

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

**RIPARIAN FOREST BUFFER
(Acre)**

CODE 391

DEFINITION

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

PURPOSES

- Create shade to lower or maintain water temperatures to improve habitat for aquatic organisms.
- Create or improve riparian habitat and provide a source of detritus and large woody debris.
- Reduce excess amounts of sediment, organic material, nutrients and pesticides in surface runoff and reduce excess nutrients and other chemicals in shallow ground water flow.
- Reduce pesticide drift entering the water body
- Restore riparian plant communities.
- Increase carbon storage in plant biomass and soils.
- Produce woody energy biomass
- Provide terrestrial wildlife and/or pollinator habitat

CONDITIONS WHERE PRACTICE APPLIES

Riparian forest buffers are applied on areas adjacent to permanent or intermittent streams, lakes, ponds, and wetlands. They are not applied to stabilize stream banks or shorelines.

For areas with unstable banks refer to the practice standard (580) Streambank and Shoreline Protection.

The riparian forest buffer is a component of a planned land management system including nutrient, pesticide, runoff, sediment, and erosion control practices.

Associated conservation practices may include but are not limited to:

- (393) Filter Strip
- (327) Conservation Cover
- (386) Field Border
- (390) Riparian Herbaceous Cover
- (382) Fence
- (472) Access Control
- (528) Prescribed Grazing
- (580) Streambank and Shoreline Protection
- (578) Stream Crossing

CRITERIA

General Criteria Applicable to All Purposes

For all purposes, the minimum width of a riparian forest buffer shall be at least 35 feet measured horizontally on a line perpendicular to the water body beginning at the normal water line, bank-full elevation, or the top of bank.

The minimum total buffer width on the Ohio and Mississippi River main stems is 100'. Buffers on these rivers may be adjusted to less than 100 feet only when the landscape or land ownership patterns will not permit installation.

Comply with all applicable federal, state and local laws and regulations during the installation, operation (including harvesting activities) and maintenance of this practice.

The riparian forest buffer shall be positioned appropriately and designed to achieve sufficient width, length, vertical structure/density and connectivity to accomplish the intended purpose(s).

The location, layout and density of the buffer should complement natural features and mimic natural riparian forests.

Dominant climax vegetation will consist of

existing, naturally regenerated, or seeded/planted trees and shrubs suited to the soil and hydrology of the site and the intended purpose(s).

Natural regeneration (succession) may be utilized on areas that are less than ½ acre in size or are inaccessible to spray equipment. These areas shall not be grazed or mowed in order to facilitate this process. An adequate nearby or adjacent seed source must be present when using natural regeneration to establish a riparian forest buffer.

Excessive sheet-rill and concentrated-flow erosion will be controlled in the areas immediately adjacent and up-gradient of the buffer site.

Refer to the practice standards (490) Tree/Shrub Site Preparation and (612) Tree/Shrub Establishment respectively for care, handling, site preparation and planting requirements of planting stock.

A minimum of four species shall be utilized for planted buffers. At least three (3) species (or 75% of the total species) planted shall produce a hard mast. These should be equally distributed throughout the site and should consist of both red and white oak species where possible. To achieve optimum interspersed, plant at least 2 species per row alternating species within the row.

Use tree and shrub species that are native and non-invasive. Substitution with improved and locally accepted cultivars or purpose-specific species is allowed. For plantings and seeding, only viable, high-quality and adapted plant materials will be used.

Favor tree and shrub species that have multiple values such as those suited for timber, biomass, nuts, fruit, browse, nesting, aesthetics and pollinators.

Table 1. *Suggested Native Tree and Shrub Species Suitable for Riparian Buffers in Kentucky* lists some trees and shrubs associated with and suited for forested riparian areas. Review the key attributes for each species to assist in selection and the design process for establishing riparian forest buffers. Species selected should be compatible with one another. Species selection should also be made based on site characteristics and species preference. Other species may be suitable. Consult the Kentucky Division of Forestry (KDF) personnel, NRCS staff forester and/or biologist, KY Department of Fish and

Wildlife Resources (KDFWR) biologists concerning the suitability of other species.

Necessary site preparation and planting shall be done at a time and manner to insure survival and growth of selected species for achieving the intended purpose(s).

The method of planting for new buffers shall include hand or machine planting techniques and be suited to achieving proper depths and placement of planting stock roots.

Periodic removal of some forest products such as high value trees, medicinal herbs, nuts, and fruits is permitted provided the intended purpose is not compromised by the loss of vegetation or harvesting disturbance.

Harvesting operations in riparian forest buffers must adhere to all current state and local regulations and required best management practices (BMPs).

Livestock shall be controlled or excluded as necessary to achieve the intended purpose. Refer to the standards (528) Prescribed Grazing and/or (472) Access Control as applicable.

Harmful plant and animal pests present on the site will be controlled or eliminated as necessary to achieve and maintain the intended purpose. If pesticides are used, refer to the standard (595) Integrated Pest Management.

Fenced water course crossings and livestock watering areas shall be located and sized to minimize impact to the riparian forest buffer vegetation and function.

Riparian areas may be established to all shrubs instead of tree species when they will be located in an area encumbered by power line easement. These areas may also be allowed to naturally regenerate as long as invasive species are not present or are not likely to dominate the site.

Additional herbaceous vegetation may be required up-gradient to the riparian forest buffer depending on the purpose. Examples include:

- when adjacent to cropland or other sparsely vegetated areas
- highly erosive areas to filter sediment
- to address concentrated flow erosion
- to maintain sheet flow.

Refer to (393) Filter Strip, (390) Riparian Herbaceous Cover and/or (342) Critical Area Treatment (327) Conservation Cover, (386) Field Border as applicable.

Additional Criteria To Reduce Excess Amounts of Sediment, Organic Material, Nutrients and Pesticides in Surface Runoff and Reduce Excess Nutrients and Other Chemicals in Shallow Ground Water Flow

The minimum width shall be at least 35 feet measured horizontally on a line perpendicular to the water body beginning at the normal water line, bank-full elevation, or at the top of the bank as determined locally.

The width will be extended in high nutrient, sediment, and animal waste application areas, where the contributing area is not adequately treated or where an additional level of protection is needed.

Existing, functional underground drains through the riparian area will pass pollutants directly to the outlet. To filter such pollutants, drains can be plugged, removed or replaced with perforated pipe/end plugs or water control structures (see Structure for Water Control, 587) to allow passage and filtration of drain water through the riparian forest root zone. Caution is advised that saturated conditions in the riparian and adjacent areas may limit existing land use and management.

Additional herbaceous vegetation is required up-gradient to the riparian forest buffer when adjacent to cropland or other sparsely vegetated or highly erosive areas to filter sediment, address concentrated flow erosion, and maintain sheet flow. Refer to and follow criteria outlined in (393) Filter Strip, (390) Riparian Herbaceous Cover and/or (Conservation Cover, (386) Field Border as applicable.

Additional Criteria to Create or Improve Riparian Habitat and Provide a Source of Detritus and Large Woody Debris.

The minimum width shall be at least 35 feet measured horizontally on a line perpendicular to the water body beginning at the normal water line, bank-full elevation, or at the top of the bank as determined locally.

The width will be extended to meet the minimum habitat requirements of the wildlife or aquatic species of concern.

Establish plant communities that address the target aquatic and terrestrial wildlife needs and have multiple values such as habitat, nutrient uptake and shading. The establishment of diverse native woody and herbaceous species will enhance wildlife and pollinator values.

Establish, favor, or manage species capable of producing stems and limbs of sufficient size to provide an eventual source of large woody debris (> 10 inches in diameter) for in stream habitat for fish and aquatic organisms.

Additional Criteria to Provide Pollinator Habitat

Riparian corridors are appropriate places to establish pollinator habitats. Desirable species should be selected that encourage use by pollinators and bloom throughout as much of the early growing season as possible. Since trees and shrubs typically are available prior to the bloom period of most herbaceous plants, they are often the most visited of plants by bees early in the season. Conversely, woody species stop blooming earlier in the growing season and the floral resources are not available throughout the growing season. Therefore, it is not advisable to depend solely upon woody species to provide pollinator resources. For this reason, it is acceptable when installing exclusively woody species enhancements to utilize bloom periods of very early, early and mid-season.

If available, refer to the Kentucky Pollinator Handbook and/or the list identified in (422) Hedgerow Planting for a listing of trees and shrubs and corresponding bloom periods that benefit pollinators.

In the absence of this information utilize a minimum of three species of trees and/or shrubs. This mixture shall consist species in the following bloom periods:

- March to April = Very Early Season
- March through May = Early Season
- May through July = Mid-Season

Trees and shrubs should be planted at a spacing to allow for maximum crown development and bloom. Planting materials may be seedlings, containerized or balled and burlapped.

Installation of trees and shrubs for this purpose should follow the Kentucky (612) Tree/Shrub

Establishment, and (490) Tree/Shrub Site Preparation as appropriate.

Additional Criteria To Create Shade to Lower or Maintain Water Temperatures

Buffers shall be maintained or established on both sides of streams insofar as practical. The buffer canopy shall be established to achieve at least 50 percent crown cover with the average canopy heights equal to or greater than the width of the watercourse or 30 feet for water bodies.

Buffer species shall include native riparian species of sufficient height and crown density potential. Place drooping or wide-crowned trees and shrubs nearest the watercourse or body. Shoreline or channel relief (e.g. deeply incised channels) and topographic shading should be taken into consideration when selecting species.

Additional Criteria for Increasing Carbon Storage in Biomass and Soils

Maximize width and length of the riparian forest buffer.

Select plants that have higher rates of carbon sequestration in soils and plant biomass and are adapted to the site to assure strong health and vigor. Plant the appropriate stocking rate for the site.

Additional Criteria for Producing Woody Energy Biomass

On sites that are to be established, select species that will meet the plant characteristics necessary for biomass production and the other identified purpose(s).

Intensity and frequency of energy biomass removals will be managed to prevent long-term negative impacts on the buffer.

The harvesting of energy biomass shall be accomplished in a manner that will not compromise the other intended purpose(s) and functions.

Criteria for Evaluation of Existing Riparian Buffers

The following is the minimum functions of an existing riparian buffer based on the water quality functions of a riparian buffer:

1. A tree and/or shrub canopy must be present that continues enough leaf and woody material to develop a forest type soil with a duff layer
2. Herbaceous layer dominated by shade tolerant vegetation indicative of forest land that contains less than 20% forage type herbaceous species.
3. Conditions 1 and 2 above must extend a minimum of 50 feet for 1st, 2nd and 3rd order streams; and a minimum of 100 feet for 4th order stream; or
4. In lieu of the above criteria, utilization of the Stream Visual Assessment Protocol 2 (SVAP2) to achieve a satisfactory score of four (4) or more for elements #4 Riparian Quantity and #5 Riparian Quality will indicate the minimum functionality.

CONSIDERATIONS

Consider adding a strip of herbaceous native vegetation upslope (formerly Zone 3) for any additional purpose criteria. Follow the appropriate practice and species selection as:

- (393) Filter Strip
- (327) Conservation Cover
- (386) Field Border
- (390) Riparian Herbaceous Cover

Consider adding additional native herbaceous species upslope to add pollinator habitat and supplement early blooming tree species.

Woody riparian pollinator plantings greater than one-half acre (0.5 acres) in size are exponentially more beneficial.

Consider existing species within riparian areas when determining the need for pollinator plantings.

When working with Kentucky's "Special Use Waters", assist landowners to increase buffer widths above the minimum to protect these resources. Kentucky's "Special Use Waters" include Cold Water Aquatic Habitat, Outstanding State Resource Waters, Exceptional Waters, Federal Wild River Areas, Federal Scenic River

Areas, Outstanding National Resource Waters, and Reference Reach Waters.

Tree and shrub species, which may be alternate hosts to undesirable pests, should be avoided. Species diversity should be considered to avoid loss of function due to species-specific pests.

Using seed and/or seedlings collected or propagated from multiple sources can increase genetic diversity.

Consider selecting species with tolerance to herbicide leakage from adjoining fields.

Allelopathic impacts of plants should be considered.

The location, layout and density of the buffer should complement natural features, and mimic natural riparian forests.

For sites where continued function of drains is desired, woody root penetration may eventually plug the underground structure. In these cases, a setback of woody vegetation planted over the drain maintained in herbaceous cover or using rigid, non-perforated pipe will minimize woody root penetration.

The species and plant communities that attain biomass more quickly will sequester carbon faster. The rate of carbon sequestration is enhanced as riparian plants mature and soil organic matter increases.

Always attempt to maximize widths, lengths, and connectivity of riparian forest buffers. Wide widths (75 feet or more) are preferred. They are more effective for the listed purposes and more feasible to manage. Narrower widths within this standard recognize the value of streamside land for farming and limited bottomland acreage in many locations.

The widths below are guides for selected wildlife species. They include the sum of buffer widths on one or both sides of water courses or water bodies and may extend beyond riparian boundaries.

Species	Desired Width (ft)
bald eagle, wood ducks, rookeries	600 +
turkey, pileated woodpecker	450
beaver, black duck, grouse	300

deer	200
songbirds, mallard	165
bass, woodcock	100

When establishing a riparian forest buffer by planting, initial plant-to-plant densities for trees and shrubs should account for their potential height at 20 years of age. 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 Table 1 or those listed in the USDA Plants Database
- 3) Those heights identified in the conservation practice (612) Tree/Shrub Establishment.

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

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

Use of this practice without other nutrient, pesticide, sediment, and erosion control practices can result in adverse impacts on buffer vegetation and stream hydrology. The expected adverse impacts could be high maintenance costs, need for re-establishment of vegetation, and delivery of excess nutrients, sediment, and other potential pollutants through the buffer by concentrated flows.

Correct problems with severely leaning trees that might contribute to unstable banks or concentrated flows. When correcting these problems, consider leaving tree root wads in the streambank if a leaning tree is removed.

Joining new buffers with existing buffers increases the continuity of cover and will further moderate water temperatures. A mix of species with growth forms that are tall and wide-crowned or drooping will increase moderation effects. For watercourses, buffers established on both sides will enhance riparian values.

Consider species that re-sprout when establishing the vegetation nearest the watercourses or bodies. For detritus and large woody debris, use species that meet the specific requirements of fish and other aquatic organisms for food, habitat, migration and spawning.

Consider species selection criteria to improve aesthetics include seasonal foliage color, showy flowers, foliage texture, form and branching habit.

Use recommendations from regional or other large-scale evaluations and plans when designing, locating, and connecting buffers for indicator and/or target species of wildlife, fish, and other aquatic organisms.

Consider the type of human use (rural, suburban or urban) and the aesthetic, social, and safety aspects of the area to determine the vegetation selection, arrangement, and management.

Complex ownership patterns of riparian areas may require group planning for proper buffer design, function, and management.

The layout and design should be appropriate for the setting as determined by adjacent land uses. A landscape analysis can help determine specific aesthetic requirements.

Where feasible, consider alternative water sources, such as tanks, ponds, wells, solar pumps, and ram pumps for livestock water supply needs.

Consider marking the boundary to prevent encroachment.

An adequate nearby or adjacent seed source must be present when using natural regeneration to establish a riparian forest buffer. Consider exposing mineral soil in order to get seed to soil contact. Caution must be utilized to avoid erosive conditions.

Other general planting density considerations for differing purposes in open areas:

Plant Types/Heights	Plant-to-Plant Spacing in feet
Shrubs less than 10 feet in height	3 to 6
Shrubs and trees from 10 to 25 feet in height	5 to 8

(includes columnar trees)	
Trees greater than 25 feet in height	12 to 25

PLANS AND SPECIFICATIONS

The following actions shall be carried out to insure that this practice functions as intended throughout its expected life. These actions include normal repetitive activities in the application and use of the practice (operation), and repair and upkeep of the practice (maintenance).

Specifications for applying this practice shall be prepared for each site and recorded using approved specification sheets, job sheets, technical notes, and narrative statements in the conservation plan, or other acceptable documentation.

At a minimum, the following will be identified in the conservation plan (as appropriate):

- Purpose of riparian forest buffer
- Size of riparian forest buffer
- minimum width of riparian forest buffer (ft.)
- length of riparian forest buffer (ft.)
- acres of riparian forest buffer (ac.)
- Field location / Plan view
- Site preparation methods
- Plant species
- Establishment method(s)
- Access control methods (if needed)
- Erosion control measures (if needed)
- Operation and Maintenance Plan

OPERATION AND MAINTENANCE

The following actions shall be carried out to insure that this practice functions as intended throughout its expected life. These actions include normal repetitive activities in the application and use of the practice (operation), and repair and upkeep of the practice (maintenance)

The riparian forest buffer will be inspected periodically and protected from adverse impacts such as excessive vehicular and pedestrian traffic, pest infestations, concentrated flows, pesticides, livestock or wildlife damage and fire.

A 60% survival rate after three years is considered satisfactory if trees are well distributed over the planted area. The planted areas will be evaluated to determine whether to replant failed

spots or if natural regeneration will meet the objectives of the landowner.

The buffer should be inspected at least annually and after heavy storm events. Check for areas where water is concentrated. Disperse concentrated flow by appropriate measures, including placement and repositioning debris.

Replacement of dead trees or shrubs and control of undesirable vegetative competition will be continued until the buffer is, or will progress to, a fully functional condition.

Any manipulation of species composition, stand structure and stocking by cutting or killing selected trees and understory vegetation shall sustain the intended purpose(s). Refer to the practice standard (666) Forest Stand Improvement.

Control or exclusion of livestock and harmful wildlife shall continue. Refer to the standards Prescribed Grazing, 528, and/or access Control, 472, as applicable.

Fertilizers, pesticides and other chemicals used to maintain buffer function shall not impact water quality.

Vehicular traffic or excessive animal traffic, and the removal or disturbance of vegetation and leaf litter must be avoided.

Where practical, management activities will be performed outside the primary nesting season (May 15 – Aug 1). An exception may be for mowing or cultivation to control vegetative competition.

As applicable, control of concentrated flow erosion and sediment deposition shall be controlled.

For the purpose of moderating water temperatures and providing detritus and large woody debris, riparian forest buffer management must maintain a minimum of 50 percent canopy cover.

For the purposes of reducing excess pollutants in surface runoff and shallow groundwater or providing habitat and corridors for wildlife, manage the canopy to maintain maximum vigor of the overstory and understory species.

Additional operation and maintenance requirements shall be developed on a site-specific basis to assure performance of the practice as intended.

REFERENCES

- Castelle, A.J., A.W. Johnson, and C. Conolly. 1994. Wetland and Stream Buffer Size Requirements - A Review. Journal of Environmental Quality - Vol. 23 No. 4. Madison, WI.
- Chesapeake Bay Program - Nutrient Subcommittee. 1995. Water Quality Functions of Riparian Forest Buffer Systems in the Chesapeake Bay Watershed. Prepared by: R. Lowrance, L.S. Altier, R.S. Schnabel, P.M. Groffman, J.M. Denver, D.L. Correll, J.W. Gilliam, J.L. Robinson, R.B. Brinsfield, K.W. Staver, W. Lucas, and A.H. Todd. Annapolis, MD.
- Cornell Cooperative Extension Service. Wildlife and Timber from Private Lands: A Landowner's Guide to Planning. Info. Bull. 193. Prepared by: D.J. Decker, J.W. Kelley, T.W. Seamans, and R.R. Roth. Ithaca, NY. Gilliam, J.W. 1994. Riparian Wetlands and Water Quality. Journal of Environmental Quality - Volume 23: 896-900.
- Schultz R.C., J.P. Colletti, T.M. Isenhardt, W.W. Simpkins, C.W. Mize, and M.L. Thompson. 1995. Design and Placement of a Multi-species Riparian Buffer Strip. Agroforestry Systems 29:201-225.
- Sweeney, Bernard W, Czapka, Stephen J., and Yerkes, Tina. 2002. Riparian Forest Restoration: Increasing Success by Reducing Plant Competition and Herbivory, Stroud Water Research Center, 970 Spencer Road, Avandale, PA 19311.
- U.S. Department of Agriculture, Forest Service, Natural Resources Conservation Service, National Agroforestry Center. 1997. Riparian Buffer for Agricultural Land. Agroforestry Note #3. Prepared by: M. Doskey, D. Schultz, T. Isenhardt. Lincoln, NE.
- U.S. Department of Agriculture, Forest Service, Natural Resources Conservation Service, National Agroforestry Center. 1997. How to Design a Riparian Buffer for Agricultural Land. Agroforestry Note #4. Prepared by: M. Doskey, D. Schultz, T. Isenhardt. Lincoln, NE.

U.S. Department of Agriculture, Forest Service,
Natural Resources Conservation Service,
National Agroforestry Center. 1997. A Riparian
Buffer Design for Cropland. Agroforestry Note #5.
Prepared by: M. Doskey, D. Schultz, T. Isenhardt.
Lincoln, NE.

U.S. Department of Agriculture, Forest Service,
Northeastern Area State and Private Forestry.
1993. Crop Tree Management in Riparian Zones.
Forest Resources Management.

U.S. Department of Agriculture, Forest Service,
Northeastern Area State and Private Forestry.
1991. Riparian Forest Buffers - Function and
Design for Protection and Enhancement of Water
Resources. NA-PR-07-91. Prepared by David J.
Welsch, Radnor, PA.

U.S. Department of Agriculture, Forest Service,
Southern Region. 1992. Stream Habitat
Improvement Handbook. Tech. Pub. R8-TP 16.
Prepared by Monte E. Sheehorn, Atlanta, GA.

Welch, David E., D.L. Smart, J.N. Boyer, P.
Minkin, H.C. Smith, T.L. McCandless. 1995.
Forested Wetlands - Functions, Benefits, and the
use of Best Management Practices. NA-PR-01-
95.

Table 1. Suggested native tree and shrub species suitable for riparian buffers in Kentucky. Species selection should be based on site characteristics and planting objectives. Other species may be used provided they are native and are recommended by KDF or KDFWR.

Species (Common/Scientific)	Oak Family	Shade Tolerance ¹	Soil Drainage Class ²	Height at 20 Years ³	Mature Height ³	Wildlife Use ⁴	Pollinator ⁵	Remarks
Baldcypress <i>Taxodium distichum</i>	-	Intermediate	Poorly – Moderately Well	45 ft.	130 ft.	M	NR	Seeds are eaten by wild turkey, wood ducks, evening grosbeak, squirrels, waterfowl and wading birds. A variety of birds and mammals, frogs, toads, salamanders and other reptiles utilize the trees for a variety of functions.
Dogwood, Red-osier <i>Cornus sericea</i>	-	Intermediate	Well - Somewhat Poorly	12 ft.	12 ft.	H	NR	Excellent streambank cover. With some wildlife benefits providing cover for various birds.
Dogwood, Silky <i>Cornus amomum</i>	-	Intermediate	Well - Somewhat Poorly	12 ft.	12 ft.	H	NR	Stoloniferous. Produces fruit in 3 to 5 years. Excellent wildlife plant.
Elderberry, Common <i>Sambucus canadensis</i>	-	Intolerant	Well - Somewhat Poorly	7 ft.	7 ft.	H	Nesting	Excellent all around wildlife plant. Suckers freely. Many species of birds and mammals utilize the fruit.
Hawthorn, Crataegus (Native KY Species)	-	Intermediate	Well - Somewhat Poorly	25 ft.	30 ft.	H	Early - Mid	Provides excellent wildlife cover. Utilize only KY native hawthorns.
Hickory, Shellbark <i>Carya laciniosa*</i>	-	Tolerant	Well – Somewhat Poorly	35	130	H	NR	The nuts of shellbark hickory are sweet and edible and the largest of all hickories. They are eaten by a wide range of wildlife species.
Holly, Deciduous <i>Ilex decidua</i>	-	Tolerant	Somewhat Poorly - Poorly	33	33	M	NR	Excellent deciduous holly. Wildlife readily utilize the fruit.
Oak, Black <i>Quercus velutina *</i>	Red	Intermediate	Well – Moderately Well	25	90	H	NR	Drier sites and overall excellent wildlife tree species. Usually occurs as a component of other upland species compositions and not the dominant species.
Oak, Bur <i>Quercus macrocarpa*</i>	White	Intermediate	Moderately Well -Somewhat Poorly	25	100	H	NR	Suitable substitute for green ash. Excellent source of food for many wildlife species including deer, turkeys, squirrels, rabbits, raccoons, and rodents. As it reaches maturity it provides roosting, loafing, and nesting for numerous species of birds.
Oak, Cherrybark <i>Quercus pagoda*</i>	Red	Intermediate	Well – Somewhat Poorly	60	110	H	NR	Many wild animals and birds use the acorns of the cherrybark as food. Excellent native riparian tree.
Oak, Chinkapin <i>Quercus muehlenbergii*</i>	White	Intolerant	Well – Moderately Well	30	80	H	NR	It is rarely a predominant tree, but it grows in association with many other species. Excellent wildlife tree utilized by many species.

Species (Common/Scientific)	Oak Family	Shade Tolerance ¹	Soil Drainage Class ²	Height at 20 Years ³	Mature Height ³	Wildlife Use ⁴	Pollinator ⁵	Remarks
Oak, Northern Red <i>Quercus rubra</i> *	Red	Intermediate	Well - Moderately Well	36	100	H	NR	An important and handsome oak. Important as a wildlife food source, timber species and ornamental.
Oak, Nuttall <i>Quercus texana</i> *	Red	Intolerant	Somewhat Poorly - Poorly	40	120	H	NR	Good tree for riparian areas frequently flooded. Native to Mississippi River area.
Oak, Overcup <i>Quercus lyrata</i> *	White	Intermediate	Moderately Well - Poorly	30	80	H	NR	Often planted for timber and ornamental. Planted to improve wildlife habitat for bottomland restoration.
Oak, Pin <i>Quercus palustris</i> *	Red	Intolerant	Moderately Well - Poorly	40	100	H	NR	Adapted to wetter sites. Good mast producer and attractive ornamental. Utilized by various wildlife especially wood ducks.
Oak, Shumard <i>Quercus shumardii</i> *	Red	Intolerant	Well – Somewhat Poorly	40	110	H	NR	Valuable contributor to rehabilitation and reforestation of bottomlands and upland sites, including minespoils. Provides an excellent shade or ornamental and median plantings. Tolerates a wide variety of conditions.
Oak, Southern Red <i>Quercus falcata</i> *	Red	Intermediate	Well – Moderately Well	35	100	H	NR	Handsome tree suited for drier sites. Provides adequate wildlife forage for a variety of species.
Oak, Swamp Chestnut <i>Quercus michauxii</i> *	White	Intolerant	Well – Somewhat Poorly	35	80	H	NR	Swamp chestnut oak acorns are eaten by white-tailed deer, wild hogs, wild turkey, black bear, squirrels, and chipmunks
Oak, Swamp White <i>Quercus bicolor</i> *	White	Intermediate	Somewhat Poorly- Poorly	30	100	H	NR	Requires moist acidic conditions. Important food for wildlife such as squirrels, black bear, ducks and turkey. Often hybridizes.
Oak, Water <i>Quercus nigra</i> *	Red	Intolerant	Moderately Well - Poorly	30	90	H	NR	Does not compete well. Frequently used for restoration activities. Minimum age for flowering and fruiting is 20 years. It produces heavy crops of acorns each year. Not recommended as an ornamental due to it being short-lived, disease-prone and extremely messy.
Oak, White <i>Quercus alba</i> *	White	Intermediate	Well - Moderately Well	25	100	H	NR	Extremely important as a timber and wildlife food tree. Slow growing and sometimes difficult to establish.

Species (Common/Scientific)	Oak Family	Shade Tolerance ¹	Soil Drainage Class ²	Height at 20 Years ³	Mature Height ³	Wildlife Use ⁴	Pollinator ⁵	Remarks
Oak, Willow <i>Quercus phellos*</i>	Red	Intolerant	Well – Moderately Well	60	100	H	NR	Acorns utilized by game animals and birds such as ducks, squirrels, deer and turkey, blue jays and red-headed woodpeckers.
Pawpaw <i>Asimina triloba</i>	-	Tolerant	Moderately Well - Poorly	30	35	H	Very Early	Site specific and often difficult to establish. Common in floodplains in the understory. Good wildlife food source.
Pecan <i>Carya illinoensis *</i>	-	Intolerant	Well Drained – Somewhat Poorly	5	140	H	NR	Nut production, wildlife habitat enhancement, esthetics, shade tree, wood and veneer production. Excellent native tree.
Persimmon <i>Diospyros virginiana</i>	-	Tolerant	Well – Somewhat Poorly	25	55	H	Early	Has a deep taproot. Somewhat utilized for wildlife food source. Often difficult to find commercially. Tolerates a wide range of conditions.
Plum, Wild <i>Prunus sp.</i>	-	Intolerant	Well – Moderately Well	24	24	H	Early	Good early pollinator tree/shrub and attractive. Used by a wide variety of wildlife. Common throughout the state.
Redbud, Eastern <i>Cercis canadensis</i>	-	Tolerant	Well – Somewhat Poorly	25	30	M	Very Early	Attractive in spring. Good very early pollinator plant for native bees and butterflies. Widely available.
Spicebush <i>Lindera benzoin</i>	-	Tolerant	Moderately Well - Poorly	12 ft.	15 ft.	M	NR	Attractive fragrant understory tree common throughout the state. Sometimes planted as an ornamental.
Viburnum, (Native KY Species)	-	Tolerant	Well - Poorly	6	20	H	Mid	Utilize species native to KY. Species suited to a wide variety of conditions and sites. Great wildlife plants.
Walnut, Black <i>Juglans nigra*</i>	-	Intolerant	Well - Moderately Well	35	90	H	NR	Prefers deep well drained soils. Important as a timber and nut crop tree. Produces juglone that inhibits competition.
Yellow Poplar <i>Liriodendron tulipifera</i>	-	Intolerant	Moderately Well - Somewhat Poorly	50	120	M	Mid	Fast growing. Attractive ornamental but very large. Provides some secondary wildlife food and is important for pollinators.

* - An asterisk indicates hard mast species

KEY

1. Shade Tolerance: Describes the relative tolerance for this plant to grow in shade conditions.

Intolerant: Will not tolerate shaded conditions.

Intermediate: Will tolerate partially shaded conditions.

Tolerant: Will tolerate full shade and usually does not prefer full sun.

2. Soil Drainage Class:

Well Drained: Water is removed from the soil readily but not rapidly and available to plants most of the growing season. Wetness does not inhibit growth of roots for significant periods.

Moderately Well Drained: Water is removed from the soil somewhat slowly during some periods. These soils are wet for only short time during the growing season. They may contain a slowly pervious layer or receive periodic heavy rainfall or both.

Somewhat Poorly Drained: Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of some plants. They commonly have a slowly pervious layer or receive periodic heavy rainfall or both.

Poorly Drained: Water is removed so slowly that the soil remains saturated for significant portions or remains wet for long periods during the growing season. Free water is commonly at the surface. Poor drainage may result from high water tables, slowly pervious layers within the profile, seepage or any combination of these factors.

3. Tree Height

Height at 20 Years: Under optimum conditions is the approximate maximum height at 20 years in feet.

Mature Height: The approximate height of the plant at maturity under good conditions.

4. Wildlife Use

H: High Value

M: Medium Value

5. Pollinator

Very Early: This plant likely blooms from March to April

Early: This plant likely blooms from March through May

Mid: This plant likely blooms from May through July.

Nesting: Provides pollinator nesting sites.

NR: This plant is not recommended for the use indicated.

NRCS, KY

November 2013