AUTHOR Douglas N. Swanston

AFFILIATION Forestry Sciences Laboratory

ADDRESS P.O. Box 20909, Juneau, AK 99802

TELEPHONE (907) 586-8811

TITLE: Slope Stability Problems Caused by Timber Cutting in Southeast Alaska

ABSTRACT

Slope failures in coastal Alaska are primarily debris avalanches and debris flows initiated in shallow hillslope depressions where subsurface water is concentrated. Subsequent channeling of the resultant soil, rock, and organic debris into pre-existing gullies and canyons during high-flow periods occasionally results in high-energy debris torrents or debris floods.

The susceptibility of hillslope depressions to failure is a function of slope gradient, overburden depth, material strength and the ability of the overburden to absorb and transmit water. A controlling factor in almost all failures is the development of a temporary water table during high-intensity, long-duration rainfall. The main factors controlling the development of debris torrents are quantity and stability of debris in channels, channel steepness, stability of adjacent hillslopes, and peak discharge characteristics of the channel.

On marginally stable slopes, timber harvesting operations have a major impact on initiation and acceleration of these landslide processes. The cutting of timber reduces or destroys the anchoring and reinforcing effects of tree root systems. Maximum reduction of effective overburden strength occurs from three to five years after timber is cut. Thereafter, strength slowly returns as new vegetation occupies the site. Low-volume road construction for timber access alters the strength-stress equilibrium of overburden materials through surcharging, removal of lateral support, and concentration of surface and subsurface flows into unstable sites. The extent and severity of these effects are influenced by initial location of the road, adequacy of design, and subsequent construction and maintenance.

Because of low population densities in southeast Alaska, damage from these processes has been restricted mainly to logging road access and anadromous fish habitat. As the population expands onto mountain slopes, and particularly into areas of active or recent logging activity, the public risk from landslides can be expected to increase in frequency and severity.