VI. Managing Water-Quality Crop Trees

Crop trees in riparian zones can be managed to improve water quality by helping control non-point source pollution. Water-quality crop trees can absorb large amounts of excess nutrients that come from agricultural fields. These trees act as effective filters by intercepting and retaining runoff sediments and excess nutrient pollutants that would otherwise end up in waterways.

Water-quality crop trees provide a viable means of mitigating the influence that some agricultural practices have on water quality.

For example, nitrogen is a nutrient that is often leached from agricultural fields as nitrate fertilizer. Water-quality crop trees can absorb nitrogen in the form of nitrate and change it to an organic compound that is stored in their woody biomass. They also convert nitrate to nitrogen gas which is released into the atmosphere when organic matter like the annual leaf fall is decomposed. In this way, the nutrients that would otherwise find their way to water courses are instead harmlessly dispersed into the air.

Water-quality crop trees are a new concept to many landowners, but there is increasing interest in managing these trees. Forestland managers need to know which species are the most effective nutrient filters.

Some landowners are very concerned about water quality, and they are interested in utilizing their woodlands to promote cleaner waterways. You may want to advise these landowners that some species of trees are more effective nutrient filters than others.

Following is an ***example*** of selection criteria developed for water-quality crop trees.

These yellow-poplar trees, located between an agricultural field and a stream, are helping to keep excess nutrients from reaching the water.

Hardwoods along a stream course or in forested wetlands are more effective nutrient filters than most conifers.

Tree tolerance to flooding and high-water tables is a major consideration when selecting crop trees in riparian zones. Sycamore is well-adapted to such locations.

Water-Quality Crop Tree Selection Criteria

- Dominant/codominant trees
  - Healthy crown; large in relation to dbh
  - A few dead, upper-crown branches are acceptable
  - Stump-sprout or seedling-origin stems are acceptable
- Expected longevity of 20+ years
- Species that are good nutrient accumulators
  - Young trees
  - Deciduous trees
- Trees tolerant to flooding

Dominant/codominant trees with healthy crowns that are large in relation to their dbh are the best choices for water-quality crop trees. Generally, these trees that have already established good, competitive positions in the stand are the ones with the greatest capacity to absorb nutrients. A few dead, upper-crown branches are acceptable if they don't appear to be indicating a significant loss of vigor. Stump-sprout or seedling-origin stems can be chosen as crop trees; however, remember that sprouts that originate near groundline are the most stable.

When selecting crop trees, choose those with an expected longevity of at least 20 years. Nutrient uptake is most rapid in young trees, and it declines with increasing age. As trees mature or begin to die, their net annual nutrient uptake tends to drop.

Trees growing in riparian zones will not reach their full potential as long-term nutrient filters unless they are properly managed. If trees mature and die at the same time, their effectiveness for filtering nutrients is diminished. For this reason, it is important to maintain various age classes within the riparian zone to provide a continuous cycle of nutrient uptake.

Generally, deciduous trees have greater nutrient demands than conifers. For example, oaks require more nutrients, especially potassium and nitrogen, than spruce and pine. Therefore, if water quality is important to landowners, they should be advised that hardwoods between agricultural fields and water courses absorb more nutrients than most conifers. This "filtering" process captures as much as 89 percent of excess nutrients before they reach waterways.

Deciduous trees can filter as much as 89 percent of the excess nutrients from agricultural fields before the pollutants reach waterways.

Basswood, yellow-poplar, dogwood, and red cedar concentrate large amounts of calcium, phosphorus, and potassium in their foliage. Beech, red spruce, the pines, and hemlock are slower in their uptake of these elements.

Red and white oak, red maple, and quaking aspen do extremely well in nitrogen uptake, but only to a point. Once their requirements are met, their growth and absorption level off. White ash, basswood, and yellow-poplar also respond well if nitrogen levels increase.

Yellow-poplar and basswood absorb large amounts of nitrogen, phosphorus, and potassium (N, P, K)— the components of fertilizer commonly used on agricultural fields.

Although deciduous species provide successful avenues for improving water quality, do they have the ability to survive in riparian conditions? This introduces another consideration — tree waterlogging tolerance to various hydrologic regimes. Waterlogging tolerance refers to a species' ability to live from seedling to maturity in various soil saturation conditions during the growing season.

White ash is a "moderately water tolerant" species that can survive occasional periods of waterlogging during the growing season.

Tolerance to flooding depends on species, age, genetics, soil conditions, and time of year.

Some species survive well in conditions of frequent flooding or waterlogging, but others may die if waterlogged for even a short period of time. Generally, waterlogging tolerance of a species increases with age and size up to maturity, but it declines with decreasing crown position. Tolerance to flooding depends on species, age, genetics, soil conditions, and time of year (growing season or dormant season).

Basswood, a "*highly water tolerant*" species, accumulates large amounts of calcium, phosphorus, and potassium in its leaves. It is able to withstand flooding for most of one growing season. However, in contrast, yellow-poplar, which is a "*least water tolerant*" species, accumulates the same elements, but cannot withstand flooding for more than a few days during the growing season.

"Highly water tolerant" species, like basswood, can survive flood events during the growing season, while a "least water tolerant" species, like yellow-poplar, usually cannot.

High concentrations of some elements may be toxic to some plant species. Flooding, or high-water tables, results in many elements becoming more available to plants, potentially reaching toxic levels. This availability, however, depends on the chemical properties of the soil and the amounts of oxygen present during flooding.

Once water levels return to normal, most nutrients return to pre-flood concentration levels unless excessive leaching has occurred. For a complete listing of tree tolerance to flooding, please refer to Appendix D, *Flood Tolerance of Specific Tree Species.*