Flume in the forest

Richard Iverson and colleagues made enough of a din to scare the bears when sending large amounts of debris down a 95-m-long flume to find out what difference wet sediments make to an avalanche.

What was the objective of the work?

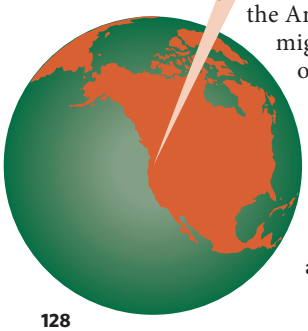
Entrainment of bed sediment has a big effect on our ability to forecast debris flow and avalanche hazards, and the basic physics of entrainment are poorly understood. That combination makes it an exciting target for research. When we began this project our main objective was to test two hypotheses about entrainment: that it can be influenced by high pore-fluid pressure that develops in bed sediments when they're overridden, and that it occurs by mass failure rather than grain-by-grain. We knew that development of high pore-fluid pressure in the bed sediment would also affect basal friction and flow dynamics, but we were kind of stunned when we saw that this feedback could be so dramatic. When our debris flows hit wet sediment beds, they seemed almost to explode, with debris churning violently and flying high above the sidewalls of the flume: debris-flow momentum quadrupled in less than ten seconds as a result of flow interaction with the wettest sediment beds.

Why did you choose this location?

A flume for running debris-flow experiments needs to be big because of the scale-dependent properties of wet granular debris. Finding a steep but accessible slope where we could build our 95-m-long United States Geological Survey (USGS) flume was a challenge. Largely because of contacts I had with a few key people who were eager to cooperate and facilitate our efforts, we built it at the H.J. Andrews Experimental Forest in Oregon. The Andrews Forest is famous mostly for ecological research, but over the years it has proved to be an almost ideal site for us to do our experimental work because of its great infrastructure and supportive staff.

Did you encounter any difficulties?

I suppose the only drawback to working at the Andrews Forest might be the climate of the western Cascade Range. At elevations around 500 m, where our flume is located, it rains about 2.5 m annually, and the rain doesn't always treat our electronic equipment kindly. Summertime weather is usually good there, however, so over the years we've become mostly summer people.



US GEOLOGICAL SURVEY

Richard Iverson and his group setting up an experiment in their flume at the Andrews Forest, Oregon, USA.

Did you have encounters with animals?

Cougars and bears routinely prowl the area where we work, but they tend to give us a wide berth, probably because of all the racket we make. In the course of our work we move many tons of sediment and water around, and the machinery that does this is inherently noisy. Nonetheless, deer in the region seem to favour the area around our flume, maybe because we scare the cougars away. Most creatures just ignore us, however. The Andrews Forest is famous for rough-skinned newts, and we also have lots of encounters with lizards, snakes and bats that have found homes in the nooks and crannies of our facility. My favourite animals are the seldom-seen Swainson's thrushes that sing high in the forest canopy around sundown on many evenings.

Any low points, close misses?

Yikes! Anyone who builds and uses new types of experimental apparatus knows that potential pratfalls are lurking everywhere. Although we have blown some opportunities to collect key data, damaged a lot of equipment and sustained a few minor injuries over the years, we've had no really serious mishaps.

Any ideas for future projects?

There is a quote from Gandhi saying that life is an endless series of experiments, and I sort of feel that way about our work at the debris-flow flume. It's the only facility of its kind in the world, and it affords countless opportunities for doing new kinds of research. In the short term we're refining our entrainment experiments and doing new types of experiments focused on grain-size segregation and breaching of earthen dams.

This is the Backstory to the work by Richard M. Iverson et al., published on page 116 of this issue.