

# Soil Facts

## *Agricultural Riparian Buffers*

In general, a riparian forest buffer system controls the stream environment.

### **Buffers:**

- Protect water resources from nonpoint source pollutants, such as sediment and nutrients.
- Moderate fluctuations in stream temperature.
- Control light quantity and quality in the stream.
- Enhance habitat diversity.
- Stabilize stream banks and modify channel morphology.
- Enhance food webs and species richness.

### **Introduction**

Natural riparian buffers are the grasses, trees, shrubs, or other vegetation growing along streams. In North Carolina, natural riparian buffers are forested.

Many factors determine the effectiveness of riparian buffers in removing agriculturally derived pollutants. However, the most important factor is hydrology: how the water moves through or over the buffer.

Sediment and sediment-associated pollutants, such as phosphorus, bacteria, and some pesticides, move to surface waters almost exclusively by surface runoff. When surface runoff is sufficiently slowed, sediment will settle out. If the runoff water does not spread over the buffer, it will move through the buffer in channels. Channels allow water to move almost as quickly through a buffer as it does from the field, thereby making the buffer ineffective at pollutant removal. Grass buffers should be used in the riparian buffer system because they are more effective than forests in spreading water and removing sediment and sediment-associated pollutants.

Most nitrogen from agricultural fields moves quickly into the soil as nitrate. Nitrate is

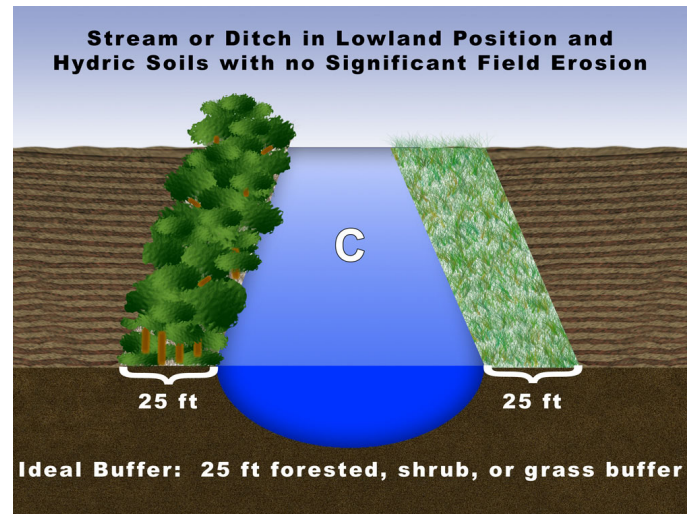
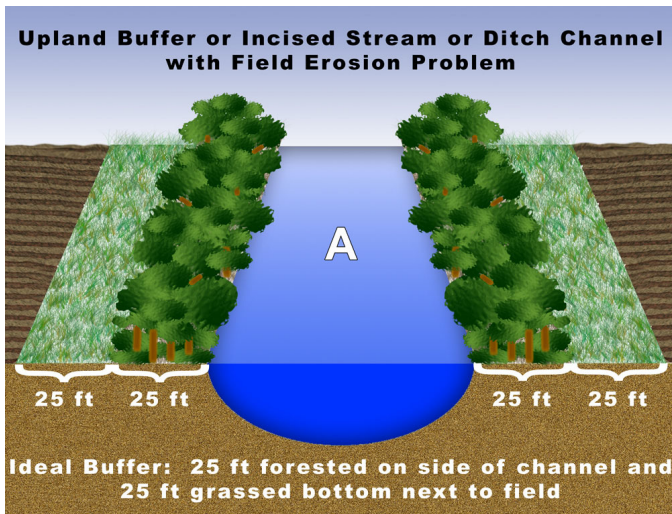
very mobile in the soil. Any nitrate not used by the crop or the soil organisms continues to move through the soil and into the shallow groundwater below the soil surface. Even when farmers follow best management practices, 20 to 40 pounds of nitrogen per acre per year routinely move into the shallow groundwater under agricultural fields, according to research done at NC State University.

To remove nitrate from groundwater before it reaches surface water, the groundwater must enter a zone where plant roots are or have been active. These plant roots may either absorb the nitrate for use in plant growth or, more importantly, provide an energy source for bacteria that convert nitrate-nitrogen to harmless nitrogen gas. This process, denitrification, occurs almost exclusively in water-saturated zones where abundant organic matter is present.

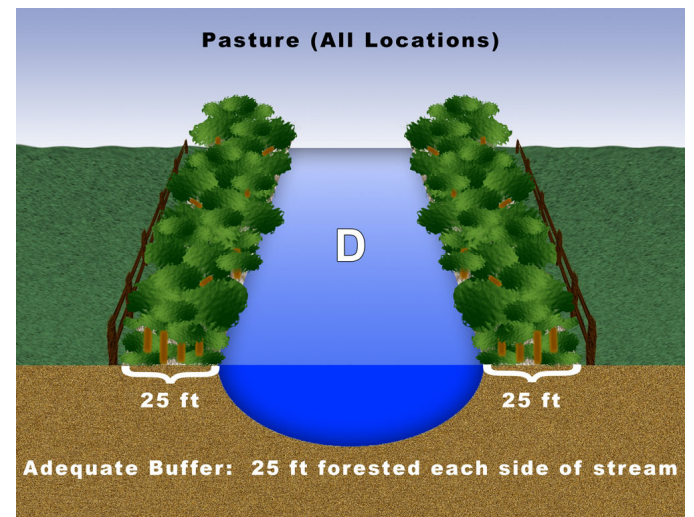
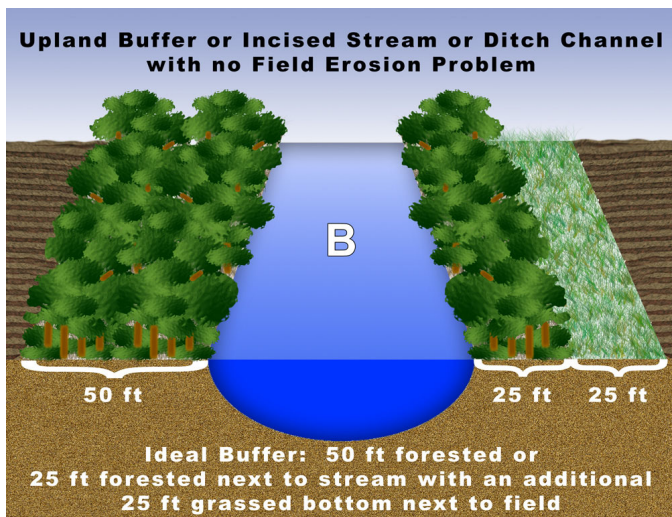
Riparian buffers reduce nitrogen under most conditions. Typically, denitrification rates measured in coastal plain forested riparian buffer areas are generally between 18 to 55 pounds of nitrogen per acre per year. There is little evidence that type of vegetation in the buffers has any influence on the ability of the buffers to reduce nitrogen. Grass buffers are more effective in reducing sediment, whereas tree buffers maintain streambank integrity and provide better habitat for macroinvertebrates (stream insects) and fish.

If the buffer is in an upland position or the stream next to the buffer is incised (the stream is very deep relative to the top of the buffer) and if conventional tillage is used in areas with moderate erosion potential, riparian buffers should consist of a 25-foot forested or shrub riparian buffer (from the edge of the stream outward) and enough grass buffer to control erosion (A). The width of the grass buffer will probably need to be at least 25 feet, but as erosion rates or slope become greater, grass buffers will need to be widened. Accumulated sediment in the grass buffer must be removed or it will fail over time; often this maintenance must also include reseeded.

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Where the majority of sediment and sediment-associated pollutants, such as phosphorus and pesticides, are controlled by no-till but the buffer is in an upland position or the stream next to the buffer is incised (B), a 50-foot buffer is needed – either 50 feet of tree buffer or 25 feet of trees next to the stream plus 25 feet of grass buffer. If the stream or ditch is in a low landscape position with hydric soils (very wet soils), then a 25-foot vegetated (trees, grass, or shrubs) buffer is considered sufficient to reduce nitrogen, assuming that erosion is minimal either because conservation tillage is used or the topography is very flat (C).



For well-maintained pastures, where the pollutant of concern is nitrogen, a fenced, 25-foot buffer is considered sufficient (D). Grass buffers can be used if the streambank is stable; otherwise, a tree buffer should be used. It is necessary to fence cattle out of streams to reduce streambank degradation and nutrient deposition. Twenty-five feet of buffer is considered sufficient to reduce the low levels of nitrate moving into the stream.

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Published by  
**NORTH CAROLINA COOPERATIVE EXTENSION SERVICE**