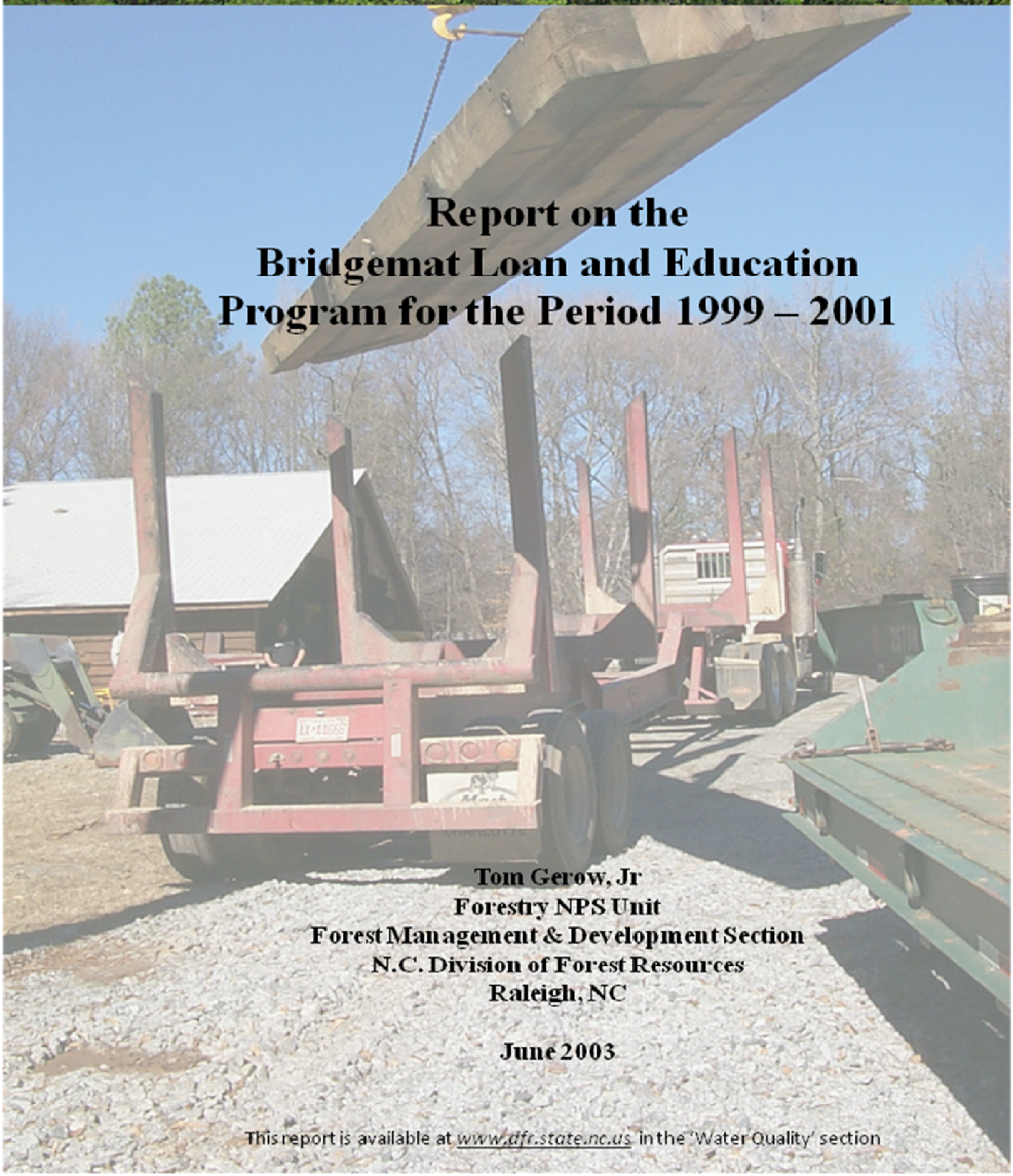
North Carolina Department of Environment and Natural Resources

Division of Forest Resources



Report on the Bridgemat Loan and Education Program for the Period 1999 – 2001

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June 2003

This report is available at www.dfr.state.nc.us in the 'Water Quality' section

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Special appreciation is noted for all of the DFR field personnel that have been executing this program on-the-ground for nearly six years, and continue to strive for innovation in promoting, educating and evaluating the use of temporary bridging systems. Also, gratitude is extended to all of the individuals that provided comments, feedback and general information regarding the use of bridgemats in North Carolina. Finally, Unit Assistant Jennifer Rall is commended for her continued work in maintaining the records and vendor relationships in support of this project.

Cover photo by Kevin Harvell, Water Quality Forester with the N.C. Division of Forest Resources.

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Note: This report has been edited from its original printed version, for clarity by the author, for the purposes of posting on the NC-DFR's Web site (tg3/09).

EXECUTIVE SUMMARY

Bridgemats can be used to provide ideal temporary stream crossings that protect water quality from non-point sources of pollution associated with forestry operations. The North Carolina Division of Forest Resources (DFR) administers a Bridgemat Loan and Education Program, in which the DFR temporarily loans bridgemats to loggers across much of North Carolina. This report discusses the Program's achievements during the 1999 to 2001 timeframe, and outlines actions that will be taken to promote the benefits of using bridgemats.

The DFR currently loans six sets of wooden bridgemats. Overall utilization of the DFR's bridgemats improved year-over-year during the period, for those years that have reliable data. All data indicate positive trends regarding the number of loan events, amount of acres involved, and number of temporary stream crossings established. The DFR is purchasing additional steel bridgemats to continue this positive trend in bridgemat use across the State. This purchase is funded by the US-EPA's Section 319(h) Non-Point Source Pollution Prevention Program.

It appears bridgemat ownership and use by logging contractors for establishing temporary stream crossings in North Carolina has trended upward since the previous reporting period of 1996 - 1998. While the primary objective of this report is not to review or analyze the use of bridgemats in the entire forestry community, discussions with several stakeholders indicate that loggers, or the companies they contract with, have increasingly purchased their own bridgemats over the last few years. Steel bridgemats are generally gaining preference over wood bridgemats in most locations of the state, due to the longevity and ease of repair of steel versus wood.

Actions to be undertaken by the DFR to expand the use and promote the benefits of using bridgemats include:

- Expand DFR's Loan Program availability through additional purchases;
- Produce an educational video showing how to use bridgemats;
- Establish permanent exhibits of installed bridgemats at selected State Forest locations;
- Create a computer slide presentation & brochures for continuing education workshops;
- Improve record-keeping and oversight to document and optimize use of DFR's bridgemats;
- Promote bridgemat use and available information on the water quality section of DFR's website;
- Educate forest products companies on the merits of purchasing their own bridgemats.

Many of the goals outlined in DFR's 2000 report have been fulfilled. Enhanced administration of the Bridgemat Loan and Education Program was successfully addressed with the creation of the Forestry NPS Unit within the DFR. This Unit will facilitate and oversee various projects related to non-point-source water pollution issues in forestry across the State. The Bridgemat Loan and Education Program is one example of these projects.

DFR BRIDGEMAT UTILIZATION, COSTS, & INVENTORY

Bridgemat Utilization

The utilization of the DFR's bridgemats improved from 2000 to 2001. In 2001, the number of loan events, and number of acres involved nearly doubled. The number of days assigned during 2001 increased by nearly 25% over the number of days in 2000.

Table A shows a summary of information that was collected at the time the bridgemats were loaned out. During 1999, the existing bridgemats were degraded to a point that very few loan events were possible. That year marked a transition period in which new bridgemats were purchased, and in-house surveys were conducted with each DFR District by the Central Office staff to summarize the history of the Loan Program. Some loan events may have occurred during 1999; however without any records to verify a loan event, no reportable data is available.

Table A: Three Year Use-Data on the DFR's Bridgemat Loan & Education Program

	1999	2000	2001
Number of Loan Events	no data	7	15
Number of Different Loggers	no data	7	15
Number of Acres Involved	no data	433	933
Total Number of Days Assigned*	no data	448	580
Average Number of Days Assigned *per* Loan Event	no data	64	39
Number of Stream Crossings Made With Bridgemats	no data	13	25

** This is the sum for all Districts that had bridgemats during the time period*

Some of the factors that may have led to the improvement in utilization include:

- Additional DFR Districts received bridgemats for the first time during 2001;
- Better follow-up by DFR's Central Office staff on requesting monthly tracking and utilization information from the Districts;
- More knowledge of the DFR's Loan Program by loggers;
- Field staff (Water Quality Foresters) in select Districts dedicated solely to handling water quality issues.

Documenting what impact the DFR's Loan Program has had on the operating and/or purchasing habits of loggers that have used the DFR's bridgemats is difficult to assess, and is beyond the scope of this report. However, there appears to be a general acceptance of using bridgemats once a logger/customer is exposed to using them. Many of the DFR's future projects for the Loan Program are intended to expand the delivery of information about the benefits of using bridgemats in forestry operations. These projects are reviewed later in this report.

Bridgemat Costs

From 1996 through 2001, nearly $28,350 has been spent by the DFR on the purchase of wooden bridgemats. The Bridgemat Loan and Education Program is funded entirely by grant awards through the U.S. Environmental Protection Agency's Non-Point-Source (NPS) Pollution Prevention Program as part of Section 319{h} of the Clean Water Act. This Federal Program focuses on the development of projects that protect water quality and/or prevent degradation that results from non-point sources, which includes most forestry "in-woods" activities. More information about the US-EPA's NPS Management Program can be found at *http://www.epa.gov/owow/nps/cwact.html*. Information regarding North Carolina's participation in the Program can found on the Division of Water Quality's website at *http://h2o.enr.state.nc.us/nps/*

Historically, bridgemats were made available (in the early-1990's) by funding from the Renewable Resources Extension Act (RREA), as administered through the Extension Forestry Department of North Carolina State University. At that time, the DFR's local offices handled the loan-out and tracking of the bridgemats. Documentation of loan events was not maintained.

Since 1996, the DFR has been directly involved with loaning out bridgemats to loggers. The DFR's purchase costs thus far are shown in Table B. All DFR mats were purchased via bid process. A "set" is defined as three individual panel sections, used together to create a crossing. Thus six (6) "sets" consists of eighteen (18) panel sections.

Table B: Purchase History and Costs

Year	Purchase Price	# of sets purchased
1996	$8,736	6
1997	-	0
1998	-	0
1999	$8,236	3
2000	$11,377	4
2001	-	0

Bridgemat Inventory

At the end of calendar year 2001, the DFR owned six sets of in-service wooden timber bridgemats (Table C). These bridgemats are constructed of untreated oak or hickory timber cants, and are twenty-four (24) feet long and approximately four (4) feet wide. No "soft" hardwood species were used in the construction of the bridgemats. Thus far in the DFR's Program, wooden bridgemats have remained acceptable for use over a three- to four-year period.

Safety considerations are the main driver for taking a set of bridgemats out of service, based upon periodic visual inspections of the bridgemats by DFR's field foresters and Central Office staff. Typically, the first signs of deterioration appear on the ends of the timber cants. Thus far, no structural failures have occurred during the use or handling of the DFR's wooden bridgemats.

Table C: DFR Mat Inventory as of year-end 2001

DFR District	Mat Set#	Coverage Area	Condition, Status
1 (Asheville)	D1-003	Central mountains	Good, In Use
2 (Lenoir)	954,5,6	Northern mountains	Good, Available
8 (Whiteville)	158071,2,3	Southern coastal plain	Good, Available
9 (Sylva)	113545,6,7	Western mountains	Good, In Use
11 (Hillsborough)	114142,3,4	Northern piedmont	Good, Available
12 (Mt. Holly)	114521,2,3	Southern foothills	Good, In Use

During the early stages of this project, bridgemat panels were simply discarded once their condition deteriorated to a point that made them unsuitable for use. At that time, there was no perceived value in retaining the mats for educational or display purposes. Since 1999, all mats have been retained. The DFR has recovered some of the old, abandoned bridgemat panels that are still suitable for display purposes.

A list of suppliers and/or manufacturers of bridge and road mats is available and maintained on the water quality section of the DFR's website. Any vendor additions or changes to the list are welcome.

Bridgemat Identification Codes

When the most recent sets of wooden bridgemats were received in 2000, a test was performed to "brand" each panel with marks that would identify them as DFR property. Alphanumeric property codes were routed into one side-edge of each panel to a depth of 0.5 inches, with each panel assigned its own unique code. Routing this information into the wood was thought to be the best long-term method of labeling each panel. The routed area on the new mats was also coated with white or yellow paint as an additional tool to quickly identify the mats once positioned on-site, and to serve as a test to determine the practicality of using paint.

Figure 1: Freshly applied ID codes

Figure 2: New bridgemats with ID codes installed

Inspection of these same bridgemats after nearly two years indicates that coding the panels with the router was successful. As seen in Figure 3, the lettering is still visible, while the surface of the mats is so scarified that repeated applications of paint and/or labels would have been needed, thus requiring additional supply and personnel costs. The photos below were taken in October of 2002. Methods of labeling steel mats will be considered; one method is to apply codes with a weld bead, located somewhere so the beads will be somewhat protected. Additional painting may also be attempted.

Figure 3: ID codes after 2+ years

Figure 4: Bridgemats after 2+ years use

TRENDS IN BRIDGEMAT USE & OWNERSHIP

During the same time period that bridgemats became available for loan in the early- to mid-1990's, scrutiny of timber harvesting operations progressively intensified across the country, including North Carolina. Among the many practices more closely evaluated are stream crossings. Studies from across the nation indicate that stream crossings, either on skid-trails or access roads, are the most likely areas in which the potential exists for any water quality degradation to occur as a result of forestry operations (Greis 2002). The use of bridgemats for stream crossings can significantly reduce sedimentation when compared to using pipe culverts, or hard-surface crossings, also known as "fords" (Taylor, et al. 2002).

Evidence indicates that many loggers and forest product companies, with this knowledge in mind, have made significant financial investments in steel bridgemats over recent years. Individual steel panels may cost upwards to $3,000 apiece. For a large company with several operations ongoing at the same time the investment in steel mats can approach tens-of-thousands of dollars. However, steel material is still favored for mass-quantity purchases since steel lasts longer and is more easily repairable than wood timbers. For these reasons, the DFR is making a transition to steel bridgemats for use in the Loan Program. Wooden bridgemats may still be considered for purchase by the DFR as conditions warrant.

Figures 5a & 5b: New Steel Bridgemats in North Carolina Awaiting Pickup by Customers

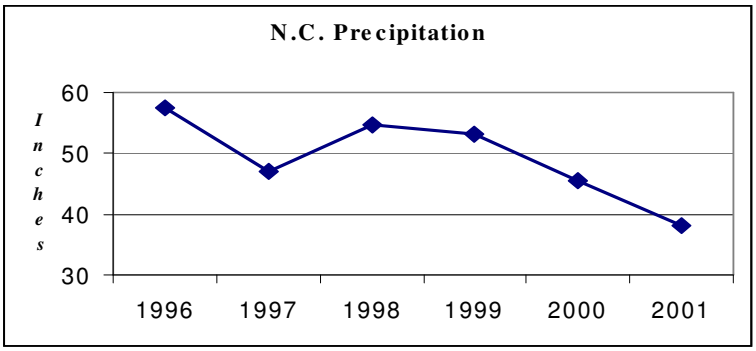
From several conversations with individuals in the forestry, logging, and timber community, it appears that purchases of bridgemats have thus far been accomplished by one of three methods, listed here in no order of frequency or significance:

- An individual logging contractor purchases the mats for use with his harvesting operations;
- A forest products company or wood dealer makes the purchase, then provides the mats to the logging contractor who is harvesting timber controlled by that company, and/or;
- A company or wood dealer shares the cost of purchasing mats with a logging contractor.

In addition, these conversations indicate the prevailing drought over this reporting period resulted in lower frequency of bridgemat use by loggers, and reduced production of bridgemats by manufacturers. While this

rationale is not appropriate from a BMP implementation standpoint, precipitation amounts for the 1996 – 2001 period were relatively low, which would corroborate this speculation, as shown in Figure 6.

Figure 6: Total Precipitation in North Carolina, 1996 – 2001 (see Appendix IV for data references)



Correctly installed bridgemats at stream or ditch crossings is a DFR-recommended BMP practice, regardless of the current or expected amount of water that exists for the duration of a forestry-related, site disturbing activity.

✗ It is inappropriate to think bridgemats are only needed for wet ground conditions. Bridgemats should be used even when no water is visible in the stream or channel.

Even during dry times with little or no water in a channel, using a bridge of some kind will protect the stream or ditch bank structure, thus preventing accelerated erosion during rain events that occur after the logging or forestry activity is complete. Also, the conditions of the stream or ditch bottom will be protected when using bridgemats by avoiding soil compaction and rutting which can result in degradation of water quality, and habitat quality for fish and aquatic organisms.

Figure 7: Properly installed wooden bridgemats in western North Carolina

PROGRAM GROWTH

As already noted, anecdotal information indicates increased ownership and usage of bridgemats by logging contractors. However, the DFR believes that ample exposure and educational opportunities exist in North Carolina for potential users of bridgemats in forestry operations, particularly in the foothills and upper piedmont regions of the State. Briefly described in this section are several projects that will promote the benefits and increase the visibility of using bridgemats for temporary water crossings in forestry operations.

Additional Bridgemats

The DFR is purchasing seven sets of steel bridgemats (twenty-one [21] individual panels; one "set" is comprised of three "panels"). While steel bridgemats cost more than wooden mats, they also have at least double the life expectancy (Shiau, et al. 2002). Steel mats may last for as long as eight to ten years while wood mats typically remain viable for only three or four years. Funding for the purchase of these mats is provided through the U.S. EPA's S.319{h} Non-Point Source (NPS) Pollution Management Grant Program, which also funded previous DFR purchases of wooden mats.

Video Series

Starting in 2003, the DFR will begin in-house production of the first video in a series that will highlight several recommended forestry BMP's. The first video will examine the use of bridgemats for establishing temporary stream or ditch crossings. This is in response to comments received by DFR personnel and others regarding concerns from some potential users about how to properly handle bridgemats.

Demonstration Exhibits

Permanent exhibits of installed bridgemats and associated forestry BMP's will be constructed at selected State Forest locations. These exhibits will allow potential and current bridgemat users to witness first-hand how to properly install, utilize and stabilize bridgemat crossings. Older, worn-out mats that are no longer suitable for logger use will be installed for these permanent exhibits, thereby allowing a longer term return on the investment of the mats, versus simply disposing of them once the functional lifespan is exceeded.

These working exhibits, in conjunction with the video series, will be offered as educational tools for individuals who need to fulfill necessary water quality requirements of the North Carolina Forestry Association's "ProLogger" continuing education program, as well as for training of DFR personnel, where applicable. In addition, visitors will better understand the achievements being made throughout the forestry community in executing forestry operations in a manner that helps protect water quality. Appendix I is a map of State Forests currently open to the public, as well as other Division of Forest Resources facilities. Information about the NCFA's ProLogger program is found at *http://www.ncforestry.org/*

'Slide Show' Presentations

A computer slide presentation outlining the fundamentals of using bridgemats for forestry operations will provide an easy-to- use "canned" presentation that can be shown to a wide variety of audiences. This presentation, along with a streaming version of the BMP video, will be available for viewing on the water quality section of the DFR's web site. Photos and images from this slide presentation can be adapted for use on a tri-fold table display that could be easily set up at events where the bridgemat program would be of interest to the audience.

Record Keeping

The creation of simple, yet effective, means to capture and analyze information that helps document the overall progress and activities of the bridgemat program has already begun, with the establishment of the Forestry NPS

Unit within the DFR's Forest Management & Development Section, and the creation of an updated tracking and utilization form. Below are some examples of what actions will be taken to promote and document the effectiveness of the DFR's Bridgemat Loan and Education Program.

- Increase visits with logging and mill operators in an effort to discuss the benefits and challenges of using bridgemats for their forestry activities.
- Improve documentation of the DFR's work in communicating the use of bridgemats to customers.
- Distribute information regarding the costs related to purchasing and using bridgemats versus other forms of stream or ditch crossings.

Internet Resources

Expanding the outlets of information delivery and feedback regarding the bridgemat program by integrating information into the water quality section of the DFR's website is deemed critical to successfully promoting the use of bridgemats, for forestry operations. Information currently available online include:

- Bridgemat loan participation request form
- List of road mat and bridgemat suppliers
- The 2000 Loan Program Report
- DFR County and District contacts for the Loan Program

The Division of Forest Resources' website can be found at *http://www.dfr.state.nc.us/;* for information regarding the Bridgemat Loan & Education Program, click on the header **Water Quality**. For updates concerning the bridgemat program, as well as other information related to forest water quality issues, an electronic "mailing list" is available, free of charge.

FOLLOW UP ON 2000 REPORT

In the DFR's 2000 report that summarized the bridgemat program from 1996 to 1998, there were several goals and recommendations regarding the continuation and growth of the Loan Program in North Carolina. Presented below is a brief summary of the recommendations and the progress of each:

1. **Recommendation: The loan program should continue in the piedmont and mountain ecoregions with a more rigorous level of administrative control**.
   Progress: The bridgemat program has continued in the mountain and piedmont areas of the state throughout the 1999-2001 period. With additional staff added at the DFR's Central Office in late 2002, enhanced facilitation of the bridgemat program will be achieved. Additional on-site monitoring of the bridgemats' use will be accomplished, along with coordination of locating the DFR's mats in areas of the State where they can be best utilized for optimum exposure and water quality protection.

2. **Recommendation: The program should be expanded to the coastal plain, with the ultimate goal of exposing all loggers engaged in timber harvests to temporary bridging**.
   Progress: The Loan Program was only partially expanded, and a set of mats is available for use in the southern coastal plain area of the state. With the purchase of twenty-one (21) steel bridgemats to occur in 2003, additional Loan Program expansion will encompass several of the DFR's thirteen districts, and allow for the availability of DFR "loaner" bridgemats in areas that have never participated in the program. Statewide coverage likely will not be undertaken, as several of the new steel bridgemat sets will be used to replace older, worn-out wooden bridgemat sets.

3. **Recommendation: Field implementation of the Loan Program has been assigned to the respective District Water Quality Forester, where applicable.**

   Progress: Water Quality Foresters continue to administer the field activities related to the program in those Districts that have a Water Quality Forester. For districts in which a Water Quality Forester has not yet been established, one individual has been assigned the responsibility of handling the bridgemats and coordinating efforts with the DFR's Central Office staff.

4. **Recommendation: A revised tracking and relocation form is completed monthly or whenever the mats are moved**.

   Progress: In 2002 this tracking form was replaced with a totally new version (Appendix II) that is easier to use and records additional information. This new bridgemat utilization form will continue to document the condition and use of the DFR's bridgemats, and will be filled out whenever the bridgemats are relocated.

5. **Recommendation: A "Participation Agreement" was created to insure proper use and accountabilities of the DFR's bridgemats by the customers (loggers)**.

   Progress: This document has since been incorporated into the new utilization form referenced above and shown in Appendix II. Incorporating both old documents together in a new format helps eliminate paperwork and makes it easier to use.

6. **Recommendation: Additional bridgemats purchased are 24 feet long to accommodate streams of greater width**.

   Progress: The scheduled purchase of new steel bridgemats in 2003 will specify a length of 25 feet, in order to optimize the use of the steel fabrication materials. Longer lengths beyond this range were not deemed to be practical for the DFR's Program due to panel weight and handling issues.

7. **Recommendation: Where applicable, DFR should initiate meetings with mill owners and timber buyers to focus on the benefits of using bridgemats during timber harvesting operations.**

   Progress: While DFR personnel do discuss the benefits of bridgemats informally with forest industry personnel and loggers in the field, formal documentation of meetings and presentation material is lacking. The DFR's new staff additions will administer the creation of several different tools for communicating the benefits of using bridgemats. In addition, DFR staff will visit with mill owners and operators, as well as timber buyers and logging contractors to discuss the benefits of using bridgemats, as well as promote the DFR's Bridgemat Loan and Education Program as an educational step towards bridgemat ownership by the contractors and/or mill owners.

CONCLUSION

During this reporting period the DFR's Bridgemat Loan and Education Program continued with success to exhibit and promote the use of bridgemats for temporary water crossings during logging operations. The number of unique loan events, and total amount of acres involved, nearly doubled from 2000 to 2001.

It appears that over the last few years more logging contractors and timber companies have purchased, and continue to use, their own inventories of bridgemats. Comments from foresters and other individuals familiar with bridgemats have indicated that many loggers "do not need" the DFR's mats because they either have mats of their own, or have mats readily available to them through other means. However rewarding this good-news-story may be, there is no doubt that ample learning and exposure opportunities exist for bridgemat use, especially in the upper piedmont/foothills and mountain areas of North Carolina.

Steel mats are the preferred choice, over wooden mats, for most future DFR acquisitions. Discussions with purchasers and manufacturers indicate that, despite the higher initial capital needed to purchase steel mats, the longevity of steel material justifies the additional costs.

Increased awareness and enhancement of the comfort level regarding the use of bridgemats will be achieved by using several of the tools and projects noted, including the video series, State Forest exhibits, computer presentation and NCFA's ProLogger workshops.

More reliable data will be used for future program evaluation to not only record information regarding the DFR's program effectiveness, but also the overall challenges faced with using bridgemats.

The Forestry NPS Unit staff will facilitate on-site visits with mill owners, operators and timber buyers throughout the state, in hopes of expanding the interest and awareness of temporary bridgemats for forestry applications. This element is crucial for the long-term acceptance and use of bridgemats across a state as geographically and hydrologically diverse as North Carolina.

To achieve widespread exposure and dissemination of information, appropriate material related to the bridgemat program will be integrated into the DFR's water quality website.

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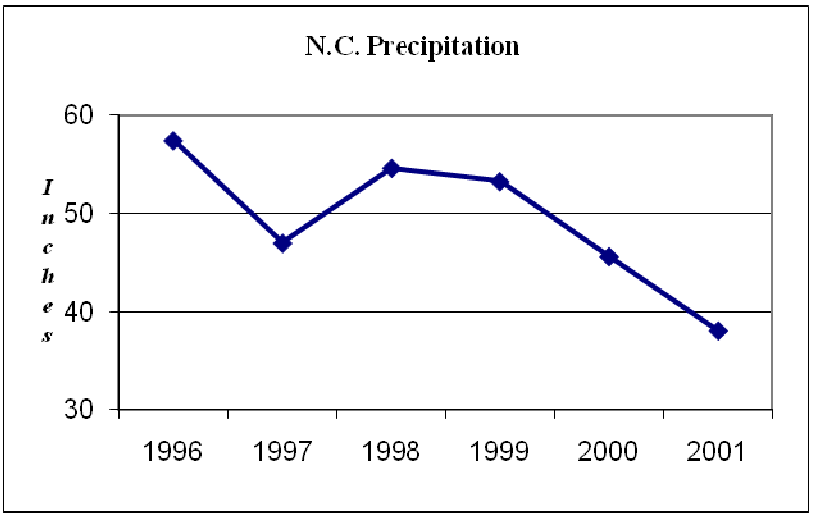
APPENDIX: Data Source Information for N.C. Precipitation

Data retrieved from Western Regional Climate Center, Desert Research Institute: Reno, NV
http://www.wrcc.dri.edu/cgi-bin/spiMAIN.pl?3104+spi1+spi6

Year	Precipitation (Inches)
1996	57.42
1997	46.99
1998	54.62
1999	53.26
2000	45.63
2001	38.08



"Time History Plot of Divisional Data" was queried using the following parameters:
North Carolina - 00 - Statewide
Precipitation
Beginning Year 1996
Ending Year 2001
Period of months each data point will represent: 12
Last month of the period: December
"Yes" Running Mean
Number of Years in the running mean: 15

Total Precipitation	12-Month Period Ending in Month 12	
YEARS : 1996 - 2001		
AVERAGE		49.333
SIGMA (RMS)		6.514
COEFF OF VAR		0.132
SKEWNESS		-0.453
MEDIAN		50.125
MAXIMUM VALUE		57.42
MINIMUM VALUE		38.08
NUMBER OBS		6
YEAR 1996. VALUE =		57.42
YEAR 1997. VALUE =		46.99
YEAR 1998. VALUE =		54.62
YEAR 1999. VALUE =		53.26
YEAR 2000. VALUE =		45.63
YEAR 2001. VALUE =		38.08