

## Riparian Forest Buffer (Acre) 391

### DEFINITION

An area of predominantly trees and/or shrubs located adjacent to and up-gradient from watercourses or water bodies.

### PURPOSES

Improve and protect water quality by reducing the amount of sediment, pesticides, organic nutrients, and other pollutants in surface runoff, as well as in shallow groundwater flow.

Provide riparian wildlife habitat, maintain or restore water temperatures for fish and other aquatic organisms, and provide a source of large woody debris to form pools, help stabilize the channel bed, and create shelter for fish and other aquatic organisms.

### CONDITIONS WHERE PRACTICE APPLIES

On areas adjacent to permanent or intermittent streams, lakes, ponds, wetlands, and areas with groundwater recharge. Refer to Michigan Natural Resources Conservation Service (NRCS) Standard 393A, Filter Strip, for information pertaining to the establishment of riparian areas consisting of herbaceous cover only.

### CRITERIA

#### General Criteria Applicable To All Purposes Named Above

The location, layout, and density of the riparian forest buffer will accomplish the intended purpose and function. All buffers, **as a minimum**, will consist of Management Zones 1 and 2. The addition of Zone 3 (Filter Strip) will be required to trap and filter sediment, nutrients, and pesticides leaving cropland or other sparsely vegetated or erosive areas.

Zone 1 - This area is adjacent to the water and will contain the trees and shrubs needed to provide aquatic shade, insect habitat, bank

stability, and large woody debris. No harvesting of timber crops or grazing of livestock will be conducted in this zone in order to promote production of large woody debris and maintain bank stability (see Figures 1a, 1b, 1c, and 1d).

Zone 2 - This zone is landward of Zone 1 and will contain the trees and shrubs and other vegetation needed to filter runoff and provide uptake of nutrients and pollutants. Together, Zones 1 and 2 will provide a travel corridor and habitat for wildlife, in addition to producing shade and a source of large woody debris. Dominant vegetation will consist of existing or planted trees and shrubs suited to the site and the intended purpose. No grazing of livestock will be permitted in this zone to protect understory and forest floor vegetation. Harvesting and cutting of trees will be permitted in this zone as long as the intended purposes are not compromised. Harvesting specifications should be modified to retain a sufficient number of trees for shading of the stream, production of large woody debris, and to leave a stable, undisturbed forest floor (see Figures 1a, 1b, 1c, and 1d).

Zone 3 - This zone is landward of Zone 2 and consists of a strip of grass or herbaceous cover to spread and filter runoff which may be transporting sediment, nutrients, and pesticides off cropland or erosive or sparsely vegetated areas. Establishment of Zone 3 will be required when the control of sediment, nutrient, or pesticide pollution is necessary (see Figures 1a, 1b, 1c, and 1d and Table 2).

Site preparation and planting shall be done at a time and manner to ensure survival and growth of selected species. Only viable, high quality, and adapted planting stock will be used (see Michigan NRCS Standard 612, Tree/ Shrub Establishment). Site preparation will be sufficient for establishment and growth of selected species and be done in a manner that does not compromise the intended purpose.

Use vegetation adapted to the site that will accomplish the desired purpose. Preference shall be given to native species in order to: reduce the introduction of invasive plant species; provide management of existing invasive species; and minimize the economic, ecological, and human health impacts that invasive species may cause. If native plant materials are not adaptable or proven effective for the planned use, then non-native species may be used. Refer to the NRCS Field Office Technical

Guide (FOTG), Section I, Invasive Plant Species for plant materials identified as invasive species.

Any use of fertilizers, pesticides, and other chemicals shall be in accordance with labeling and not compromise the intended purpose(s).

The location, layout, and density of the forest buffer should complement natural features.

Any removal of timber or other crops shall be in a manner that maintains the intended purpose(s).

Any livestock access shall be provided in accordance with Michigan NRCS Standard 575, Animal Trails and Walkways.

Harmful pests present on the site will be controlled or eliminated as necessary to achieve and maintain the intended purpose(s).

Consideration will be given to allelopathy when selecting plantings.

Other applicable Michigan NRCS standards include, but are not limited to:

- Animal Trails and Walkways - 575
- Critical Area Planting - 342
- Fence - 382
- Filter Strip - 393A
- Forest Harvest Trails and Landings - 655
- Streambank and Shoreline Protection - 580
- Stream Channel Stabilization - 584
- Tree /Shrub Establishment - 612
- Use Exclusion - 472

#### **Additional Criteria To Provide Optimum Fish And Wildlife Habitat**

Specify in the management plan the type, amount, and distribution of vegetation required by wildlife and the management condition needed for survival and reproduction of sustained populations or communities. Avoid the use of non-native species of trees, shrubs, grasses, and forbs which may become hosts to undesirable pests. Species diversity should be considered to avoid loss of function due to species-specific pests.

Address riparian forest buffer restoration on a watershed basis to reduce forest fragmentation and provide corridors for wildlife by maintaining continuous streamside vegetation.

The management plan will consider habitat and population objectives such as: habitat diversity, habitat linkages, daily and seasonal habitat ranges, limiting factors, and native plant communities.

Riparian widths and tree species will vary depending on the requirements of the fish and wildlife species and associated communities of concern (see Table 1).

Corridor configuration, species selection, and management should enhance habitats for threatened, endangered, and other species of concern where applicable.

Where wildlife management is an objective, the food and cover value of the planting can be enhanced by using an approved habitat evaluation procedure to aid in selecting plant species and providing for other habitat requirements necessary to achieve the objective.

The plant communities established and target successional stage will depend on wildlife needs and existing resources in the watershed.

Snag retention is a critical component of the riparian forest buffer ecosystem.

#### **Additional Criteria To Protect Or Improve Water Quality**

Concentrated flow erosion or mass soil movement shall be controlled in the up-gradient area immediately adjacent to Zone 2 prior to establishment of the riparian forest buffer.

The native plant community will be maintained to optimize erosion and water quality functions of the riparian zone.

Establish alternative water sources or control access by fencing to manage livestock access to the stream and all zones of the riparian forest buffer.

The severity of bank erosion and its influence on existing or potential riparian trees and shrubs will be assessed. Watershed-level treatment or bank stability activities may be needed before establishing a riparian forest buffer.

Where ephemeral, concentrated flow erosion, and sedimentation is a concern in the area up-gradient of Zone 2, the application of a vegetated strip (Zone 3) consisting of grasses and/or forbs shall be required (see Michigan NRCS Standard 393A, Filter Strip).

When concentrated flow erosion and sedimentation cannot be controlled vegetatively, consider structural or mechanical treatments.

## CONSIDERATIONS

### **Location and Layout of New Riparian Forest Buffers in Areas Without Existing Woody Vegetation**

For a riparian forest buffer to achieve intended purpose(s), it must be properly located and sized (width, length, area) in relation to the stream or water body. The buffer is located immediately adjacent to the watercourse or water body needing protection or enhancement. For streams, one or both sides may need treatment.

### **Establishment of Riparian Forest Buffers to Reduce Pollution by Sediment, Nutrients, Pesticides, or Other Pollutants and Restore Overall Water Quality**

As a minimum, where soil erosion or nutrient or pesticide pollution is present or a concern, the riparian forest buffer will consist of Zones 1, 2, and 3. The total combined width of these 3 zones shall be no less than 55 feet. Zone 1 (identified as Zone 1 in Figure 1a) begins at the normal water line, or at the upper edge of the active channel, or shore or top of the bank and extends a minimum distance of 15 feet, measured horizontally on a line perpendicular to the water course or water body. Zone 2 (identified as Zone 2 in Figure 1a) extends immediately upslope from Zone 1 for a minimum distance of 20 feet. This zone will be managed to function as a zone of nutrient uptake and pesticide and pollutant entrapment. Zone 3 (identified as Zone 3 in Figure 1a) extends a minimum of 20 feet upslope, dependent on slope (see Table 2), from Zone 2. This zone will be established and managed in accordance to Michigan NRCS Standard 393A, Filter Strip.

Establishment of riparian forest buffers is not advised in areas of extremely high runoff or severe shoreline or streambank erosion unless Michigan NRCS Standard 580, Streambank and Shoreline Protection, measures can be successfully implemented. In such cases, these measures will be installed prior to the establishment of the riparian forest buffer.

### **Establishment of Riparian Forest Buffers to Provide Wildlife Habitat, Maintain or Restore Water Temperature, and Provide Large Woody Debris**

Riparian forest buffers established primarily for the above purpose(s) will contain, as a minimum, Zones 1 and 2. The total combined width of these two zones shall be no less than 100 feet. Zone 1 (identified as Zone 1 in Figure 1b) begins at the ordinary high water mark or at the upper edge of the active channel or shore or top of the bank and extends a minimum distance of 15 feet, measured horizontally on a line perpendicular to the water course or water body. Zone 2 (identified as Zone 2 in Figure 1b) extends immediately upslope from Zone 1 for a minimum distance of 85 feet. If soil erosion, nutrient, pesticide, or other pollution is present, Zone 3 will be required. Zone 3 will extend a minimum of 20 feet, dependent on slope (see Table 2), immediately upslope of Zone 2. Note: If Zone 3 is present, Zone 2 may be reduced to a width of no less than 65 feet.

### **Buffer Width Requirements for Selected Wildlife Species**

Widths below include the sum of buffer widths (Zones 1 and 2 combined) on both sides of water courses or water bodies and may extend beyond riparian boundaries. (In such cases, refer to Michigan NRCS Standard 612, Tree/Shrub Establishment, for establishment of upland forests.)

**TABLE 1 - RECOMMENDED WIDTHS (ZONES 1 AND 2 COMBINED) FOR VARIOUS WILDLIFE SPECIES ON BOTH SIDES OF A WATERCOURSE**

Species	Desired Width (Ft.)
Bald eagle, cavity nesting ducks, heron rookery, sandhill crane, neotropical migrants	600
Pileated woodpecker, kingfisher	450
Beaver, mink, salmonids	300
Deer	200
Muskrat	165
Frog, salamander, turtle	100

Joining of existing and new buffers increases the continuity of cover and will further moderate water temperatures. For habitat purposes, the buffer length can be extended along the entire stream reach on both sides within the ownership (or beyond, if possible) or

to existing riparian forests; i.e., the longest distance possible.

**Location and Layout of Riparian Forest Buffers in Areas With Existing Woody Vegetation for All Purposes**

Riparian forest buffers may be established within areas of existing woody vegetation. Species and stocking density should be assessed to determine if the intended purpose(s) will be served. If additional stocking is required, species selected will be adapted to the site and not compromise the function and purpose(s).

**Establishment of Riparian Forest Buffers in Areas With Existing Woody Plants That Are Less Than 100 Feet Wide**

Riparian forest buffers established under the above condition will have, as a minimum, Zones 1 and 2. The combined width of Zones 1 and 2 shall be no less than 35 feet for the purpose of sediment, nutrient and pesticide reduction. For wildlife habitat, temperature reduction and woody debris enhancement, a minimum width of 100 feet for Zones 1 and 2 will be needed. Zone 1 (identified as Zone 1 in Figure 1c) begins at the ordinary high water mark, or at the upper edge of the active channel, or shore or top of the bank and extends a minimum distance of 15 feet, measured horizontally on a line perpendicular to the watercourse or water body. Zone 2 (identified as Zone 2 in Figure 1c) extends immediately upslope from Zone 1 for a minimum distance of 20 feet. If soil erosion, nutrient, pesticide, or other pollution is present, Zone 3 will be required. Zone 3 will extend a minimum of 20 feet, dependent on slope (see Table 2) immediately upslope of Zone 2 (see Figure 1c).

**Establishment of Riparian Forest Buffers in Areas With Existing Woody Plants That Exceed 100 Feet in Width**

Riparian forest buffers established under the above condition will have, as a minimum, Zones 1 and 2. The combined width of Zones 1 and 2 shall be determined by the slope of the land immediately above the watercourse or waterbody but shall be no less than 100 feet (see Table 3). Zone 1 (identified as Zone 1 in Figure 1d) begins at the ordinary high water mark, or at the upper edge of the active channel, or shore or top of the bank and extends a minimum distance of 15 feet, measured horizontally on a line perpendicular to the watercourse or water body. Zone 2 (identified as Zone 2 in Figure 1d) extends immediately upslope from Zone 1 for a

minimum distance of 85 feet. If soil erosion, nutrient, pesticide, or other pollution is present, Zone 3 will be required. Zone 3 will extend a minimum of 20 feet, dependent on slope (see Table 2), immediately upslope of Zone 2 (see Figure 1d).

**Woody Plant Materials Selection and Size**

Dominant vegetation in the riparian forest buffer will consist of existing or planted trees and/or shrubs suited to the site and the intended purpose(s). Select native species having multiple values such as those suited for timber, biomass, nuts, fruit, browse, nesting, aesthetics, and tolerance to locally used herbicides. Species that resprout are preferred when establishing new rows nearest to watercourses or waterbodies subject to flooding or ice damage. For production of detritus or large woody debris, use species that will meet the specific requirements of fish and other aquatic organisms for food, habitat, migration, and spawning (see Table 4, Plant List, for Riparian Forest Buffers). Plantings will consist of two or more species with individual plants suited to the site.

<b>TABLE 2 - FILTER WIDTH FOR ZONE 3 VEGETATION IN A RIPARIAN FOREST BUFFER</b>	
<b>Land Slope of Contributing Area Above Filter Strip (%)</b>	<b>Filter Width (Ft.)</b>
0-8	20
9-15	30
>15	40

<b>TABLE 3 - COMBINED WIDTHS FOR ZONES 1 AND 2 FOR RIPARIAN FOREST BUFFERS WITH EXISTING WOODY VEGETATION THAT EXCEEDS 100 FEET *</b>	
<b>Slope of Land Above Water Body or Stream (%)</b>	<b>Minimum Width of Strip (Ft.)</b>
0-10	100
10-20	115
20-30	135
30-40	155
40-50	175
50+	Activity may not be advisable due to erosion potential. Extreme care must be taken to prevent movement of soil

- \* Note: Contact Michigan Department of Natural Resources, Forest Management Division for regulations on federally designated Wild and Scenic Rivers and state designated Natural Rivers.

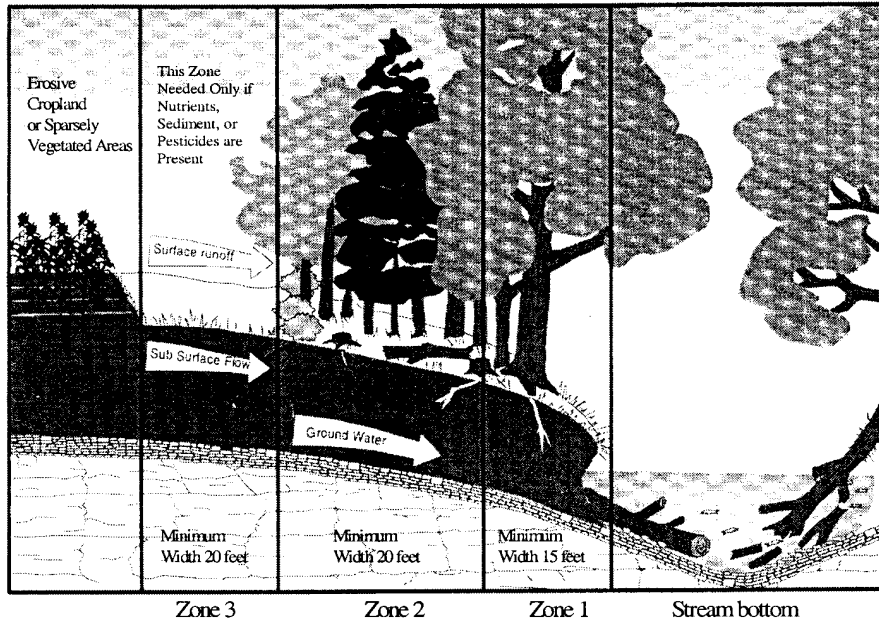


Figure 1a. Riparian Forest Buffer Widths for Purpose of:  
 Sediment, Nutrient, and Pesticide Reduction

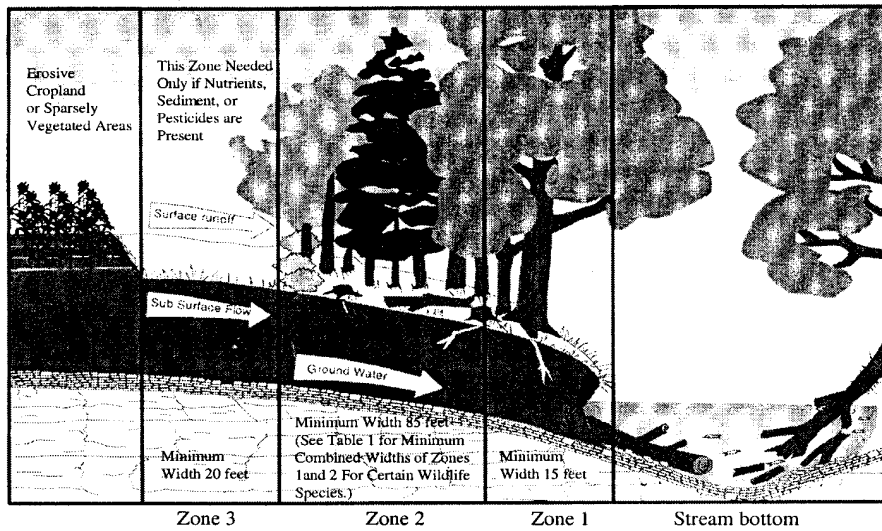


Figure 1b. Riparian Forest Buffer Widths for Purpose of:  
 Wildlife Habitat, Temperature Reduction, and Large Woody Debris

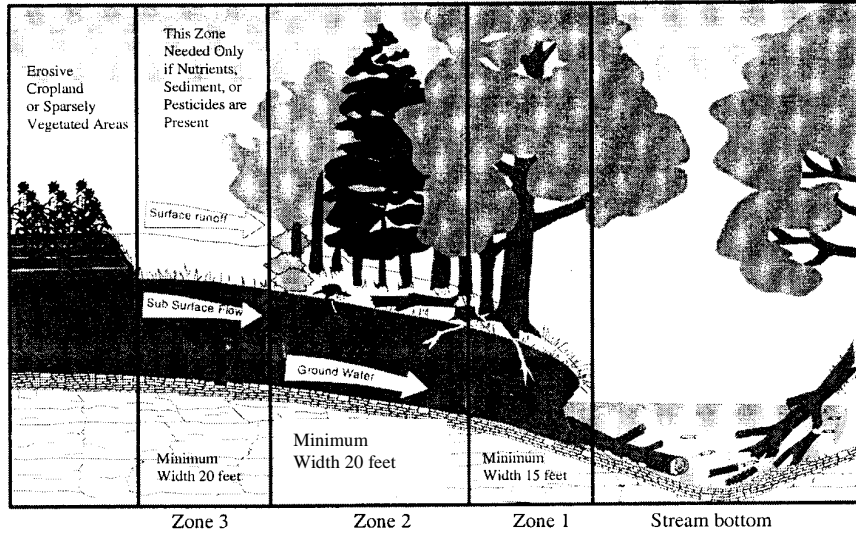


Figure 1c. Riparian Forest Buffer Widths for Areas with Existing Woody Plants that Are Less Than 100 ft Wide for the Purpose of Sediment, Nutrient and Pesticide Reduction.

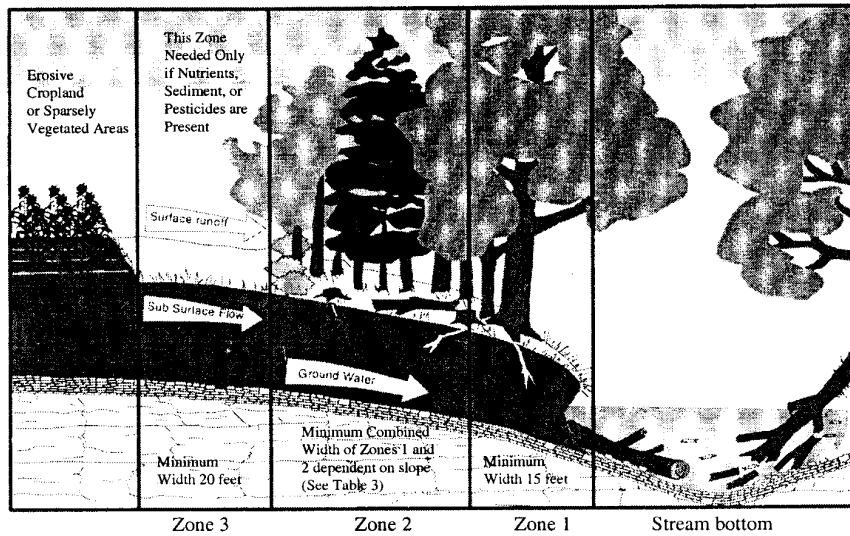


Figure 1d. Riparian Forest Buffer Widths for Areas with Existing Woody Plants that Exceed 100 feet in width for the purpose of sediment, nutrient and pesticide reduction.

**TABLE 4 – PLANT LIST FOR RIPARIAN BUFFERS**

Species	Flooding Tolerance	Large Debris	Soil Drainage	Shade Value	Wildlife Value	Height (Ft.)
Ash, Green	H	M	W, WD	H	M	60
Black	H	M	W, WD	H	M	60
White	L	M	WD	H	M	70
Balm-of-Gilead	M	M	W	M	M	70
Basswood	L	H	WD	H	H	75
Birch, Yellow	M	H	W, WD	M	M	70
Buttonbush	VH	L	W, WD	L	M	10
Cherry, Black	L	L	WD	L	H	70
Cottonwood	H	H	W, WD	M	H	90
Cranberry, Highbush	H	L	W, WD	L	H	15
Dogwood, Red-osier	H	L	W, WD	L	H	12
Silky	H	L	W, WD	L	H	12
Maple, Silver	H	H	W, WD	H	M	80
Sugar	L	H	WD	H	H	80
Red	H	H	W, WD	H	M	70
Oak, Bur	H	M	A	H	H	70
Red	L	M	W, WD	H	H	80
Swamp White	M	M	W, WD	H	H	70
White	L	H	WD, D	H	H	70
Pine, White	M	H	W, WD	L	M	90
Spruce, White	M	M	W, WD	M	M	75
Black	M	L	W, WD	L	M	60
Sycamore	H	H	W, WD	M	H	90
Tuliptree	L	M	WD	M	M	90
Walnut, Black	M	M	WD	M	H	80
White Cedar	M	L	W, WD	M	L	50
Willow, Black	VH	L	W	L	L	60

KEY	
A = All	M = Medium
D = Dry	VH = Very High
H = High	W = Wet
L = Low	WD = Well Drained

**Flooding Tolerance** - General capacity of the plant to withstand standing water. VH = able to survive deep, prolonged flooding for more than one year; H = able to survive deep flooding for one growing season, with mortality occurring if repeated the following year; and M = able to survive flooding or saturated soil for 30 consecutive days of flooding during the growing season without mortality.

**Large Debris** - Potential for the plant to produce trunk and limbs larger than ten inches in diameter before senescence. H = large debris possible within the life span of the plant; and L = large debris unlikely within the life span of the plant.

**Soil Drainage** - Adaptability of plant to grow in varying soil moisture conditions. W = wet or fully saturated soil; WD = well drained; D = dry soil conditions; and A = all soil conditions.

**Shade Value** - The density or fullness of shade provided by an individual plant's crown in full leaf-out condition. H = large crown providing full shade; M = partially open or medium sized crown that provides patchy or incomplete shade; and L = very open or small crown that provides minimal shade.

**Wildlife Value** - The potential for the plant to provide cover, useful cavity sites, and/or quality fruit production. H = excellent cover, large cavity potential, and/or high quality fleshy fruit or nut production; M = moderate cover, cavity, and fruit production; and L = low cover, cavity potential, and dry, non-nut/fruit production.

**Height** – Potential height at physical maturity.



**Plant Spacing and Density**

Initial plant-to-plant densities for trees and shrubs will depend on their potential height, crown characteristics, and growth form. Heights may be estimated based on: 1) performance of the individual species (or comparable species) in nearby areas on similar sites, or 2) predetermined and documented heights using Forestland/Windbreak/Conservation Tree/Shrub Suitability Groups (see Section II of the Michigan NRCS FOTG).

Types/ Heights	Plant-To-Plant Spacing In Feet No Less Than:
Shrubs less than 10 feet in height	8
Shrubs and trees from 10-25 feet in height	10
Trees greater than 25 feet in height	12

**Care, Handling, Size, and Planting Requirements for Woody Planting Stock**

Planting stock will be stored in a cool, moist environment (34-38 degrees F.) or heeled-in. Keep stock tops dry and free of mold, and roots moist and cool during all stages of handling and storage. Live cuttings and seedlings that will not be immediately planted shall be promptly heeled-in or placed in controlled storage (34-38 degrees F.) and protected until planting time. Plant stock size will be selected according to a shoot-to-root ratio of 2:1 (see Figure 2).

Proper plant and root placement of rooted stock will be accomplished mechanically or by hand (see Figure 3) using a planting bar or shovel.

Refer to Michigan NRCS Standard 612, Tree/Shrub Establishment; NRCS Conservation Design Sheet 612, Weed Control for Tree and Shrub Establishment; and Michigan State University-Extension Bulletin E-771, "Tree Planting in Michigan" for developing site-specific plans for establishing trees and/or shrubs.

**PLANS AND SPECIFICATIONS**

Specifications for this practice shall be prepared for each site. Specifications shall be recorded using approved specification sheets, job sheets, conservation design sheets, and/or narrative statements in the conservation plan. As a minimum, species, size, site preparation, spacing, location, and

width of the buffer to be established will be addressed in the specifications.

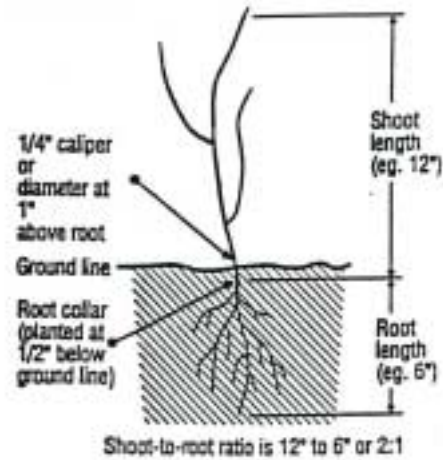


Figure 2. Plant or stock size requirements

**OPERATION AND MAINTENANCE**

The purpose of operation, maintenance, and management is to ensure that the practice functions as intended over time.

The riparian forest buffer will be inspected periodically and protected to maintain the intended purpose from adverse impacts such as: excessive vehicular, pedestrian, or animal traffic; timber removal; pest infestations and pesticide use on adjacent lands; livestock damage; and fire.

As applicable, control of concentrated flow erosion or mass soil movement shall be maintained in the up-gradient area immediately adjacent to Zone 2 to maintain buffer function.

Operation of heavy equipment, grazing of livestock, and harvesting of timber will not be permitted in Zone 1. Harvesting of wood products in accordance with proper forest management for the species (in accordance with accepted silvicultural methods and Society of American Foresters Standards) may take place in Zone 2. Consult Michigan NRCS Standard 655, Forest Harvest Trails and Landings for proper design of harvest trails and landings. Livestock will be excluded from Zone 2 to maintain species diversity and the desired stocking density. Zone 3 (Filter Strip) will be operated and maintained in accordance with Michigan NRCS Standard 393A, Filter Strip.

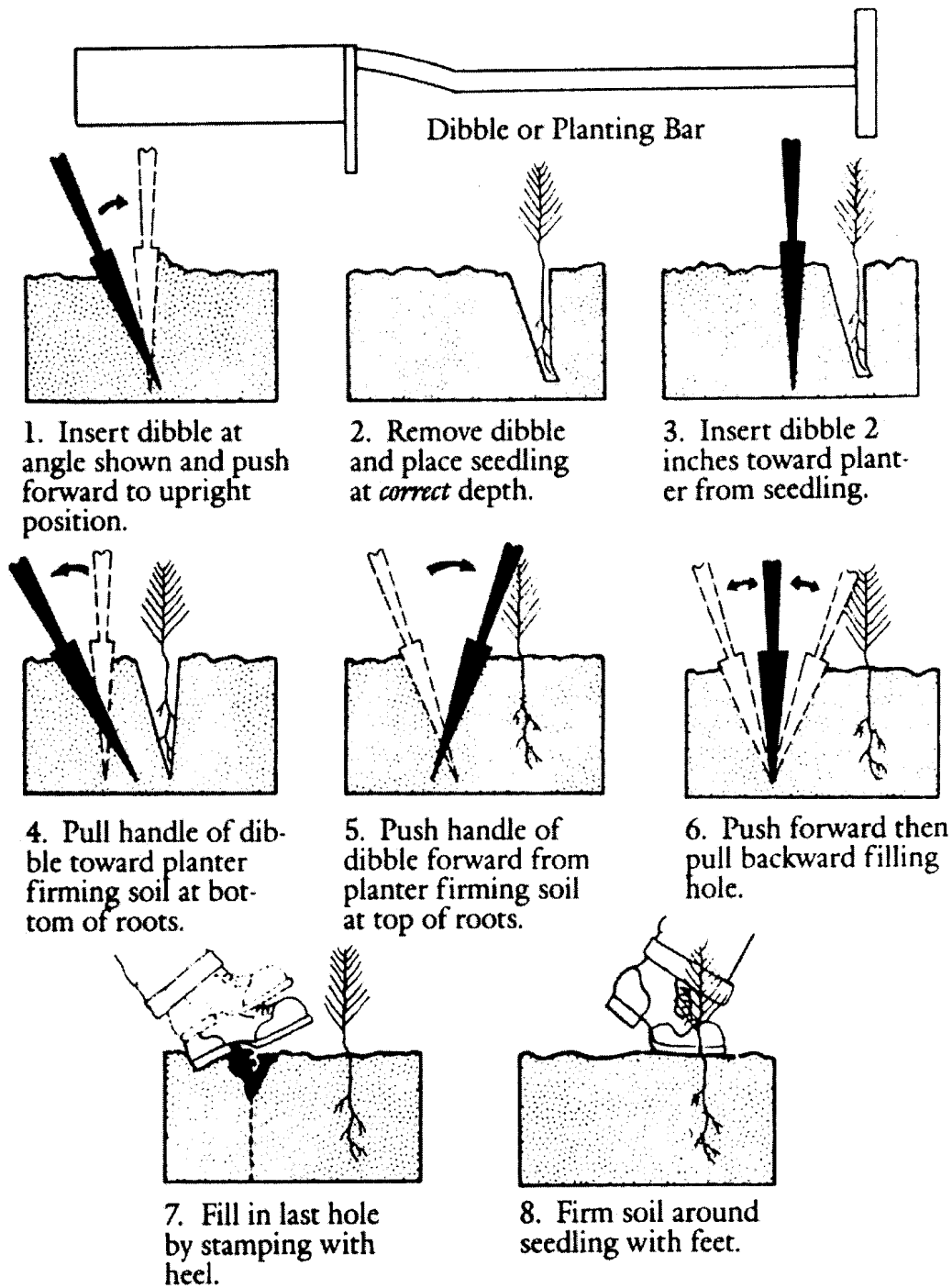


Figure 3. Proper plant and root placement of rooted stock using a planting bar.

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