Virginia Cooperative Extension
Virginia Tech • Virginia State University
www.ext.vt.edu

Slash Application Cost Estimates for Skid Trail Closure in the Virginia Piedmont

Neila Cole, Graduate Research Assistant, Forest Resources and Environmental Conservation, Virginia Tech
Chandler Dangle, Graduate Research Assistant, Forest Resources and Environmental Conservation, Virginia Tech
Fletcher Meadema, Graduate Research Assistant, Forest Resources and Environmental Conservation, Virginia Tech
Scott M. Barrett, Assistant Professor and Extension Specialist, Forest Operations, Forest Resources and Environmental Conservation, Virginia Tech
W. Michael Aust, Professor of Forestry, Forest Resources and Environmental Conservation, Virginia Tech

Introduction

Best management practices (BMPs) were developed after the passage of the Federal Water Pollution Control Act of 1972 to mitigate pollutants and sediment from entering streams. Forest operations are a potential source of sediment to streams surrounding harvest areas. Specifically, roads, skid trails, landings, and stream crossings can cause accelerated erosion due to the soil disturbance caused by logging equipment and exposure of bare soil (Appelboom et al. 2002). Soil erosion can result in decreased productivity, degraded water quality, and increased costs associated with state and federal environmental regulations.

Using logging residues such as the tops and limbs from trees to stabilize skid trails, stream crossing approaches, and ephemeral drains or wet spots both during and after harvesting operations can reduce soil erosion, protect stream water quality, and lower logging costs associated with best management practices (Vinson et al. 2017; Wade et al. 2012). Logging residues, often referred to as slash, provides immediate cover to the bare ground, slowing water velocity and trapping sediment so that soil particles are not eroded and carried directly into streams. Slash can minimize rainfall impact on soil and also provide a barrier to sheet flow because it makes contact with the ground. In addition, slash takes longer to decompose, therefore providing cover for a longer period of time than seed or mulch, and slowly releasing nutrients back into the soil. Slash may also act as a deterrent for off-road vehicles. Slash is often readily available on the harvest site, and is generally considered more cost effective if

Stream crossing approach closed with slash.

applied during harvest operations as the skidder is travelling to the landing and back, rather than after the harvest is completed.

As part of an independent study in Forest Boundaries and Roads at Virginia Tech, three graduate students developed a questionnaire to present to loggers at a SHARP Logger training class in Amherst, Virginia, in April 2017. The questions were designed to capture the process of slash application regarding estimated time and costs, as well as other characteristics related to implementation of forestry BMPs. Few studies have been conducted to analyze the costs of slash application in the southeast. While many natural resource managers understand that slash is a beneficial alternative for closing out a skid trail, our primary objective was to estimate costs for applying slash as a BMP.

Methods

The questionnaire consisted of eight multiple choice or fill in the blank questions and one open-ended comment section. The questionnaire was distributed during a SHARP Logger training, and was collected after the participants finished. The data were characterized by summary statistics and compared to the results of the relatively few studies that have estimated the cost of slash application. We asked about the location and timing of slash application, use of other closure techniques, typical length of trail requiring cover, and the time and cost estimated to complete the application during and after harvesting operations. A total of 23 questionnaires were completed and returned. We interpreted the answers to the best of our abilities if responses were unclear, and eliminated responses that did not answer the question in an interpretable manner; therefore, not all questions have 23 responses.

In order to obtain a standardized response for the time-cost relationship, we used a Scheduled Machine Hour (SMH) value of $90 (Hanzelka et al. 2016) to convert the logger's estimated time in minutes to apply slash on 100 feet of trail, and then compared that cost to the cost they estimated in dollars per 100 feet of trail. Thus each logger response provided two independent estimates of slash application costs based on the logger's direct estimate of costs and estimated time.

Stream crossing stabilized with hardwood slash.

Results

The majority (56.5%) of respondents preferred to use slash to close out a skid trail as compared to grass seed (17.4%), seed and mulch (13%), or a combination of grass seed, mulch, and slash (13%). The two most frequently selected locations for applying slash were stream crossing approaches and primary skid trails in general. Forty percent of loggers thought they applied slash on <100-foot lengths at a time, and 87% of loggers reported they applied slash during the harvesting operation rather than after (9%) or both (4%).

The average and median time loggers reported spending on slash application for 100 feet of skid trail were 39 and 30 minutes, respectively, during operations and 52 and 47.5 minutes after harvest (Figure 1). When converted to dollars per 100 feet of trail based on time estimates, average and median cost

estimates were $58.36 and $45 during harvesting operations and $78 and $71.25 after harvest (Table 1). The loggers estimated an average and median cost of $53.22 and $22.50 during operations and $160.36 and $100 after harvest. When asked if they thought applying slash was more or less expensive than applying seed or mulch, 70% said slash was less expensive.

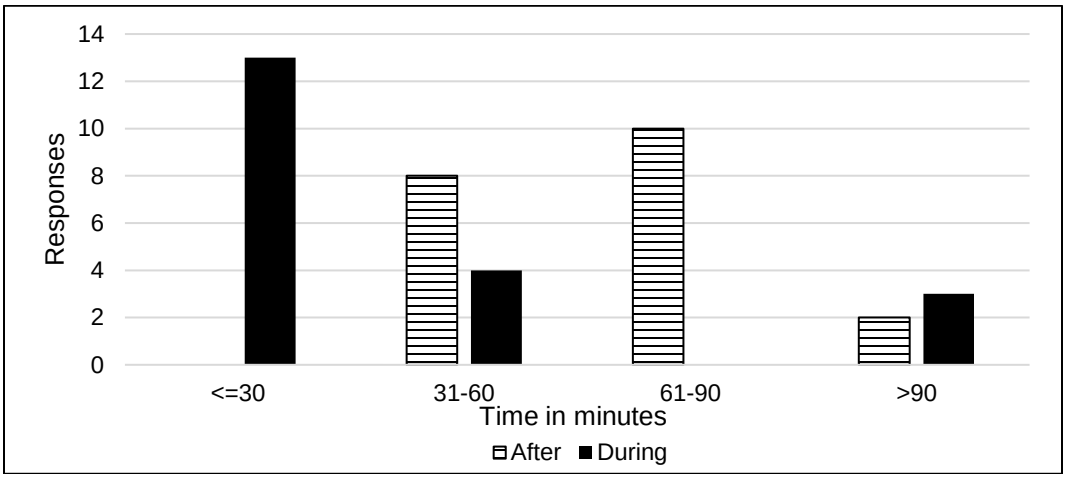

Figure 1. Estimated time in minutes to apply slash during versus after a harvest.

Table 1. Survey results comparing time and cost for applying slash during and after harvest.

	Average Cost/100 ft. Trail		Median Cost/100 ft. Trail	
	Estimated by Logger	Calculated Based on Estimated Time	Estimated by Logger	Calculated Based on Estimated Time
During	$53.22	$58.36	$22.50	$45.00
After	$160.35	$78.00	$100	$71.25

Conclusions

In agreement with other studies (McKee et al. 2012, Sawyers et al. 2012, and Wear et al. 2013), slash application does take longer if applied following harvest, and can be up to four times more efficient if utilized during operations (Sawyers et al. 2012).

While our sample was a relatively small portion of logging operations in Virginia, these results provide valuable information with regard to future explorations and characterization of BMP implementation. When compared to other studies performed at Virginia Tech that looked at slash application, our results are in general agreement with prior findings (Table 2). Overall, our survey results indicate that slash applications to close 100 feet of skid trail will cost approximately $53-58 during the harvest and $78-160 if applied after the harvest is completed.

Table 2. Comparison of 2017 survey results to other studies.

Per 100 Feet of Trail	Average Cost (dollars)		Average Time (minutes)	
	During	*After*	*During*	*After*
Our Survey (Logger's estimate)	$53.22	$160.35	39	52
Our Survey (Calculated SMH)	$58.36	$78.00	-	-
Sawyers et al. (2012)	$56.25	$77.84	-	60
Wear et al. (2013)	-	$120 per crossing	-	2 hours per crossing for slash only
McKee et al. (2012)	-	$445 per crossing		3-4 hours for all BMP closure at crossing

Literature Cited

Appelboom, T., G. Chescheir, R. Skaggs, and D. Hesterberg, 2002. Management practices for sediment reduction from forest roads in the coastal plains. Transactions of the American Society of Agricultural Engineers 45(2):337-344.

Hanzelka, N.C., M.C. Bolding, S.M. Barrett, and J. Sullivan. 2016. Productivity and costs of utilizing small-diameter stems in a biomass-only harvest. International Journal of Forest Engineering DOI: 10.1080/14942119.2015.1135615.

McKee, S.E., L.A. Shenk, M.C. Bolding, W.M. Aust. 2012. Stream crossing methods, costs, and closure best management practices for Virginia's loggers. Southern Journal of Applied Forestry 36(1):33-37.

Sawyers, B.C., M.C. Bolding, W.M. Aust, and W.A. Lakel III. 2012. Effectiveness and implementation costs of overland skid trail closure techniques in the Virginia Piedmont. Journal of Soil and Water Conservation 67(4):300-310.

Vinson, J.A., S.M. Barrett, W.M. Aust, and M.C. Bolding. 2017. Evaluation of bladed skid trail closure methods in the Ridge and Valley region. Forest Science. https://doi.org/10.5849/FS.2016030R1.

Wade, C.R., M.C. Bolding, W.M. Aust, and W.A. Lakel III. 2012. Comparison of five erosion control techniques for bladed skid trails in Virginia. Southern Journal of Applied Forestry 36(4):191-197.

Wear, L.R., W.M. Aust, M.C. Bolding, B.D. Strahm, and C.A. Dolloff. 2013. Effectiveness of best management practices for sediment reduction at operational forest stream crossings. Forest Ecology and Management 289:551-561.