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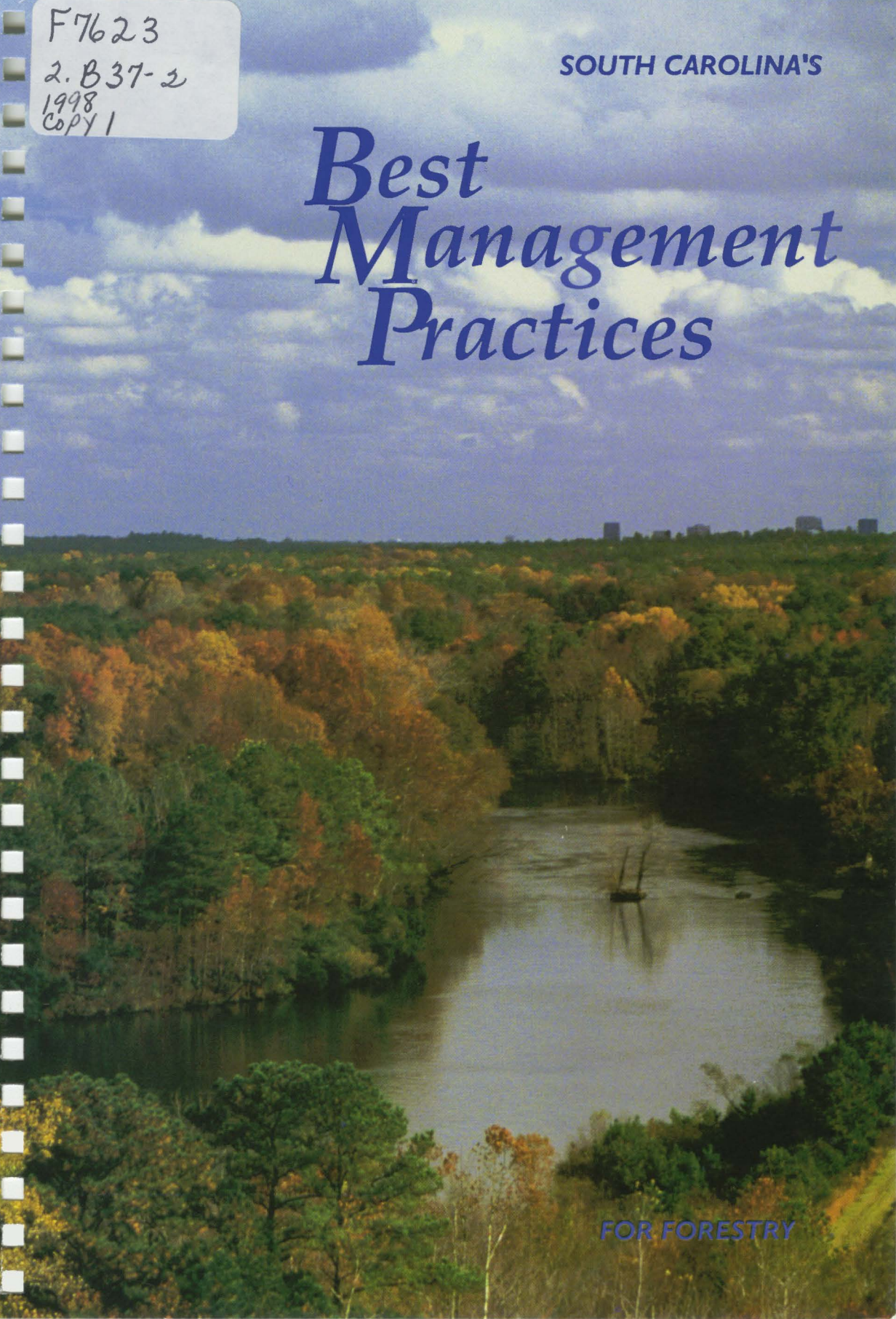
SOUTH CAROLINA'S

# Best Management Practices



FOR FORESTRY

## *Acknowledgments:*

The South Carolina Forestry Commission gratefully acknowledges the assistance and cooperation of the South Carolina Forestry Association and the Association's Best Management Practices Task Force in the development of this publication. Special acknowledgment goes to the BMP Development Committee representing the Forestry Commission, Clemson University, Industry, and the U.S. Forest Service for technical input.

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**About the cover:** *The lower Saluda River begins at the base of the Lake Murray Dam. From the dam, the river flows eleven miles before joining the Broad River to form the Congaree River near Columbia. Trout thrive in the lower Saluda due to the cold water discharge from the depths of Lake Murray through the Saluda Hydroelectric Plant. The use of Best Management Practices in forestry operations within the Saluda River Watershed will protect the fishery habitat and water quality for downstream water users.*

SOUTH CAROLINA'S

# BMP

# Best Management Practices

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Best Management Practices

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# INTRODUCTION

South Carolina's Forestry **Best Management Practices** (BMPs) give forest landowners and the professional forestry community guidelines to follow in practicing good stewardship on our valuable forestland. Good stewardship during forestry activities will protect the water quality of nearby streams, lakes, or ponds. Most of the BMPs in this manual address the protection of water quality or the requirements of Section 404 (dredge and fill) of the Clean Water Act. The BMPs in this manual have been designed to be consistent with the management measures as described in the Environmental Protection Agency (EPA) publication entitled Guidance Specifying Management Measures for Sources of Non-Point Pollution in Coastal Waters, January 1993. All forestry practices must comply with the Endangered Species Act (see p. 52). Additional BMPs are included as recommendations to landowners to conserve site productivity, depending on the landowner's goals. BMPs are not to be construed as required under any laws pertaining to water quality on sites where there is no risk of off-site impact. Additional management options are included where wildlife is a primary concern of the landowner.

The concept of BMPs was first introduced in response to federal legislation, the Clean Water Act, as a practical and effective means to reduce *nonpoint source (NPS) pollution.* Compliance with BMPs is required for forestry activities which involve discharge of dredge or fill materials into jurisdictional wetlands to qualify for the *silvicultural* exemption under Section 404 (f) of the Clean Water Act. Compliance with BMPs is recommended on all sites on which there is a potential for violating water quality criteria as defined by the South Carolina Pollution Control Act.

The South Carolina Forestry Commission is the lead agency in South Carolina in designing, interpreting, monitoring, and updating forestry BMPs. Questions pertaining to interpretations of this manual should be directed to the S.C. Forestry Commission. Certain landform features may require variances from specified BMPs to better protect the environment. Variances can only be granted by the S.C. Forestry Commission. Future BMP manual revisions will be based on scientific research, monitoring results, and technological improvements.

BMPs related to water quality should be viewed as standards which may require adjustment based on specific site conditions and ownership boundaries. For example, natural disasters such as hurricanes, tornadoes, floods, or wildfires create extreme conditions for which BMPs are not designed. The responsibility of adjusting BMPs may rest on either the landowner or the operator depending upon contract terms. Because of the technical nature of these guidelines, landowners are encouraged to make use of a *licensed forester* or other *qualified professionals* as needed.

An effort has been made in writing this BMP manual to italicize technical words or phrases and clearly define them in the glossary.

# Streamside Management Zones

Land adjacent to perennial, intermittent, and ephemeral streams and ponds or lakes requires special attention during forestry operations. These Streamside Management Zones (SMZs) are critical areas where NPS pollutants can enter the aquatic system (Figure 1).

- *Perennial streams* are identified by well-defined banks and *natural channels*, and have continuously flowing water most years.
- *Intermittent streams* also have well-defined banks and natural channels, but typically have flowing water from a headwater source for only a portion of the year.
- *Ephemeral streams* generally do not have well-defined channels, and flow only in response to localized precipitation.

Identifying the type of stream is important in prescribing the level of streamside protection. Usually a landowner or manager will be most familiar with a stream's flow characteristics and can make the determination. However, in some situations the landowner or manager may be uncertain or have little knowledge of a stream's flow characteristics. For example, braided streams with multiple interconnected channels can be difficult to identify. In these situations a *licensed forester* or other *qualified professional* should be consulted.

The SMZ is divided into two parts: the primary and the secondary. The primary SMZ is 40 feet wide on each side of the stream, except for *designated trout waters* with slopes greater than 5% where the primary SMZ is 80 feet. The width of the secondary SMZ depends on the average percent slope perpendicular to the stream. Minimum required widths of secondary SMZs under various conditions are listed in Figure 2.

Best Management Practices

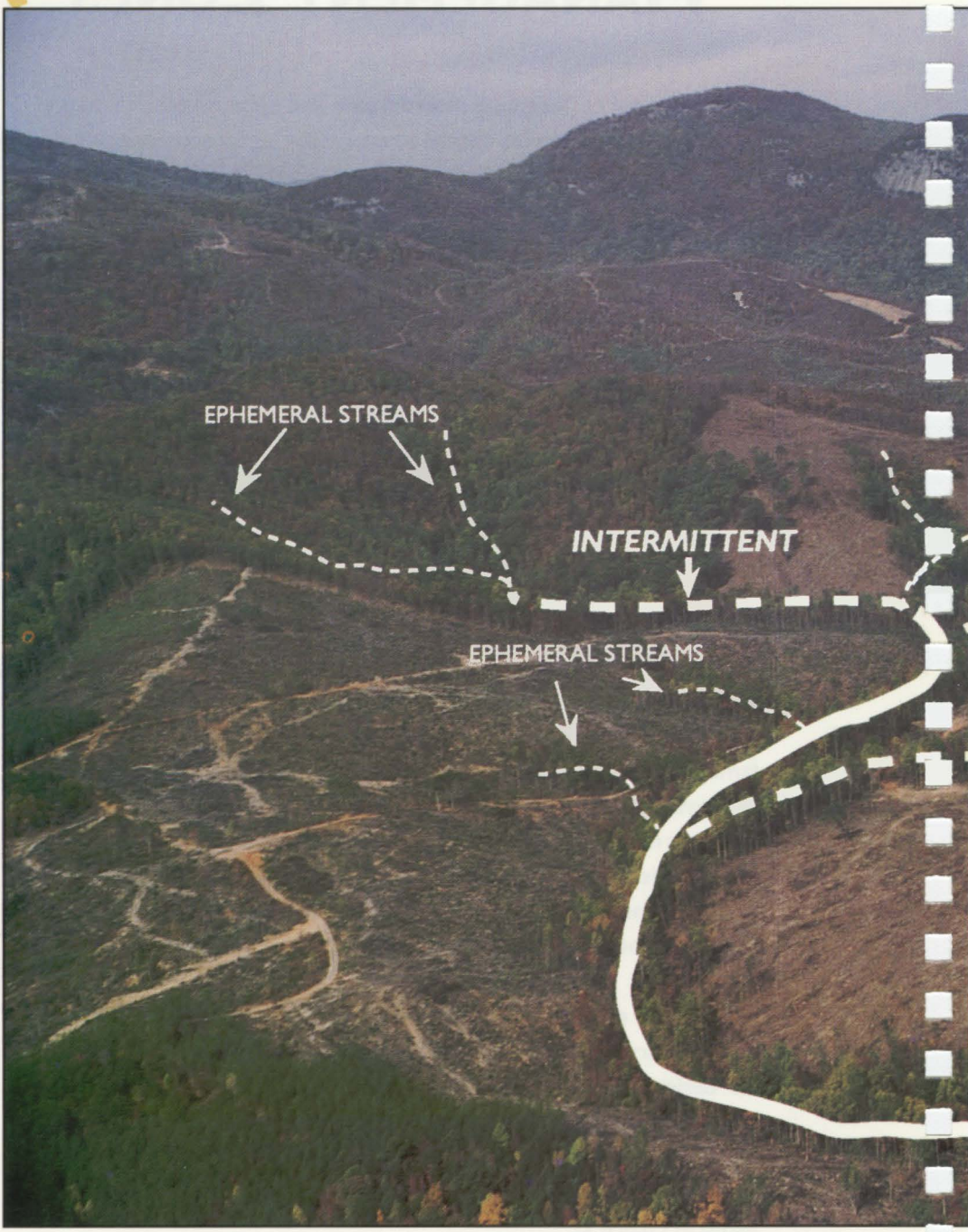
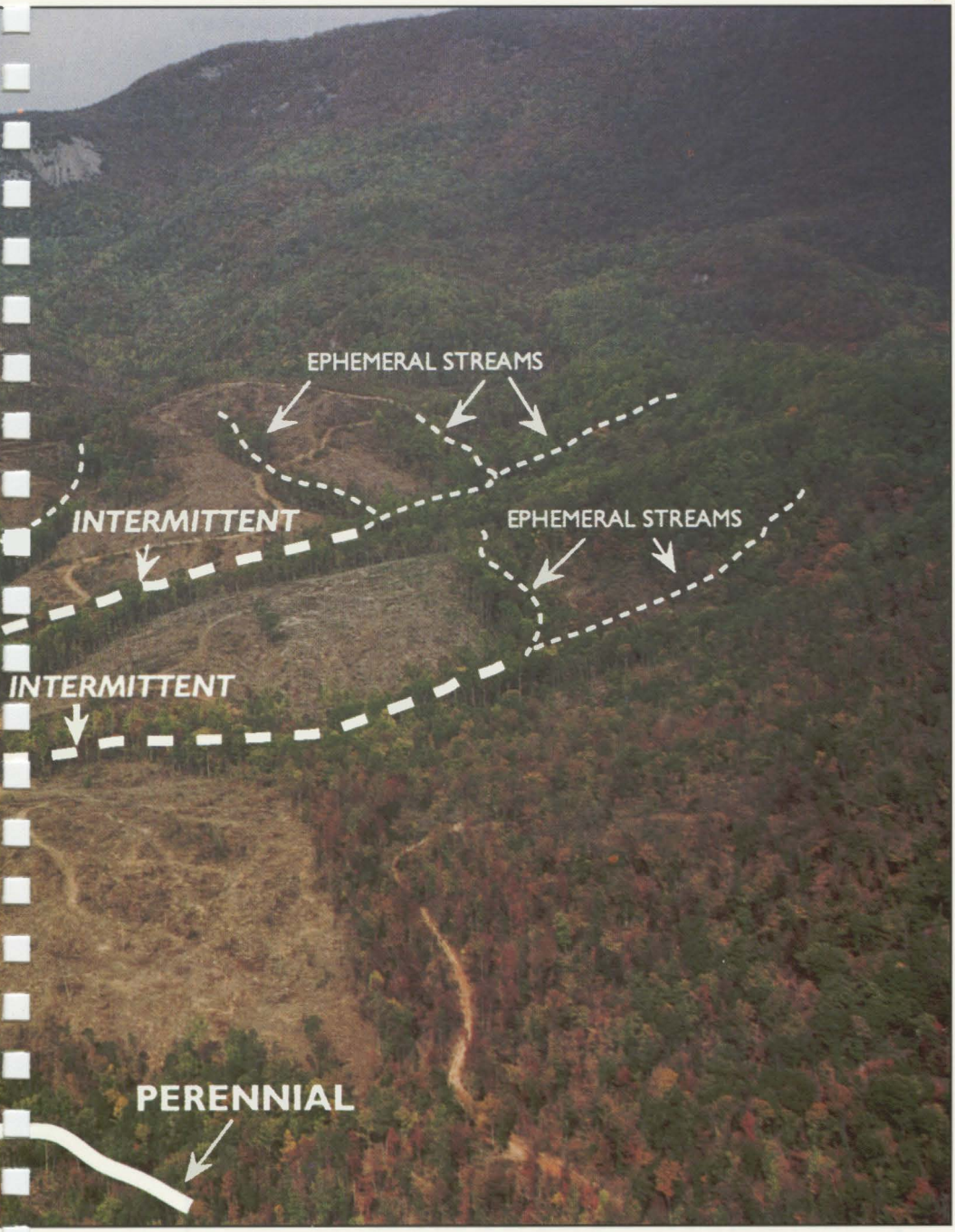



*Figure 1. Areas of land called watersheds collect precipitation and funnel it through a network of stream channels to an outlet at the bottom. Perennial, intermittent, and ephemeral streams are often found in forested watersheds.*




*Ephemeral streams drain water to intermittent stream channels. These carry the water to perennial streams which flow to the watershed outlet.*

Best Management Practices

Forest management activities are restricted within both the primary and secondary SMZs. These restrictions are listed below.

## PRIMARY SMZ

### *Perennial and Intermittent Streams*

#### BMPs

- On perennial streams, select individual trees for harvest, making sure to leave a minimum of 50 square feet of overstory *basal area* per acre evenly spaced throughout the zone. Leave all trees if less than 50 square feet of overstory basal area per acre exists. The intent is to maintain sufficient overstory and understory cover to provide shade, maintain bank stability, and protect water quality.
- On intermittent streams, permanent residual tree cover is not required as long as other vegetation and organic debris are left to protect the forest floor and stream banks.
- Fell trees away from the stream except where safety is a concern.
- Remove trees in a manner that minimizes disturbance of the forest floor, exposure of *mineral soil*, or degradation of stream bank stability. Under dry ground conditions, *directional felling* and removal of trees with mechanical equipment may be utilized.
- Hand plant or direct seed where *artificial regeneration* is desired.
- Remove tops or other *logging debris* dropped into stream channel.
- Handle and store toxic and hazardous material such as fuels, lubricants, and solvents outside of the SMZ.

### ● Avoid

- Logging debris in the stream.
- Mechanical *site preparation* or machine planting.
- Portable sawmills or *log decks*.
- Broadcast application of any *pesticide*.
- Road construction except where necessary for stream crossing.

## SECONDARY SMZ

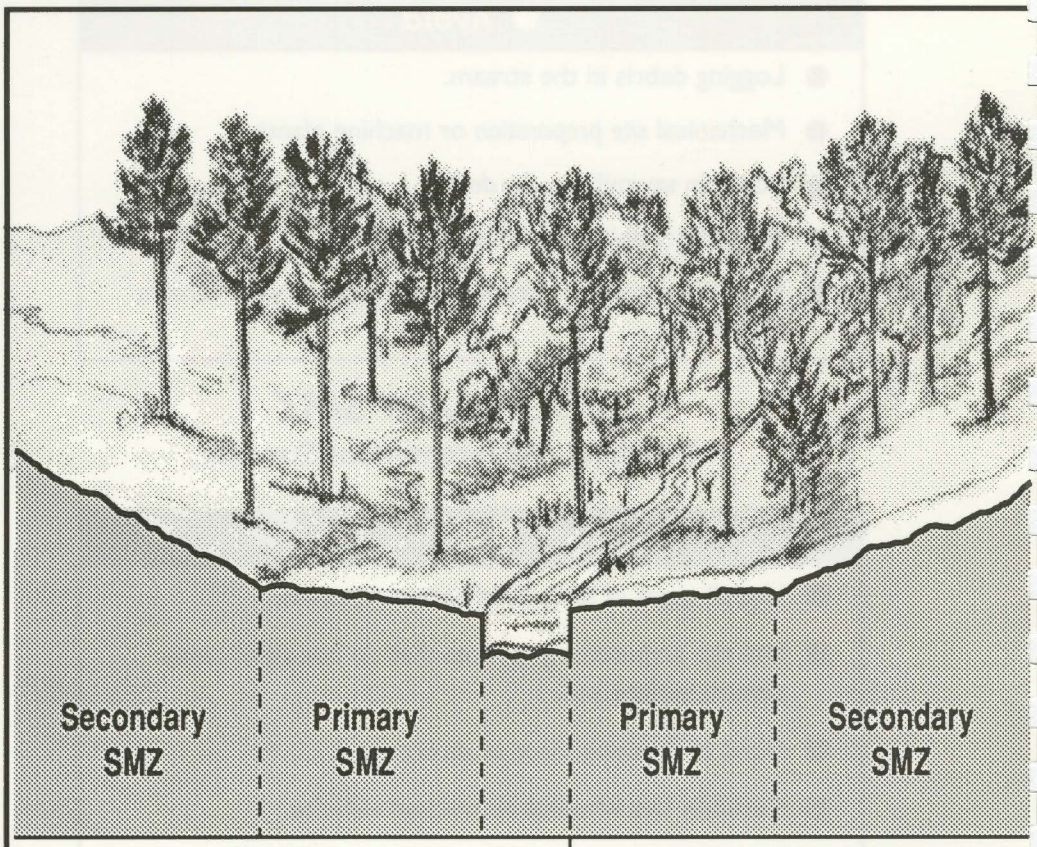
***Perennial and Intermittent Streams***

### ■ BMPs

- Use all types of *silvicultural* harvest systems.
- Use *site preparation* practices that do not significantly disturb surface soil.
- Hand or machine plant or direct seed.
- Carefully use wheeled or tracked vehicles.
- Handle and store toxic and hazardous materials such as fuels, lubricants, and solvents outside of the SMZ.

### ● Avoid

- Portable sawmills and *log decks*.
- Road construction, except where necessary for stream crossing.
- *Excessive rutting*, especially where ruts run perpendicular to a stream.
- Exposing more than 15% of the mineral soil.




| Percent Slope Perpendicular to Stream | Width of SMZ on each side (feet) | | |
|---|---|---|---|
| | Primary | | Secondary |
| | TROUT | | |
| Less than 5% | 40 | 40 | 0 |
| 5% - 20% | 40 | 80 | 40 |
| 21% - 40% | 40 | 80 | 80 |
| Greater than 40% | 40 | 80 | 120 |

*Figure 2. Recommended primary and secondary Streamside Management Zone (SMZ) widths for perennial and intermittent streams.*

### *Ephemeral Streams*

Ephemeral streams generally flow in the upper reaches of a *watershed* following precipitation. Although well-defined channels may be present in unique situations, ephemeral streams (commonly referred to as drains) rarely carry enough runoff to displace soil, but they may displace the *litter* on top of the soil. They do flow directly into *intermittent* and *perennial streams*. Therefore, the forest floor in ephemeral areas should be protected so that *sediment* can be filtered out before runoff enters the watercourse. Handle and store toxic and hazardous material such as fuel, lubricants, and solvents outside the ephemeral area.

#### ● *Avoid*

- Portable sawmills and *log decks* within the drain.
- *Skidding* logs during wet conditions within the drain except at infrequent planned crossings.
- *Site preparation* practices that significantly disturb the soil within the ephemeral area.
- Applying *pesticides* or fertilizers if surface water is present.
- Altering the flow of the runoff.
- Road construction except where necessary for crossings.
- Emptying road runoff directly into drains.

### *Trout Waters*

Trout require cool, clear streams. They, and the aquatic insects they feed on, are especially sensitive to increased sedimentation. Since South Carolina is near the southern limit of the trout's range, water temperature is also a critical factor. It is therefore important to take special precautions to minimize sedimentation and to maintain a shade cover to prevent excessive warming of the water.

#### ■ *Additional BMPs*

- Increase the width of the primary SMZ from 40 feet to 80 feet on slopes over 5%.
- Drain water from roads and skid roads onto ridges and side slopes. Drainage structures should not divert water directly into streams.
- Revegetate exposed soils within the SMZ following road construction as soon as possible to take advantage of the loose soil conditions for seeding.
- Use mulch, gravel, and/or rock if needed to help stabilize fills where roads and skid roads cross streams.

## Trout Waters in South Carolina

| Water Body | County | Description |
|---|---|---|
| Cox Camp Creek | Greenville | The entire creek tributary to the Middle Saluda River |
| East Fork Chattooga River | Oconee | That portion of the river from its confluence with Indian Camp Branch to the Chattooga River |
| Emory Creek | Pickens | The creek from the northern boundary of Table Rock Resort property to its confluence with the Oolenoy River |
| Lake Jocassee | Oconee | The entire lake |
| Matthews Creek | Greenville | From the end of State land in the Mountain Bridge Area to its confluence with the South Saluda River |
| Saluda River (main stem) | Lexington/Richland | That portion from the Lake Murray Dam to the confluence with the Broad River |
| Savannah River | Abbeville | From Lake Hartwell Dam to the head-waters of Lake Russell |
| Swaford Creek | Oconee | The entire creek tributary to East Fork Chattooga River |
| Whetstone Creek | Oconee | The entire creek tributary to the Chattooga River |
| Willis Creek | Pickens | The creek from the northern boundary of Table Rock Resort property to its confluence with the Oolenoy River |

# STREAM CROSSINGS

Stream crossings are sometimes necessary for access to forestlands. All crossings need to be planned to minimize environmental impacts. Specific practices are recommended in this section to assure minimum impacts on water flow and aquatic organisms. Bridges, *culverts*, and *fords* are all acceptable stream crossings when matched to the site and installed properly.

Bridge construction across navigable waterways is under the jurisdiction of the South Carolina Department of Health and Environmental Control (DHEC).* Permanent bridges (those that would remain in place for a period greater than six months) must meet higher standards than temporary bridges. Anyone planning to construct a bridge across a navigable waterway must contact DHEC for permit application forms and technical design information.

*DHEC: 2600 Bull St., Columbia, S.C. 29201 (803-734-5360)

## BMPs

- Cross streams at right angles except where prevented by geologic features.
- Keep approaches to stream crossings to as gentle a slope as practical.
- Use drainage structures, such as *water turnouts* or *broad-based dips*, on both sides of a crossing as needed to prevent road and ditch runoff from entering the stream.

## ■ BMPs continued

- Ensure proper sizing and installation of culverts (Table 1).
- Stabilize disturbed soil around crossings soon after construction (Table 2).
- Use a *licensed forester* or other *qualified professional* to locate stream crossings prior to road construction to minimize impacts.
- Consider using portable bridges instead of culverts.
- Follow all BMPs listed under **Forest Wetland Road Construction** (p. 26).

## ● Avoid

- Using soil as fill material except when installing culverts.
- Allowing runoff from roadside ditches to flow directly into streams at the crossings.
- Altering the flow of the stream.

### Culvert Installation

- Place culvert on the *grade* of the existing stream channel.
- Install culverts which are long enough to extend beyond the *toe of the fill* slopes.
- Compact backfill material to prevent water from seeping around the culvert.
- Cover the culvert with enough fill to prevent damage by traffic.
- If *erosion* is a problem, construct a headwall on the inlet side and an *apron of rip-rap* at the outlet, if the outlet is placed above the toe of the fill.
- Stabilize disturbed soil. If mulch and seed are used, refer to Table 2.

### Woody Fill

Woody material may be used as fill to protect stream banks and bottoms in crossing small *intermittent* and *ephemeral streams* with well-defined channels if:

- Soil is not introduced into the stream with the woody fill. Soil blocks the pore space among the woody debris, impeding drainage and increasing the amount of *sediment* in the watercourse.
- Stream flow is not blocked or diverted.
- Woody material that restricts flow of water is removed.

## Culvert Installation

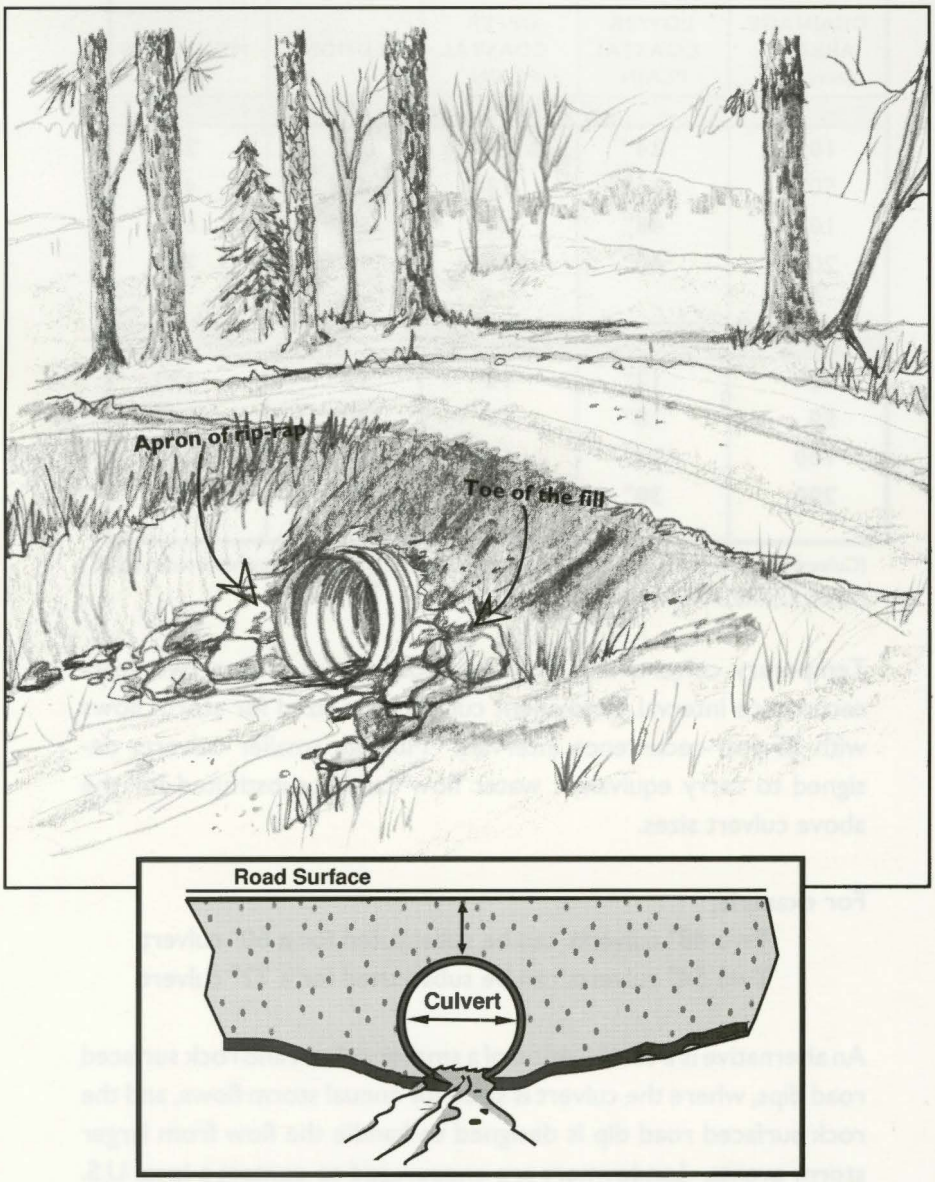



*Figure 3. Earth cover over pipe should be a minimum of 12" or 1/2 the culvert's diameter, whichever is greater.*

Table 1: Recommended Diameters for Permanent/Temporary Culverted Crossings

| DRAINAGE AREA (acres) | LOWER COASTAL PLAIN | UPPER COASTAL PLAIN | PIEDMONT | MOUNTAIN |
|---|---|---|---|---|
| **PERMANENT** | | | | |
| 10 | 24" | 12" | 30" | 24" |
| 50 | 36" | 18" | 48" | 48" |
| 100 | 48" | 24" | 54" | 60" |
| 200 | 60" | 36" | 72" | 72" |
| **TEMPORARY** | | | | |
| 10 | 12" | 12" | 18" | 12" |
| 50 | 18" | 12" | 30" | 24" |
| 100 | 24" | 18" | 36" | 30" |
| 200 | 30" | 24" | 42" | 36" |

(Culvert diameters are based on U.S. Geological Survey (USGS) data as reported in USGS Report 91-4157, Columbia, S.C., 1992.)

Temporary culverts are sized for storm flows with a two-year-recurrence interval. Permanent culverts are sized for storm flows with 25-year-recurrence intervals. Multiple smaller culverts designed to carry equivalent water flow can be substituted for the above culvert sizes.

For example:

Two 48" culverts can be substituted for a 60" culvert.
Two 54" culverts can be substituted for a 72" culvert.

An alternative is a combination of a smaller culvert and rock surfaced road dips, where the culvert is sized for annual storm flows, and the rock surfaced road dip is designed to handle the flow from larger storm events. Landowners are encouraged to contact a local U.S. Natural Resources Conservation Service representative or other qualified professional to design culverted crossings specifically for each site.

Table 2: Recommendations for Seeding, Mulching, and Fertilizing Roads, Fills, and Other Disturbed Areas

| AREA | SPRING AND EARLY SUMMER | | LATE SUMMER, FALL, AND EARLY WINTER | |
|---|---|---|---|---|
| MOUNTAINS | Kentucky 31 Fescue (early spring) | 30 lbs./acre | Kentucky 31 Fescue | 30 lbs./acre |
| | (or) Orchard Grass (late spring) | 12 lbs./acre | Annual Rye | 10 lbs./acre |
| | Browntop Millet | 10 lbs./acre | *Unscarified Sericea Lespedeza | 25 lbs./acre |
| | *Scarified Sericea Lespedeza | 20 lbs./acre | | |
| PIEDMONT | Kentucky 31 Fescue (early spring) | 30 lbs./acre | Kentucky 31 Fescue | 30 lbs./acre |
| | Browntop Millet | 10 lbs./acre | Annual Ryegrass | 5 lbs./acre |
| | Bahia | 10 lbs./acre | Annual Rye | 10 lbs./acre |
| | *Scarified Sericea Lespedeza | 20 lbs./acre | *Unscarified Sericea Lespedeza | 25 lbs./acre |
| COASTAL PLAIN | Bermuda grass (hulled) | 4 lbs./acre | Bahia | 30 lbs./acre |
| | Bahia | 25 lbs./acre | *Unscarified Sericea Lespedeza | 60 lbs./acre |
| | *Scarified Sericea Lespedeza | 25 lbs./acre | Annual Rye | 20 lbs./acre |
| | Browntop Millet | 10 lbs./acre | | |

*Sericea may be left off on low erosion hazard areas.

NOTE: Fertilize with 800 to 1,000 lbs. per acre of 6-12-12. Mulch slopes with 4,000 lbs. small grain straw or 5,000 lbs. hay per acre.

Best Management Practices

# FOREST ROAD CONSTRUCTION

Forest roads are needed to provide access for forest management and recreational activities. *Permanent main access* (MA) *roads* and *temporary limited use* (LU) *roads* should be planned in advance of road construction in order to protect water quality.

Historically, roads have been one of the major sources of *sediment* from forestry related activities. Planning can reduce *skidding* distances and eliminate unnecessary roads. Use of *broad-based dips*, *water bars*, *filter strips*, and other sediment control techniques can significantly lower the amount of *erosion* which might otherwise occur.

To protect water quality, roads should be designed to minimize the amount of sediment entering stream channels.

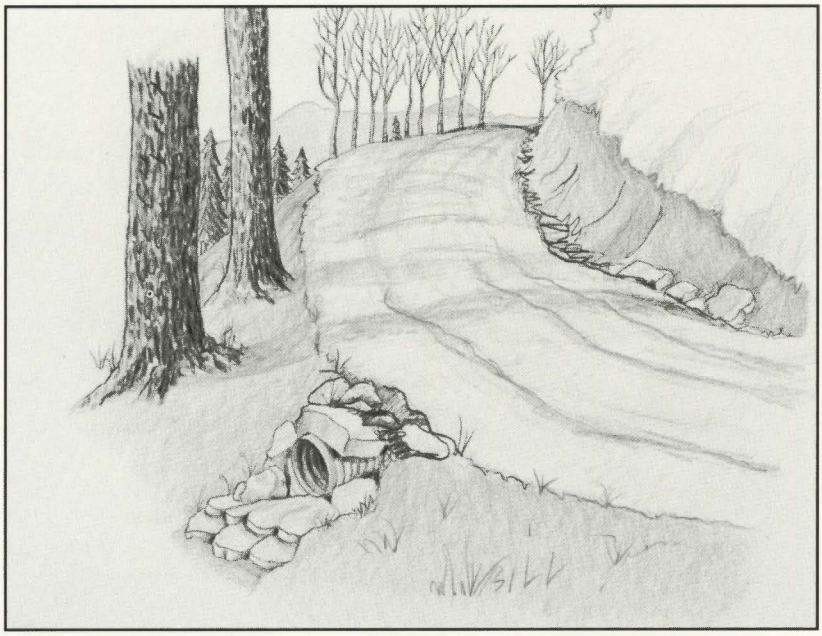


*Figure 4. Culverts provide cross drainage for roads with inside ditches.*

## BMPs

### Planning

- Identify and avoid *sensitive sites* where possible.
- Design the road system to meet long-range objectives rather than simply to access individual sites. Numerous separate road projects tend to have more environmental impact than one well-designed road system.
- Locate roads on the sides of ridges to ensure proper drainage.
- Follow the *contour* as much as possible, with *grades* between 0% and 10%, except where terrain requires short, steep grades. Breaking or changing grade frequently will cause fewer erosion problems than long, straight, continuous gradients.
- Use *outsloped roadbeds*, on hilly or mountainous terrain, to remove surface runoff from the road as quickly as possible, except where safety and environmental concerns dictate otherwise.
- Construct roads only wide enough to handle equipment that will use the road (usually 12 to 14 feet travel width for LU roads and 16 to 20 feet travel width for MA roads). Narrow roads may need to be widened on curves, with periodic pull-outs for passing.
- Construct a road right-of-way wide enough to minimize shade from roadside trees where surface drainage is a problem. This will allow roadbeds to dry out following rainfall.
- In lowland areas, keep road surfaces as close to ground surface level as possible (normally less than two feet above the forest floor).

## BMPs continued

### Construction

- On steep grades, where inside ditches are required, install *culverts* at specified intervals (Table 3) to remove surface runoff with minimal erosion.
- Install culverts or construct broad-based dips (or other suitable drainage structures) so that they are large enough and frequent enough to accommodate expected volumes of water (Table 3).
- Cover culverts with enough compacted fill to prevent damage by traffic.
- Ensure that culverts, *water turnouts*, and broad-based dips empty road runoff onto the undisturbed forest floor.

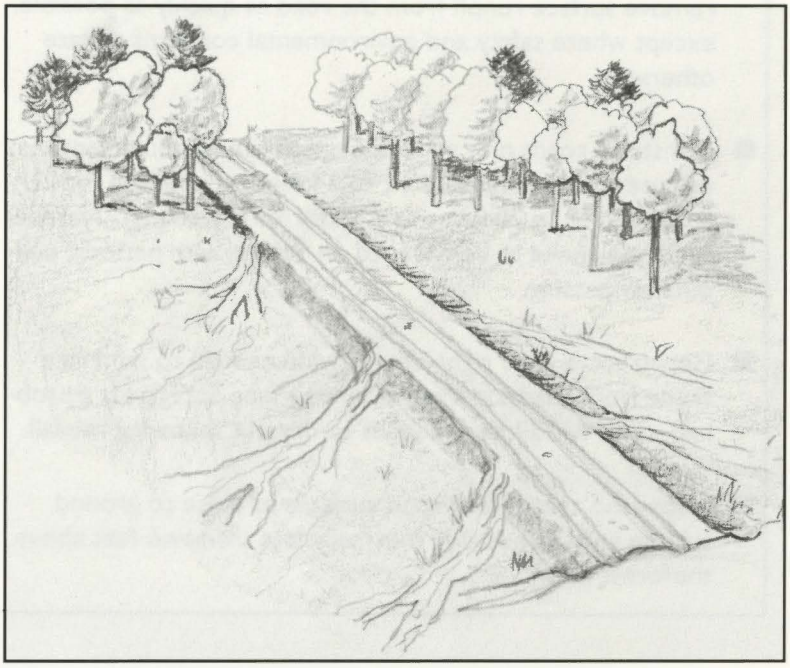


*Figure 5. Water turnouts empty road runoff onto the undisturbed forest floor.*

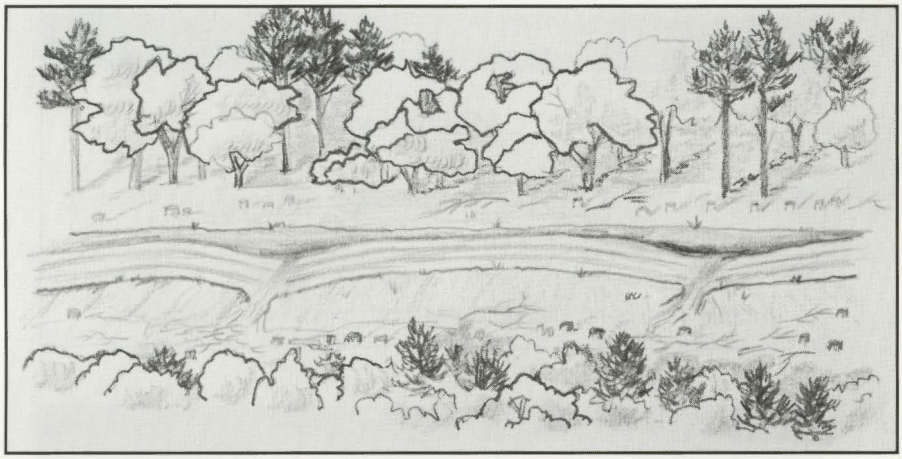


*Figure 6. Broad-based dips remove road runoff while allowing vehicles to maintain normal speeds.*

## BMPs continued

### Stabilization

- Protect the culvert inlet with a headwall of stable material where necessary. If the culvert outlet is above the *toe of the fill*, stabilize fill with rip-rap or other suitable material.
- Where erosion may occur, stabilize exposed *mineral soil* when road construction is completed. Soil stabilization may include *mulching*, rocking, seeding with grasses, or using erosion-resistant fabrics.
- Use water bars when retiring LU roads and *skid trails* or where broad-based dips cannot be constructed.

Best Management Practices

## BMPs continued

### Maintenance

- Maintain culverts to prevent blockage and resultant flooding.
- Minimize road grading and reshaping on hilly or mountainous terrain unless required to repair damaged road sections.

## Avoid

- Road construction inside SMZ except where necessary to cross streams.
- Locating roads on broad, flat ridges where water tends to collect, resulting in poor drainage.
- Traffic on soft roads during wet ground conditions.
- Constructing forest access roads that are wider or longer than necessary for normal forestry activities.
- Emptying road runoff directly into drains.

Table 3: Recommended Maximum Spacing for Drainage Structures

| Slope (Percent) | Broad-Based Dips and Culverts (feet) | Water Bars and Turnouts (feet) |
|---|---|---|
| 2 | 300 | 245 |
| 5 | 180 | 125 |
| 10 | 140 | 80 |
| 15 | 125 | 60 |
| 20 | 120 | 50 |
| 25 | 115 | 40 |

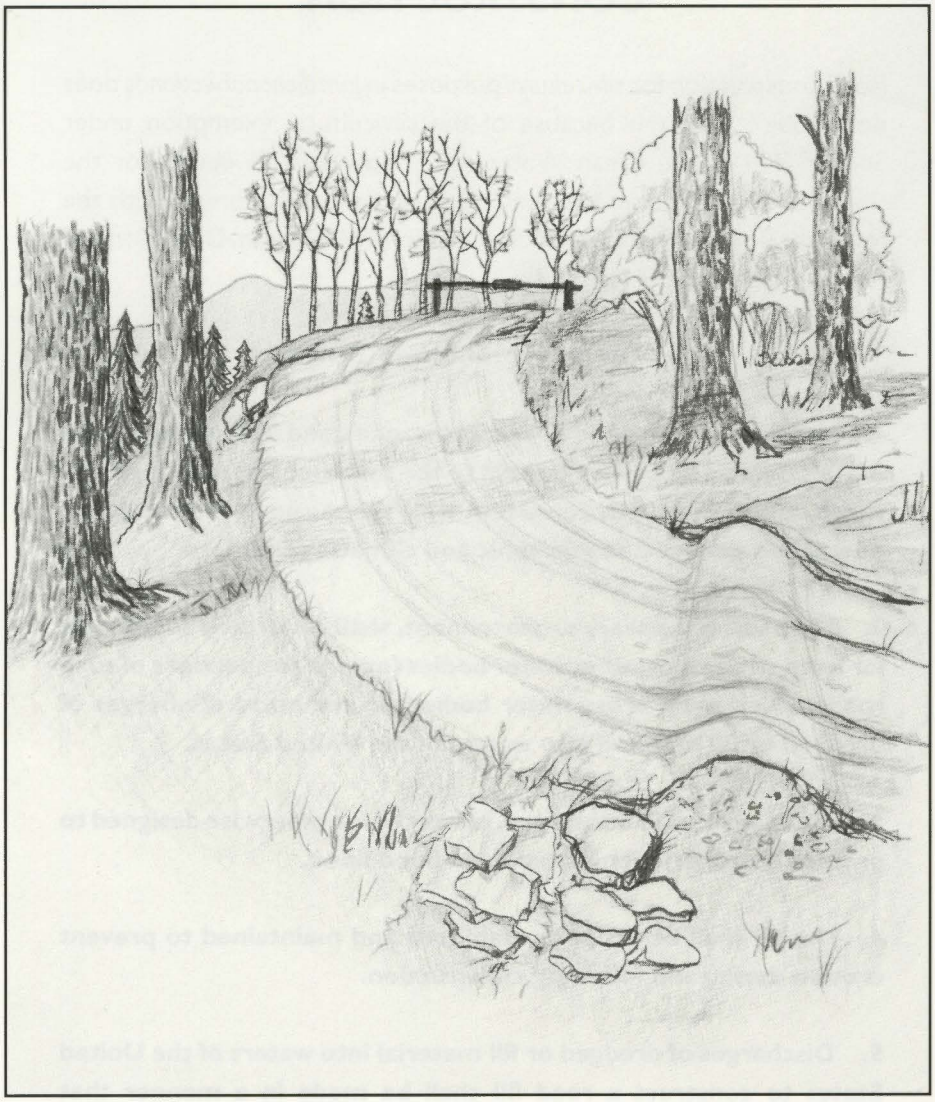


*Figure 7. Water bars are used to remove surface runoff when retiring limited use roads.*

# FORESTED WETLAND ROAD CONSTRUCTION

Road construction for *silvicultural* purposes in *jurisdictional wetlands* does not require a permit because of the silvicultural exemption under Section 404 of the Clean Water Act. However, to qualify for the silvicultural exemption, the road construction must comply with the following BMPs, (from Clean Water Section 404 Program Definition and Permit Exemption, Part 232.3).

## *Federally Mandated BMPs*

**1. Permanent roads, temporary access roads, and *skid trails* in waters of the United States shall be held to the minimum feasible number, width, and total length consistent with the purpose of silvicultural operations and local topographic and climatic conditions.**

**2. All roads, temporary or permanent, shall be located sufficiently far from streams or other water bodies (except for portions of such roads which must cross water bodies) to minimize discharges of dredged or fill material into waters of the United States.**

**3. The road fill shall be bridged, culverted, or otherwise designed to prevent the restriction of expected flood flows.**

**4. The fill shall be properly stabilized and maintained to prevent erosion during and following construction.**

**5. Discharges of dredged or fill material into waters of the United States to construct a road fill shall be made in a manner that minimizes the encroachment of trucks, tractors, or other heavy equipment within the waters of the United States (including adjacent wetlands) that lie outside the lateral boundaries of the fill itself.**

6. In designing, constructing, and maintaining roads, vegetative disturbance in the waters of the United States shall be kept to a minimum.

7. The design, construction, and maintenance of the road crossing shall not disrupt the migration or other movement of those species of aquatic life inhabiting the water body.

8. Borrow material shall be taken from upland sources whenever feasible.

9. The discharge shall not take, or jeopardize, the continued existence of a threatened or endangered species as defined under the Endangered Species Act, or adversely modify or destroy the critical habitat of such species.

10. Discharges into breeding and nesting areas for migratory waterfowl, spawning areas, and wetlands shall be avoided if practical alternatives exist.

11. The discharge shall not be located in the proximity of a public water supply intake.

12. The discharge shall not occur in areas of concentrated shellfish production.

13. The discharge shall not occur in a component of the National Wild and Scenic River System.

14. The discharge of material shall consist of suitable material free from toxic pollutants in toxic amounts.

15. All temporary fills shall be removed in their entirety and the area restored to its original elevation.

Additional BMPs are listed below as interpretation of the 15 federally mandated BMPs.

## BMPs

- The height of both MA and LU roads on high ground should normally be less than two feet above the forest floor.
- Where a MA or LU road crosses a stream or slough, or enters a *peat* or *muck swamp*, the fill should not be higher than the road at either end, except as required by DHEC for crossing navigable streams. Normally the road height should be two to three feet above the forest floor, but it may be higher in low areas.
- MA roads at streams should be bridged or culverted with permanent structures of a size and frequency to allow expected flow of water. Where *fords* are used in lieu of bridges or culverts, they must have adequate rock bases to protect the stream bed.
- Stabilize soils around each structure where MA roads cross *intermittent* or *perennial streams* which have an average annual flow of five cubic feet per second or greater, and where rainwater runoff from the road will likely cause serious *erosion* and stream sedimentation.
- Where LU roads cross intermittent or perennial streams, temporary bridges or culverts of sufficient size and frequency should be used to minimize interference with the flow of water. When a silvicultural operation is completed, temporary bridges and culverts should be removed, and LU roads cross-ditched where needed to allow normal water flow.

## BMPs continued

- Obtain roadbed material from upland *borrow pits* whenever possible. For roads that cross sloughs or muck swamps, the base may be logs or sand and clay. Logs are preferable because they reduce the amount of fill material required. Roads with only a sand or clay base gradually settle into the peat or muck, and must be constructed higher initially to ensure adequate width.

- Roads in muck swamps, *headwater swamps*, and *black river bottoms* may be constructed from *dredge material* obtained from a ditch along the upper side of the road, then capped with fill from an upland area. Continuous side ditches are preferred. They reduce the impoundment of water on the upper side of the road, provided there are adequate culverts to move water from the upper to the lower side. Ditch bottoms should follow surface topography and culverts should be located in the lower areas. Such ditches should not be designed to carry water for more than one-fourth mile. They must be separated from navigable water by vegetated *filter strips*.

- Ditches should not convert wetlands to uplands.

Best Management Practices

# TIMBER HARVESTING

Executing an environmentally responsible and economically efficient timber harvest operation, especially one near *sensitive sites*, requires a thorough understanding of the land, the trees, the capabilities of the logger and logging equipment, and the markets for timber products. Landowners are encouraged to seek the advice of a *licensed forester* or the South Carolina Forestry Commission to plan and execute timber harvests carefully. Timber harvesting contracts should specify compliance with BMPs.

*Harvesting* trees is not just the end of the growing cycle of a forest; it is the start of the next generation. Many commercial tree species need exposed *mineral soil* and the direct sunlight of an open area for their seeds to germinate and successfully become established. Harvesting operations usually provide both of these conditions. To minimize water quality impacts of harvesting, the landowner or his agent should carefully consider road location, stream crossings, and the method of *regeneration* before logging begins.

It is necessary to protect sensitive areas, plan for regeneration, and consider the areas beyond the actual harvest site if negative environmental impacts are to be avoided. For instance, bottomland hardwood sites, *Carolina Bays*, and other swamps differ from upland forest types in that their soils are wet for most, if not all, of the year. They are frequently connected directly to an aquatic system; they often have overland water flow from nearby stream flooding; and they may accumulate *sediments*, nutrients, and pollutants from upstream *erosion* and runoff. These areas may require special harvesting equipment and/or special harvesting techniques.

## Water Quality

The primary water quality impact associated with timber harvesting is the degradation of aquatic habitat quality due to increased sediment inputs and elevated water temperatures. The following BMPs are designed to minimize harvesting impacts on water quality.

### BMPs

#### Planning

- Carefully plan the harvest to minimize the number of stream crossings required.
- Identify locations for stream crossings where impacts to the stream are likely to be minimal. Follow all stream crossing BMPs.
- Identify areas that are the most acceptable *log deck* locations (stable soil). If it is necessary to stabilize areas for decking, limit the amount of area filled to the smallest practical size.
- Identify sensitive areas such as SMZs, *ephemeral streams*, and erosive soils.

#### Execution

- Establish SMZs adjacent to all *perennial*, *intermittent streams*, and lakes.

## BMPs continued

### Execution

- Take precautions to minimize excessive *rutting* in active floodplains, bottomland hardwood swamps, and erosive slopes. If soils are excessively wet, special techniques are available to minimize rutting, soil compaction, and/or interference with normal flow of water.

  Examples of these techniques:
  a. debris or mats on *skid trails*
  b. *high flotation equipment*
  c. concentrating logs in felling and forwarding operations to minimize the number of skid trails
  d. other low-impact techniques

- Cease harvesting operations when overland water flow impairs beneficial uses of water bodies downstream from the harvesting operation. Turbid water flowing from the site is a useful indicator of possible impairment of beneficial uses downstream.*

- Lay out skid trails to minimize water quality impacts (see **Skid Trails** p. 36).

- Service equipment away from water bodies and wetlands when possible.

### Follow-up

- Remove any blockage intended for temporary crossing in a bottomland hardwood slough or drain if it is directly connected to a perennial stream.

## Avoid

- Locating *log decks* in sensitive areas.
- Skidding beside or within a stream *channel.*
- Skidding straight up and down (perpendicular to the *contour*) on steep hillsides if mineral soil is exposed. Use BMPs such as water bars, soil stabilization, etc., where this type of skidding is unavoidable.
- Skidding across perennial or large intermittent streams, except over an adequately designed and constructed *ford, culvert,* or bridge (see **Stream Crossings** p. 14).*
- Skidding over small intermittent or ephemeral streams during wet conditions unless the banks (if present) have been protected by placing woody material in the water course (see **Stream Crossings** p. 14).*
- Removing culverts from stream channels following logging when the crossing will be used within ten years.
- Using soil fill, either alone or in combination with woody debris fill, for skid trail stream crossings.

* Braided stream systems typically have multiple, interconnected channels and a high water table for much of the year. Logging under these conditions often requires the use of specialized logging equipment. BMPs concerning stream crossings are not always applicable when crossing braided streams due to their unique characteristics. Increased turbidity downstream from a logging operation should not be of a duration or magnitude to impair the beneficial uses of the water body. Upon completion of the logging operation, block any channels that were created by skidding logs across the terrain in braided stream systems.

## On-Site Impacts (Non-Water Quality)

Harvesting sites with stable, non-erosive soils that are not closely associated with streams has little potential to impact water quality. However, logging during wet conditions can cause exposure of mineral soil and *rutting* which may result in *erosion*, soil compaction, or puddling. Such soil disturbance may cause a loss in *site productivity*. These impacts can often be reduced with *site preparation* techniques. Because rutting may impact site productivity on certain sites, landowners should consider logging under drier conditions if they do not wish to bear the expense of site preparation or skid road rehabilitation.

Rapid reforestation is an effective means of improving the visual impact of harvest operations. Regeneration techniques such as *single-tree selection*, *patch clearcuts*, or *shelterwood harvests* can be used to minimize visual impact. These systems, however, may be less efficient than *clearcutting* for regenerating the site, and they require additional logging entries which can further impact site productivity.

Two ways to improve the initial visual impact of a clearcutting operation are:

1. Leave a strip of trees along well-traveled highways;
2. Limit the size of the area to be harvested at any one time. (This is probably the most effective way to reduce negative visual impact.)

### ■ BMPs

***Planning***

- Where clearcutting is the desired harvesting method, special emphasis should be given to the timber harvest planning process. Consider surrounding land use, wildlife habitat, and aesthetics, especially when clearcuts approach 100 acres.

## BMPs continued

### Planning

- Plan skid trails to occupy the least amount of area possible to log the site effectively (See **Skid Trails** p. 36).

### Execution

- Use high flotation harvesting equipment or another low impact harvesting system if *excessive rutting* is occurring due to wet soil conditions (see **Rutting** p. 37). Bunching stems and placing them near the *primary skid trail* can reduce excessive rutting. Log a dry alternative site if possible.
- Use woody debris, mats, or other techniques to stabilize skid trails if excessive rutting is occurring.
- Take steps to avoid depositing mud on paved roads.

### Follow-up

- Site prepare to reduce on-site impacts.
- Create conditions that are conducive to rapid regeneration.
- Clean up and/or contain fuel and oil spills immediately. Comply with state and federal regulations concerning reporting of spills.
- Dispose of oils, lubricants, their containers and other wastes according to local, state, and federal regulations.
- Report any fuel, oil, or chemical spills to the Emergency Response Unit of the Department of Health and Environmental Control at 803-253-6488.

## *Skid Trails*

- Control water flow on skid trails with *broad-based dips*, *wing ditches*, or *water bars*.
- Skid logs uphill, when possible, so surface runoff will be dispersed as it flows downhill. However, skid trails should not be located perpendicular to the contour unless appropriate BMPs are used.
- Retire *primary skid trails* on erosive slopes by installing water bars and seeding them upon completion of logging.
- Construct *bladed skid trails* according to LU road specifications except for the slope restrictions.

**To reduce harvesting impacts on sites that will not be treated with mechanical site preparation:**

- Plan primary skid trails on selective cuts so that they can be used with each successive harvest of the area.
- Locate primary skid trails so they occupy the least amount of area to log the site effectively.
- Concentrate skidding on a few trails to minimize overall soil compaction on fine textured (clay or loamy) soils.

### *Rutting*

During dry conditions, rutting occurs mostly in isolated, moist areas, or on primary *skid trails* where repeated skidder traffic gradually compacts the soil. Usually these ruts are not a significant concern. However, when certain soils are moist or wet, rutting can be a significant problem, especially if *natural regeneration* methods are planned. Rutting is a highly visible impact of logging, but the effects of rutting on site productivity are poorly understood over the wide range of soil types in South Carolina.

Because of the potential impacts on certain soils, precautions should be taken during planning and conducting timber harvesting to minimize depth of rutting and the amount of area with ruts. *

* See glossary for definitions of *rutting* and *excessive rutting*.

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# SITE PREPARATION

Rapid *regeneration* of forestland is both economically and environmentally important. Root systems help stabilize soils and thereby reduce the risk of *erosion*. Trees also intercept water and impede storm water runoff. Many sites require some type of treatment to accomplish quick and effective regeneration of the desired tree species, or to reduce some undesired effects of logging.

Prior to *artificial regeneration*, a *site preparation* method is usually chosen that enhances seedling survival and/or controls competing vegetation. Sites may also be prepared simply to make an area more amenable to planting.

For *natural regeneration*, certain site preparation methods may enhance sprouting or seed germination.

Many site preparation techniques are available. The technique used depends on soils, slope, condition of the site, natural vegetation, crop tree species, and cost. Soils, slope, and ground cover are three principal factors that determine the potential for erosion on any site. Soils with a shallow surface layer (A1) generally have limited capacity to absorb water and are more likely to erode. Steeper slopes provide rainwater runoff more velocity, and thus energy, to erode soils. Ground cover helps hold soil in place and dissipates some of the energy of rainfall.

Site preparation techniques can be grouped into three categories: mechanical, chemical, and prescribed fire.

- **Mechanical Site Preparation** is often described in terms of its intensity—the degree to which it disturbs the soil. Methods vary from low to very high intensity. High intensity is defined as soil disturbed and exposed on more than 50% of the site. *Disking* and *bedding* are examples of high intensity methods. *Chopping* is a low intensity method. Some combinations of methods, for example, shear-rake-disk, are considered more intensive because they expose more soil. Erosion potential increases with higher intensity methods, especially on sloping lands. High intensity mechanical methods are most appropriate on flat land and gentle slopes. Low intensity methods may be appropriate on moderate slopes.

- **Chemical Site Preparation** Many *herbicides* are available for preparing forest sites. They control most undesirable vegetation in place, and do not disturb the *litter*. Because herbicides are selective, the prescription should carefully consider the vegetation to be treated. Most herbicides may be successfully applied either from the ground or aircraft. When used properly, chances of off-site impacts are minimal.

- **Prescribed Fire** is often used in conjunction with mechanical or chemical site preparation, but it may be used alone. A properly conducted prescribed burn, which consumes a portion of the litter without altering the soil, only slightly increases the potential for erosion. Very hot fires which expose much *mineral soil* on steep slopes may significantly increase erosion potential.

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In order to identify methods appropriate for certain sites, percent slope is used in the following guidelines. However, the measures of slope are only guidelines because other factors must also be taken into consideration. Furthermore, slope usually varies over a site being reforested. If in doubt about the appropriate method to use, seek the advice of a *licensed forester* or other *qualified professional.*

### BMPs

- On slopes 5% or less, any method may be used.
- On slopes 6-10%, intensive mechanical methods should follow the *contours* of the land.
- On slopes 11-20%, mechanical methods, other than chopping, should follow the contours of the land. If erosion potential appears high, leave untreated strips 5 to 10 feet wide approximately 100 feet apart.
- On slopes 21-30%, use only herbicides, prescribed fire, or low intensity mechanical methods.
- On slopes greater than 30%, use only herbicides, hand tools, and/or prescribed fire, but be aware that extremely hot fires may significantly increase erosion potential.
- Herbicides and prescribed fire are acceptable site preparation methods on all slopes if conducted properly.
- Where accelerated erosion is likely, use methods which leave *logging debris* and other litter scattered over the site.
- Minimize moving soil into *windrows* and piles.

## BMPs continued

- Break windrows to allow for fire control equipment, wildlife crossing, and drainage of surface runoff.
- Prepare planting beds only as high as necessary for seedling survival.
- When constructing beds on sloping land greater than 5%, follow land contours and break frequently within the beds.
- Construct *water bars* or use other methods to prevent erosion in firebreaks and protective lines that have been pushed around herbicide application sites.
- Leave vegetation and limit soil disturbance in *gullies* that have stabilized and are no longer eroding.
- Contact a *licensed forester* or other *qualified professional* for advice on stabilizing gullies that continue to erode.
- Contact a licensed forester or other qualified professional for advice on site preparation burning.
- Refer to **Streamside Management Zones** (p. 5) for specific restrictions.
- Refer to **Prescribed Burning** (p. 44) and **Pesticides** (p. 46) for specific guidelines concerning burning and pesticide application.
- Leave a vegetated *buffer strip* at least 10 feet wide on edges of public roads to catch soil particles and slow runoff.

## Avoid

- Any mechanical methods on slopes greater than 30%.
- Intensive mechanical methods on slopes greater than 20% or on other sites with high potential for erosion (considering soil, slope, and ground cover).
- Constructing windrows, on slopes greater than 5%, which will funnel surface runoff into *perennial*, *intermittent*, or *ephemeral streams*.
- Mechanically preparing sites when equipment will cause excessive soil disturbance due to saturated or very wet soil conditions.
- Blocking any drainage with beds, windrows, or similar structures.
- Connecting planting beds to ditches if *jurisdictional wetlands* will be converted to uplands.

# REFORESTATION

Reforestation can be accomplished either naturally or artificially. Natural reforestation depends on seed in place on the forest floor, seed from seed trees, and sprouting of cut trees. Trees that reforest a site naturally are often the best suited for that particular site. In many cases, though, past management of forestland necessitates the use of *artificial regeneration.* In other cases, artificial regeneration is used to favor commercially valuable tree species. When planting or seeding a harvested site, choose tree species that are suited to that site.

Whether a site is reforested naturally or artificially, it is best to begin the new stand as quickly as possible. Any increase in *erosion*, water yield, and storm flow coming from a logged site diminishes rapidly as the site revegetates.

## ■ BMPs

- Hand plant steep, erodible sites.
- Machine plant on the *contour* to reduce the erosion hazard on slopes greater than 5%.
- Consult a *licensed forester* for advice on reforestation alternatives.

## ● Avoid

- Leaving planting bags or other garbage on the site.

# Prescribed Burning

South Carolina law requires that the South Carolina Forestry Commission be notified prior to burning. Precautions must be taken to prevent the fire's escape. Ensure that the burn site is enclosed by adequate *fuel breaks*; have sufficient manpower, tools, and equipment available to control the fire; and stay with the fire until it is safe.

Prescribed fire is a very useful *silvicultural* tool. It can be used to prepare a site for planting by reducing *logging debris* or to prepare a seedbed for seed fall. Prescribed fire can also be used later in the life of a forest for silvicultural purposes, to improve wildlife habitat, and to reduce the hazard of wildfire.

Studies have shown that properly planned and conducted prescribed burning has no significant impact on water quality. Most problems associated with prescribed burning are a result of poor planning and changing weather conditions. Where a prescribed fire becomes too hot, the entire *humus layer* can be consumed, exposing the underlying *mineral soil* to *erosion*.

Prescribed burning requires an understanding of weather conditions, fuel conditions, wildfire danger, smoke management, and a host of other factors. It should only be attempted by experienced personnel.

## BMPs

- Comply with smoke management guidelines. Smoke should be monitored after the burn until it is no longer a hazard.
- Have firefighting equipment readily available.
- Time prescribed fires so that the moisture level of the forest floor prevents the entire humus layer from being burned.
- Locate firebreaks on the *contour* as much as possible.
- On *grades* over 5 percent and over 200 feet long, construct *water bars* in firebreak lines at frequent intervals to slow surface runoff.
- Use hand tools when it is necessary to tie firebreak lines into stream channels.

## Avoid

- Burning when conditions will cause a fire to burn too hot and expose mineral soil.
- Impacting smoke sensitive areas.
- Allowing high intensity fire to enter *filter strips* or primary Streamside Management Zones (SMZs).
- Burning on severely eroded forest soils where the average litter *duff* depth is less than one-half inch.
- Constructing water bars in firebreak lines that divert surface runoff directly into streams.

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# PESTICIDES

*Pesticides*, including both *herbicides* and insecticides, are valuable tools in maintaining a healthy forest. Herbicides are often used to control unwanted vegetation in the establishment of both natural stands and plantations. The use of herbicides, rather than mechanical methods, is recommended on erodible piedmont and mountain sites to protect water quality. Insecticides may be used to control certain insect infestations where outbreaks are localized.

Proper planning and conscientious execution of the plan are the keys to safe use of pesticides. The plan should clearly delineate the area to be treated and should include buffers to protect bodies of water and neighboring landowners' property. The plan should also specify chemicals to be used, method of treatment, application rate, target species, acceptable wind directions and wind speeds, and nearby sensitive areas.

## BMPs

- FOLLOW LABEL DIRECTIONS and applicable state and federal laws in the storage, transportation, handling, and application of all pesticides.
- Obtain *Material Safety Data Sheets (MSDS)* from the manufacturer for toxicological information and personal safety protection requirements.
- Apply *restricted use pesticides (RUP)* only under the supervision of a certified pesticide applicator. Information on the certification process is available from: Department of Fertilizer and Pesticide Control, 256 Poole Agricultural Center, Clemson University, Clemson, S.C. 29631.

## BMPs continued

- Dispose of pesticide containers and/or excess pesticide according to state and federal regulations.
- Aerial application should only be done when wind speeds are 5 mph or less for liquid formulations, and 8 mph or less for granular formulations. Ground application should only be done when wind speeds are 10 mph or less.
- Except for directed hand equipment applications, use caution when winds are blowing toward sensitive areas. Wait until winds change or use wider buffers.
- Do all on-site pesticide handling, such as tank mixing, away from streams, ponds, and drainage areas.
- Clean up and/or contain all pesticide spills immediately and comply with state and federal regulations concerning reporting spills of hazardous materials.
- Maintain records of the use of restricted use pesticides (RUP) as directed by state and federal regulations.

## Avoid

- Applying pesticide directly to water bodies (streams, lakes, swamps) unless specifically prescribed and approved for aquatic management needs.
- Broadcast applications of pesticides within primary Streamside Managment Zones (SMZs).
- Applying any herbicide adjacent to the primary SMZ that would damage trees in the primary SMZ.

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# FERTILIZATION

Fertilization, a common practice in agriculture, is also useful for enhancing tree growth. The primary plant nutrients in *silvicultural* fertilizers are nitrogen and phosphorus. Phosphorus deficient sites are generally the poorly drained clays and sands of the Atlantic Coast *flatwoods*. These sites often exhibit dramatic responses to the phosphorus fertilizer. To determine the effectiveness of nitrogen fertilizers, factors such as soil moisture, soil depth, stand stocking, and existing nutrient levels must be considered.

Fertilizers can be applied safely with ground and air equipment. Research shows that little or no measurable increase in nitrogen or phosphorus occurs in streams following forest fertilization, provided care is taken not to apply the fertilizer directly on open water. With proper planning and site selection, forest fertilization poses little risk of environmental harm.

## ■ BMPs

- Use fertilizer, in prescribed amounts, only where site characteristics indicate that tree growth will be improved.
- Protect water bodies with appropriate buffers to ensure fertilizer is not applied to them directly.
- Properly dispose of fertilizer containers.

## ● Avoid

- Applying fertilizer prescribed for silvicultural purposes to water bodies, such as streams, ditches, or ponds.

# Minor Drainage

Minor drainage has been used as *a silvicultural* tool in the South since the 1940s on *flatwood* sites with an excess of surface water for a portion of the year. In recent years some of these sites have been designated *jurisdictional wetlands*. Activities on jurisdictional wetlands are subject to federal regulations under the Clean Water Act.

The purpose of minor drainage is to remove excess surface water to facilitate access and *regeneration*. The degree of drainage is determined by ditch depth, ditch spacing, surface topography, and soil characteristics. It is impossible to prescribe specific minimum ditch depth and spacing without evaluating the site. Each drainage system must be designed for a specific site.

Minor drainage for silvicultural purposes does not require a permit because of silvicultural exemptions under Section 404 of the Clean Water Act. However, such drainage must be part of an "ongoing" silvicultural operation. Minor drainage may not be used to convert a jurisdictional wetland to an upland.

The South Carolina Forestry Commission (803-896-8800), U.S. Army Corps of Engineers in Charleston (803-727-4731), U.S. Environmental Protection Agency in Atlanta (404-347-4015), and U.S. Natural Resources Conservation Service (803-765-5681) are available for consultation and guidance.

## BMPs

- Use minor drainage only where it is necessary to minimize *harvesting* impacts or to facilitate regeneration of desired wetland species.
- The depth, spacing, and number of ditches in a drainage system should only be sufficient to remove excess surface water.
- Design ditches to minimize the need for frequent maintenance.
- Place spoil so as not to impede the entry of surface water into the ditch. Use *culverts* if necessary to prevent ponding.
- Empty ditches into areas where the runoff will be diffused and filtered by the forest floor before reaching a *natural channel.*
- Maintain ditches only as frequently as necessary to keep the drainage system functioning. Place fill on either side of a ditch, preferably the uphill side.

## Avoid

- Converting jurisdictional wetlands to an upland.
- Emptying a drainage ditch directly into a *perennial* or *intermittent stream.*

## Avoid continued

- Re-dredging ditches deeper than original depth or width.
- Causing ponding of surface water through placement of ditch fill.
- Using silvicultural exemptions to try to achieve non-silvicultural objectives.

NOTE: "Jurisdictional wetland", "minor drainage", and "ongoing silvicultural operation" have not been precisely defined at the time of this publication. Drainage ditch construction, intended for purposes other than minor drainage, requires a permit from the U.S. Army Corps of Engineers (803-727-4731). Violations of the federal regulations governing drainage ditch construction in wetlands can result in stiff penalties including fines and jail sentences.

# Endangered Species Act

The Federal Endangered Species Act of 1973 was enacted to conserve threatened and endangered species of wildlife and plants. The U.S. Fish and Wildlife Service is responsible for all on-shore and freshwater species. Anyone violating this law is subject to civil and criminal penalties. The State Endangered Species Act is modeled after the Federal Endangered Species Act. The State Act is used to conserve wildlife and plant species considered to be threatened and endangered in the state.

Information on threatened and endangered species is available from a variety of sources, including the U.S. Fish and Wildlife Service and the South Carolina Department of Natural Resources.

## ADDITIONAL MANAGEMENT OPTIONS:

# WILDLIFE MANAGEMENT

Depending on the landowner's objectives, timber management practices, such as *harvesting*, *site preparation*, and *prescribed burning* can be used to enhance wildlife habitat. However, due to the diversity of habitats and wildlife species in the state, it is impractical to provide specific recommendations for wildlife management in this document. If wildlife is a priority on the site to be managed, contact the South Carolina Department of Natural Resources for detailed recommendations prior to initiating timber management activities. Management advice can also be obtained through certified consulting wildlife biologists or *licensed foresters*.

Listed below are examples of general practices which will enhance many wildlife species.

- Leave primary SMZs wider than the minimum widths specified in the section entitled **Streamside Management Zones** (p. 5).
- Maintain stands of trees in different age and size classes dispersed through the forest.
- Leave some mature *mast-producing trees*, such as oak, which are important for squirrels, turkeys, and raccoons. They also benefit deer, quail, and many other wildlife species. Mast producers are most effective if retained in groups or stands.

## Best Management Practices

- Manage for tree species diversity as well as age class diversity across the forest.
- If *clearcutting*, harvest smaller areas in somewhat linear, irregular shapes, preferably along natural topographic breaks.
- Leave strips of trees connecting mature stands to serve as cover and wildlife travel corridors where areas have been or will be clearcut within a few years of one another.
- Leave *snags* and hollow den trees for cavity-dependent wildlife species, preferably in association with groups of mature trees.
- Provide supplemental wildlife plantings. These plantings can be made on old *logging decks*, under electric transmission lines, at edges of clearcuts, in firebreaks, or in other openings.
- Discharges into waters of the U.S. expressly for wildlife management purposes require a permit from the U.S. Army Corps of Engineers in Charleston (803-727-4731).

# GLOSSARY

*Apron of rip-rap* - A layer of rock used for stabilizing soil that is subject to erosion.

*Artificial regeneration* - The establishment of a forest by planting seedlings or by seeding an area.

*Basal area* - A measure of the cross-sectional area taken up by trees at 4.5 feet above ground level.

*Bedding* - A site preparation technique, usually in wet areas, whereby a small ridge of soil is formed as an elevated planting or seedbed.

*Best Management Practices* (BMPs) - Forest management practices, developed pursuant to federal water quality legislation, to minimize or prevent nonpoint source water pollution. Often in more general usage referring to any good forest stewardship practices.

*Black river bottom* - The floodplain of a major water system originating in the coastal plain.

*Bladed skid trail* - A path most frequently traveled by harvesting equipment, normally leading to a landing for processing, that has been intentionally cleared down to the soil layer by a machine.

*Borrow pit* - An area that has been excavated for earthen material.

*Broad-based dip* - A surface drainage structure designed to convey surface runoff off of a road while allowing vehicles to maintain normal speeds.

*Buffer strip* - A relatively undisturbed section of forest adjacent to an area requiring special attention or protection such as a stream, lake, or road.

*Carolina Bay* - An elliptical depression with a northwest-southeast longitudinal axis usually surrounded by a sandy, convex rim.

*Channel* - A natural stream which conveys surface runoff water within well-defined banks.

*Chemical site preparation* - The use of herbicides to control plant competition to prepare an area for the establishment of a future forest either by artificial or natural means.

*Chopping* - The flattening of vegetation remaining after harvest in order to concentrate it near the ground.

*Clearcutting* - The total removal of a merchantable tree crop from an area.

*Contour* - An imaginary line on the land surface that is at a constant elevation.

*Culvert* - A metal, concrete, or plastic pipe through which water is carried.

*Designated trout waters* - Water bodies specifically conducive to trout as designated by the South Carolina Department of Health and Environmental Control.

*Directional felling* - Felling trees so that they fall in a predetermined direction which will cause the least damage to the site.

*Disking* - Tilling soil to reduce competing vegetation.

*Drainage structure* - A man-made structure that facilitates the movement of water off an area.

*Dredge material* - Material unearthed when a ditch is excavated.

*Drought index* - A measure of soil or vegetation dryness.

*Duff* - The partially decayed organic matter on the forest floor.

*Edge* - An area where two or more vegetation types converge.

*Ephemeral stream* - A watercourse generally without a well-defined channel which flows only in response to rainfall or snowmelt. Ephemeral streams flow for less than 20% of the year during normal rainfall conditions.

*Erosion* - The detachment and transportation of soil particles.

*Excessive rutting* - The determination of excessive rutting is highly subjective and must be made by a licensed forester or other qualified professional experienced in local logging operations, soil types, and site conditions (see definition of *licensed forester* and *qualified professional*). The determination must consider rutting extent and depth, soil type, slope, position on slope, management prescription, and any other pertinent factors.

*Filter strip* - A vegetated area of land separating a water body from forest management activities.

*Flatwoods* - Areas in the coastal plain that lie in broad interstream divides where natural drainage systems are poorly developed.

*Flood attenuation* - Forest management activities that lessen the severity of potential flooding.

*Ford* - A natural or paved stream crossing suitable for shallow streams with stable bottoms.

*Forest practice* - An activity related to the growing, protecting, harvesting, or processing of forest tree species.

*Fuel break* - An area cleared of vegetation to remove the fuel sources from a fire.

*Grade* - The slope of a road, usually expressed as a percent.

*Gully* - An eroded channel (generally at least 12 inches deep) which has deepened to the point that it cannot be removed by tillage.

*Harvesting* - The removal of merchantable tree crops from an area.

*Headwater swamp* - An area of potentially saturated land at the source of a flowing water body.

*Herbicide* - Any chemical or mixture of chemicals intended to prevent the growth of or promote the removal of targeted trees, bushes, and/or herbaceous vegetation.

*High flotation equipment* - Machinery that exerts low ground pressure.

*Humus layer* - The organic layer of the soil formed by the decay of organic matter.

*Intermittent stream* - A watercourse that flows in a well-defined channel for 20 - 90% of the year during normal rainfall conditions.

*Jurisdictional wetlands* - Areas subject to the regulations of the Clean Water Act of 1977; generally concave or low-lying topographic forms that collect, store, or flow water frequently enough to favor a majority of plants that are adapted to saturated soil conditions.

*Licensed forester* - A person who is registered and qualified to engage in professional forestry practices as determined by the South Carolina State Board of Registration for Foresters.

*Litter* - The uppermost, slightly decayed layer of organic matter on the forest floor.

*Log deck* - A place where logs or tree-length material is processed for loading and transporting.

*Logging debris* - The unutilized and generally unmarketable accumulation of woody material, such as limbs, tops, and stumps, that remains after timber removal.

*Low impact harvesting system* - A system of logging equipment that has minimal residual impact on an area or the land.

*Mast-producing tree* - A tree that produces nuts, such as oak or walnut.

*Material Safety Data Sheet (MSDS)* - The basic hazard communication tool that gives details on chemical and physical dangers, safety procedures, and emergency responses for chemicals.

*Mechanical site preparation* - The cutting of all standing material with blades or choppers to prepare an area for the establishment of a future forest either by artificial or natural means. Other practices include disking, bedding, and raking.

*Mineral soil* - The inorganic layer of earth composed of sand, silt, and clay, in varying amounts, with less than 20 percent organic matter in the surface layer.

*Muck swamp* - A very poorly drained area, usually with standing water, characterized by heavy organic matter accumulation.

*Mulching* - Covering an area loosely with some material to hold soil in place and facilitate revegetation. Straw and bark are common mulches.

*Natural channel* - A watercourse created by the erosive forces of water moving over land. Drainage ditches are not considered natural channels.

*Natural drain* - A naturally occurring conduit for the flow of water.

*Natural regeneration* - The planned regeneration of a forest that either uses existing trees as a source of seed or encourages sprouting from stumps or roots.

*Nonpoint source (NPS) pollution* - Pollution which is (1) induced by natural processes, including precipitation, seepage, percolation, and runoff; (2) not traceable to any discrete or identifiable facility; and (3) controllable through the utilization of wise management practices.

*Outsloped roadbed* - A roadbed along a hill constructed so that water will flow across the road toward its downhill side.

*Patch clearcut* - A tree regeneration method whereby all of the merchantable trees in a relatively small area are removed.

*Peat swamp* - A poorly drained area with heavy accumulations of raw organic matter, resembling muck swamps but in general heavier and of better site quality.

*Perennial stream* - A watercourse that flows continuously (at least 90% of the year) in a well-defined channel.

*Permanent main access road* (MA) - A road normally constructed on a ridge or higher ground that tends to parallel the general flow of water, except when it crosses from one drainage system to another.

*Pesticide* - Any chemical substance that is used to control undesirable insects, diseases, vegetation, animals, or other forms of life.

*Prescribed burning* - The controlled use of fire to reduce or eliminate the unincorporated organic matter of the forest floor, or low, undesirable vegetation.

*Primary skid trail* - The path most frequently traveled by harvesting equipment, normally leading to a landing for processing.

*Qualified professional* - A person whose training and experience qualifies him/her to make forestry and water quality recommendations. Examples of qualified professionals include: hydrologists, soil scientists, forest engineers, or technically trained individuals functioning under the direct supervision of a qualified professional.

*Regeneration* - Renewal of a forest by either natural or artificial means.

*Restricted use pesticides (RUP)* - Pesticides that are to be applied only by certified persons for specific uses.

*Rotation* - The planned number of years between the establishment of a crop of trees and its final cutting at a specified stage of maturity.

*Rutting* - Tracks in the soil resulting from the passage of heavy equipment.

*Sediment* - Eroded soil particles that are deposited downhill or downstream by surface runoff.

*Seep* - A place where groundwater flows slowly to the surface and often forms a pool; a small spring.

*Sensitive site* - An area that may have the following traits: highly erosive soils, steep slopes, excessively wet soils, connected aquatic systems, endangered species habitat, or other unique traits.

*Shearing* - The cutting of merchantable residual trees and stumps close to the ground after harvest.

*Shelterwood harvest* - A method for regenerating a site that involves the gradual removal of the residual stand in a series of partial cuts. A fundamental characteristic of the shelterwood method is the establishment of a new forest stand before complete removal of the parent stand.

*Silviculture* - The science and art of cultivating forests based on the knowledge of the life history and general characteristics of forest trees; the principles, theories, and practices for protecting and enhancing the establishment, growth, development, and utilization of forests for multiple benefits.

*Single-tree selection* - A regeneration method adapted for shade tolerant species whereby each small even-aged component of an uneven-aged stand occupies the space created by the removal of a single mature individual or small clumps of several such trees.

*Site productivity* - An expression of an area's natural fertility or capacity to grow vegetation, especially trees.

*Site preparation* - A forest activity to remove unwanted vegetation and other material to cultivate or prepare the soil for reforestation.

*Skid trail* - A temporary, non-structural pathway over forest soil for dragging felled trees or logs to a landing for processing.

*Skidding* - Moving logs or felled trees from the stump to a landing, usually with the forward end supported off the ground.

*Snag* - A standing dead tree from which the leaves and most of the branches have fallen.

*Streamside management zone* (*SMZ*) - An area adjacent to the bank of a stream or body of open water where extra precaution is necessary to carry out forest practices in order to protect bank edges and water quality.

*Temporary limited use road (LU)* - A road constructed into an area to gain access for a specific operation such as harvesting that will be abandoned and allowed to revert to natural vegetation once the operation is complete.

*Toe of the fill* - The base of the fill surrounding a culvert, etc.

*Transpiration* - The vaporization of water from the living cells of plant tissues.

*Water bar* - A mound or ridge of soil formed across a road or trail for the purpose of deflecting water onto the adjacent area, usually into the forest litter.

*Water yield* - A drainage basin's total yield of liquid water during some period of time.

*Water turnout* - The extension of an access road's drainage ditch into a vegetated area to provide dispersion and filtration of stormwater runoff.

*Watershed* - All land and water within the confines of a drainage basin.

*Windrow* - Logging debris and unmerchantable woody vegetation that has been piled in rows.

*Wing ditches* - Drainage structures that divert water flow from along a downward-sloping roadside, dispersing the water into a vegetated area to minimize erosion.

Best Management Practices

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