Silvicultural Best Management Practices Implementation Monitoring for Virginia

2010

Introduction

In June 2002, the Southern Group of State Foresters Water Resources Committee published the framework for state agencies to monitor silvicultural best management practice (BMP) implementation. This standardized protocol was intended to ensure that data collected by southern states could be effectively combined into one report. This report is periodically compiled, prepared and submitted to the USDA Forest Service Region 8, as well as USEPA in Atlanta, GA. However, this protocol is sufficiently flexible to be applied to each state's individual BMP guidelines. At the direction of the State Forester, Virginia is monitoring 240 harvested tracts each year and compiling an independent yearly report based on this protocol. These data are also submitted periodically for the Southern Group report.

Methods

The Southern Group of State Foresters (SGSF) protocol provides the rationale for the new methods developed and adopted by the Virginia Department of Forestry in 2007. The fourth quarter (October – December) 2007 is the first sampling period for which the new monitoring system was used in Virginia.

Sixty tracts are selected randomly every quarter from harvests that received a VDOF final inspection two quarters previous to the audit quarter. This allows approximately six months between BMP implementation and the audit field visit. This timing allows for an assessment of how BMP integrity changes over time and allows for a modest sampling of silvicultural practices like site preparation, tree planting and weed control. The selection process has changed recently and VDOF is randomizing within each of the three administrative regions (Eastern, Central and Western) with the number of selected tracts proportional to the number of harvests for each sample quarter. This guarantees that BMP audits are concentrated in areas where most harvesting is occurring. In this, the third audit cycle (1st quarter 2010 – 4th quarter 2010), there are 240 total audits completed and the regional breakdown is displayed in Table 1 below.

Table 1. Number of BMP audits completed by VDOF administrative region during the third audit cycle for the 2010 calendar year.

Region	Number of Audits
Eastern	114
Central	78
Western	48

Each tract audited is treated as a discreet unit but the data from each of those units are combined to determine average conditions by region and state. This approach guarantees that the averages reported are weighted by region according to the relative number of harvests in each region for this year. Each audit is comprised of 117 questions in 10 categories (Appendix A). These categories and questions relate directly to the major recommendations outlined in the BMP manual entitled Virginia's Forestry Best Management Practices for Water Quality, Fourth Edition. This manual was published by the VDOF in July 2002 and is available online (http://www.dof.virginia.gov/wq/index-BMP-Guide.shtml). In most cases, a large portion of the questions may not apply to any specific tract. Questions or entire categories that do not apply to a tract are given a non-applicable (N/A) status and are not included for calculation of final results. This ensures that calculated averages do not reflect missing items that do not apply to the harvest.

Each audit tract will result in a "%Yes" score for each BMP category. That percentage describes what proportion of audit questions in that category that were applicable to that tract were positively fulfilled by the operator in the field. The audit questions are evaluated and answered during a field visit by one of four water quality engineers and/or nine water quality specialists who are full-time VDOF personnel. Every auditor is regularly trained in a group setting to maintain

accuracy and consistency across the state. This allows VDOF to evaluate audit results generally by BMP category or type. Overall tract scores are averages of all applicable BMP question results regardless of category for that tract. All tracts for each audit cycle are then averaged across the three regions and are weighted according to number of audits in that region. Regions with more harvests have a greater impact on audit results statewide. This approach is used to ensure that each region can address BMP deficiencies locally without degrading the value of statewide results reported to the SGSF and EPA.

Each individual question in the audit process is also tracked over time to determine which BMP issues in the BMP Manual are in need of improvement. This information is particularly valuable to the SHARP Logger program (an SFI industry-sponsored logger training program) as it can help guide future educational efforts. This data also will assist VDOF, industry and consulting personnel as they inspect tracts and assist operators on the ground.

Results

The data for the 2010 audit are displayed as a series of tables and charts to follow. Table 2 and Figure 1 display overall average data for the entire state by BMP category. Confidence in the data is reported as a 95 percent margin of error and was calculated according to the SGSF protocol and generally accepted statistical procedures.

These results are also displayed graphically in Figure 1. The total number of audit tracts in this audit cycle is 240 and Table 3 shows that not all categories were applicable to every tract.

These data indicate that very little site preparation (fire, mechanical and chemical) is taking place up to six months after harvest, and it is for this reason that extreme caution should be used when considering the importance or value of the site preparation averages. Less than half of all audit tracts had at least one stream or wetland crossing. It is apparent that three very important categories that often lead to water quality concerns – roads, crossings and skid trails – tend to lag behind other categories with regard to implementation percentage. This is particularly obvious in the western region of the state (Tables 2 and 3).

Figure 2 indicates that the vast majority of tracts scored an overall implementation percentage of 70 percent or greater. While the overall mean implementation for all tracts is 82.7

Table 2. Statewide data for the BMP audit by BMP category. These data represent statewide averages for Virginia for the 2010 audit cycle.

BMP Category	Number of Tracts	Yes (%)	Margin of Error (%)
Roads	203	74.4	+/- 6.0
Decks	235	89.1	+/- 4.0
Crossings	103	82.3	+/- 7.4
SMZs	156	85.8	+/- 5.5
Wetlands	10	98.0	+/- 8.7
Planning	240	75.7	+/- 5.4
Skidding	226	77.7	+/- 5.4
Mechanical	6	87.6	+/- 26.4
Fire	1	74.4	+/- 34.9
Chemicals	0	–	–
All	240	82.7	+/- 4.8
Logging	240	84.5	+/- 4.6
Site Prep.	17	81.0	+/- 22.2

Table 3. Regional data for the BMP audit by BMP category. These data represent regional averages for all three regions for the 2010 audit cycle.

BMP Category	Eastern (% Yes)	Central (% Yes)	Western (% Yes)
Roads	75.2	75.6	70.1
Decks	91.8	89.2	84.3
Crossings	73.8	89.1	80.0
SMZs	88.3	90.8	69.8
Wetlands	95.9	100	N/A
Planning	75.3	84.9	54.6
Skidding	85.6	79.0	61.8
Mechanical	93.3	81.8	N/A
Fire	72.7	66.2	58.3
Chemicals	N/A	N/A	N/A
All	84.9	85.0	70.1
Logging Only	85.1	87.3	73.2
Site Prep. Only	93.3	78.1	N/A

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2010

Figure 1: Average BMP implementation by BMP category, including all three regions and statewide average in the 2010 audit cycle in Virginia.

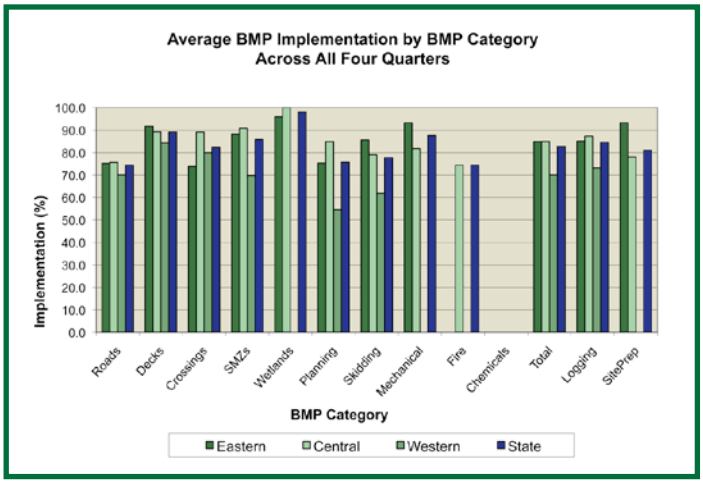
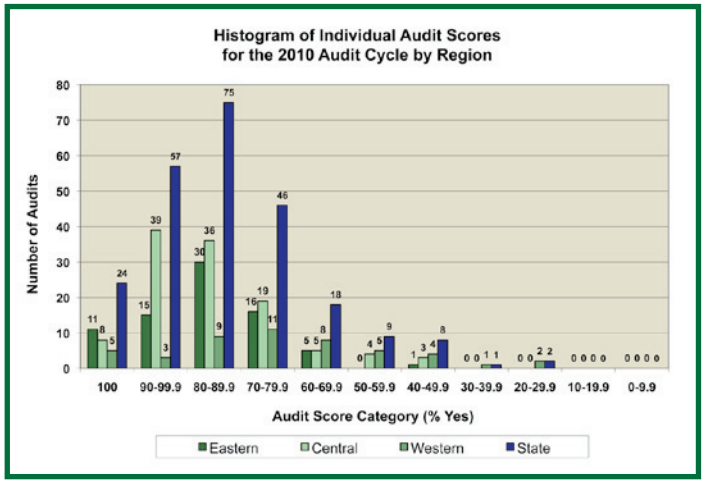


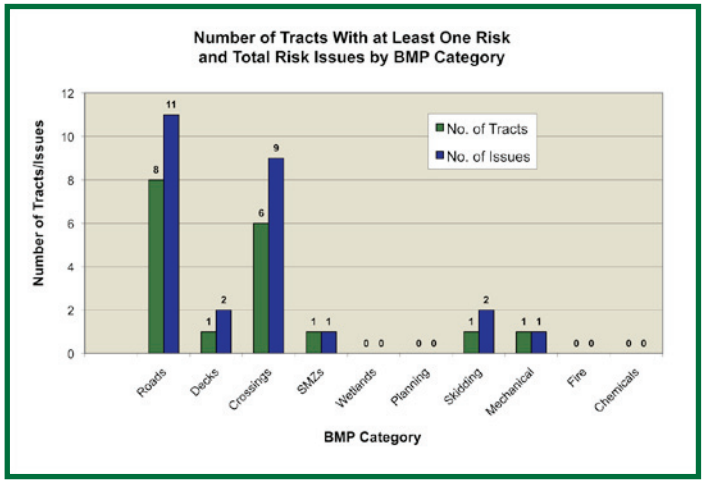
Figure 2: Score distribution of all 240 audits for the 2010 audit cycle in Virginia. Data labels indicate number of audits in each category.



percent (Table 2), the median is 84.4 percent. Given the slightly skewed distribution of the overall scores in Figure 2, the median is perhaps a better judge of central tendency of the data. This audit report include the expectation that all BMPs should be done per the manual regardless of likely impacts on water quality on each job. In most cases, BMPs that are not done do not directly impact water quality whether completed or not. These BMPs can be considered "luxury" BMPs as they are recommended by the manual but are not necessarily impacting water quality. Any BMP failures on the part of the operator that directly impact water quality are apparent in the significant risk and active sedimentation percentages as reported in Figure 3 and the following explanation. These singular failures are also handled through the VDOF silvicultural water quality law enforcement process.

It was determined by the SGSF that each state should monitor significant risks to water quality and associated active sedimentation. The definition of significant risk describes a water quality concern that is observed on an audit tract that, due to a lack of BMPs, is causing or is likely to cause pollution. When a significant risk was noted during an audit field visit, the auditor also determined if active sedimentation was occurring. Audits that indicated a significant risk were isolated and evaluated independently of all other audits in Figure 3 below. Out of the 240 tracts in this audit cycle, 14 (5.8 percent) had at least one significant risk and three of those tracts (1.3 percent) had an active sedimentation concern.

Figure 3: Number of audit tracts with at least one significant risk and total risk by BMP category. Some tracts had multiple risks in multiple categories.



It is apparent in Figure 3 that tracts which had at least one risk often had multiple risks. A second analysis including only tracts with at least one risk determined that the average percent Yes score for those 14 tracts was 68 percent, which indicates that significant risks to water quality tend to occur on tracts where overall BMP implementation is poor. Only

three of the 14 risk tracts had an overall score in excess of 80 percent. Significant risks to water quality obviously occur in a small minority of cases. Individual BMP issues that are often associated with significant risks are included in Table 4 below.

The issues described in Table 4 indicate that operations that disturb or expose soil near to streams are more likely to cause a risk if not properly stabilized. A combination of improper road drainage and unstable stream crossing approaches combine to include a large number of risks. Nearly all risks are related directly to unstabilized, exposed soil near a waterway. Simply avoiding most operations in or near to riparian areas would likely reduce risks to water quality. Minimizing roads, decks and stream crossings would clearly be beneficial to water quality risk reduction and would also reduce the number of BMP issues that need attention during and after the operation.

Table 4: Individual audit issues that are often associated with significant risks to water quality.

BMP Category	Specific Issue	Risks
Roads	Drainage problems, dips, bars, sloping	2
	Lack of gravel/vegetation on slopes	1
	Turnouts directed into riparian zones	6
Decks	Deck in SMZs	1
	No soil protection measures	1
	No water diversion	1
	No sediment trapping structures	2
Stream Crossings	Culvert size and installation	1
	No water diversions on approaches	1
	Headwall instability	1
	Lack of bank stabilization	1
SMZs	Exposed soil not covered or vegetated	1
	SMZ too narrow or inconsistent widths	1
Skidding	Rutting near streams	1
	Channelized flow near streams	2
	Lack of waterbars or turnouts	2
Mechanical SP	Excessive soil exposure	2

Silvicultural Best Management Practices Implementation Monitoring for Virginia

2010

Appendix A: Individual Audit Questions and Scores		
Roads		**% Yes [1]**
1	Was road construction and use minimized?	99.7
2	Are roads on the contour where practical?	96.2
3	Are new roads located and constructed to allow for proper drainage?	89.3
4	Are new roads located to avoid erodible, wet and sensitive ground?	97.4
5	Are grades between 2% and 10% except for necessary deviations?	96.7
6	Are roads outsloped where needed and conditions allow?	80.1
7	Are roads daylighted where needed and feasible?	88.3
8	Is access being controlled with a functional gate or barrier?	60.5
9	Are under-road culverts installed, spaced and maintained properly?	77.8
10	Is water diverted from the road surface at specified intervals using dips, bars or traps?	34.7
11	Is construction of dips, bars, turnouts and traps adequate to maintain function?	53.5
12	Is gravel or vegetation present to protect water bars from erosion?	53.1
13	Are temporary roads retired with properly constructed water bars or tank traps?	62.6
14	Is water being "turned out" into surrounding landscape with appropriate structures?	44.4
15	Are turnouts functioning properly?	58.6
16	Are turnouts directing water and/or sediment away from riparian areas?	64.1
17	Are riprap and/or brush dams used where needed to slow water and trap sediment?	46.9
18	Are roads built outside of SMZs where possible?	96.4
19	Are roads in SMZs as far from the channel as possible and built to prevent stream sedimentation?	91.4
Decks		**% Yes**
1	Are log decks located on relatively well-drained ground with low to moderate slopes?	99.3
2	Are appropriate soil protection measures in place to prevent erosion on the deck?	78.2
3	Are all log decks located at least 50 feet from the nearest SMZ.	92.8
4	Are water diversion structures installed to prevent water from crossing the deck?	28.3
5	Are water diversion and sediment trapping structures present if needed to prevent pollution?	79.1
6	Are all decks limited in size?	97.2
7	Are fluid spills from equipment minimal?	97.7
8	Are decks reshaped where needed to ensure drainage?	84.7
Stream or Wetland Crossings		**% Yes**
1	Are stream crossings minimized?	96.8
2	Are stream crossings installed at or near to right angles where possible?	100.0
3	Are culverts and bridges of adequate length?	71.5
4	Are culverts properly sized according to the BMP manual Tables 6 and 7 or Talbot's formula?	46.6
5	Are permanent bridge abutments adequate and stable?	100.0

6	Are culverts covered with adequate and appropriate fill material?	65.0
7	Are culverts covered with gravel to reduce erosion near the stream?	53.5
8	Are headwalls stabilized with vegetation, rock or fabric to minimize cutting?	70.1
9	Are culvert pipes installed properly in the channel to avoid undercutting and channel erosion?	83.5
10	Are fords used only where a natural rock base (or geoweb) and gentle approaches allow?	66.7
11	Is the addition of unnatural materials in the stream to facilitate the use of a ford minimized?	66.7
12	Do all ford crossings avoid restricting the natural flow of water?	83.3
13	Do all ford crossings have a 50-foot approach of clean gravel?	38.9
14	Do all ford crossings have underlying geo-textile where needed (on approaches)?	50.0
15	Are approaches stable and unlikely to contribute sediment to the stream?	78.4
16	Are temporary culverts, pole bridges and bridges removed?	96.6
17	Are stream banks and approaches re-claimed with sufficient vegetation, rock or slash?	77.8
18	Were pole bridges used only in appropriate circumstances?	50.0
19	Are water diversion structures present when needed on approaches?	66.9
Streamside Management Zones (SMZ)		**% Yes**
1	Are all SMZs a minimum of 50 feet wide on each side of the stream bank?	59.5
2	Do all intermittent and perennial streams have an SMZ?	82.6
3	Do all sinkholes or karst features have an SMZ?	66.7
4	Does at least 50% of the original basal area exist in the SMZ?	70.8
5	Is SMZ width relatively consistent along the entire length?	84.6
6	Did the logger avoided partial or patch clear cutting in the SMZ?	69.9
7	In tidal areas, has a 50-foot SMZ been maintained from the grass or marsh edge?	100.0
8	Are SMZ widths modified to accommodate cold water fisheries and municipal water supplies?	100.0
9	Did the logger avoid exposing large sections of soil in the SMZ?	92.7
10	Was exposed soil in the SMZ revegetated or covered with organic materials?	88.9
11	Is the SMZ free of roads and landings where possible?	89.4
12	Did the logger avoid silvicultural debris in the stream that would warrant a law enforcement action under the "debris in the stream law"?	99.6
13	Did the logger avoid silvicultural sediment in the stream that might endanger public health, beneficial uses or aquatic life as stated in the "silvicultural water quality law"?	92.8
Wetlands		**% Yes**
1	Did operations in wetlands avoid altering hydrology of the site to such a degree as to convert a wetland to a non wetland?	100.0
2	Is water movement maintained on the site?	100.0
3	Were the 15 mandatory road BMPs followed for wetland roads?	100.0
4	Were the six mandatory site-prep BMPs followed as needed?	100.0
5	Was the harvesting system appropriate for the site conditions?	100.0

6	Was low-ground-pressure equipment (LGP) utilized where needed?	85.7
7	Did the operation avoid activities during particularly wet weather?	92.9
8	Are landings located on appropriate ground?	100.0
Harvest Planning		**% Yes**
1	Is there evidence or knowledge of a harvest plan (painted lines, flagging, delineated hazards, SMZs, or decks, engineered roads, etc…)?	57.2
2	Is there evidence that the logger utilized a harvesting system that is generally appropriate for the site and timber conditions?	92.2
3	In the case of severe site conditions (very wet or steep), was the harvesting system modified to reduce damage to soil, site and water?	44.1
Skidding		**% Yes**
1	Are bladed skid trails limited to less than 26% grade unless absolutely necessary?	80.7
2	Are bladed skid trails limited to sideslopes less than 60%?	82.4
3	Are un-bladed trails limited to sideslopes less than 36% in general?	97.9
4	Are all skid trails free from channelized flow that is likely to cause sedimentation?	84.2
5	Are all skid trails located outside the SMZ?	90.4
6	Did the logger avoid skidding logs through intermittent or perennial streams?	97.5
7	Were brush mats used to stabilize trails and prevent erosion where needed?	51.7
8	Do trails avoid long, continuous grades?	85.3
9	Do trails avoid rutting that will likely cause channelized erosion near a stream?	88.5
10	Are water bars established on trails at recommended intervals where erosion is likely?	39.4
11	Are water turnouts built to ensure drainage of skid trails where needed?	30.2
12	Are appropriate cross drainages installed where springs or seeps crossed the trails?	34.4
13	Is vegetation established where needed on trails to prevent erosion and sedimentation?	39.1
Mechanical Site Prep*		**% Yes**
1	Is soil disturbance minimized across the site relative to establishment goals?	83.3
2	Are SMZs maintained with no significant disturbance?	100.0
3	Did opeators prevent debris or soil in the stream sufficient to degrade banks or impede flow?	100.0
4	Did all mechanical operations take place on the contour to the extent possible?	83.3
5	Did all mechanical operations avoid wet or fragile ground?	66.7
6	Did all mechanical operations avoid slopes in excess of 45%.	100.0
7	Did raking, piling and windrowing avoid excessive movement or exposure of mineral soil?	83.3
8	Was bedding conducted on the contour where possible?	N/A
9	Did bedding contractor avoid tying beds into streams, ditches or drainage structures?	N/A
10	Is scalping and furrowing less than 6 inches deep and on the contour?	N/A
11	Was sub-soiling or ripping done on the contour?	N/A
12	Did scalping, furrowing and sub-soiling avoid connections to drainages?	N/A

13	Was machine planting done on the contour?	N/A
14	Did machine planters avoid excessive slopes?	N/A
*(chopping, disking, bulldozing, piling, raking, subsoiling, bedding, mounding, windrowing, etc.)		
Fire		**% Yes**
1	Are water bars installed properly on firelines, roads and cleared areas?	50.0
2	Is vegetation or slash on firelines and cleared areas to prevent erosion as needed?	16.7
3	Did the burning crew avoid exposing large areas of mineral soil?	83.3
4	Are command and staging areas located away from streams?	100.0
5	Is all refuse and sewage disposed of properly?	100.0
6	Were steep grades and/or fragile soils protected from excessive burn and ground disturbance?	83.3
7	Is all fire-related debris removed from stream channels?	100.0
8	Were high-intensity site-prep burns kept out of the SMZs?	100.0
9	Were prescribed burns on fragile soils and steep slopes absolutely necessary to achieve goals?	100.0
10	Did the burning crew avoid pushing firelines directly into streams?	100.0
11	Does fireline construction follow appropriate skid trail BMPs?	16.7
12	Does fireline construction divert water away from streams where necessary?	100.0
13	Did fireline construction avoid disturbing existing gullies?	66.7
14	Did fire crew avoid plowing up and down slopes where possible?	100.0
15	Are large areas of bare soil re-vegetated where slope exceeded 5%?	0.0
Chemical Applications (pesticides and fertilizers)		**% Yes**
1	Did chemical applicators avoid applying chemical directly into streams or SMZs?	N/A
2	Did chemical applicators avoid accidental drift into sensitive areas or SMZs?	N/A
3	Did applicators avoid mixing chemicals or filling equipment where runoff would likely enter a stream?	N/A
4	Did applicators remove all refuse from the tract?	N/A

[1] Shaded "Percent Yes" figures indicate scores less than 70 percent, which clearly indicates a need for improvement.

Acknowledgements

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