

Our Ocean Backyard — *Santa Cruz Sentinel* columns by Gary Griggs, Distinguished Professor of Earth and Planetary Sciences, UC Santa Cruz.

**#254 January 21, 2018
Fires, Rainfall, and Debris Flows**



1972 Big Sur debris flows. A car crushed by a boulder and a house alongside Highway 1 destroyed by the event

Ventura and Santa Barbara counties, and particularly the village of Montecito, were hit hard these past weeks; first the largest wild land fire in California history, followed by intense rainfall that triggered devastating and deadly debris flows.

The Thomas fire came during December, which would normally be a wet winter month, but it was one of the driest Decembers on record. Warm Santa Ana winds coming off the mountains pushed the fire down the mountains and into coastal communities. The fire burned 440 square miles of steep mountain terrain, the equivalent of burning the trees and brush off almost three-fourths of all of Santa Cruz County- from Waddell Bluffs on the north to the Pajaro River on the south and from the crest of Highway 17 to the sea.

The fire literally scorched the earth, burning off the cover of plants and trees, which would have both broken up the rainfall and also anchored the soil in place. The heat incinerated the surface layer of organic matter that normally would absorb and hold the moisture. Instead a nearly water repellant layer was created that led to rapid runoff of the short duration but intense rainfall of the early morning of January 9.

Just half an inch of rain (13mm) fell on the hillsides above Montecito in about five minutes at 3:30 am on January 9. The water from this intense rainfall quickly began to flow downhill picking up dirt and turning it into mud. As the flow increased in volume and velocity, it picked up cobbles, then boulders and soon turned into a debris flow.

While the mud and debris was initially concentrated in a few stream channels, the increasing volume of water and debris from upslope as well as what was being picked up along the way, soon overtopped the channels and spread out on either side. While no one was measuring all of this in the dark at this early morning hour, the mud marks and debris left behind indicate the flows were up to 15 feet thick and were probably moving about 20 miles/hour. This is considerably faster than the average person can run.

Twenty-four people died and 65 houses and 8 businesses were destroyed as the mud and debris flowed rapidly through a swath of Montecito with very little warning. 163 more people have been hospitalized, 462 more homes and 20 more businesses were damaged. While there apparently were evacuation warnings, it seems that after the fire in December, many people were simply suffering from

evacuation fatigue and chose to stay at home. Some were fortunate and survived, and some sadly were not, even within in the same home.

Cars and trucks, were picked up like toys by the debris flows, twisted and squashed, and two were carried all the way to the beach, as was a stuffed grizzly bear, apparently a hunting trophy swept out of someone's home. Some houses were ripped off their foundations while others were completely filled with mud and boulders.

The power of thousands of cubic yards of mud and debris, five to fifteen feet thick, moving at 20 miles per hour through a normally quiet, semi-rural neighborhood is truly hard to imagine until you see the photographs of crushed cars and homes reduced to piles of rubble. Much of the mud and debris came to rest on State Highway 101, completely closing it off to traffic for at least two weeks.

Forty-six years ago, in the late summer of 1972, a major forest and brush fire (the Molera fire) swept quickly through the Big Sur area, burning 4000 acres (a little over 6 square miles) of steep coastal mountains above the Big Sur River. The conditions were similar to those above Montecito this past December. Days of sustained rainfall in November were followed by short periods of very intense rainfall and led to extensive mud and debris flows coming off the steep, burned over slopes.

These flows, estimated at 10,000 cubic yards (about 1000 dump truck loads) flowed quickly down the steep mountain slopes along the drainages. They covered Highway 1 and partially destroyed or inundated the picturesque village of Big Sur, including houses, businesses, mobile homes, automobiles, and even a bulldozer.

Boulders up to 10 feet across and redwood trees up to 3 feet in diameter were carried along by the rapidly moving flows and left material that hardened to the consistency of concrete.

Santa Cruz County has its own history of debris flows. In January 1982, the entire San Francisco Bay area suffered through an intense storm which produced about 18,000 landslides and debris flows, including the disastrous Love Creek failure above Ben Lomond (more to come).