Snow Avalanche HJA 082808.doc

Observations of evidence of a snow avalanche on Lookout Mountain, Andrews Forest, 2008

The Sitka-alder (*Alnus viridis* subsp *sinuate*) chutes on the north and east faces of Lookout Mountain have been suspected of being sites of snow avalanches. They have been observed since the early 1970s, but exhibited no evidence of snow avalanching until Fred Bierlmaier noted toppled trees and bare soil in one chute in the summer of 2008. On August 1, 2008, Fred Swanson and Alan Tepley hiked out the Lookout Mountain trail in the H.J. Andrews Experimental Forest and then eastward down the long, Sitka-alder track in the N1/2 of the S1/2 of Sec 32, T15S, R6E, and reached upper Lookout Creek in clearcut unit L704. The track extends from an elevation of ca. 1500 m down to 1070 m elevation with a slope of ca. 50% in its upper part, based on the June 2004 Andrews Forest topographic map (see location map). The following observations were made during this brief field investigation.

Field Observations

Both from across the valley (see photographs looking westward from Road 1506 in upper part of cutting unit L704A) and on the ground we observed no evidence of snow avalanching in the wide, upper part of the chute. In its upper third the chute is a continuous canopy of Sitka alder with stems strongly bowed downslope by the history of snow loading and snow creep. The chute constricts about one third of the way downslope (GPS coordinate: 569927 N, 4895941 W); at this point we began to note signs of avalanche damage among the trees within 8-10 m of the chute on its south side. The indications of snow avalanche the previous winter included deposition of piles (up to 1m high) of limb and foliage litter lodged against the upslope side of tree boles and abrasion/delimbing of the uphill side of conifer saplings. Just downslope of this site a patch of ca. one dozen trees (15-40 cm DBH) have been toppled by root throw and stem snapping. There is no sign of damage to the Sitka alder in the axis of the chute viewed from 10-30 m distance. There appears to have been damage to conifers (e.g., delimbing on upslope side of boles up to ca. 4 m) on the north side of the chute at this elevation.

A short distance downslope (GPS coordinates: 570111 N, 4896024 W) the chute is narrowing further and the adjacent forest contains large old-growth trees. Patches of bare mineral soil and transported trees are encountered at this point in the chute; and we observed abraded saplings of cedars and silver fir along the chute margin.

Toppled trees occurred as isolated individuals but more commonly as discrete patches of toppled trees along the margins of the runout path. Some toppled trees fell as far as 40 m into adjacent forest, striking other trees. The toppled trees were up to ca. 60 cm DBH. In the lower part of the track the channel down the chute is steep-sided and about 5 m deep. The snow avalanche scoured the banks of the channel to mineral soil and stripped of shrubs, which are mainly vine maple (*Alnus circinatum*), in a spotty pattern.

Viewing the intersection of the chute with upper Lookout Creek from the opposite valley side and on the ground at the downstream point of intersection, it appears that there was no significant delivery of wood to the channel. It appears that 60-80 trees were toppled along the entire length of the chute, but most remained partially rooted or detached, and close to their rooting sites. Therefore, it does not appear that the snow avalanche mobilized a large enough of wood to create a discrete wood deposit at the end of the runout zone.

Meteorological Conditions in Winter 2008

Meteorological conditions of the winter of 2008 were unusual (Julia Jones, personal comm., based on Andrews Forest records in the Forest Science Data Bank). The Upper Lookout Meteorological Station (UpLo, elevation 1294 m, about the midpoint of the track) is conveniently only 1 km south of the avalanche site, but unluckily its snow sensor was not functioning during much of the 2008 winter. Based on the historic relation of snow depth between UpLo and VanMet stations in the Andrews Forest, we estimate there was a peak of 1600 mm of snow water equivalent on about April 1, 2008. During a field visit on April 2, John Moreau observed about 4.3 m of snowpack containing 35.8% water (F. Bierlmaier, personal communication), and Bierlmaier commented that this snow depth was reached and then partially melted several times during early 2008. This is the greatest snowpack recorded since measurements began in 1987. This was a La Nina winter, but not a particularly strong one; La Nina winters are characterized by deep snowpack in this area.

Discussion

The Sitka-alder chute is wide and shallow at the top and narrows downslope to a constriction about one third of the way down its length. The striking absence of conspicuous damage to trees and soil in the upper part of the track may reflect several factors: 1.) a snow avalanche can move over prostrate alder bent downslope by the warm, wet, think mantle of creeping snow without affecting the alder; 2.) the avalanche may have narrowed and thickened as the chute narrowed and deepened, and therefore the force of moving snow may have increased; 3.) the avalanche appears to have had a slightly northerly trajectory and first toppled forest on the north side of the chute at the point of constriction and then may have flowed off this hillside and damaged forest on the south side of the chute before flowing back to the north side; 4) toppled trees entrained and transported in the avalanche may have served as tools to aggravate damage to standing trees down the flow path. The latter phenomenon would be similar to the role of moving (floated) wood in streamflow and debris flows (e.g., Johnson et al 2000).

For other disturbance processes affecting the Andrews Forest ecosystem, such as fire, debris slides and flows, windthrow, we have attempted to make estimates of the recurrence interval and regime of each process. However, this is not possible for snow avalanches, because the sample size is so small. A minimum estimate of the period since the last event of this magnitude could be based on the ages of trees toppled in the 2008 event. Further work on the history of events in the Andrews Forest could include search for dateable scars on trees along the lower parts of this and other possible snow avalanche chutes. Another area with a possible dendrochronological history of snow avalanches is

the north face of Carpenter Mountain in the area burned by fires in the early 20th century. The 1946 air photos of this area contain breaks in the developing forest canopy that may reflect snow avalanches after the forest cover was diminished by several stand-replacement fires.

Foot travel

We descended about halfway down the length of the chute on the south side, which was hard going thru salmon berry, devilsclub, and patches of Sitka alder; and quite steep. We then moved to the north side of the chute and found foot travel in the forest at the edge of the chute much easier; the more southerly aspect supports a more open understory. Travel thru shrubby clearcut L704 is very difficult.

Literature Cited

Johnson, S. L.; Swanson, F. J.; Grant, G. E.; Wondzell, S. M. 2000. Riparian forest disturbances by a mountain flood -- the influence of floated wood. Hydrological Processes. 14: 3031-3050.

Figures

1. Location map of shrub-covered chute on east flank of Lookout Mountain that experienced a snow avalanche in the winter of 2008.

2. Photograph looking west to the east flank of Lookout Mountain. Shrub-covered chute with disturbed patches in the lower portion is in center right of the photo.

3. Close-up photograph of lower portion of the affected chute. Upper Lookout Creek is at bottom of the photograph.

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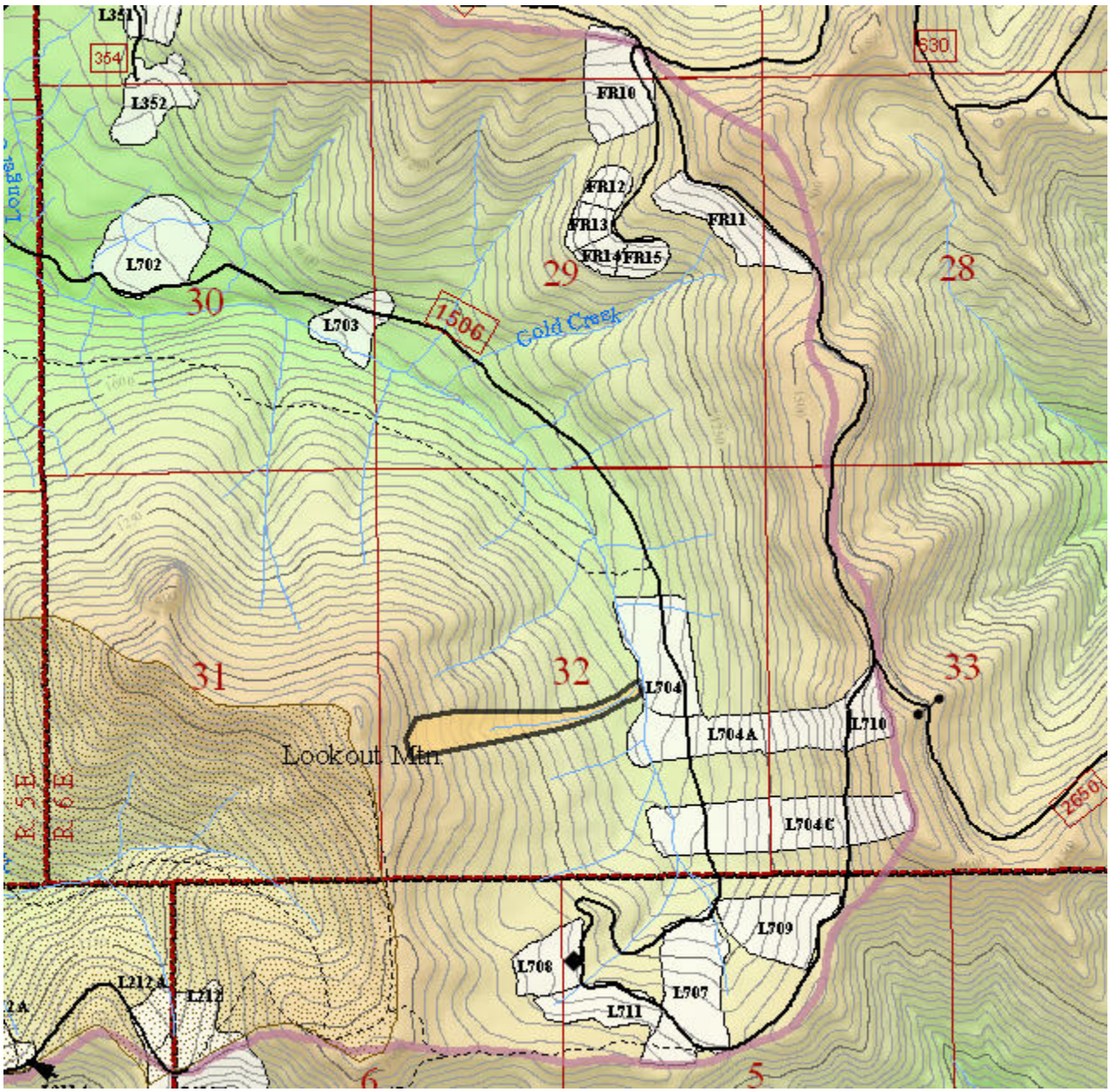
August 27, 2008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