

Voluntary Implementation of Forestry Best Management Practices in East Texas



Results from Round 7 of
BMP Implementation Monitoring

TEXAS FOREST SERVICE

A Member of the Texas A&M University System

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*Results from Round 7 of BMP Implementation Monitoring
2007-2008*

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TEXAS FOREST SERVICE

Sustainable Forestry
Best Management Practices Project

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EXECUTIVE SUMMARY

A Best Management Practices (BMP) monitoring program evaluated the level of implementation of voluntary forestry BMPs. A total of 152 sites on which silvicultural activities occurred were evaluated. These sites were monitored between June 20, 2007, and November 18, 2008, and are believed to be a representative sample of the forestry activities that occurred in East Texas during that time.

Overall BMP implementation on the sites monitored was 91.5%. In general, implementation was highest on sites under public ownership. These national forestland sites had an overall implementation of 100%, while industrial sites had a 91.1% implementation rating. Corporate lands (commercial landowners that do not have wood processing facilities) scored 95.7% overall, while family forest owners scored 88.7%.

Implementation with BMPs was statistically significantly higher when:

- the landowner was familiar with BMPs
- the logging contractor had attended formal BMP training
- a forester was involved in the sale or activity
- BMPs were included in the timber sale contract
- the landowner was a member of the American Tree Farm System
- the timber was delivered to a Sustainable Forestry Initiative[®] (SFI[®]) mill

Implementation was generally lowest on sites when:

- owned by family forest owners
- a forester was not involved in the sale or activity
- BMPs were not included in the timber sale contract
- the logger had not attended the BMP workshop

Major deficiencies noted during the evaluations were:

- failure to remove and stabilize stream crossings on temporary roads
- inadequate SMZ width along intermittent and perennial streams

Major improvements from previous rounds were:

- a decrease in the number of significant risks to water quality
- avoiding or minimizing the number of temporary stream crossings
- higher overall BMP implementation on site preparation and wetlands

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BACKGROUND AND OBJECTIVES

The Clean Water Act (CWA), as reauthorized in 1987, called for states to establish a program for development and implementation of Best Management Practices to reduce nonpoint source (NPS) water pollution. The Act also required states to develop methods for determining “BMP effectiveness,” including a measure of BMP implementation.

The Texas Silvicultural Nonpoint Source Pollution Project, funded by a FY05 CWA Section 319(h) grant from the Environmental Protection Agency (EPA) through the Texas State Soil and Water Conservation Board (TSSWCB), requires that a monitoring program be conducted to document the level of voluntary implementation of BMPs and effectiveness of BMPs in reducing NPS pollution from silvicultural activities. Objectives of the monitoring program are to:

- 1) Measure the degree of implementation of BMP guidelines by forest landowners, silvicultural contractors, forest industry, and government agencies.
- 2) Evaluate the effectiveness of BMPs as applied in the field and identify any weaknesses in the BMP guidelines.

This report documents the findings of the BMP implementation monitoring for 152 sites evaluated between June 20, 2007, and November 18, 2008. This data represents Round 7 of BMP implementation monitoring conducted by Texas Forest Service. Previous surveys were published in October 1992, March 1996, April 1998, September 2000, November 2002, and October 2005. These reports can be viewed online at <http://texasforestservicetamu.edu/sustainable/bmp>.

DISTRIBUTION AND SELECTION OF IMPLEMENTATION MONITORING SITES

To obtain a valid estimate of overall implementation of forestry best management practices, monitoring sites were distributed regionally within East Texas and among all forestland ownership categories. Sites were believed to be representative of the distribution of all silvicultural activities across East Texas. The distribution of monitoring sites was based on the estimated annual timber harvest for each county as reported in the Texas Forest Service publication, *Texas Forest Resource Harvest Trends 2005*, and the average annual removals of growing stock by ownership class, as reported in the United States Forest Service publication, *East Texas Forests, 2003 (SRS – 137)*. See Table 1.

Table 1. Distribution of Implementation Monitoring Sites by County.

County	Number of Sites Monitored
Anderson	3
Angelina	8
Bowie	3
Cass	9
Cherokee	5
Gregg	1
Grimes	1
Hardin	8
Harrison	6
Houston	5
Jasper	12
Liberty	6
Marion	3
Morris	1
Nacogdoches	8
Newton	7
Orange	1
Panola	6
Polk	12
Red River	3
Rusk	5
Sabine	4
San Augustine	4
San Jacinto	4
Shelby	4
Smith	2
Titus	1
Trinity	4
Tyler	7
Upshur	4
Walker	4
Wood	1
Total	152

QUALITY CONTROL

To eliminate bias, implementation monitoring sites were selected in a random manner using several methods, including aerial detection and information collected by Texas Forest Service (TFS) personnel. All monitoring evaluations were conducted by one or a combination of two trained foresters assigned to the TFS BMP Project. Using only BMP Project employees as inspectors provided greater accuracy and quality control.

At the beginning of the monitoring project, as well as periodically throughout the project, BMP Project foresters jointly evaluated tracts to maintain and improve consistency and fairness. The TFS BMP Project collected monitoring data in accordance with a Quality Assurance Project Plan, approved by TSSWCB and EPA.

MONITORING CHECKLIST

The monitoring checklist that was used in Round 7 was also used for the previous three surveys, a period dating back to 1999. This objective, 42-question form followed the *BMP Implementation Monitoring Framework*, a guidance document approved by the Southern Group of State Foresters to promote consistency among the southern states when conducting BMP implementation monitoring.

The form evaluated BMPs for seven different categories: Permanent Roads, Temporary (secondary) Roads / Skid Trails, Stream Crossings, Streamside Management Zones, Site Preparation, Landings, and Wetlands. Each question was worded so that a positive answer was recorded with a “Yes,” while a negative answer, indicating a departure from BMP recommendations, was answered “No.” Questions that were not applicable to the tract were answered “NA.” This format allowed readers to quickly determine any problem areas identified during an inspection. A comments section at the end of the form provided additional information regarding BMP implementation.

Each tract was rated with a number representing percent implementation. This score was computed by dividing the number of questions receiving a yes answer by the total applicable questions [$Y/(Y+N)$]. Tracts were also evaluated to determine if “significant risks” to water quality existed. A significant risk is an existing on-the-ground condition resulting from failure to correctly implement BMPs, that if left unmitigated, has already or will likely result in an adverse change in the chemical, physical or biological condition of a waterbody. Such change may or may not violate water quality standards.

Tract evaluations were entered into a database for storage and analysis. This data was also imported into a Geographic Information System (GIS) for further analysis and geographical representation. The form is found in the Appendix.

INSPECTION CONTACTS

Landowners were contacted prior to the inspection of the site so that permission for entry onto the property could be obtained. During this initial contact, the forester explained the program and invited the landowner and his/her representative to join the BMP forester on site during the evaluation. Sites were not inspected if the landowner denied access. In nearly all cases on commercial forestland, an industry or corporate forester accompanied the BMP forester.

Landowners, logging contractors, and timber buyers (where applicable and identifiable) were provided a copy of the completed checklist, along with a cover letter explaining the BMP Project and instructions on interpreting the form. Recommendations for remediation, if applicable, were made.

RESULTS

Between June 20, 2007, and November 18, 2008, TFS BMP foresters evaluated BMP implementation on 152 sites, totaling 13,742 acres, throughout East Texas. These 152 tracts are geographically represented by ownership category in Figure 1. Tabulated results by question on the BMP implementation monitoring checklist are located in the Appendix.

SITE CHARACTERISTICS

Ninety of the 152 sites (59%) were on family forest lands. Forty-seven sites (31%) were owned by corporate landowners. Eight sites (5%) were owned by forest industry. Seven sites (5%) were on publicly owned lands.

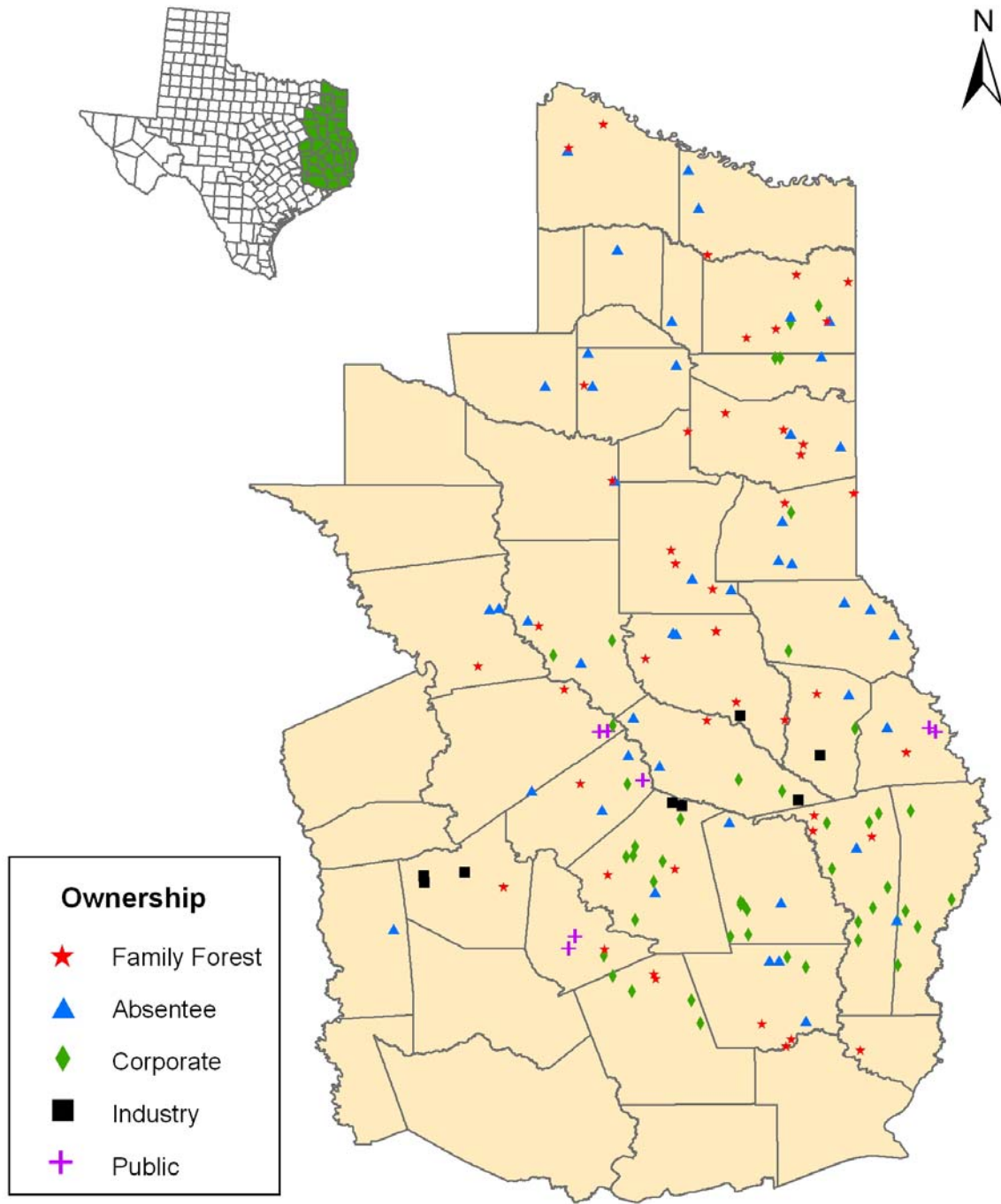
The majority of sites (58%) were monitored after a regeneration harvest, including 87 clearcuts and one partial harvest (seed tree harvest). Forty-five thinning and nineteen site preparation operations were evaluated. In 34 cases, the site preparation evaluation was included in elements of the preceding timber harvest operation or succeeding planting operation.

Professional foresters were involved in planning and/or implementing the silvicultural operation on 103 (68%) of the sites. Private consultants were involved on 49 of the sites. On 47 sites, the forester was employed by forest industry or corporations, while U.S. Forest Service foresters were involved on seven sites.

Terrain classification and soil erodibility were recorded from the Natural Resources Conservation Service (NRCS) Soil Survey, if available, or estimated by the forester in the field. Thirty-six sites (24%) were on flat terrain. One hundred fifteen sites (75%) were on hilly terrain and one (1%) was on steep terrain. Forty-eight sites (32%) were on soils with low erodibility, 95 sites (64%) on medium erodibility soils, and nine (1%) were on high erodibility soils.

Of the 152 sites, 112 had either a perennial (12) or intermittent (68) stream or both perennial and intermittent (32). A permanent water body was found within 1,600 feet of 87 sites (57%).

Figure 1. Site Locations by Ownership Category.



PERMANENT ROADS

Permanent roads were evaluated for implementation of BMPs when they were used in the forestry operation. Permanent roads in the forestry context are generally graded dirt roads that are used for year-round access. County roads were not included in the monitoring, as they are not under the management control of the landowner. Permanent roads were applicable on 119 of the 152 sites. The percent implementation for permanent roads was 94% with one significant risk was noted. The lowest average category score (81%) was for having roads well drained with appropriate structures. The area with the highest level of implementation was for roads meeting grade specifications (100%). See Table 2. Figure 2 breaks down the numbers of sites into ownership type.

Table 2. Implementation of BMPs Relating to Permanent Roads.

BMP	Yes	No	N/A	% Implementation	Number of Significant Risks	Margin of Error
Respect sensitive areas	117	1	34	99	0	1.8
Roads meet grade specifications	119	0	33	100	0	-
Rutting within allowable specs	118	1	33	99	0	1.8
Well drained with appropriate structures	93	22	37	81	1	7.3
Ditches do not dump into streams	101	2	49	98	0	2.8
Roads reshaped and stabilized	100	19	33	84	0	6.7

SKID TRAILS AND TEMPORARY ROADS

Skid trails and temporary roads were evaluated on 95 of the 152 monitoring sites. Skid trails are routes through the logging area in which logs are skidded or dragged to a central loading point called a “set” or “landing.” Temporary roads are not designed to carry traffic long-term and are usually retired, closed, or reforested after the harvest activity. The percent implementation for temporary roads was 88% with no significant risks noted. The lowest implementation category was for having roads well drained with appropriate water control structures (76%). The area with the highest implementation (99%) was for roads meeting grade specifications. See Table 3 and Figure 3.

Figure 2. BMP Implementation on Permanent Roads by Ownership Type.

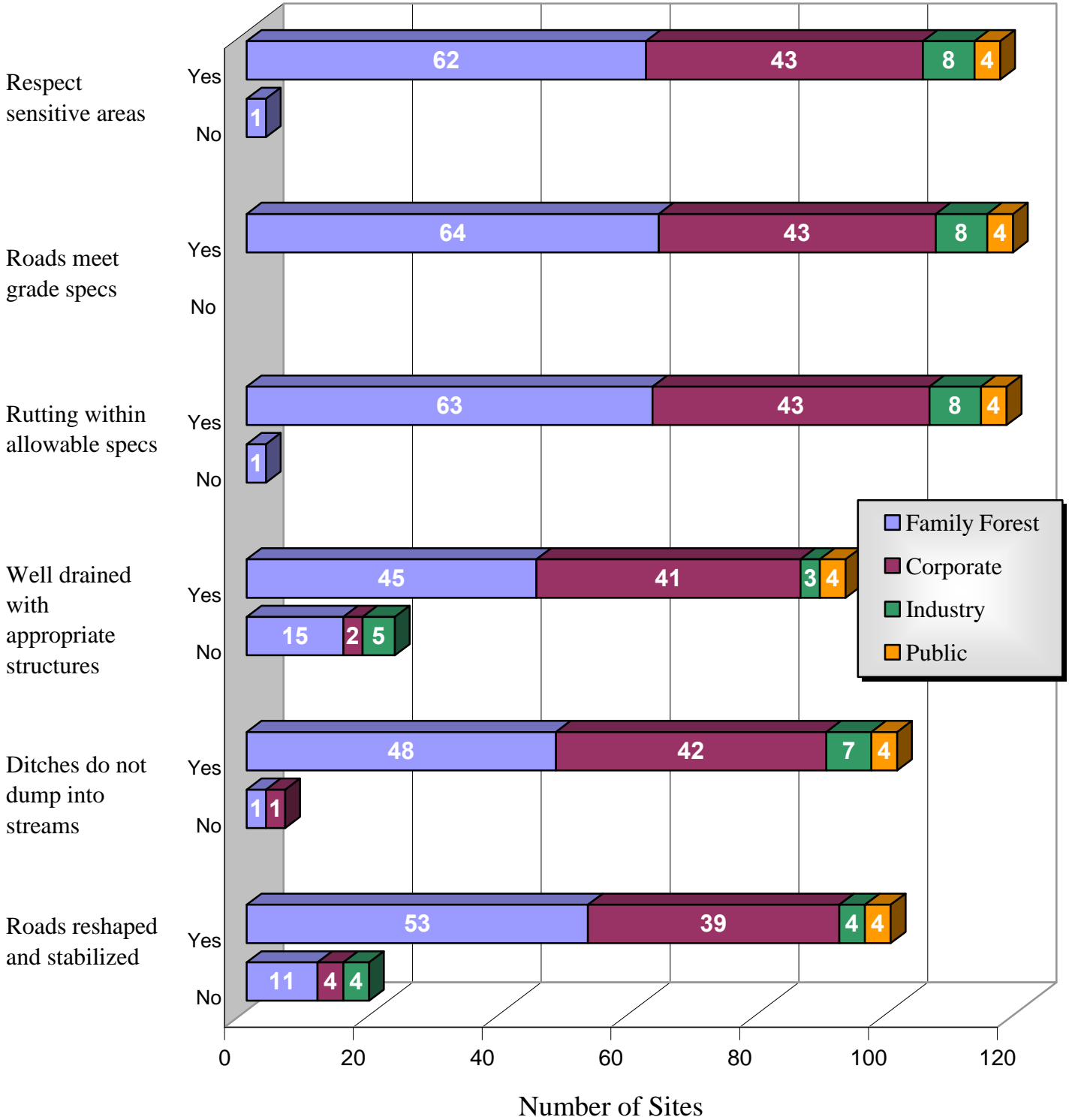


Table 3. Implementation of BMPs Relating to Skid Trails and Temporary Roads.

BMP	Yes	No	N/A	% Implementation	Number of Significant Risks	Margin of Error
Slopes less than 15%	94	1	57	99	0	2.0
Respect sensitive areas	91	3	58	97	0	3.5
Roads well drained with appropriate structures	67	21	64	76	0	9.1
Roads stabilized	76	18	58	81	0	8.1
Rutting within allowable specifications	84	11	57	88	0	6.7

STREAM CROSSINGS

Stream crossings were evaluated on 73 sites. Fourteen sites had crossings on permanent roads only, 53 had crossings on temporary roads only, and six had crossings on both permanent and temporary roads. The percent implementation for stream crossings was 82% with a total of 15 significant risks noted. The lowest implementation category for stream crossings on both permanent and temporary roads was stabilization of crossings (75% and 56%, respectively). However, stabilizing crossing on temporary roads was up by (+81%), a tremendous improvement over round six. It is important to note that the highest implementation in both categories was for avoiding or minimizing the number of crossings. See Figure 4 and Table 4.

Figure 3. BMP Implementation on Skid Trails/Temporary Roads by Ownership Type.

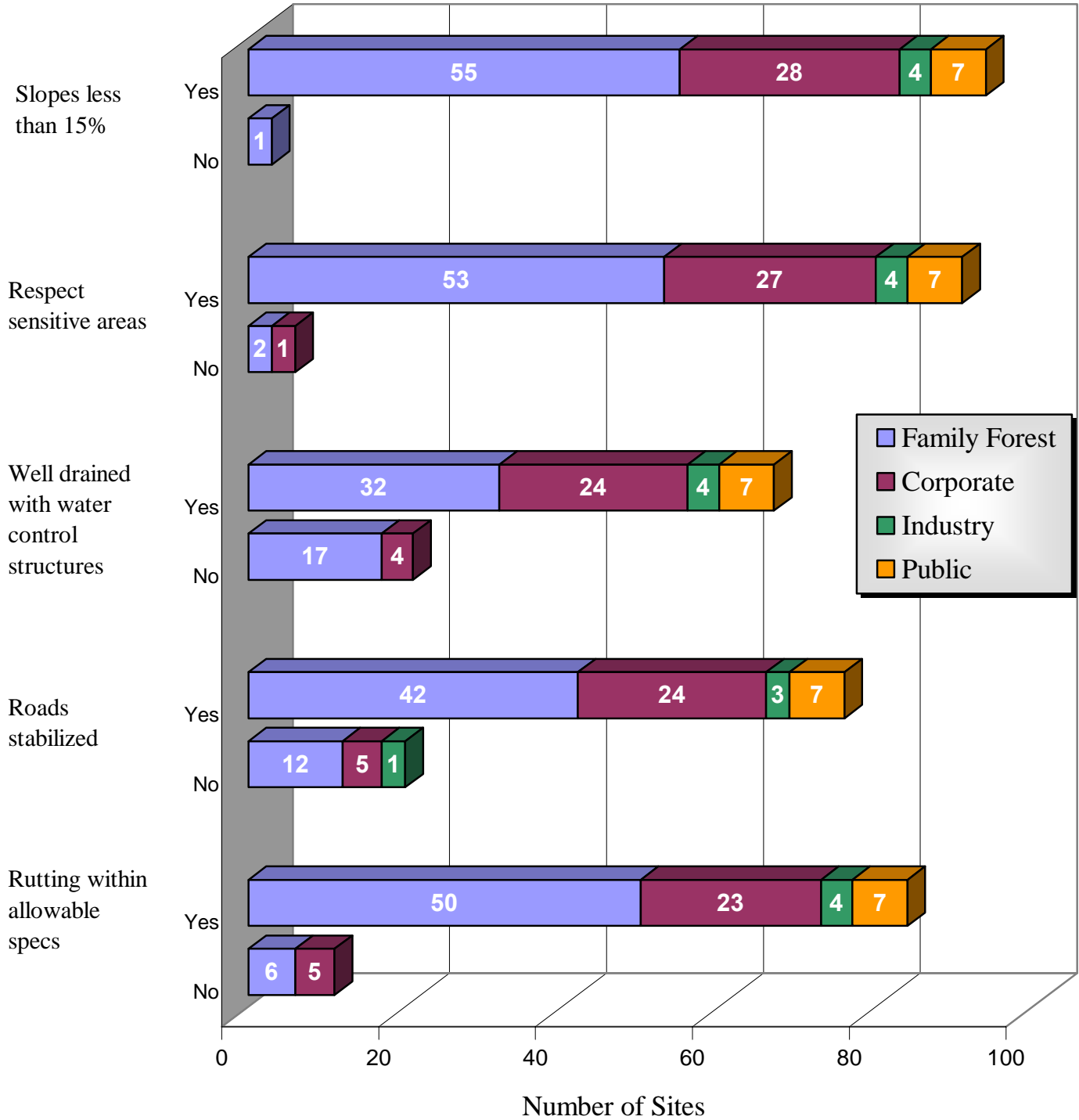


Figure 4. BMP Implementation on Stream Crossings by Ownership Type.

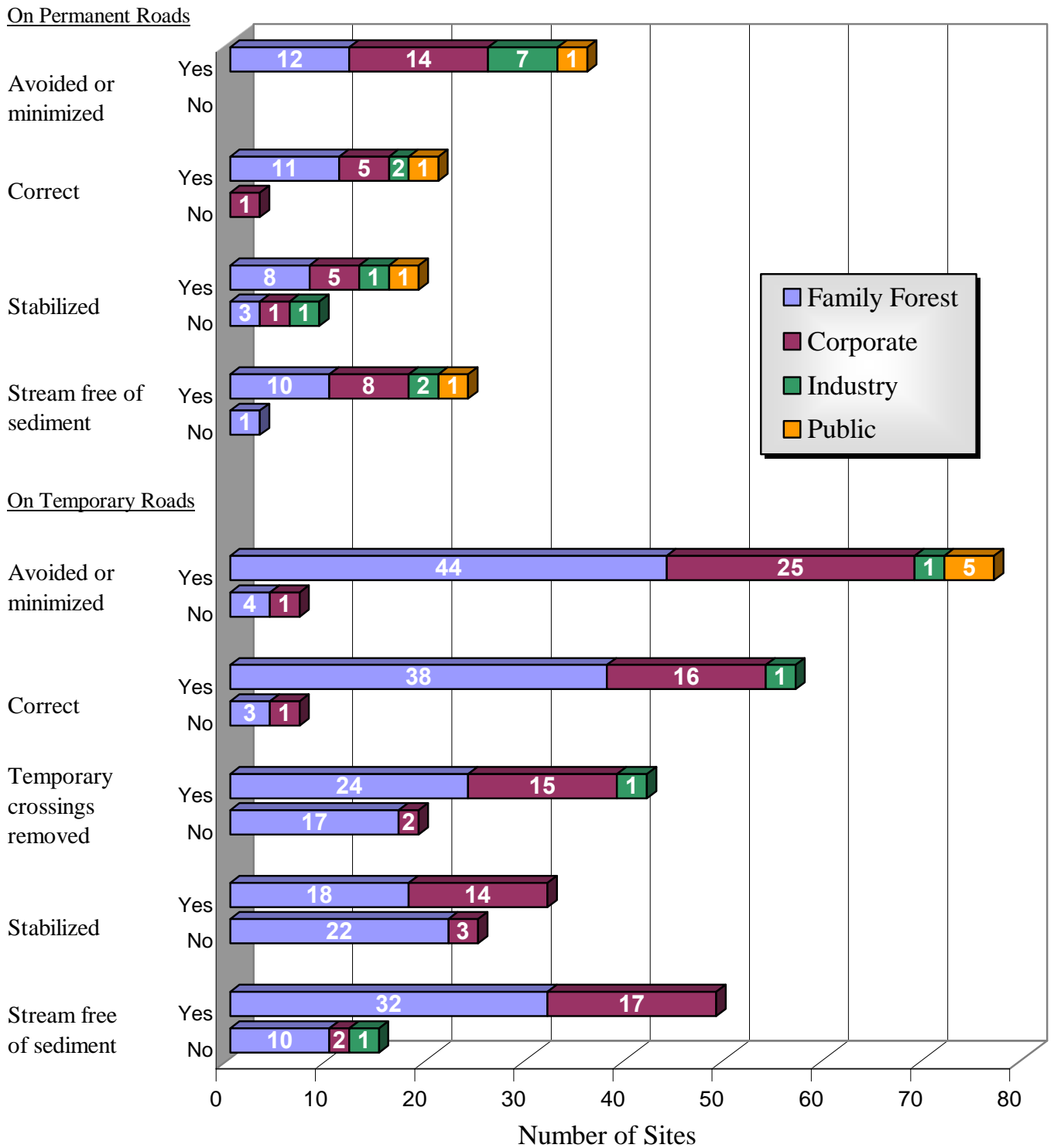


Table 4. Implementation of BMPs Relating to Stream Crossings.

BMP	Yes	No	N/A	% Implementation	Number of Significant Risks	Margin of Error
Permanent Roads						
Avoided or minimized	34	0	118	100	0	-
Stream crossings correct	19	1	132	95	0	9.7
Stream crossings stabilized	15	5	132	75	2	19.4
Stream free of sediment	21	1	130	96	1	8.4
Temporary Roads						
Avoided or minimized	75	5	72	94	0	5.3
Stream crossings correct	55	4	91	93	0	6.6
Temporary crossings removed	40	19	93	68	5	12.1
Stream crossings stabilized	32	25	95	56	6	13.1
Stream free of sediment	49	13	90	79	1	10.3

STREAMSIDE MANAGEMENT ZONES

Streamside management zones (SMZs) are recommended on all perennial and intermittent streams. All sites with either a perennial or intermittent stream were evaluated for the presence and adequacy of SMZs. Streams were present on 112 of the 152 sites. Of these 112 sites, 12 had perennial streams only, 68 had intermittent streams only, and 32 had both perennial and intermittent streams. Overall implementation of SMZs was 88%. One significant risk was noted, a major improvement from the previous round which had seven significant risks. The lowest implementation was for inadequate SMZ width (67%), while the highest was for stream free of sediment and SMZs present on permanent streams (99% and 98% respectively). See Figure 5 and Table 5.

Figure 5. BMP Implementation on Streamside Management Zones by Ownership Type.

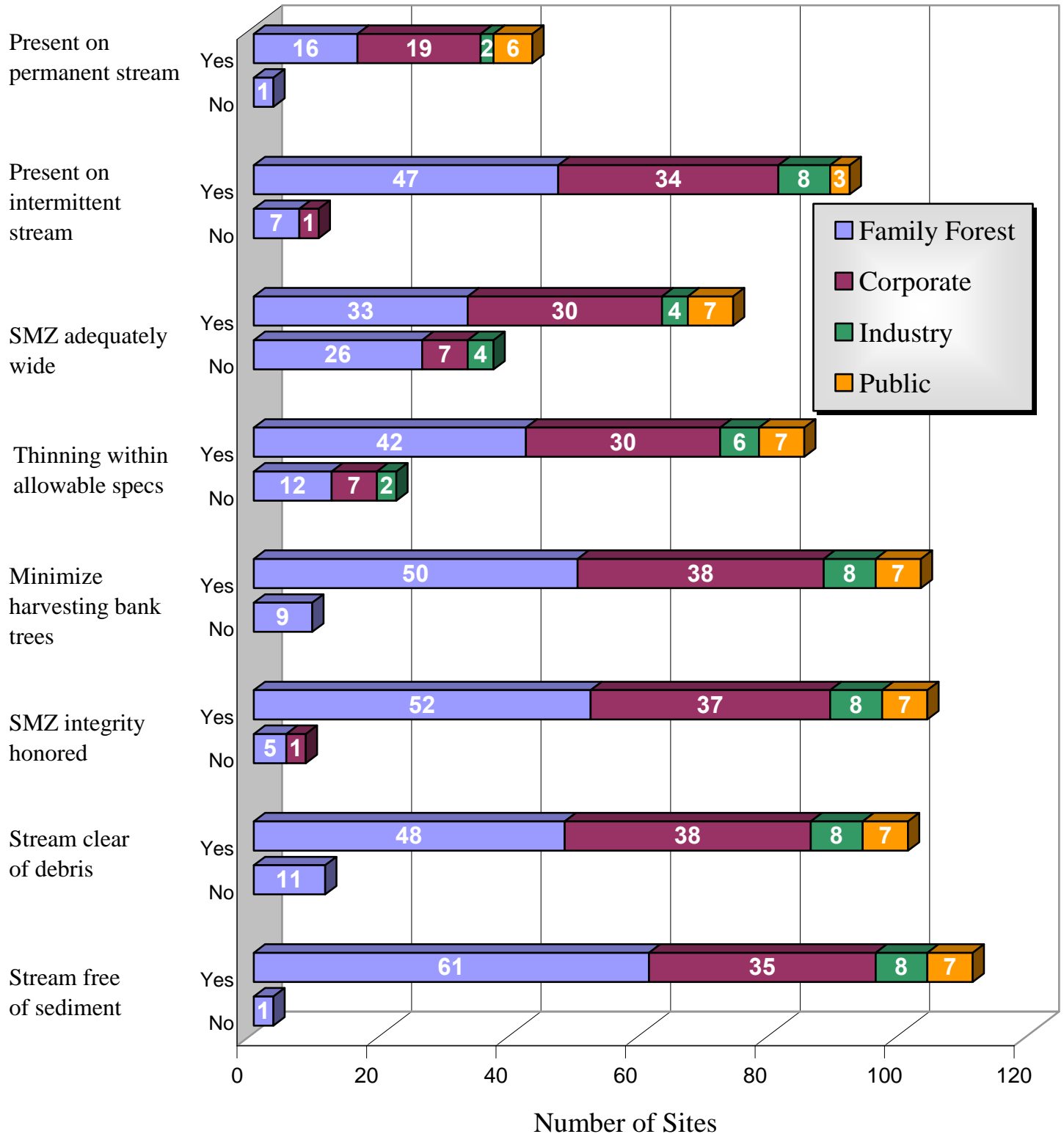


Table 5. Implementation of BMPs Relating to SMZs.

BMP	Yes	No	N/A	% Implementation	Number of Significant Risks	Margin of Error
Present on perennial stream	43	1	108	98	0	4.2
Present on intermittent stream	92	8	52	92	0	5.4
Adequately wide	74	37	41	67	0	8.9
Thinning within allowable specs	85	21	46	80	0	7.8
Minimize harvesting bank trees	103	9	40	92	0	5.1
Integrity honored	104	6	42	95	0	4.2
Stream clear of debris	101	11	40	90	1	5.7
Stream free of sediment	111	1	40	99	0	1.9

SITE PREPARATION

Fifty-three sites were evaluated for implementation with site preparation BMPs. A variety of site preparation techniques were evaluated, including 38 with some combination of shearing, piling, subsoiling, bedding, and/or burning. Fifteen sites involved application of herbicide only. The implementation for site preparation was 98% with one significant risk noted. The lowest implementation was for honoring SMZ integrity and respecting sensitive areas (96% for both categories). See Table 6 and Figure 6.

Table 6. Implementation of BMPs Relating to Site Preparation.

BMP	Yes	No	N/A	% Implementation	Number of Significant Risks	Margin of Error
Respect sensitive areas	51	2	99	96	1	5.4
No soil movement on site	56	0	96	100	0	-
Firebreak erosion controlled	20	0	132	100	0	-
SMZ integrity honored	43	2	107	96	0	5.8
Windrows on contour/free of soil	9	0	143	100	0	-
No chemicals off site	32	0	120	100	0	-
Mechanical site prep / machine planting on contour	31	1	120	97	0	6.0
Stream free of sediment	43	1	108	98	0	4.2

LANDINGS

Landings, sometimes called sets, are areas where logs are gathered, delimbed, bucked, and loaded onto log trucks. Landings were evaluated on 114 sites with an overall implementation of 98%. Several areas were found to have fully implemented BMPs (100%), including respecting sensitive areas, being on well drained locations, and being located outside of the SMZ. The lowest implementation was for landings being free of oil/trash (90%). There were no significant risks noted on landings. See Table 7 and Figure 7.

Table 7. Implementation of BMPs Relating to Landings.

BMP	Yes	No	N/A	% Implementation	Number of Significant Risks	Margin of Error
Location free of oil/trash	103	11	38	90	0	5.6
Located outside of SMZ	92	0	60	100	0	-
Well drained location	114	0	38	100	0	-
Number and size minimized	113	1	38	99	0	1.9
Respect sensitive areas	114	0	38	100	0	-
Restored/stabilized	112	1	39	99	0	1.9

WETLANDS

Seventeen sites had wetland or “wetland like” areas – not necessarily jurisdictional wetlands. These sites had an overall implementation of 100%. No significant risks were noted and all mandatory road BMPs for wetlands were followed. See Table 8 and Figure 8.

Table 8. Implementation of BMPs Relating to Wetlands.

BMP	Yes	No	N/A	% Implementation	Number of Significant Risks	Margin of Error
Avoid altering hydrology of site	17	0	135	100	0	-
Road drainage structures installed properly	14	0	138	100	0	-
Mandatory road BMPs followed	11	0	141	100	0	-

Figure 6. BMP Implementation on Site Preparation by Ownership Type.

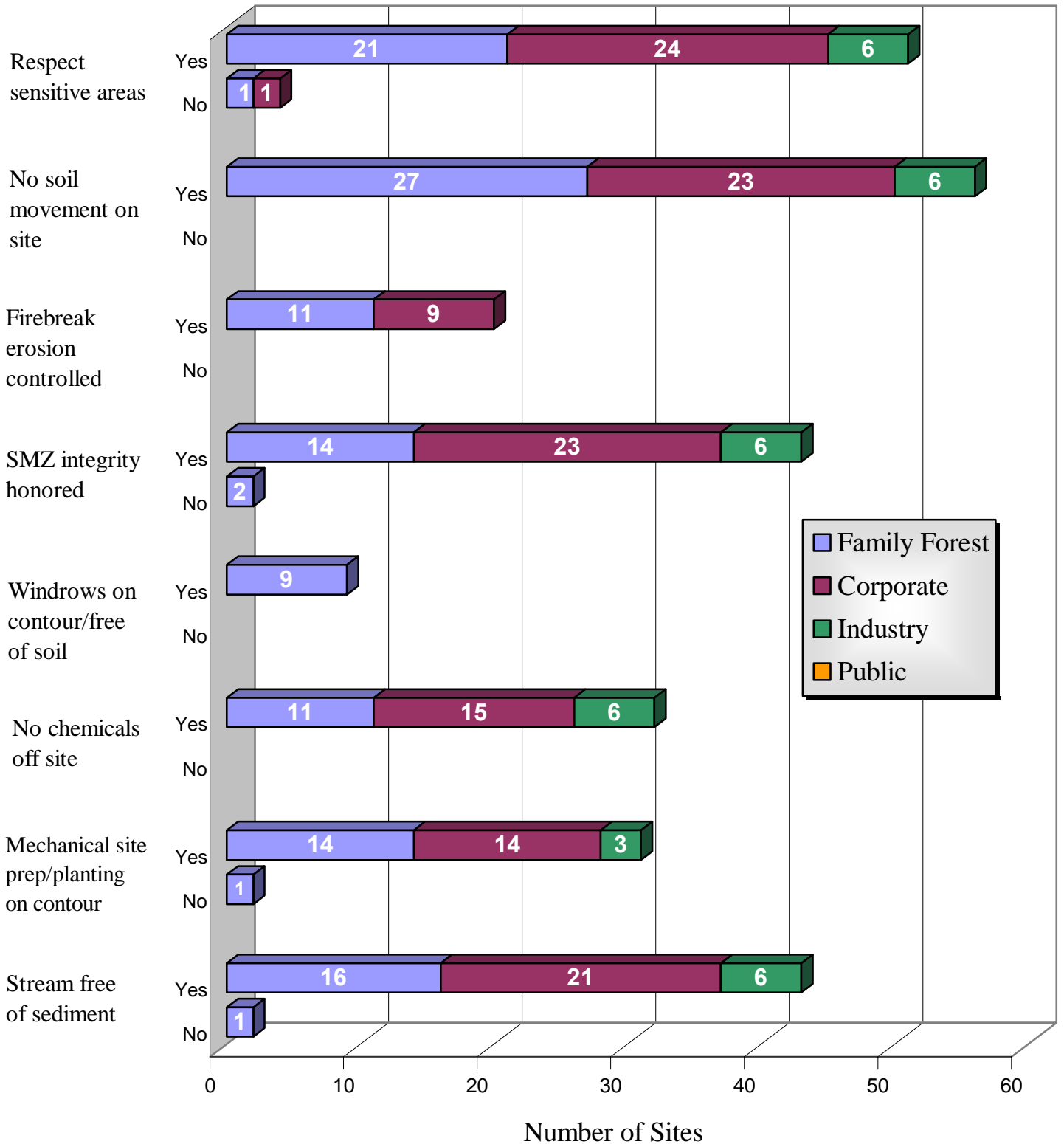


Figure 7. BMP Implementation on Landings by Ownership Type.

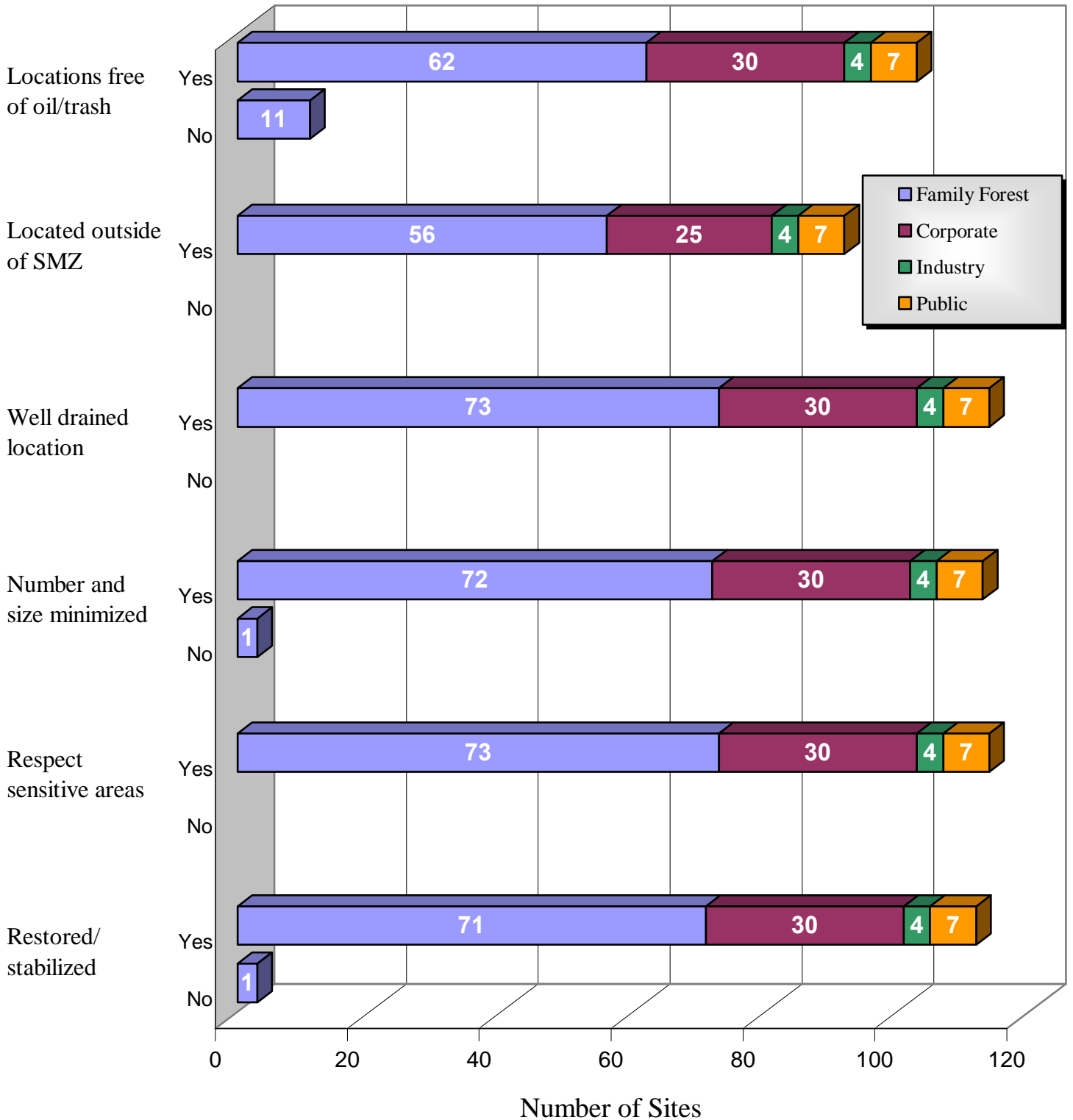
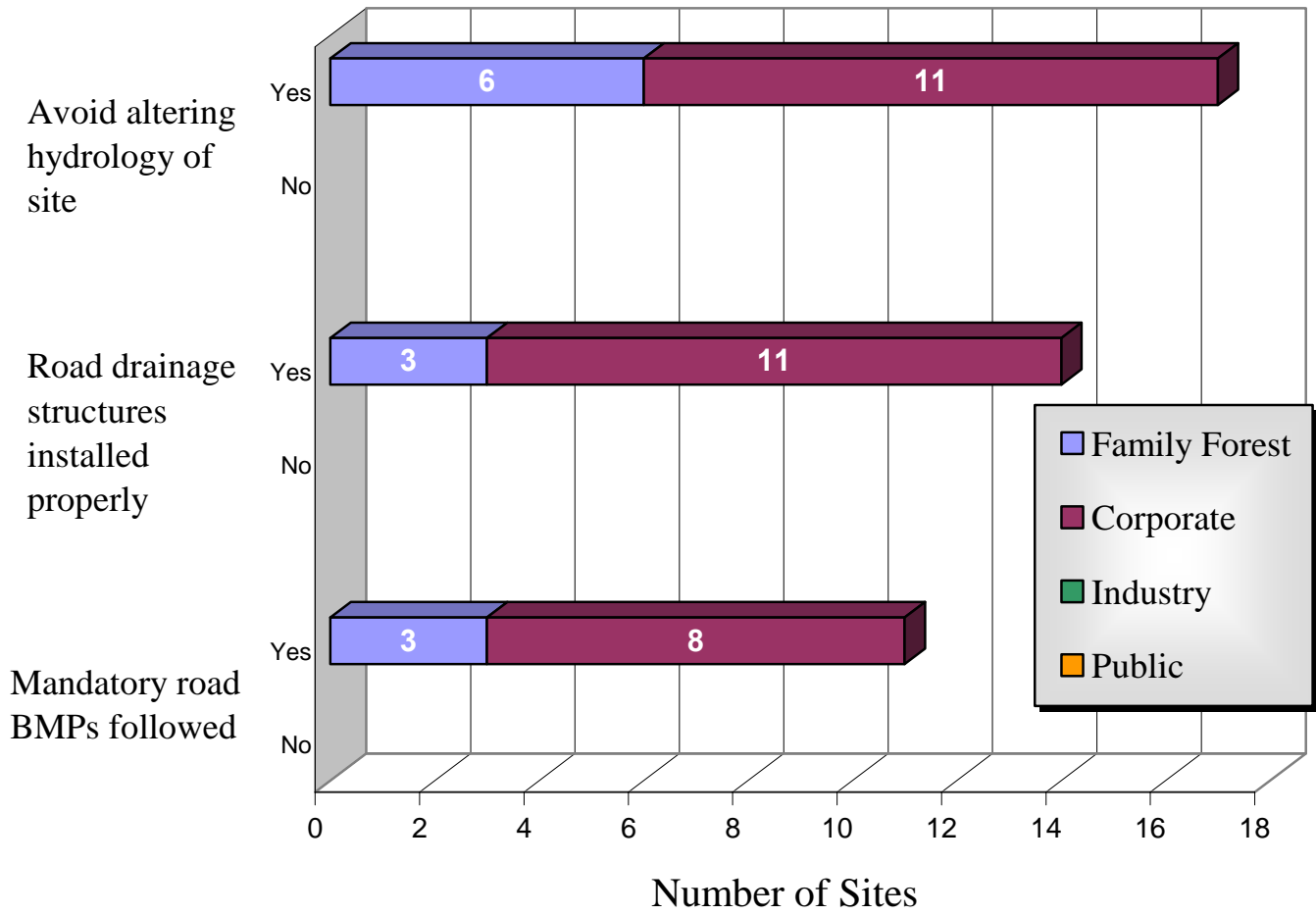


Figure 8. BMP Implementation on Wetlands by Ownership Type.



OVERALL BMP IMPLEMENTATION

To illustrate the range of the overall implementation scores, Figures 9 and 10 separate the results into five categories: 0-50%, 51-70%, 71-80%, 81-90%, and 91-100%. Figure 9 geographically illustrates implementation across all ownership types. Figure 10 provides the number of tracts across all ownership types receiving the respective level of implementation.

IMPLEMENTATION BY SITE CHARACTERISTICS

Ownership

BMP implementation varied by ownership type. The public ownership category fared best, with 100% for the seven tracts with no significant risks noted.

The 47 sites owned by corporate landowners had an overall BMP implementation of 95.7% with only two significant risks.

Forest industry owned eight of the sites and had an overall implementation of 91.1% with only two significant risks.

Family forest owners had an implementation rating of 88.7% with 14 significant risks on 90 sites. This represents the lowest level of the four ownership types.

Type of Activity

Four types of silvicultural activities were monitored: regeneration harvests, partial regeneration cuts, thinning, and site preparation. Nineteen sites were evaluated for site preparation only, although site preparation was evaluated along with a regeneration harvest or planting 34 times. See Table 9.

Table 9. Overall BMP Implementation by Type of Operation.

Type of Operation	BMP Implementation
Regeneration harvest (clearcut)	89.3%
Regeneration harvest (partial cut)	89.4%
Thinning	96.8%
Site preparation (only)	88.8%

Figure 9: Overall Implementation Scores Across all Ownerships and Monitoring Criteria.

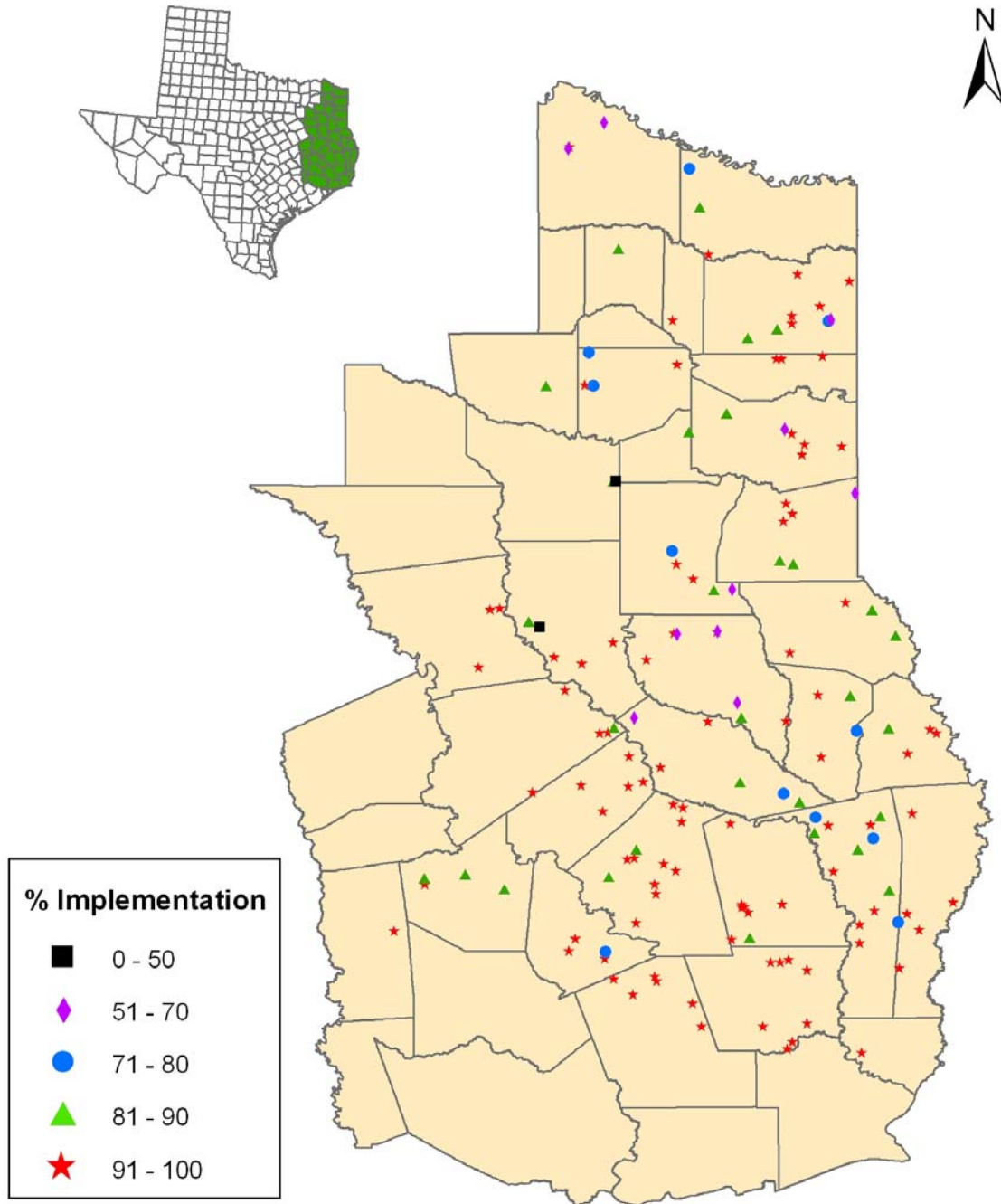
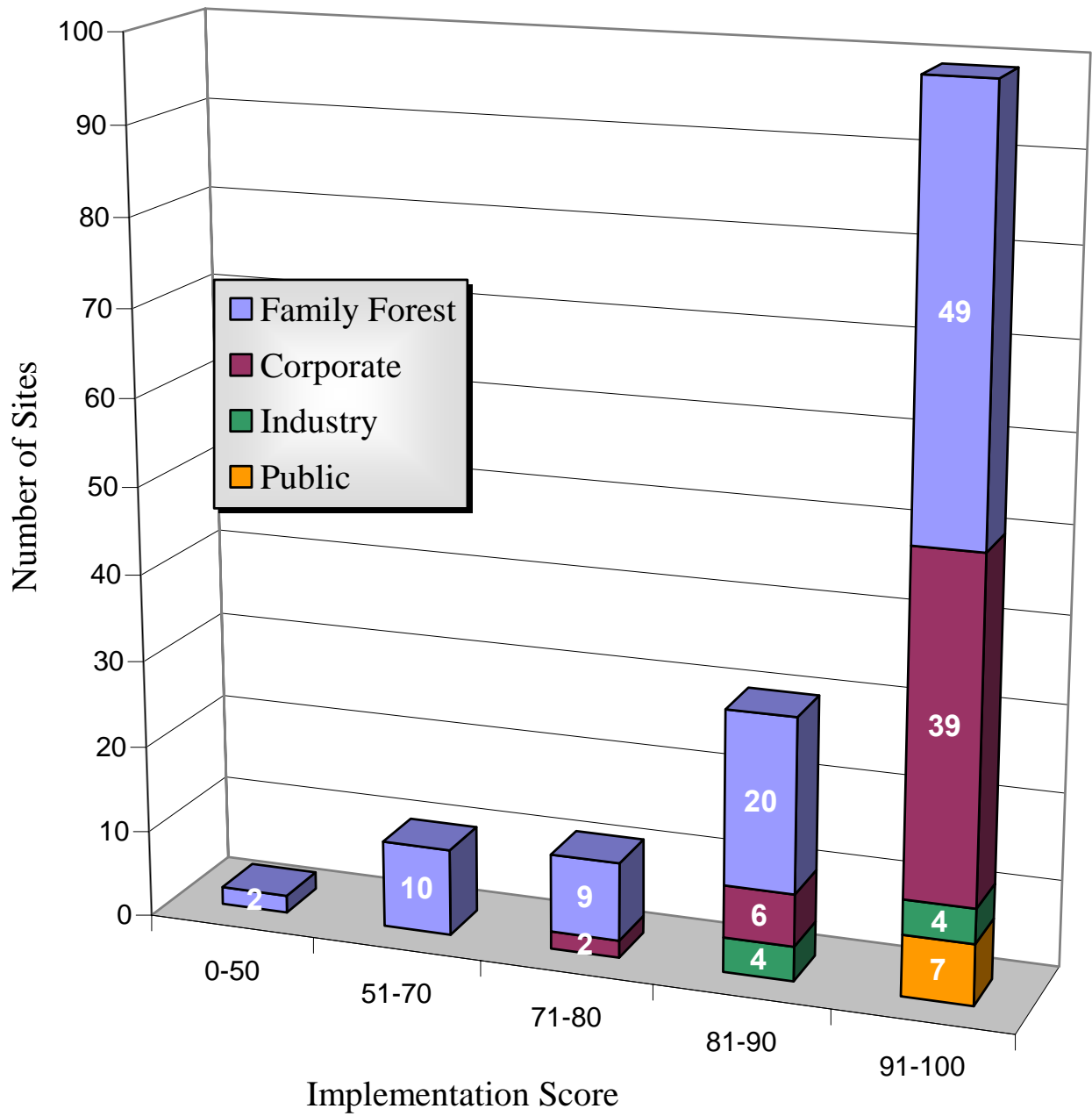


Figure 10. Overall Implementation Scores by Number of Sites and Ownership.



Region

East Texas was divided into two regions, North and South, for easy comparison of BMP implementation rates. The line was drawn along the northern boundary of Leon, Houston, Angelina, San Augustine, and Sabine Counties. Eighty-seven sites were monitored in the southern region and had an implementation rating of 94.6%, while 65 sites were monitored in the northern region with an implementation rating of 87.4%. The higher BMP implementation in Southeast Texas is expected due to the high concentration of corporate, public, and industrial ownership, flatter topography, and less erodible soils.

Terrain

Monitoring sites were classified as *Flat*, *Hilly*, or *Steep*. BMP implementation on the 36 flat sites was 93.6% with four significant risks; on the 115 hilly sites, 90.9% with 14 significant risks; and on the one steep site, 92.9% with no significant risks.

Erodibility

Monitoring sites were identified as having *Low*, *Medium*, or *High* soil erodibility. BMP implementation on a total of 48 low erodibility sites was 91.6% with six significant risks; on 95 medium erodibility sites, 91.2% with 11 significant risks; and on nine high erodibility sites, 90.9% with nine significant risks.

Distance to Permanent Water

Distance to the nearest permanent waterbody was determined for each monitoring site. BMP implementation on 81 sites with permanent water less than 300 feet away was 91.6% with 14 significant risks. On five sites with permanent water 300 to 800 feet away, implementation was 84.5% with three significant risks. On four sites with permanent water 800 to 1600 feet away, implementation was 90.5% with no significant risks. Of the 62 sites in which permanent water was greater than 1,600 feet away, BMP implementation was 92.1% with one significant risk.

River Basin

Monitoring sites were identified to be in the following river basins: Cypress, Neches, Red, Sabine, San Jacinto, Sulphur, and Trinity. BMP implementation was highest in the San Jacinto River Basin (100%) on 4 sites and lowest in the Red River Basin (74.1%) on two sites. See Table 10 and Figure 11.

Hydrologic Unit Code (Watershed)

Monitoring sites were also tracked by their eight digit hydrologic unit code (HUC). Three HUCs (12030203, 12040101, 12040103) had an implementation score of 100%. Thirteen of the 22 watersheds (59%) scored over 90%. The lowest rated watershed had a BMP implementation rating of 74.1% (1140106). See Table 11 and Figure 12.

Table 10. BMP Implementation by River Basin.

River Basin	Number of Sites	% Implementation	Significant Risks
Cypress	20	89.7	2
Neches	72	91.7	8
Red	2	74.1	1
Sabine	29	90.4	2
San Jacinto	4	100.0	0
Sulphur	7	90.8	2
Trinity	18	94.0	3

Table 11. BMP Implementation by Hydrologic Unit Code.

Hydrologic Unit Code	Number of Sites	% Implementation	Significant Risks
11140106	2	74.1	1
11140302	6	91.1	2
11140303	1	88.9	0
11140304	3	88.5	0
11140305	2	94.4	0
11140306	11	90.5	0
11140307	4	85.7	2
12010002	10	85.2	1
12010004	9	91.4	1
12010005	9	95.9	0
12020001	6	87.8	1
12020002	17	93.4	3
12020003	10	91.6	1
12020004	8	86.4	1
12020005	13	87.4	2
12020006	12	96.1	0
12020007	6	98.1	0
12030201	1	88.1	1
12030202	15	93.5	2
12030203	3	100	0
12040101	1	100	0
12040103	3	100	0

Proximity to 303 (d) Listed Stream Segments

The proximity of BMP monitoring sites to 303(d) listed (impaired) stream segments was analyzed using GIS. Twenty-four sites were identified to be within one mile of a listed stream segment and had an implementation rating of 92.7%. It should be noted that BMP implementation was higher near these listed waters than the overall BMP implementation for all monitored sites. Forest operations provided greater water quality protection near these sensitive areas.

Figure 11. Site Location by River Basin.

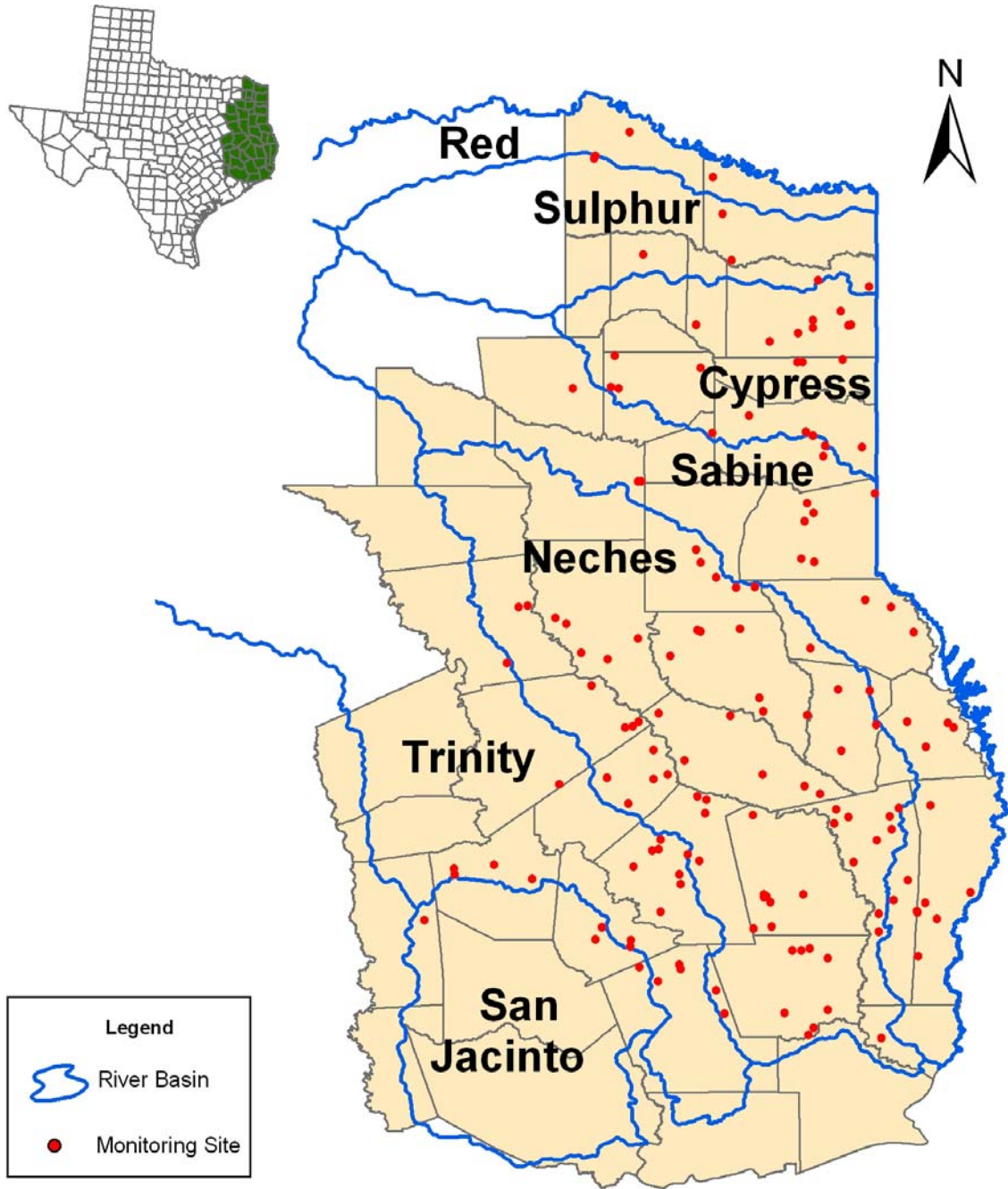
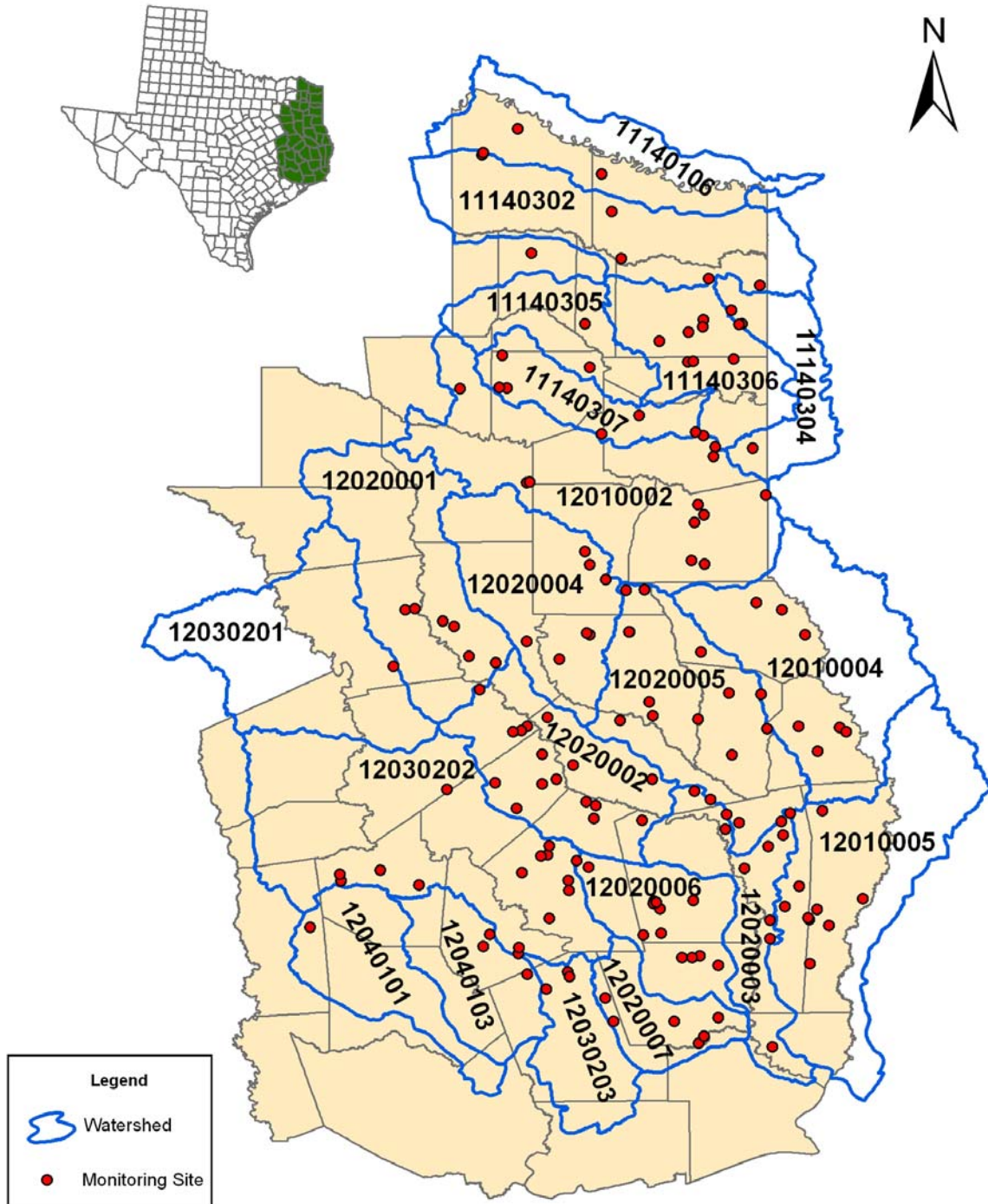


Figure 12. Site Location by Hydrologic Unit Code (Watershed).



STATISTICAL ANALYSIS

Statistical tests were performed to provide further information about the accuracy of the data collected. BMP trend analyses were also performed on certain categories to determine statistical significance. By understanding these trends where higher BMP implementation occurred, Texas Forest Service can develop outreach efforts that encourage the use of these practices.

STATISTICAL TESTS

Margin of Error

The margin of error expresses the maximum likely difference observed between the sample mean and the true population mean with 95% probability. It is an important statistical calculation that was performed on all individual BMPs (i.e. SMZs present on perennial streams) using the respective percent implementation and total number of applicable questions. The formula used to calculate the margin of error is listed below. See Tables 2 – 8.

$$m = 2\sqrt{\frac{P(100 - P)}{n}}$$

Where m = margin of error for a single BMP
 P = the percent implementation for a single BMP
 n = the number of sites on which the BMP was evaluated

Confidence Interval

The 95% confidence interval is a tool that statisticians use to demonstrate their confidence in the measured mean of a sample. It provides a range for which they are 95% confident (i.e. 19 times out of 20) that the actual mean will be found. To calculate the confidence interval, the mean, variance, standard deviation, standard error, and margin of error must also be calculated. The formula used to calculate the confidence interval is listed below. For Round 7, the 95% confidence interval for the overall BMP implementation across all sites was (89.7, 93.4).

$$\mathbf{95\% \text{ CI} = \text{Mean} \pm \text{Margin of Error}}$$

STATISTICAL SIGNIFICANCE OF BMP TRENDS

Two different statistical analyses were performed on the following categories:

- Forester Involved in Sale or Activity
- Logger Attended BMP Training
- Landowner Familiar with BMPs
- BMPs Included in the Timber Sale Contract
- Landowner Member of Tree Farm
- Timber Delivered to SFI[®] Mill

The first statistical analysis was a parametric two sample t-test, which was included because of the large sample size. This percentage data had to undergo an arcsin square root transformation prior to analysis. Percentage data must be transformed because they are not normally distributed, which invalidates the normality assumption of the parametric test. A non-parametric test (Wilcoxon) was also performed to add greater statistical validity. To determine statistical significance, the resulting *P* value was compared to the level of significance. The *P* value is the probability of observing a value of the test statistic as contradictory (or more) to the null hypothesis as the computed value of the test statistic. In these tests, a 0.05 (5%) level of significance was used. For the two implementation ratings to be significantly different, the *P* value must be lower than the level of significance. The implementation ratings for the “yes” and the “no” answers were calculated to be significantly different in all of these categories. See Table 12.

Table 12. Results of Statistical Tests Determining Statistically Significant Differences.

	% Implementation		Parametric <i>P</i> value	Non Parametric <i>P</i> value	Level of Significance	Statistically Different?
	Yes	No				
Forester Involved	94.9	84.0	< 0.001	< 0.001	0.05	YES
Logger Attended BMP Training	93.9	81.7	< 0.001	< 0.001	0.05	YES
Landowner Familiar with BMPs	95.2	84.5	< 0.001	< 0.001	0.05	YES
BMPs in Contract	95.5	80.6	< 0.001	< 0.001	0.05	YES
Landowner Member of Tree Farm	95.9	87.5	0.009	0.016	0.05	YES
Timber Delivered to SFI [®] Mill	95.3	85.9	< 0.001	< 0.001	0.05	YES

Forester Involved in the Sale or Activity

BMP implementation was higher when a professional forester was involved in the sale or activity. One hundred three sites were identified as having a professional forester involved and had an implementation rating of 94.9%. Sites in which there was no forester involvement had a BMP implementation rating of 84.0%. See Figure 13.

Logging Contractor Attended BMP Workshop

Logging contractor familiarity with BMPs influenced implementation. Texas Forest Service BMP Project staff offers a BMP workshop in which contractors are made more aware of BMPs and water quality. One hundred twenty-two inspections identified the logging contractor as having attended the formal BMP training, with an implementation of 93.9%. Sites in which there was no attendance by the logger at the formal BMP training or if the logger was unknown had an implementation rating of 81.7%. See Figure 13.

Landowner Familiarity with BMPs

Landowner familiarity with BMPs also influenced BMP implementation. Sites whose owners were not familiar with BMPs (52) had an overall implementation rating of 84.5%, while sites whose owners were familiar with BMPs (100) had an implementation rating of 95.2%. See Figure 13.

BMPs Were Included in the Timber Sale Contract

BMPs were included in the timber sale contract, if applicable, on 111 sites. Implementation on sites with BMPs included in the contract was 95.5%, while implementation on tracts without BMPs in the contract was 80.6%. See Figure 14.

Landowner Member of American Tree Farm System

Membership in the American Tree Farm System can have an impact on implementation. This certification system is primarily open to family forest owners. In order to maintain this certification, members must implement BMPs on their forest operations. Landowners were identified as Tree Farmers on 13 sites and had an implementation rating of 95.9%, while implementation for nonmembers on 77 sites was 87.5%. See Figure 14.

Timber Delivered to SFI[®] Mill

BMP implementation was higher on sites in which the receiving mill was known to be a SFI[®] member. This occurrence was documented on 91 sites with a rating of 95.3%, compared to an 85.9% rating on 61 sites in which the timber went to other mills or the receiving mill was unknown. See Figure 14.

Figure 13. Overall Implementation by Various Types of Involvement.

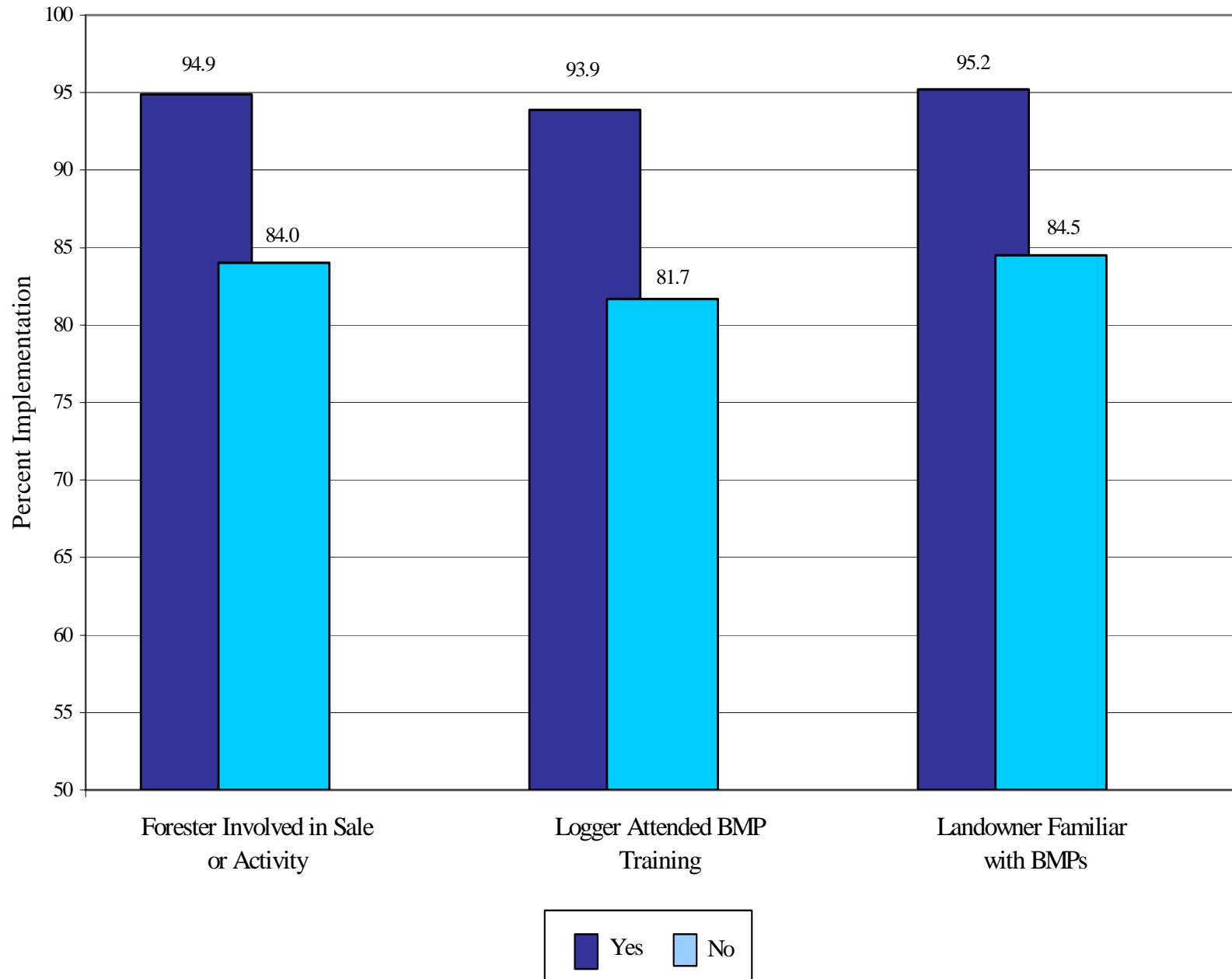
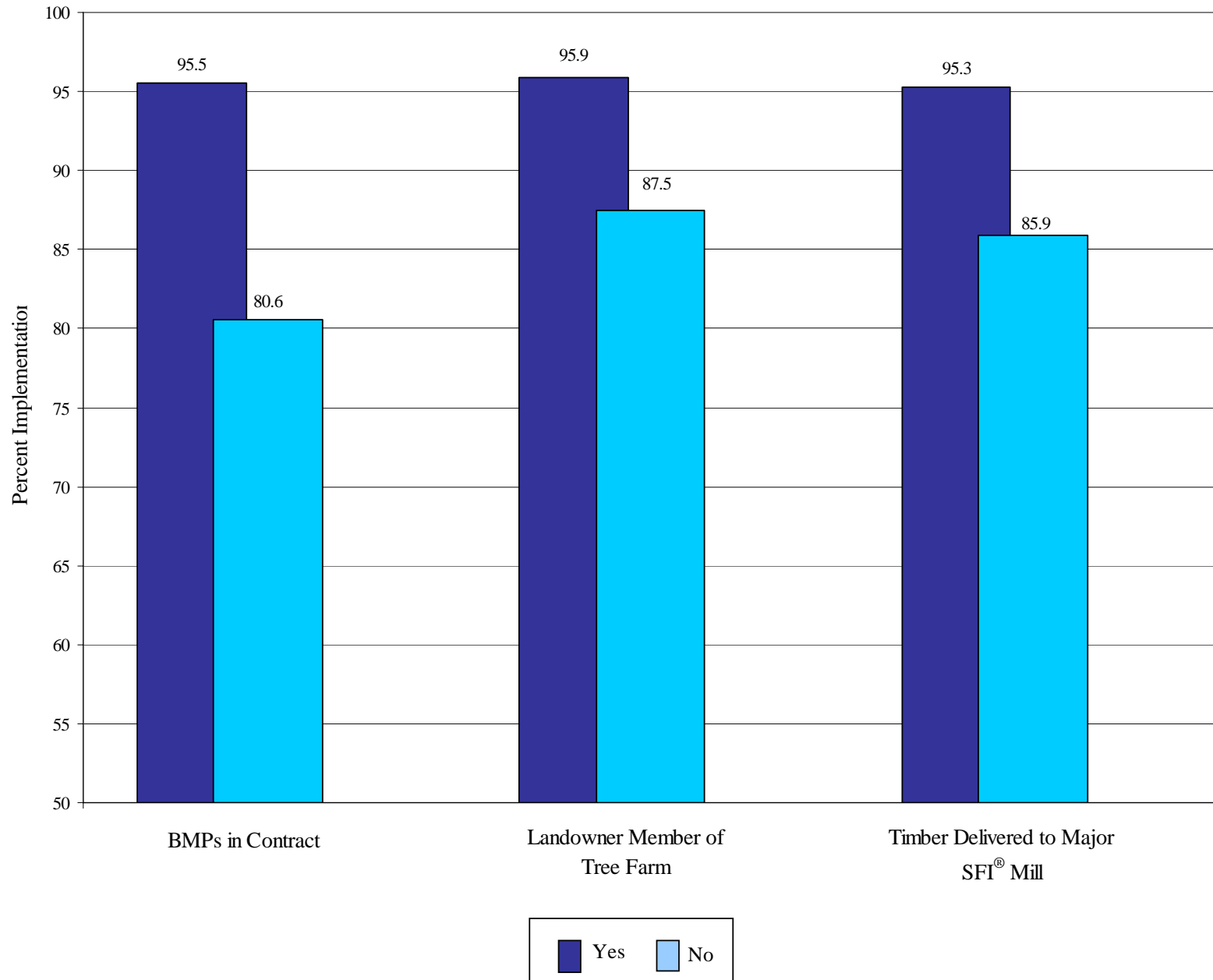


Figure 14. Overall Implementation by Various Categories.



DISCUSSION

As mentioned in the monitoring checklist section of this report, the current methodology used to monitor BMP implementation has been in place since 1999. Prior to that, a more subjective approach was used in which tracts were scored as *No Effort*, *Poor*, *Fair*, *Good*, or *Excellent*. In order to determine percent implementation for an individual tract under this older method, passing tracts (*Fair*, *Good*, or *Excellent*) scored 100%, while failing tracts (*No Effort*, *Poor*) scored 0%.

The current, objective method more accurately scores percent implementation. Individual tracts are rated on a 0 - 100 percent scale based on their actual level of BMP implementation. Due to the change in reporting methods, results from rounds 4 - 7 *cannot* be directly compared to Rounds 1 - 3. However, tract evaluations conducted in Rounds 1 - 3 were scored using the current method in the Texas Forest Service report, *A History of BMP Implementation Monitoring in Texas, 2007*, to facilitate this comparison.

A brief discussion of the previous rounds of monitoring is provided to give a historical perspective on BMP monitoring in Texas.

OVERALL IMPLEMENTATION – Rounds 1, 2, 3, 4, 5, and 6

Round 1 of BMP implementation monitoring, completed in 1992, yielded an overall implementation rate of 88.2%. Round 2, which was completed in 1996, showed an overall implementation rate of 87.4%. Round 3, completed in 1998, reported overall BMP implementation at 87.3%. Round 4, completed in 2000, documented overall BMP implementation at 88.6%. Round 5, completed in 2002, showed overall BMP implementation at 91.5%, while Round 6 reported overall BMP implementation at 91.7%.

BMP implementation on industry land had steadily increased from 89.6% in Round 1 to 95.1% in Round 2 to 98.4% in Round 3. Implementation on industrial lands scored 94.2% in Round 4, 96.1% in Round 5, and 95.7% in Round 6. A new landowner category was developed in Round 6 (corporate) in response to the changes in land ownership from the divestiture of industrial forestlands. Overall BMP implementation for corporate landowners in Round 6 was 96.0%. These consistently high scores document the diligence of forest industry in using voluntary BMPs on their operations.

BMP implementation on publicly owned land has increased from 93.3% in Round 1 to 100% in Round 2, and maintained its 100% implementation through Round 3. Implementation on public lands scored 97.9% in Round 4, 98.4% in Round 5, and 98.3% in Round 6.

In Round 1 of monitoring, implementation on family forest owners was 86.3%. During Round 2, implementation was 82.9% and decreased to 76.3% in Round 3. However, in Round 4, implementation made an upward shift to 81.2%, increased to 86.4% in Round 5, and reached an all time high of 88.7% in Round 6.

OVERALL IMPLEMENTATION – Round 7

BMP implementation on public land for Round 7 was 100% with no significant risks to water quality identified. Implementation on industry land during this time period was 91.1% with two significant risks, while implementation on corporate land was 95.7% with two significant risks. Family forest owners received an implementation rating of 88.7% with 14 significant risks. This resulted in an overall BMP implementation of 91.5% with a total of 18 significant risks across all ownership categories. See Table 14.

BMP implementation on family forest owners lagged behind other ownerships and accounted for 14 of the 18 significant risks. Family forest owners are generally less involved in forest management, only infrequently sell timber, may be absentee, and may lack technical knowledge necessary to implement BMPs. It is important to note that the average size of the harvested family forest owner tract was smaller than the industrial and corporate tracts. This lower level of implementation occurred on smaller tracts while the higher level of BMP implementation occurred on larger tracts of land.

Table 14. Percent Implementation by Ownership and Round.

	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7
Family Forest Owner	86.3	82.9	76.3	81.2	86.4	88.7	88.7
Corporate	-	-	-	-	-	96.0	95.7
Industry	89.6	95.1	98.4	94.2	96.1	95.7	91.1
Public	93.3	100	100	97.9	98.4	98.3	100
Overall	88.2	87.4	87.3	88.6	91.5	91.7	91.5

AREA WEIGHTED BMP IMPLEMENTATION

Traditionally, monitoring sites have been weighted equally when determining percent implementation scores. This method is good for determining overall BMP implementation across the state or for a particular landowner category. However, it does not provide this information on a landscape scale like the area weighted BMP implementation method. Using this approach, larger tracts are weighted more heavily than smaller tracts, primarily because they have a greater opportunity to impact water quality. The results were reanalyzed using the above-mentioned approach. BMP implementation scores actually increased for the family forest owner, industry, and overall. See Table 15.

$$AW \% = \Sigma (((\text{Tract A} / \text{Total A}) * 100)) * \% \text{ BMP})$$

Where AW % = area weighted BMP implementation %
 A = area (acres)
 % BMP = individual tract % BMP implementation

Table 15. Area Weighted Percent Implementation by Ownership, Round 7.

Landowner Type	Area Weighted % Implementation
Family Forest Owner	91.4
Corporate	95.7
Industry	91.6
Public	100
Overall	93.7

CONCLUSION

Positive statistical correlations between landowner familiarity with BMPs, forester involvement, logging contractor training in BMPs, and BMP implementation were shown. This demonstrates the importance for family forest owners to involve a forester and a BMP-trained logging contractor to ensure BMP implementation.

Forest industry also played a significant role in increasing BMP implementation. This occurred primarily because of its support of the Texas Forest Service BMP Program and participation in SFI[®]. Water quality protection is obviously a top priority for the forest industry, as evident by requiring all contractors to attend BMP training workshops, including BMPs in their timber sale contracts, and procuring wood for their mills from landowners that implement BMPs.

Special programs and incentives advocated by Texas Forest Service are continuing to have an effect on BMP implementation. The Texas Reforestation and Conservation Act of 1999 encouraged landowners to leave a streamside management zone when harvesting timber by giving them special property tax incentives for doing so. The American Tree Farm System requires landowners to implement BMPs on their operations in order to maintain their certification. Texas Forestry Association sponsors many workshops each year emphasizing sustainable forestry.

Overall BMP implementation maintained a very high level. Most notable is the family forest owner, whose implementation increased by 12.4% since Round 3, which had the lowest rate since the monitoring began. This increase demonstrates that the ongoing education and training strategies geared towards loggers, landowners, and foresters were the driving force behind the increases in implementation.

Although BMP implementation remains at a very high level, there is still room for improvement. The past round of monitoring noted a deficiency in removing and stabilizing stream crossings on temporary roads and leaving inadequate streamside management zone widths along waterbodies. Texas Forest Service has already begun to address this issue. A BMP training workshop focusing specifically on stream crossings has been developed. Early response to this course has been excellent. Future courses will be developed on streamside management zones and forest roads. Improvement was also made in reducing the number of significant risks to water quality from the previous round; however, there still is work to do in this area. Continuing effective educational programs for family forest owners, providing technical assistance to the forestry community on BMPs, and conducting BMP training for loggers can minimize the potential water quality impacts from silvicultural operations.

Appendix

Implementation Monitoring Checklist

Evaluation Criteria

Summary of Results

I. General Landowner and Tract Information

 Site ID

County <input style="width: 80px;" type="text"/>	TFS Block and Grid <input style="width: 80px;" type="text"/>	Region <input style="width: 80px;" type="text"/>	Owner Type <input type="checkbox"/> N <input type="checkbox"/> A <input type="checkbox"/> C <input type="checkbox"/> I <input type="checkbox"/> P
Latitude <input style="width: 80px;" type="text"/>	Longitude <input style="width: 80px;" type="text"/>	Landowner: Name <input style="width: 80px;" type="text"/> <input style="width: 80px;" type="text"/>	
Forester Type <input style="width: 80px;" type="text"/>	Name <input style="width: 80px;" type="text"/>	Address <input style="width: 80px;" type="text"/>	
Timber Buyer <input style="width: 80px;" type="text"/>	Contractor <input style="width: 80px;" type="text"/>	City <input style="width: 80px;" type="text"/>	State <input style="width: 40px;" type="text"/>
Activity <input style="width: 80px;" type="text"/>	Acres Affected <input style="width: 80px;" type="text"/>	Zip <input style="width: 80px;" type="text"/>	Phone <input style="width: 80px;" type="text"/>
Estimated Date of Activity <input style="width: 80px;" type="text"/>	Date of Inspection <input style="width: 80px;" type="text"/>	Accompanied by <input style="width: 80px;" type="text"/>	
Inspector <input style="width: 80px;" type="text"/>			

II. Site Characteristics

Terrain: <input type="checkbox"/> Flat <input type="checkbox"/> Hillly <input type="checkbox"/> Steep Erodibility hazard: <input type="checkbox"/> Low <input type="checkbox"/> Medium <input type="checkbox"/> High Type stream present: <input type="checkbox"/> Perennial <input type="checkbox"/> Intermittent Watershed Code <input style="width: 80px;" type="text"/>	River Basin <input style="width: 80px;" type="text"/> Distance to nearest permanent water body: <input type="checkbox"/> < 300' <input type="checkbox"/> 300 - 800' <input type="checkbox"/> 800 - 1600' <input type="checkbox"/> 1600'+ Predominant soil series/texture: <input style="width: 80px;" type="text"/> <input type="checkbox"/> Clay <input type="checkbox"/> Clay Loam <input type="checkbox"/> Loam <input type="checkbox"/> Sandy Loam <input type="checkbox"/> Sand
--	--

III. Permanent Roads

1. Respect sensitive areas, such as SMZs, steep slopes, and wet areas 2. Meet grade specifications by having slopes between two and ten percent 3. Ruting within allowable specs of less than six inches deep for not more than fifty feet 4. Well drained with appropriate structures to minimize soil movement 5. Wing ditches, waterbars, and water turnouts do not dump into streams 6. Reshaped and/or stabilized to minimize soil movement	YES NO N/ANN Sig. Risk <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Section Total 0 0 0 Percent Implementation N/A
BMPs present <input type="checkbox"/> RD <input type="checkbox"/> WD <input type="checkbox"/> WB <input type="checkbox"/> RE <input type="checkbox"/> OC <input type="checkbox"/> PL <input type="checkbox"/> RS <input type="checkbox"/> CU <input type="checkbox"/> SD <input type="checkbox"/> BD	

IV. Secondary (temporary) Roads / Skid Trails

1. Respect sensitive areas, such as SMZs, steep slopes, and wet areas 2. Slopes less than 15% and laid out on the contour of the land 3. Ruting within allowable specs of less than six inches deep for not more than fifty feet 4. Well drained with appropriate structures to minimize soil movement 5. Stabilized to minimize soil movement	YES NO N/ANN Sig. Risk <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Section Total 0 0 0 Percent Implementation N/A
BMPs present <input type="checkbox"/> WD <input type="checkbox"/> WB <input type="checkbox"/> RE <input type="checkbox"/> OC <input type="checkbox"/> PL <input type="checkbox"/> RS <input type="checkbox"/> LS	

V. Stream Crossings

On Permanent Roads

1. Crossings avoided or minimized
2. Stream crossings correct
3. Stream crossing stabilized
4. Stream free of sediment

YES	NO	NA/NN	Sig. Risk
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

On Temporary Roads

5. Crossings avoided or minimized
6. Stream crossings correct
7. Temporary crossings removed
8. Stream crossings and approaches stabilized
9. Stream free of sediment

YES	NO	NA/NN	Sig. Risk
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

BMPs Present CU BR LW

Section Total
 Percent Implementation

VI. Streamside Management Zones

1. Present on permanent stream
2. Present on intermittent stream
3. SMZ adequately wide by leaving fifty feet on both sides of the stream
4. Thinning within allowable specs by leaving 50 square feet of BA
5. Minimize harvesting bank trees
6. SMZ integrity honored by keeping skidders, roads, landings, and firebreaks out
7. Stream clear of debris, such as tops and limbs
8. Stream free of sediment

YES	NO	NA/NN	Sig. Risk
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section Total
 Percent Implementation

VII. Site Preparation

Site preparation method

Regeneration method

1. Respect sensitive areas by preventing site prep intrusion
2. No soil movement on site, especially broad scale sheet erosion
3. Firebreak erosion controlled to prevent potential erosion
4. SMZ integrity honored by preventing site prep intrusion
5. Windrows on contour / free of soil to minimize soil disturbance
6. No chemicals off site or entering water bodies
7. Mechanical site prep, machine planting on contour
8. Stream free of sediment

YES	NO	NA/NN	Sig. Risk
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section Total
 Percent Implementation

VIII. Landings

1. Locations free of oil / trash and properly disposed of
2. Located outside of SMZ to minimize traffic and erosion in the SMZ
3. Well drained location to minimize puddling, soil degradation, and soil movement
4. Number and size minimized
5. Respect sensitive areas, including steep slopes and wet areas
6. Restored / stabilized by back blading, spreading bark, or seeding to minimize erosion

YES	NO	NA/NN	Sig. Risk
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section Total
 Percent Implementation

IX. Wetlands (may or may not be jurisdictional)

- 1. Avoid altering hydrology of site by minimizing ruts and soil compaction
- 2. Road drainage structures installed properly to maintain flow of water
- 3. Mandatory road BMPs followed

YES NO NA/NN Sig. Risk

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section Total

Percent Implementation

X. Overall Compliance

- III. Permanent Roads
- IV. Skid trails/Temporary Roads
- V. Stream Crossings
- VI. Streamside Management Zones
- VII. Site Preparation
- VIII. Landings
- IX. Wetlands

YES NO NANN Sig. Risk

<input type="text" value="0"/>	<input type="text" value="0"/>	<input checked="" type="checkbox"/>	<input type="text" value="0"/>
<input type="text" value="0"/>	<input type="text" value="0"/>	<input checked="" type="checkbox"/>	<input type="text" value="0"/>
<input type="text" value="0"/>	<input type="text" value="0"/>	<input checked="" type="checkbox"/>	<input type="text" value="0"/>
<input type="text" value="0"/>	<input type="text" value="0"/>	<input checked="" type="checkbox"/>	<input type="text" value="0"/>
<input type="text" value="0"/>	<input type="text" value="0"/>	<input checked="" type="checkbox"/>	<input type="text" value="0"/>
<input type="text" value="0"/>	<input type="text" value="0"/>	<input checked="" type="checkbox"/>	<input type="text" value="0"/>
<input type="text" value="0"/>	<input type="text" value="0"/>	<input checked="" type="checkbox"/>	<input type="text" value="0"/>

Overall Total

Total Significant Risk

Percent Implementation

Needs Improvement Pass

No Effort Poor Fair Good Excellent

Follow Up Questions

Was activity supervised by landowner or representative?
Who?

YES NO NA/NN

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------

Was landowner familiar with BMPs?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------

Has logger attended BMP Workshop?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------

Were BMPs included in the contract?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------

Is landowner a member of TFA? Landowner Association? Tree Farm? Other?
Organization

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------

Was timber delivered to SFI mill?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------

Does landowner plan to reforest?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------

Does landowner have a forest management plan?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------

Is remediation planned by landowner (if needed)?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------

Date

Comments (Explain observed actions in the field check. Make recommendations.)

**Evaluation Criteria for BMP Monitoring Checklist
Texas Forest Service BMP Project**

I. General Landowner and Tract Information

County: Texas County inspection was located.

TFS Block and Grid: Enter only entry point if multiple blocks or grids.

Latitude and Longitude: coordinates in decimal degree (D.d) format.

Forester Type: Professional, i.e. consultant, industry, etc.

Forester Name: First and last name.

Timber Buyer: First and last name or Corporation name.

Logging Contractor: First and last name or business name.

Activity: Type activity occurring, e.g. harvesting, site preparation, etc.

Acres Affected: Acres affected by activity.

Estimated Date of Activity: Quarter and year activity appears to have occurred. Use first entry if multiple entries.

Date of inspection: mmddyy.

Inspector: Name of TFS forester doing BMP inspection.

Accompanied by: Name of landowner, industry or consulting forester, logger, etc. who is present during the inspection.

Owner Type: Nonindustrial (N), Absentee nonindustrial (A), Corporate (C) Industry (I), Public (P).

Name, Address, City, Zip, and Phone: Contacts for the landowner.

II. Site Characteristics

Terrain: Check only one; Flat, Hilly, or Steep.

Erodibility hazard: Check only one; Low, Medium, or High.

Type stream present: Perennial or Intermittent.

Watershed Code: 8 digit hydrologic unit code where site is located.

River Basin: River basin where site is located.

Distance to nearest permanent water body: Distance to nearest blue line stream or lake.

Predominant soil series: Series name from Soil Survey data (if available).

Predominant soil texture: Check only one; Clay, Clay Loam, Loam, Sandy Loam, or Sand.

III. Permanent Roads

1. Respect sensitive areas: Do roads avoid wet areas, SMZs, steep slopes if an alternative exist, erosion prone areas if an alternative exists, etc.?
2. Roads meet grade specs: Pertains to new roads or roads which are substantially reworked. Are roads within 2-10 percent grade except for short distances? Are roads on contour? Are ridge tops avoided?
3. Rutting within allowable specs: Is the road free of ruts in excess of 6 inches deep for more than 50 feet?
4. Well drained with appropriate structures: Are roads constructed so that water will quickly drain from them to minimize soil movement?
5. Ditches do not dump into streams: Are water turn outs and water bars venting far enough from the stream to prevent sediment from entering the stream channel?
6. Roads reshaped and stabilized: If needed, are roads reworked to minimize soil movement?

BMPs present: Which types of BMPs were used? Rolling dips (RD), Wing ditches (WD), Water bars (WB), Revegetate (RE), On contour (OC), Proper placement (PL), Reshaping (RS), Culverts (CU), Side Ditch (SD), Broad based dip (BD).

IV. Skid Trails/Temporary Roads

1. Respect sensitive areas: Do skid trails and temporary roads avoid wet areas, SMZs, steep slopes if an alternative exist, erosion prone areas if an alternative exists, etc.?
2. Slopes less than 15 %: Are skid trails run on or near contour, rather than up and down steep slopes?
3. Rutting within allowable specs: Are skid trails and temporary roads free of ruts in excess of 6 inches deep for more than 50 feet?
4. Roads well drained with water bars or other water control structures: Were BMPs installed effectively to reduce erosion from the road?
5. Roads stabilized: If needed, are skid trails and temporary roads reworked to minimize soil movement?

BMPs present: See Section III above.

V. Stream Crossings

On Permanent Roads:

1. Crossings avoided or minimized: Was an effort made to use as few crossings as possible?
2. Stream crossings correct: Are crossings installed correctly? Are crossing located properly? Are culverts properly sized? Are bridges used where necessary? Are crossings at right angles?
3. Stream crossings stabilized? Are stream banks and approaches stabilized? Are washouts evident?
4. Stream free of sediment: Has sedimentation from the road into the stream channel been minimized?

On Temporary Roads

5. Crossings avoided or minimized: Was an effort made to use as few crossings as possible?
6. Stream crossings correct: Are crossings installed correctly? Is the crossing located so as to minimize the potential erosion in the stream channel? Is the crossing at a right angle to the stream channel?
7. Temporary crossings removed: Have the temporary crossings been removed? Excess fill removed from the stream channel
8. Stream crossings stabilized: Banks and approaches stabilized against erosion? Are washouts evident?
9. Stream free of sediment: Has sedimentation from the road into the stream channel been minimized?

BMPs present: Which types of BMPs were used? Culverts (CU), Bridge (BR), Low water crossing (LW).

VI. Streamside Management Zones

1. Present on permanent stream: Is there an SMZ present on any permanent stream?
2. Present on intermittent stream: Is there an SMZ present on any intermittent stream?
3. SMZ adequately wide: Is the stream being protected from erosion and deposition of sediment? Does the width meet the guidelines recommendations?
4. Thinning within allowable specs: If thinning was done, is the basal area remaining at least 50 square feet? Is there minimal soil disturbance from felling and skidding?
5. Minimize harvesting bank trees: Was an effort made to minimize harvesting bank trees? Were trees felled across the stream?
6. SMZ integrity honored: Was an effort made to stay out of the SMZ with skidders, landings, roads, etc. (except for designated stream crossings)? Is the SMZ free of firebreaks?
7. Stream clear of debris: Are tops and limbs removed from permanent and intermittent stream channels? Has any brush or debris pushed into the stream channel been removed?
8. Stream free of sediment: Has sedimentation reaching the stream channel through the SMZ been minimized?

VII. Site Preparation

Site preparation method: Shear/pile/burn, Sheer only, Drum chop, Hot fire, Chemical, Disk/bed, Sub-soil, Disk/burn, Disking only.

Regeneration method: Mechanical, Hand, Natural, None.

1. Respect sensitive areas. Effort to prevent site prep intrusion into sensitive areas? Effort to prevent heavy equipment intrusion into sensitive areas? Effort to prevent fire intrusion into sensitive areas?
2. No soil movement on site: Is there no soil movement on site? Are rills or gullies prevented? Is there no problem with broad scale sheet erosion?
3. Firebreak erosion controlled: If present, has potential erosion from firebreaks been minimized as per guideline recommendations?
4. SMZ integrity honored: Effort to prevent site prep intrusion into the SMZ? Effort to prevent heavy equipment intrusion into the SMZ? Effort to prevent fire intrusion into the SMZ? Are perennial or intermittent streams free of debris?
5. Windrows on contour / free of soil: Are windrows on contour on hilly lands rather than up and down slopes? Was soil disturbance minimized? Was soil in windrows minimized?
6. No chemicals off site: Does it appear that chemicals were used according to label directions? Have they remained on site and out of water bodies?
7. Mechanical site prep and machine planting on contour: Are rows on contour on hilly lands rather than up and down slopes?
8. Stream free of sediment: Has sedimentation reaching the stream channel because of site prep activities been minimized?

VIII. Landings

1. Locations free of oil / trash: Any sign of deliberate oil spills on soil? Is trash picked up and properly disposed of?
2. Located outside of SMZ: Was the landing located 50 feet outside SMZ so as to minimize traffic and erosion in the SMZ?
3. Well drained location: Were the landings located so as to minimize puddling, soil degradation and soil movement?
4. Number and size minimized: Were the number and size of landings kept to a minimum?
5. Respect sensitive areas: Were landings kept out of wet areas, steep slopes, and other erosion prone areas if an alternative exist?
6. Restored / stabilized: Has the landing been back bladed or otherwise restored as per guideline recommendations? Has erosion been minimized through spreading bark, etc., seeding, water bars, or other recommended BMP practices?

IX. Wetlands (may or may not be jurisdictional)

1. Avoid altering hydrology of site: Were ruts and soil compaction kept to a minimum?
2. Road drainage structures installed properly: Were BMPs installed effectively to maintain the flow of water and keep erosion to a minimum in the wetland?
3. Mandatory road BMPs followed: Were the 15 federal mandatory BMPs followed?

X. Overall Implementation

Section implementation percentages are determined by dividing the number of questions receiving a yes answer by the total applicable questions in each section. $Y/(Y+N)$

Overall implementation is determined in a similar manner using the totals from all sections combined. $Y/(Y+N)$

Significant Risk. A significant risk is an existing on-the-ground condition resulting from failure to correctly implement BMPs, that if left unmitigated will likely result in an adverse change in the chemical, physical or biological condition of a waterbody. Such change may or may not violate water quality standards.

Subjective Score.

No Effort: Substantial erosion as a result of operations. Sedimentation in streams. Temporary stream crossings not removed. No SMZ when needed, etc. Poor attitude evident about the job.

Poor: Some effort at installing BMPs. Generally poor quality construction or no effort in certain locations which suffer from erosion, stream sedimentation, etc. Substantial lack of BMPs in a particular emphasis such as roads, skid trails or SMZ.

Fair: (1) Generally a pretty good effort at BMPs. Poor application procedures perhaps. Lack of BMPs in a particular emphasis but with moderate consequences. (2) No BMPs on a site which requires few BMPs but has some resultant minor problems.

Good: (1) BMPs generally installed correctly. Guidelines generally followed. Allows for some failures of BMP devices or failure to observe guidelines but with light consequences. (2) Good quality job which required no BMPs and has few problems.

Excellent: (1) BMPs installed correctly. Guidelines followed. (2) Some BMPs implemented even when they might not have been required. Few if any problems exist.

Follow up Questions

Was activity supervised by a professional forester or representative? Check Yes, No, or NA

Who? If yes, list name of individual.

Was landowner familiar with BMPs? Check Yes, No, or NA.

Has logger attended BMP workshop? Check Yes, No, or NA

Were BMPs included in the contract? Check Yes, No, or NA

Is landowner a member of TFA? Landowner Association? Other? Check Yes, No, or NA

Organization: If yes, list name of organization.

Was timber delivered to SFI mill? Check Yes, No, or NA

Does landowner have a forest management plan? Check Yes, No, or NA

Is remediation planned by the landowner? Check Yes, No, or NA.

Date: If yes, include date of planned remediation.

Summary of Responses to BMP Compliance Monitoring Checklist Items, All Sites, Round 7

I. General Landowner and Tract Information

<u>Owner type</u>		<u>Forester type</u>		<u>Activity</u>	
Family Forest Owner	45	Industry / Corporate	47	Regeneration Harvest	
Absentee	45	Private Consultant	49	Clearcut	87
Corporate	52	Public	7	Partial	1
Industry	3			Thin	45
Public (Fed, State)	7			Site Prep only	19

II. Site Characteristics

<u>Terrain</u>		<u>Erodibility hazard</u>		<u>Type stream present</u>	
Flat	36	Low	48	Perennial	12
Hilly	115	Medium	95	Intermittent	68
Steep	1	High	9	Both	32
				None	40

<u>Distance to nearest permanent water body</u>		<u>Predominant soil series/texture</u>			
< 300'	81	Clay	1	Sandy loam	103
300 - 800'	5	Clay loam	15	Sand	10
800 - 1600'	4	Loam	23		
1600' +	62				

III. Permanent Roads

119 applicable

	<u>Yes</u>	<u>No</u>	<u>NA/NN</u>	<u>Sig. Risk</u>
1. Respect sensitive areas	117	1	34	0
2. Roads meet grade specs	119	0	33	0
3. Rutting within allowable specs	118	1	33	0
4. Well drained with appropriate structures	93	22	37	1
5. Ditches do not dump into streams	101	2	49	0
6. Roads reshaped and stabilized	100	19	33	0

IV. Skid Trails/Temporary (secondary) Roads

95 applicable

	<u>Yes</u>	<u>No</u>	<u>NA/NN</u>	<u>Sig. Risk</u>
1. Slopes less than 15%	94	1	57	0
2. Respect sensitive areas	91	3	58	0
3. Roads well drained with water bars or other water control structures	67	21	64	0
4. Roads stabilized	76	18	58	0
5. Rutting within allowable specs	84	11	57	0

V. Stream Crossings

<u>On Permanent Roads</u>		<u>Yes</u>	<u>No</u>	<u>NA/NN</u>	<u>Sig. Risk</u>
34 applicable					
1. Crossings Avoided or minimized		34	0	118	0
2. Stream crossings correct		19	1	132	0
3. Stream crossings stabilized		15	5	132	2
4. Stream free of sediment		21	1	130	1
<u>On Temporary Roads</u>					
80 applicable					
5. Crossings avoided or minimized		75	5	72	0
6. Stream crossings correct		55	4	91	0
7. Temporary crossings removed		40	19	93	5
8. Stream crossings and approaches stabilized		32	25	95	6
9. Stream free of sediment		49	13	90	1

VI. Streamside Management Zones		112 applicable		
	<u>Yes</u>	<u>No</u>	<u>NA/NN</u>	Sig. Risk
1. Present on permanent stream	43	1	108	0
2. Present on intermittent stream	92	8	52	0
3. SMZ adequately wide	74	37	41	0
4. Thinning within allowable specs	85	21	46	0
5. Minimize harvesting bank trees	103	9	40	0
6. SMZ integrity honored	104	6	42	0
7. Stream clear of debris	101	11	40	1
8. Stream free of sediment	111	1	40	0

VII. Site Preparation		56 applicable		
	<u>Yes</u>	<u>No</u>	<u>NA/NN</u>	Sig. Risk
1. Respect sensitive areas	51	2	99	1
2. No soil movement on site	56	0	96	0
3. Firebreak erosion controlled	20	0	132	0
4. SMZ integrity honored	43	2	107	0
5. Windrows on contour/free of soil	9	0	143	0
6. No chemicals off site	32	0	120	0
7. Machine planting on contour	31	1	120	0
8. Stream free of sediment	43	1	108	0

VIII. Landings		114 applicable		
	<u>Yes</u>	<u>No</u>	<u>NA/NN</u>	Sig. Risk
1. Locations free of oil/trash	103	11	38	0
2. Located outside of SMZ	92	0	60	0
3. Well-drained location	114	0	38	0
4. Number and size minimized	113	1	38	0
5. Respect sensitive areas	114	0	38	0
6. Restored/stabilized	112	1	39	0

IX. Wetlands		17 applicable		
	<u>Yes</u>	<u>No</u>	<u>NA/NN</u>	Sig. Risk
1. Avoid altering hydrology of site	17	0	135	0
2. Road drainage structures installed properly	14	0	138	0
3. Mandatory road BMPs followed	11	0	141	0

X. Overall Compliance				
	<u>Yes</u>	<u>No</u>	<u>NA/NN</u>	Sig. Risk
III. Permanent Roads - 94%	648	45	219	1
IV. Skid Trails/Temporary Roads - 88%	412	54	294	0
V. Stream Crossings - 82%	340	73	953	15
VI. Streamside Management Zones - 88%	713	94	409	1
VII. Site Preparation - 98%	285	6	925	1
VIII. Landings - 98%	648	13	251	0
IX. Wetlands - 100%	42	0	414	0

Follow-up Questions				
	<u>Yes</u>	<u>No</u>	<u>NA/NN</u>	
Was activity supervised by a professional forester?	103	49	0	
Was landowner familiar with BMPs?	100	52	0	
Has logger attended BMP workshop?	122	8	22	
Were BMPs included in the contract?	111	34	7	
Is landowner a member of TFA, CFLOA, ATFS, etc.?	81	58	13	
Was timber delivered to SFI mill?	91	31	30	
Does landowner have a forest management plan?	108	44	0	
Does landowner plan to reforest?	98	3	51	