IN THE LAB Wall Street Journal 7/27/90 3280 [redacted]

Mudslides Reveal Their Secrets on Flume

By James P. Miller
Staff Reporter of The Wall Street Journal

BLUE RIVER, Ore.—Richard Iverson is disappointed his work isn't going downhill.

For hours, Dr. Iverson and his researchers have been raining water on a 10-ton pile of dirt to start it sliding down a giant cement flume here in the Willamette National Forest. But it won't budge.

"Still no basal saturation," says a scientist monitoring gadgets in a nearby shed. "I think we're limited by the infiltration capacity." That means the big dirt pile isn't soaking up much water.

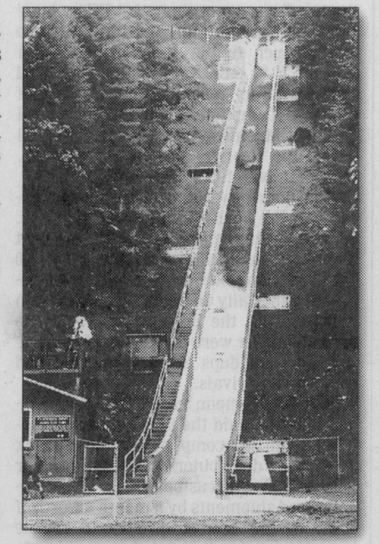
Finally, Dr. Iverson agrees to an injection of water from below. It is the hydrologic equivalent of inducing labor. The mound begins to leak and bulge. A mudslide, one of nature's more dangerous and mysterious phenomena, is about to occur.

As a landslide researcher for the U.S. Geological Survey, Dr. Iverson is one of the world's leading authorities on mudslides. But by his own admission, there is much he doesn't know about them. Scientists don't yet understand when and why mudslides begin well enough to make firm predictions or warnings. The mystery leaves residents of hillsides and valleys world-wide at risk.

Every year, hundreds of people die in mudslides, which strike particularly hard in the world's impoverished hillside shantytowns. In 1985, in the worst such disaster ever recorded, snow that had melted in an otherwise insignificant volcanic eruption sent a surge of mud roaring miles down a valley in Colombia, killing 23,000 people. Just in May, a mudslide near Naples, Italy, claimed the lives of more than 150 people.

Studying mudslides has been dangerous work. Twenty years ago, several researchers in Japan died when the hillside they were systematically saturating broke loose, roared down the hill and across the valley, and buried them and their observation post on the opposite slope.

The flume, which allows researchers to create landslides on demand under controlled conditions, is designed to avoid such an incident here. After years of lobbying by Dr. Iverson and others, the USGS agreed to spend a quarter of a million dollars to build it in 1992. At 310 feet long, and with a 150-foot vertical drop—roughly the height of a 15-story building—it looks like the world's most dangerous toboggan run.



This giant flume is helping scientists understand deadly mudslides

Scientists understand fluid dynamics well enough to predict water's path in a flood, or the movement of solid material in an avalanche. But for the more complex dynamics of mudslides, they lack the data to create a good predictive model. A better model would help land-use planners figure out where houses or nuclear-power plants could be built safely, and make better predictions about the effects of loggers' mountainside clear-cuts. It also could help authorities issue earlier mudslide warnings and develop more effective barriers.

Dr. Iverson, 43 years old, is a lanky, bearded man who has been researching mudslides for the past 14 years. He works at the USGS Cascades Volcano Observatory in Vancouver, Wash., three hours northwest of the flume and near the site of the Mount St. Helens volcano. With his experiments on the flume, he expects to generate an avalanche of data about mudslides.

But as a day on the hillside reveals, much remains unknown about mudslides, including how to get one to start on schedule. Dr. Iverson and as many as seven other USGS researchers spend several weeks each summer at the flume, at the federal H.J. Andrews Experimental Forest research site in the mountains east of Eugene. Along with scientists studying other aspects of forest ecology, like mushroom growth and stream silt, they sleep in bunkhouses under fir trees 200 feet tall. They have barbecues in the evening. Sometimes, scientists from slide-prone countries such as Japan, China and Switzerland join the group.

It is the kind of research many 10-year-olds would relish. On some days, the hydrologists pile 40 tons of soupy mud behind big steel gates at the top of the flume and release it downhill. Instruments embedded in the base collect arcane data.

Sometimes, the scientists place obstructions in front of the flow, like the steel cables some mountain towns have strung in front of suspect hillsides, and then use laser beams to precisely measure the cables' effect on flow pattern. They methodically alter the consistency of the soil, then swing open the gates once again. "It's the classic science thing," says Dr. Iverson,

Please Turn to Page B5, Column 1

Flume Reveals Mudslides' Secrets

Continued From Page B1

"we try to hold all the variables constant except one."

Twenty-ton trucks lug gravel and dirt up the hillside. With their work boots, rain gear and long-handled shovels, the researchers in blue jeans resemble a construction crew or a logging gang that just happens to be chatting about pore-pressure diffusion rates and internal shear stress as they trudge up the flume's 261 steps.

Research assistants add water to a pile to achieve just the right viscosity. The scientists position themselves by the viewing ports built along the flume's sides. And—*whoosh!*—down roars a fast-moving stream of muck, spilling a carpet of mud onto the valley floor. "I used to refer to it as mudpies for big boys," Dr. Iverson says.

Soil is a solid because the force of friction binds its particles together. Usually, when it gets wet, it just turns into slow-moving mud. But something else happens when water enters the soil and can't escape. If the rising internal water pressure exceeds the binding force of friction, under the right circumstances it will cause a hillside to liquefy almost instantaneously. The earth doesn't become mud: It becomes a deadly free-flowing slurry that can attain a speed of 20 miles an hour and bulldoze trees and houses in its path.

Scientists call that process "mobilization," and it is what the team is trying to achieve today. The sprinklers designed to replicate rainfall have been running full-blast for hours, and a hard natural rain is falling. But the heavily compacted mound remains immobile. Finally, after water is introduced from below, the pile's internal pressure begins to rise swiftly. "Deformation!" calls out the scientist monitoring the equipment. "It's gonna go right now."

With a sucking sound, a portion of the squirming pile suddenly liquefies and courses down the flume. The research assistants cheer. But to the disappointment of the mudslide researchers, much of the mound stays put.

"It's piping," someone says. The water has found a subsurface exit route.

"Once that happens it's all over," another scientist replies.

It is all valuable data, as far as Dr. Iverson is concerned. "Look at that stratigraphy!" he exclaims, examining the compacted layers of earth left on top. Except for a laborious cleanup with fire hose and shovels, the last of the week's mudslides are over.

Dr. Iverson is planning the next series of slides for late summer. He is hoping to develop a rock-shaped instrument that he can throw in the mud, to acquire information without disturbing the natural flow. "A tri-axial accelerometer, basically," he says. "A smart rock."

H-P to Sell Servers to DirecTV

PALO ALTO, Calif. — **Hewlett-Packard** Co. said it will provide more than 30 MediaStream broadcast servers to **Hughes Electronics** Corp.'s DirecTV.