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ORANGE COUNTY
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DANGER UNDERGROUND

The Downside to Life on the Hillside

By PATRICK MOTT

A rainy winter, after two years of drought, may be a mixed blessing to some hillside residents of Orange County who know that with the water comes the possibility of major threats to their property — landslides and mudslides.

Lying in their beds in the predawn darkness of Oct. 2, 1978, Dick Harley and his family thought that the popping sound was hail hitting their roof. They looked outside — no hail was falling. The sound began to take on a crackling quality, like fire.

"Then," Harley said, "we realized that the end of our driveway had curled up and a neighbor had tripped over it. We knew then that the earth was doing something strange."

Harley's entire neighborhood was sliding away. The crackling noise that he and his family heard above their heads was the sound of nails being ripped loose from rafters as the house shifted. In a few seconds, 22 homes in Laguna Beach's Bluebird Canyon were on their way to being destroyed or rendered worthless by the largest and most destructive landslide in recent Orange County history.

The Harleys, along with dozens of other confused and frightened residents, were quickly evacuated to City Hall, but they returned after daybreak to a point near the canyon where they should have been able to see their home.

"But it wasn't there any more," Harley said. "The whole block had dropped maybe 50 feet."

It had rained heavily during that late winter of 12 years ago, and most Southern Californians welcomed it. The region had suffered a long and costly drought that prompted restaurants to withhold ice water and many residents to cut back severely on home water use.

But the same water that brought relief to parched Southlanders be-

gan accumulating in large quantities in the ground beneath Bluebird Canyon, swelling the clay-type strata and acting as a kind of lubricant. And six months later, 3.5 acres of residential neighborhood crashed down the hill, leaving dozens of residents homeless.

Now, after two years of drought, weather forecasters say that Southern Californians once again may be facing a rainy late winter. And throughout the hillside neighborhoods of Orange County, residents again must deal with the possibility that living in the heights has a downside.

While Southern Californians know, from their experience with earthquakes, that the ground beneath their feet is far from static, hillside residents also know — or should — that the land on which they live has the potential to be even more unstable in nature, that gravity, water, soil and bedrock composition, geologic history and man-made changes can combine to damage or destroy their homes and property in the form of a mudslide or a landslide. Both earth movements can be dramatic and frightening.

A mudslide (geologists call it a mud or debris flow) involves only the top few feet of soil but sometimes can occur with startling speed. It happens when a barren or sparsely planted hillside, often with lightly compacted or clay-like topsoil, becomes saturated with water. The load becomes too much for the earth to bear and the soil flows downhill.

A landslide is more complex and can be massively destructive. It involves deeper strata, often well into the bedrock layers. Like mudslides, landslides often occur in

Please see SLIDE, N5

POTENTIAL SLIDE AREAS



The most slide-prone section of the county is in the south — from Laguna Beach and Laguna Hills south to the county line. However, any hilly area is susceptible to landslides.

MISTAKES MADE BY HOMEOWNERS



Overwatering. A hillside doesn't need much. Saturating it may weaken it.



Improper drainage. Water draining over the edge of a slope weakens it.



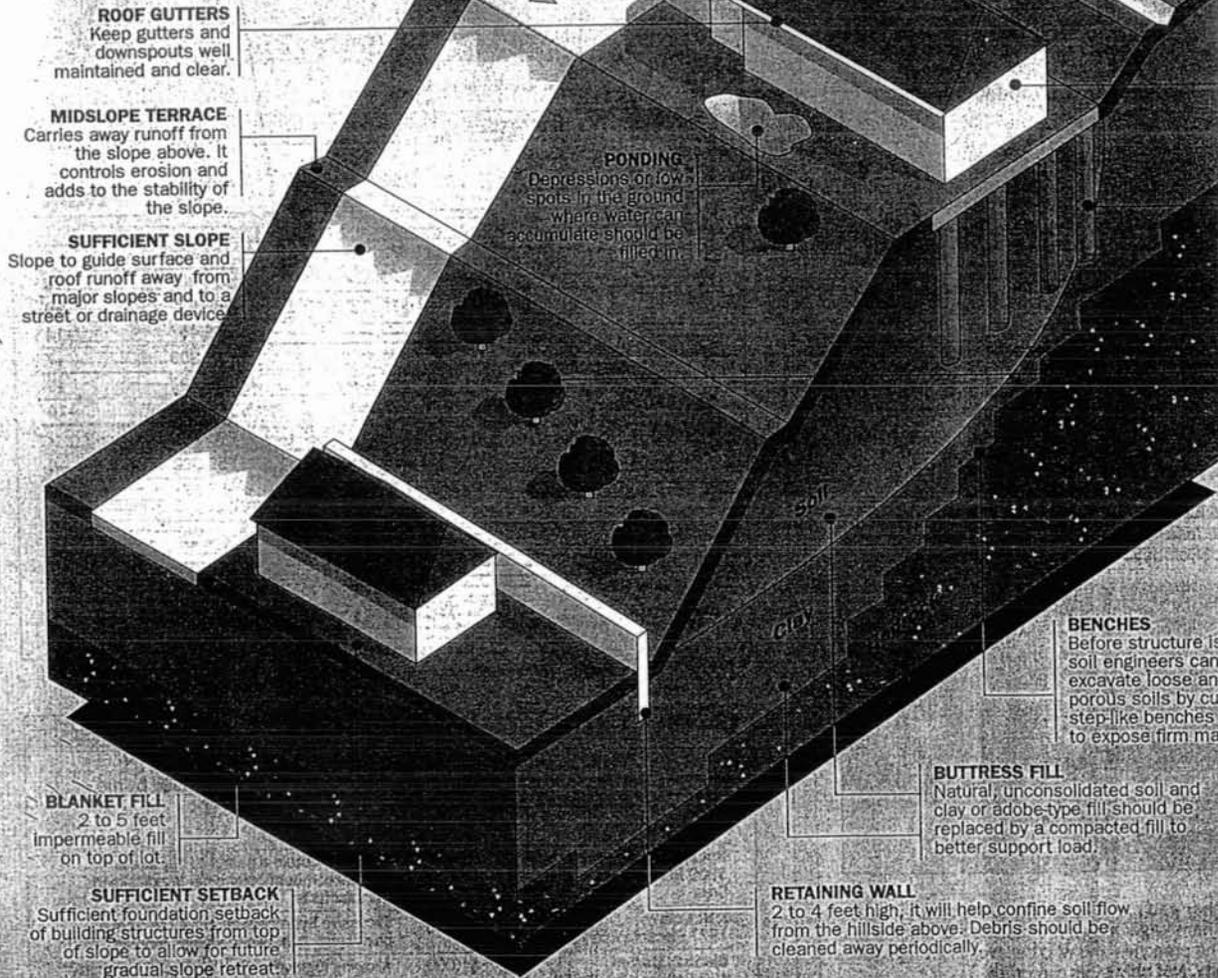
Choosing the wrong ground cover. Plants that make a pretty display may not prevent costly erosion.



Ignoring risks. It pays to get a geologist to check for a slide area before buying, particularly if the home you want is older.

LANDSLIDE PREVENTION

The risk of landslides and mudslides can be lowered before a structure is ever built through the use of shallower grading and proper soil compacting and drainage. For existing older structures on hillsides, however, there are several "fix-it" techniques that can help.



ROOF GUTTERS

Keep gutters and downspouts well maintained and clear.

MIDSLOPE TERRACE

Carries away runoff from the slope above. It controls erosion and adds to the stability of the slope.

SUFFICIENT SLOPE

Slope to guide surface and roof runoff away from major slopes and to a street or drainage device.

PONDING

Depressions or low spots in the ground where water can accumulate should be filled in.

BLANKET FILL

2 to 5 feet impermeable fill on top of lot.

SUFFICIENT SETBACK

Sufficient foundation setback of building structures from top of slope to allow for future gradual slope retreat.

RETAINING WALL

2 to 4 feet high; it will help confine soil flow from the hillside above. Debris should be cleaned away periodically.

BENCHES

Before structure is built, soil engineers can excavate loose and porous soils by cutting step-like benches in order to expose firm material.

BUTTRISS FILL

Natural, unconsolidated soil and clay or adobe-type fill should be replaced by a compacted fill to better support load.

PAVED DRAINS AND DITCHES

These carry away excess water from the slope and should remain clean.

BOARDED UP DOORS AND WINDOWS

Debris often enters building through windows. Be prepared to board them up during a flow.

PILINGS

Sunk 30 to 50 feet deep, these can be used to anchor a structure built on a sandy soil layer or on loosely compacted soil.

GROUND COVER

Plants with deep root systems should be used to anchor the topsoil, but should not be over-watered.

SOME CAUSES OF LANDSLIDES

1. Gravity - The steeper a slope, the greater its potential to slide.

2. Strata composition - Clay-type strata retain water and can cause slippage.

3. Water - Lubricates the underlying strata or causes it to lift and become unstable.

4. Earthquakes - Can trigger landslides or mud flows.

PAST LANDSLIDES IN ORANGE COUNTY

OCT. 2, 1978

22 homes are destroyed as 3.5 acres of land in Laguna Beach's Bluebird Canyon slide downhill.

FEB. 17, 1980

Two homes are destroyed and another damaged after a slide in the Arch Beach Heights area of Laguna Beach.

JUNE 13, 1980

Two homes are damaged in the La Esperanza landslide in San Clemente.

DEC. 30, 1983

Three houses are destroyed after sliding down a slope in San Clemente following a water main break.

SEPT. 3, 1986

Seven homes are evacuated in San Clemente after a landslide left the houses perched atop a 20-foot escarpment.



SLIDE

Continued from N1

clay-rich, unconsolidated strata that are prone to absorb and retain water.

When water seeps into the deeper clay layers, it generally stops there, since clay tends to be impermeable. The water, denser than the strata that are now above it, buoys up those strata, loosening them and creating a kind of lubricated layer. If the hillside is steep enough and the load above heavy enough, large sections of earth, sometimes many yards wide, can slide all at once. The hillside can look as if a huge hand scooped out a rather neat portion of it with a spoon. This is similar to what happened at Bluebird Canyon.

Landslides also can be triggered by water seeping into cracks in the ground that were formed after a long dry period that caused the ground to contract and split. The water applies pressure to the sides of the crack and can cause a bloc of land to break away.

Both landslides and mudslides can also be triggered by earthquakes.

Orange County is familiar with both phenomena. They have occurred with varying frequency in every hillside area of Orange County at various points in geologic time. They have damaged or destroyed property in such disparate areas as Fullerton, Brea, La Habra, Anaheim Hills, Orange, Laguna Beach, Laguna Hills, Laguna Niguel, Dana Point, San Juan Capistrano and San Clemente. However, it is in the South County where the most susceptible, clay-rich earth is concentrated in a wide-ranging stratification known to geologists as the Capistrano Formation, which takes in much of the coastal land from Laguna Beach to the San Diego County line.

This area has not been quiet in recent years. According to a study published in 1984 by the California Department of Conservation's Division of Mines and Geology, 71 landslides, rock falls or mudslides occurred in the South County's coastal area between 1977 and 1984.

Still, much of the land in that area (as well as in other hilly parts of the county, such as Anaheim Hills) is highly prized by developers because of the views—and consequent higher real estate and home sale values—it offers. Demand remains high. And in some areas of proposed development, so do the risk of landslides and mudslides.

The million-dollar question is: how do you foil Mother Nature?

How you do it depends in large part on whether you live in an older house or a relatively new one, but the principles are about the same, say geologists, engineers and soil specialists.



"About 20 years back, there were very few requirements that the county and cities had to enforce on developments," said Banwari Bishnoi, a senior civil engineer in the developmental services division of the Orange County Environmental Management Agency.

"Then, if you were building a little house, the geotechnical report would be maybe a one-page letter. The reports we review these days on any good-sized project could be 50 to 100 pages and have all kinds of analyses that we were not generally asked to do 20 years ago."

Because of the less-stringent requirements for geological study, grading, compacting, erosion control, governmental enforcement of codes and other factors that existed two decades ago, houses 20 years old or older may be more at risk than structures in newer developments, the specialists say. Older slopes may have a gradient of as much as 1:1 (a 45-degree slope), drainage and ground cover may not meet current standards and the underlying strata may be subject to movement. There are several options and each involves eliminating the causes of specific problems, said Jerry Treiman, a geologist with the Department of Conservation's Division of Mines and Geology in Los Angeles.

If a slope is too steep, Treiman said, it can be regraded to redistribute the load, or it can be buttressed with earthfill structures. If ground water is a problem, wells can be drilled that will remove the excess water from the slide plain.

In extreme cases, said Iraj Poormand, executive vice president and principal engineer for Leighton & Associates, an Irvine-based geotechnical and environmental-engineering firm, concrete cylinders can be inserted into the hillside to "nail" it down. And, he said, a variety of gutters, terrace pipes, conduits and other drainage systems can be installed.

There is another option for the owner of an older hillside house, Poormand said: do nothing.

"There have been instances," he said, "when people have called us in [for consultation], and we couldn't bless the property. We couldn't say whether [a slide] would happen next year or 10 years or 100 years from now. But we could say that it was not as stable as the code would require if you

were going to build that house today. Yet, they finally decided to purchase the house. There are other factors in life."

The costs of stabilizing improvements may be unacceptably high to the homeowner or buyer. Poormand said. They may believe that the view is worth the risk. Or, he said, a person who lives in a cliffside house may know that the cliff edge is retreating toward the house at a rate of one foot every two years—but the yard that extends to the edge is 100 feet wide. The house will be at risk, but not in the owner's lifetime.

"Sometimes," Poormand said, "doing nothing is the most prudent reaction."

Still, Bishnoi said, "It's a very difficult thing, if you already have a development, to know whether it's going to be unsafe or that sooner or later there are going to be slides. Our concentration really is on the newer areas that are being built now."

Today, slide-prevention measures come under the heading of doing it right the first time.

Geological reports are more thorough and exact, more extensive drainage and soil compaction techniques are used, and most grading is done at the shallower angle of 2:1. It is even possible, geologists say, to build a tract of homes on an ancient landslide and to stabilize the slope to such a degree that new slides are highly unlikely, at least in the short term.

(In the case of Bluebird Canyon, the area was regraded and compacted and the drainage systems were reworked in such a way that the neighborhood was stabilized geologically, Harley said. Most of his neighbors who lost their homes to the 1978 slide returned to build again on their property, he added.)

But even the most precisely planned home site can be covered by a mudslide—or even fall victim to a landslide—if the owner of the land does not plant and maintain it properly, for there are rules for hillside dwellers that do not apply on flat land.

Those rules were looser—officially, anyway—20 years ago "and that left some slopes vulnerable to erosion problems," said Robert Cardoza, principal partner in the Costa Mesa landscape-architecture

firm of Cardoza DiLallo Harrington. "The primary problem was that some of the types of [plant] materials that were recommended were shallow rooting and required a greater degree of watering. And if the compaction wasn't suitable, you'd have a slide."

Also, Cardoza said, there is among many hillside homeowners a certain resistance to the types of plants that would best anchor the topsoil of their slopes. Often, the best plants for the purpose aren't pretty enough.

Flowers, ice plant and grass may make a nice display on a hillside, but their root systems are shallow and won't help hold back sedimentary topsoil in heavy rains. Also, he said, such plants tend to need a lot of watering, which can undermine the integrity of a hillside. Over-watering, said Cardoza, is one of the major causes of slope failure.

Better bets are plants native to Southern California—the type of natural ground cover seen on undeveloped hillsides, as well as larger plants such as acacia trees.

However, said Cardoza, "the problem with that type of material for the most part is that it's not necessarily available and that it doesn't cover enough to satisfy the home buyer. They do take time and they aren't necessarily ornamental at first."

Deep-rooting trees are highly desirable, he said, but as grows the tree, so grows the dreaded NIMBY (Not In My Back Yard) complex.

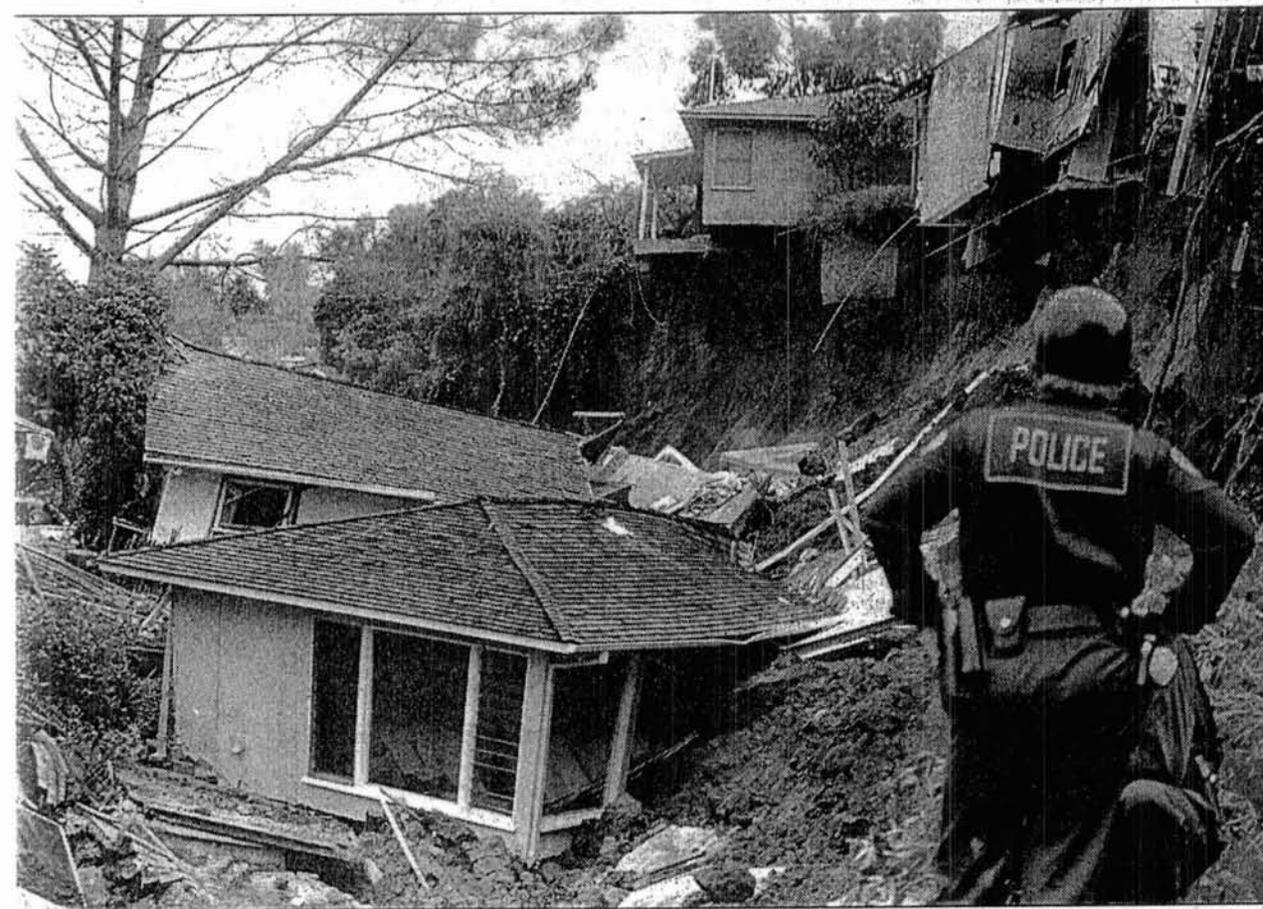
"People live on hillsides primarily for the view," he said, "and the ones who have that view don't want anything blocking it. They don't want their million-dollar view blocked with a tree."

Likewise, developers often resist regulation from city and county governments, Bishnoi said.

"Right now," he said, "the standard of review is very high, though some of the developers and outside consultants may resent it. We take more time and effort, and sometimes we ask them to investigate more, but that's part of the system. It's all economics. It's a balance of how much risk and how much money. We don't want to overdo it. It has to make engineering sense because you can over-regulate to the extent that it can be economically disastrous."

What if it actually happens? What if the kitchen fills up with mud, or the patio falls over the cliff; or the garage ends up three feet lower than the house? Who's at fault? The city? The county? The developer? The geologists? The homeowner? God? No one?

The results of such an investigation, the specialists say, can be



"Most people say, 'Oh, it's not going to happen to me,'" Treiman said. "They put their faith in the governing authorities to have mitigated the hazard. They say, 'If they let me build it, it must be safe.'"

The best insurance, according to geologists and others, is forethought. If you are buying an older house on a hillside, or an empty hillside lot, review the geologic reports on the area or hire a geological consultant. If the development is new, know what sort of maintenance the property will require. And realize, above all, that there are no guarantees.

"With hillsides," Bishnoi says, "they may be safe today, but something could make them unsafe tomorrow. Landslides are here to stay. There will never be a time when there are no more landslides."

Said Cardoza: "All we can do is diminish or reduce the risk. We're not God. You can never say for sure. But we've learned a lot in the last 20 years to reduce the risk."

Which is what happened in Bluebird Canyon, said Harley. After the neighborhood was regraded and brought up to more current construction standards, he and his family came back.

"I had no misgivings whatsoever," said Harley, "mostly because we had a lot of confidence in the geologists and the construction companies. The land is stable. There has been some settling that was predicted by the geologists, but the stabilization program was successful as far as we're concerned. The geologists explained to us quite accurately the geology [of the canyon] before the landslide, and in the process of stabilizing the slide they cured those geological problems."

So much so, he said, that he and his family were inspired to build "a substantially larger house."

And in the process they became the first family to rebuild on the land that had once so violently slid from under them.

Patrick Mott is a regular contributor to Orange County Life.

Los Angeles Times

Police surveyed the damage wrought in October, 1978, by a massive landslide that wrecked 22 homes in Laguna Beach's Bluebird Canyon.



Byzantine and are often inconclusive. In many cases, it is the homeowner who ends up footing the bill.

And, said Jan Milne, an administrative assistant for the Western Insurance Information Service, insurance companies in Southern California do not offer policies that specifically cover landslides or mudslides.

Los Angeles Times

Residents watched as a bulldozer leveled homes damaged beyond repair in the Bluebird Canyon slide.