AN EVALUATION OF TIMBER HARVEST PLANNING TRAINING ON LOGGING QUALITY IN THE VIRGINIA PIEDMONT

by

Gregory S. Meade

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APPROVED:

R.M. Shaffer, Chairman

W.M. Aust

R.G. Oderwald

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Gregory S. Meade

Robert M. Shaffer, Chairman

Department of Forestry

(ABSTRACT)

Interest in BMP-related logger education and training has increased dramatically in recent years. Harvest planning is a critical component of forestry water quality BMPs. All states’ BMP manuals recommend written timber harvest plans, and several states require them by law. The objective of this study was to evaluate the impact of harvest planning training and the use of written timber harvest plans on BMP compliance, landowner satisfaction and weather-related downtime in the Virginia Piedmont. Nine randomly chosen loggers (study group) from the Virginia Piedmont participated in two days of intensive harvest planning field training. Nine additional loggers were randomly chosen as a control group. Study loggers prepared and followed written timber harvest plans for the 29 tracts they harvested during the 8-month study period immediately following the training. Study Group loggers outperformed Control Group loggers for mean BMP compliance (90% vs. 86%), mean landowner satisfaction (3.54/4.0 vs. 3.27/4.0), and mean weather-related downtime (10% vs. 13%). Absolute scores for all evaluation criteria for both groups were good, and differences, though statistically significant, were relatively small, leading to conclusions that:

- Loggers in the Virginia Piedmont are generally doing a good job.

- Loggers in the Virginia Piedmont are planning their operations, whether a written plan is required or not.

- Harvest planning training and written harvest plans can marginally improve BMP compliance, landowner satisfaction and weather-related downtime, even for loggers who are already performing well.
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INTRODUCTION

Logger training has become an important issue to the forest industry. The American Forest and Paper Associations "Sustainable Forestry Initiative" (SFI) requires member firms to "establish training programs for loggers by January 1, 1996, and report annually the number of loggers trained" (AF&PA 1995). The forest industry generally believes that logger training and education is important and has substantially increased its level of support. With this increase in logger training comes the need to justify the training. Meaningful evaluations are one of the few ways that training can be properly justified.

Logger training is not a new concept. Loggers have been trained at various times and locations in everything from bookkeeping to chainsaw safety. Training has been conducted by experienced loggers, private or public foresters, and college professors. Training has often been directed at increasing the profitability of the logging operation, decreasing accidents and injuries, or reducing environmental impacts to the forest resource.

Training can make the logger more efficient and profitable, and is also in the best interest of the entire forestry community. Trained loggers are likely to be more dependable for supplying a steady flow of wood to the forest industry. Trained loggers
are also more likely to follow environmental regulations because they understand what the regulation is designed to do and why it is important. Today’s modern logger must deal with high overhead costs, a shrinking labor pool, equipment maintenance and repair, and environmental regulations. Successful loggers must have varied knowledge and skills, many of which can be enhanced by appropriate training and education.

Few studies have been conducted to evaluate the effects of logger training. With increased effort going into training and education, an increased amount of evaluation is warranted. These training evaluations must be conducted properly and the results reported honestly, so improvements can be made in the content and delivery of logger training and education.

A documented case of successful logger training and education is Virginia’s voluntary Best Management Practices (BMP) program. With the pending reauthorization of the federal Clean Water Act, forestry Best Management Practices have become increasingly important in many states. More than 1,000 Virginia loggers have participated in a BMP workshop. The success of Virginia’s BMP training for loggers is undeniable, as BMP compliance went from less than 50% at the start of the program in 1988 to the present compliance level of over 90% (Reisinger 1994). As illustrated by this dramatic improvement in BMP compliance, logger training can be very effective.
Another issue in the forestry community is increased regulation of timber harvesting. Loggers are already faced with a significant amount of regulation, such as safety standards, hauling, insurance, and environmental regulations. Some states, such as California, West Virginia, Maryland, and Massachusetts, have enacted State Forest Practices Acts that require written harvest plans be submitted and approved by a state agency or agencies. States that do not require written harvest plans are under pressure from the Environmental Protection Agency (EPA) to make harvest plans mandatory (EPA 1973).

With the importance placed on logger training and harvest planning, it is natural that interest in training loggers in the subject of harvest planning has increased. Training in harvest planning for loggers should introduce them to basic planning principles they can readily apply to their own equipment spread and site conditions. The training should be specific enough to identify common problem areas all loggers must contend with, such as stream crossings and deck locations.

This increased interest in logger training and harvest planning, as well as the debate over the pros and cons of requiring loggers to prepare and submit written pre-harvest plans to satisfy regulatory requirements, provide the impetus for this study. The study objective is to determine the effects of harvest planning training and the preparation of written, formal harvest plans on BMP implementation, landowner satisfaction and weather-related downtime for loggers in the Virginia piedmont.
LITERATURE REVIEW

LOGGER TRAINING

Logger training has become such a relevant topic that several recent meetings and conferences have been dedicated to determining the best methods such as the 1996 American Pulpwood Association conference on logger training in Atlanta. State agencies, forest industry, universities, forest associations and councils, and the Extension Service are all interested in providing loggers with quality education and training (Shaffer 1996). This effort has been for the betterment of the logger themselves as well as to improve the public’s perception of production forestry.

Logger education has been approached at three levels. The broadest level is the national level, where programs such as LEAP, “Logger Education to Advance Professionalism”, have been endorsed and funded by the United States Department of Agriculture (McEvoy 1995). There have also been numerous national conferences dedicated to logger education, such as the 1996 American Pulpwood Association conference on logger training. The state level is probably the most widespread means of logger education. Virtually every state where logging is important now has a statewide logger education program in place. For example Tennessee’s “Master Logger” program, North Carolina’s “Pro Logger” program, and Virginia’s “Forestry and Harvesting
Education” program (McEvoy 1995). Most of these state-level programs have several things in common. They tend to be administered by the state department of forestry, state extension service, and/or state forestry association. There is also a local or regional level of logger training often supported by a state or local “loggers council”.

With the majority of logger education programs conducted by state agencies or similar non-profit organizations, logger education is usually provided to loggers at a very low cost or no cost at all. However, some groups offer logger education as a “for profit” business. The most notable example is Soren Eriksson’s “Game of Logging” program (Jarvis 1993).

Logger education programs have been offered in many different subjects, from safety to business skills to Best Management Practices. Obviously with such diverse topics, each training opportunity should be approached individually. Complicating the training is the fact that loggers have different types of operations, work under varied conditions, and have varying experience and skill levels. However there are certain basic guidelines and strategies that have been successfully used to produce meaningful, quality training.

Richard Lewis, American Pulpwood Association President, described several key points that he feels are vital to successful logger training (1995). The most important
point is that the goal must be well understood. Regardless of the type of training being offered, the primary goals should be to increase the logger's knowledge, skill and ability, and pride. Lewis feels that everyone involved in training must realize and appreciate the vital part loggers play in the management of the forest. Lewis also believes that the planning phase must include loggers to ensure its success. Previously educated or outstanding loggers should be considered for training instructors.

Past experiences offer the best guidelines for future training programs. John Garland, timber harvesting extension specialist at Oregon State University, has twenty years of experience in logger training. Over time he has developed guidelines that he follows when developing logger training (Garland 1992).

- The first point is to determine if the problem is important.
- If everyone involved feels the issue is not important, it is doomed from the beginning.
- If the issue is important enough to warrant attention, it must then be determined if education is part of the solution to the problem.
- For education to be effective, there must be an understandable and demonstrable goal.
- Perhaps one of the most important areas to focus on when developing a training program is knowledge of the audience. Extension education is normally a one or two day program with little time allowed for getting to know the audience and making changes during the
program. Personal experience and good background information can overcome this problem.

- Training programs often have logistical problems. Materials, location, trainers, and funding are all very important and require attention.

- The instructors are key to the program's success. "Train-the-trainer" events are useful in assuring that the instructors are qualified to conduct the program.

Evaluation of the program cannot be overlooked. Sufficient time should be allowed for evaluation at the event (Garland 1992). Obtaining evaluation forms once the participants leave the program requires a monumental effort. For post-session evaluation, Garland recommends the following three questions:

1. What percentage of the information was new to you?

2. What percentage of the information will you be able to apply in your present circumstances?

3. After this program will you be able to... (perform the objective of the training, i.e. layout designated skid trails)?

These questions and any others that are relevant can be used to evaluate the training and seek improvements. For evaluation of behavioral changes, a scientific study is required, making this type of evaluation difficult to obtain.
A Minnesota study surveyed loggers on preferred training topics and the best methods of implementing the training (Smidt and Blinn 1994). One hundred and ten loggers were surveyed by telephone. The results were broken into two groups, Northern and Southeastern Minnesota loggers. The study found that nearly all the Northern loggers had attended some type of educational program while only 33 percent of Southeastern loggers had participated. Loggers offered several suggestions to increase attendance at training sessions. These included stumpage discounts, field sessions, and the chance to share views with other participants. Loggers are more inclined to attend training sessions on safety and environmental regulations such as BMP training. Loggers named program content, applicability of information, and quality of the instructors as being key factors for a successful program.

Using the results of the survey, a systematic approach was developed for conducting logger education (Smidt and Blinn 1994). Key points to consider when implementing logger training are:

1) Establish program goals that provide a clear sense of direction and a basis for evaluation.

2) Identify specific target audiences.

3) Assess the needs of each audience.

4) Establish specific learning objectives for each audience.
5) Design and implement learning experiences for each audience.

6) Conduct evaluations on an ongoing basis.

Other key points mentioned as being important to successful training include, presenting only topics than can be successfully developed, and considering that loggers are not accustomed to a classroom environment. Trainers should use interaction, repetition of key points, and specific examples when in the classroom. However classroom time should be limited to a minimum amount and field sessions should be used as often as possible.

A number of successful logger training and education programs have been documented.

Shaffer (1992) describes lessons learned from participating in Virginia’s BMP logger education program. He stresses the necessity for the instructor to establish credibility with the audience. For example, to educate loggers on BMPs the trainer must not only understand the BMP regulations, but must understand logging in general. Other points are to keep the problem and solution in perspective, and avoid an “I know what’s best for you” attitude. Making sure that those being educated are part of the educational planning process can help ensure that the attitude of the trainer and trainee is favorable to a learning environment.
Anderson (1992) describes how loggers were trained and motivated to adopt new methods of timber felling. Cash incentives were given to loggers who adopted the training. Loggers were visited by the training sponsors at unannounced times, and were evaluated on the job as to their use of the new felling techniques. Depending on how the timber cutter scored, he could receive a cash bonus payment. Accordingly, worker compensation rates for the trainees dropped, safety equipment use increased, log quality improved, and more loggers were selected to receive training (Anderson 1992).

A relatively new area of logger training is silviculture education. Previously, safety and production skills were the most common areas of training. The need for silviculture education for loggers has been seen and answered, most visibly with a national Extension Service program called LEAP, “Logger Education to Advance Professionalism” (Bihun and Jones 1993). This program attempts to introduce loggers to forest management ideas and methods. Many foresters feel that since loggers are the people implementing the majority of forest practices, they should have a basic understanding of how their operations affect the forest. It is hoped that this training will allow loggers to conduct silviculturally sound harvesting when foresters are not involved in the process.

In Tennessee’s Master Logger program, silviculture training was initially received by the loggers with little enthusiasm. However, by the end of the training loggers
generally agreed the silviculture program was the best part of the program, which also included safety, business management, and other areas (Bihun and Jones 1993).

Silviculture training for loggers has been successful for various reasons. Many loggers see it as an opportunity to improve their public image, and allow them to understand what they are being asked to carry out in the woods. Other loggers point to the fact that voluntary training of this type could help keep more regulations out of logging. To initially attract loggers to silviculture training, it has often been linked with other successful programs such as BMP training (Bihun and Jones 1993).

Some training programs attract logger participants by placing them on special “referral lists” after they have completed the training. These lists are usually distributed by a state agency such as the Extension Service. In Vermont, loggers who completed the silviculture education program were placed on a list made available to landowners interested in contacting loggers (McEvoy 1993). This is obviously a benefit to the logger in generating potential clients.

National Woodlands, a publication for forest landowners, has promoted logger training as something that forest landowners should support (Johnson 1993). Johnson explains the types of training that are available for loggers, and extensively describes his experience of attending a training session conducted by Soren Erikson on timber felling.
Johnson makes the analogy of a trained logger being much like a trained doctor. He explains that you would not want "just anybody" removing your appendix, and you should not want "just anybody" to remove your timber. Johnson recommends trained loggers as the first choice for harvesting a landowner's timber.

TRAINING EVALUATION

Training and development has been described as "The $100-Billion Opportunity" (Phillips 1990). Training and education is an all-industry-wide occurrence, and several practical guides for evaluating training have been developed. The following section describes basic evaluation processes that can be applied to any type of training, including logger training.

Before any meaningful evaluation can occur, there must first be a sound reason for the evaluation. One obvious reason for an evaluation is to justify the training program. There would be no need to continue a program not meeting its goals. Another reason is to determine if the benefits of the training outweigh the costs of the training. Determination of the trainee's long term retention of the training is another reason for evaluation (Salinger and Deming 1982).
Once it has been determined that an evaluation of training is needed, the training itself must be planned accordingly. Phillips (1990) describes four common problems of training evaluation:

* Lack of commitment by upper management. The evaluation effort must be supported throughout the organization.

* Inappropriate program design. Programs may be centered around the interests of the trainer, not the interests of the group being trained. This often leads to ineffective programs and inconclusive evaluations.

* Lack of evaluation know-how. There has been relatively little published in the field of evaluation, compared to training and development publications.

* Uncontrollable variables affecting job performance. Training programs typically are designed to change job performance. Jobs today are becoming increasingly more complicated, and attributing a change in job performance solely to training is difficult.

Critical decisions need to be made when planning an evaluation. These areas are described in detail by Dopyera and Pitone (1983).

* What is the purpose of the evaluation? The two common reasons for evaluation are justification and determination. Many evaluations fall under justification, such as the Return on Investment of training, i.e. did the training improve the profitability of those trained? Evaluations that stem from determination efforts tend to be very useful. Several
examples of determination evaluations are: Training needs assessment, Program improvements, Impact evaluation, and Evaluation process, which determines if the evaluation itself is effective.

- What will be measured? The most common measurement is on the training delivery. A post training questionnaire can gauge the reaction to the trainer, content, materials, and facilities. This type of evaluation is useful in judging the acceptance of training. However, it does not assess if any learning as taken place. Many evaluators are interested in knowledge transfer, and measuring that transfer. A pre-test/post-test can provide an easy method to collect knowledge transfer data. However, testing can be viewed negatively by the trainees, and could cut down on training participation. Whereas testing does measure knowledge transfer, it does not measure behavior changes. The surest way to measure knowledge transfer is to evaluate the training after the trainee returns to the workplace. This is also the most costly and time consuming method.

- How comprehensive will the evaluation be? This can be answered by the purpose of the training and the support available. Obviously a long-term evaluation cannot exist without sufficient funding or communication. A long-term study will need more planning and support to be effective. Short-term evaluations may be needed so that immediate results can be obtained.
- Who has the authority and responsibility? This is an important aspect of evaluation that can easily be overlooked. Will the same group that was responsible for the training also be responsible for the evaluation? Outside consultants and research universities are “third party” options available for evaluation. Whenever choosing the evaluating group several criteria should be considered.

- Is there adequate money allocated for outside assistance?
- Does the proposed evaluation group have the expertise and credibility in this field?
- Can the evaluating group gain the required data for analysis?
- Is the evaluating group objective, regardless of the results?

If these questions can be satisfactorily answered, than the evaluation should go smoothly and efficiently.

- From where will the data come? Most often the data will come directly from the participants, in the form of test results, opinions, and actions. Managers responsible for the trainees are good sources for evaluating the trainees back on the job. An often overlooked source of data is the customers. Customer satisfaction ratings are important to some studies.

- How will the data be collected and compiled? After the source of data is determined, the next logical step is determining the best method for collection of the data. The timing of data collection is critical, particularly if the analysis is going to include pre-test data.
Another consideration is using an experimental design that includes a treatment and a control group. The amount of data collected could affect how the data is collected. Based on the specific needs for the study there are several methods for collecting data. The following are proven ways to gather data, with points to consider included:

- Interviews, when well constructed and conducted in the proper manner, can provide quality data.

- Questionnaires provide more consistent data because all respondents are exposed to the same questions. Questionnaire design is crucial to prevent it from being confusing.

- Observations provide objective data on job performance but can be time consuming and expensive to gather.

- Tests are easy to score and interpret. Results are easy to compile and review. However, tests are not received well by all and can be met with resistance.

- How will the data be analyzed and reported? The audience is a major consideration when preparing a report for release. The data should be analyzed as to provide the best information possible. Accuracy of the data and analysis are extremely important and can not be over-emphasized. When preparing the report it is important to remember who the client is, and to aim the report towards the client.
The above outline can provide the basis for virtually any training evaluation. However, there are certain key areas and special situations in training evaluation that can discussed in more detail.

One area receiving increased attention as the money invested in training increases is the training “return on investment” (ROI). Some organizations may consider training worthwhile as long as it breaks even, or shows a slight positive return. Other organizations are looking at training as an investment and are not satisfied with a marginal return. What ROI each organization is willing to accept is an individual consideration. Before any meaningful ROI calculations can take place, the available evaluation data must be transformed into money values (Phillips 1990).

Transforming hard data, such as output, savings, time, and improved quality, is considerably easier to convert to dollars than soft data, such as opinions and estimation. When calculating any type of return of training, an accurate cost for training must be determined. The cost of training should include the fee paid to the trainers, as well as the lost production, if any, of the trainees. Care should be taken when assigning value to soft data, such as opinion surveys. This type of information is subjective and can be met with skepticism if the values appear unrealistic. The process of assigning values to soft data must be carefully explained and supported by other studies if possible. A conservative estimate will often be received easier by critics and improves credibility (Phillips 1990).
Once values have been assigned there are several options for the specific type of calculation conducted. Some organizations are interested only in ROI, which calculates annual savings compared to the average investment over the useful life of training. Calculating the payback period for the training is often considered when training effects are long term. Other organizations may be more concerned with accident prevention, which may be difficult to value.

Calculating a return on training should be done with caution and careful consideration. This type of evaluation is not practical for all training, and applying such evaluation to unsuitable training will produce unreliable results. When assigning values to data, caution must be used so as not to credit an improvement to training when other factors may have influenced the improvement.

There are several factors that are out of the control of trainers. For example, the management of an organization has a great deal of control of the success of a training and development program. For a meaningful training program, management must be fully committed. This commitment includes allowing personnel the time to attend, financial backing for the training, willingness to adapt the new changes to the workplace, and a show of support by attending training sessions (Phillips 1990).
What happens to an evaluation after it is conducted? The results should be communicated first to the sponsoring organization. The evaluation results can do several good things for a training program. Among them are program justification, funds for more training, program credibility, increased interest in training, and verification of the importance of program evaluation (Phillips 1990)

When training does not produce the desired results, a diagnosis must be conducted on the training and evaluation procedure. Bakken and Bernstein (1982) have developed five sources of frequent training or evaluation failure:

1- Training objectives were not clearly stated.

2- Course content was not relevant to objectives.

3- Course content was not based on appropriate assumptions about how adults learn.

4- Training was not properly delivered.
   - Instructors lacked skills or expertise
   - Other factors such as the audience interfered with program delivery.

5- Organizational factors prevented transfer of training to the job site.
LOGGER TRAINING EVALUATIONS

Literature dealing strictly with logger training evaluation is very limited. Considering the large amount of money and effort placed on training loggers, very little effort has been spent on evaluation. One of the few logger training programs that has been formally evaluated is Mississippi’s Logger Safety Training Project (Doolittle 1993).

Mississippi’s Logger Safety Training Project was designed to provide logging employees the initial safety training for a mechanized logging operation as required by Federal OSHA regulations (Doolittle 1993). The training project also supplied the logging contractors and supervisors with detailed information informing them about OSHA requirements, and providing the necessary materials needed to organize a company safety program.

Before the training took place, twenty logging crews were randomly selected from those who had pre-registered for the training. These twenty crews were evaluated before and after the training sessions. A safety checklist was developed from the training material for the following five logging tasks: skidder operator, feller-buncher operator, loader operator, chain saw operator, and bulldozer operator. The same safety checklist was used for both the pre and post-training inspections, and the inspections were conducted by
personal thoroughly experienced with logging equipment, operations and safety requirements (Doolittle 1993).

On the twenty crews, 119 individual employees were evaluated, with the majority being skidder operators, chain saw operators, and loader operators. Eight bulldozer operators and sixteen feller-buncher operators were evaluated.

The post-training evaluations found that all groups showed improvement in their overall safety compliance rates. The study found a ten percent increase in the percentage of acts performed safely, from a pre-training score of 64 percent to a post training score of 74 percent. Skidder, feller-buncher, and loader operators improved by more than ten percentage points, while chainsaw operators and bulldozer operators improved by five percentage points or less.

Even with improvements noted in all groups, each group still had at least one area with high deficiencies. For the skidder operators, only 19 percent of those evaluated were using ear protection, and feller-buncher operators were only in compliance with this requirement 25 percent of the time. Loader operators were below 50 percent compliance in two areas, (1) securing the boom when not in use and (2) wearing a hard hat. Chain saw operators, traditionally those at greatest risk to injury, were the worst group for compliance in the before and after training safety checks. Over one-half of the chain saw
operators were not complying with the majority of the safety checks. Bulldozer operators made the smallest improvement after the training, of two percentage points, and most failed to wear a seat belt and hearing protection.

Although the training in Mississippi created positive results for overall safety compliance, several areas were uncovered that had very low compliance rates, even after direct exposure to proper methods. The evaluation proved that in the short term improvements were made in safety compliance. However, the evaluations were conducted approximately four weeks after the training and do not provide for conclusions on the long term results of the training.

Two long term evaluations of logger training have been conducted. The first was an evaluation of chain saw safety training in Southwestern Virginia. This evaluation was designed to gather data 3 years before training and 3 years after training. A long term training evaluation was the objective of the study (Reisinger 1995).

The training was provided for manual timber fellers operating in steep mountainous terrain. Over a two year period 22 timber cutters were trained by “The Game of Logging” (GOL) Timber Cutter Training. This training was conducted by Soren Eriksson, a noted timber felling expert. It involved hands-on field training that focused on proper manual chainsaw tree felling. The GOL program has been utilized in several
states in the Eastern and Southeastern United States. It has been implemented as a component of training required by NORTIM, a prominent risk management group in Pennsylvania that provides many logging contractors with Workers Compensation insurance (Reisinger 1995).

The training was initiated by the need to reduce butt log damage resulting from poor felling techniques. Additionally, several timber cutters had sustained serious injuries in southwest Virginia. The training was administered over a four month period at one month intervals, to allow time for the participants to practice the new techniques before the following training session.

The sponsors of the training, Columbia-Carolina Corporation, Mullican Lumber Company, and the Tennessee Valley Authority, created an incentive program to insure that the training would be adopted at the job site. The incentive program consisted of three unannounced field inspections over a three month period immediately following completion of the training. The inspectors observed the timber cutter fell trees and inspected five stumps for proper felling techniques. A cash incentive was paid to the timber feller depending on how well he adopted and used the new techniques. All 22 timber cutters participated in the incentive program, and 70 percent were judged as “successfully” and “permanently” adopting the GOL methods of timber felling. The local mills also reported that log quality from the participating loggers increased, and the
number of chain saw accidents in the short term dropped dramatically. However, this evaluation was only over a three month period, and further evaluation was needed for a long term analysis. Researchers from Virginia Tech's Forestry Department designed an evaluation for the 22 loggers involved in the GOL training to determine if the training was effective in changing timber cutters habits over a long term period. All timber cutters who were trained in 1991-1992 were contacted for the study. Due to two timber cutters moving out of the area, only 20 timber cutters could be interviewed and evaluated for the long term study. The evaluation consisted of interviews and field observations to determine if the trained cutters were still using the GOL methods after three years. Worker Compensation Insurance records would also be used to determine the cutter's accident history.

The evaluations revealed that thirteen of the trainees were still cutting timber. Three timber cutters had been injured but planned to return to cutting timber soon, while four had changed occupations altogether. During the interviews, it was found that fourteen of the 20 timber cutters had been involved in a total of 21 accidents in which a Workers Compensation claim was filed. Interestingly, seven of the accidents occurred before the GOL training, and 14 occurred after the training. Nearly one-half of the accidents reported resulted in no lost time, and the accidents that did require lost time averaged 29 weeks of lost time per accident.
This long term study provided some interesting insights, however, at the time this literature review was completed the final analysis had yet to be completed, and the results are preliminary.

Another documentation of logger training's long term effectiveness was presented by Reisinger and Shaffer (1994). Virginia’s voluntary Best Management Practices (BMP) were implemented in 1988 as a result of the Clean Water Act and Chesapeake Bay Agreement. The goal of forestry BMPs was to reduce sediment created by forestry operations.

To meet the program goals, a coalition of public and private forestry officials was created to develop a BMP implementation plan. As a result, a revised BMP manual was published and a large scale logger education program was launched in Virginia in 1988. Training efforts would concentrate on making loggers aware of the Chesapeake Bay mandate, and the need to adopt the voluntary BMPs as a way to avoid a regulatory program. The training would also provide the loggers with the technical knowledge necessary to properly implement the BMPs.

Training was conducted jointly by the Virginia Department of Forestry (VDOF) and Virginia Tech Forestry Extension. Over the first three years, the program included several training methods for loggers and foresters, including workshops, short courses and
field demonstrations. Training materials included videotapes, publications, newsletters, newspaper articles, workshops, and personal contact.

Evaluation of the training was performed by the VDOF through BMP field inspections of all logging sites five acres in size or larger. The inspections were designed to conclude if the logger was properly implementing voluntary BMPs and in compliance with Virginia’s forestry water quality law. The BMP inspections, one during and one after logging, reinforced what the loggers had learned during the training and convinced loggers that voluntary BMP compliance would be monitored.

The effectiveness of Virginia’s BMP training program can be evaluated based on the field inspection system. An initial survey of harvest sites was conducted in 1987 to determine the current level of BMP implementation prior to the training program. This survey indicated that less than 50 percent of the harvesting sites had implemented BMPs. In 1994, the current BMP implementation rate was 92 percent overall. This is more than a forty percent increase in the compliance rate established prior to the training program (Shaffer 1993).

Virginia’s BMP training program proved that large scale logger education programs could be effective. Several factors helped this program to be effective, one being the willingness of the entire Virginia forestry community to promote and support
voluntary BMPs. Another factor was that the training did not force methods on a logger without explaining why they were important, and the impact each logger could have.

Finally, the BMP evaluation program reinforced the training, provided individual attention, and served as a critical evaluation tool.

**HARVEST PLANNING**

According to technical specifications in Virginia’s Best Management Practices Guide, Pre-Harvest Planning is the number one BMP and is the most important step in harvesting timber and protecting water quality (Virginia Department Of Forestry 1988). The Virginia Department of Forestry has developed the following definition for harvest planning:

"Harvest planning includes the collection of information about the area to be harvested. Use of this information can determine the best time and most efficient harvest method. An effective harvest plan will take into consideration all aspects of a timber harvest which may lead to water quality degradation. The plan provides for the implementation of applicable BMPS which will minimize the adverse affects of the operation in water quality."
The Virginia Department Of Forestry has a primary responsibility to protect forest water quality, and thus promotes the positive impact that harvest planning can have on protecting water quality. Other state’s BMP manuals place similar importance on harvest planning. For example, the Texas “Best Management Practices for Silviculture” includes a section on planning as a measure to reduce the amount of nonpoint pollution (Texas Forestry Association 1989). Virtually every forestry BMP manual published by a state agency includes a section on harvest planning. Most State Forestry agencies recommend that harvest plans be written, including a map of the area to be logged, deck locations, roads, trails, and location of BMPs. Virginia’s BMP inspection forms contain a category asking whether or not a harvest plan has been completed prior to harvest. Written pre-harvest plans are strongly recommended, but not required by law, in Virginia as well as a majority of other states.

Thirteen states currently require written harvest plan by law. In California, a written timber harvest plan must be prepared and reviewed by several state agencies before the landowner is granted permission to harvest timber (Shaffer 1991). A registered forester must prepare the harvest plans, and the review process often takes several months. States in this region that require written harvest plans to be reviewed prior to harvest include Maryland and West Virginia. In Maryland the harvest plan must be submitted to and approved by the local Soil Conservation District. Loggers in Maryland are permitted to prepare the harvest plan themselves, however, regulations vary
depending on which county you happen to be in (Maryland Department of Natural Resources). In some counties, the Department of Forestry forester must visit the site and verify that the plan is acceptable. In other counties the plan must be approved and a permit issued before any timber can be removed.

West Virginia also requires a written harvest plan. It must be submitted to the State Forestry Agency before harvesting begins. However, the logger can begin harvesting as soon at the plan has been filed (West Virginia Forestry Department 1989). The Environmental Protection Association (EPA) recommends that states require mandatory written pre-harvest plans as one of their “Management Measures” for the reauthorization of the Clean Water Act. EPA personnel have stated that mandatory harvest plans are the most effective way to protect forestry water quality, by preventing problems before they occur (EPA 1973).

Harvest planning provides a logger with benefits beyond BMPs. Loggers are primarily concerned with running an efficient operation, since their pay is based on production (Shaffer 1995). Proper planning can increase operational efficiency. For example, loggers should carefully plan deck locations to balance haul road construction with skid distances. Several advantages can be obtained through careful harvest planning, including fewer days missed due to weather because properly located road, deck, and skid trails allow the logger to work when he otherwise may not have been able to. Optimal
equipment arrangements can also increase productivity. Trouble areas can be identified and avoided or controlled so as to minimize the effect on production and environmental damage (Shaffer 1995).

Robert Shaffer (1994) has developed a practical harvest planning guide for loggers. Shaffer emphasizes that the planner must be thoroughly familiar with the logging operation and the tract conditions such as type of cut, topography, hydrology, boundaries, and any applicable laws and regulations. Once the planner has all necessary information, the following twelve steps can provide the necessary outline for a comprehensive harvesting plan.

- Study applicable maps and conduct an on-the-ground reconnaissance of the area to be logged.
- Identify and mark streamside management zones.
- Locate and flag log decks.
- Locate and mark logging road stream crossings.
- Locate and mark logging road entrance points from public roads.
- Locate any other logging road “control” points.
- Locate and flag the logging road gradeline or centerline.
- Locate and flag designated skid trails if necessary.
- Specify logging road standards.
• Specify stream crossing structures, if applicable.

• Determine the schedule of operations and harvest patterns.

• Specify tract “close-down” requirements.

Harvest Planning is an important aspect of logging, and has received much recent attention. For a logging operation to be successful, much like any complicated operation, planning must be an integral part of the process. A recent study in Virginia showed that 93% of loggers in the state routinely plan their harvesting operation (Worrell 1996). This percentage includes informal planning along with written harvest plans. If a logger remains solvent in today’s competitive and regulated business climate, it stands to reason that he is planning his operation to some degree on a regular basis.

Summary

Logger training is an area of recent increased interest by the forestry community. For training to be successful in the long-term, it must be evaluated. To date, very little formal evaluation of logger training has occurred.

Harvest planning is an important step in successful timber harvesting. Several states require written timber harvest plans, while other states recommend it as a critical
part of their BMPs. It is generally accepted that loggers will gain benefit from training programs in harvest planning.
METHODS AND PROCEDURES

The study objective is to evaluate the impact of harvest planning training and the use of written harvest plans on BMP implementation, landowner satisfaction, and weather-related downtime for loggers in the Virginia Piedmont.

The Virginia Piedmont was chosen for the study location because this region offers a wide range of operating conditions, timber types and logging operations. The varying conditions found in this region provide a challenge for the timber harvest planner.

Loggers for the study were randomly chosen from a population of 53 area loggers provided by the Farmville Region of the Virginia Department of Forestry from their BMP inspection records. Loggers who contracted exclusively for large forest products firms where a company-employed forester typically participated in the harvest planning process were not included in the population.

Nine loggers were randomly chosen (drawn from a hat) for the study, or “Trained” group (Table 1). Nine additional loggers were randomly chosen for a control, or “Untrained” group, who remained unaware of the study.
Table 1. The Study Group’s Equipment and Employee Information.

<table>
<thead>
<tr>
<th>Logger</th>
<th>Equipment</th>
<th>Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 feller buncher, 2 grapple skidders, 1 knuckleboom loader w/ CTR delimber, 2 road tractors, 4 log trailers</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>1 feller buncher, 2 grapple skidders, 1 stroke delimber, 1 knuckleboom loader, 3 road tractors, 5 log trailers, 1 bulldozer</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>1 feller buncher, 2 grapple skidders, 1 stroke delimber, 1 knuckleboom loader, 5 road tractors, 9 log trailers, 1 bulldozer</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>2 chainsaws for manual felling, 2 grapple skidders, 1 knuckleboom loader, 1 bulldozer, 2 road tractors, 3 log trailers</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>2 chainsaws for manual felling, 1 grapple skidder, 1 knuckleboom loader, 1 road tractor, 2 log trailers</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>1 feller buncher, 2 grapple skidders, 1 knuckleboom loader, 2 road tractors, 3 log trailers</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>1 feller buncher, 1 grapple skidder, 1 knuckleboom loader, 1 road tractor, 2 log trailers</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>1 feller buncher, 1 grapple skidder, 1 knuckleboom loader, 1 road tractor, 2 log trailers</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>1 feller buncher, 2 grapple skidders, 1 knuckleboom loader, 3 road tractors, 5 log trailers</td>
<td>8</td>
</tr>
</tbody>
</table>
The Study Group completed two days of intensive Harvest Planning Training during October, 1994. Instructors from Virginia Tech's Department of Forestry led the field-oriented training. The training was based on VCES Publication No. 420-088, "A Logger's Guide to Harvest Planning", by R.M. Shaffer (see Appendix A). Use of a topographic map as an important harvest planning tool was emphasized during the training. The first day of training consisted of a brief classroom session to familiarize the participants with the training and give a brief outline for harvest planning. Afterwards the training continued at one of the two field training areas. The training took place on two challenging tracts of timber, which required careful planning to successfully harvest. At the first tract a group discussion was held were various aspects of harvest planning were examined. The training culminated on the second tract with each participant preparing a written harvest plan for a 50-acre tract in Amelia County, Virginia. Each logger's plan was then critiqued by the instructors and other participants.

Study group loggers agreed to use the training to prepare and follow written harvest plans for each tract they harvested during the next 8 months, until July 1, 1995. It was necessary to complete the study at that time because the VDOF had determined that they would no longer conduct BMP inspections on all harvested tracts after that date. The written harvest plan would include a form prepared by the researchers (see Appendix B) similar to the harvest plan required by law in neighboring West Virginia. Copies of each
Plan would be promptly mailed to the researchers at Virginia Tech. Periodic on-site visits would be made by the researchers to each Study Group logger's job to insure consistency in the study.

The following data were gathered over the 8-month study period following the training for both the Study and Control Groups:

1. BMP Final Inspections, as conducted by Virginia Department of Forestry personnel on each harvested site. Additionally, BMP Final Inspections were collected for the Study Group loggers for the 12-month period prior to the training.
2. A "forest landowner satisfaction" telephone interview was conducted by the researchers for each harvested tract.
3. The number of scheduled operating days missed due to weather-related downtime was provided by each logger in the Study and Control Groups.

Virginia Department of Forestry BMP Final Inspection forms were "graded" by the researchers to provide a numerical score for BMP implementation on each tract harvested (see Appendix C). Scores were based on the percentage compliance with Virginia's BMP guidelines. BMP implementation scores were chosen as an evaluation measure because most State BMP manuals, including Virginia's, state that harvest planning is a prerequisite to successful BMP implementation.
Forest landowner “satisfaction” was measured by quantifying the responses of landowners who had timber harvested by the study and control group loggers during the study period. Telephone interviews were used to gather the necessary information utilizing questions regarding the quality of the work performed by the logger (see Appendix D). Scores were assigned to each landowner based on their response to a question regarding their overall level of satisfaction as: poor, fair, good, or excellent. The preceding questions were used to focus the landowners attention on the various quality aspects of the logging job. Landowner satisfaction was chosen as an evaluation measure because it is generally agreed that increased attention to harvest planning leads to overall improvement in job quality, and landowners would be more satisfied by a high quality logging job on their land.

The percentage of scheduled operating days missed due to weather-related downtime was chosen as the final evaluation measure. Most State’s BMP manuals state that one of the major advantages of formal harvest planning is proper location of haul roads and log decks in areas where soils are stable and properly drained, thus allowing operations to continue during wet weather when otherwise the job would be stopped. Loggers in the Control Group and Study Group were contacted periodically to obtain this information. This is the only part of the study the Control Group loggers were aware of, since they had to be contacted personally to obtain this information.
Production, while logically affected by harvest planning, was not chosen as an evaluation measure because of the large number of variables that can dramatically affect it. Examples include mill quota, equipment breakdown, labor availability, timber stand characteristics, haul distance, and many others.

Data analysis consisted of conducting t-tests to determine whether statistically significant differences occurred between:

1. Mean BMP Implementation scores for the Study Group during the pre-training and the post-training period.
2. Mean BMP Implementation scores for the Study and Control Group.
3. Mean Landowner Satisfaction scores for the Study and Control Group.
4. Mean percentage of scheduled operating days missed due to weather-related downtime for the Study and Control Group.

Finally, Study Group loggers were interviewed informally and their opinions of the training and use of the written harvest plans were recorded.
RESULTS

The study objective was to evaluate the impact that harvest planning training and written harvest plans had on BMP implementation, landowner satisfaction with harvesting, and weather-related downtime. In each corresponding Table the number of samples used for that comparison is listed as N. P values for each t-test are reported so the exact level of statistical significance is known.

BMP IMPLEMENTATION

A two-sample t-test was used to test for different populations for the mean BMP implementation scores for the pre-training and post-training Study Group, and the post-training study group and the control group. An F-test was used to determined if the variances could be pooled. In both cases pooled variance was acceptable when alpha = .05.

Each final BMP inspection completed by VDOF personnel was considered a separate sample. The pre-training Study Group sample comprised of 28 inspections, and the post-training sample was contained 29 inspections. The Control Group sample was comprised of 21 final inspections (Table 3, Table 5).
The first test hypothesis was that the post-training Study Group’s mean BMP implementation score would be statistically higher than the pre-training score. The null hypothesis was there is no difference between the two scores. A one tailed t-test was used, and the P value was .85 (Table 2), suggesting that there is no difference between the scores.

A second test hypothesis was that the Study Group’s BMP implementation score would be statistically higher than the Control Group’s. The null hypothesis was there is no difference between the groups. A one tailed t-test was used, and the P value was .15 (Table 4). The P value suggests there is a 85% probability that the post-training Study Group’s mean implementation scores are statistically significantly higher than the Control Group’s.
Table 2. Two sample t-test results for BMP implementation scores for mean pre-training and mean post-training Study Group.

<table>
<thead>
<tr>
<th>Test Group</th>
<th>N</th>
<th>Mean</th>
<th>Standard Dev</th>
<th>SE Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Training</td>
<td>28</td>
<td>.932</td>
<td>.120</td>
<td>.023</td>
</tr>
<tr>
<td>Post-Training</td>
<td>29</td>
<td>.899</td>
<td>.116</td>
<td>.022</td>
</tr>
</tbody>
</table>

Pooled StDev = .118

T = -1.05, P = .85, DF = 55
Table 3. Data points for BMP implementation scores for the pre-training Study Group and
post-training Study Group.

<table>
<thead>
<tr>
<th>Pre-Training Study Group</th>
<th>Post-Training Study Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 100%</td>
<td>100%</td>
</tr>
<tr>
<td>2. 100%</td>
<td>96%</td>
</tr>
<tr>
<td>3. 100%</td>
<td>92%</td>
</tr>
<tr>
<td>4. 92%</td>
<td>84%</td>
</tr>
<tr>
<td>5. 100%</td>
<td>100%</td>
</tr>
<tr>
<td>6. 100%</td>
<td>77%</td>
</tr>
<tr>
<td>7. 100%</td>
<td>77%</td>
</tr>
<tr>
<td>8. 100%</td>
<td>100%</td>
</tr>
<tr>
<td>9. 85%</td>
<td>100%</td>
</tr>
<tr>
<td>10. 92%</td>
<td>100%</td>
</tr>
<tr>
<td>11. 46%</td>
<td>77%</td>
</tr>
<tr>
<td>12. 96%</td>
<td>96%</td>
</tr>
<tr>
<td>13. 92%</td>
<td>96%</td>
</tr>
<tr>
<td>14. 86%</td>
<td>62%</td>
</tr>
<tr>
<td>15. 96%</td>
<td>100%</td>
</tr>
<tr>
<td>16. 91%</td>
<td>96%</td>
</tr>
<tr>
<td>17. 72%</td>
<td>96%</td>
</tr>
<tr>
<td>18. 77%</td>
<td>100%</td>
</tr>
<tr>
<td>19. 100%</td>
<td>81%</td>
</tr>
<tr>
<td>20. 100%</td>
<td>100%</td>
</tr>
<tr>
<td>21. 100%</td>
<td>77%</td>
</tr>
<tr>
<td>22. 86%</td>
<td>100%</td>
</tr>
<tr>
<td>23. 100%</td>
<td>77%</td>
</tr>
<tr>
<td>24. 100%</td>
<td>85%</td>
</tr>
<tr>
<td>25. 100%</td>
<td>96%</td>
</tr>
<tr>
<td>26. 100%</td>
<td>92%</td>
</tr>
<tr>
<td>27. 100%</td>
<td>100%</td>
</tr>
<tr>
<td>28. 100%</td>
<td>92%</td>
</tr>
<tr>
<td>29.</td>
<td>100%</td>
</tr>
</tbody>
</table>
Table 4. Two sample t-test for BMP implementation scores for the mean Study Group, and mean Control Group.

<table>
<thead>
<tr>
<th>Test Group</th>
<th>N</th>
<th>Mean</th>
<th>StDev</th>
<th>SE Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study Group</td>
<td>29</td>
<td>0.899</td>
<td>0.116</td>
<td>0.022</td>
</tr>
<tr>
<td>Control Group</td>
<td>21</td>
<td>0.860</td>
<td>0.153</td>
<td>0.033</td>
</tr>
</tbody>
</table>

Pooled StDev = 0.133

T = 1.03, P = .15, DF = 48
Table 5. Data points for BMP Implementation scores for the Study Group and Control Group.

<table>
<thead>
<tr>
<th></th>
<th>Study Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>100%</td>
<td>91%</td>
</tr>
<tr>
<td>2.</td>
<td>96%</td>
<td>96%</td>
</tr>
<tr>
<td>3.</td>
<td>92%</td>
<td>100%</td>
</tr>
<tr>
<td>4.</td>
<td>84%</td>
<td>77%</td>
</tr>
<tr>
<td>5.</td>
<td>100%</td>
<td>91%</td>
</tr>
<tr>
<td>6.</td>
<td>77%</td>
<td>77%</td>
</tr>
<tr>
<td>7.</td>
<td>77%</td>
<td>91%</td>
</tr>
<tr>
<td>8.</td>
<td>100%</td>
<td>39%</td>
</tr>
<tr>
<td>9.</td>
<td>100%</td>
<td>86%</td>
</tr>
<tr>
<td>10.</td>
<td>100%</td>
<td>67%</td>
</tr>
<tr>
<td>11.</td>
<td>77%</td>
<td>100%</td>
</tr>
<tr>
<td>12.</td>
<td>96%</td>
<td>81%</td>
</tr>
<tr>
<td>13.</td>
<td>96%</td>
<td>96%</td>
</tr>
<tr>
<td>14.</td>
<td>62%</td>
<td>91%</td>
</tr>
<tr>
<td>15.</td>
<td>100%</td>
<td>85%</td>
</tr>
<tr>
<td>16.</td>
<td>96%</td>
<td>69%</td>
</tr>
<tr>
<td>17.</td>
<td>96%</td>
<td>67%</td>
</tr>
<tr>
<td>18.</td>
<td>100%</td>
<td>85%</td>
</tr>
<tr>
<td>19.</td>
<td>81%</td>
<td>92%</td>
</tr>
<tr>
<td>20.</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>21.</td>
<td>77%</td>
<td>100%</td>
</tr>
<tr>
<td>22.</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>23.</td>
<td>77%</td>
<td></td>
</tr>
<tr>
<td>24.</td>
<td>85%</td>
<td></td>
</tr>
<tr>
<td>25.</td>
<td>96%</td>
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</tr>
<tr>
<td>26.</td>
<td>92%</td>
<td></td>
</tr>
<tr>
<td>27.</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>28.</td>
<td>92%</td>
<td></td>
</tr>
<tr>
<td>29.</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>
LANDOWNER SATISFACTION

A two sample t-test was used to test for different populations in the mean landowner satisfaction scores for the Control and Study Group. An F-test was used to determine if the variance could be pooled. Pooled variance was found to be acceptable when alpha = .05.

The test hypothesis was that the post-training Study Group’s mean landowner satisfaction score would be statistically higher than the Control Group’s mean landowner satisfaction score. The null hypothesis was there is no difference between the two groups. A one tailed t-test was used to evaluate the P value. The P value was .17, suggesting there is an 83% probability that the Study Group’s mean landowner satisfaction score is statistically higher than the Control Group’s mean landowner satisfaction score (Table 6). As stated earlier, numeric scores for each landowner were derived by asking landowners to rate the overall logging job quality on their property as:

1 = Poor
2 = Fair
3 = Good
4 = Excellent

The landowner satisfaction samples were comprised of 28 landowners for the Study Group and 11 landowners for the Control Group (Table 7).
Table 6. Two sample t-test results for mean landowner satisfaction scores for the mena Study Group and mean Control Group.

<table>
<thead>
<tr>
<th>Test group</th>
<th>N</th>
<th>Mean</th>
<th>St Dev</th>
<th>SE Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study Group</td>
<td>28</td>
<td>3.53</td>
<td>.732</td>
<td>.14</td>
</tr>
<tr>
<td>Control Group</td>
<td>11</td>
<td>3.27</td>
<td>.817</td>
<td>.25</td>
</tr>
</tbody>
</table>

Pooled StDev = .756

T = .98, P = .17, DF = 37
Table 7. Data points for landowner satisfaction scores for the Study Group and Control Group.

<table>
<thead>
<tr>
<th></th>
<th>Study Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>3.0</td>
<td>4.0</td>
</tr>
<tr>
<td>2.</td>
<td>4.0</td>
<td>2.0</td>
</tr>
<tr>
<td>3.</td>
<td>3.0</td>
<td>4.0</td>
</tr>
<tr>
<td>4.</td>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>5.</td>
<td>4.0</td>
<td>3.0</td>
</tr>
<tr>
<td>6.</td>
<td>4.0</td>
<td>2.0</td>
</tr>
<tr>
<td>7.</td>
<td>4.0</td>
<td>3.5</td>
</tr>
<tr>
<td>8.</td>
<td>4.0</td>
<td>3.0</td>
</tr>
<tr>
<td>9.</td>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>10.</td>
<td>3.5</td>
<td>2.5</td>
</tr>
<tr>
<td>11.</td>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>12.</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>14.</td>
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<tr>
<td>15.</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>3.0</td>
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<tr>
<td>17.</td>
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<tr>
<td>18.</td>
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<tr>
<td>19.</td>
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<tr>
<td>21.</td>
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<tr>
<td>22.</td>
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</tr>
<tr>
<td>23.</td>
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<td></td>
</tr>
<tr>
<td>24.</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>25.</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>26.</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>27.</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>28.</td>
<td>3.0</td>
<td></td>
</tr>
</tbody>
</table>
WEATHER-RELATED DOWNTIME

A two sample t-test was used to test for different populations in the mean percentage of weather-related downtime for the Study Group and Control Group. An F-test was used to determine if the variance could be pooled. Pooled variance could be used when alpha = .05.

The test hypothesis was that the Study Group's mean percentage of weather-related downtime would be less than the Control Group's mean percentage of weather-related downtime. The null hypothesis was that there is no difference between the two groups. A one tailed t-test was used and the P value was .12 (Table 8). The P value suggests there is a 88% probability that the post-training Study Group missed statistically fewer scheduled days because of weather-related downtime than the Control Group.

The sample for weather-related downtime consisted of each logger's percentage of weather-related downtime during the study period. Both the Study and Control Group had nine samples (Table 9).
Table 8. Two sample t-test results for mean percentage of scheduled operating days missed due to weather-related downtime, for the mean Study Group and mean Control Group.

<table>
<thead>
<tr>
<th>Test Group</th>
<th>N</th>
<th>Mean</th>
<th>St Dev</th>
<th>SE Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study Group</td>
<td>9</td>
<td>.101</td>
<td>.054</td>
<td>.018</td>
</tr>
<tr>
<td>Control Group</td>
<td>9</td>
<td>.131</td>
<td>.048</td>
<td>.016</td>
</tr>
</tbody>
</table>

Pooled StDev = .051

$T = 1.24$, $P = .12$, $DF = 16$
Table 9. Data points for percentage of scheduled operating days missed due to weather-related downtime, for the Study Group and Control Group.

<table>
<thead>
<tr>
<th>Study Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 15%</td>
<td>12%</td>
</tr>
<tr>
<td>2. 17%</td>
<td>5%</td>
</tr>
<tr>
<td>3. 2%</td>
<td>11%</td>
</tr>
<tr>
<td>4. 13%</td>
<td>18%</td>
</tr>
<tr>
<td>5. 13%</td>
<td>18%</td>
</tr>
<tr>
<td>6. 2%</td>
<td>18%</td>
</tr>
<tr>
<td>7. 8%</td>
<td>15%</td>
</tr>
<tr>
<td>8. 13%</td>
<td>7%</td>
</tr>
<tr>
<td>9. 8%</td>
<td>14%</td>
</tr>
</tbody>
</table>
DISCUSSION

Statistical tests show significant differences in three of the four areas tested. The Study Group loggers outperformed the Control Group loggers in each of the three areas tested: BMP implementation, landowner satisfaction with logging, and the percentage of scheduled days missed due to weather-related downtime.

The one test where no statistical difference was found was BMP implementation scores for the pre-training and post-training Study Group. Weather conditions could have varied between the two periods (8 months prior to the training, and the 8-month study period after the training) causing BMP implementation to become more difficult during the post-training time period. Perhaps the VDOF scrutinized the Study Group loggers more critically during the post-training period, since they were part of a research project and VDOF personnel knew their BMP inspections may be evaluated by outside sources. Also as stated earlier, Virginia's loggers have been subjected to six years of rigorous BMP training and evaluation, creating a high awareness level. This educational effort and high awareness level may have already captured most of the potential for improving BMP implementation.
A close look at the three areas were a significant statistical difference was shown reveals some interesting information. BMP implementation scores were statistically higher for the Study Group than the Control Group at a significance level of 85%, however the relative difference is only four percentage points (90% vs. 86%). Perhaps more important than the statistical difference between the two groups is the relatively high scores of both groups. The findings show that the Study Group and Control Group both performed well with regard to BMPs, and the statistical difference would be difficult to observe in field conditions, based on the small relative difference.

Similar positive results can be found in the Landowner Satisfaction survey. A statistical difference was found at a significance level of 83%, however the relative difference is small. The Study Group scored 3.53, and the Control Group 3.27 on a 4.0 scale. Both group's relative scores are between the "good" and "excellent" range for landowner satisfaction, implying that all loggers involved in the study are doing a "good" job in the view of the landowners surveyed.

The Study Group missed statistically fewer weather-related days than the Control Group at a significance level of 88%. The absolute scores for the Study and Control Group were 10% and 13% respectively, a small relative difference. Based on 240 operating days per year on average, the Study Group would miss 24 days and the Control Group would miss 31 days due to weather-related downtime. Seven additional operating
days per year could be realized by the Study Group as a possible result of the harvest planning training.

As stated all statistical differences found in the analysis had small absolute differences, and all scores were relatively high, reflecting positively on the loggers in both groups. It is difficult to determine what, if any, outside influences may have impacted the data gathered during the study. An attempt was made to keep the study confidential, so as to not alter the harvest practices of the Control Group. With the small relative differences this experimental error should be considered. It is unclear if all differences found between the Study and Control Groups can be attributed solely to the harvest plan training and written harvest plans.

For example, factors other than harvest planning could play a role in how many days a logger misses due to weather-related downtime. Individual tract characteristics, working habits, equipment capabilities, and pressure to make equipment payments could all affect the number of days missed due to weather-related downtime. These same circumstances could also affect how a logger performs in day to day operations, in turn affecting BMPs and overall landowner satisfaction. It can be assumed that since all loggers for the study were selected at random this variability is evenly spread across both groups.
The results are clear in one area: whatever gains were made by harvest planning training and written harvest plans were relatively small, and both groups of loggers performed at a relatively high level with regard to the criteria evaluated.

**LOGGER FEEDBACK**

The nine study group loggers were interviewed at the conclusion of the study, and their opinions of the training and use of written harvest plans were recorded.

All nine loggers interviewed felt they had benefited from the training. Their answers on the benefits varied and are listed below:

- Discussing issues with other loggers. (2 loggers)
- Discussing portable haul road and skid trail bridges.
- Learned what was expected of him now and what might be expected in the future.
- Introduced to new ideas, such as portable bridges. (2 loggers)
- Introduce to guidelines for harvest planning, and emphasized the use of topo maps and field reconnaissance.
- Opportunity to discuss water quality issues with other loggers, VDOF personnel, and academic experts.
- Discussion of road and deck BMP requirements.
The Study Group loggers all reported benefits from the training, and increased awareness on certain issues. Individual logger “professionalism” could have been increased through this gained knowledge and awareness. Although no direct data was gathered in this area professionalism could be a very important benefit, particularly to a profession such as logging which historically has suffered from a poor perception by the general public.

Loggers were also questioned about the effectiveness of preparing written harvest plans prior to harvesting timber. Five loggers reported there was some benefit to written harvest plans. The most common benefit stated was that it forced them to plan earlier. Four loggers reported no benefit to completing written harvest plans prior to harvesting timber. These four loggers stated that they have always planned their logging operation and written plans were merely a formality that did not alter their planning process.

The loggers opinions regarding written harvest plans support Worrell’s earlier study which reported 93% of loggers perform harvest planning on some level (1996). Nearly half of the Study Group loggers reported their planning process was not enhanced by written harvest plans, and those loggers that reported benefits gained by written harvest plans were simply planning sooner than before. This leads to a conclusion that the Study
Group loggers were generally planning their harvesting operations prior to the training and introduction to written harvest plans.

Loggers were asked if they could recommend any improvements to the training provided. Only one logger offered a recommendation: spend more time on his job site to gain a better understanding of his operation.
SUMMARY AND CONCLUSIONS

SUMMARY

The objective of this research was to evaluate the impact of harvest planning training for loggers and written timber harvest plans on BMP implementation, landowner satisfaction, and weather-related downtime in Virginia’s Southern Piedmont.

Data was collected for eighteen randomly selected “independent” loggers in Virginia’s Southern Piedmont. The loggers were divided into a Study Group and a Control Group. The Study Group received two days of intensive harvest planning training and agreed to submit a written harvest plan prior to logging for each tract they harvested during the 8-month study period. BMP implementation data was recorded by the VDOF and submitted to the researchers. Landowner satisfaction “interviews” were conducted by telephone to gather landowner’s opinions about overall logging quality on their property. Loggers in both groups recorded their production downtime and the reason for this downtime.

The results of testing showed the Study Group outperformed the Control Group in all three areas tested. The three areas are:
1. BMP implementation. The mean Study Group score was 90% compliance compared to 86% compliance for the Control Group.

2. Landowner satisfaction. The mean Study Group score was 3.54 compared to 3.27 for the Control Group, on a 4.0 scale.

3. Weather-related downtime. The Study Group reported that 10% of scheduled operating days were missed due to weather-related downtime, compared with 13% of scheduled operating days missed by the Control Group.

Pre-training and post-training BMP implementation scores for the Study Group were also examined. Testing shows there was no difference in the pre-training and post-training BMP implementation scores for this group.

CONCLUSIONS

Based on the information gathered during this research the following conclusions are offered:

- Loggers in the Southern Piedmont of Virginia are doing a good job. The Study Group
and Control Group both had high absolute scores in BMP implementation and landowner satisfaction. The percentage of scheduled days missed due to weather-related downtime for both groups of loggers was similar, and within the expected range.

- Loggers in the Southern Piedmont of Virginia are generally planning their harvesting operations, regardless of whether a written harvest plan is “required” or not. At this time it does not appear beneficial to adopt regulations that require loggers to prepare written harvest plans in Virginia.

- Harvest planning training and written harvest plans can marginally improve BMP implementation, landowner satisfaction, and weather related downtime in Virginia.

RECOMMENDATIONS FOR FURTHER RESEARCH

1) A similar study in an area without the historically strong BMP education program and high BMP awareness would likely yield more dramatic results. In such an area larger gains could be expected in BMP implementation and perhaps landowner satisfaction as well.
2) The impact of harvest planning training on the logger's production should be examined if outside variables that affect production such as quota, weather variability, equipment variability, and timber stand characteristics be accounted for or equalized among a group of loggers.

3) The impact of logger training in general should be examined in other areas such as logger “professionalism” and the public’s perception of logging. The public’s interest in how the environment is affected by those who work in the forest will only continue to increase in the future.
LITERATURE CITED


Maryland Department of Natural Resources. How To Obtain Logging Permits in Maryland’s 23 Counties. Department of Natural Resources, Annapolis, MD. 46p.


Shaffer, R. 1996. Personal communication


Appendix A. A Logger’s Guide to Harvest Planning, By R. M. Shaffer
A Logger's Guide to Harvest Planning

Robert M. Shaffer*

Timber harvesting is an extremely complex operation. It involves several interrelated processes carried out over a large and sometimes highly variable area, often taking several weeks or months to complete. Since pay is based on production, operational efficiency is critical. In addition, today's logging contractor must comply with numerous laws and regulations affecting every facet of his business. Best Management Practices, or BMP's, are recommended operation guidelines for logging that are designed to minimize environmental impact and maintain water quality. To incorporate BMP's into a logging operation while carrying out that operation in the most efficient manner requires PLANNING.

There are two stages of harvest planning — preliminary pre-harvest planning and comprehensive harvest planning. A pre-harvest plan is a fairly simple plan commonly prepared by a "service" forester or forestry consultant for a forest landowner prior to conducting a timber sale. It normally identifies recommended streamside management zones as well as potential problem areas like fragile soils or steep slopes that may require special treatment during the harvesting operation.

A comprehensive harvest plan is much more complex and detailed. It is usually prepared by the logger or logging manager just prior to beginning the harvesting operation. The logging plan may include recommendations on logging roads, log decks, streamside management zones, stream crossings, skid trails, and the schedule of activities. The logging planner must have the following information at his disposal:

- The type of cut (clearcut, row thinning, individual tree selection, etc.). Will trees be removed from the streamside management zones? This could affect deck size and location, equipment restrictions or job layout.

- The terms of the timber sale contract. For example, the length of time on the contract may dictate the time of year that the tract will be logged, which may impact the haul road construction standards.

- The tract topography. In the mountains, topography will often limit the logger's options for road and deck location. In addition to slope, aspect and exposure should also be considered.

- The tract soil conditions. Soils will affect road and deck location, especially in the coastal plain and piedmont regions. Soils also impact equipment decisions and scheduling of activities.

- The tract hydrology. Knowing how much water to expect in a stream after a big rain will affect decisions on stream crossing structures.

- The tract boundaries, easements, and rights-of-way. This information is necessary to locate access points and haul roads.

- The timber volumes to be removed by species and product, and the distribution of those volumes across the tract. This information is vital for determining haul road standards, deck size and location, and scheduling.

- The logging system and equipment spread. The planner must be intimately familiar with the characteristics of the logging operation, including any equipment limitations or operating constraints. For example, the type of log truck (tandem or tractor/trailer) will impact the haul road layout, acceptable curve radius, and landing size.

- The applicable laws and regulations affecting logging, including the current non-regulatory BMP's. These will affect all aspects of the harvest plan.

There are several tools available to the harvest planner. Topographic maps, available from the U.S. Geological Survey, are a must in the piedmont or mountain regions. Soil survey maps are most important in the coastal plain.

*Extension Specialist, Timber Harvesting, Virginia Tech
regions, where soils impact logging operations much more than topography. Soils maps for each county can be obtained from the Soil Conservation Service. A detailed timberstand map can be of great assistance in planning log deck location and scheduling operations. Many landowners have these on file for their property, prepared by a service forester or forestry consultant. County ownership maps are available commercially in some states. They can save time in obtaining rights-of-way or easements, or in notifying adjoining landowners regarding boundary line problems or questions that may arise during harvesting.

In the piedmont or mountains, every logging planner needs an instrument to determine percent slope. By degree of accuracy, the available options are an Abney level (about $100), a clinometer (about $75), and a slope gauge ($0-10). An accurate estimate of slope is necessary to maintain acceptable road grade, determine spacing between required water-bars, and comply with various BMP recommendations. Plastic flagging of various colors is an important tool for the logging planner. Boundaries, log deck locations, “back-lines” for skidding zones, streamside management zones, and designated skid trails can all be effectively marked and distinguished by flagging of different colors. Plastic flagging, as well as slope-determining instruments, can be purchased from any forestry or engineering supply company.

Perhaps the most important tools available to the harvest planner are his legs and eyes, to be used in a thorough, on-the-ground reconnaissance of the tract to be harvested. This “walk-through” will often uncover important features that maps, no matter how accurate, will not show.

Finally, several publications are available that outline or explain the various laws, regulations, or “recommendations” that impact timber harvesting. Examples are the “Logger’s Guide” that explains the BMP’s (available from the Virginia Department of Forestry) and Publication 420-142, Laws and Regulations Affecting a Logging Business in Virginia (available from Virginia Cooperative Extension).

Steps To Prepare A Harvest Plan

The following twelve “steps” provide a possible framework for a comprehensive harvest plan.

**STEP 1. Study applicable maps and conduct an on-the-ground reconnaissance of the area to be logged.** Note the slope, aspect, soils, timber, streams, access, boundaries, old logging roads, “indicator” plants, etc. Put it down on paper as you go - a good method is to carry a large-scale topo map covered with a sheet of acetate or mylar on a clipboard, then mark important details and locations on the acetate “map.” Become totally familiar with all of the tract characteristics that will impact logging. It is possible that a close reconnaissance may cause the harvest planner or logger to postpone or reschedule harvest of a particular tract to minimize probable production delays, possible equipment damage, or site damage.

**STEP 2. Identify and mark streamside management zones (SMZ’s).** These are one of the most important and effective ways to reduce stream sedimentation in a logged area, and should be implemented whenever possible. SMZ’s are low cost (to the logger), highly effective, and improve the looks of a clearcut operation. A suggestion: mark SMZ’s where some timber will be selectively removed with a different colored flagging from SMZ’s that will not be cut at all.

**STEP 3. Locate and flag log decks.** These are critical decisions that will directly affect production. Log deck location is a tradeoff between skidding distance and haul road construction -should you locate a log deck in the far corner of the tract and build a quarter-mile of haul road to get the trucks to it (keeping maximum skidding distance to 500 feet), or should you simply skid the timber from that area 2000 feet back to the big deck in the middle of the tract? The “best” answer depends upon factors such as road cost, skidding cost, timber volumes in the area in question, skidder payload, system balance, and environmental impact. Individual landing size will vary depending upon type of loader, type of trucks, number of sorts, topographic constraints, landing layout, need to inventory material, timber volume skidded to the deck, and environmental impact. Log decks should generally be kept as small as feasible, and should be well “daylighted” to facilitate drying out after a shower. An ideally located log deck will be on a slightly sloped area (to facilitate drainage) with stable soils that do not easily rut.

**STEP 4. Locate and mark logging road stream crossings.** Generally, the best rule regarding stream crossings is not to have any, if possible. They can be expensive and a potential source of major environmental and water quality problems. However, if it is determined that a stream crossing is necessary, choosing the proper location is critical. Look at the stream width, water depth, stability of the stream bottom and banks, the approach topography and soils, and the high water mark. Choose a location that will minimize the chance of stream sedimentation arising from logging as well as hauling.
STEP 5. Locate and mark logging road entrance points from public roads. In some areas, entrance points must be approved by the resident highway engineer. Generally, the law requires that a truck driver pulling onto the highway from a temporary log road be able to see clearly in either direction for a minimum of 200 feet. In addition to safety, operational aspects must be considered when locating an entrance point. Truck turning radius, angle of approach, and directivity of travel loaded and empty must be considered. Will "set-out" trailers be dropped off and picked up at roadside? Entrance points should always be located on well-drained, stable soils. Provisions must sometimes be made to keep mud from being transferred onto the highway, in the form of rock, mats or other surfacing material applied at the entrance point.

STEP 6. Locate any other logging road "control" points. These are points or locations that the logging road must either connect or avoid. Actually, entrance points, stream crossing locations, and log deck locations are all "positive" control points for the haul road network. Examples of "negative" control points might be rock outcrops or gumbo clay flats, areas that the haul road cannot pass through.

STEP 7. Locate and flag the logging road gradeline (in the mountains) or centerline (in the coastal plain). This step can sometimes be a real challenge, especially in the mountains. A good procedure is to first attempt to plot the gradeline on a topo map, connecting the positive control points while keeping the road at an acceptable grade (Virginia BMP's recommend a maximum 15 percent grade for no more than 200 feet at a time). Ideally, the grade should be kept at 10 percent or less. With a topo map, it is relatively easy to determine the grade of the proposed route between two control points - simply estimate the on-the-ground distance by the map's scale, then divide that into the gain or loss in elevation as estimated by counting the contour intervals between the control points. Adjust (lengthen or shorten) the route on the map until the acceptable grade is reached. Then take the map to the woods, and flag a "trial" gradeline using a slope-determining instrument set at the desired grade and following the proposed map route as closely as possible. If you're lucky, the initial trial gradeline will work as well on the ground as it looked on the map! Unfortunately, however, it often requires some "adjusting" on the ground to make it work.

Locating a centerline on relatively flat coastal plain terrain is usually somewhat easier. Soils are often the primary consideration - try to locate the haul road on well-drained, stable soils, with good load bearing capacity, like clay or sandy clay loams with a solid base.

In either case, the gradeline (centerline) location must consider log truck characteristics such as tractor/trailer "tracking" and "tail swing" when laying in curves or switchbacks. The relationship between grade and "loaded" travel direction must also be considered when locating a curve near the bottom of a grade or in a location that will cause the driver to shift gears.

STEP 8. Locate and flag designated skid trails, if necessary. In general, designated skid trails should be avoided if at all possible, as they greatly increase the environmental impact and chance of erosion and stream sedimentation. They are a "necessary evil" for skidder logging on steep mountain slopes of 35-40 percent or greater, where "direct line" skidding would be too hazardous. Skidder winchline distance is the key factor in locating designated skid trails in the mountains.

STEP 9. Specify logging road construction standards. There are generally three logging road standards. The most common by far is a "branch" logging road. It is designed as a temporary road that will be "retired" immediately after logging is completed. A branch road is usually not much more than a 10-12 foot wide trail where the surface organic material has been graded off. There is no surfacing, and drainage is handled through a few, well-placed water turn-outs or broad based dries.

A "primary" logging or forest road is designed for permanent, all-weather use. It has a 20-foot subgrade, permanent ditches, cross-culverts, stabilized banks, and occasional crushed rock surfacing. A primary road is expensive and can only be justified on very large timber sales where the road will be used for several years.

In the middle is a "secondary" logging road - narrower subsurface than a primary road, with ditches, but without any surfacing. It is designed for all-weather use, and is a good choice for extended logging jobs that must operate year round.

In specifying logging road standards, the harvest planner must consider cost, the volume of timber to be hauled over the roads, the time of year that the roads will be used, the type of trucks using the roads, the length of road to be built, the available road construction equipment, and the time it will take to construct the roads. In addition, he should consider the use and availability of temporary road stabilizing or surfacing options like crushed rock, geotextiles, or mats (wooden, metal, or rubber). These are best applied at potential "trouble spots" BEFORE a problem occurs.

STEP 10. Specify stream crossing structures, if applicable. The common choices, from least to most expensive, are a ford, a culvert with dirt fill, a "low-water" bridge, and an elevated timber bridge. The "best" choice depends upon the cost, the stream characteristics, the amount of use anticipated, the load bearing
requirements, the area of forestland drained by the stream, the previous “high-water” mark, the time of year the structure will be used, and the environmental impact. A proper stream crossing structure will minimize any disruption to the normal stream flow and pattern - don’t try to force a wide, shallow stream through a narrow, deep structure. In addition to the normal structures, a few temporary, re-useable, stream crossing structure alternatives are available. They include the “Dambridge” (a heavy rubber mat that forms a trough when a vehicle crosses, then “floats” on top of the stream when not in use) and a folding steel “portable bridge” that can be towed behind a pickup truck.

STEP 11. **Determine the schedule of operations and harvest patterns.** This step is especially critical on a large tract. Is it better to complete the road system first and then begin cutting on the back side, or should you start at the front and build road as you go? The most efficient schedule of operations depends on the tract topography, time of year, current and anticipated weather conditions, road construction requirements, cash flow situation, and outside factors like quota restrictions or mill needs. Equipment, maintenance, safety meetings, and planned holidays or mill shut-downs should be included in scheduling. Goals for daily and weekly production should be set and compared against actual production. Scheduling should be constantly refined and updated as the operation progresses.

**STEP 12. Specify tract “close-down” requirements.** These primarily involve the implementation of BMP’s that will minimize erosion and stream sedimentation on the tract in the period after harvesting has been completed. They include re-grading ruts, installing water-bars on abandoned roads or designated skid trails, seeding certain landings and roads, removing any temporary stream crossing structures, scattering brush, opening ditches or water turnouts, and any clean-up necessary to leave the tract in acceptable shape. Many of these operations can be scheduled during “slow” times as harvesting is completed on various parts of the tract, thereby avoiding a massive job at the end. It is important to make the landowner aware of his responsibility to maintain the tract in the environmentally sound condition in which it was left after logging was completed and BMP compliance recorded.

SAFETY must remain a constant consideration throughout the harvest planning process. Every decision made by the harvest planner will have safety implications, from the location of a log deck to the scheduling of activities. Plan for a safe operation, and then monitor employees closely to make sure it happens.
Appendix B. Outline used by Study Group Loggers for Written Harvest Plans
TIMBER HARVEST PLAN

DRAW A SKETCH MAP OF THE TRACT OR ATTACH A TOPOGRAPHIC MAP. SHOW THE APPROPRIATE LOCATION OF STREAMS, HAUL ROADS, LOG DECKS, ACCESS POINTS, STREAM CROSSINGS, SMZ'S, EXISTING ROADS, FIELDS, ETC.

1. Is there a stream on the tract that requires a Streamside Management Zone (SMZ)?
   YES   NO
   If YES: Did you mark or flag the SMZ(s)?
   Show location of SMZ(s) on map.

2. Will you have to haul or skid logs across a stream on this tract?
   YES   NO
   If YES: What kind of crossing(s) will you use (culvert, bridge, logs, etc.)?
   Will the crossing be temporary or permanent?
   Show location of crossing(s) on map.

3. Will you close the haul road(s) to traffic when logging is completed?
   YES   NO
   If YES: Will you need water bars?
   Show approximate location(s) on map.

4. Will any skid trails need water bars?
   YES   NO
   If YES: Show approximate location on map.

5. Will you need to re-seed any log decks, roads, or skid trails when logging is completed?
   YES   NO
   If YES: Show approximate location on map.

6. Comments

MAIL A COPY OF THE PLAN TO: Bob Shaffer, Dept. of Forestry, Virginia Tech, Blacksburg, VA 24061-0324. THANKS!
Appendix C. Example of Virginia’s Department of Forestry Final BMP Inspection Form and Explanation of Scoring Method Used by Researchers
**REPORT-SHP1300**

**Virginia Department of Forestry**

**SHP ANW SEED TREE INSPECTION FORM**

October 17, 1995 12:17

<table>
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<th>CHA-94-029</th>
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<th>A</th>
<th>Landowner Name:</th>
<th>Tract Name:</th>
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<td>Submitted By:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of Harvest:</td>
<td>CLEAR</td>
<td>Intended Land Use:</td>
<td>FOREST</td>
<td>Total Acres Cut:</td>
<td>12.0</td>
</tr>
</tbody>
</table>

**LANDOWNER**

**LOGGER**

**TIMBER STANDER**

**CONSULTANT**

Was the WOF notified of timber sale prior to harvest? No
Was a pre-harvest plan developed for the timber sale area? No
Was the WOF notified 24 hours prior to cutting? No
Was SMZ designated (flagged) prior to harvest? No
Was land harvested due to DDF recommendation? No

---

### MAUL ROADS

1. Total length of haul road. Units | Quantity
--- | ---
Feet | 285.0
2. Length of haul road with slope more than 10% (15% for less than 200 feet allowable). Feet | 0.0
3. Length of haul road within 50 feet of stream. Feet | 0.0
4. Length of improper stream crossings (Nm. of crossings x distance (50 ft min)). Feet | 0.0
5. Length of haul road without proper bridge or culvert. Feet | 0.0
6. Length of haul road with cuts greater than 6" deep for more than 50 ft. (8" in wild). Feet | 0.0
7. Length of retired road not seeded properly. (Final Inspection only). Feet | 0.0
8. Length of retired road where access is not controlled properly. (Final Inspection only). Feet | 0.0

---

### TIMBER CUTTING AND TRANSPORT

A. DISPERSE ACTIVITY (sawyer, skidder, etc.) Acres | Quantity
--- | ---
9. Area traveled over by equipment. Acres | 12.0 (7/9)
10. Area rutted, degraded by equipment (continuous rutting 6" or more (8" in wild). Acres | 0.3

---

### CONCENTRATED ACTIVITY (skid trails)

11. Length of skid trail with slope more than 15% (steep for up to 50 feet allowable). Feet | 0.0 (12/9)
12. Length of skid trail within 50 feet of stream. Feet | 0.0
13. Length of improper stream crossings (Nm. of crossings x distance (50 ft min)). Feet | 0.0
14. Length of skid trail without proper bridge or culvert. Feet | 0.0
15. Length of skid trail with cuts greater than 6" deep for more than 50 ft. (8" in wild). Feet | 0.0
16. Length of retired skid trail not seeded properly. (Final Inspection only). Feet | 0.0

---

### STREAM SIDE MANAGEMENT ZONE

17. Total length of perennial streams on the tract. (Final Inspection only) Feet | 0.0 (12/9)
18. Total length of intermittent stream on the tract. (Final Inspection only) Feet | 0.0
19. Length of improper SMZ on perennial streams. Feet | 0.0
20. Length of perennial stream with debris in the stream. Feet | 0.0 (1/9)
21. Enforcement debris in the stream violation (yes or no) No

---

### WORKING MAN-MADE DITCHES AND DRAINAGES

22. Total length of ditches and drainages. Feet | 0.0
23. Length of ditches and drainages blocked or impaired. Feet | 0.0

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### LANDINGS

24. Total number of landings. Number | 3.0 (12/9)
25. Number of landings within 50 feet of an SMZ. Number | 0.0
26. Number of landings that are not properly drained. Number | 0.0
27. Number of landings with trash, oil, or additional problems. Number | 1.0 (1/9)
28. Number of retired landings with greater than 5% slope, not seeded. (Final Inspection) Number | 0.0

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Is there ANYTHING ELSE that needs to be noted? (7/9) If "YES" please refers to COMMENTS No

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Scoring System for BMP Implementation

Final BMP inspection forms were scored on a percentage basis of applicable areas of BMP compliance. The Virginia Department of Forestry BMP final inspection form has 22 criteria that are evaluated for compliance with Virginia’s Best Management Practices. They are items 2-8, 10, 11-16, 19-21, 23, 25-28, on the preceding form. On a tract with perennial or intermittent streams all 22 areas are applicable. Tracts without any streams have 15 areas which are evaluated for BMP compliance (items 2, 3, 5-8, 10, 11, 14-16, 23, 26-28).

All evaluated items were given equal weighting. The example BMP final inspection form on the previous page was completed for a tract on which no stream was present, and thus only had 15 items of possible compliance. The logger in this example was not in compliance with BMPs items 15, 27, and 28, and thus received a score of 12/15 or 80%.
Appendix D. Landowner Satisfaction Interview Form
LANDOWNER SATISFACTION SURVEY

LANDOWNERS NAME: 
DATE: 
DATE LOGGED: 
LOGGER: 

1. Did the logger remove the timber within the contract period. Y N 
2. Did the logger cut low stumps and use most of the wood in each tree. Y N 
3. Did the logger leave the roads and fences in good condition. Y N 
4. Did the logger protect the streams on the property during logging. Y N 
5. Did the logger clean up the trash around the landings. Y N 
6. Did the logger damage trees that were not supposed to be cut. Y N 
7. Did the logger track excessive mud onto the public road while he was hauling. Y N 
8. Did the logger leave the harvested land in generally good condition. Y N 
9. Overall, in your judgement, would you describe the logging job as:
   1 poor 
   2 fair 
   3 good 
   4 excellent
VITA

The author was born on May 20, 1972 in Kingsport, Tennessee and was raised in rural Patrick County, Virginia. His interest in forestry started at Patrick County High School, where he competed in several forestry related contests and was encouraged to pursue a forestry related education at Virginia Tech.

While enrolled at Virginia Tech in the Industrial Forestry Operations undergraduate program, the author completed two forestry internships, one with Chesapeake Corporation and the other with the City of Newport News Waterworks Division. After graduating with a Bachelor of Science in May 1994, he enrolled in the Industrial Forestry Operations graduate program at Virginia Tech in August 1994.

The author graduated with a Master of Science in Forestry in May 1996 and accepted a job with Champion International in Roanoke Rapids, North Carolina.

[Signature]

Gregory S. Meade