

**BMP effectiveness at operational stream crossings on forest roads and skid trails in
Virginia**

Chandler L. Dangle¹, M. Chad Bolding², W. Michael Aust³, Scott M. Barrett⁴

Operational stream crossings on forest roads and skid trails are sensitive areas within timber harvests that can negatively impact site productivity and water quality if they are not correctly mitigated with best management practices (BMPs). The state of Virginia has three physiographic regions (Mountains, Piedmont, Coastal Plain) that pose specific challenges to the logging industry regarding water quality protection. Haul roads and skid trails require various methods of drainage and erosion control to maintain sufficient working conditions and access to timber. Our team sampled 25 haul road and 25 skid trail stream crossings from each physiographic region in Virginia for BMP implementation and efficiency. We modelled erosion rates using WEPP:Road and USLE-Forest to achieve erosion estimates at different levels of BMP implementation. We also explored the effects of road type, crossing structure, soil texture, cover percentages, and region on modelled erosion rates and costs. This study developed a cost-benefit ratio that depicts the dollar amount spent on improving BMPs to reduce one megagram of erosion at or near the stream by hypothetically upgrading the stream crossings to a superior BMP category that reduces erosion and enhances the benefits of BMPs. Potential erosion rates decreased with increasing BMP implementation (p-value <0.0001). Average audit scores for stream crossings were 88% on skid trails and 82% on haul roads. To upgrade from a BMP- to BMP-standard, the cost-benefit ratio averaged \$166.62/Mg for skid trails and \$2274.22/Mg for haul roads. Enhancement at the BMP+ level is not economically efficient and BMP implementation at stream crossings reaches maximum efficiency at the BMP-standard level.

¹ Graduate Research Assistant, Department of Forest Resources and Environmental Conservation, Virginia Tech. 228 Cheatham Hall, Blacksburg, VA 24061. clipham@vt.edu

² Associate Professor, Department of Forest Resources and Environmental Conservation, Virginia Tech. 228 Cheatham Hall, Blacksburg, VA 24061. bolding@vt.edu

³ Professor, Department of Forest Resources and Environmental Conservation, Virginia Tech. 228 Cheatham Hall, Blacksburg, VA 24061. waust@vt.edu

⁴ Assistant Professor and Extension Specialist, Department of Forest Resources and Environmental Conservation, Virginia Tech. 228 Cheatham Hall, Blacksburg, VA 24061. sbarrett@vt.edu