

Forestry Best Management Practices for Water Quality Protection in Arkansas

Implementation Report



Arkansas Forestry Commission
March 2005

Executive Summary

The Arkansas Forestry Commission (AFC) surveyed the implementation of voluntary forestry Best Management Practices (BMPs) on 249 sites comprising 20,280 acres. These sites were selected from a pool of 500 candidate sites representing a sample of typical forest operations that occurred statewide between September 2002 and March 2004.

Overall BMP implementation on the sites monitored was 88 percent compared to 83 percent for the 2000 - 2001 survey. In general, implementation was highest on public and forest industry sites and lowest on private non-industrial sites. Federal tracts averaged 99 percent implementation, state tracts averaged 96 percent implementation, industrial sites averaged 93 percent implementation, and private non-industrial forest landowners (PNIFLOs) averaged 80 percent implementation. Statistically, there was no significant difference in the implementation rate of BMPs on federal, industrial, or state lands while PNIFLOs scored significantly lower.

Implementation rate by physiographic region:

- Delta - 93 percent
 - Ozark – 86 percent*
 - Ouachita – 90 percent*
 - Southwest – 89 percent*
- * No statistically significant difference

Implementation rate by BMP category:

- Harvesting – 96 percent
- Regeneration – 84 percent
- Roads – 84 percent
- Streamside Management Zones – 84 percent

Implementation rate was statistically higher on PNIFLO tracts if:

- Professional foresters assisted the landowner
- The landowner expressed familiarity with BMP guidelines
- The landowner required a written sales contract for the harvest
- The landowner required implementation of BMPs during harvest

BMP implementation was generally lowest on PNIFLO surveyed sites if:

- No professional assistance was provided for the forest operation
- Neither BMPs nor a written contract were required for harvest
- The harvest occurred in the Ozark region of the state

Improvements needed on all ownership classes were:

- Water-bars and rolling dips on skidtrails
- Construction of firelines in SMZs by hand or back-blading
- Water-bars on firelines
- Seeding and mulching where needed to stabilize soil

BMP implementation rates for roads:

- Was lowest in the Ozark region
- Increased more than 30 percent on PNIFLO ownership when landowners received BMP information from a forester
- Was highest on Federal ownership

Significant improvements from previous surveys include:

- Increase in implementation rate by each BMP category
- Ninety-nine percent of loggers surveyed reported receiving BMP training
- Industrial and public ownerships had very high and statistically identical implementation rates

Acknowledgements

The AFC acknowledges the following individuals and groups for their contributions to this survey:

Mr. John Greis, Environmental Specialist, with the U. S. Forest Service in Tallahassee, Florida for his assistance with development of the survey questionnaire.

Dr. Ron McNew, Statistician, University of Arkansas at Fayetteville, Arkansas for his assistance in statistical analysis and reporting of survey data.

The landowners who, through granting access to their lands, made this survey possible.

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Background and Objectives

The 1972 Clean Water Act required states to establish a program to encourage implementation of Best Management Practices (BMPs) to control non-point sources of pollution. Reauthorization of this Act in 1987 additionally required states to develop methods for determining and measuring effectiveness of these voluntary BMP guidelines.

The AFC is responsible for the State's Forestry BMP program and has relied on a voluntary program of implementation based on training and education of forest landowners and users. Initial forestry BMP guidelines were developed in the early 1970s. Forest erosion data obtained through soil loss monitoring, and information gathered investigating forestland complaints was the basis of the first education and training efforts.

In 1996, Arkansas adopted BMP implementation survey procedures developed by the Southern group of State Foresters titled *Silviculture Best Management Practices Implementation Monitoring, a Framework for State Forestry Agencies*. This document provided a framework for monitoring BMP implementation that is statistically sound, objective, technically feasible, and consistent with BMP program efforts in all 13 southern states.

Objectives of the implementation monitoring program include:

1. Measuring, documenting, and reporting the statewide extent of implementation of forestry BMPs.
2. Evaluating the general effectiveness of BMPs as applied operationally in the field.
3. Determining the need and direction of forest BMP education and outreach programs.

This report documents findings of the fourth BMP implementation survey which was performed from March, 2003 until June 2004. The AFC completed and published its first implementation report in May, 1998, the second in July, 1999, and the third in 2001.

This fourth survey differs from the previous three surveys in that new BMP guidelines were adopted March 16, 2002, and a new BMP Implementation Questionnaire Form was developed to match these new guidelines. The new form does a better job of measuring the implementation of BMPs recommended in the new guidelines. The fourth survey looks at four major BMP categories, compared to six in the old form. The number of questions in each category changed.

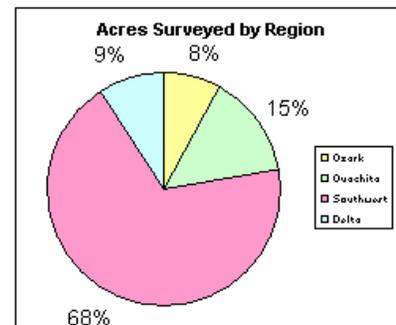
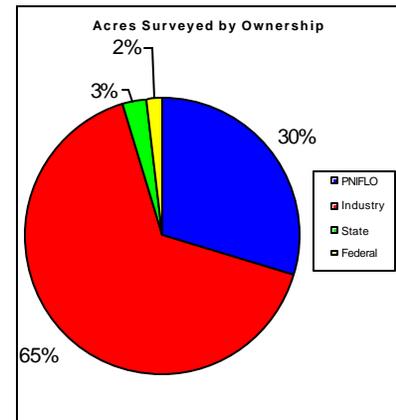
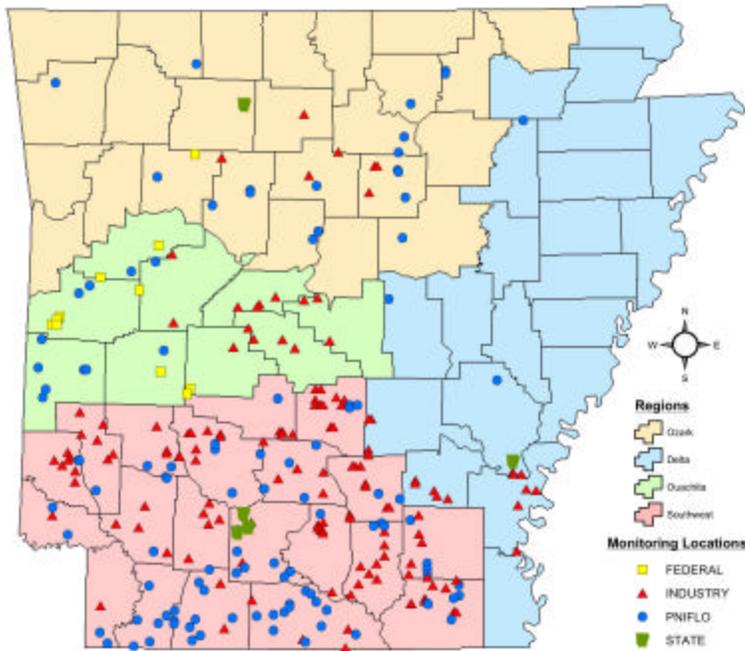
Survey Methods

The fourth survey was conducted according to the publication “*Silviculture Best Management Practices Implementation Monitoring, a Framework for State Forest Agencies*” adopted in 1996.

Site Selection

Prior to the survey AFC personnel identified more than 500 harvested sites. From this pool, 249 tracts were randomly selected for the actual implementation survey. Distribution of selected sites was based on 2001 timber severance tax records (Appendix, page 29). Statistical analysis from previous surveys indicated this sample size would yield results within a 95 percent confidence level.

Monitoring Site Distribution



AFC personnel received landowner permission and completed information sheets for each candidate site. Sites were selected without regard to ownership. Only sites representing typical silvicultural operations and not land conversions were used. Final harvest tracts were preferred, as they reflected maximum potential for erosion.

Site Characteristics

PNIFLOs owned 102 of the sites surveyed, forest industry owned 130 of the sites, the U.S. Forest Service owned 11 of the sites, and the State of Arkansas owned 5 sites.

The survey recognized four physiographic regions of the state: Ouachita, Ozark, Delta, and Southwest. Seventy percent of the survey sites were located in the Southwest region. The Ouachita region contained fourteen percent of the sites, the Ozark region had nine percent, and the Delta Region had seven percent of the sites.

Two hundred twenty-one tracts surveyed were final harvest cuts, sixteen were thinned, and twelve tracts were seed tree harvest. The BMP implementation rate on final harvest tracts was 88 percent, on thinned tracts 90 percent, and on seed tree harvests 98 percent.

Professional foresters were involved in silviculture treatments on all industrial, state, and federal tracts surveyed. Professional foresters were involved in 84 of 102 PNIFLO tracts surveyed.

Monitoring Personnel

As in previous AFC implementation surveys, the BMP Forester completed all site evaluations. The use of one trained experienced person in performing the survey insured consistency of the data acquisition and control of the survey process.

Prior to monitoring, all site owners or their representatives were contacted and invited to participate in the survey. In most cases involving industrial and public ownership site survey, the BMP Forester was accompanied by a landowner representative. In most cases involving PNIFLO sites, no landowner representative was present.

Monitoring Questionnaire

The monitoring questionnaire was revised to reflect new BMP guidelines adopted in March, 2002.

The questionnaire contains 67 questions divided into four BMP categories: Streamside Management Zones, Roads, Harvesting, and Regeneration. All questions were taken verbatim from the new BMP guideline book. Reference numbers given each question match section and sub-section numbers for the applicable BMP recommendation in the book. Each question was worded so that a positive answer was recorded with a Yes while a departure from BMP recommendations received a No response. Answers for questions that did not apply were indicated by NA.

A final score, expressed as a percent of positive answers versus total answers, was given to each tract. Compiling data from all tracts allowed analysis of statewide BMP implementation. Analysis of BMP implementation for tract ownership and state physiographic region was also conducted.

Significant Risk

Each question also included a determination of significant risk. A significant risk is a situation or set of conditions that has resulted in or very likely will result in the significant and measurable degradation of water quality, and can be remedied or otherwise mitigated.

No significant risks were noted during this survey.

Statistical Analysis of Data

As with any survey, samples are taken to estimate the true answer. Accuracy of the estimate is affected by the number and uniformity of the samples taken. In this BMP Implementation Survey each result is accompanied by a margin of error. Statistical analysis of the samples indicates the true number will be within this margin of error 95 percent of the time.

To allow comparison of the results one has to know if the differences are real or a result of sampling error. Statistical significance is also reported to allow comparison of the reported results. Analysis of variance and multiple t-tests were performed on the survey data. Statistically significant differences were those which occurred at a five percent probability level. That is, with 95 percent confidence, one can claim differences are significant and not a result of sampling error.

Overall BMP Implementation

Data was grouped within four major BMP categories: Roads, Harvesting, Regeneration, and Streamside Management Zones (SMZs). Overall implementation percent and percent by these major categories is presented below.

Table 1: Overall BMP implementation summary

Category	Number of Tracts	Implementation Percent	Margin of Error	Statistical Significance*
Roads	183	84.21	3.31	b
Harvesting	248	95.77	1.17	a
Regeneration	109	84.31	4.31	b
Streamside Management Zones	185	83.63	3.33	b
Overall Implementation Rate	249	88.08	1.69	

* Implementation percents having a different significance letter are significantly different at the 5 percent probability level.

The category of Harvesting had a significantly higher BMP implementation rate than the BMP categories of Roads, Regeneration, and SMZs. This higher rate indicates forest operators have a good knowledge of the recommended BMPs and implemented them during the operation of timber felling, skidding, and location of landings.

The categories of Roads, Regeneration, and SMZs all had an implementation rate of 84 percent, which is significantly lower than the Harvesting category. The recommended BMPs for these categories generally require specialized equipment and as a result cost more to implement than those recommended in the Harvesting category. The higher cost might explain the lower scores for these categories

In general, for the Roads and Regeneration categories, implementation of BMP close-out procedures needed the most improvement. Observation during survey noted the lack of water-bar installations where needed, and poor construction of water-bars when present. Water-bars are a BMP soil stabilization practice implemented in close-out operations for non-active roads, skid-trails and fire-lines. Correct water-bar installation and spacing requires technical skill, plus the use of specialized equipment such as a bulldozer. All harvest operations utilize skidders, while not many utilize a bulldozer. On the majority of sites surveyed, operators utilized skidders for harvest operations and water-bar construction, an action that usually resulted in improper and ineffective water bars.

For the SMZ category, excessive harvest of timber within SMZs caused the most concern. Incorrect identification of ephemeral versus non-ephemeral streams was the main issue. Also a lack of knowledge that SMZs are recommended for lakes and ponds contributed.

BMP Survey Results

Roads

The Road category has historically scored low in comparison to other categories. The high cost of construction has often resulted in a lack of Road BMP implementation on forestlands, especially for PNIFLOs.

Proper road construction is a result of good planning and is usually done prior to the start of the logging operation. If not implemented properly, roads are the category of recommended BMPs that have the most potential of contributing sediment to Arkansas' streams.

As in previous surveys, the highest implementation of forest road erosion control measures was observed on federally owned tracts, 98 percent (Table 10, page 32). The lowest implementation of recommended erosion control measures was found on PNIFLOs, 69 percent (Table 7, page 31).

Table 2: Forest road survey results

Road BMPs	Number of Tracts	Implementation Percent	Margin of Error
3.12. Roads located to avoid or minimize stream crossings?	157	99.36	1.27
3.13. Streams were crossed at right angles?	110	100	0
3.14 Where topography permitted, roads were located along the contour and along the crest of long ridges?	169	97.63	2.35
3.25. Side cast or fill material placed above the ordinary high water mark of any stream, except where necessary to stabilize stream crossings?	45	95.56	6.21
3.27. Seeding and mulching were employed in a timely manner to reduce erosion?	84	29.76	10.04
3.36a. Water turnouts, broad-based dips or rolling dips in-stalled before a stream crossing to direct road runoff water into undisturbed areas of the SMZ?	77	80.52	9.09
3.36b. Roads, with the exception of stream crossings, located outside the SMZ?	149	98.66	1.89
3.42. Erodible areas, where natural vegetation is not sufficient to stabilize the soil, revegetated or stabilized?	38	60.53	16.07
3.48. Where needed, roadbed reshaped and all drainage systems opened when all forestry activities were completed?	166	92.77	4.03
3.52. On roads, temporary crossing structures removed and stream banks stabilized and restored after use?	21	61.9	21.72
3.53. Permanent stream crossings used bridges, culverts, shelf rock fords, geoweb, concrete slabs or other materials?	78	96.15	4.38

3.54. Low water ford banks are stable and stream bottoms are hard?	44	81.22	11.76
3.55. Except at stream crossings, equipment kept out of streambeds?	138	98.55	2.04
3.56. Are concrete slabs installed and functioning properly?	5	100	0
3.61 Broad-based dips present where needed?	107	97.2	3.21
12.10 Broad-based dips properly constructed?	106	100	0
3.71. Rolling dips present where needed?	43	55.81	15.33
12.20. Rolling dips properly constructed?	24	91.67	11.53
3.83. Wing ditches present where needed?	123	80.49	7.18
12.30. Wing ditches constructed and functioning properly?	104	96.15	3.79
3.85. Wing ditches not feeding directly into adjacent drainage, gullies, or channels?	103	98.06	2.73
3.90. Culverts present where needed?	99	89.9	6.09
3.92. Culverts installed properly?	90	94.44	4.86
12.40. Appropriate culvert size used?	90	90	6.36
3.97. Where needed, aggregate or other suitable material used on approaches to fords, bridges, and culvert crossings?	79	92.41	6.00
13.10. Water bars present as specified on inactive roads?	101	60.40	9.78
4.13. Water bars installed and functioning properly?	66	83.33	9.25
4.14. Sufficient distance left between outflow discharge of waterbar and stream to allow "sediment fallout"?	63	98.41	3.17
Forest Roads Implementation Rate	183	84.21	3.31

In this survey, all questions in the Road category scored above the 80 percentile range with the exception of those questions associated with lack of soil stabilization and temporary road stream crossings. Generally, better attention was paid to BMP implementation prior to and during harvest. Usually, BMP implementation was poorer for close-out operations. Note questions 3.27, 3.42, 3.52, 3.71 and 13.10

Areas of most concern:

- Lack of seeding and mulching where needed to prevent excessive erosion
- Lack of removing temporary stream crossings structures or stabilizing stream banks after use
- Lack of rolling dips where needed
- Lack of water bars on closed roads

Failure to implement water-bars and rolling dips can be associated with the lack of proper equipment or the lack of expertise to construct the structures where needed. Interviews with loggers indicated the failure to implement the structures occasionally were a result of the

landowner’s request. In those instances the landowner desired vehicle access to the harvested tract.

Generally, permanent road stream crossings were properly implemented. However, at temporary low water fords often left logs and soil in the stream channel. This can be attributed, again, to improper close-out procedures, and on occasional sites, landowner request for access to these areas.

Harvesting

The category of Harvesting scored significantly higher than the other three categories. Recommended BMPs for basic timber removal were generally implemented to a high degree. All landowner groups implemented these recommended BMPs very well (Tables 7, 8, 9, and 10, pages 31 and 32). Specific BMPs implemented well included log landings, skidding on contours, and removal of litter.

High scoring of Harvest BMPs can be attributed to the large number of loggers trained by the Arkansas Timber Producers Association (ATPA) as required by the Sustainable Forestry Initiative Program (SFI) which is supported by the industrial forest landowners.

Areas of most concern: (see questions 5.17, 5.47, and 5.53)

- Lack of water bars on closed skid trails
- Lack of removal of temporary fill material from stream beds and stabilization of stream banks on closed skid trails
- Lack of rolling dips on skid trails

As in the Road Category, better attention is paid to the implementation rate of BMPs associated with active logging sites. More attention is needed to install the proper BMPs after the logging job is complete.

Table 3: Harvesting survey results

Harvesting BMPs	Number of Tracts	Implementation Percent	Margin of Error
5.17 Are water bars constructed on skid trails per specifications in Table 13.1, Figure 13.1, page 46?	40	45	15.93
5.23. Are the size and number of log landings minimized?	237	100	0
5.24. Are landings located away from SMZs on firm level ground?	193	97.14	2.06
5.25. Are landings located on dry sites so natural drainage disperses water onto the forest floor but not into a stream?	236	98.31	1.68
5.41. When skidding, where contours followed to the greatest extent possible?	140	97.14	2.83
5.43. Skid trails on slopes have occasional breaks in grade or logging slash that disperses water?	85	95.29	4.62

5.44. At skid trail stream crossings, soil not used as a temporary fill material when water was in the stream?	63	88.89	7.98
5.47. On skid trails temporary fill material removed from stream beds and stream banks stabilized?	55	63.64	13.09
5.48. No skid trails in stream channels?	191	100	0
5.52. Was skid trail construction minimized at grades greater than 30 percent?	30	100	0
5.53. On grades greater than 30 percent, were frequent rolling dips installed?	7	28.57	36.89
5.62. Litter, such as oil cans, grease containers, crankcase oil filters, old tires, and used fluids absent from the site?	247	96.36	2.39
Harvesting Implementation Rate	248	95.77	1.17

Regeneration

The category of Regeneration consists of reforestation and site preparation activities. Site preparation normally occurs on final harvest tracts and involves operations that prepare the ground for the reforestation efforts that follow. Standard site preparation operations consisted of chemical application of herbicides to remove competing vegetation, mechanical ground clearing to remove competing vegetation, a combination of both these methods, or, on some tracts, simply burning the timber residue following harvest. To restrict these fires to the site, control the rate of burning, and protect SMZs from intensive heat, fire-lines are installed, usually by bulldozer.

The sampled sites on State and Federal lands did not have a final harvest and as a result did not have a score for the regeneration category. Industry tracts did score better than the PNIFLO tracts (Tables 7, 8, 9, and 10, pages 31 and 32).

Table 4: Regeneration survey results

Regeneration BMPs	Number of Tracts	Implementation Percent	Margin of Error
6.15. Has intensive site preparation been avoided on soils the NRCS has identified as highly erodible?	71	95.77	4.81
6.16. Existing water control devices (i.e. culverts, wing ditches) not damaged?	57	98.25	3.51
6.17. Heavy equipment operations avoided in wet soil conditions?	83	98.80	2.41
6.18. Did Intensive site preparation follow the contours of the land?	46	91.30	8.40
7.11. Forest chemicals apparently excluded from SMZs?	55	81.82	10.50
8.11. Machine planting follows the contour of the land?	0	0	0
8.13. No evidence of machine planting equipment crossing or turning around in roads, road ditches, and wing ditches?	0	0	0

10.12a. Fire lines installed parallel to streams and not plowed through the SMZ?	40	65	15.28
10.12b. Firelines within the SMZ constructed by hand?	12	8.33	16.67
10.13. On final harvest cuts, when slopes of the site exceed 20 percent, individual fire strips do not exceed 300 feet in width between ignition and burnout?	9	77.78	29.40
10.34. On slopes exceeding 5 percent, and at approaches to streams and roads, were water bars installed in fire lines according to the BMP recommendations for skid trails?	37	27.03	14.80
Regeneration Implementation Rate	109	84.31	4.31

The average BMP implementation score for the category of Regeneration was the same as for Roads, 84 percent. All questions that scored below the 80 percentile range concerned practices associated with site preparation burning.

Areas of most concern:

- Fire lanes plowed through the SMZ
- Fire lines not constructed by hand in the SMZ
- Fire strips greater than 300 feet on steep slopes
- Lack of water bars on fire lanes after close out

The potential for erosion on firelines is high and approximately equal to forest roads, since they consist of exposed mineral soil. Firelines are recommended to follow contours, but are often located on or parallel to land boundary lines. These lines have high potential for erosion since they are plowed without regard to contours. In some cases the firelines may be straight up or down hill.

Soil stabilization is very important to the prevention of erosion on firelines. In the Regeneration category, one BMP that received little implementation included constructing firelines in the SMZ by hand. Where firelines were noted in the SMZ, they were virtually all plowed by blade or fireplow.

Occasional burned sites were surveyed where excessive erosion of mineral soil had occurred. Lack of protective organic residue, plus presence of cracked rocks indicated that extreme temperatures had resulted from the burn process. Regulating the width of fire strips can control the intensity of the burn and its consequent erosive potential.

As in the categories of Roads and Harvesting, water bars are not being installed. One difference in this category is that proper equipment is available, since bulldozers are used to construct firelines and are necessary to construct proper water bars. Training and education efforts will help create a knowledge and awareness of the problems associated with fire lanes.

Streamside Management Zones

One hundred eighty-five survey sites of the 249 sampled contained non-ephemeral streams (perennial or intermittent). This is consistent with past surveys and highlights the need for water quality protection in silviculture operations. Overall, 84 percent of the recommended BMPs were properly implemented in the SMZ category. This is the same as the Roads and the Regeneration categories.

Table 5: Streamside Management Zone survey results

Streamside Management Zone BMPs	Number of Tracts	Implementation Percent	Margin of Error
2.11. Minimum SMZ width (35') present for SMZs bordered by land with less than 7 percent slope?	151	78.81	6.67
2.12. Minimum SMZ width (50') present for SMZs bordered by land with slopes 7-20%?	42	92.86	8.04
2.13. Minimum SMZ width (80') present for SMZs bordered by land with slopes > 20 percent?	8	100	0
2.14a. Basal area of residual trees in SMZ meet guidelines?	162	77.16	6.62
2.14b. Spacing of SMZ overstory trees meet guidelines?	165	74.55	6.80
2.16. SMZ trees removed in a manner that minimizes disturbance to the forest floor, exposure of mineral soil, or reduction of stream bank stability?	134	90.30	5.13
2.18. Absence of significant logging debris in stream channel?	177	85.31	5.34
2.19. Absence of toxic and hazardous materials such as fuels, lubricants, and solvents in SMZs?	183	100	0
2.23. Mechanical site preparation did not disrupt the ephemeral stream channel?	57	71.93	12.01
2.31. SMZ provided between braided stream channels as well as the prescribed SMZ width adjacent to the most exterior channels?	12	83.33	22.47
2.41. Appropriate SMZ provided for lakes and ponds?	10	40	32.66
2.51. Trees growing directly on the bank or overhanging a water body were not cut?	156	80.13	6.41
2.52. Mineral soil not exposed by prescribed fire?	30	86.67	12.62
2.53. SMZ is free of log decks?	181	98.90	1.56
2.55. Cave entrances and sinkholes free of logging debris?	1	100	0
6.12. Boundaries of all SMZs defined where site preparation occurred?	121	74.38	7.97
Streamside Management Zone Implementation Rate	185	83.63	3.33

Areas of most concern:

- SMZ width less than specified, especially on operable terrain
- Basal area less than specified and/or spacing of leave trees not even
- Ephemeral stream channels disturbed by mechanical site preparation practices
- Lack of SMZs for lakes and ponds
- SMZ boundaries not defined for site preparation practices

One should note that question 2.19, which addresses the presence of toxic or hazardous materials in the SMZ, scored 100 percent. Loggers and landowners are doing a good job of cleaning up the logging jobs, especially in SMZs.

It is generally recognized that SMZs protect water quality. However, the high value of the wood products within these zones can lead to over-harvest. Utilization of timber within SMZs is certainly tempting, especially for PNIFLOs. PNIFLOs scored lower in the SMZ category than industry or either of the government landowners. However, to protect water quality, the BMP recommendation is to leave a minimum of 50 square feet of basal area per acre. If there is less than 50 square feet in the SMZ, it is recommended that no harvesting take place. Leave trees should be evenly spaced throughout the zone.

The AFC recommends three widths of SMZs for non-ephemeral streams. These width classes vary by the slope adjacent to the stream and are reflected in questions 2.11, 2.12, and 2.13 in Table five. Of special note is the fact that the highest implementation score for proper SMZ width occurred in the steepest slope category.

In contrast the survey indicated the SMZ width on lesser slopes was not as good as on the steeper slopes. Observation of the steeper sites, slopes exceeding 50-60 percent, indicate SMZs greatly exceeded the minimum recommended widths of 80 feet due to being too steep for equipment to operate. Slopes of lesser degree were operable to the point all timber was accessible for those operators or landowners inclined to over-harvest for the value of the forest products they contained.

The two lowest implementation rates in the SMZ category were noted for the lack of SMZs afforded lakes and ponds, and mechanical site preparation disrupting ephemeral stream channels. Recommendation of SMZ coverage for lakes and ponds is a new guideline effective with this survey. A lack of knowledge of this guideline is contributing to its' failure of implementation.

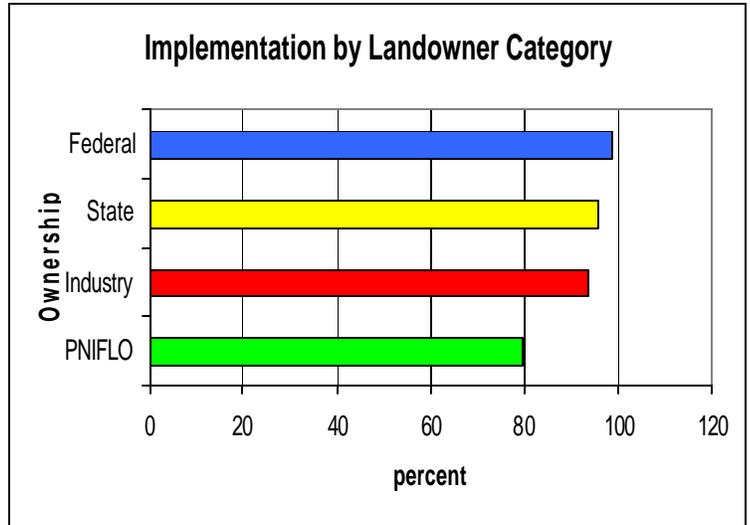
An intact forest floor along ephemeral streams is recommended, however, unless the mechanical operator lifts the blade or plow of the equipment when crossing the channel of the stream, erosion that leads directly to a non-ephemeral stream occurs. Logger BMP training is extensive, but site preparation operators are not specifically targeted.

Landowner Implementation

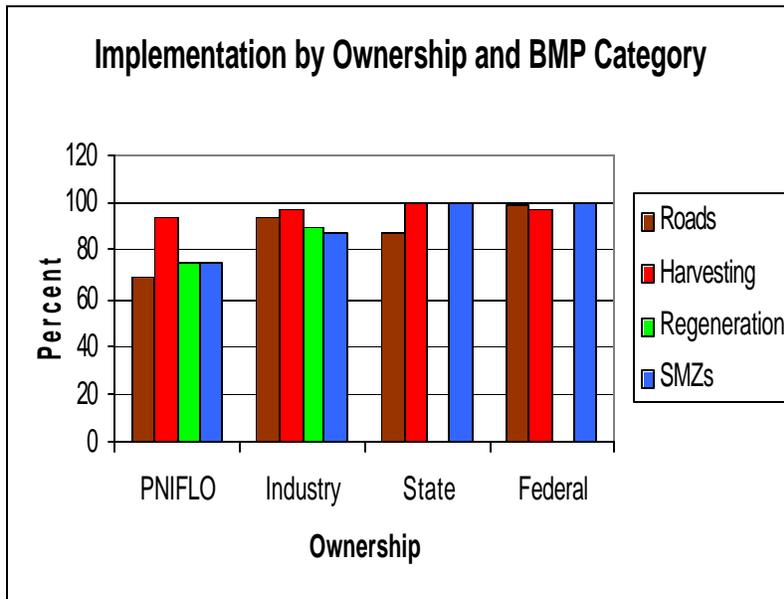
Landownership was grouped in four major categories: Industrial, Federal, State, and PNIFLO. All classes of forest land ownership scored higher BMP implementation rates than in past surveys.

PNIFLO

Though implementation rates are at an all time high, the PNIFLO score of 80 percent was significantly lower than other classes of forestland ownership. Industrial, federal and state ownerships scored above 90 percent. PNIFLOs owned 41 percent of the sites surveyed and as a group need the most improvement in how they implement recommended BMPs (Table 6, page 31). Increased emphasis is needed to reach PNIFLOs with the message of the benefits of proper BMP implementation.



By primary category of BMPs, PNIFLO implementation rate for every BMP category was lower than the other classes of forest ownership (Tables 7, 8, 9, and 10, pages 31 and 32). The Harvesting category, as was true for all classes of forest ownership, had the highest score. This is consistent with the Overall Implementation Ratings presented in Table 1 on page 10 and the explanation given is especially true for PNIFLOs.



PNIFLO implementation rates for the primary category of Roads had the lowest score and is where the most improvement is needed (Table 7, page 31). Survey observations of Roads on PNIFLOs indicated an extensive use of old, existing roads rather than construction of new roads. Most old existing roads were not constructed according to current BMP guidelines.

Industry

Although industry averaged 93 percent implementation, versus 99 percent for federal ownership, and 96 percent for state ownership, statistically, there was no significant difference between implementation rates (Table 6, page

31). Proper BMP implementation for all three of these ownerships is very good. Federal and state land has always scored very well in the past and has set the standard. Industry's increased emphasis on proper BMP implementation is reflected in their better performance for this survey.

Industrial BMP implementation rate was significantly higher for the primary BMP categories of Roads and Harvesting (Table 8, page 31). A good road system and strong industry certification program has resulted in a high score for these two categories. Companies with forest land certification programs that require BMP training for loggers have a higher degree of BMP implementation.

The primary BMP categories of Regeneration and SMZs scored significantly lower than Harvesting on industrial lands (Table 8, page 31). Survey observations and discussions with industrial foresters indicate that lower SMZ implementation rates may be due to interpretation of ephemeral versus non-ephemeral streams. Also, regeneration activities that involve site preparation are predominant on industrial ownerships. Survey observations indicate these activities present a larger profile of opportunity for lack of BMP implementation.

State

State forest land ownership represented only two percent of total tracts and three percent of total acres surveyed. Five tracts were surveyed (three were AFC property and two were Game and Fish property). The Regeneration category was not applicable to the scoring process since all tracts surveyed were select harvest or thinned. One hundred percent of the recommended BMPs for Harvesting and SMZ were implemented properly.

Federal

Federal lands surveyed for BMP implementation were National Forest lands located in the Ouachita and Ozark National Forests. As in the category of State ownership, no tracts surveyed were final harvests and there was no indication of any site preparation done, therefore the BMP category of Regeneration was not applicable.

Eleven federal sites were surveyed which represented four percent of the tracts and 2 percent of the acres surveyed. Scores for all BMP categories were very close to 100 percent. As in past surveys, federal lands set the gold standard for others to follow.

PNIFLO Questionnaire

In Arkansas' BMP surveys, PNIFLOs have consistently had lower implementation scores in comparison to other landowner categories. This landowner group owns approximately 60 percent of the commercial forestland in Arkansas, and provides the same ratio of wood product that is produced annually in the state. In view of that fact, it is a priority that actions are taken to bring BMP implementation rates for this group to the level of other forest land ownership classes.

In an attempt to find answers and determine direction for future education efforts, PNIFLOs were polled about their BMP awareness during their forest operations. The effect that BMP awareness, or lack of it, has on BMP implementation rates on PNIFLO lands are revealed in the following tables.

Table 11: *Question 1 - Was professional forestry assistance provided?*

	Number	Acres	Implementation Percent	Margin of Error	Statistical Significance*
Yes	84	5,189	82.08	3.05	a
No	18	856	68.58	8.08	b

* Implementation percents having a different significance letter are significantly different at the 5 percent probability level.

The majority of PNIFLOs responded in the affirmative when asked if they did seek professional assistance when performing forest operations. For the group that had forestry guidance, a statistically significant increase of 13 percent in BMP implementation resulted. The message is clear: PNIFLOs need to be contacted and made aware of BMP guidelines.

Table 12: Implementation rates for landowners that received professional assistance.

	Number of Tracts	Acres	Implementation Percent	Margin of Error	Statistical Significance*
Roads	58	3,994	75.45	6.05	b
Harvesting	84	5,189	94.80	2.46	a
Regeneration	35	2,196	74.81	8.67	b
SMZs	59	3,774	76.67	6.49	b

* Implementation percents having a different significance letter are significantly different at the 5 percent probability level.

Table 13: Implementation rates for landowners that did not receive professional assistance.

	Number of Tracts	Acres	Implementation Percent	Margin of Error	Statistical Significance*
Roads	14	690	44.24	17.65	c
Harvesting	18	856	86.99	6.31	a
Regeneration	3	281	78.33	23.33	ab
SMZs	9	442	63.90	17.12	bc

* Implementation percents having a different significance letter are significantly different at the 5 percent probability level.

For those PNIFLOs that did not receive professional forestry assistance, the implementation rates for Roads, Harvesting, and SMZs were all lower than for those who received assistance. This is especially true for the Road category, where most improvement is needed. There was a 31 percent decrease in BMP implementation in the Road category for PNIFLOs who did not receive professional assistance. Said another way, when PNIFLOs received professional help, BMP implementation for roads improved 31 percent which is a larger increase than any other category. Yet, even with professional help BMP implementation for PNIFLO roads still need the most improvement. There was also more than a 13 percent decrease in the SMZ category for PNIFLOs who did not receive professional assistance.

Table 14: Forester groups providing assistance to PNIFLOs.

Foresters	Number	Acres	Implementation Percent	Margin of Error	Statistical Significance*
AFC	23	1,247	79.62	5.17	a
Industrial	17	1,221	87.25	6.88	a
Consultant	44	2,721	81.36	4.36	a

* Implementation percents having a different significance letter are significantly different at the 5 percent probability level.

PNIFLOs were polled and asked if they had received professional forestry assistance in their forest operation, they were also asked which of the three forester groups, AFC, Industry, or Consultant, provided the assistance.

As seen in Table 14, results of the poll indicated the Forest Consultants group provided the most assistance. Statistically, there was no significant difference in the BMP implementation rates for landowners no matter which group provided the assistance.

Table 15: *Question 2* - Was the landowner familiar with BMP guidelines?

	Number	Acres	Implementation Percent	Margin of Error	Statistical Significance*
Yes	72	4,612	81.85	3.43	a
No	29	1,394	73.65	5.9	b

* Implementation percents having a different significance letter are significantly different at the 5 percent probability level.

Table 15 indicates that most landowners surveyed were familiar with BMP guidelines. For those PNIFLOs that merely expressed familiarity with the BMP guidelines, their forest operations scored a statistically significant eight percent higher implementation rate than for those PNIFLOs not familiar with the guidelines. Clearly, landowners need to be made aware of BMP guidelines.

Table 16: *Question 3* - Did the landowner require a written sales contract for the timber harvest?

	Number	Acres	Implementation Percent	Margin of Error	Statistical Significance*
Yes	80	4,802	81.39	3.29	a
No	21	1,205	74.43	7.15	b

- Implementation percents having a different significance letter are significantly different at the 5 percent probability level.

Table 16 reveals the majority of PNIFLOs required written sales contracts for their forest operations. These landowners scored a statistically significant seven percent higher BMP implementation rate than for those PNIFLOs that did not have a sales contract. As with having professional assistance and being familiar with the BMP guidelines, having timber sales contracts increases PNIFLO BMP implementation.

Implementation by Physiographic Region

Implementation rates within four major Arkansas land divisions were compared for this survey.

Table 18: Implementation rate by physiographic region

Region	Number of Sites	Acres	Implementation Percent	Margin of Error	Statistical Significance*
Ozark	23	1,619	82.91	7.48	b
Ouachita	38	2,942	87.09	5.25	ab
Southwest	174	13,858	88.67	1.83	ab
Delta	14	1,861	91.99	5.01	a

* Implementation percents having a different significance letter are significantly different at the 5 percent probability level.

The Delta Region scored the highest BMP implementation rate (Table 22, page 24). However, only 14 tracts comprising 1,861 acres were surveyed. None of the tracts surveyed in the Delta had a final harvest. In contrast the forestry “bread basket” of the state, the Southwest Region, scored only four percent less. The Southwest region had 174 tracts surveyed that comprise nearly 14,000 acres. Together the Southwest and Ouachita regions comprised 84 percent of the sites sampled.

Statistically, there was no significant difference between the Ozark, Ouachita, and Southwest Regions in BMP implementation rates.

The Ozark Region had a significantly lower implementation rate than the Delta. Observation of sites during the survey indicated the Ozark Region is in most need of education and training in BMP awareness.

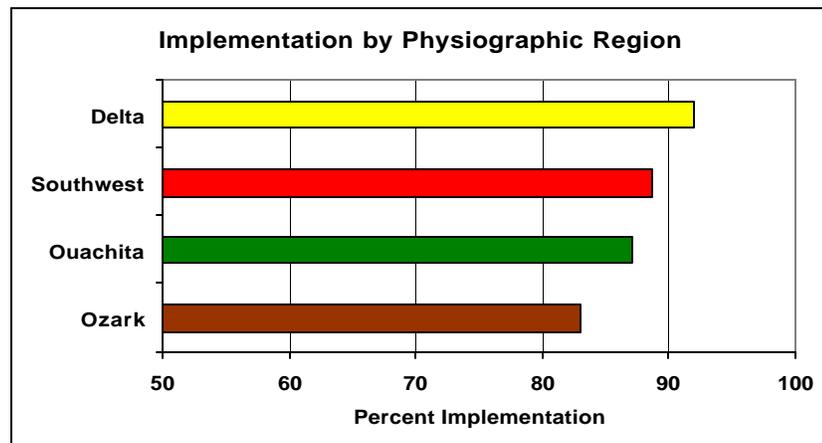


Table 19: Ozark Region

Category	Number of Tracts	Acres	Implementation Percent	Margin of Error	Statistical Significance*
Roads	20	1,436	72.23	14.88	b
Harvesting	23	1,619	93.27	4.49	a
Regeneration	7	617	91.19	8.51	ab
SMZs	10	866	85.68	13.69	ab

* Implementation percents having a different significance letter are significantly different at the 5 percent probability level.

In the Ozark Region, implementation of BMPs in the Road category scored significantly lower, by more than 20 percent, than the Harvesting category. This is a direct reflection of the expense, and expertise, required for BMP implementation in this steep Region.

The steep slopes of the rugged Ozark Region require the ultimate in BMP implementation, expertise, and expense. If BMP recommendations are properly applied in this mountainous terrain high numbers of various soil stabilization techniques, such as rolling dips, turnouts, water bars, and artificial revegetation practices are a necessity.

Table 20: Ouachita Region

Category	Number of Tracts	Acres	Implementation Percent	Margin of Error	Statistical Significance*
Roads	36	2,887	85.43	8.19	b
Harvesting	38	2,942	95.35	2.44	a
Regeneration	17	1,917	83.07	9.95	ab
SMZs	28	2,559	80.42	10.24	b

* Implementation percents having a different significance letter are significantly different at the 5 percent probability level.

The Ouachita Region, like the Ozark Region, is mountainous, though the terrain is not as steep or rugged as the Ozarks. Pine is the predominant timber type, and as a result there is a much larger forest industry influence. The same could be said for the Southwest Region. Pine is also the predominant timber type and there is a very large forest industry influence. However, the coastal plain dominates the Southwest region and the terrain is much less rugged. It is impressive that all four BMP categories scored very well in both the Southwest and Ouachita Regions where most of the harvesting operations occur. One could assume a large forest industry influence committed to the principals of the Sustainable Forest Initiative (SFI) of the American Forest and Paper Association (AF&PA) increase BMP implementation rates regardless of the terrain.

Table 21: Southwest Region

Category	Number of Tracts	Acres	Implementation Percent	Margin of Error	Statistical Significance*
Roads	117	10,196	85.12	3.63	b
Harvesting	173	13,674	95.97	1.45	a
Regeneration	82	6,396	83.40	5.26	b
SMZs	137	11,506	84.71	3.52	b

* Implementation percents having a different significance letter are significantly different at the 5 percent probability level.

Since the Southwest and Ouachita regions led the state in timber production and in number of tracts surveyed, BMP implementation rates, by BMP category, parallel the statewide rates as shown in Table 1, page 10.

Table 22: Delta Region

Category	Number of Tracts	Acres	Implementation Percent	Margin of Error	Statistical Significance*
Roads	10	1,636	93.21	5.39	ab
Harvesting	14	1,861	98.57	2.86	a
Regeneration	3	144	100	0	ab
SMZs	10	1,361	75.75	22.34	b

* Implementation percents having a different significance letter are significantly different at the 5 percent probability level.

Logger Training

BMP Logger Training, conducted by the Arkansas Timber Producer’s Association, has been ongoing since 1995. At the date of this report 11,968 individuals, representing 19 states are on record as having received BMP training. On tracts selected for the implementation survey, AFC personnel were asked to determine if the logger had received BMP training prior to harvesting the tract.

Table 23: Loggers trained prior to harvesting a tract.

	Number	Acres	Implementation Percent	Margin of Error	Statistical Significance*
Yes	234	19,190	88.74	1.68	a
No	3	116	78.14	17.88	a

* Implementation percents having a different significance letter are significantly different at the 5 percent probability level.

Unlike past surveys, virtually all loggers (99 percent) reported having received prior BMP training. It is extremely difficult to find active loggers that have not received BMP training. The BMP implementation score for the extremely low number of loggers not receiving training may not be representative of how loggers would perform without BMP training. Even though these few loggers did not receive formal training, they are aware of the importance of implementing BMPs.

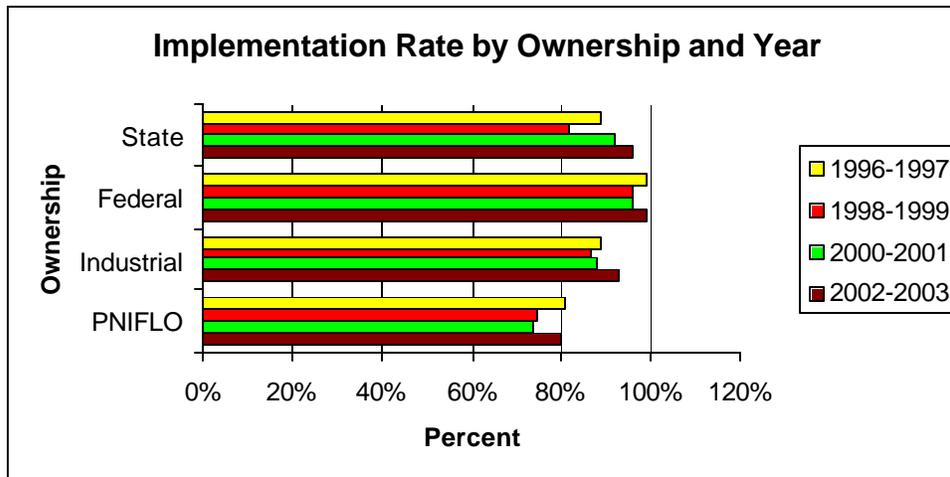
Historical versus Current BMP Implementation Scores

This fourth implementation survey averaged 88 percent implementation, five percent higher than the 2000 - 2001 survey average of 83 percent.

BMP implementation rates increased for all classes of ownership, all categories of BMPs, and all four Regions of the state surveyed.

This increase in implementation rates can be attributed to two factors. First and foremost, the increased use of forestry BMPs in Arkansas forest operations. The second is the new survey form that was developed to better represent the new BMP guidelines. More BMP recommendations are addressed in the new survey form, some of which are common and easily implemented. These BMPs may have always been implemented, but were captured for the first time with the new survey form.

On the positive side, there is no doubt that a high BMP implementation rate is occurring due to the stringent guidelines adopted by forest companies under their respective forest certification programs.



BMP implementation rates for the PNIFLO ownership category have consistently lagged behind the implementation rates of other ownership categories.

Conclusion

Statewide forest BMP implementation rates have remained in the lower 80 percentile range for the past two surveys. The survey average leaped to 88 percent, an increase of five percentage points, since the last survey. Implementation in all landowner categories showed improvement.

The advent of forest industry certification programs such as AF&PA's Sustainable Forest Initiative has had a major positive impact on implementation of BMPs. Ninety-eight percent of the loggers surveyed received BMP training by the Arkansas Timber Producer's Association. Industrial land BMP implementation rate increased from 88 percent in the 2000-2001 survey to 93 percent in this survey. Statistically, forest industry lands scored as well as both Federal and State lands surveyed.

Of major importance are the statistics that highlight the increase in BMP implementation when PNIFLOs are educated and are involved with the professional forest community. Since this landowner component scored significantly lower in implementation than the other landowner groups, and the fact that they own and provide approximately 60 percent of Arkansas woodlands and wood products, it is of primary importance that state and industrial education efforts be centered on this group. The training that has been emphasized for loggers need now be directed toward the PNIFLO base of Arkansas.

Four major physiographic regions of Arkansas, the Ozark, Ouachita, Delta, and Southwest, were checked for implementation. There were no significant differences in BMP implementation by regions except for the Delta, which scored significantly higher, but had very little volume harvested compared to the other three regions of the state. No final harvests were surveyed in the Delta.

The Ozark region showed the lowest BMP implementation score for the Roads category. This predominantly hardwood region of PNIFLOs will receive increased harvest attention in future years. BMP training and education efforts need to increase in the Ozark Region.

Overall, BMP training needs more emphasis for close-out procedures. BMP implementation for the harvesting category is consistently high in all regions and for all landowners. BMPs implemented after the harvest is complete need to improve. Implementation of water bars whether for roads, skid trails, or fire lanes needs improvement. Artificial regeneration of areas subject to erosion also needs to be implemented more. All training and education efforts need to emphasize these BMPs.

Appendix

Wood Harvest and Distribution of Implementation Survey Sites	29
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Wood Harvest and Distribution of Implementation Monitoring Sites.

Delta Region	2001 Annual Harvest (Tons)	Number of Sites
Arkansas	139033	2
Chicot	52747	1
Clay	29827	0
Craighead	14216	0
Crittenden	37652	0
Cross	21755	0
Desha	384474	3
Greene	7540	0
Jackson	3996	1
Jefferson	480591	3
Lawrence	10407	0
Lee	71484	0
Lincoln	268445	4
Lonoke	31660	0
Mississippi	1724	0
Monroe	45450	0
Phillips	63922	0
Poinsett	19022	0
Prairie	51795	0
St. Francis	25985	0
Woodruff	5746	0
Total Delta	1,767,471/8%	14 / 7%

Ouachita Region	2001 Annual Harvest (Tons)	Number of Sites
Garland	306797	4
Logan	102827	3
Montgomery	432868	2
Perry	290474	5
Polk	282686	6
Pulaski	154178	2
Saline	340414	5
Scott	421311	6
Yell	443032	5
Total Ouachita	2774587/ 12%	38/ 14/%

Ozark Region	2001 Annual Harvest (Tons)	Number Of Sites
Baxter	19677	0
Benton	6986	0
Boone	24318	0
Carroll	24861	0
Cleburne	300060	3
Conway	186057	2
Crawford	26982	0
Faulkner	47525	2
Franklin	40790	1
Fulton	8327	0
Independence	127,366	2
Izard	48,681	1
Johnson	145,008	3
Madison	94,934	1
Marion	40,319	1
Newton	73,542	2
Pope	158,623	4

Randolph	17,973	0
Searcy	62,024	2
Sebastian	44,666	0
Sharp	41,620	0
Stone	146,324	2
Van Buren	184,150	5
Washington	47,487	1
White	134,849	2
Total Ozark	2,053,149/ 9%	23 / 9%

Southwest Region	2001 Annual Harvest (Tons)	Number Of Sites
Ashley	1,198,231	13
Bradley	1,177,990	12
Calhoun	633,741	8
Clark	979,084	11
Cleveland	867,300	10
Columbia	806,377	11
Dallas	1,033,203	9
Drew	1,154,349	10
Grant	1,694,837	13
Hempstead	557,431	5
Hot Spring	375,791	3
Howard	663,477	8
Lafayette	429,235	6
Little River	434,329	3
Miller	534,150	3
Nevada	570,729	10
Ouachita	891,534	9
Pike	569,418	6
Sevier	578,289	8
Union	1,448,257	16
Total Southwest	16,597,752 / 72%	174/ 70%
Grand Total State-2001	23,192,599/ 100%	249/100%

Tables

Table 6: Implementation by Landowner Category

Ownership	Number of Sites	Acres	Implementation Percent	Margin of Error	Statistical Significance*
PNIFLO	102	6,045	79.7	3.05	b
Industry	131	13,258	93.43	1.34	a
State	5	652	95.57	4.2	a
Federal	11	325	98.77	1.15	a

* Implementation percents having a different significance letter are significantly different at the 5 percent probability level.

Table 7: PNIFLO implementation rate by BMP category

Category	Number of Tracts	Acres	Implementation Percent	Margin of Error	Statistical Significance*
Roads	72	4,684	69.38	6.58	b
Harvesting	102	6,045	93.42	2.37	a
Regeneration	38	2,267	75.09	8.13	b
SMZs	68	4,216	74.98	6.11	b

* Implementation percents having a different significance letter are significantly different at the 5 percent probability level.

Table 8: Industrial Implementation by BMP Category

Category	Number of Tracts	Acres	Implementation Percent	Margin of Error	Statistical Significance*
Roads	95	10,494	93.6	1.92	ab
Harvesting	130	13,074	97.3	1.12	a
Regeneration	71	6,807	89.24	4.61	bc
SMZs	107	11,274	87.59	3.86	c

* Implementation percents having a different significance letter are significantly different at the 5 percent probability level.

Table 9: State Implementation by BMP Category

Category	Number of Tracts	Acres	Implementation Percent	Margin of Error	Statistical Significance*
Roads	5	652	87.75	14.92	a
Harvesting	5	652	100	0	a
Regeneration	0				
SMZs	4	612	100	0	a

* Implementation percents having a different significance letter are significantly different at the 5 percent probability level.

Table 10: Federal Implementation by BMP Category

Category	Number of Tracts	Acres	Implementation Percent	Margin of Error	Statistical Significance*
Roads	11	325	98.65	1.42	a
Harvesting	11	325	97.56	3.28	a
Regeneration	0				
SMZs	6	190	100	0	a

* Implementation percents having a different significance letter are significantly different at the 5 percent probability level.

Table 18: Implementation by Physiographic Region

Region	Number of Sites	Acres	Implementation Percent	Margin of Error	Statistical Significance*
Ozark	23	1,619	82.91	7.48	b
Ouachita	38	2,942	87.09	5.25	ab
Southwest	174	13,858	88.67	1.83	ab
Delta	14	1,861	91.99	5.01	a

* Implementation percents having a different significance letter are significantly different at the 5 percent probability level.

Table 24: Implementation Rate by Ownership and Year

Survey Year	Land Ownership Category			
	PNIFLO	Industrial	Federal	State
2002-2003	80%	93%	99%	96%
2000-2001	74%	88%	96%	92%
1998-1999	75%	87%	96%	82%
1996-1997	81%	89%	99%	89%