Maine Forestry Best Management Practices (BMP) Use and Effectiveness—Data Summary 2010-2011

Richard Wing & Sons Logging protecting water quality in the Sebago Lake watershed with a steel bridge cost shared through the Maine Forest Service. Sebago Lake supplies drinking water for the City of Portland. Photo Credit: Ken Canfield

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The data in this document were generated using the procedures outlined in the two volumes of the **Best Management Practices (BMP) Monitoring Manual: Implementation and Effectiveness for Protection of Water Resources**:

Field Guide (NA–FR–02–06)
Desk Reference (NA–FR–02–07)

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Executive Summary

The Maine Forest Service (MFS) has worked closely with Maine's professional forestry community for many years to develop and refine forestry Best Management Practices (BMPs) to protect water quality. MFS BMPs stress a strong understanding of water quality protection principles needed to use the "toolbox" of BMP practices effectively. MFS prefers a flexible, voluntary BMP approach over prescriptive regulation. Voluntary BMPs based on water protection principles allow loggers to select efficient practices that result in the desired outcome; protection of water quality. For an outcome based BMP system to be successful, a strong training program must be in place as well as a monitoring system to ensure that BMPs are working on a statewide basis. MFS's key partner in training development and delivery has been Maine's Sustainable Forestry Initiative Education Committee. The Certified Logging Professional Program, Qualified Logging Professional Program, Professional Logging Contractors of Maine and the Northeast Master Logger Program have all been instrumental to training program delivery. These public-private partnerships have advanced Maine's BMP educational efforts far beyond what they would be if they were solely a government effort.

As of this writing, forestry operations do not have permitting requirements under the Clean Water Act because there is a "silvicultural exemption" given in that law, as long as best management practices (BMPs) are used to help control non-point source (NPS) pollution. The NPS silvicultural exemption is currently under challenge in the Supreme Court. The court's ruling could have significant impacts on the industry and how Maine administers its BMP program. The MFS is statutorily responsible for the development of forestry BMPs 38 MRSA §410-J in Maine and has issued a BMP manual as required by EPA. As part of this mandate, MFS also monitors and reports on the use and effectiveness of BMPs on harvest operations across the state.

MFS has conducted random, statewide monitoring of BMPs on timber harvesting operations since March 2000. The objective of this ongoing effort is to assess the use and effectiveness of BMPs in Maine. Starting in 2010 the publication cycle has been changed from an annual to a biannual report. This report presents an analysis of data collected on 110 timber harvest during 2010 and 2011. MFS continues this monitoring effort as a part of regular field activities and expects to generate subsequent reports.

Data in this report was collected and analyzed using the "Best Management Practices Implementation Monitoring Protocol," an original project of the Northeastern Area Association of State Foresters' (NAASF) Water Resources Committee. This protocol assesses the overall effectiveness of the suite of BMPs used rather than monitoring the simple installation of prescribed, individual practices, which do not necessarily guarantee success in protecting water quality.[1]

As BMPs are voluntary measures to protect water quality, MFS does not use BMP monitoring to assess compliance with nor enforce laws and rules. When monitoring

[1] Welsch D., R. Ryder, T. Post. 2007. Best Management Practice (BMP) Manual –Field Guide: Monitoring, Implementation, And Effectiveness for Protection of Water Resources: U.S. Department of Agriculture, Forest Service, NA-FR-02-06, 129 pp.

staff observe concerns or minor issues during BMP monitoring, MFS works closely with the landowner in a non-regulatory manner to seek corrective measures. Education and intervention usually result in quick corrective action, thereby avoiding lengthy regulatory processes that may prolong erosion problems and result in greater negative environmental impacts.

Assessing the overall effectiveness of the suite of BMPs used rather than monitoring the installation of prescribed individual practices allows assessment of whether BMPs effectively protected water quality. For example, simply finding that waterbars were installed does not indicate whether they were effective in directing water into the filter area and keeping sediment out of the waterbody. This approach supports MFS's desire to pursue outcome-based forest policy, a science-based voluntary process that achieves mutually beneficial economic, environmental, and social outcomes in the state's forests. Outcome-based policies are an alternative to prescriptive regulation. They demonstrate measurable progress towards achieving statewide sustainability goals and allow landowners to use creativity and flexibility to achieve objectives, while providing for the conservation of public trust resources and the public values of forests. MFS uses BMP monitoring to focus educational outreach efforts to loggers, foresters, and landowners and identify trends for targeting technical assistance.

Highlights of educational portion of the BMP program since the publication of the last report include:

- Over 20 temporary bridge mat construction workshops held
- Publication of the MFS BMP field manual in a French Language version
- Development of a new half day workshop module on installing streams crossings that allow fish passage
- Revamp of the standard introductory BMP training program
- Development of YouTube video on water bar installation
- Over 1000 loggers/foresters and landowners have attended MFS sponsored water quality related workshops.

Key findings of this report include:

- **90% of cases evaluated found no sediment entered a waterbody; this is an increase from 83% in 2005.**
- **When applied appropriately, BMPs avoided soil movement into waterbodies at 92% of the approaches to stream crossing structures and 81% of the crossing structures themselves.**
- **At sites where BMP principles and practices were <u>not</u> applied appropriately sediment reached the water at 17% of the approaches and 39% of the stream crossings.**
- **On 99% of harvests evaluated there was no evidence of chemical spills.**
- **BMPs were not applied on 7% of approaches and 7% of stream crossings. When taking into account avoided crossings, BMPs were not applied on 4% of sites.**

Introduction

The best management practices (BMP) protocol provides an efficient, economical, standardized, and repeatable BMP monitoring process that is automated from data gathering through the generation of a standard data summary. It uses commonly available software and inexpensive field data recording devices. It is compatible with existing State BMP programs and is available for use by forestry agencies, forest industry, and green certification organizations.

Further information, manuals, software programs, and training in the protocol procedures and report generation can be obtained from David Welsch, U.S. Forest Service, Northeastern Area State and Private Forestry, Watershed Team.

Background

The BMP protocol project was a cooperative effort of the Forest Service, U.S. Department of Agriculture, and the Northeastern Area Association of State Foresters–Water Resources Committee (NAASF–WRC). The project was funded by grants from the U.S. Forest Service and the U.S. Environmental Protection Agency (EPA).

The original concept and question sequence was developed by Roger Ryder and Tim Post of the Maine Forest Service in collaboration with David Welsch and Albert Todd of the U.S. Forest Service, Northeastern Area State and Private Forestry (NA S&PF). The NA S&PF proposed the method to the NAASF–WRC and the EPA for development as a potential regional protocol. After the withdrawal of the Maine Forest Service, David Welsch served as the project coordinator through the development, testing, and implementation of the project.

State forestry agencies from Delaware, Indiana, Maine, Maryland, Massachusetts, New Hampshire, New York, Ohio, Pennsylvania, Vermont, Virginia, West Virginia, and Wisconsin; the New York City Watershed Agricultural Council Forestry Program; and the U.S. Forest Service Northern Research Station and NA S&PF have collaborated in the development and testing of the BMP protocol.

Data Summary

The information in this data summary was compiled from a sample data set using measurements from **110** sample units.

The data summary is a computer-generated set of graphs and charts summarizing the sample unit data in a standardized format to facilitate comparison with data collected from other times and differing geographical areas.

Each sample unit contains the potential for approximately 200 observations and includes a number of observations of some types of data.

The data collection procedure is described in the U.S. Forest Service publication *Best Management Practices (BMP) Monitoring Manual—Field Guide: Implementation and Effectiveness for Protection of Water Resources* (NA–FR–02–06), which includes the question set and instructions for making and recording the observations. Diagrams and definitions are also included.

Data summary generation, quality control, risk analysis, and statistical sample design information are described in *Best Management Practices (BMP) Monitoring Manual—Desk Reference: Implementation and Effectiveness for Protection of Water Resources* (NA–FR–02–07).

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General Information Feature

This report presents the results of data gathered for the BMP protocol project on new sample units for the State of Maine.

- A total of **110** new sample units were sampled.

Number of Samples Taken by Year

Year of Sample	Number of Samples
2010	55
2011	55

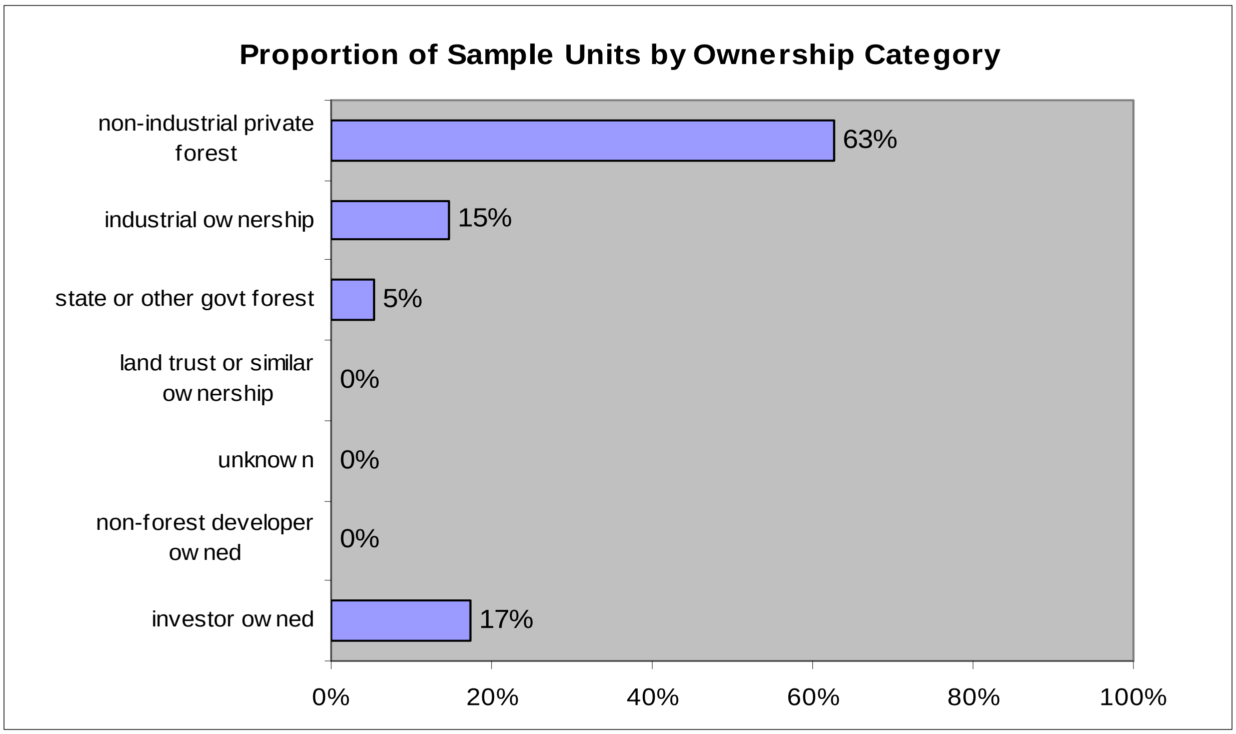


Figure 1 Proportion of Sample Units By category (n=110)

Acres Monitored

Total number of acres monitored: **13,466**

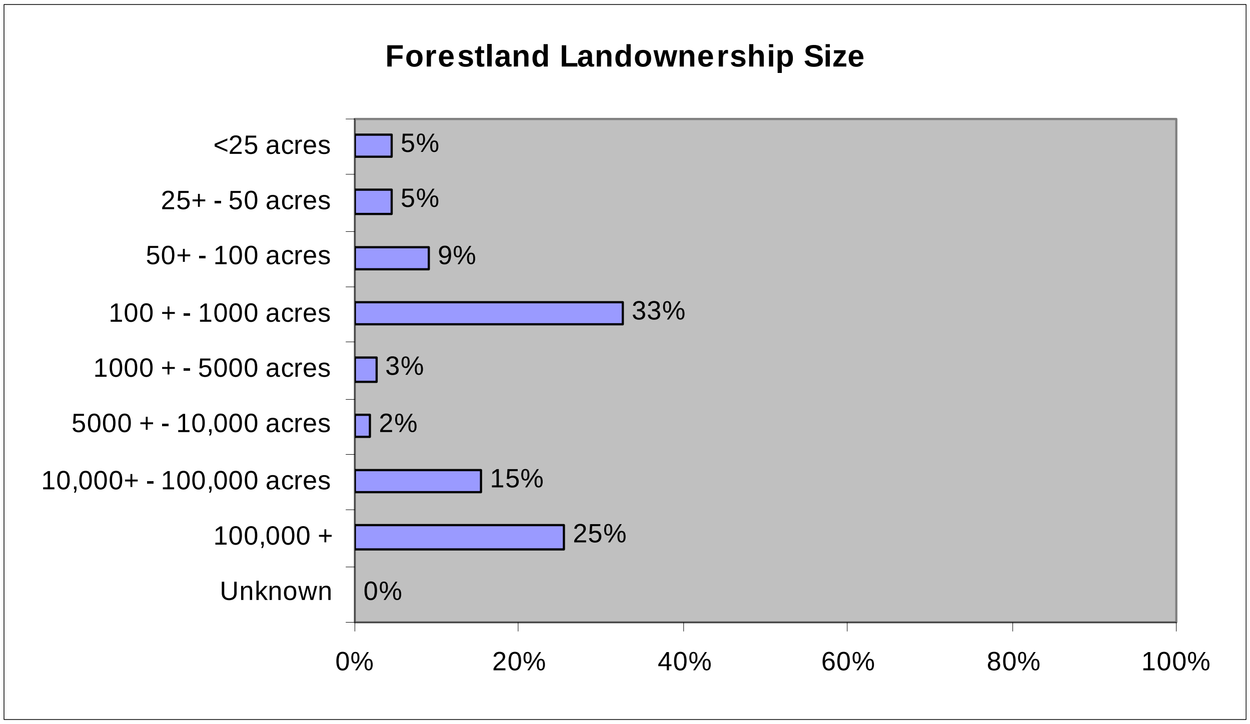


Figure 2 Ownership Size (n=110)

The total number of acres monitored equates to the area sum of all sample units where data was collected. One or two sample units were chosen at each harvest monitored. MFS personnel focused on recently harvested areas adjacent to surface water. Sample units are delineated by cutting boundaries, ownership boundaries and by the crossing of natural perennial and intermittent streams and some ditches. The crossing and its approaches are investigated and the data recorded in the sample unit being entered as the water body is being crossed. The delineation of sample units and the features to be included within them are shown on the following illustration.

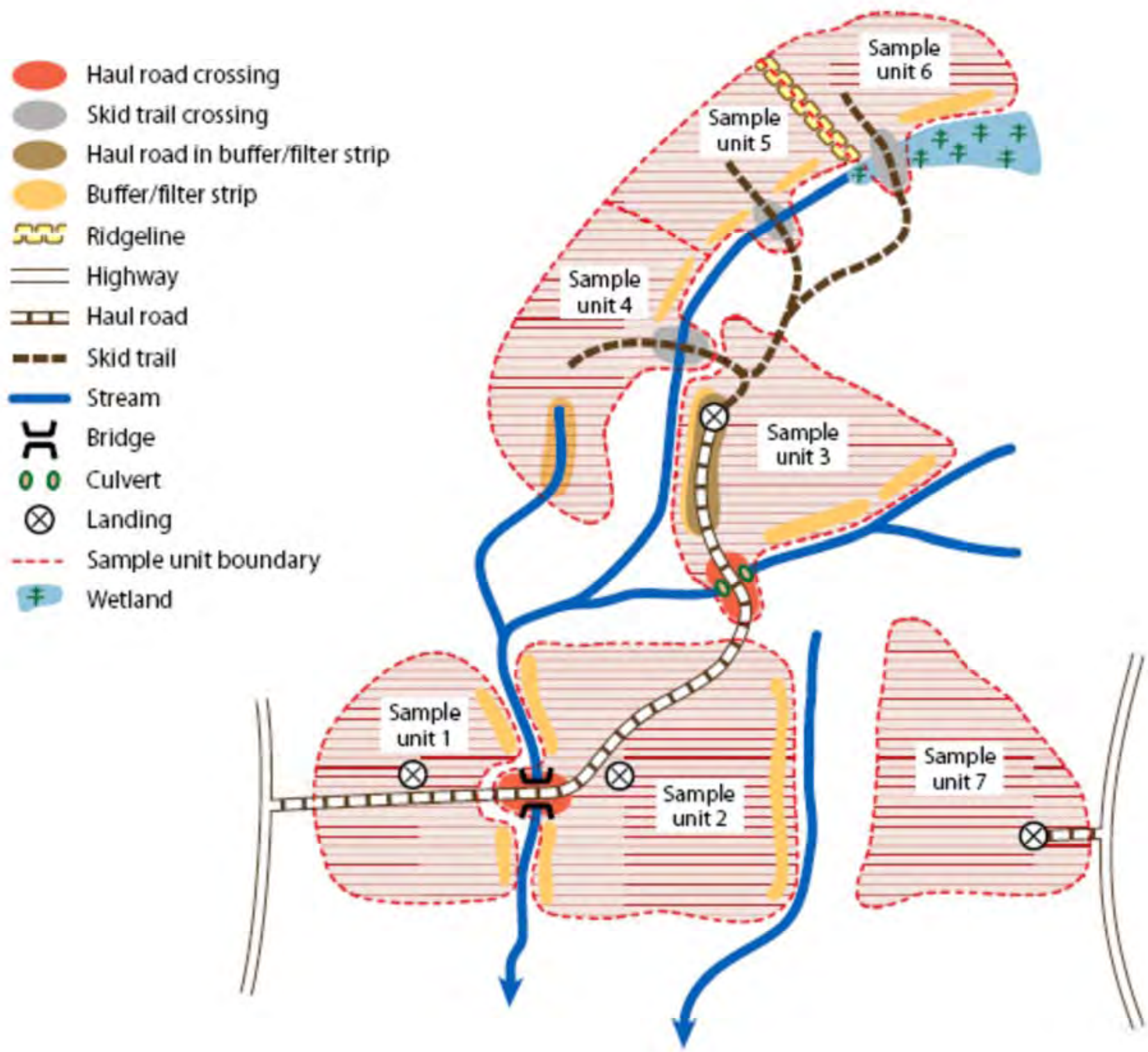


Figure 3 Sample Unit delineation

***BMP Principle**: Pre-Harvest Planning*

Laying out the harvest on the ground can help identify sensitive areas, reduce skid trails, and avoid unnecessary stream crossings.

Harvest Systems Used

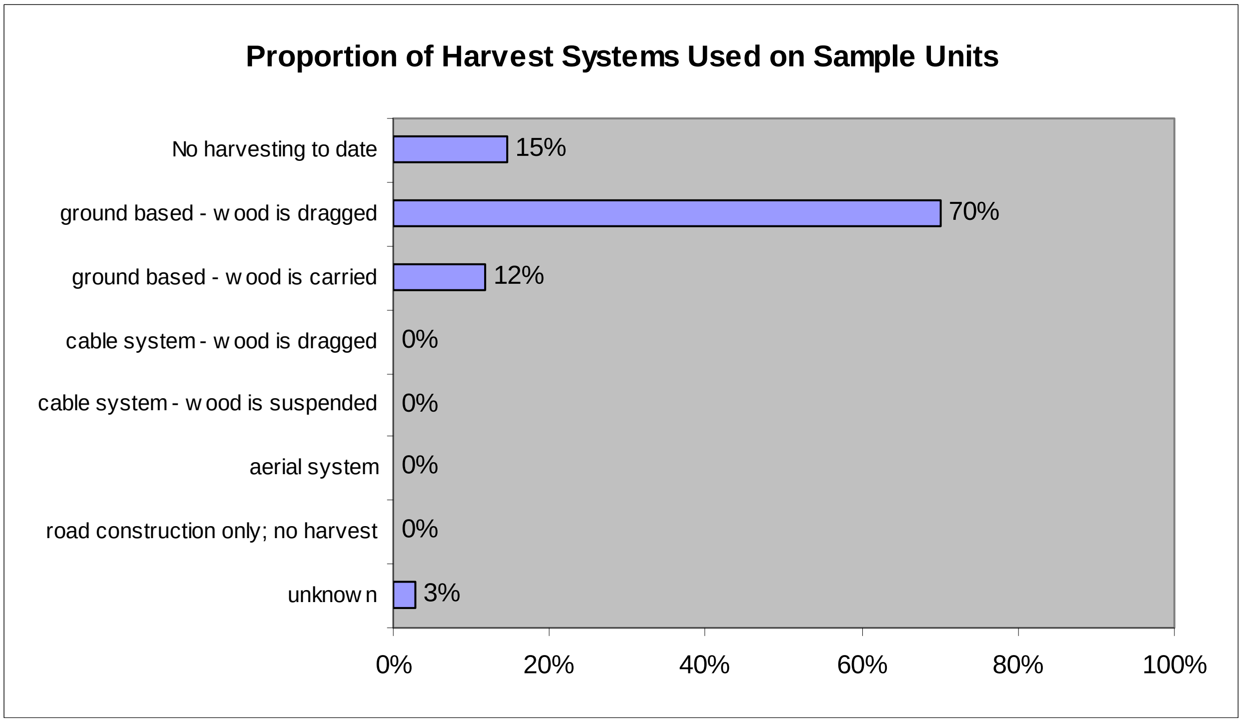


Figure 4 Harvest Systems (n=110)

Ground based - dragged harvesting systems usually require use of cable or grapple skidders where trees are harvested individually or pre-bunched mechanically and dragged to the landing for further processing, sorting, or loading for off-site transport. Harvests that are primarily ground based dragged typically result in greater amounts of exposed soil. **Ground based - carried** harvesting systems generally result in less exposed soil hence reduced environmental risk. Trees are typically cut to length in the woods and then carried or "forwarded" to the landing for further processing, sorting, or loading for off-site transport.

Cable - dragged or suspended and aerial harvesting systems common in western mountain states are rare in Maine. Prolonged steep slopes and naturally occurring unstable soils generally do not occur in Maine to the same extent as out West.

When used properly carried wood systems (e.g. the forwarder seen on the right) can result in less soil disturbance vs. dragged wood systems (e.g. the cable skidder seen on the left). Regardless of the type of system used, operator skill and training are critical to good results.

BMP Implementation

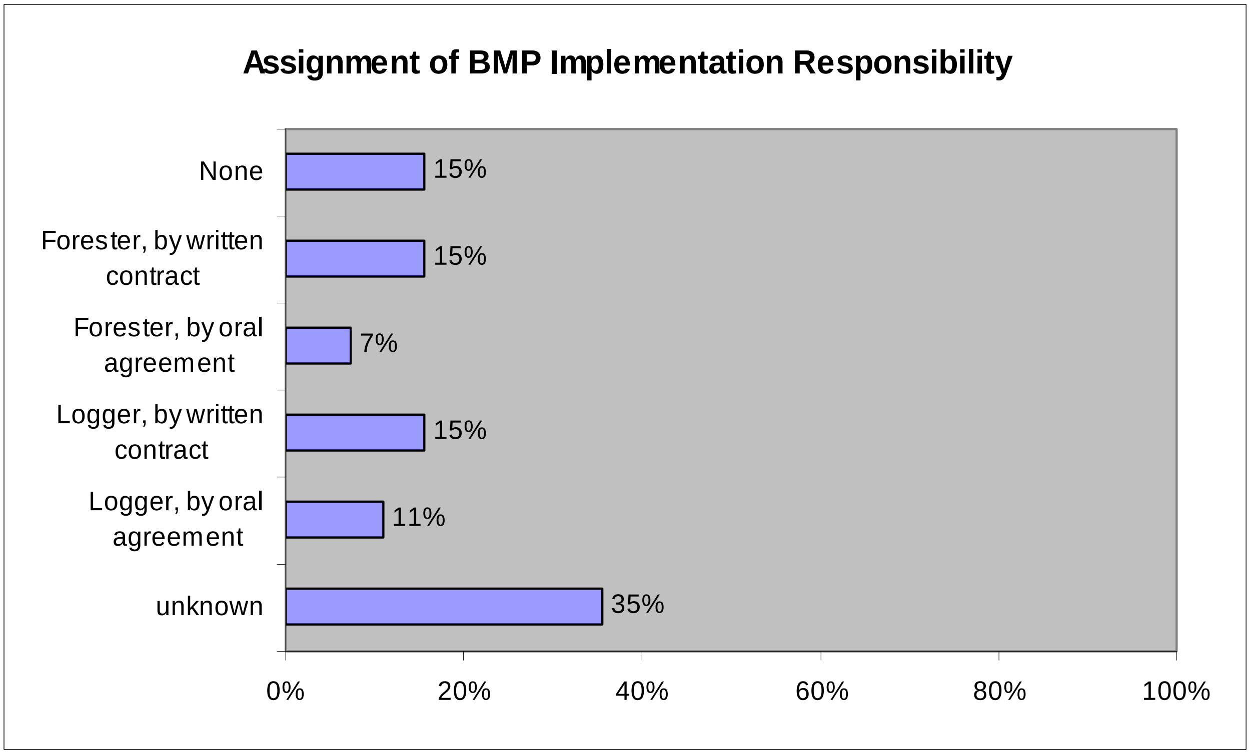


Figure 5 Assignment of BMP Responsibility (n=110)

The Maine Forest Service recommends identifying who is responsible for BMP implementation within a written timber sale agreement that clearly explains landowner, logger, and forester expectations.

***BMP Principle**: Define objectives and responsibilities*

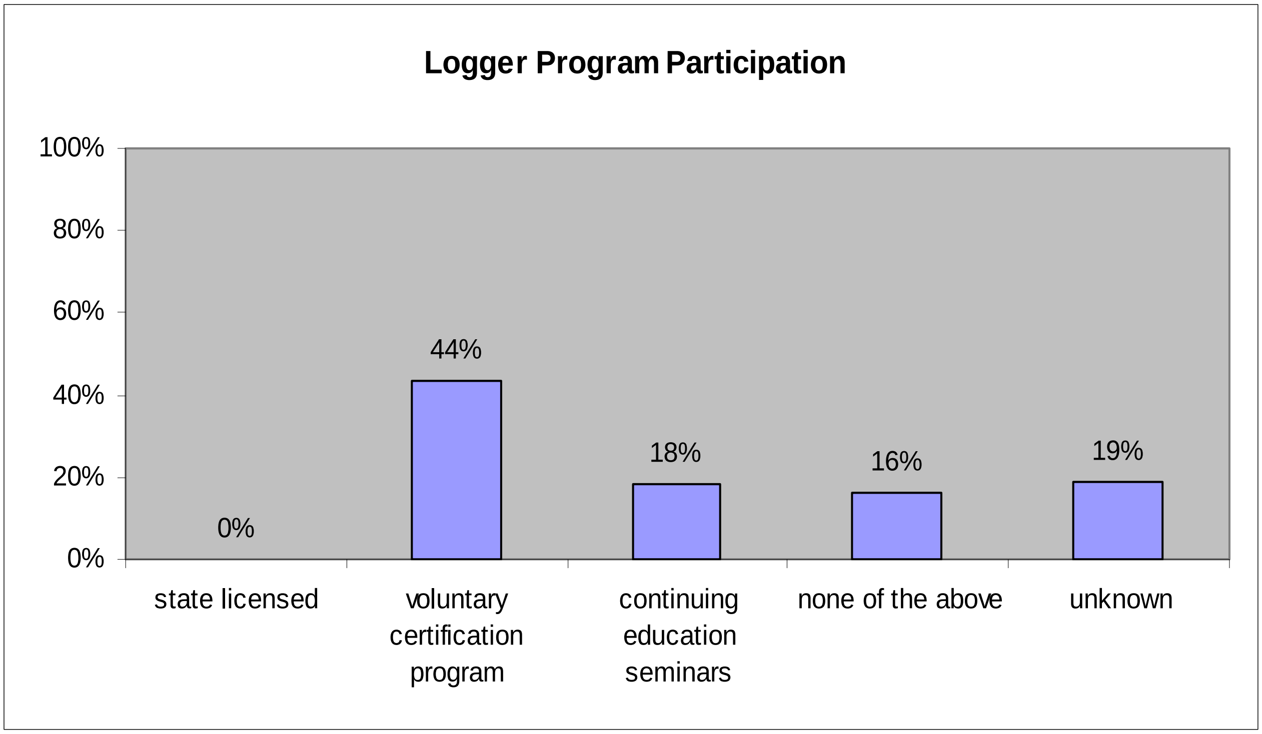


Figure 6 Logger program participation (n=110)

Discussion
Many loggers voluntarily participate in second and third party certification programs in Maine; Certified Logging Professional (CLP), Qualified Logging Professionals (QLP) and Maine's Master Logger. CLP with assistance from many partners has certified over 5000 loggers since 1991, there are currently over 100 Northeast Master Logger Certified companies in Maine. CLP along with other logger certification programs require continuing education credits and periodic field auditing on active timber harvests. Maine logger programs have significantly reduced logger worker compensation costs by promoting safety and accident prevention.

Soil Movement, Sedimentation, and Stabilization

There are **5** opportunities to observe the occurrence of soil movement, sedimentation, or stabilization for each sample unit. They are at Approach Area A–Outside the Buffer/Filter Strip, Approach Area A–Inside the Buffer/Filter Strip, the crossing structure, Approach Area B–Inside the Buffer/Filter Strip, and Approach Area B–Outside the Buffer/Filter Strip. **Proportions in this section are based on the total number of opportunities to make observations about soil conditions.**

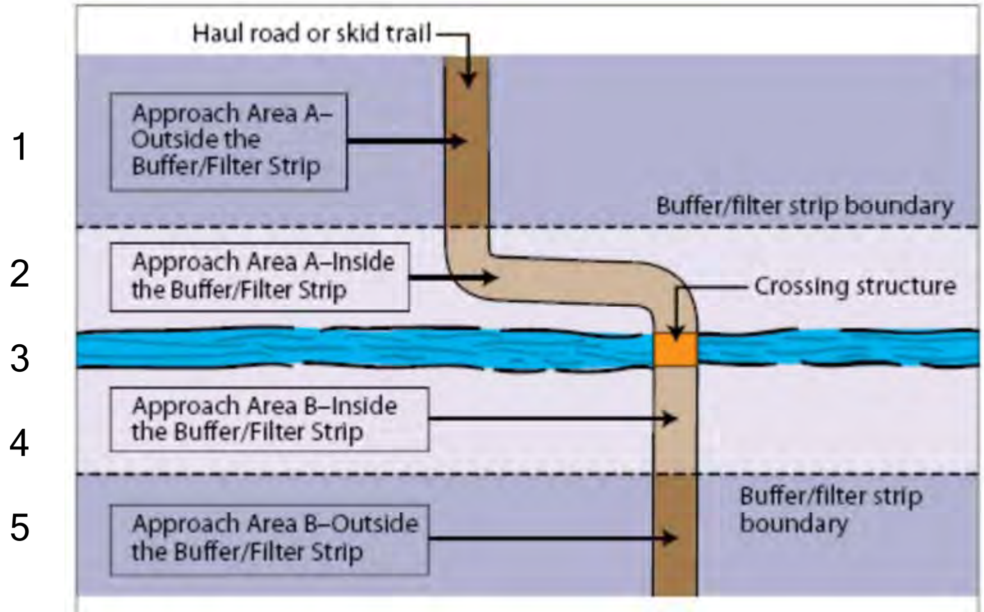


Figure 7 Showing 5 opportunities to observe soil movement at any typical haul road or skid trail stream crossing

For the **110** new sample units, there are **550** opportunities to observe soil conditions.

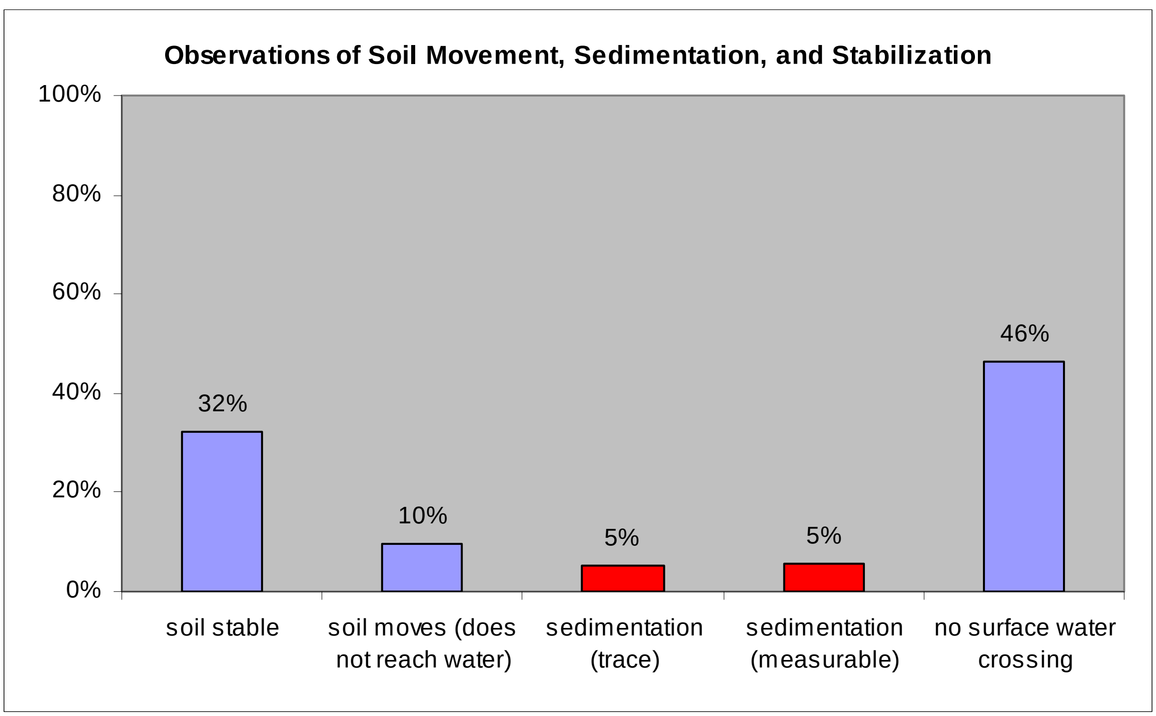


Figure 8 Proportions are based on the total number of opportunities to observe soil conditions in the protocol

Discussion

Of the 550 opportunities to observe soil conditions, 10% showed either trace or measurable amounts of sediment reached the waterbody. 46% of harvests avoided water crossings, avoiding a crossing is considered a valid BMP. Excluding avoided water crossings sediment reached the waterbody on 18% of observations.

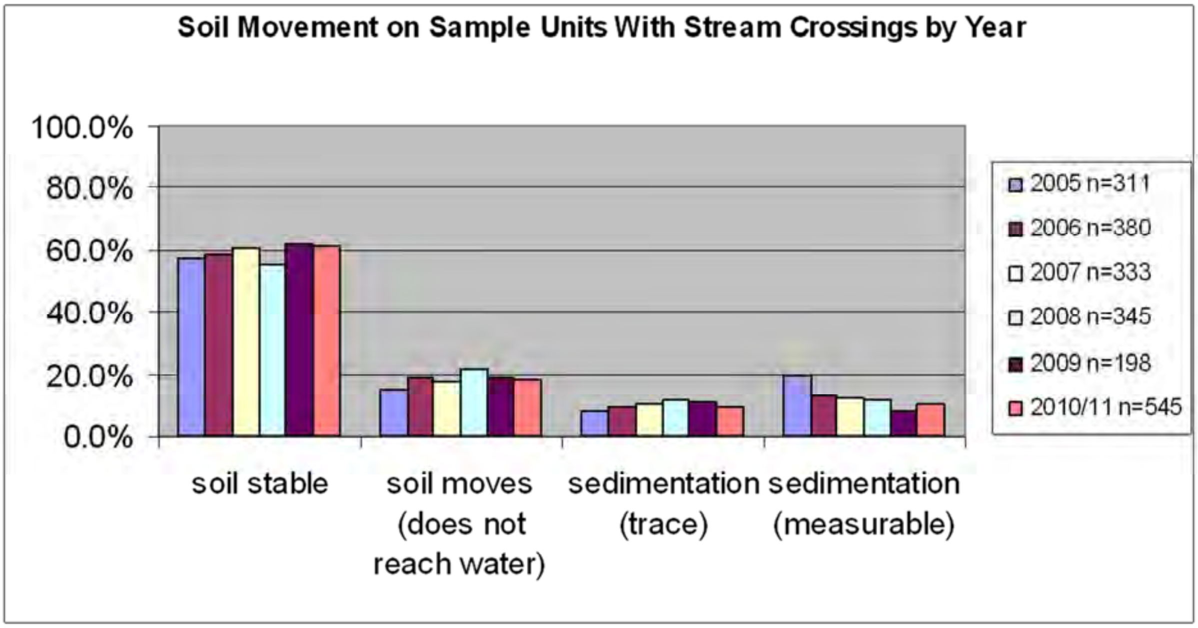


Figure 9 Proportions are based on the total number of opportunities to observe soil conditions in the protocol on sample units with crossings since 2005. Note the trend of decreasing rates of measurable sedimentation overtime.

Sedimentation by Area of Origin

There are **58** observations of sediment reaching the surface water body or deposited within bankfull channel width of the water feature.

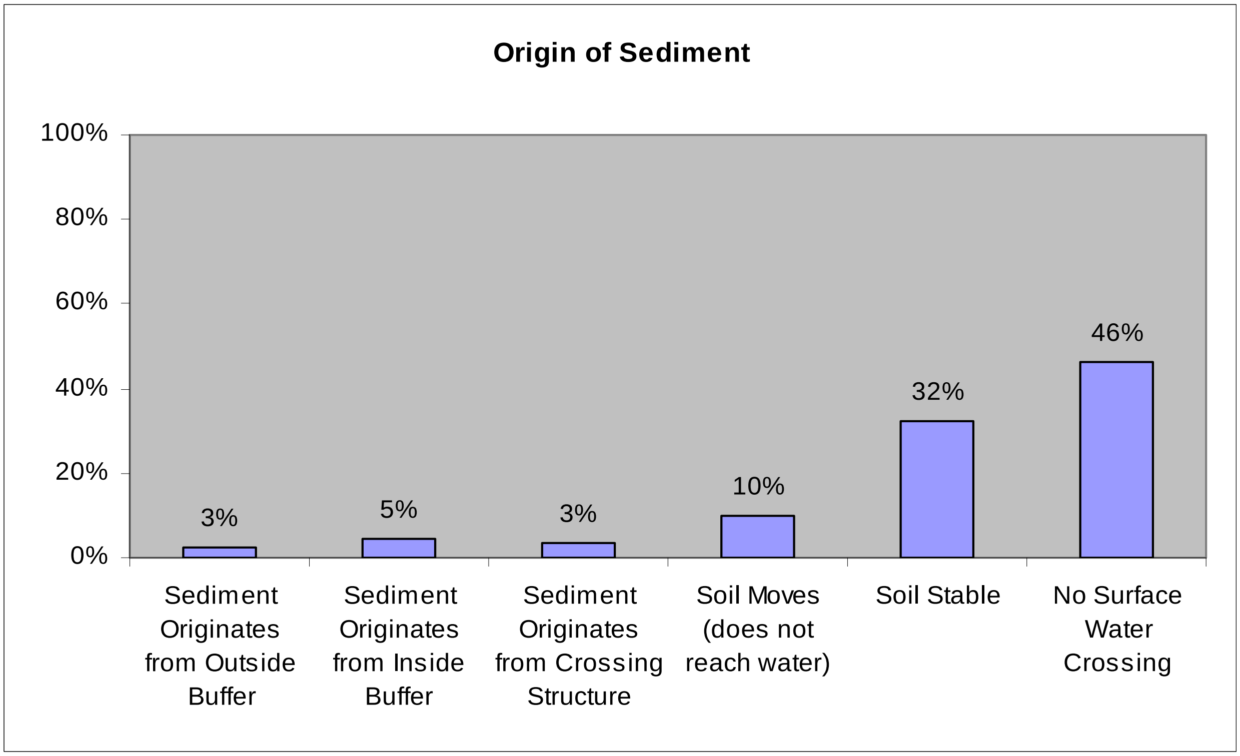


Figure 10 Origin of Sediment (n=550)

Trace and Measurable Sediment by Area of Origin

The following charts compare observations of trace amounts of sediment by area of origins to observations of measurable amounts of sediment by area of origin.

There are **28** observations of trace amounts of sediment reaching the surface water body or deposited within bankfull channel width of the water feature.

There are **30** observations of measurable amounts sediment reaching the surface water body or deposited within bankfull channel width of the water feature.

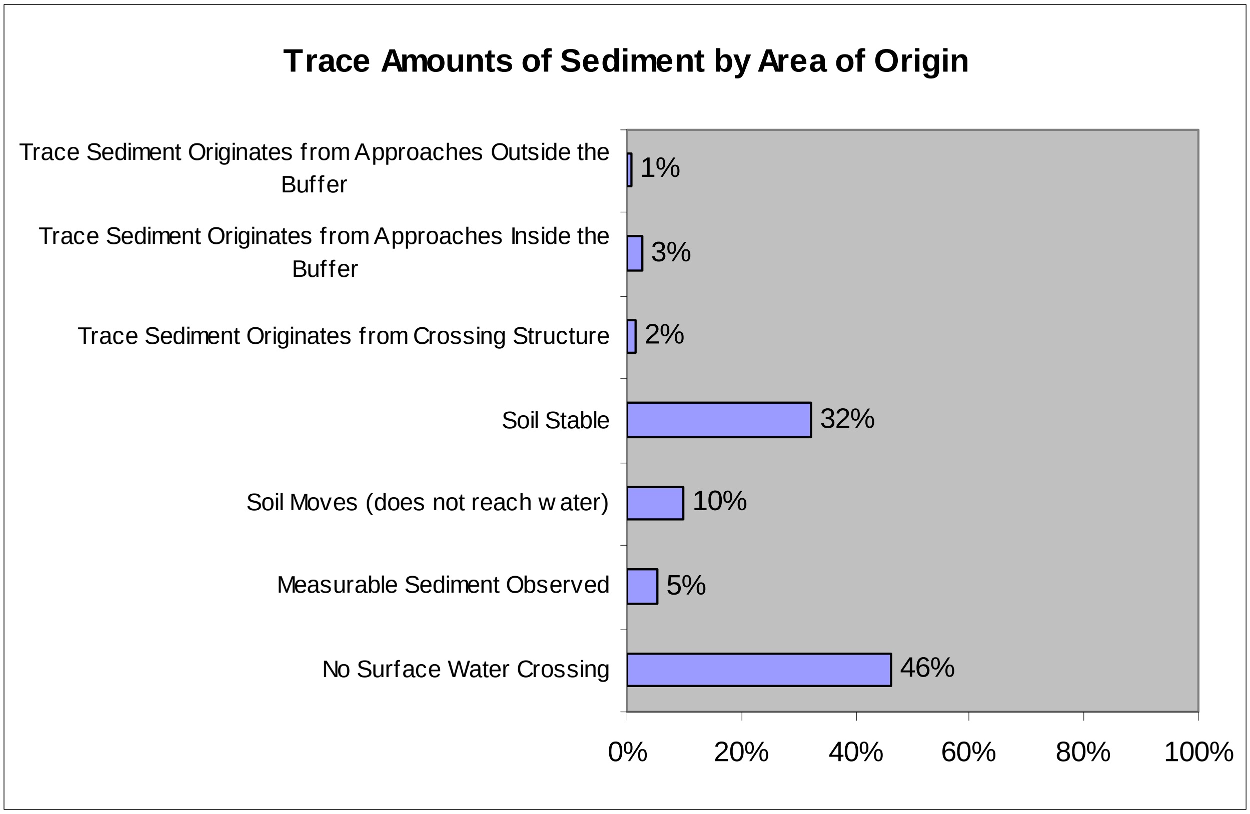


Figure 11 Trace amounts of sediment by origin (n=550)

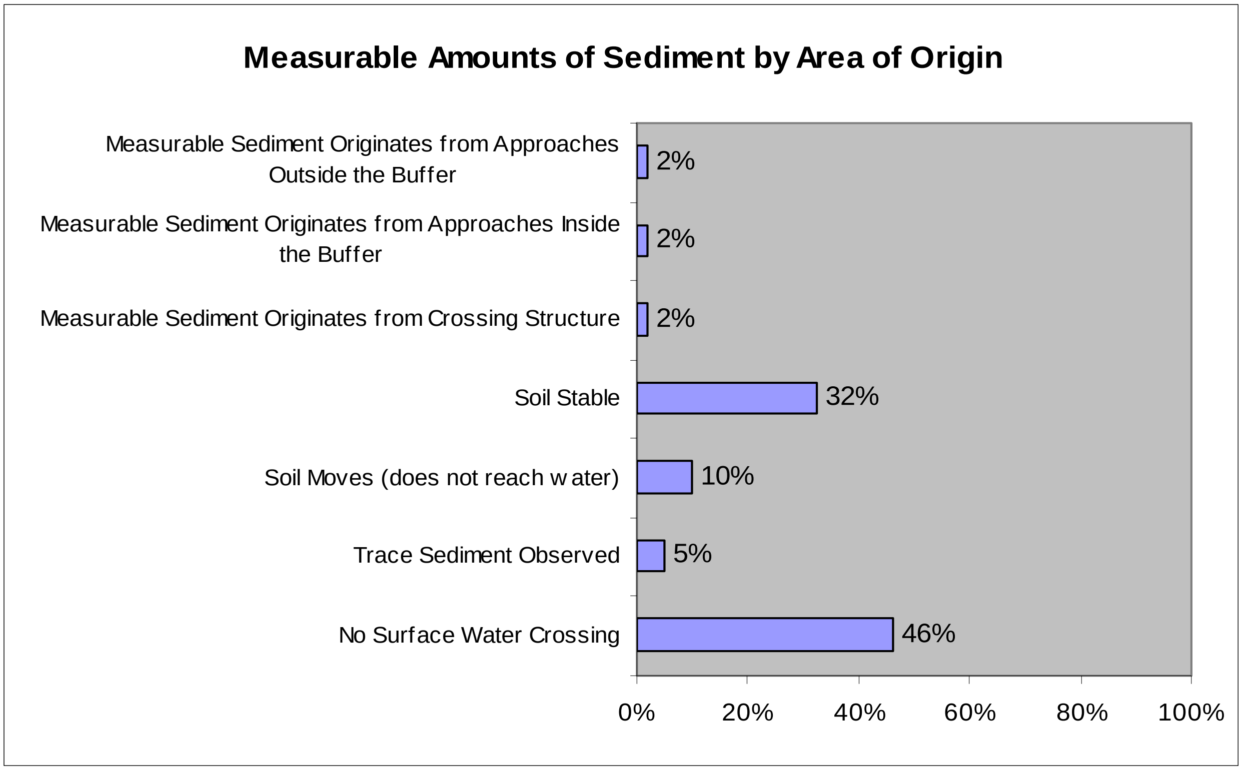


Figure 12 Measurable amounts of sediment by origin (n=550)

***BMP Principle**: Minimize and Stabilize Exposed Soil*

The amount of exposed soil is directly correlated to amount of water quality risk associated with timber harvesting. The Maine Forest Service recommends minimizing exposed mineral soil adjacent to water bodies and stabilizing immediately if it occurs. Follow recommended filter area widths in MFS's Best Management Practices for Forestry: Protecting Maine's Water Quality adjusting for percent slope and distance to waterbody.

Approaches to Water Crossing

There are **4** opportunities to observe the occurrence of soil movement, sedimentation, or stabilization from the approaches to a surface water crossing. They are at Approach Area A–Outside the Buffer/Filter Strip, Approach Area A–Inside the Buffer/Filter Strip, Approach Area B–Inside the Buffer/Filter Strip, and Approach Area B–Outside the Buffer/Filter Strip. **Data reported in this section contains information only from sites that had surface water crossings.**

For the **110** new sample units, there are **232** opportunities to observe soil conditions at approaches to crossings.

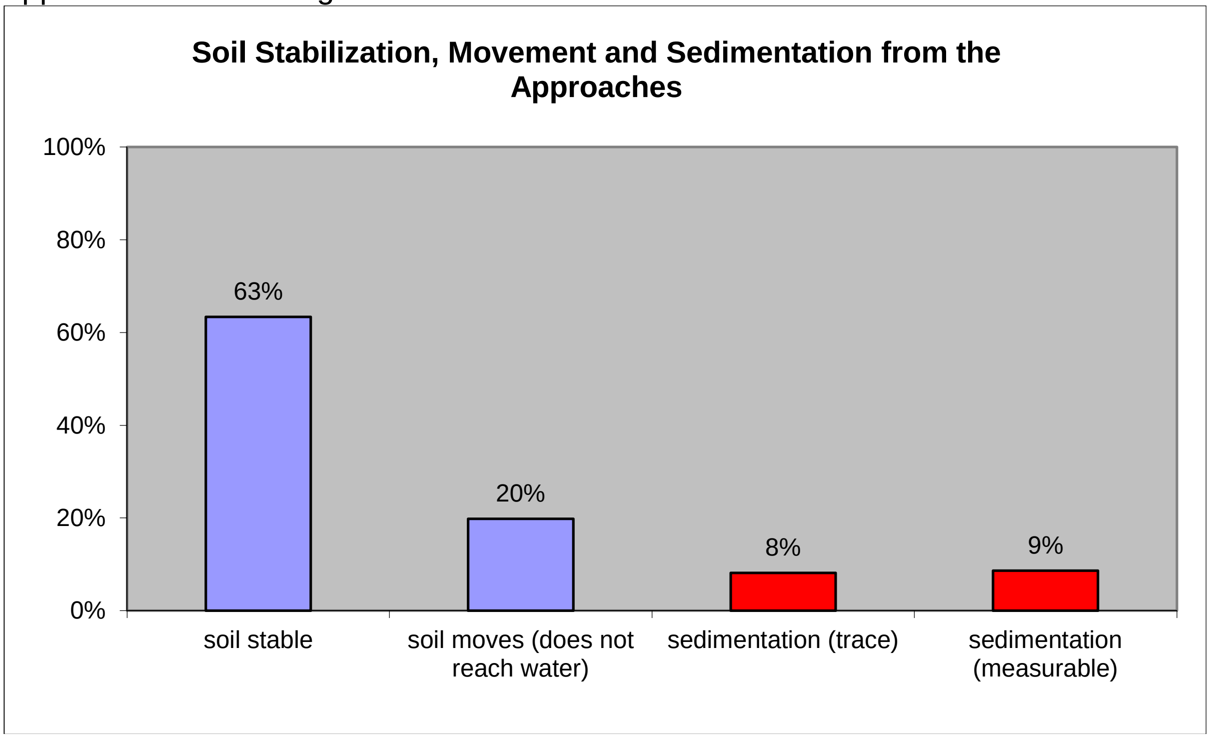


Figure 13 Observations of soil stabilization, movement and sedimentation at the approaches (n=232)

<u>Discussion</u>

Excluding avoided stream crossings (46%), there were 232 opportunities to observe soil conditions, 83% of observations showed that no sediment reached the waterbody from the approaches, 17% showed either trace or measurable amounts of sediment reached the waterbody.

Sediment from the Approaches

There are **19** observations of trace amounts of sediment reaching the surface water body or deposited within bankfull channel width of the water feature.

There are **20** observations of measurable amounts of sediment reaching the surface water body or deposited within bankfull channel width of the water feature.

The following table compares volumes of measurable amounts of sediment.

Table 1 Volume of sedimentation at approaches (cubic feet)

	Approaches Outside the Buffer/Filter Strip	**Approaches Inside the Buffer/Filter Strip**
	Sediment evident in water body	**Sediment evident in water body**
Average	4	4
Median	4	1
Maximum	10	30

Table reflects the average, median, and maximum of sediment volumes 1 cubic foot or greater.

Specific Cause of Sedimentation from the Approaches

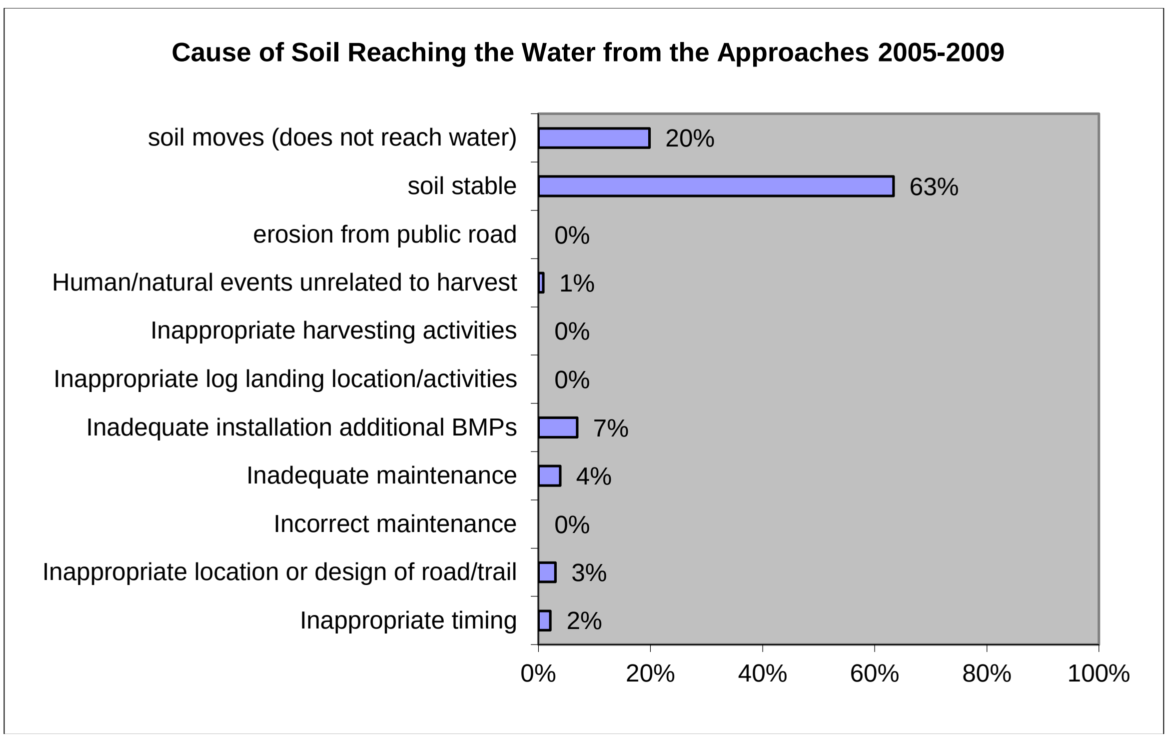


Figure 14 Cause of soil reaching the water from the approaches (n=232)

BMP Maintenance refers to reshaping or reinforcing installed BMPs to compensate for wear from use or erosion or in anticipation of seasonal shutdown or extreme weather events. Inadequate installation of additional BMPs or incorrect BMP maintenance are the primary causes for sediment reaching the water from the approaches.

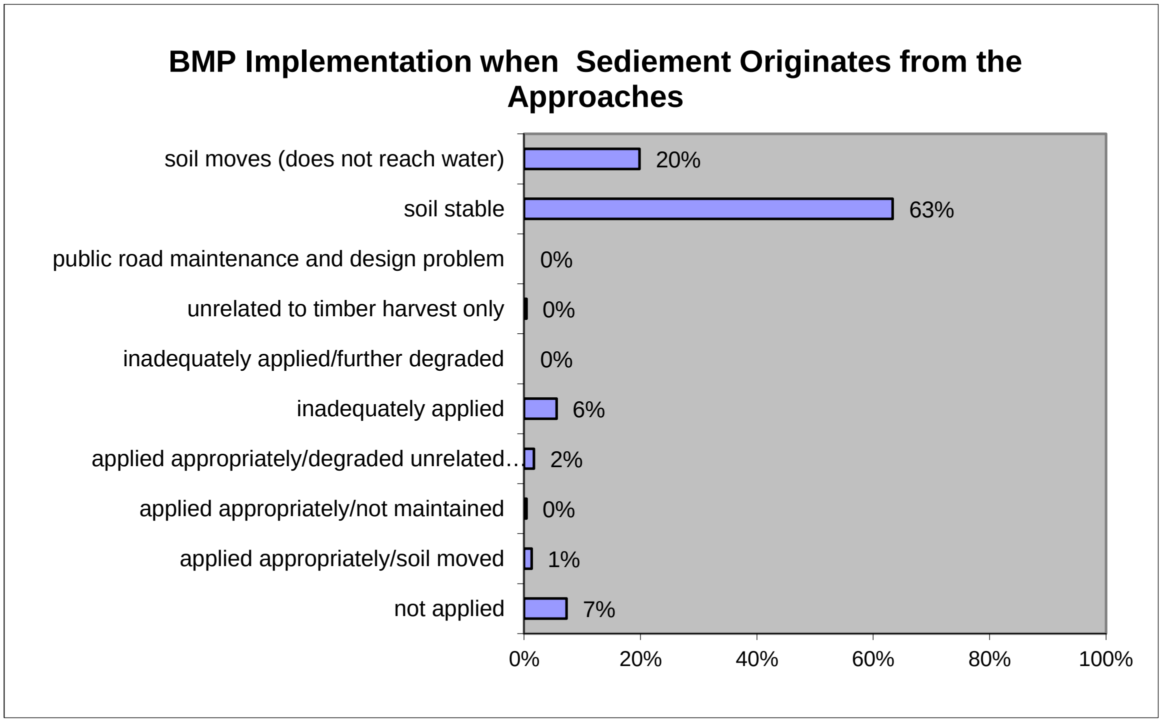


Figure 15 BMP implementation at approaches (n=232)

Discussion

Where crossings were present, BMPs kept sediment from reaching the waterbody from the approaches in 83% of cases. When soil did reach the waterbody it was most likely to do so when BMPs were either not applied or applied inadequately or incompletely. In a few cases BMPs were applied appropriately, but soil still reached the waterbody. Activities unrelated to the timber harvest (extreme weather, beavers, ATVs) accounted for the balance of sedimentation observations. Avoided water crossings and properly implemented BMPs prevented soil from reaching the water at 92% of the approach observations.

There are four equally important phases of BMP implementation;

1) Plan ahead – avoid water crossings, locate access roads, landings and trails properly, and time operations appropriately
2) Build it right – adequately apply initial BMP installations
3) Maintain it – monitor, repair and add additional BMPs as necessary during the active portion of the harvest
4) Close it out properly- identify long-term maintenance and monitoring needs, successfully establish soil stabilization, and anticipate activities unrelated to timber harvesting that may degrade final stabilization efforts.

Crossing Structure

There is **1** opportunity to observe the occurrence of soil movement, sedimentation, or stabilization from the crossing structure. **Data reported in this section contains information only from sites that had surface water crossings.**

For the **110** new sample units, there are **59** opportunities to observe soil conditions at the crossing structure.

Soil Stabilization, Movement, and Sedimentation from the Crossing Structure

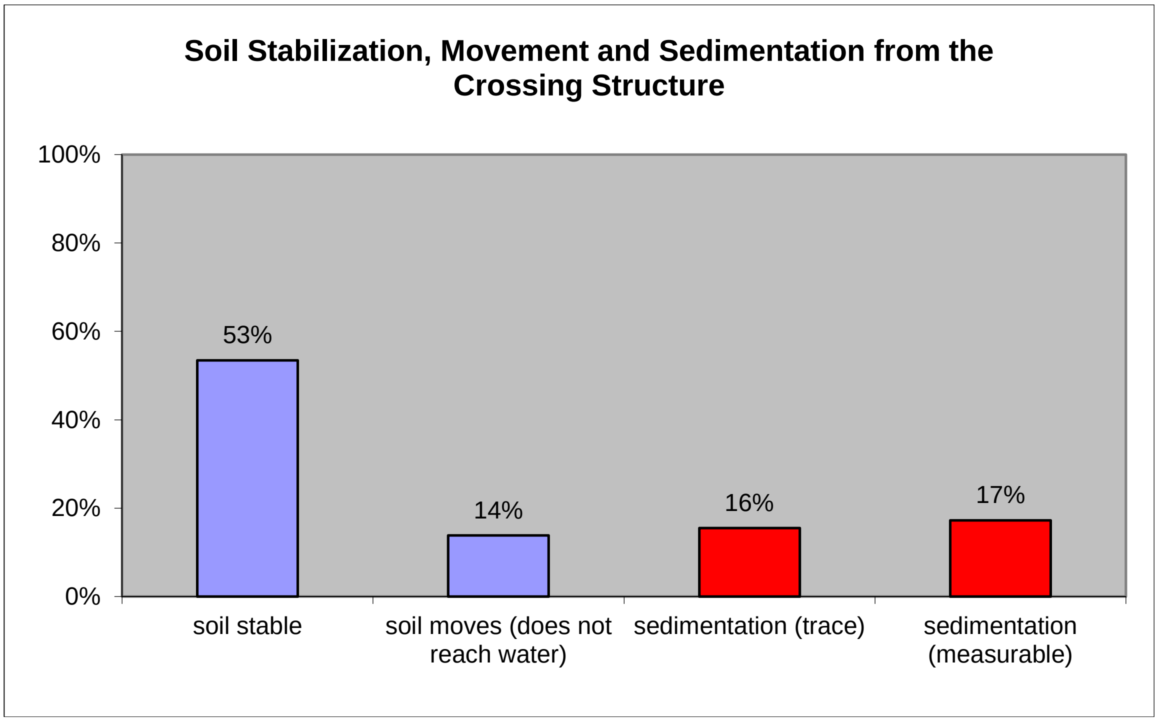


Figure 16 Observations of soil stabilization, movement and sedimentation from the crossing structure. (n=59).

<u>Discussion</u>

Excluding avoided crossings, 67% of crossings had no sediment enter the waterbody. 33% of crossings had sediment enter the waterbody. 17% of all observations showed measurable soil movement into the waterbody originating from the crossing.

Sedimentation from the Crossing Structure

There are **9** observations of trace amounts of sediment reaching the surface water body or deposited within bankfull channel width of the water feature.

There are **10** observations of measurable amounts of sediment reaching the surface water body or deposited within bankfull channel width of the water feature.

Table 2 Volume of Measurable Sediment Observed in the Water and Attributable to the Crossing Structure (cubic feet)

	Sediment evident in water body
Average	47
Median	3
Maximum	650

Discussion

The average volume of sediment entering the water for crossings was 47 cubic feet. This average was skewed by a single very large sedimentation event caused by a structure failure. This event demonstrate the importance of proper crossing structure design and sizing since failure has the potential to lead to large sediment inputs. Because of the influence of this event the median value of 3 cubic feet value is probably more useful in determining the impact of sedimentation occurring at "typical" crossings (Table 2).

Structure Type Associated With Sedimentation

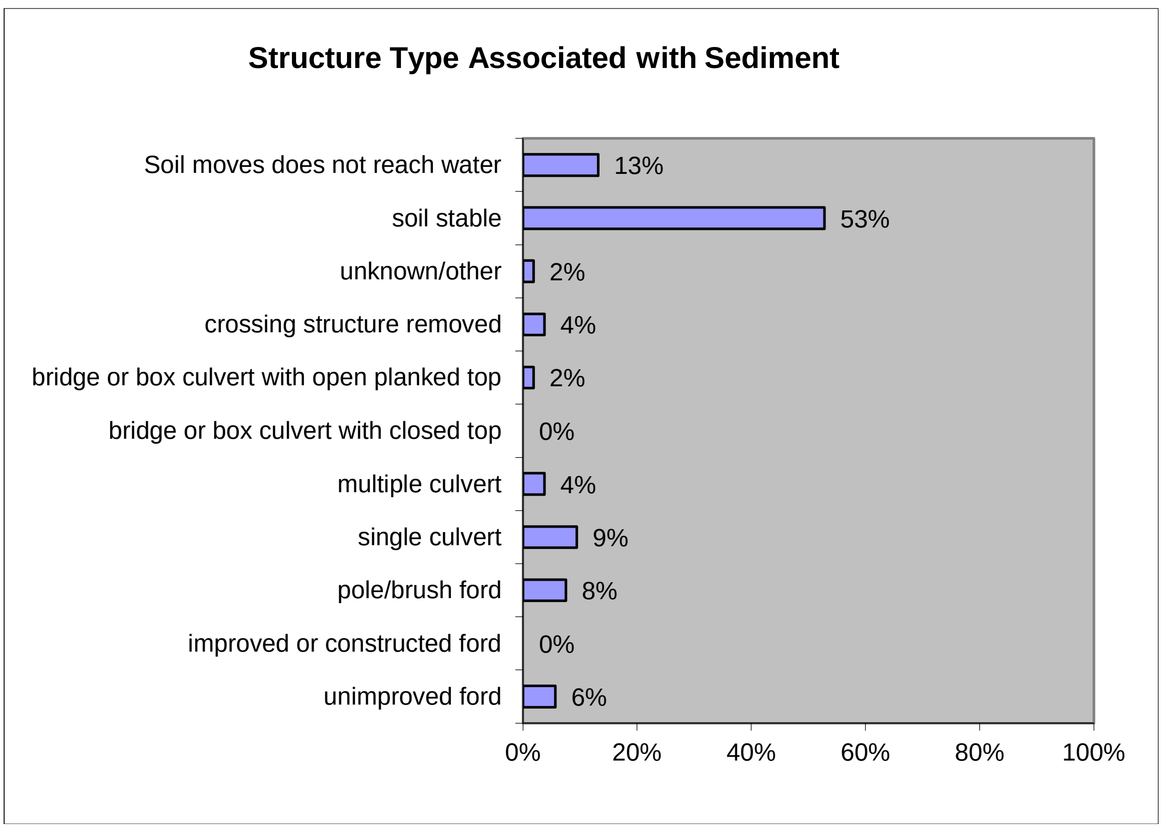


Figure 17 Structure type associated with sedimentation (n=59)

Likelihood of Structure Type Being Associated With Observations of Trace Sediment or Measurable Sediment

When measurable sedimentation was observed at the crossing, the structure present was most often a single culvert. However this does not indicate the relative risk of sedimentation occurring since single culverts were also the most commonly evaluated structure. To assess this risk, each structure type was analyzed separately to see how often sedimentation occurred for that type.

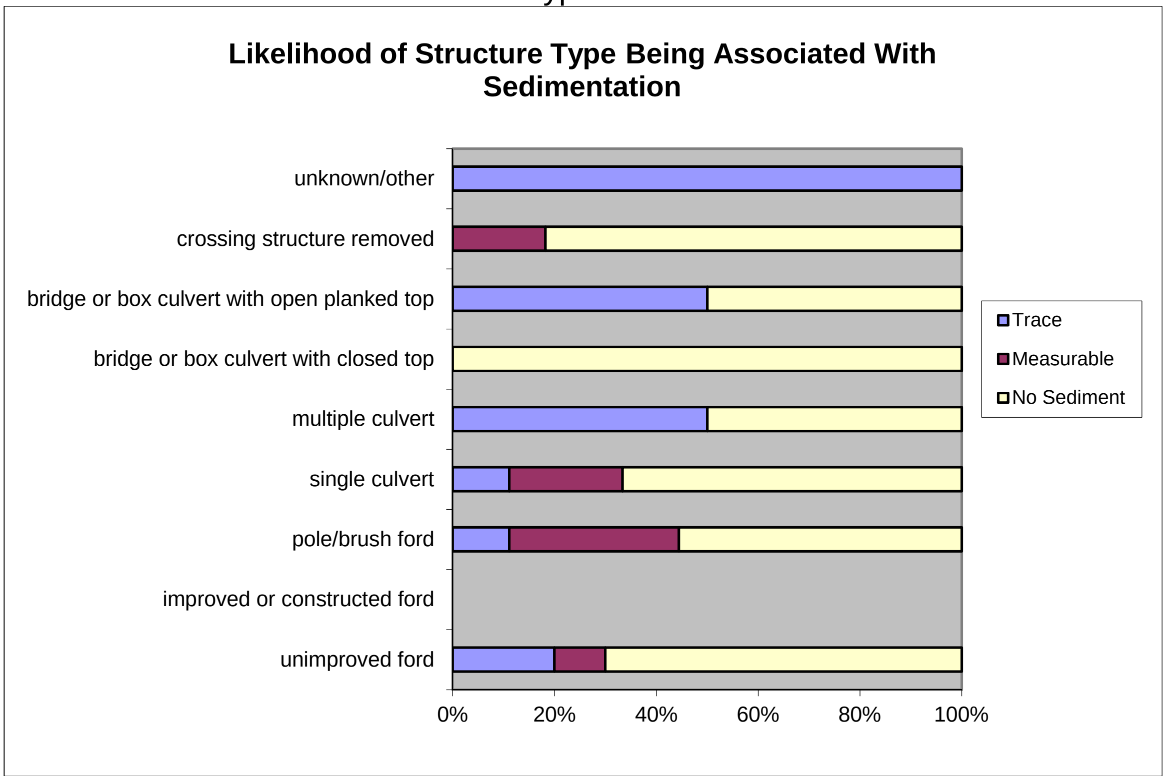
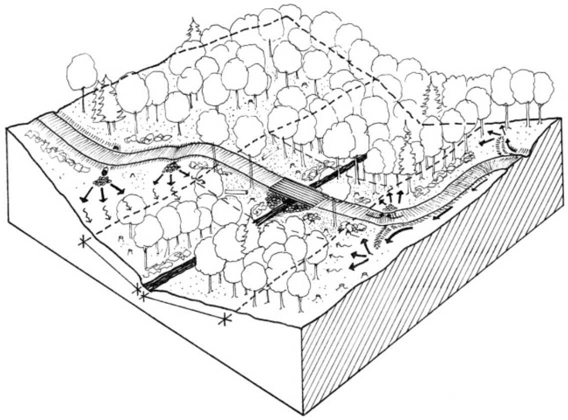


Figure 18 Likelihood of structure type being associated with sedimentation

Elevated crossing structures, crossings not at the lowest point in the road profile, divert storm flow into adjacent filter areas. By elevating the approaches inside the buffer/filter strip, stormwater can be easily diverted away from the crossing structure. Crossings located at the lowest point of the road profile can fail prematurely from side embankment erosion immediately adjacent to the structure.



Note elevated crossing diverting water flow into filter areas

Activities Related to Sedimentation

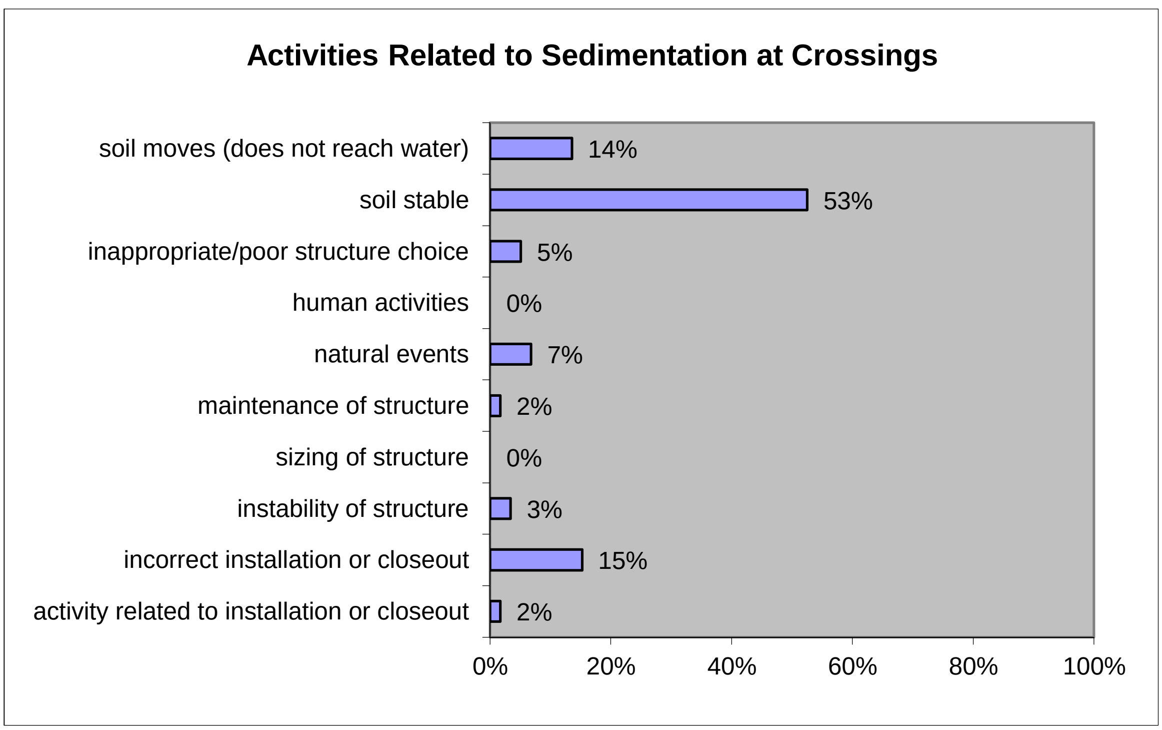


Figure 19 Activities related to sedimentation at crossings (n=59)

Table 3 Quantities of Sedimentation by Crossing Structure Type

	Sediment Volumes (cubic feet)		
	Average	**Median**	**Maximum**
Unimproved ford	4	3	8
Improved/constructed ford	N/A	N/A	N/A
Pole/brush ford	10	10	20
Single culvert	124	5	650
Multiple culvert	2	2	2
Bridge/box culvert, closed top	N/A	N/A	N/A
Bridge/box culvert, open top	5	5	5
Structure removed	3	3	3
Unknown/other	N/A	N/A	N/A

N/A values indicate that no volume measurements were recorded.

Discussion

BMPs are designed to be reasonable measures to minimize the amount of sedimentation that occurs. Incorrect installation or closeout of crossings were the most common causes of sediment entering the waterbody from the crossing structure. It is very difficult to install or remove a crossing without some level of sedimentation occurring. A small one time input of sediment from a crossing removal or instalation is often of less biological importance than ongoing, chronic sediment inputs. Use of stabilization BMPs after removal or installation are critical to ensure that chronic sedimentation inputs are avoided.

Sedimentation Related to the Application of BMP Principles and Practices

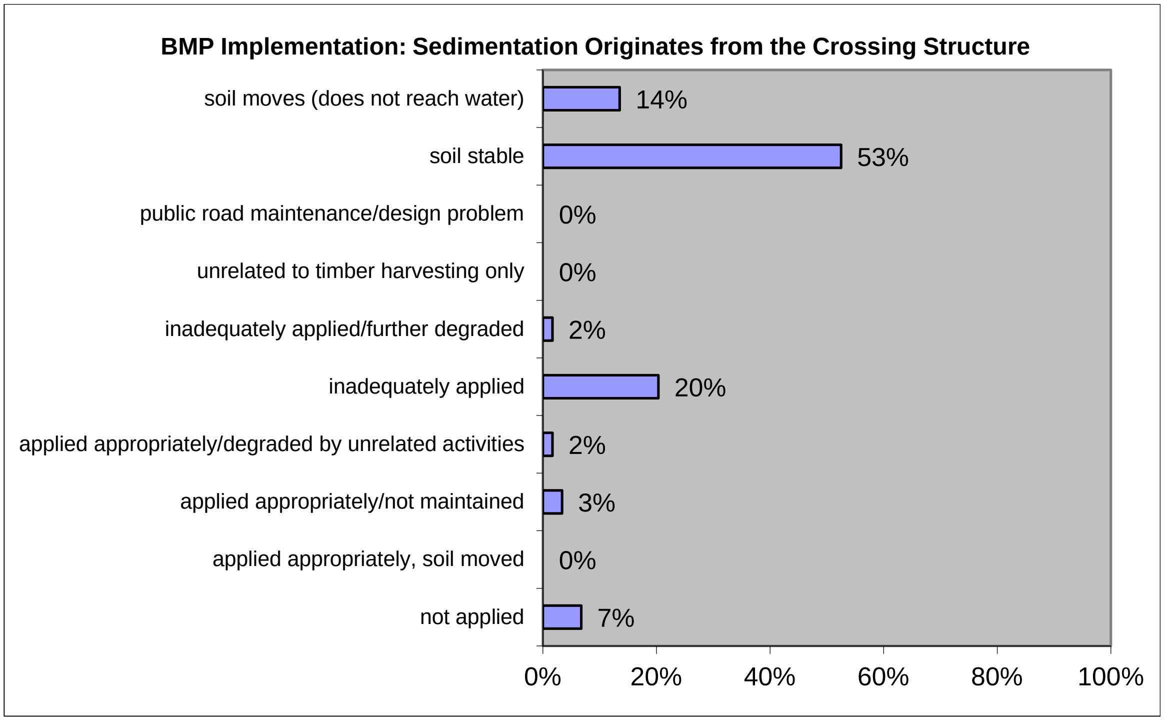


Figure 20 BMP application when sediment (both trace and measurable) originating from the crossing structure entered the waterbody 2005-2009 (n=59).

Discussion

When a crossing was present, 33% of all observations showed soil movement into the waterbody originating from the crossing. Inadequate or incomplete application of BMP principles and practices was the overwhelming cause of sediment reaching the water. Being sure that BMPs are installed correctly to achieve the intended outcome appears to be an area to focus further training on. This illustrates that it is not just sufficient to install a BMP, that BMP needs to be installed adequately to achieve its intended outcome. Activities unrelated to the timber harvest (extreme weather, beavers, ATVs) accounted for the balance of observations where sediment reached the water from the crossing. Avoided water crossings and properly implemented BMPs prevented soil from reaching the water at 81% of the crossing observations.

Crossing Structure Specifications

A total of **110** new sample units were sampled.

- **59** sample units have surface water crossings.

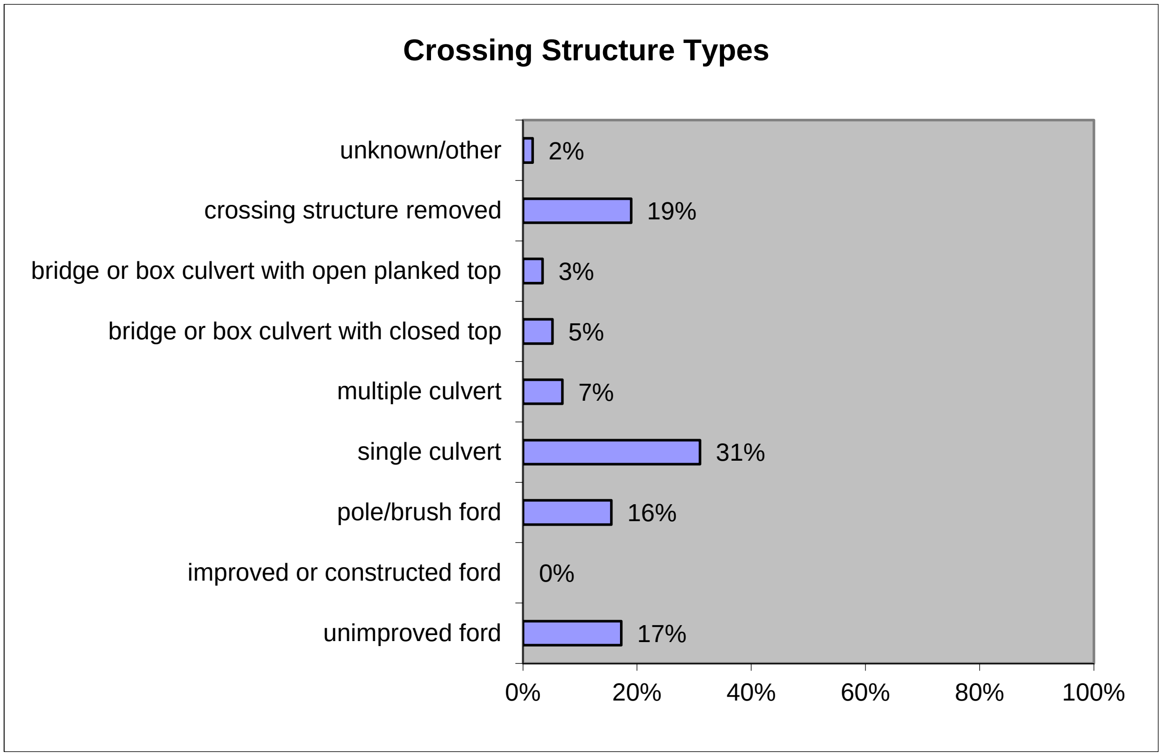


Figure 21 Crossing structure types (n=59)

Structure Type by Road Type

- There are **33** sample units with a skid trail at the water crossing.
- There are **26** sample units with a haul road at the water crossing.

The following charts compare crossing structure types by road type at the water crossing.

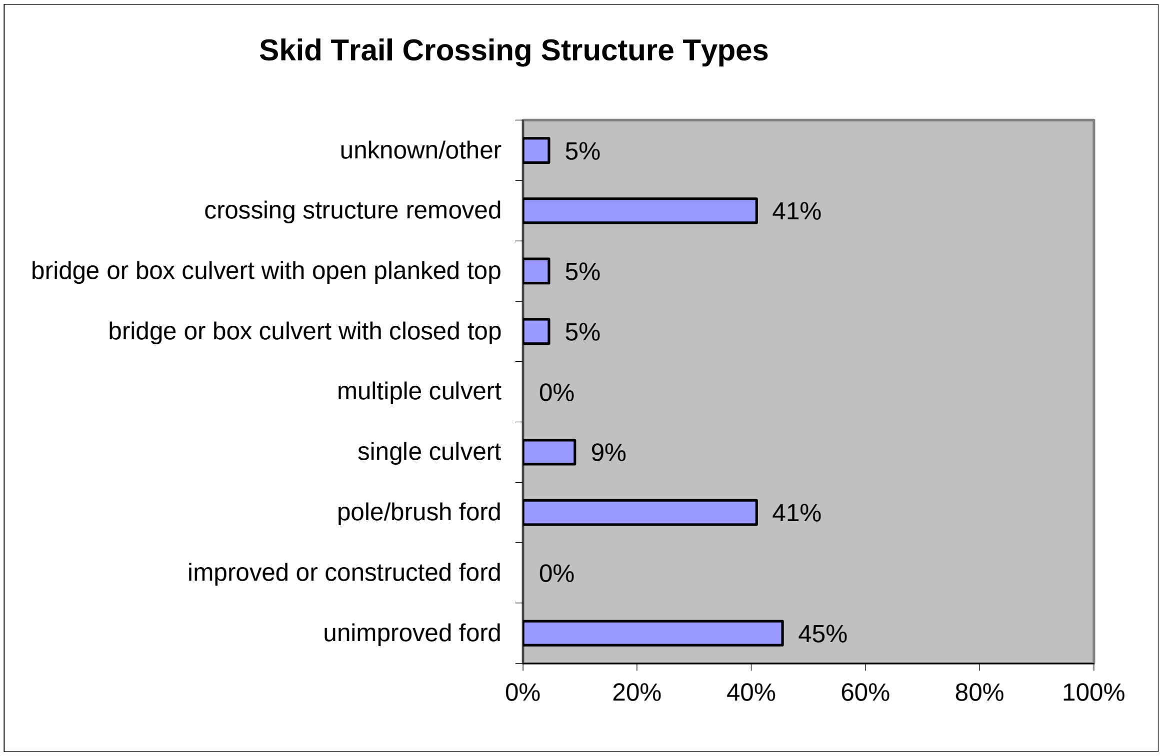


Figure 22 Structure type associated with skidder crossing (n=26)

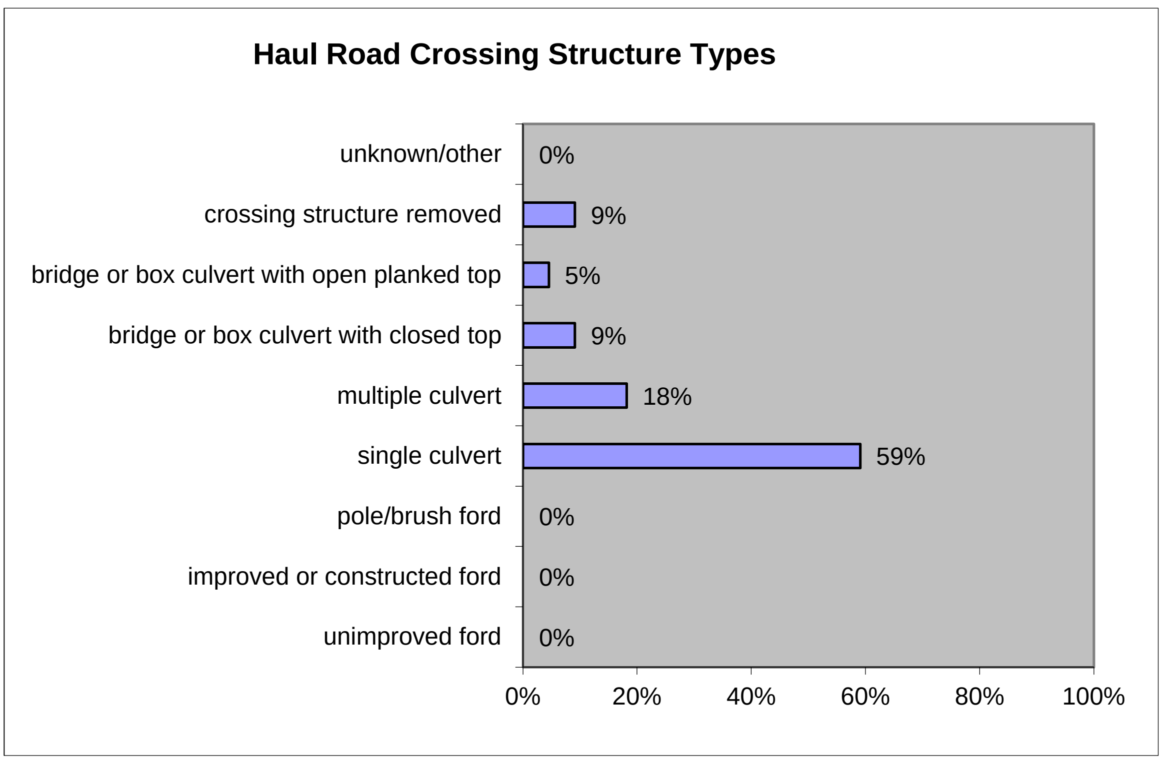


Figure 23 Structure type associated with haul road crossing (n=33)

Discussion

Fifty-nine crossings where identified as either haul road or skid trail; 33 haul road, 26 skid trail. A haul road may be defined as forest access system designed to transport harvested forest products to a location or facility for resale, sorting or processing into value added forest products. Skid trails primarily bring trees that have been harvested to a concentration point directly associated with the forest operation notification for either further preparation for transport on a haul road or public transportation route. Haul road stream crossings were evaluated if they were directly associated with the sample unit. Haul road crossings associated with multiple harvests or large amounts of acreage not directly associated with harvest were not evaluated.

Haul Road

Skid Trail

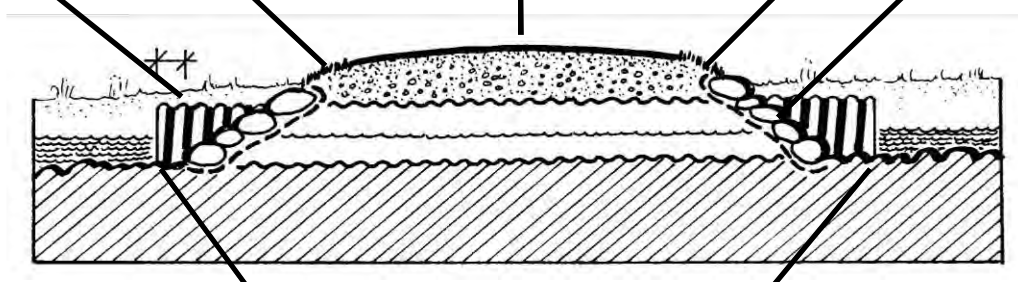
Structure Type Associated With Water Body Type

- There are **40** crossings associated with a perennial water feature.
- There are **13** crossings associated with an intermittent water feature.
- There are **6** crossings associated with an ephemeral water feature.

It is very important that permanent structures be designed and installed according to minimum standards and BMP recommended guidelines. Proper installation maximizes the useful life of the crossing structure thus reducing maintenance and unnecessary replacement costs due to premature failure.

Single culverts were the most prevalent structure delivering sediment to the water feature.

When installing permanent crossings:



Structure Type Associated With Downcutting or Scouring Within 100 Feet of the Outlet

- There are **9** observations of stream downcutting or scouring within 100 feet of the outlet end of the structure.
- **49** sample units show no evidence of stream downcutting or scouring within 100 feet of the outlet end of the structure.

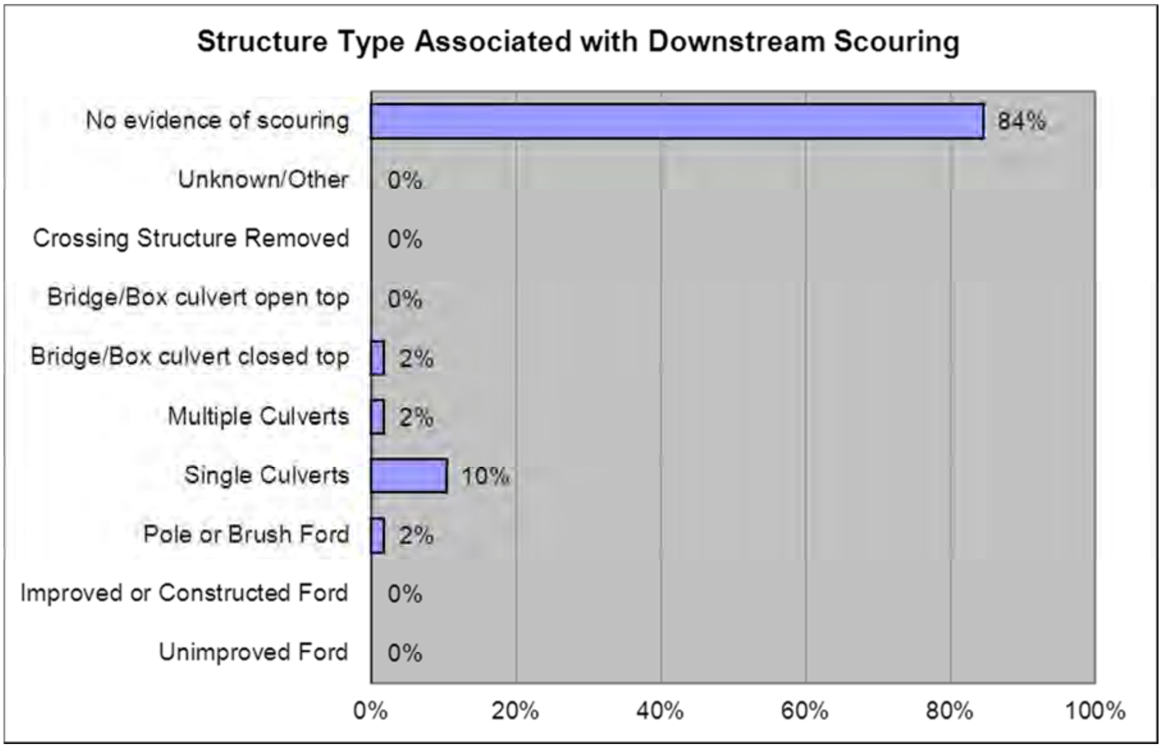


Figure 24 Structure Type Associated with Stream downcutting or scouring (n=59)

<u>Discussion</u>

84% of crossings did not show evidence of downcutting or scouring. 62% of sites where down cutting or scouring was observed were associated with single culverts. On haul roads single culverts were the predominant crossing structure used to cross both perennial and intermittent streams. Outlet downcutting and scouring are indicative of undersized structures that restrict normal stream by not extending to the stream bank width. Undersized structures inhibit fish passage by restricting and concentrating flow. Properly installed crossings do not constrict the stream bed to fit the size of the structure. Undersized structures can limit fish passage by creating velocity, jump, and debris barriers. When replacing washed out or failing crossing structures, current minimum size standards should be applied to avoid premature structure failure and ensure stream channel connectivity.

Haul Road or Log Landing in the Buffer/Filter Strip

There is **1** opportunity to observe the occurrence of soil movement, sedimentation, or stabilization from the haul road or log landing inside the buffer/filter strip. **Proportions are based on the total number of opportunities to make observations about soil conditions at the haul road or log landing inside the buffer/filter strip.**

For the **110** new sample units, there are **110** opportunities to observe soil conditions at the haul road or log landing inside the buffer/filter strip.

- **3** sample units have a haul road or log landing located within the buffer/filter strip.

Soil Stabilization, Movement, and Sedimentation

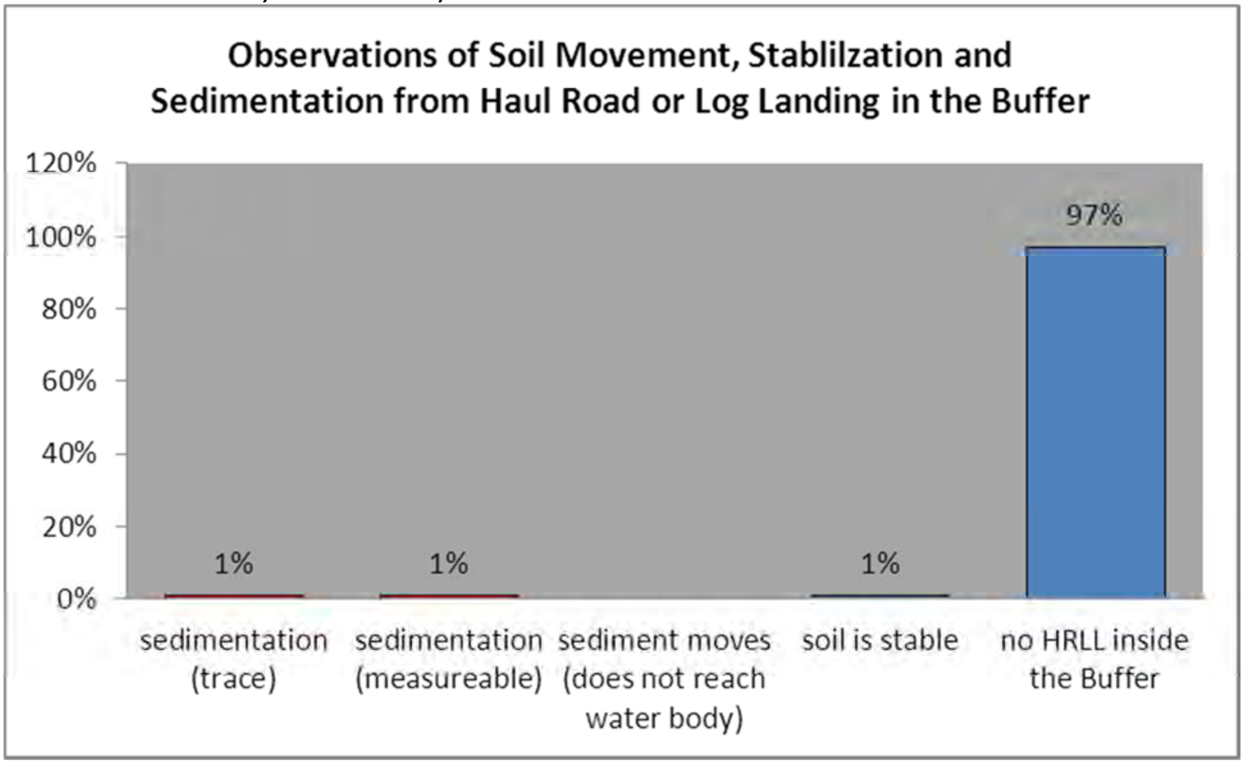


Figure 25 Observations of soil movement, stabilization and sedimentation from haul road or log landing in the buffer (n=110)

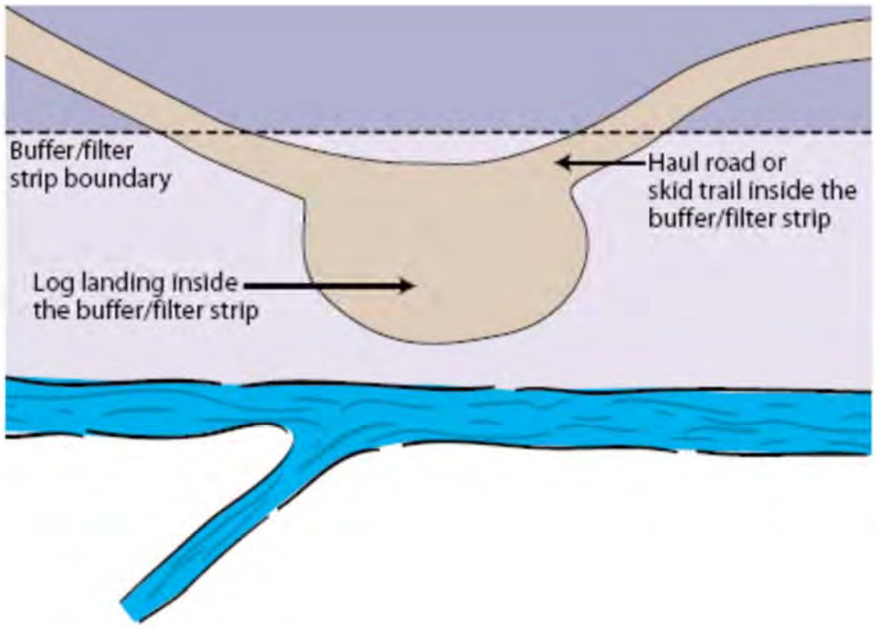
Discussion

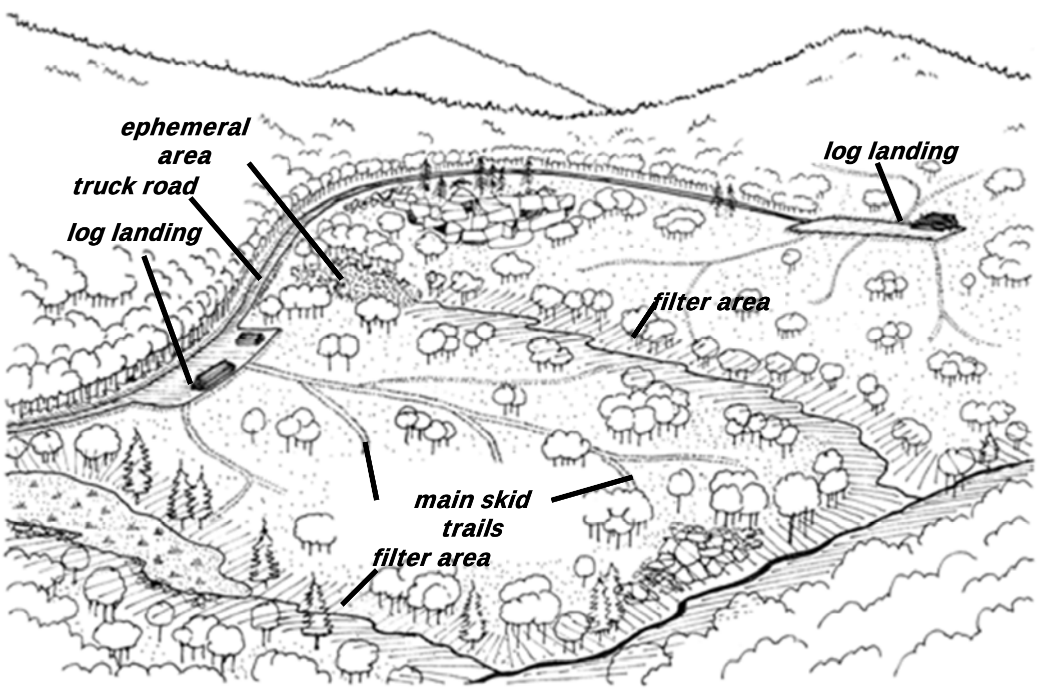
Areas of prolonged exposed soil during a given timber harvest are typically located on haul roads and landings. These locations pose the greatest risk to adjacent water resources from soil movement and potential chemical contamination from fuel oil and maintenance fluid use and storage. Locating haul roads and landings outside buffer filter strip, significantly reduces environmental risk and BMP implementation costs.

97% of timber harvests monitored did not have landings or haul roads within the buffer. New construction typically avoids placing these forest access systems within these sensitive areas. Practitioners routinely scrutinize appropriateness of reuse when accessing historical haul roads and skid trails to regain access to areas that have not been harvested in recent years.

As with other findings, analysis shows when BMPs are applied, negative impacts to forested water resources are greatly reduced if not totally eliminated. Locating haul roads and landings outside the buffer during the pre-harvest planning is an effective BMP commonly implemented by Maine forest practitioners.

Haul Road and Log Landing in a Buffer Filter Strip





Selecting haul road and landing locations carefully can minimize risk to sensitive areas

Chemical Pollutants

110 new sample units were sampled.

Evidence of Potential Pollutants

- **1** sample units had evidence of lubricant, fuel, hydraulic fluid, and/or anti-freeze spillage resulting from harvest operations.
- **4** sample units had evidence of discarded batteries and/or other potential pollutant containers present.
- **0** sample units had evidence of chemical spills as well as discarded batteries and/or other potential pollutant containers present.

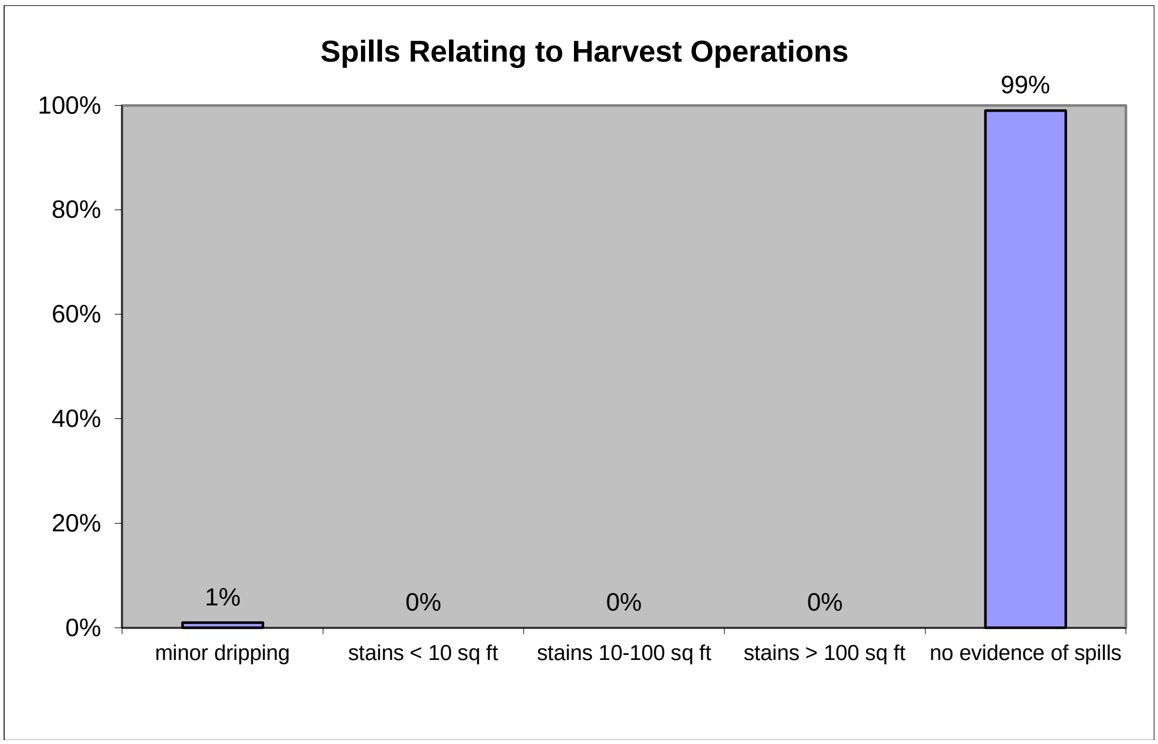


Figure 26 Spills relating to harvest operations (n=110)

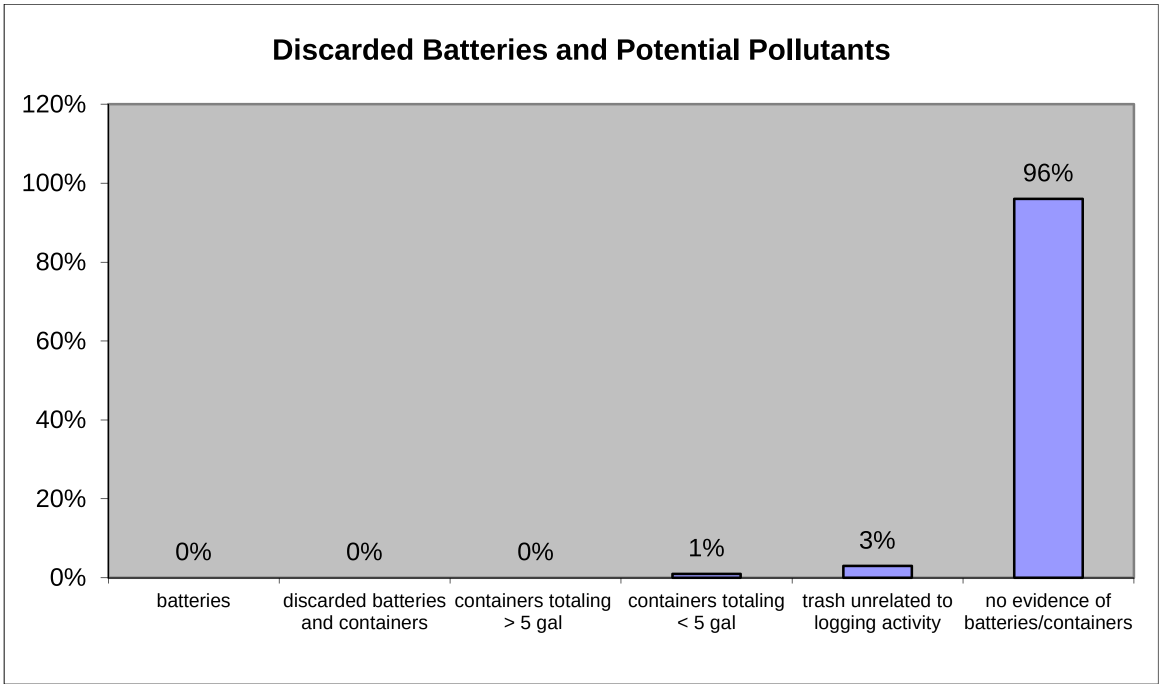


Figure 27 Discarded batteries and other pollutants (n=110)

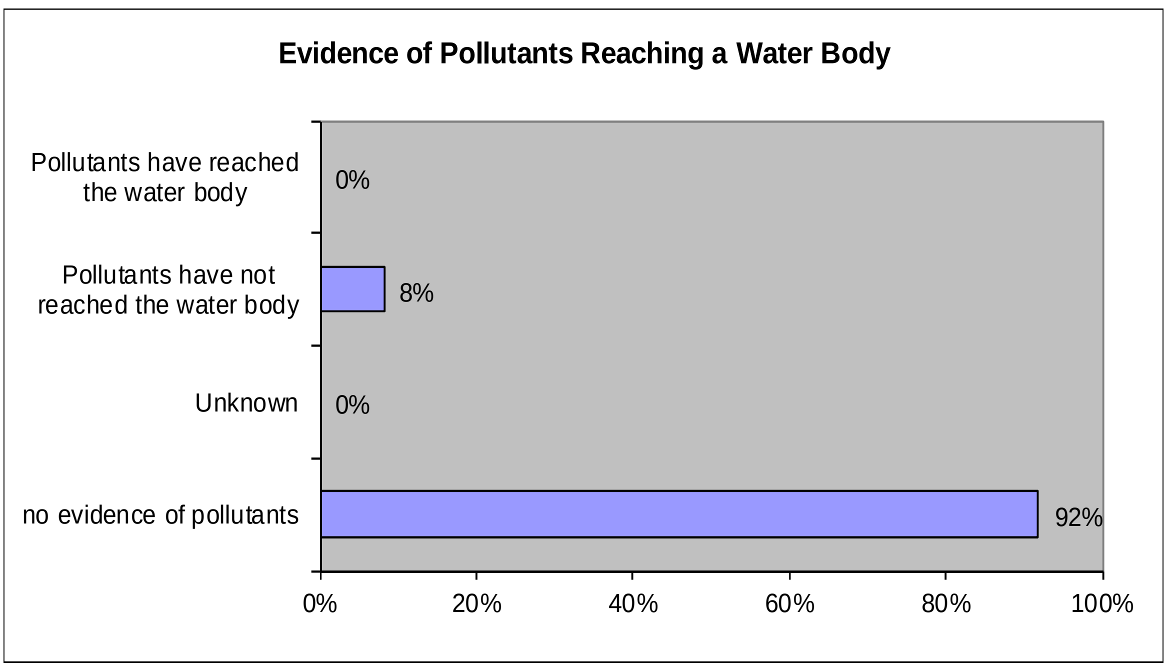


Figure 28 Evidence of pollutants reaching a waterbody (n=110)

Discussion

Although no chemical pollutants made it to the waterbody, contamination remains a concern particularly in areas where groundwater may serve as private or public drinking water sources in near future. Forest practitioners should take great care handling and disposing fuel oil, ant-freeze, hydraulic fluid, and batteries. These common items are considered hazardous when not used and stored properly.

<u>Hazardous Materials BMP Practices</u>

- Use appropriate containers for collecting and storing oils, fuels, coolants, or hazardous wastes
- Maintain and repair all equipment outside filter areas
- Have spill kits or other absorbent materials for mopping up spills readily available
- If a spill occurs keep it for flowing off the yard and into surface waters
- Know state agency phone to call in case of an emergency
- Collect trash and dispose of properly

Wetland Crossings

110 new sample units were sampled.

- **8** sample units have a wetland crossing.

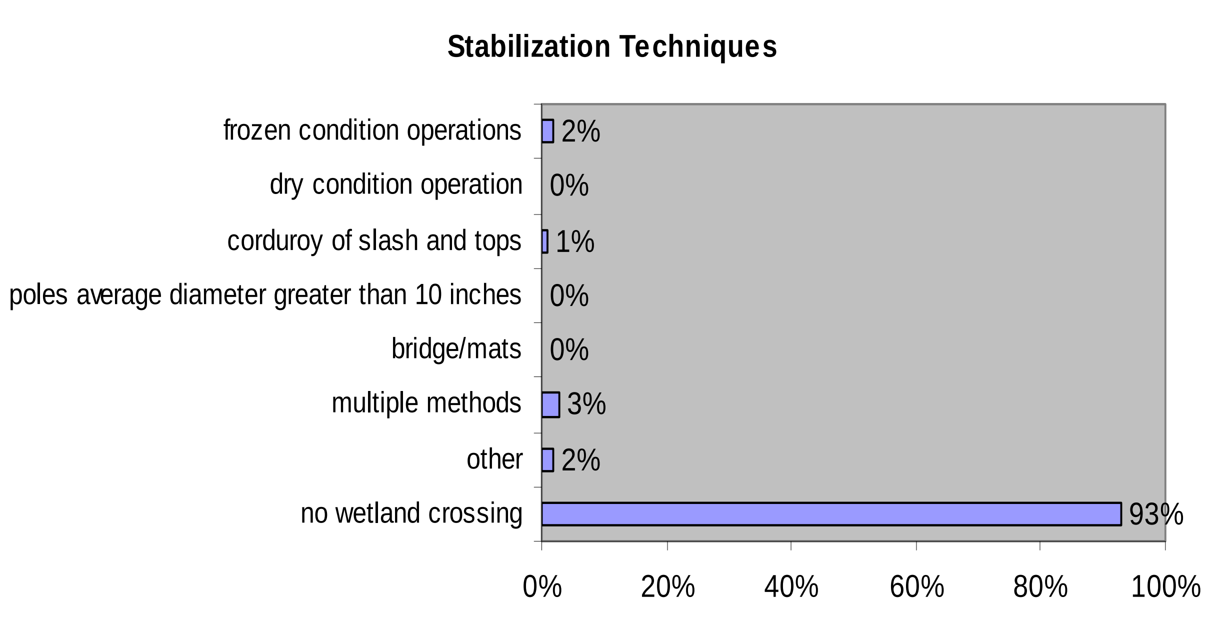


Figure 29 Wetland crossing stabilization techniques (n=110)

Table 4 Wetland Crossing Length from Upland to Upland

	Length (feet)
Average	197
Median	175
Maximum	325

Rutting Depth and Sedimentation

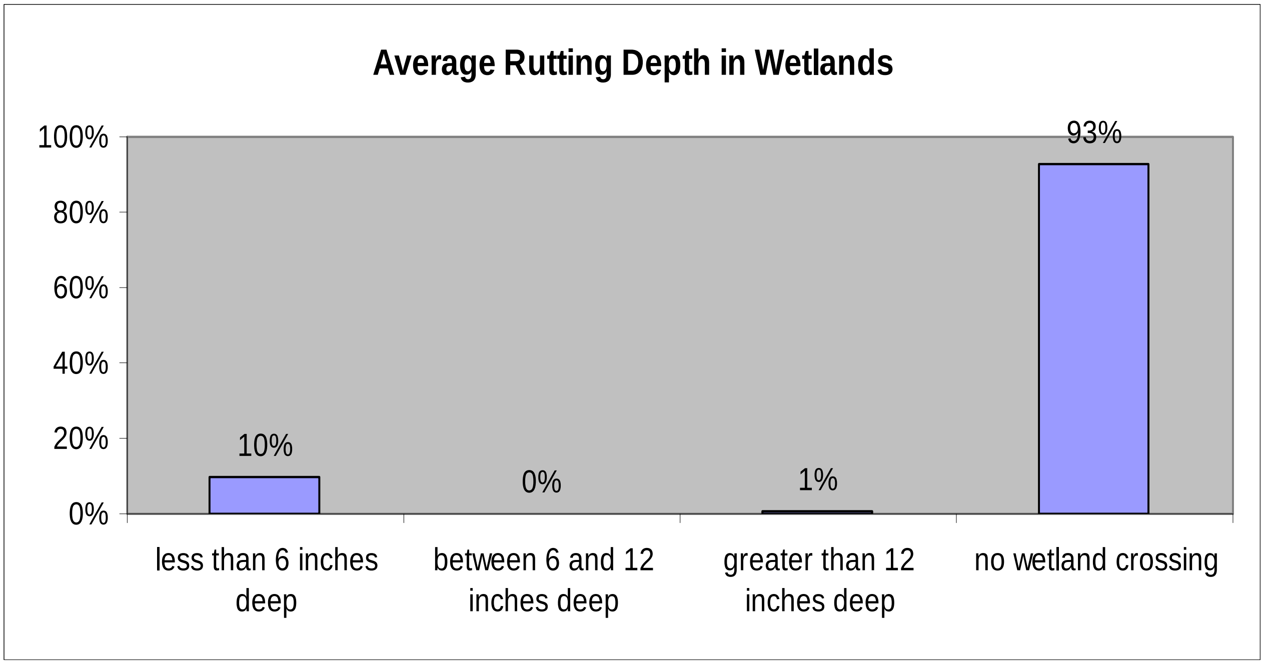


Figure 30 Average rutting depth in wetlands (n=110)

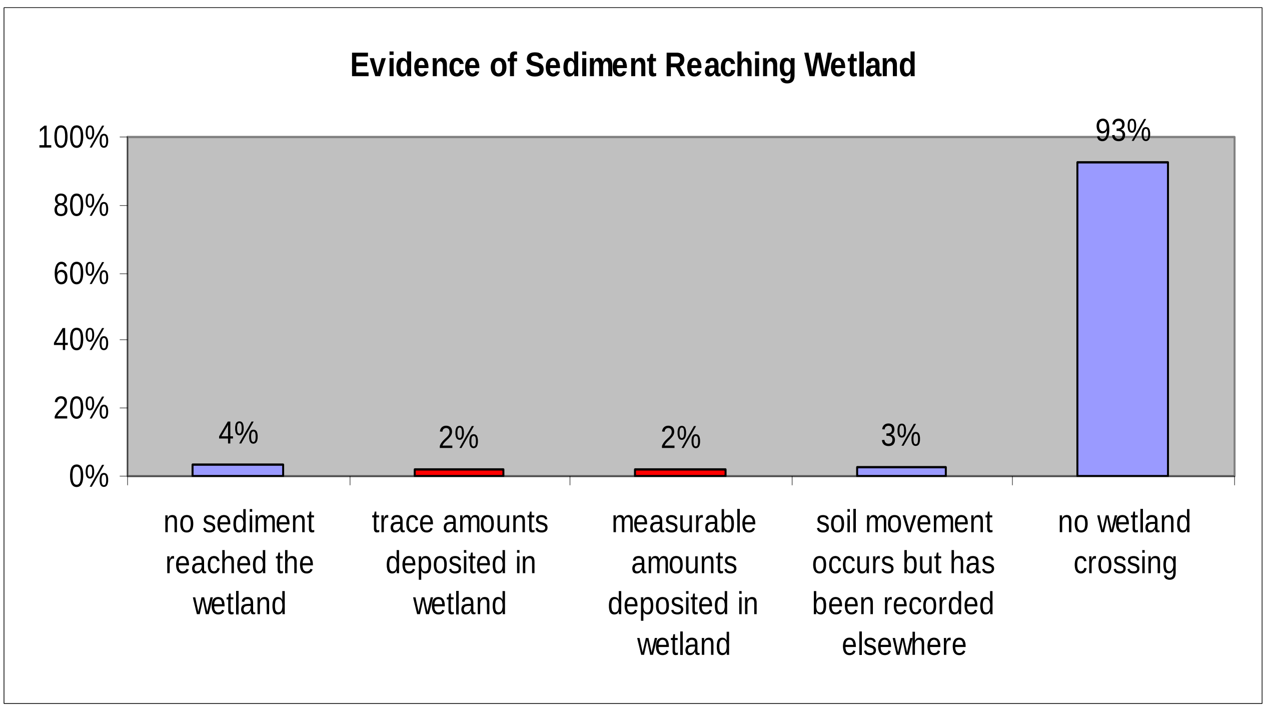


Figure 31 Evidence of sediment reaching wetlands (n=110)

Discussion

BMPs recommend avoiding wetland crossings whenever possible. With 93% of the samples having no wetland crossings it is evident that this BMP is commonly practiced in Maine. When wetlands do need to be crossed, adequate cross drainage must be installed so water flow is not inhibited.

Conclusions

The creation of the Northeast Regional Forestry BMP protocol and the effort of the MFS and its partners to collect data in a consistent manner on an ongoing basis, allows us to quantify trends in BMP performance. Previous BMP monitoring efforts tended to occur in a periodic fashion and often used different protocols making direct comparisons difficult. The Northeast Regional Forestry BMP Protocol allows an objective assessment of the continual improvement process.

The 2010-2011 BMP monitoring results are generally consistent with the past few years and to continue to show a general acceptance of the use of effective BMPs by the states forestry and logging communities.

The fact that 90% of cases evaluated showed no sedimentation and only 4% of crossings and approaches did not have BMPs applied indicates that most foresters and loggers understand the importance of maintaining water quality and know what steps to take to protect it.

Monitoring, education and training is key to sustaining the progress that has been made with Forestry BMPs and will allow Maine’s forestry community to continually improve as we move into the future.

Appendix A

The Seven BMP Fundamentals

Most BMP techniques are based on a few basic principles. This section provides an overview of these fundamental BMPs and how they protect water quality. Understanding these principles will enable you to select or adapt the BMPs that are the most appropriate and effective. Think of these principles as goals. Any single practice or combination of practices that effectively achieves one or more of these key goals could be considered an appropriate BMP.

1. DEFINE OBJECTIVES AND RESPONSIBILITIES

- **Determine the harvest objectives with the landowner, forester, and logger.** The first step in planning, prior to beginning work, is to communicate with everyone involved what the harvest objectives are. Discuss what's going to be cut, where, and the desired condition of the remaining forest.

- **Decide who is responsible for BMPs.** You will want to agree in advance (and in a written contract) who is responsible for implementing the BMPs, including deciding when to operate, locating streams, laying out the operation, and planning and maintaining the BMPs.

- **Find out what legal requirements apply to waterbodies in the harvest area.** The basic legal requirement in Maine is to keep pollution—including mud, silt, rock, soil, brush, or chemicals —out of the water. When working near waterbodies, find out what town, state, or federal standards apply, and if permits are needed.

2. PRE-HARVEST PLANNING

Pre-harvest planning is good business practice and avoids many problems. Planning will help reduce costs, make the job more efficient, protect roads and trails that will stay in place after the job, leave the job looking better, *and* protect water quality.

- **Determine the harvest area limits and property boundaries on the ground. Know whose responsibility it is to identify the property boundaries correctly.** While not essential to protecting water quality, locating property boundaries is common sense and good planning. There may be survey pins, blazes, wire fences, or stone walls that mark boundaries or property corners. Forest type maps, soil or topographic maps, or aerial photos help, too.

- **Identify streams, lakes or ponds, wetlands, and other features on maps and on the ground.** Maps and aerial photographs can help identify features like waterbodies, steep slopes, or poorly drained soils. Walking the property to locate important features on the ground is essential. If possible, do your planning on bare ground in wet seasons when surface water is visible.

- **Identify the areas where you need BMPs.** Forest harvesting BMPs are most critical in and immediately next to waterbodies including intermittent and perennial streams, lakes or ponds, wetlands and coastal areas—wherever direct impacts to surface water may occur. You may also need to use BMPs in other areas of the watershed where flowing water could be substantially altered or carry sediment into these waterbodies.

- **Lay out the harvest operation on the ground.** Harvest planning includes determining where operational features such as roads, stream crossings, landings, cut-and-fill areas, main skid trails, and particular BMPs will be needed. While on-site, make sure everyone involved in the harvest operation is aware of the layout—especially roads, skid trails, and filter areas next to waterbodies.

- **Choose BMPs that are appropriate to the site conditions.** Most sedimentation occurs during short periods of heavy rain or snowmelt. How much rain falls during a storm, how much water streams carry, how stable the soils are, and what type of vegetation is present are all conditions that vary. BMPs that are sited, designed, and installed to anticipate adverse conditions work best.

- **Decide on BMPs for the entire harvest area and for closeout before beginning work.** BMP systems need not be complicated, but they require planning across the entire harvest area and over the entire duration of the operation, including closeout. Applying BMPs in one location can sometimes solve problems elsewhere on the site, or prevent problems after the operation is complete. When you understand the natural drainage system in the watershed, often you can use a combination of simple BMPs that are more effective—and cheaper—than more complex or expensive techniques.

- **Consider the needs of future operations on the same property.** Will roads, trails and landings be used again in five years, 15 years, or longer? Are there other areas of the property that can be accessed using the same roads? If you need to access the lot in the future, plan roads and trails accordingly. Otherwise, consider restricting vehicle access after the harvest. Because of the possibility of extreme weather conditions, it is important to design and close out roads properly. Identify which structures—such as culverts—will be left in place, and which will be removed. Considering the future can avoid problems and costly solutions.

3. ANTICIPATE SITE CONDITIONS

- **Time operations appropriately.** Harvesting under frozen, snow-covered, or dry conditions can minimize the need for additional BMPs. At the same time, a range of BMPs that are appropriately chosen, installed, and maintained can extend the harvest season. Use extra caution during fall and spring when streams are high and the ground is typically wetter—you may need to use additional BMPs to control the larger volume of water.

- **Determine whether previous operations in the harvest area created conditions that are impacting—or could impact—water quality.** Old roads, log landings, and skid trails can be reused or upgraded. However, in some situations, avoiding or retiring them is a better choice. Using old roads, landings, and trails may be cheaper in the short run, but may be more costly to fix or maintain later. Pre-existing conditions may also influence your choice of BMPs.

- **Plan to monitor, maintain, and adjust BMPs as needed, especially to deal with seasonal or weather-related changes.** After installation, many BMPs require maintenance or modification. Conditions-such as the amount of water flowing in streams, soil moisture, or the depth of frost—can change quickly, even with one storm. Take into account how conditions may change, and maintain or install additional BMPs as needed. Determine who will be responsible **for** this work. In many instances, the landowner will want to periodically check and maintain BMPs that have been installed after harvesting is done. This often prevents washouts and a loss of access while protecting water quality at the same time.

4. CONTROL WATER FLOW

- **Understand how water moves within and around the harvest area, and decide how water flow will be controlled.** Concentrated flows of water on roads, skid trails, landings, and in drainage systems develops more force and a greater ability to erode soil and carry sediment. It is easiest and most effective to control small volumes of water, before they converge and accumulate into concentrated flows.

- **Slow down runoff and spread it out.** Many BMPs work by directing small amounts of water into areas of undisturbed forest floor where it can be absorbed.

- **Protect the natural movement of water through wetlands.** Wetlands play an important role in the environment by storing water in wet periods and slowly releasing it back into the surrounding ground and streams. Logging roads and trail crossings can affect the flow of water within or through a wetland. This changes how much water the wetland stores, the degree of flooding that occurs, and the rate at which water leaves the wetland. Such impacts can affect the health of the wetland and waterbodies downstream.

5. MINIMIZE AND STABILIZE EXPOSED SOIL

Limiting soil disturbance and stabilizing areas where mineral soil is exposed are among the most important BMPs for preventing erosion. These practices are most critical in and around filter areas—forest areas bordering waterbodies. Generally speaking, there are two major objectives:

- **Minimize disturbance of the forest floor, especially in filter areas.** The forest floor absorbs water and filters out sediment and other pollutants. Exposed soil, on the other hand, can erode very rapidly. Most of the sediment that ends up in streams near managed forests comes from exposed soil on roads, landings, and skid trails. Know where the filter areas are and how to protect their capacity to absorb and filter runoff.

- **Stabilize areas of exposed soil within filter areas and in other locations where runoff has the potential to reach filter areas.** Use BMPs during or immediately after the harvest to prevent exposed soil or fill from eroding. These techniques and materials can be used near waterbodies, at stream crossings, road cut-and-fills, ditches, landings, and skid trails. In some situations, you may need to seed and/or plant vegetation in order to stabilize the soil.

6. PROTECT THE INTEGRITY OF WATERBODIES

- **Protect stream channels and banks.** Blocking or altering streams (with slash, for instance) may keep fish from swimming past the blockage. Damaged stream banks erode quickly, causing sedimentation and siltation. By protecting the physical integrity of streams, BMPs prevent these problems.

- **Leave enough shoreland vegetation to maintain water quality.** BMPs maintain the benefits that nearby trees and plants provide waterbodies. Streamside vegetation shades the water, minimizing temperature changes. Live roots stabilize the banks and maintain the soil's physical and chemical properties. Trees along the banks drop leaf litter and woody debris that supply nutrients and become habitat for plants and animals in the stream. Shoreland vegetation plays an important role in maintaining water quality.

7. HANDLE HAZARDOUS MATERIALS SAFELY

- **Be prepared for any emergency.** Keep an emergency response kit and contact information at the site for fuel, oil, or chemical spills. Remember that fertilizers, herbicides, pesticides, and road chemicals (calcium chloride, road salt, etc.) are hazardous materials, too. Know whom to call for help with unexpected erosion, accidents, or other emergencies. Having a backup plan and being prepared for unexpected and special situations can help avoid or minimize negative impacts to water quality. Industry groups, equipment suppliers, and local and state government agencies all have specialists available to help.

- **Use and store hazardous materials properly.** The best way to avoid accidental spills of hazardous materials is to store and handle them so that the chance of these types of emergencies occurring is minimized.