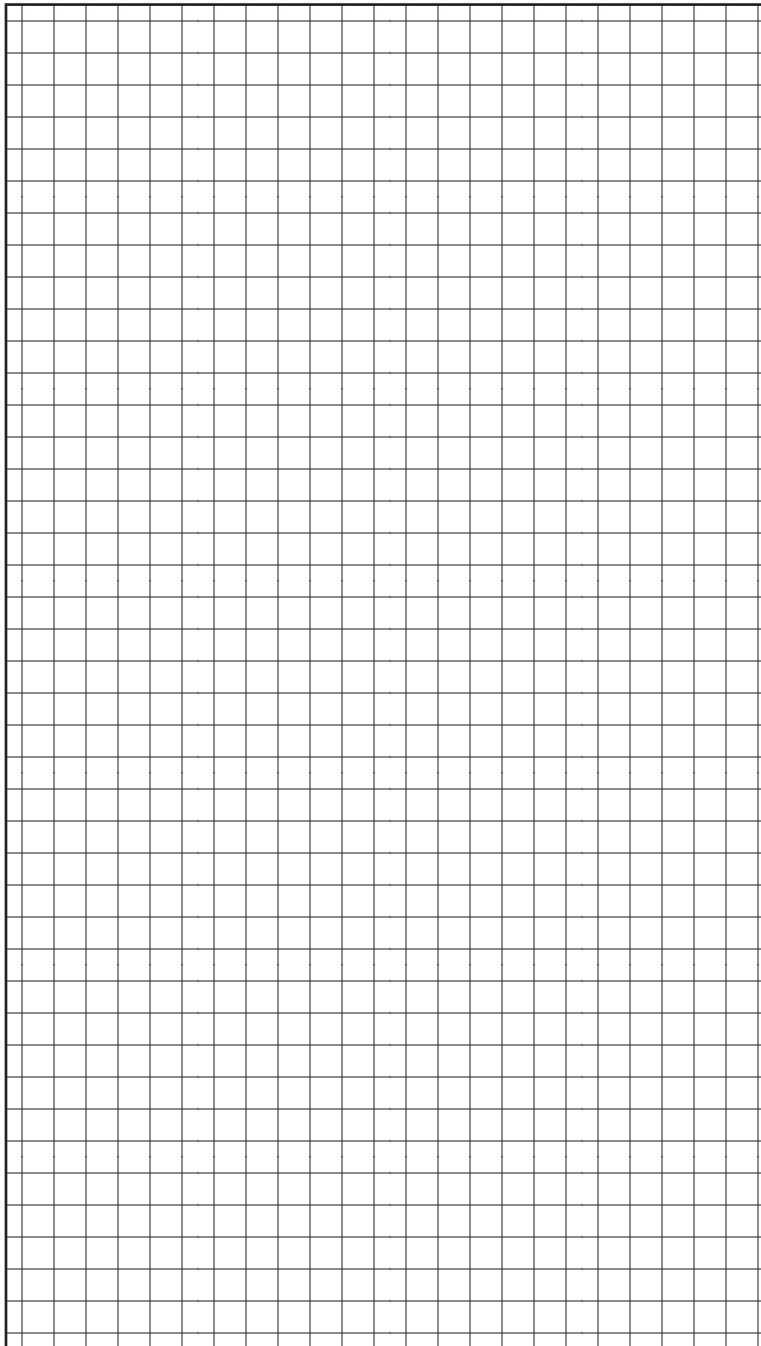
Remember, you are planting for the future as well as the present.

So when we say "large" or "medium" in this guide we're usually talking about how big the tree will be when it grows to maturity.

On the worksheet we're also referring to how big (which sometimes means "how old") the tree is when it's planted.

Planning Grid

Copy and use this grid, or use graph paper, to draw your stream and the depth of your buffer, and count your units. Use another sheet to mark the locations of different species and sizes of plants.



Shopping List

of Large Trees ____

Species:

_____	_____
_____	_____
_____	_____

of Medium/Understory Trees ____

Species:

_____	_____
_____	_____
_____	_____
_____	_____

of Small Trees and Shrubs ____

Species:

_____	_____
_____	_____
_____	_____
_____	_____

Groundcover:

_____	_____
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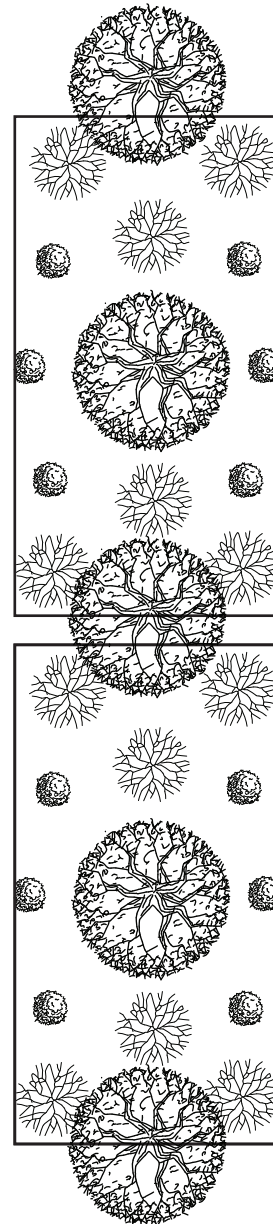
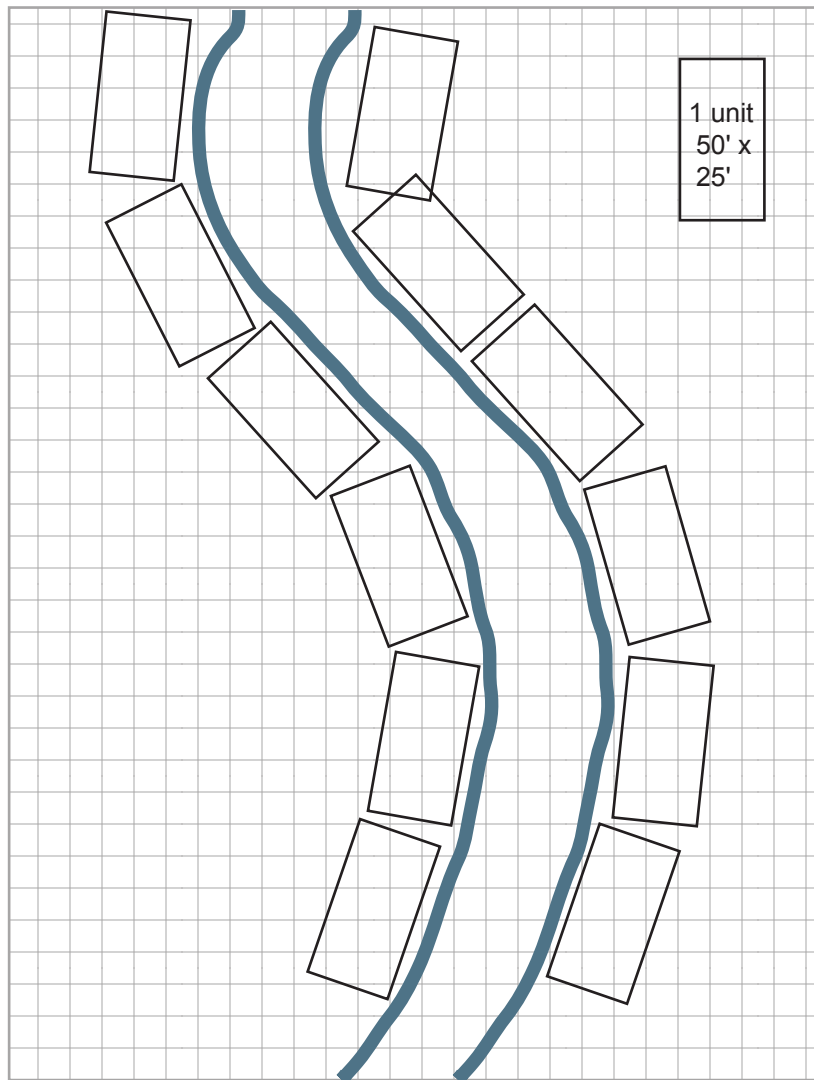
The idea is to include a variety of generations when you plant, so that some are older and some are babies, while others are just reaching adolescence.



Example - 25' deep, two sides

Example:

This buffer will be 300' long and 25' deep, planted on both banks.

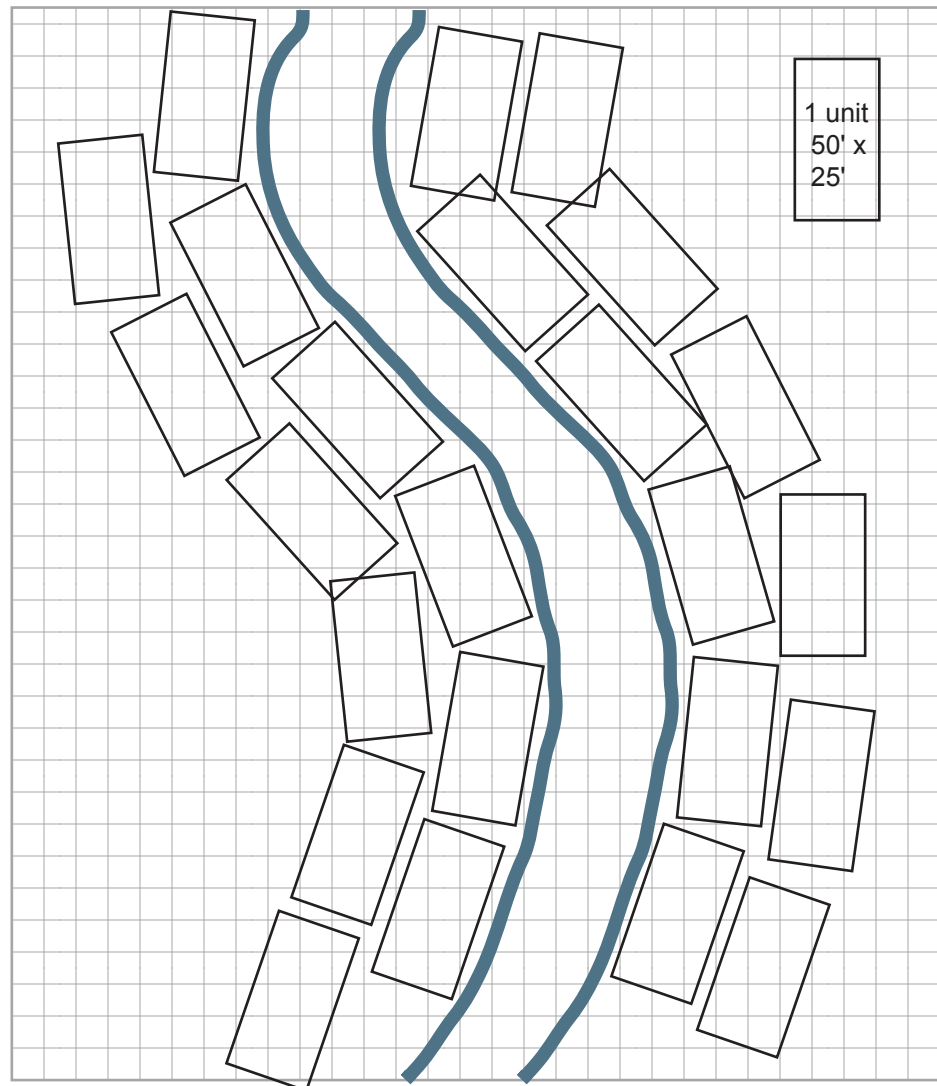


A 25' buffer is the minimum depth for a meaningful buffer.
50' is better if you have the room.
100' is the best, especially if your stream floods often.
But...even a single line of trees and vegetation is better than nothing.

Example - 50' deep, two sides

Example:

This buffer will be 300' long and 50' deep, planted on both banks.



If your area can accommodate a deeper buffer but your budget cannot, consider spreading the units apart and filling the spaces with more small trees, shrubs, native wildflowers and native grasses. The point is to get as much vegetation, other than turf grass, growing along the stream so the roots can soak up water and keep it from flowing across the land.

What to plant

Plant natives

Native trees and plants are those that have traditionally made up the ecosystem we live in. They provide the food and shelter for fish, birds and animals that live here and have evolved in the same ecosystem. They have the best chance of survival, since their needs and the climate, soils, wildlife and other characteristics of the local ecosystem work as a unit. They have the deepest root systems and therefore can absorb more water and stabilize soils better than non-natives. If an exotic plant's leaf falls into a stream, but the macroinvertebrates there can't eat it, it hurts more than helps.

Plant a diverse mix of species

Mix up the kinds of trees and plants you use. Figure that no more than 20% of your project should include any one type (maple, oak, tulip tree, willow.) If a pest comes in and wipes out a specific species, you won't lose more than a fifth of your trees. And a diverse mix of plants means you'll have a diverse mix of fish and birds.

Plant trees that provide habitat

That means trees with leaves that shade and fall into the stream, with roots and branches that provide shelter, and with berries, nuts or seeds that feed wildlife.

Plant different sizes and ages

Use young trees and older larger trees so there will be a succession as new generations grow in. Choose some that will grow quickly to fill the space, and others that grow slowly to become big and strong.

Cover the ground

Use shrubs, especially multi-stemmed shrubs like dogwoods or shrub versions of trees like serviceberry, to fill in the lowest level of the forest. These will spread roots to hold soil and water while trees' roots grow in and among them, and are especially effective along the edge of the stream. They also offer habitat to birds and small animals.

Planting the right tree in the right place will guarantee success. Some trees need full sun, others don't. Some like wet feet and can tolerate standing in water, some can't. Check the needs of the trees you choose. Ones with "river" or "swamp" in their name can be obvious about their preferences, but ask the nurseryman if you're not sure.



What NOT to plant

Don't plant exotic species

Exotic species are ones that have been imported from other countries or areas of the country and have not evolved as part of the local ecosystem. It may be difficult to resist that lovely Japanese maple, but let exotic species only make up a tiny portion of the planting. Avoid them entirely if you can. They don't provide food or habitat for native fish or animals, they need more care and maintenance, and their roots don't stabilize soils as well as natives.

Think of exotic species as if they were an alien family that moves into your house, empties your pantry and replaces the foods you can eat with their own foods that you can't eat. This is what happens to wildlife when invasives move in. Not a good thing.

Don't plant invasive species

An invasive species is one that spreads so fast and so widely that it takes over and crowds out other plants or climbs and smothers trees. Invasive plants can be native, but you have to avoid those. Some of the most problematic ones are Japanese knotweed, buckthorn, morning glory, wild grapevines, garlic mustard, common reed grass (phragmites,) and purple loosestrife.

Don't plant too much of one thing

Diversity is important. Monocultures are not only boring, they don't provide enough different kinds of leaves, habitat, roots or food to support a diverse collection of birds and bugs and fish.

Don't plant turf grass

The grass on our lawns is neither native nor natural, which is why it takes so much work. The fertilizer it takes to keep it green runs off into streams, makes algae grow, and that removes oxygen that fish and aquatic bugs need to live. The pesticides that kill the weeds also run into streams to kill all kinds of insects that fish need to live on. Lawn grass is not good at absorbing stormwater. It is about as impervious as your driveway.

If your streambank has invasive species growing along it, remove the invaders before you plant or your new planting won't stand a chance.



Suggested trees and shrubs for wet soils

For wet sites closest to the stream

Common Name	Scientific Name	Height
-------------	-----------------	--------

Large/Canopy Trees

Red Maple	<i>Acer rubrum</i>	40'-60'
Silver Maple	<i>Acer saccharinum</i>	50'-70'
River Birch	<i>Betula nigra</i>	40'-70'
Sycamore	<i>Platanus occidentalis</i>	75'-100'
Cottonwood	<i>Populus deltoides</i>	75'-100'
Swamp White Oak	<i>Quercus bicolor</i>	50'-60'
Pin Oak	<i>Quercus palustris</i>	60'-70'
Bur Oak	<i>Quercus macrocarpa</i>	80'-100'
Sweetgum	<i>Liquidambar styraciflua</i>	80'-100'

Medium Trees

Box Elder	<i>Acer negundo</i>	30'-50'
Black Gum	<i>Nyssa sylvatica</i>	30'-50'
Black Willow	<i>Salix nigra</i>	35'-50'
Weeping Willow	<i>Salix babylonica</i>	30'-40'
Beech	<i>Fagus grandifolia</i>	30'-50'
Chokecherry	<i>Prunus virginiana</i>	20'-30'

Shrubs/Small Trees/Understory Trees

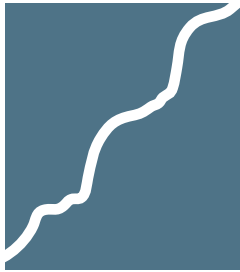
American Hornbeam	<i>Carpinus caroliniana</i>	20'-30'
Silky Dogwood	<i>Cornus amomum</i>	15'-20'
Sumac	<i>Rhus hirta</i>	20'-25'
Buttonbush	<i>Cephalanthus Occidentalis</i>	6'-15'

These lists are suggestions.
All are native to Ohio and the region.

Few trees and shrubs enjoy having their roots in wet soils for long periods of time, but those on the list do need a lot of water so are favored in areas that take a long time to drain.

Most of the trees in the "wet" list will do well in upland areas as long as soils have water draining through them on a regular basis.

Explorers settling the American frontier looked for certain trees to guide them to water. They knew that a willow or sycamore, which could be recognized from afar, signaled that there would be ample water for a good settlement site.



Suggested trees and shrubs for well-drained soils

For well-drained sites along riparian areas

Common Name	Scientific Name	Height
-------------	-----------------	--------

Large/Canopy Trees

Black Maple	<i>Acer nigrum</i>	50'-70'
Yellow Birch	<i>Betula lutea</i>	50'-70'
Shagbark Hickory	<i>Carya ovata</i>	60'-80'
Common Hackberry	<i>Celtis occidentalis</i>	50'-75'
Kentucky Coffeetree	<i>Gymnoclaus dioicus</i>	60'-75'
Butternut	<i>Juglans cinerea</i>	40'-60'
Black Walnut	<i>Juglans nigra</i>	50'-75'
Tulip Poplar	<i>Liriodendron tulipifera</i>	70'-90'
Cucumber Magnolia	<i>Magnolia acuminata</i>	50'-80'
Wild Black Cherry	<i>Prunus serotina</i>	50'-60'
Red Oak	<i>Quercus rubrum</i>	60'-75'
Hardy Catalpa	<i>Catalpa speciosa</i>	40'-60'

Medium Trees

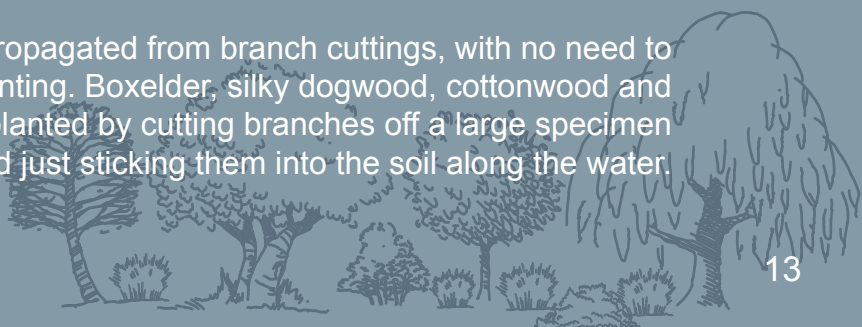
Ohio Buckeye	<i>Aesculus glabra</i>	20'-40'
Black Gum	<i>Nyssa sylvatica</i>	30'-50'
Quaking Aspen	<i>Populus tremuloides</i>	40'-50'
Eastern Redbud	<i>Cercis canadensis</i>	20'-30'

Shrubs/Small Trees/Understory Trees

Allegheny Serviceberry	<i>Amelanchier laevis</i>	20'-25'
Common Pawpaw	<i>Asimina triloba</i>	15'-20'
Flowering Dogwood	<i>Cornus florida</i>	15'-30'

The trees on this list grow well in the part of the buffer area that isn't wet all the time. "Well-drained" means places where soil doesn't stay saturated but allows water to percolate through.

Some trees can be easily propagated from branch cuttings, with no need to root them in pots before planting. Boxelder, silky dogwood, cottonwood and willows are ones that can be planted by cutting branches off a large specimen and just sticking them into the soil along the water.



When, how and where to buy your trees and plants

Trees are best planted in very early spring (before mid-May,) while trees are still dormant – before the leaves come out – or in fall (October) after the leaves are off the tree. Summer planting is stressful for trees in their growth period, and you have to do a lot more watering.

If you have a landscaper do the work, or have a team of strong folks with big trucks, you can get balled-and-burlapped specimens for the largest trees. Otherwise, try to get a landscaper to order bare-root trees. They're easier to handle and plant.

Container trees are readily available at garden centers, but the quantity you need may not be in stock all at once. Make arrangements in fall for a planting the following spring, or early spring for fall planting, so you can order what you need well in advance.

There are excellent nurseries in Ohio, Pennsylvania, and Indiana, with websites where you can order most of the container plants you need and have them shipped to you.

Maintaining your riparian forest

Got deer?

If deer are present in your neighborhood, you'll need to keep your trees and shrubs from becoming deer dinner. You can purchase deer guards from forest supply houses like A. M. Leonard, or make your own cylinders of chicken wire.

Water a lot

Water regularly and amply. Five gallons per inch diameter of trunk when you plant, five more per tree every week during which you don't get a few inches of rain. If there's water in your stream, use it to water the trees. Scoop it out with a bucket on a rope. Kids love to help with this part.

To mulch or not to mulch? It's up to you. If you want to give the new trees a chance to get established before grass grows around them and competes for water and nutrients, then by all means, mulch. It will keep you from damaging the trunks with your weed whacker.

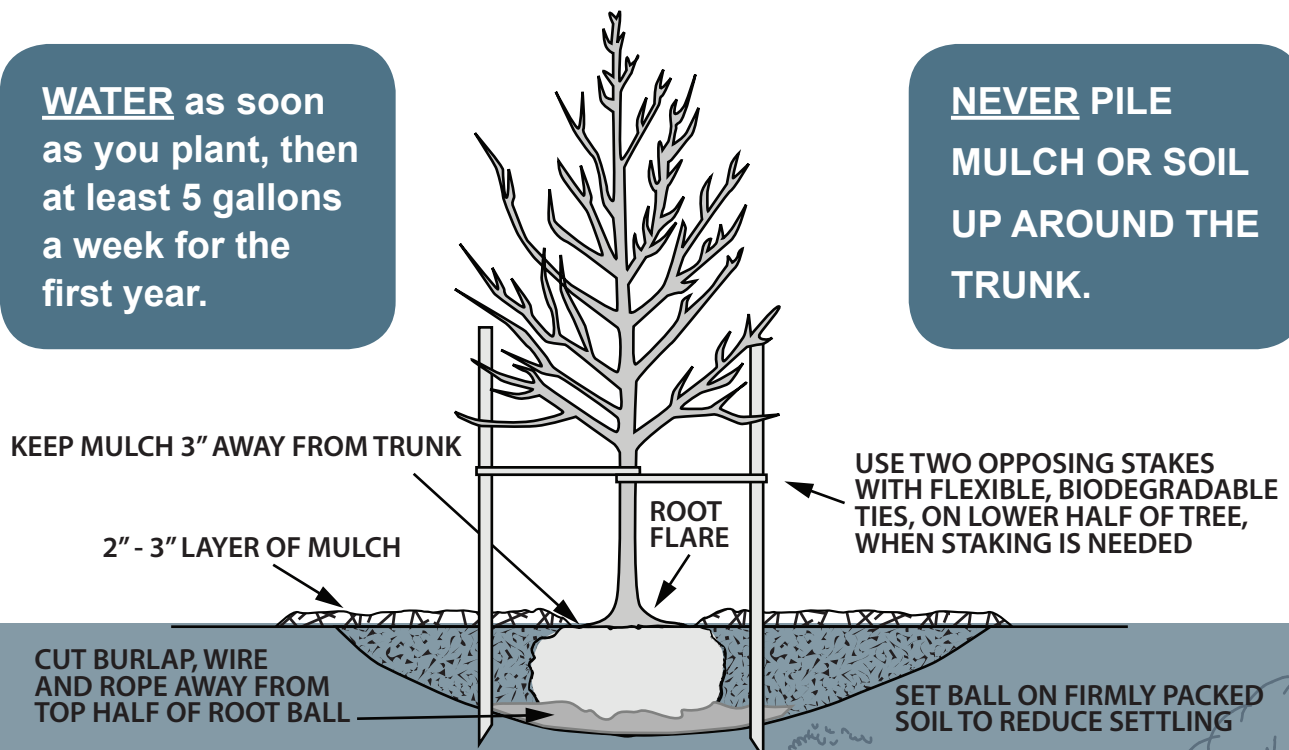
How to plant a tree (or just about anything)

Whether your tree or shrub comes balled-and-burlapped, or in a pot, or as a bare-root tree or seedling, there are a few basic rules that must be followed in order to give your new planting a fighting chance:

1. Dig the hole at least twice as wide as the root system.
2. Dig it as deep as the ball or pot to start.
3. Find the "root flare," the place at the base of the trunk where it starts to spread out just above the topmost root. You might have to dig away soil to find it, since nursery plants are often planted too deep in their pots or balls.
4. If using container or bare-root plants, spread the roots out on a pile of soil built up in the bottom of the hole.
4. Adjust the planting depth so that the root flare shows just above ground level. Don't plant too deep, and don't plant too high.
5. Keep mulch at least a hand-length away from the trunk.

WATER as soon as you plant, then at least 5 gallons a week for the first year.

NEVER PILE MULCH OR SOIL UP AROUND THE TRUNK.



Additional Resources

Riparian Setbacks

Summary of riparian setback codes for Northeast Ohio communities:

www.crwpp.org/files/riparian_regulation_summary_ohio_august2013.pdf

Stream protection and restoration

Life at the Water's Edge - www.summitswcd.org/forms/Waters_Edge.pdf

Understanding the Benefits of Healthy Riparian Areas - <http://ohioline.osu.edu/ls-fact/0001.html>

Chesapeake Bay Riparian Handbook: A Guide for Establishing and Maintaining Riparian Forest Buffers, USDA, Forest Service, Northeastern Area. 481 pgs.

http://www.chesapeakebay.net/content/publications/cbp_13019.pdf

Native trees and plants - sources

Riverside Native Trees (nursery and information)

<http://riversidenativetrees.com/>

Ohio Prairie Nursery (wildflowers and grasses; consulting)

<http://ohioprairienursery.com/cart/services.html>

Native Ohio Plants (nursery and good photos)

http://www.nativeohioplants.com/html/plant_descriptions.html

About trees, planting, care, benefits

Trees Are Good/International Society of Arboriculture

<http://www.treesaregood.com/treeowner/treeownerinformation.aspx>

Index of Ohio Trees (descriptions, photos, identification, information)

<http://forestry.ohiodnr.gov/trees>

Deciduous Trees for Ohio - OSU Factsheet

<http://ohioline.osu.edu/hyg-fact/1000/1082.html>

Urban Forestry

Ohio Department of Natural Resources, Division of Forestry

<http://forestry.ohiodnr.gov/urban>





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To our Cuyahoga River Remedial Action Plan (RAP) and Cuyahoga ReLeaf™ partners, thanks for always being there when we've needed you, whether to answer questions or plant trees.

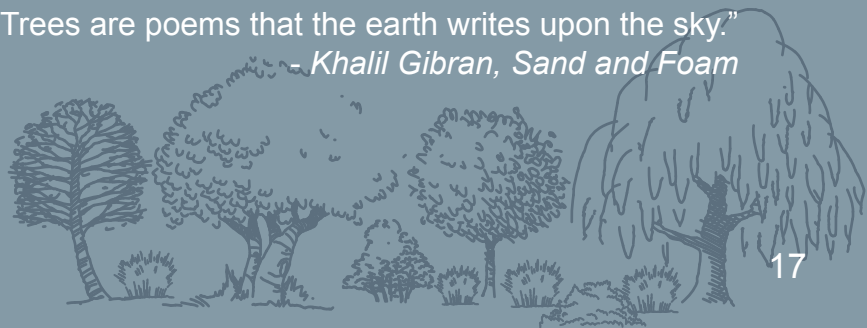
Thanks to Denny Taylor at Hiram College who lets us test our education efforts through his Igniting Streams of Learning in Science program, and the teachers and students who are our guinea pigs...er, field testers.

And thanks to all the volunteers who have dug and planted and mulched and watered the riparian forests we've restored, especially the Friends of Big Creek and Euclid Creek and the Mill Creek Partnership, the city arborists and the people who just love trees.

We learned a lot from you, and we hope others can now learn from us.

The Cuyahoga ReLeaf Team

"Trees are poems that the earth writes upon the sky."
— Khalil Gibran, *Sand and Foam*





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