

ESTIMATING THE PROBABILITY OF POST-FOREST DEVELOPMENT LANDSLIDES IN THE PRINCE GEORGE FOREST REGION

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In British Columbia, terrain stability field assessments are required in areas with moderate to high likelihood of landslides before timber harvesting, forest road construction, or road deactivation is permitted. The assessments address the impacts forest development could have on the stability of landslide-prone slopes. Landslide risk assessments are an integral part of terrain stability field assessments. Presently, forestry-related landslide risk assessments generally involve the qualitative ratings of post-forest development landslide hazards, consequences, and risks using low, moderate and high ratings.

Since 1997, I have been undertaking numerous terrain stability field assessments for the BC Timber Sales Program (formally Small Business Forest Enterprise Program) in the Prince George Forest Region. In addition, I have also investigated many forestry-related landslides and provided geotechnical recommendations for their remediation.

Geographically, the Prince George Forest Region occupies northeastern British Columbia and has a total area of nearly 32 million hectares. The region covers some of the major physiographic units of the Interior Systems, including the northern part of the Interior Plateau, the Omineca Mountains, parts of the Rocky Mountain Trench, the Rocky Mountains, and the Cariboo Mountains, as well as parts of the Alberta Plateau. The Prince George Forest Region therefore has many diverse landforms, which consist of plains, basins, dissected plateaus, highlands and mountains.

Characterizing landslide-prone terrain requires interpretation of geomorphic history, water conditions, material thickness and properties, topography and discontinuities, and prediction of how they could change in the future. In the Prince George Forest Region, forestry-related landslides occur on all slope types. Landslides occur in both competent and weak slopes, as well as on gentle and steep slopes.

Disruption of hillslope drainage and seepage patterns is the dominant factor causing most of the landslides in the Prince George Forest Region. Changes to forest hydrology generally result from indiscriminate ground disturbance and drainage structure placements associated with timber harvesting, site preparation, and forest road construction and deactivation. Other factors affecting post forest development slope stability include oversteepened road cut and fill slopes and, poor road fill construction.

It is difficult to determine a time frame within which a landslide will occur under natural conditions. It is even more difficult and often more subjective to determine the probability of natural landslide occurrence. However, in the Prince George Forest Region, landslides related to forestry operations tend to occur within ten years of forest development with some occurring as early as one year after forest development, depending on the extent to which the natural water flow patterns along landslide-prone slopes are disrupted. Surprisingly, landslides associated with road fills containing a large amount of wood debris may take up to 25 years to occur, but oversteepened road cuts have failed during their construction.

Landslides investigated in the Prince George Forest Region from 1996 to 2002 indicate that the Poisson distribution model can be used to quantitatively predict the probability of landslides occurrence if forest road construction, deactivation or timber harvesting significantly modify hillslope drainage and seepage.