Humans and Landslides

Are humans at fault for the Starrigavan Valley and Redoubt Lake slides?

Image of the Frank Slide in British Columbia. Extensive coal mining was heavily implicated in this slide, which killed 70-90 citizens of Frank in 1903. Photo courtesy of Marek Slusarczyk.

Landslides seem so rare, destructive, and unnatural. Sometimes, they are. Sometimes landslides can be directly linked to logging or mining activity, as with the 1903 Frank Slide in British Columbia. Sometimes, however, landslides are simply a geologic certainty, guaranteed to happen given a long-enough time frame. Generally, landslides are directly related to weather events, but is global warming increasing or decreasing the likelihood of landslides? In Southeast Alaska in particular, what are the links between logging and landslides and between climate change and landslides? Was either a factor in the Starrigavan or Redoubt Lake slides?

Logging and Landslides by Numbers

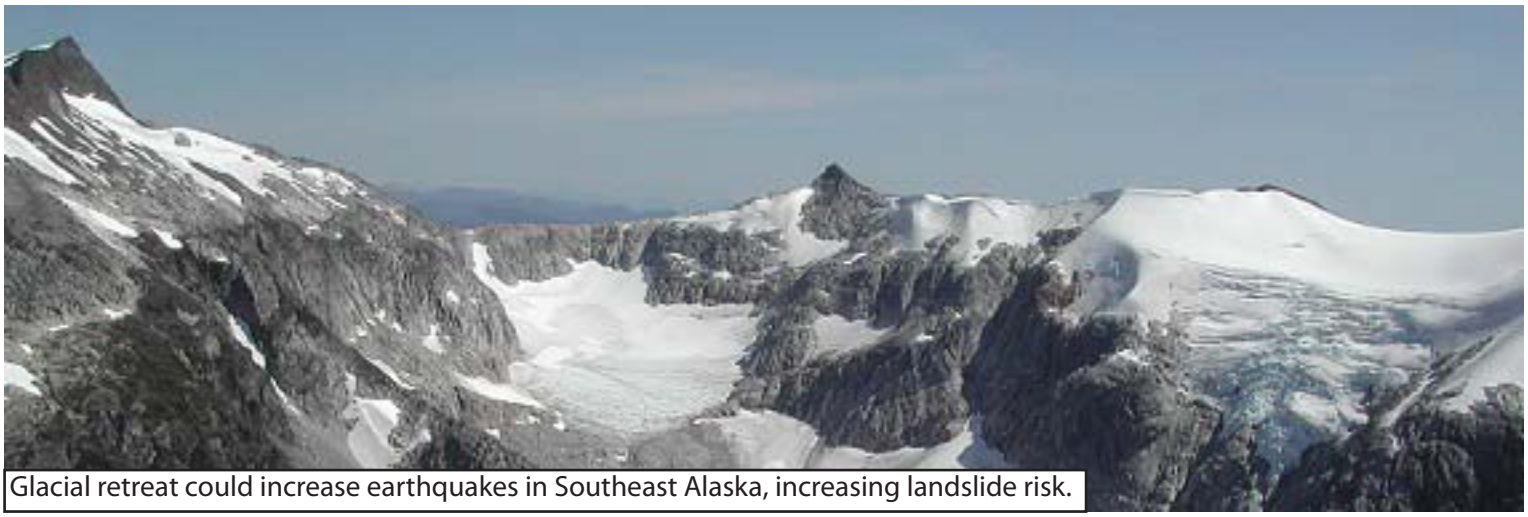
Description	Logged Areas	Old Growth Areas
Average Size	0.5 acres	3.1 acres
Debris torrents	27%	10%
Number of slides (POW 1971-1991)	86	60
Rockfall initiated slides	n/a	1%

Logged slope on POW. As the trees grow back, slope instability will increase as the old root systems rot, then decrease slowly over the next few decades as new trees grow up.

Logging and Lanslides: A Summary

The link between logging and landslides is well documented: logged areas slide 3-5x more often than unlogged forest in the Tongass. Taken alone, though, this fact is a bit misleading. While there are many more landslides on logged areas and those landslides start and lower slope angles, landslides that initiate in old-growth forests tend to be much larger than their human-caused counterparts. The more unstable nature of logged slopes means that the soil fails at lower stress levels, so the landslides generally don't have the energy to cause the devestation seen in the Starrigavan and Redoubt Lake slides. Instability in logged areas typically peaks about 5 years after the logging has occurred, but remains elevated for decades after.

The other factor to keep in mind when looking at landslide fequencies is where those landslides occur. Almost half of all landslides in second-growth forests occur on slopes over 36 degrees, but only 1% of logged slopes are that steep. Logging certainly causes slides, but where those slides occur is considerably more predicatable.The frequencies of landslides in different land areas are important, but those numbers alone do not paint the full picture of logging and slope instability.



Glacial retreat could increase earthquakes in Southeast Alaska, increasing landslide risk.

Logging decreases slope stability, but even old-growth forests succumb to gravity. This old-growth forest has been cleared by debris flows and avalanches.

Starrigavan and Redoubt: Are We to Blame?

Of the two human-affected risk factors for landslides, logging is easy to rule out for both Starrigavan and Redoubt. Each slide started in old-growth timber on steep, unstable slopes. Like Redoubt and Starrigavan, most slides in unlogged areas are large and powerful.

Climate change is harder to rule out. No specific landslide will ever be due exclusively to climate change; slope angle, rainfall, and soil characteristics will always be determining factors. But was the rainstorm that triggered the Starrigavan slide made more likely by increasing temperatures? Are increased temperatures leading to more or less frost fracturing of rock faces like those surrounding Redoubt Lake? It may be impossible to ever assign a concrete number to human culpability (or lack thereof) for specific landslide events. What is clear, however, is that we can expect more landslides in the future. How we prepare for those events, mitigate their hazards to life and property, and take steps to limit the amount of climate change that does occur is entirely up to us.

Climate Change and Landslide Risk factors in the Tongass

As the Tongass warms, winter precipitation will shift toward more rain and less snow. There is also an increased likelihood of rain on snow events, which frequently contribute to a slope's oversaturation. The increased rainfall caused by climate change is likely to be exacerbated in Southeast Alaska as we shift from a cool phase to a warm phase of the Pacific Decadal Oscillation. In short, the warming-induced precipitation will increase landslide hazard.

While increased precipitation will be the most important driver in increased landslide risk, climate change could increase landslide frequency in a few other ways as well. First, higher windspeeds associated with larger storms will lead to more windthrow, reducing slope stability created by root systems. Secondly, as our glaciers retreat, the decreased pressure along fault planes will allow them to slip more easily. That means more earthquakes and, in turn, more landslides.

Protecting the Tongass since 1967