Unstable Ground: Landslide Policy in the United States*

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INTRODUCTION

Landslides are a nationwide hazard to life and property in the United States: They cause millions of dollars of damage to roadways and structures every year, and they threaten public safety.[1] Although most landslides occur naturally, human actions also trigger them. As development encroaches upon potentially unstable hillside areas, landslide hazards are increasing in many parts of the country.[2]

In recent years, the landslide problem has increasingly entered the legal and public policy arenas. In some communities, identifying landslide hazard areas has become an important factor in land use planning, zoning, and building-code decisionmaking. Many landslide-prone communities have no such policies, however, and landslide hazards continue to grow in those areas. At the local government level, the issue of reducing landslide hazards is controversial: It is intertwined with questions of public safety, property values, and local economic benefits of real estate development. In the courts, landslide litigation has become more complex as the list of potentially liable parties has expanded to include insurance carriers, builders, engineers, sellers, realtors, neighbors, and public agencies.[3] Recent major court decisions, particularly in California, have further complicated landslide law.[4]

Public policies for reducing landslide hazards and compensating

1. *See infra* notes 26-37 and accompanying text.
2. *See infra* notes 19-22 and accompanying text.
3. *See infra* notes 159-229 and accompanying text.
4. *See, e.g.,* Sprecher v. Adamson Cos., 30 Cal. 3d 358, 636 P.2d 1121, 178 Cal. Rptr. 783 (1981).

landslide victims are at best piecemeal and poorly coordinated; at worst, they are misguided, unenforced, or nonexistent. Neither legislatures nor the courts have taken a comprehensive approach toward solving this problem.

This Comment reviews the physical and legal scope of the landslide problem in the United States, presents strategies for reducing landslide damage and equitably allocating liability, and recommends that a multifaceted, coordinated approach to landslide-damage reduction be adopted. Section I details the magnitude of the landslide problem. It describes the physical processes and provides estimates of the direct and indirect costs of landslides, including social costs.

Section II describes and evaluates the following policy strategies that have been attempted or proposed to resolve aspects of the landslide problem: (1) Research and education, (2) land use planning, (3) grading ordinances and site inspection, (4) tort liability as a deterrent, (5) insurance, (6) assessment districts, and (7) hazard mitigation as a condition of disaster aid. Each Subsection within this Section concludes that, while each of these policy strategies solves part of the landslide problem, none of them alone adequately addresses the whole problem.

Section III proposes a comprehensive approach, which employs a combination of the policy strategies presented in Section II. Each strategy outlined in Section II attacks some aspect of the landslide problem, and Section III proposes the most appropriate role for each of these strategies. An insurance program is highlighted as the primary short-term strategy. More effective grading codes and continued research are proposed as the major long-term strategies. Most of these strategies could be self-supporting, with no need for major increases in federal or state funding. Section III concludes with a discussion of probable legal issues that may be raised by the proposal.

I

THE LANDSLIDE PROBLEM IN THE UNITED STATES

A. Physical Characteristics and Extent of Damages

The word "landslide" encompasses a range of processes: slumps to flows, rapid to slow movements, and large to small earth displacement.[5] Landslides can creep slowly, or they can attain avalanche speeds.[6] Their

5. The range of landslide types is summarized best by Varnes, *Slope Movement Types and Processes,* in LANDSLIDES: ANALYSIS AND CONTROL 12 (R. Schuster & R. Krizek eds. 1978). Their classification scheme is based on seven types of "slope movement," including falls, topples, slides, and flows, and three types of material, including bedrock and two types of soil. Examples of specific classifications include the following diverse movements: Large, slow-moving slumps; rapid rockfalls; slow, plastic slides and flows; and very rapid, wet debris flows.

6. Debris flows can move at speeds estimated up to 40 feet per second (27 miles per

widths can range from a few feet to greater than a mile.[7] Although large, rapid slides are spectacular media attractions, persistently creeping slides and the cumulative effect of many small landslides cause a significant amount of property damage in the United States.[8]

Landslides are a natural process of the earth's surface, inevitably resulting from rainfall, earthquakes, and gravity. They are an extreme form of erosion—the inexorable process that wears down geologically uplifted land masses. Landslides occur when external forces exceed resisting forces within the soil and rock of a hillside.[9] The most frequent landslide-triggering mechanism is water from intense rainfall or human-introduced sources.[10] Although earthquakes also cause a great number of landslides,[11] heavy precipitation is a much more frequent event and, hence, causes more landslides.

Landslides are part of a complex system of geologic interactions and

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hour). *See* R. CAMPBELL, SOIL SLIPS, DEBRIS FLOWS, AND RAINSTORMS IN THE SANTA MONICA MOUNTAINS AND VICINITY, SOUTHERN CALIFORNIA 25 (U.S. Dep't of the Interior Geological Survey Professional Paper No. 851, 1975). One of the fastest moving slides recorded was the 1970 rockfall debris flow in Yungay, Peru. This slide transported over 65 million cubic yards of material at a velocity of 175 to 210 miles per hour. *See* Varnes, *supra* note 5, at 21.

7. For example, Devil's Slide, in San Mateo County, California, encompasses a one-mile-wide area of a coastal mountain. TRANSPORTATION LABORATORY, CAL. DEP'T OF TRANSP., ENGINEERING GEOLOGY OF THE DEVIL'S SLIDE ii-v (July 1980). The Portuguese Bend landslide, in Los Angeles, is approximately one kilometer square. B. BOLT, W. HORN, G. MACDONALD & R. SCOTT, GEOLOGICAL HAZARDS 194 (2d ed. 1977). Movement of the Portuguese Bend landslide has been continuous for over 30 years; the total horizontal displacement exceeds 600 feet near the coast. Ehlig, *The Portuguese Bend Landslide: Its Mechanics and a Plan for Its Stabilization,* in LANDSLIDES AND LANDSLIDE MITIGATION IN SOUTHERN CALIFORNIA 181 (Geological Society of America Guidebook and Volume, Trips 3, 13 and 16, 1986).

8. A United States Department of the Interior Geological Survey report notes that "the day-to-day accumulation of landslide events results in surprisingly large losses that receive little attention." R. FLEMING & F. TAYLOR, ESTIMATING THE COSTS OF LANDSLIDE DAMAGE IN THE UNITED STATES 4 (U.S. Dep't of the Interior Geological Survey Circular No. 832, 1980).

9. Engineers call the ratio of these two forces the "factor of safety." When the factor of safety is less than 1.0, the slope fails. Resisting forces within the hill can decrease as a result of long-term chemical weathering or the introduction of water by precipitation or human interference. External forces can increase due to excavation or erosion at the base of a slope, added weight from human structures or debris on the top of a slope, or transitory stresses such as earthquakes. *See, e.g.,* Terzaghi, *Mechanism of Landslides,* in APPLICATION OF GEOLOGY TO ENGINEERING PRACTICE 83-123 (S. Paige ed. 1950).

10. Shallow soil slides occur during heavy rain. R. CAMPBELL, *supra* note 6, at 1. Debris flows, one type of shallow slide, occur suddenly during the most intense periods of rainfall and move at high speeds. In contrast, deep-seated slides often do not move until several months after the rainy season, as groundwater slowly seeps down to the failure surface. Landscape irrigation, septic systems, and drainage-diversion structures can also contribute water to unstable hillsides. The most frequent preventive measure to retard slow-moving landslides is to drain the water and divert surface flows off the slope. *See, e.g.,* LANDSLIDES: ANALYSIS AND CONTROL, *supra* note 5, at 176.

11. *See* Keefer, *Landslides Caused by Earthquakes,* 95 GEOLOGICAL SOC'Y AM. BULL. 406 (1984).

are not yet well understood by geologists. Predicting the locations and establishing the probabilities of future landslides is difficult. At best, geologists can qualitatively identify zones of relative landslide hazard;[12] the quantitative probabilities of landslides at specific sites within these zones, however, frequently cannot be established.[13] Slope stability of specific sites can only be understood after extensive exploration. By comparison, flood hazards can be quantitatively identified by generally accepted statistical methods.[14]

Landslides become a problem when they occur in urbanized or developing areas. At one time, landslides were primarily the concern of highway engineers who designed and maintained public roads on unstable hillslopes.[15] In recent years, however, a greater number of landslides have damaged private property, largely due to increased development in hillside areas.[16] Moreover, urban development itself sometimes causes landslides.[17]

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12. Geologists can use geologic and topographic maps and aerial photography to identify areas of potential instability, but without detailed and expensive field exploration, geologists can say little about the quantitative landslide potential of individual sites. Public agencies have produced many generalized maps that qualitatively identify areas of high relative landslide susceptibility. *See, e.g.*, T. NILSEN, R. WRIGHT, T. VLASIC & W. SPANGLE, RELATIVE SLOPE STABILITY AND LAND-USE PLANNING IN THE SAN FRANCISCO BAY REGION, CALIFORNIA (U.S. Dep't of the Interior Geological Survey Professional Paper No. 944, 1979) [hereinafter NILSEN & WRIGHT]. Such maps, however, traditionally have focused on hazards to structures on hillslopes and have neglected the serious hazards posed to structures located below unstable slopes. *See* M. BLAIR, T. VLASIC, W. COTTON & W. FOWLER, WHEN THE GROUND FAILS: PLANNING AND ENGINEERING RESPONSE TO DEBRIS FLOWS 10 (1985).

13. Quantitative studies show that landslides in California tend to occur when late-season storms exceed a certain intensity threshold. *See* T. NILSEN & B. TURNER, INFLUENCE OF RAINFALL AND ANCIENT LANDSLIDE DEPOSITS ON RECENT LANDSLIDES 13 (U.S. Dep't of the Interior Geological Survey Bulletin No. 1388, 1975); R. CAMPBELL, *supra* note 6, at 22-24. Thus, estimating frequencies of landslide-triggering events in general is possible, but such estimates do not predict the frequencies of landslides at specific sites. Some United States Geological Survey (USGS) officials, however, believe that identifying landslide hazard zones in sufficient detail for planning purposes is now possible. Interview with Earl Brabb, Geologist, USGS, in Menlo Park, California (July 24, 1984). Furthermore, USGS has recently made considerable progress in producing landslide-probability maps. Telephone interview with Russell H. Campbell, Geologist, USGS (Aug. 29, 1984); *see also* FEASIBILITY OF A NATIONWIDE PROGRAM FOR THE IDENTIFICATION AND DELINEATION OF MUD FLOW AND OTHER LANDSLIDE HAZARDS (R. Campbell ed., USGS Open-File Report No. 84-276, 1984).

14. *See generally* T. DUNNE & L. LEOPOLD, WATER IN ENVIRONMENTAL PLANNING 279-391 (1978).

15. The two classic National Academy of Science reports on engineering analysis and mitigation of landslides, COMMITTEE ON LANDSLIDE INVESTIGATIONS, LANDSLIDES AND ENGINEERING PRACTICE (E.B. Eckel ed., Highway Research Bd. Special Report No. 29, 1958) and LANDSLIDES: ANALYSIS AND CONTROL, *supra* note 5, were published by the Highway Research Board and its successor, the Transportation Research Board.

16. *See generally* COMMITTEE ON GROUND FAILURE HAZARDS, COMM'N ON ENGINEERING AND TECHNICAL SYSTEMS, NAT'L RESEARCH COUNCIL, REDUCING LOSSES FROM LANDSLIDING IN THE UNITED STATES 7 (1985) [hereinafter COMMITTEE ON GROUND FAILURE HAZARDS].

17. Overly steep slope cuts, poorly placed fills, and the modification of surface drainage that sometimes results from development, increase the number of landslides. USGS notes that

Although landslides are often perceived as a "California problem," principally because California is the most urbanized of the nation's landslide-prone areas, landslides cause significant property damage and threaten public safety in more than half the states.[18] As a result of urbanization, the threat of landslides is increasing substantially in Washington,[19] Utah,[20] and Colorado.[21] The three regions that have experienced the greatest landslide damage are the Appalachians, the Rocky Mountains, and the Pacific coast.[22] Recent significant landslides have included huge, slow-moving slides that severely damaged entire subdivisions;[23] avalanchelike debris flows that obliterated homes in their paths;[24]

80% of the damaging slides in Contra Costa County, California, are associated with manmade modifications of natural slopes. *See* T. NILSEN & B. TURNER, *supra* note 13, at 6.

Logging practices also contribute to slope failures in many parts of the country. *See, e.g.*, Swanson, *Timber Harvesting, Mass Erosion, and Steepland Forest Geomorphology in the Pacific Northwest,* in GEOMORPHOLOGY AND ENGINEERING 199 (D. Coates ed. 1976).

18. COMMITTEE ON GROUND FAILURE HAZARDS, *supra* note 16, at 8.

19. *See generally* D. TUBBS, LANDSLIDES IN SEATTLE 1-3 (State of Washington, Dep't of Nat. Resources Division of Geology and Earth Resources Information Circular No. 52, 1974).

20. *See, e.g.*, COMMITTEE ON NATURAL DISASTERS, COMM'N ON ENGINEERING AND TECHNICAL SYSTEMS, NAT'L RESEARCH COUNCIL, THE UTAH LANDSLIDES, DEBRIS FLOWS, AND FLOODS OF MAY AND JUNE 1983 (1984).

21. *See* COMMITTEE ON GROUND FAILURE HAZARDS, *supra* note 16, at 10.

22. *Id.* at 9. *See generally* D. RADBRUCH-HALL, LANDSLIDE OVERVIEW MAP OF THE CONTERMINOUS UNITED STATES 4 (U.S. Dep't of the Interior Geological Survey Professional Paper No. 1183, 1982). In the Eastern United States, Allegheny County (Pittsburgh area, Pennsylvania), and Hamilton County (Cincinnati area, Ohio), are the two most troublesome landslide areas. *See, e.g.*, R. BRIGGS, J. POMEROY & W. DAVIES, LANDSLIDING IN ALLEGHENY COUNTY, PENNSYLVANIA (U.S. Dep't of the Interior Geological Survey Circular No. 778, 1975). In the Rocky Mountains, unstable slopes increasingly have become a problem in rapidly developing areas of Utah and Colorado. California and Washington have some of the most severe landslide problems in the United States. These problems include slope instabilities in urbanizing areas of southern California, the San Francisco Bay Area, and Seattle. *See* D. TUBBS, *supra* note 19.

23. There are homes built upon many large, slow-moving landslides. In 1956, the Portuguese Bend landslide, in Los Angeles, moved 20 meters over several months and destroyed a major subdivision built upon it. *See* B. BOLT, W. HORN, G. MACDONALD & R. SCOTT, *supra* note 7, at 194-96. Adjacent to this 600-acre landslide, the Abalone Cove slide has threatened for several years 100 homes built upon it. Letter from Tom Bandy, Executive Director, Abalone Cove Landslide Abatement District, to Robert B. Olshansky (Sept. 10, 1984) (copy on file with authors). More recently, the 1983 Big Rock Mesa landslide, in Los Angeles County, damaged 200 homes and left 30 homes uninhabitable. *County Ruled Liable for Slide Damage at Malibu,* L.A. Times, Oct. 5, 1985, at B1, col. 1. The Blakemont landslide, in Kensington, Contra Costa County, California, encompasses 19 acres and affects 150 residences located upon it. Blakemont Property Owners Ass'n, Request for Proposal (Aug. 31, 1984) (copy on file with authors).

24. *See, e.g., 3 Children Buried in House,* San Francisco Chron., Jan. 6, 1982, at 1, col. 1; *Victims of the Bay Area Storm, id.* at 16, col. 3. For a description of the January 1982 debris flows in the San Francisco Bay Area, see generally DEBRIS FLOWS, LANDSLIDES, AND FLOODS IN THE SAN FRANCISCO BAY REGION JANUARY 1982: OVERVIEW AND SUMMARY OF A CONFERENCE HELD AT STANFORD UNIVERSITY AUGUST 23-26, 1982 (National Academy Press pub. 1984) [hereinafter DEBRIS FLOWS]. A debris flow in Farmington, Utah, in 1983 damaged a five-block area of the city. COMMITTEE ON NATURAL DISASTERS, *supra* note 20, at 62. During the years 1962-71, 23 people in the Los Angeles area died as a result of

and large, rapid slope failures that buried homes and residents.[25]

Landslides produce great economic loss. In the United States, landslides annually cause economic loss estimated from $245 million[26] to $1 billion.[27] In each of the landslide-prone localities of the San Francisco Bay Area, California; Allegheny County, Pennsylvania; and Hamilton County, Ohio; average yearly losses range as high as $4 million to $6 million.[28] In Los Angeles, California, landslide damages in the rainy years of 1978 and 1980 were estimated at $50 million and $70 million, respectively.[29] In addition to the direct costs, landslides have many indirect costs. For example, road blockages cause great inconvenience and loss of time to many people.[30] Other indirect costs of landslides include reduced agricultural and industrial production, decreased property values and the accompanying reductions in revenues from property taxes, time lost from work, loan foreclosures on damaged properties, and loss of savings.[31]

In addition to economic costs, landslides take a psychological toll.[32]

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debris flows. *See* R. CAMPBELL, *supra* note 6, at 1. Of the 150 people killed by Hurricane Camille in central Virginia in 1969, many were probably killed by debris flows. G. WILLIAMS & H. GUY, EROSIONAL AND DEPOSITIONAL ASPECTS OF HURRICANE CAMILLE IN VIRGINIA, 1969, at 1 (U.S. Dep't of the Interior Geological Survey Professional Paper No. 804, 1973).

25. In what was probably the single greatest landslide disaster in the United States, a 1985 landslide in Mameyes, Puerto Rico, instantly buried 263 homes and killed hundreds of people. *Hundreds Feared Killed by Puerto Rico Mud Slide,* N.Y. Times, Oct. 9, 1985, at 1, col. 1. During the January 1982 storm in northern California, a 1,000-foot-long slab of a hillside in Santa Cruz County collapsed on 9 homes, killing 10 people. Cotton & Cochrane, *Love Creek Landslide Disaster, January 5, 1982,* 35 CAL. GEOLOGY 153, 154 (1982).

26. E. BRABB, MINIMUM LANDSLIDE DAMAGE IN THE UNITED STATES, 1973-1983, at 4 (U.S. Dep't of the Interior Geological Survey Open-File Report No. 84-486, 1984).

27. Schuster & Fleming, *Economic Losses and Fatalities Due to Landslides,* 23 BULL. A. ENGINEERING GEOLOGISTS 11, 13 (1986).

28. R. FLEMING & F. TAYLOR, *supra* note 8, at 1.

29. STORMS, FLOODS, AND DEBRIS FLOWS IN SOUTHERN CALIFORNIA AND ARIZONA 1978 AND 1980: OVERVIEW AND SUMMARY OF A SYMPOSIUM, SEPTEMBER 17-18, 1980, at 17 (National Academy Press pub. 1982).

30. For example, the 1983 Thistle landslide in Utah completely blocked for several months the Denver and Rio Grande Western Railway, U.S. Highway 89, and U.S. Highway 6/50. COMMITTEE ON NATURAL DISASTERS, *supra* note 20, at 53. This may be the single most expensive landslide in United States history. *Id.* at 1.

California State Highway 1, the only transportation artery along much of the western coast, has been periodically closed by landslides. In fact, near Devil's Slide, San Mateo County, Highway 1 was closed a total of 351 days from 1980 through 1983. CALIFORNIA DEP'T OF TRANSPORTATION, DEVIL'S SLIDE DRAFT EIR 16 (Nov. 1983). A massive landslide near Big Sur blocked another section of Highway 1 for nearly a year. Works, *Landslide on State Highway 1,* 37 CAL. GEOLOGY 130, 130 (1984). In 1983, yet another major highway was blocked by a huge landslide on U.S. Highway 50 between Sacramento and Lake Tahoe. The highway was closed for more than two and one-half months, and business lost in El Dorado County, which includes the resort town of South Lake Tahoe, was estimated at $70 million. *Highway 50 Reopens, and Tahoe Rejoices,* San Francisco Chron., June 24, 1983, at 2, col. 1.

31. *See* R. FLEMING & F. TAYLOR, *supra* note 8, at 5-7.

32. Although there are no data on this, the authors' personal experience investigating

The land provides a foundation for people and their homes. The threat, however small, of a landslide can be unnerving, and the constant creep of a slow landslide is an ever-present psychological strain. Even with full financial recovery, destruction of one's home is an extremely stressful event.

Landslides are also a hazard to public safety. They threaten people in residences, in businesses, and on roadways. The magnitude of the potential for loss of human life from a landslide was demonstrated by a recent landslide in Puerto Rico that killed several hundred people.[33] Although loss of human life from landslides in the United States is relatively rare compared to losses in other parts of the world,[34] twenty-five people were killed by landslides resulting from the January 1982 storm in the San Francisco Bay Area.[35] Landslides in the United States cause an average of twenty-five deaths per year,[36] and that number exceeds the average number caused by earthquakes.[37]

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landslides in residential areas has shown that landslides have tremendous psychological effects and place a great strain on the family lives of their victims. All natural disasters, including landslides, cause increased divorce rates and mental health problems. Interview with Wilma O'Callaghan, Planning Chief, Cal. Dep't of Mental Health, Office of Planning and Policy Development, in Boulder, Colorado (July 22, 1986). Also, a recent nationwide study on the effects of natural hazards reported that 45% of flood victims "felt depressed" in the aftermath of the event, and 22% of hurricane victims and 20% of earthquake victims experienced the same sensation. It seems fair to assume that landslide victims would respond much like the victims of other natural hazards. *See* P. ROSSI, J. WRIGHT, E. WEBER-BURDEN & J. PEREIRA, VICTIMS OF THE ENVIRONMENT 174 (1984).

33. *See supra* note 25.

34. Many more landslide deaths occur in other countries. For example, from 1971 to 1974, approximately 600 people per year were killed by slope failures worldwide. COMMITTEE ON GROUND FAILURE HAZARDS, *supra* note 16, at 11. Disastrous debris flows and landslides in Peru in 1962, 1970, and 1974 destroyed towns killing 4,000, 18,000, and 450 people, respectively. R. Schuster, *Introduction* to LANDSLIDES: ANALYSIS AND CONTROL, *supra* note 5, at 5. From 1969 to 1972, landslides killed 130 people per year in Japan, nearly equal to the number killed by all other natural disasters. *Id.* One of the most disastrous European landslides occurred in 1963 in Italy; a huge slide into the Vaiont Reservoir sent a 100-meter-high wave over the dam and killed between 2,000 and 3,000 people downstream. COMMITTEE ON GROUND FAILURE HAZARDS, *supra* note 16, at 11.

35. DEBRIS FLOWS, *supra* note 24, at 1.

36. Krohn & Slosson, *Landslide Potential in the United States,* 29 CAL. GEOLOGY 224, 231 (1976).

37. R. Schuster, *supra* note 34, at 6. Since 1900, earthquakes have caused approximately 990 deaths in the United States, including 700 in the 1906 San Francisco earthquake. B. BOLT, EARTHQUAKES: A PRIMER 198-201 (1978). Thus, the United States during this century has witnessed approximately 12 deaths per year caused by earthquakes. Between 1941 and 1974, flood-caused deaths in the United States totaled 3,135, averaging 92 deaths per year. *See* W. PETAK & A. ATKISSON, NATURAL HAZARD RISK ASSESSMENT & PUBLIC POLICY 66 (1982). It should be noted, however, that landslide statistics are generally not reported separately from earthquake or flood-damage statistics; thus, much of the reported "earthquake" and "flood" damages and many of the related deaths are attributable to landslides triggered by earthquakes or severe storms.

B. Social Issues

In addition to the magnitude of landslide damage, another landslide-related problem is the inequity of cost distribution. One frequent complaint is that under existing policies flatlanders subsidize hilldwellers.[38] After major landslides, federal or state governments furnish disaster aid in the form of grants or low-interest loans to rebuild roads and private structures.[39] Thus, general funds are used to alleviate problems that only occur in unstable hillside areas. Additionally, local governments or utility districts frequently pay for the repair and maintenance of roadways and pipelines; this cost is borne by the entire population of a city, county, or region, though only hilldwellers receive the benefits.[40] Flatlanders also subsidize hilldwellers through the payment of insurance premiums. Insurance companies pay for a significant amount of landslide damage to private property. Frequently, payment is through a policy for which landslide risk was never actuarially considered, such as all-risk homeowner policies having unenforceable landslide exclusions.[41] Thus, flatlanders pay higher premiums to cover the losses of hilldwellers. The problem of inequity is exacerbated by the tendency in the United States for the wealthy to live in the hills, while the less wealthy live in the flatlands.[42]

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38. *See* Mader, *Earthquakes, Landslides and Public Planning,* 9 CRY CAL. 16, 19 (1974); Interview with Earl Brabb, *supra* note 13 (residents of urbanized flatlands in some San Francisco Bay Area communities have been able to use the cost argument to restrict hillside development).

39. *See* Disaster Relief Act, 42 U.S.C. §§ 5121-5202 (1982) (federal disaster assistance policies and programs). *See generally* COMPTROLLER GENERAL OF THE U.S., FEDERAL DISASTER ASSISTANCE: WHAT SHOULD THE POLICY BE? 1-11 (1980).

40. In urban settings, slope failures on private property have many public cost repercussions. They can affect neighboring properties or public infrastructures, and thus they can indirectly affect the local economy. Often when a failure occurs, the original developer and owner cannot be located, and a public agency must assume some of the repair costs. George Mader, a land use planner specializing in geologic hazards, asserts that because the burden shifts onto all the taxpayers in the community, "geologic hazards are not private matters, but concern the public in general." Mader, *supra* note 38, at 19.

James Slosson, a geologic consultant and former California State Geologist, maintains that society as a whole can no longer afford the tremendous public costs of landslide damage to individual properties, such as the costs of repair, maintenance, and litigation resulting from slides in Malibu, California. Interview with James Slosson, Geologic Consultant, in Van Nuys, California (Aug. 20, 1984).

41. *See infra* notes 258-61 and accompanying text.

42. In 1984, the Los Angeles County Board of Supervisors voted to underwrite a controversial $4 million drainage project to halt the Big Rock Mesa landslide, which threatens over 200 expensive homes in Malibu. Supervisor Kenneth Hahn termed the drainage project "the biggest welfare program in the county." *Supervisors to Help Battle Big Rock Mesa Landslide,* L.A. Times, Nov. 9, 1984, at 1, col. 4.

C. *Roadblocks to Resolution—Limited Availability of Landslide Information and Inaccurate Perceptions of Landslide Risks*

A key aspect of the landslide problem is the inconsistent availability of hazard information. The problem of uneven information availability has many layers. Many people are unaware that they live in a hazardous location. Even where the information is available, few legal and no statutory mechanisms guarantee the transmission of relevant information to prospective buyers.[43] Renters are not necessarily informed of landslide hazards even if their landlords have access to hazard information. Land-use-planning agencies serving the public interest do not always possess landslide hazard information or act upon such information when they have it.[44] Finally, even if the information is gathered, made understandable to the layperson, and disseminated to the community, many citizens probably will not incorporate the information into their actions.[45]

Individual perceptions of landslide risk coupled with the geographically limited and low-frequency characteristics of landslides create dilemmas for agencies designing hazard-mitigation policies. Typically, individuals tend to underestimate low-probability events such as landslide hazards.[46] When confronted with a low annual landslide risk of 1 in 500 for their parcel, residents often behave as if there were no risk at all. While local residents act as if there is virtually no risk, the cumulative risk in a landslide-prone community may be quite significant. In most local jurisdictions, landslides have a relatively low annual probability of occurrence. Local officials tend to ignore the risk of natural hazards such as landslides.[47] Contrary to the perception of local officials, landslides are a frequent and costly phenomenon for state and

43. In California, the Alquist-Priolo Special Studies Zones Act, CAL. PUB. RES. CODE §§ 2621-2630 (West 1984), requires disclosure of an earthquake hazard when property is sold within a designated fault-rupture-hazard zone, but the authors know of no other geologic hazard disclosure statutes. *See* Campbell, *The Influence of Geologic Hazards on Legislation in California,* 30 CAL. GEOLOGY 219 (1977). For a discussion of the legal requirements for disclosure, see *infra* notes 182-96 and accompanying text.

44. *See, e.g., infra* note 47 (regarding disinterest in flood information). Furthermore, in a heavily regulated society, people tend to trust that the government has in some way ensured their safety. People familiar with landslide cases have noted that landslide damage would be greatly reduced if government agencies performed the jobs the public believed they were performing. Interview with Judge Coleman Fannin, Contra Costa County Superior Court Judge, in Martinez, California (Dec. 6, 1985).

45. *See* H. KUNREUTHER, DISASTER INSURANCE PROTECTION: PUBLIC POLICY LESSONS 236-37 (1978).

46. A study of public perceptions about flood and earthquake insurance found that people "refuse to attend to or worry about events whose probability is below some threshold, the level of which may vary from individual to individual and from situation to situation." *Id.* at 236. In the foreword to this path-breaking study, noted economist Kenneth Arrow writes that the results are "certainly disconcerting from the point of view of generally accepted theory," which has always postulated individual risk aversion for low-probability, high-loss events. *Id.* at vii.

47. A major study of flood-mitigation policies supports this conclusion: The study found

federal governments. States, with federal help, must repeatedly provide cleanup funds and annually confront issues of public safety, cost, and efficient and equitable use of state resources. Attempts by state and federal governments to force these concerns onto disinterested local governments cause tension.[48]

II
POLICY STRATEGIES

Many policies and programs have been attempted or proposed to equitably resolve landslide problems. Some emphasize scientific or technical approaches; others stress land use planning and regulatory programs (e.g., regulating construction practices); still others emphasize financial mechanisms such as insurance. Each approach involves tradeoffs: Most of them solve one aspect of the landslide problem while ignoring or exacerbating other aspects. This Section examines the most frequently proposed and attempted solutions and evaluates the strengths, weaknesses, and side effects of each solution.

A. Research and Education—Prerequisites to Effective Reduction of Landslide Hazards

Knowledge of landslide processes must be increased before landslide-reduction measures can be implemented effectively. Developing the technical capability to accurately designate hazard zones and quantify landslide probabilities would simplify the task of designing land use policies and grading codes. Improved technical knowledge of landslide processes could also lead to better engineering designs on unstable slopes.[49] Several federal and state technical agencies have initiated and participated in programs promoting research and education about landslide hazards. The following seven Subsections discuss the goals of using research and education to reduce landslide hazards, describe a number of federal and state programs that have been implemented, outline some proposed research and mapping projects, and examine the limitations of this approach.

1. Goals

The goals of organized landslide research and educational programs are to understand landslide mechanisms, synthesize this knowledge into

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that local officials exhibit a very low level of concern about flood hazards. *See* P. ROSSI, NATURAL HAZARDS AND PUBLIC CHOICE 9 (1982).

48. *See infra* notes 325-28 and accompanying text.

49. *See, e.g.*, COMMITTEE ON GROUND FAILURE HAZARDS, *supra* note 16, at 26 ("The magnitude and extent of landslide damage in the United States can be reduced significantly by improvements in landslide engineering practice. These in turn will come about as a result of research and effective technology transfer.").

a form useful to practitioners, and publish and disseminate this information.[50] Research into landslide mechanisms generally aims at understanding locations, causes, rates, processes, magnitudes, and future risks of landslides.[51] Synthesis of such knowledge can help define hazard zones and develop cost-effective engineering solutions. Technical agencies publish this information, often in the form of maps, to educate and affect the decisions of local planning agencies.[52] Leaders in these activities have been the United States Geological Survey (USGS), the California Division of Mines and Geology (CDMG), and geological agencies in several other states.

2. *Example—USGS-HUD Work in the San Francisco Bay Area*

In the 1970's, USGS teamed up with the United States Department of Housing and Urban Development, Office of Policy Development and Research (HUD) in a project called the "San Francisco Bay Region Environment and Resources Planning Study." The experimental study was designed "to facilitate the use of earth-science information in regional planning and decisionmaking."[53] The study produced several maps and publications related to landslides. USGS used aerial photography to prepare detailed landslide-deposit maps for public distribution.[54] This landslide work is summarized in a major publication[55] that describes landslide processes in the region, discusses how to incorporate such in-

50. *See, e.g.,* COMMITTEE ON GROUND FAILURE HAZARDS, *supra* note 16, at 28-30; U.S. GEOLOGICAL SURVEY, GOALS AND TASKS OF THE LANDSLIDE PART OF A GROUND-FAILURE HAZARDS REDUCTION PROGRAM 1 (U.S. Dep't of the Interior Geological Survey Circular No. 880, 1982) [hereinafter USGS].

51. *Id.* at 8.

52. *See, e.g.,* Brown, *Foreword* to NILSEN & WRIGHT, *supra* note 12, at III.

53. *Id.* Mr. Brown, the study's project director, described the research and education rationale for the study:

> [I]t bears on a complex issue that is of national concern: how best to accommodate orderly development and growth while conserving our natural resource base, insuring public health and safety, and minimizing degradation of our natural and man-made environment. The complexity of the problem can be greatly reduced if we understand the natural characteristics of the land, the processes that shape it, its resource potential, and its natural hazards . . . .
>
> The study is intended to aid the planning and decisionmaking community by (1) identifying important problems that are rooted in the earth sciences and related to growth and development in the bay region; (2) providing the earth-science information that is needed to solve these problems; (3) interpreting and publishing findings in forms understandable to and usable by laypersons; (4) establishing new avenues of communication between scientists and users[;] and (5) exploring alternate ways of applying earth-science information in planning and decisionmaking.

Id.

54. *E.g.,* T. NILSEN, PRELIMINARY PHOTOINTERPRETATION MAP OF LANDSLIDE AND OTHER SURFICIAL DEPOSITS OF THE MOUNT DIABLO AREA, CONTRA COSTA AND ALAMEDA COUNTIES, CALIFORNIA (U.S. Dep't of the Interior Geological Survey Misc. Field Studies Map No. MF-310, 1971).

55. NILSEN & WRIGHT, *supra* note 12.

formation in the planning process, and includes several colored maps depicting the relative stability of slopes in the region.

3. *Mapping Programs of the California Division of Mines and Geology*

Over the years, CDMG has prepared a number of landslide susceptibility maps under cooperative mapping programs with several counties.[56] These maps have helped local governments that have not benefited from USGS slope-stability maps of the San Francisco Bay Area. Unfortunately, in recent years, state funding constraints have virtually eliminated these state-local cooperative mapping programs.[57]

In response to the continued need for statewide mapping, the California legislature enacted the Landslide Hazard Identification Program in 1983.[58] This was the first such landslide statute enacted by any state; it established a program within CDMG for the state to independently develop maps of landslide hazards within urban and urbanizing areas of the state and to provide other technical assistance to local agencies in their land use decisions for landslide-prone areas.[59] Because CDMG has

56. The counties included Los Angeles, Orange, San Bernardino, Sonoma, Ventura, and others. Interview with Ted Smith, Geologist, Cal. Division of Mines and Geology, in San Francisco, California (July 24, 1984); Interview with Art Keene, Los Angeles County Geologist, in Los Angeles, California (Aug. 20, 1984).

57. Memorandum from Douglas W. Sprague, Special Representative, Cal. State Mining and Geology Board, to Geohazards Committee of State Mining and Geology Board (July 1, 1981) (on file with authors).

58. CAL. PUB. RES. CODE § 2670 (West 1984).

59. The bill that finally passed, A.B. 101, Cal. Legislature 1983-84 Regular Session (introduced Dec. 10, 1982), was a considerably amended version of the original bill, A.B. 2779, Cal. Legislature 1981-82 Regular Session (introduced Feb. 24, 1982). A.B. 2779 proposed a "landslide hazard protection program," declared that landslides pose a hazard in all 58 counties of California and not only provided for technical assistance to counties but also required incorporation of the information into local plans and ordinances. *Id.* §§ 2671, 2687. The bill was patterned after the Alquist-Priolo Special Studies Zones Act for earthquake fault zones. *See supra* note 43.

The California Association of Realtors strongly opposed the mandatory provisions of A.B. 2779, fearing they would depress property values. Telephone interview with Jack Shelby, Lobbyist for the California Ass'n of Realtors (Aug. 23, 1984). There is no evidence, however, that the existing Alquist-Priolo fault zones depress property values. *See* R. PALM, REAL ESTATE AGENTS AND SPECIAL STUDIES ZONES DISCLOSURE: THE RESPONSE OF CALIFORNIA HOME BUYERS TO EARTHQUAKE HAZARDS INFORMATION 93 (1981). The California League of Cities also opposed the mandatory provisions because of the significant costs these provisions would impose upon local governments. Telephone interview with Rusty Selix, California League of Cities (Aug. 27, 1984).

CDMG requested that the geographic scope be limited to urban and urbanizing areas because the statewide scope would have strained CDMG's budget. Interview with Ted Smith, CDMG, in San Francisco, California (July 24, 1984). CDMG also realized that a landslide zonation program, as initially envisioned by A.B. 2779, would be immensely more complex and costly than the existing Alquist-Priolo zonation program for faults, *see supra* note 43, because identifying landslide zone boundaries and designing hazard-reduction measures would require much more site-specific discretion than the same procedures taken for faults. *Id.*

Ultimately, the State Department of Conservation retreated from the mandatory provision for local regulation, believing that the existence of information would obligate the govern-

just begun publishing these maps,[60] it is still too early to gauge the effectiveness of this program.

4. Programs and Legislation in Other States

While California has taken the lead in landslide hazard mapping and information programs, many other states with landslide problems have initiated their own programs or have enlisted the aid of USGS. In recent years, with cooperative funding by USGS, state geological agencies in Idaho, New York, Pennsylvania, Virginia, West Virginia, and Wyoming have undertaken landslide mapping.[61] The state geological agencies of Colorado and Washington publish maps and reports describing landslides and other geologic hazards in those states. USGS has also done much mapping and assessing of landslide hazard in the area around Pittsburgh, Pennsylvania.[62] The Colorado Land Use Act[63] specifically requires consideration of geologic hazards,[64] including landslides. Extensive effort has been spent in Colorado identifying geologic hazard areas for purposes of local land use regulations.[65] This effort has included several state-sponsored conferences on environmental geology designed to foster the exchange of information about geologic processes between geologists and policy officials.[66] Recently, legislation was proposed in

ment to act. Telephone interview with Mary McDonald, Legislative Coordinator, Dep't of Conservation (July 31, 1984). A.B. 101, California Legislature 1983-84 Regular Session (introduced Dec. 10, 1982), with no requirement for local regulation, coupled with a provision for giving low priority to unwilling local jurisdictions, *id.* § 2685(b), and a 1989 sunset clause, *id.* § 2674, appears to weaken the original A.B. 2779 to the extent that the current statute is simply an enabling mechanism for CDMG to resume its early 1970's mapping work.

Despite these drawbacks, a legislatively mandated landslide-mapping program is a great advance. Moreover, the California legislature declared that "areas subject to landslide and other slope instability hazards should be identified and that cities and counties are encouraged to develop land use management policies and regulations to prevent or minimize those hazards to protect the public health and safety." *Id.* § 2671.

60. The first two maps derived from this program were released in the fall of 1986. *See DMG Releases,* 39 CAL. GEOLOGY 240 (1986).

61. *See* COMMITTEE ON GROUND FAILURE HAZARDS, *supra* note 16; *see also* Lessing & Erwin, *Landslides in West Virginia*, in 3 REVIEWS IN ENGINEERING GEOLOGY 245 (D. Coates ed. 1977).

62. *See, e.g.*, J. POMEROY & W. DAVIES, MAP OF SUSCEPTIBILITY TO LANDSLIDES, ALLEGHENY COUNTY, PENNSYLVANIA (U.S. Dep't of the Interior Geological Survey Misc. Field Studies Map No. MF-685B, 1975); R. BRIGGS, J. POMEROY, & W. DAVIES, *supra* note 22.

63. COLO. REV. STAT. § 24-65-101 (1982).

64. *Id.* § 24-65.1-202.

65. *See generally* Soule, *Engineering Geologic Mapping and Potential Geologic Hazards in Colorado,* 21 BULL. INT'L A. ENGINEERING GEOLOGY 121 (1980).

66. *See, e.g.*, COLORADO GEOLOGICAL SURVEY, COLO. DEP'T OF NAT. RESOURCES, PROCEEDINGS OF THE GOVERNOR'S THIRD CONFERENCE ON ENVIRONMENTAL GEOLOGY: GEOLOGIC FACTORS IN LAND-USE PLANNING HOUSE BILL 1041 (D. Shelton ed. 1977).

Utah[67] and Pennsylvania[68] to identify and reduce landslide hazards.

5. *National-Scale Landslide Research*

Currently, there is no organized nationwide effort to fund or coordinate landslide research. Several university researchers, however, are studying aspects of the landslide problem.[69] In addition, since 1980, USGS has conducted a modest research program on the reduction of ground-failure hazards[70] and has recently proposed an expanded program of landslide studies to acquire data and promote its effective use.[71] Still, national landslide-research expenditures are much less than the amount spent for earthquake hazard research, even though landslide damage in the United States exceeds earthquake damage.[72]

Although promising research has been done at the national level, it has suffered from a lack of focus. Some coordination of this work, coupled with modest funding increases, could aid in markedly increasing the knowledge of landslide processes and in improving the private and public use of this information.[73] The Committee on Ground Failure Hazards, recently organized by the National Academy of Sciences, has taken the lead in proposing a coordinated program,[74] and USGS has identified research tasks that a landslide-hazard-reduction program should include.[75]

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67. *See* Geologic Hazards Information Act, H.B. 28, 1984 Utah Budget Session. This bill, supported by the state geologist but not passed by the legislature, would have provided for generalized mapping of Utah's geologic hazards and for wide distribution of the maps to local officials and interested individuals.

68. *See* Landslide Hazard Act, H.B. 768, General Assembly of Pennsylvania Session of 1985. This comprehensive bill, which is still awaiting final action on the floor, Telephone interview with Diane Stein, Staff of Rep. Thomas Murphy (Sept. 16, 1986) (Rep. Murphy sponsored this bill), would provide for designating landslide hazard zones, require permits prior to development in those zones, regulate sales and improvement of realty in the zones, and require fire and casualty insurance companies to offer landslide insurance.

69. *See* E. BRABB & A. FITZSIMMONS, ADDRESSES, TOPICS OF INTEREST, AND GEOGRAPHIC DISTRIBUTION OF PROFESSORS WORKING ON LANDSLIDES IN THE UNITED STATES (Natural Hazards Research and Applications Information Center Special Publication No. 8, 1984). These academic research projects are primarily in university departments of geology, civil engineering, and geography.

70. USGS, *supra* note 50, at 2.

71. *Id.* at 1.

72. The annual average amount of damages and number of lives lost from landslides far exceeds losses caused by earthquakes. *See* COMMITTEE ON GROUND FAILURE HAZARDS, *supra* note 16, at 14. Despite this fact, annual research funding for landslides is less than 10% of that for earthquakes ($3-5 million for landslide research versus $50 million for earthquake research). *Id.*

73. *See id.* at 3-5.

74. *See id.*

75. *See* USGS, *supra* note 50. In response to this USGS work, Senator Orrin Hatch of Utah, who has witnessed in his state three consecutive years of severe flooding and landslide problems, began drafting legislation that would create a federal task force to facilitate landslide-information exchange and coordination among federal agencies. *See* Letter from Sen. Orrin Hatch to L.O. Giuffrida, Director, Federal Emergency Management Agency (Mar. 4, 1985) (on file with authors). Senator Hatch's staff concentrated on this proposed bill in 1985,

USGS has also conducted significant research on developing probabilistic risk maps[76] and, based on this work, recently estimated the technical scope and costs of a comprehensive nationwide landslide-hazard-mapping program.[77]

6. *Effect of Landslide Information on Public Behavior*

Although accurate information about landslides is the cornerstone of effective governmental regulation, the effect of information not linked to any regulatory mechanisms on landslide hazards is unclear. To some extent, the existence of landslide information should cause local agencies to address the landslide hazards because the agencies' awareness of the problem increases their legal duty.[78] On the other hand, even when they are informed, public officials tend to discount the importance of some low-probability hazards.[79] A concerned, informed public is needed to create, partly through the use of legal action, the political climate for the most effective agency use of information. Such a potential climate is unlikely to be forthcoming, though, because considerable evidence shows that most people having hazard information discount it or assume that the government will ultimately protect them.[80]

To be effective in the absence of regulation, landslide hazard information must be internalized into market transactions so that the risk will

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but it now seems unlikely that the bill will be introduced. Telephone interview with Sharon Mathews, Assistant to Sen. Hatch (Mar. 4, 1986).

76. Telephone interview with Russ Campbell, Geologist, USGS (Aug. 29, 1984).

77. Detailed mapping for a metropolitan area of 1,000 square miles would cost $125,000 to $350,000 spread over one and one-half to four years. *See Methods and Costs for the Delineation of Susceptibility to Mud Flows and Other Landslides,* in FEASIBILITY OF A NATIONWIDE PROGRAM FOR THE IDENTIFICATION AND DELINEATION OF MUD FLOW AND OTHER LANDSLIDE HAZARDS B-11 (R. Campbell ed., U.S. Dep't of the Interior Geological Survey Open-file Report No. 84-276, 1984) [hereinafter *Methods and Costs*]. A nationwide program would cost anywhere from $1 million for a generalized assessment, *id.* at B-8, to $20 million per year for 35 years of detailed landslide-susceptibility delineation, *id.* at B-11. Compare this latter figure to the much higher estimates of $245 million to $1 billion annually spent on United States landslide damages. *See supra* text accompanying notes 26-27.

The cost of performing a nationwide mapping program is less than the cost spent on current direct federal outlays following landslides. The Federal Emergency Management Agency (FEMA) alone spends an average of approximately $20 million per year on landslide disaster assistance and mudslide insurance. Telephone interview with Arthur Zeizel, Hydrogeology Program Manager, FEMA (Jan. 21, 1986). This suggests that such a nationwide mapping program, if it could significantly reduce future landslide damages, would be quite cost-effective in the long run.

78. *See generally infra* notes 222-29. The government is often immune from discretionary policy decisions, so long as its decisions are well-reasoned and based on available information.

79. *See supra* note 47.

80. *See* R. PALM, *supra* note 59, at viii, ix. "This result corresponds with those of other studies which have refuted the notion that merely providing people with more information about hazards to life and property will necessarily result in greater awareness and the adoption of protective measures." *Id.; see also supra* notes 46 (discussion on the personal discounting of low-probability hazards) & 47 (low concern by officials about flood hazards).

be reflected in lower property values. Whether landslide hazard information will affect land values is doubtful, though, because there is evidence that designating other hazard areas, such as floodplain[81] or fault zones,[82] has not affected property values. Ironically, if these programs were effective and did lower land values, landowners and developers would probably exert political pressure to revise or abolish the programs, and the technical agencies producing the information would come under greater public scrutiny. One way that hazard information could affect the market is if agencies supplied the information to mortgage lenders.[83] Because owners of severely damaged homes sometimes discontinue loan payments [84] or even abandon the property, lenders would serve their self-interests by avoiding hazardous areas.

7. *Research and Education Summary*

In conclusion, research funding could be a cost-effective, long-term strategy for government. If the research ultimately leads to reduction of damages, government would save on disaster aid.[85] Research could also lead to effective methods of reducing landslide damage to public facilities, such as roadways, and thus, it could reduce direct government maintenance costs.

Because basic research is always a long-range strategy, it does little to resolve current problems even if the research eventually produces valuable information. Yet, many public safety and policy problems related to landslides demand immediate attention. Rather than depend entirely on long-term research and education, means to reduce these problems should be developed now, even on the basis of imperfect information.

B. *Land Use Planning—Controlling Development on Unstable Lands*

Planning and zoning can be effective means for local government to divert development from unstable areas.[86] Land use plans can designate certain areas as undevelopable due to unsafe slopes. By incorporating

81. *See, e.g.*, D. DAMIANOS & L. SHABMAN, LAND PRICES IN FLOOD HAZARD AREAS: APPLYING METHODS OF LAND VALUE ANALYSIS (Virginia Water Resources Center Bulletin No. 95, 1976).

82. *See* R. PALM, *supra* note 59, at 93.

83. Use of hazard information by concerned lenders would also be an effective means of ensuring disclosure to homebuyers. This is one of the key conclusions of Palm's fault-zone study. *See id.* at 104.

84. *See* Norton, *Counseling Clients Whose Property Incurs Earth Movement Damage,* CAL. LAW., Sept. 1982, at 26. *See generally* D. ERLEY & W. KOCKELMAN, REDUCING LANDSLIDE HAZARDS: A GUIDE FOR PLANNERS 21 (American Planning Ass'n Planning Advisory Service Report No. 359, 1981).

85. For an example, see *supra* note 77, discussing the potential cost effectiveness of a nationwide mapping program.

86. *See generally* Kockelman, *Some Techniques for Reducing Landslide Hazards,* 23 BULL. A. ENGINEERING GEOLOGISTS 29, 39-43 (1986).

landslide hazard information into long-term local plans, local governments give developers advance notice of land use policies and the reasons for those policies. Further, designation of potentially unstable zones can provide a basis for designing zone-specific regulations and ordinances.[87] Planning is often defined as the conversion of knowledge and information into action.[88] Thus, land use planning heavily depends on accurate information and is closely linked to research and education programs such as those outlined above.[89]

1. Landslide Information in Local Planning—California Examples

Partly due to California's planning laws, local governments in California use landslide information more than local governments in other states. Specific problems and increased awareness in particular areas of California also contribute to the use of landslide information by California communities. Further, California planning law explicitly encourages communities to consider landslides when making their land use plans.[90] Each of the state's cities and counties must have a "general plan"[91] documenting its decisions concerning the future development of the community.[92] Part of this plan must address the potential for "slope instability leading to mudslides and landslides."[93] The general-plan enabling statute, however, does not explicitly identify the means of implementing or enforcing this mandate.

The town of Portola Valley, California, near the USGS western regional office in Menlo Park, is frequently cited as a good example of how a community can effectively employ geologic hazard information in land use planning.[94] Most of the town lies in a valley formed by the active San Andreas fault, and there have been numerous landslides in the area. A geologic map and a slope-stability map were incorporated into the town's

87. One of the more powerful of these ordinances, the grading ordinance, is discussed *infra* in the text accompanying notes 127-58.

88. *See, e.g.*, de Neufville, *Planning Theory and Practice: Bridging the Gap*, 3 J. PLAN. EDUC. & RES. 35 (1983); Friedmann & Hudson, *Knowledge and Action: A Guide to Planning Theory*, 40 J. AM. INST. PLANNERS 2 (1974).

89. *See supra* text accompanying notes 50-77.

90. *See* CAL. PUB. RES. CODE § 2671(b) (West 1984).

91. CAL. GOV'T CODE §§ 65100-65912 (West 1983 & Supp. 1986).

92. *See* CALIFORNIA OFFICE OF PLANNING AND RESEARCH, GENERAL PLAN GUIDELINES xvii (1984). A general plan consists of various topical elements, seven of which are required: land use, circulation, housing, conservation, open space, noise, and safety. CAL. GOV'T CODE § 65302 (West Supp. 1986). The plan is a guide for local decisionmaking and serves to identify the community's goals, express government policies regarding future development, give government the ability to analyze local conditions, and provide citizens with information about their community and government. CALIFORNIA OFFICE OF PLANNING AND RESEARCH, *supra*, at xviii.

93. CAL. GOV'T CODE § 65302(g) (West Supp. 1986) (safety element).

94. *See* T. NILSEN, R. WRIGHT, T. VLASIC & W. SPANGLE, *supra* note 12, at 68-69; *see also* Mader, *supra* note 38, at 16-18.

general plan in 1974. The plan specifies permissible uses and residential density for each land-stability category and requires that maps and associated policies be used in all decisions made by the town staff, commissions, and council. In addition, the town retains a consulting geologist.[95]

Some jurisdictions in the San Francisco Bay Area have adopted slope-density regulations, which establish "maximum permissible densities of development for terrain with various degrees of steepness."[96] Under different versions of the regulations, the average slope of a parcel dictates either the minimum subdivided parcel size[97] or the minimum-percentage of open space.[98] San Mateo County, for example, uses a landslide-susceptibility map[99] to limit development of the least stable lands to less than one unit per forty acres and requires a geologic report for all structures in these zones. If the geologic report concludes that the density requirement can be safely exceeded in a parcel, however, the county can approve higher densities.[100]

Another way to utilize landslide hazard information in land use planning is reflected in the California Environmental Quality Act (CEQA).[101] Under CEQA, environmental documents must be prepared for all potentially significant public and private projects,[102] and landslide hazards must be considered in the CEQA environmental review process.[103] Therefore, if landslide information is readily available for a proposed development site, local agencies must consider potential impacts of landslides and possible measures to mitigate them.

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95. T. NILSEN, R. WRIGHT, T. VLASIC & W. SPANGLE, *supra* note 12, at 68.

96. *Id.* at 80.

97. For example, Los Altos Hills, California, has adopted such a regulation. *See id.*

98. Pacifica, California, has adopted this type of regulation. *See id.* at 81. Specifying a minimum percentage of open space encourages the clustering of dwelling units because the portion of a given parcel available for development is reduced. This allows for needed housing development while encouraging the safety of the development and preserving open space.

99. E. BRABB, LANDSLIDE SUSCEPTIBILITY IN SAN MATEO COUNTY, CALIFORNIA (U.S. Dep't of the Interior Geological Survey Misc. Field Studies Map No. MF-360, 1972). USGS, which has its western regional office in San Mateo County, prepared this map as part of a pilot study that produced several hazard maps of the county. San Mateo has been fortunate in that it has been able to use USGS maps as a basis for its land use regulations.

100. Interview with Earl Brabb, *supra* note 13. The advantage of this system is that it provides for site-specific review of all but the lowest density development proposals. Decisions are sometimes inconsistent, however, because the several county departments involved in the review process have wide discretion in granting exemptions. Telephone interview with Al Neufeld, Geologist at the San Mateo County Public Works Dep't (July 31, 1984).

101. CAL. PUB. RES. CODE §§ 21000-21165 (West 1986).

102. *See* OFFICE OF PLANNING & RESEARCH, STATE OF CALIFORNIA, CEQA: THE CALIFORNIA ENVIRONMENTAL QUALITY ACT—STATUTE AND GUIDELINES 60-63 (June 1986).

103. According to CEQA guidelines, projects can "have a significant effect on the environment" if they "[c]ause substantial flooding, erosion or siltation" or "[e]xpose people or structures to major geologic hazards." *Id.* app. G(q), (r), at 284.

2. *Problems with Using Slope-Stability Information in Land Use Planning*

For a number of reasons, few communities in the United States explicitly use slope-stability information in land use planning. Even in communities that have regulations aimed at landslide reduction, lack of adequate enforcement is a frequent problem.[104] Possible explanations of why slope-stability information is not more frequently used in local land use planning include (1) political pressure on local officials to approve questionable developments in potentially unstable areas;[105] (2) local officials who are apathetic about landslide hazards;[106] (3) the higher priority given to other environmental and social considerations;[107] (4) the belief that landslides can be prevented by better engineering and, therefore, are not an important consideration in land use decisionmaking;[108] and (5) local officials' fear of being subjected to "taking"[109] claims.

Although the courts have not formulated a clear test for distinguishing a land use restriction so severe that it constitutes a "taking" from a permissible restriction upon the use of private property, courts have generally allowed land use regulations that substantially advance legitimate

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104. Based on the authors' professional experience in the San Francisco Bay Area, it appears that, although many communities adopt regulations aimed at landslide reduction, few adequately monitor or enforce the regulations.

105. Local real estate and development interests frequently exercise significant influence over local government decisions. Even the California Association of Realtors strongly opposes mandatory mapping of landslide hazards. *See supra* note 59. In addition, there is a general concern among landowners that published hazard information will affect their property values. *See, e.g., The Assembly Select Committee on Landslide Prevention, Transcript of Hearing,* California Assembly 73-76 (Apr. 18, 1980) (statement of Coreen Young, Vice President, State Board of Registration of Geologists and Geophysicists) [hereinafter *The Assembly Select Committee*]. An example of local landowners' resistance to hazard-related land use restrictions is the public response to proposed floodplain zoning in Rock Island County, Illinois. *See* Moline, *Perception Research and Local Planning: Floods on the Rock River, Illinois*, in NATURAL HAZARDS: LOCAL, NATIONAL, GLOBAL 52 (G. White ed. 1974). Moline describes a hearing on proposed floodplain zoning at which a vocal crowd insisted that their flood problems largely stemmed from government action (or inaction) and that individuals should not be restricted in the purchase and use of private property. *Id.* at 57-58.

106. For a discussion of public officials' disinterest in flood hazards, see P. ROSSI, *supra* note 47.

107. These include not only economic considerations, such as property values, jobs, and tax revenues, but also conflicting environmental concerns. For example, in portions of California, the landscape consists largely of hills and fertile valleys. Land use development decisions must consider not only landslide hazards but also the agricultural value of fertile lowlands, the floodplain hazards of valley bottoms, and the erosion potential of hillside agriculture.

108. This sentiment was expressed regarding the flood hazard at the public hearing in Rock Island County, Illinois. *See* Moline, *supra* note 105, at 57.

109. The fifth amendment provides in part that private property shall not be "taken" for public use without just compensation. U.S. CONST. amend. V. A "taking" means any situation in which the value of a person's property has been so substantially diminished that, in all fairness, the burden should be shared by the public. Penn Cent. Transp. Co. v. New York City, 438 U.S. 104, 130 (1978).

state interests,[110] do not deny owners economically viable use of their land,[111] and do not unduly burden individuals.[112] To avoid being subjected to "taking" claims, landslide-related land use regulations should clearly serve a legitimate state interest, be supported by scientific data evidencing a connection between the regulation and the state interest,[113] and should not substantially reduce the value of land.[114] Because landslide data is imprecise, governments often have difficulty showing a connection between the regulation and the state interest, and consequently, many local governments are hesitant to establish landslide-related regulations that significantly reduce land values.[115] Regulatory schemes that could reduce landslide hazards while retaining property values include transferring development rights from unstable areas to more developable lands, permitting construction only if certain engineering mitigation measures are performed, and conducting land-banking programs in which a government agency purchases land and resells it with deed restrictions on the type and density of development.[116]

One way to maintain property values, thereby avoiding taking problems, while limiting development in landslide-prone areas is to use low-density zoning.[117] Many criticize this method, though, as merely a

110. *See* Agins v. City of Tiburon, 447 U.S. 255, 260 (1980).

111. *See id.*; Penn Cent. Transp. Co. v. New York City, 438 U.S. 104 (1978). Retaining "economically viable use," however, may mean a substantial diminution of property value. "[I]n instances in which a state tribunal reasonably concluded that 'the health, safety, morals, or general welfare' would be promoted by prohibiting particular contemplated uses of land, this Court has upheld land-use regulations that destroyed or adversely affected recognized real property interests." *Id.* at 125; *see also Agins,* 447 U.S. at 261; Euclid v. Ambler Realty, 272 U.S. 365 (1926). In regard to floodplain land use restrictions under the National Flood Insurance Program, a federal district court found the resultant diminution of land value to be reasonably related to the public interest. *See* Texas Landowners Rights Ass'n v. Harris, 453 F. Supp. 1025, 1031-32 (D.D.C. 1978), *aff'd,* 598 F.2d 311 (D.C. Cir.), *cert. denied,* 444 U.S. 927 (1979). Additionally, defendants cannot legitimately claim that expectations of development have been taken. *See Penn Cent.,* 438 U.S. at 130. "[T]he submission that appellants may establish a 'taking' simply by showing that they have been denied the ability to exploit a property interest that they heretofore had believed was available for development is quite simply untenable." *Id.*

112. *See Agins,* 447 U.S. at 260.

113. *See* J. KUSLER, REGULATING SENSITIVE LANDS 156 (1980). Supporting data serve to document and verify that the regulations advance legitimate state interests. *See supra* text accompanying note 110. Accurate data collection ensures that the regulatory means have a substantial relation to the goals. *See* Welch v. Swasey, 214 U.S. 91, 105 (1909).

114. *See supra* note 111 and accompanying text.

115. *See* J. KUSLER, *supra* note 113, at 163. Kusler advises, in regard to regulating sensitive lands, that "it is often politically advisable to avoid potential litigation through a conscious attempt to permit private economic land uses while minimizing their impacts and preserving important values." *Id.*

116. *See* Kockelman, *supra* note 86, at 34.

117. For example, Los Altos Hills, California, requires a minimum parcel size of one acre on 10% slopes, increasing incrementally to four acres on 45% slopes. *See* T. NILSEN, R. WRIGHT, T. VLASIC & W. SPANGLE, *supra* note 12, at 80.

convenient rationale for exclusionary zoning.[118] This argument has some merit: Landslide safety depends more on the location, design, and size of building pads than on the density of dwelling units. Moreover, public safety and open-space concerns in landslide-prone areas could be addressed just as easily by small, intensive clusters of well-engineered multistory buildings. Costly engineering measures could also be used more economically in clustered developments than in more isolated single dwelling units.

Sometimes, low-density zoning actually creates landslide problems. For example, roads and utilities built over wide areas of unstable terrain can trigger landslides or be damaged by natural slope failures.[119] The limited tax revenues from the small number of low-density hillside homeowners to support maintenance and repairs exacerbates this problem. Septic systems, which are commonly used to dispose of sewage in low-density areas, present another problem: They often raise groundwater levels, thereby increasing landslide risks.[120]

The above discussion identifies some of the informational, political, and legal constraints that limit the ability of land use regulations to reduce landslide hazards. Because of these constraints, land use planning must be tailored to the particular landslide problems of each jurisdiction.

3. *Theoretical Questions—Can Land Use Planning Reduce Landslide Hazards?*

Ideally, every community would have access to perfect information about landslide hazards. Local governments could then draw precise landslide hazard maps and could justify prohibiting construction in designated unstable areas. But because landslide hazard information is usu-

118. Some people have argued that many communities hide behind the cloak of ecological planning or public safety to exclude lower income groups and to enhance the property values of the community by limiting supply. *See* B. FRIEDEN, THE ENVIRONMENTAL PROTECTION HUSTLE 8-10 (1979); *see also* Dowall & Landis, *Land-Use Controls and Housing Costs: An Examination of San Francisco Bay Area Communities,* 10 J. AM. REAL EST. & URB. ECON. A. 69 (1982). Dowall and Landis assert that environmental land use controls restrict the housing supply, raise the price of houses, increase the property values of present homeowners, and close the market to first-time buyers. *Id.* at 69-75. Landslide prevention frequently is cited in political battles that stem from other, more basic issues. For example, the arguments over the repair or rerouting of California State Highway 1 at Devil's Slide, *see* CALIFORNIA DEP'T OF TRANSPORTATION, *supra* note 30, hide the underlying emotional issue of coastal residential development in Half Moon Bay, a town whose most direct highway access to San Francisco crosses Devil's Slide.

119. The large number of cuts and fills required to grade roadways through hilly terrain increases the probability of undercutting or overloading a marginally stable slope and causing a landslide. Road construction also alters surface-drainage patterns and can focus storm runoff onto marginally stable slopes, thus triggering landslides.

120. For example, a substantial cause of the Big Rock landslide, in Malibu, was the high groundwater level, caused by septic systems. *See* Hansch v. County of Los Angeles, No. WEC 86007, slip op. at 10 (Los Angeles County Super. Ct. Jan. 31, 1986).

ally imperfect, land use regulations must allow some development in landslide-prone areas.

There are several possible government responses to imperfect landslide hazard information. One response, noted above, is to zone hazard areas for lower densities.[121] Such zoning restricts the number of structures in hazard areas while permitting construction on the relatively stable portions of large parcels.[122] Another response is to use hazard information as a basis for flexible regulations. For example, regulations could require engineering reports for potentially unstable sites.[123] These reports would provide a relatively easy way for local governments to acquire landslide hazard information, which could then be used to further refine the regulations. Under a variation of this approach, local governments could have strict uniform building and grading regulations for potentially hazardous areas but allow site-specific engineering reports to waive some of the restrictions.[124] This approach is restrictive enough to provide for public safety yet flexible enough to be politically acceptable because it allows some development.

A major limitation on using land use planning for landslide hazard reduction is that it cannot reduce preexisting hazards; it only affects new development. Land use planning can counter this limitation, however, by facilitating the use of insurance to compensate property owners for landslide damages. Private insurers would be less hesitant to offer landslide insurance in jurisdictions having strict land use plans and policies.[125] Publicly supported insurance programs probably would require strict land use planning as a condition of eligibility for landslide insurance.[126]

In conclusion, land use planning can be used effectively to reduce landslide hazards. Its use is circumscribed, however, by the quality of information provided, local politics, concerns about property values, and its inability to reduce preexisting hazards.

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121. *See supra* text accompanying note 117.

122. *But see supra* note 118 and accompanying text (criticism of low-density zoning).

123. This is generally a major component of a grading ordinance. *See infra* notes 127-33 and accompanying text.

124. San Mateo County, California, for example, has strict regulations limiting development densities in designated hazard areas, but the County can make exceptions based on site-specific engineering geology reports. Telephone interview with Al Neufeld, *supra* note 100.

125. Landslide insurance is not generally available in the United States. *See infra* notes 254-55 and accompanying text. Communities with strict land use regulations have fewer property owners in high-risk areas, and this presents less of a risk to potential insurers. Strict hazard-reducing regulations could reduce the two major obstacles to landslide insurance: (1) moral hazard (whereby insured persons choose to reduce their care), *see infra* note 305 and accompanying text, and (2) adverse selection (whereby only high-risk-property owners purchase insurance, threatening the solvency of an insurance fund), *see infra* notes 256-57 & 302 and accompanying text.

126. *See infra* note 306 and accompanying text.

C. Grading Ordinances and Site Inspection

Another approach for reducing landslide hazards to new developments, which combines land use planning and engineering techniques, is to require detailed site analysis and construction monitoring. This approach generally includes regulations requiring site evaluation for potentially unstable property and regulations controlling the entire design and construction process of all earthmoving projects. The set of local regulations that controls this process is usually called a grading ordinance,[127] and it is typically part of a community's building code.[128]

1. Principles of the Grading Ordinance

A grading ordinance requires developers to obtain grading permits[129] and provide engineering or geologic reports for proposed building sites. These reports analyze slope stability, provide detailed designs and specifications for quantity and quality of fill, and document site preparation and earthwork. Local governments implement grading ordinances through the building-permit process by making compliance with grading ordinances a prerequisite to the approval of final building and occupancy permits. Grading ordinances cannot be as specific as building codes because natural soils, unlike standardized building products, are heterogeneous;[130] consequently, although the ordinances contain some design specifications, they primarily regulate the preparation and review of the reports they require.[131] Because implementing grading ordinances depends upon a high degree of professional discretion in preparing and evaluating geologic and engineering reports, the ordinances are generally accompanied by professional licensing procedures[132] or peer review boards.[133] Grading ordinances usually require that reports be prepared by licensed professionals or at least be reviewed by recognized specialists in the field.

There are several advantages to the use of grading ordinances as a means of reducing landslide hazards. First, grading ordinances are rela-

127. *See* C. SCULLIN, EXCAVATION AND GRADING CODE ADMINISTRATION, INSPECTION, AND ENFORCEMENT 13-29 (1983).

128. *E.g.*, UNIFORM BUILDING CODE ch. 70 (Int'l Conference of Building Officials 1985).

129. Local governments require grading permits as a condition for approving significant earthmoving projects. Generally, moving less than 50 to 150 cubic yards does not require a permit. *E.g.*, OAKLAND, CAL., MUNICIPAL CODE ch. 2, art. 6 (1977) (50 cubic yards); RICHMOND, CAL., MUNICIPAL CODE ch. 12.44 (1980) (150 cubic yards).

130. *See* C. SCULLIN, *supra* note 127, at 22-23.

131. For example, chapter 70 of the Uniform Building Code provides minimum standards for slope cuts, setbacks, drainage and terracing, and erosion control. UNIFORM BUILDING CODE §§ 7009-7013. It also addresses inspection procedures, *id.* § 7014, and specifies the recommended scope of soils engineering and engineering geology reports, *see id.* § 7006(e), (f).

132. *See* C. SCULLIN, *supra* note 127, at 15.

133. *See, e.g.*, Dallaire, *Consultants Reviewing Plans of Other Consultants in Fairfax County, Va.; Landslides Greatly Reduced*, 46 CIVIL ENGINEERING—ASCE 77 (1976).

tively uncomplicated for local governments to adopt and administer. Second, local governments can design the administration and implementation of the ordinance to parallel existing building-permit procedures. Finally, these regulations are less likely to be politically controversial than areawide land use restrictions because they meet the same widely accepted public safety goals as building codes and do not restrict development types and densities.

Grading codes potentially represent an extremely effective means of reducing the probability of destructive landslides and incorporating the costs of hillside development into the purchase price of property. In addition, the existence of well-enforced grading codes could encourage private or public insurers to offer earth-movement insurance policies.[134]

2. *A Model—The City of Los Angeles*

In 1952, the City of Los Angeles adopted what was probably the first grading ordinance.[135] This ordinance regulated grading in designated hillside areas by requiring permits, inspections by city personnel, and certification of plans prior to construction. Initially, the ordinance required only soil testing, but in 1956, it was amended to also require geologic reports.[136] Landslides caused by the rains of 1961-62 showed that the procedures for geologic investigation and inspection still were not strict enough.[137] In 1963, the City of Los Angeles adopted a more stringent code that provided for not only soil and geologic reports but also inspections and approvals throughout the grading process and final certification of completed earthwork by the city engineer.[138]

The Los Angeles code has been extremely effective in reducing landslide damage. Most of the landslide damage reported over the past twenty years has occurred on sites developed prior to the enactment of the grading code.[139] Many other cities and counties have imitated the

134. Well-enforced grading codes would reduce landslide risks and thereby make landslide coverage more attractive to insurers. The effect would be similar to that of land use regulations in general. *See supra* note 125.

135. *See* C. SCULLIN, *supra* note 127, at 14.

136. *Id.* at 15.

137. *Id.*

138. Fleming, Varnes & Schuster, *Landslide Hazards and Their Reduction,* 45 AM. PLAN. A.J. 428, 435 (1979).

139. In his frequently cited study of landslides caused by the 1969 rains, geologist James Slosson found that 10% of pre-1952 graded sites were damaged, 1.3% of 1952-62 sites were damaged, and only 0.15% (17 out of every 11,000) of post-1962 sites suffered damage. Slosson, *The Role of Engineering Geology in Urban Planning,* in THE GOVERNOR'S CONFERENCE ON ENVIRONMENTAL GEOLOGY 8 (Colorado Dep't of Natural Resources Geological Survey Special Publication No. 1, 1969). In a similar study following 1978 storm damage, Slosson found that 7.5% of all pre-1963 graded sites failed, compared to the 0.7% (210 out of every 30,000) of post-1963 sites that failed. Slosson & Krohn, *Mudflow/Debris Flow Damage, February 1978 Storm—Los Angeles Area,* 32 CAL. GEOLOGY 8, 8-9 (1979).

Many of the 1978 failures of post-1963 sites were due to natural mudflows and debris

Los Angeles grading code, but the Los Angeles code is still considered the most effective.[140] The primary reason for the success of the Los Angeles ordinance is that technically trained inspectors familiar with specific districts of the city enforce it.[141] The system is funded through development fees and is self-supporting. Similarly effective systems can be established in jurisdictions of any size as long as local officials support strict procedures.

3. *Ordinances in Other Jurisdictions*

Cities and counties in California operate under a variety of statutes and ordinances regulating the development of landslide-prone areas. Many jurisdictions in southern California have adopted relatively strict grading codes patterned after the Los Angeles code.[142] Although many of these codes initially were administered poorly, administration has generally improved over the years.[143] Some jurisdictions in northern California have also adopted grading codes.[144] California state law requires that a preliminary soil report accompany all subdivision applications unless the local government specifically waives the requirement.[145] The California Environmental Quality Act[146] review process is another mechanism for ensuring proper site design for California developments.[147]

Other jurisdictions in the United States having unstable slopes have also established standards and procedures for hillside development. In 1975, Fairfax County, Virginia, began requiring soil engineering studies for projects in designated areas having soil problems.[148] An engineering peer review board must review and approve the soil reports before recommending projects to the county building department for permits. In 1974, the City of Cincinnati, Ohio, enacted an excavation and fill ordinance, which supplemented the city's zoning districts for hillside areas.[149] Prince Georges County, Maryland, adopted a detailed grading

flows emanating upslope from developed properties; this suggests a need for amending ordinances to require consideration of offsite problems posing hazards to future development sites. *See id.*

140. *See* Fleming, Varnes & Schuster, *supra* note 138, at 434.

141. Telephone interview with Joseph Cobarrubias, Chief Geologist, City of Los Angeles (Aug. 23, 1984).

142. Beverly Hills, Pasadena, Glendale, Burbank, San Diego, Los Angeles County, and Orange County have adopted similar grading codes. *See* C. SCULLIN, *supra* note 127, at 14.

143. *See id.* at 14-15.

144. *E.g.*, CONTRA COSTA COUNTY, CAL., BUILDING REGULATIONS ch. 716-2 (1986); SAN MATEO COUNTY, CAL., ADMINISTRATIVE CODE ch. 8 (1984); SANTA CLARA COUNTY, CAL., ORDINANCE CODE ch. III (1980); OAKLAND, CAL., MUNICIPAL CODE ch. 2, art. 6 (1977); RICHMOND, CAL., MUNICIPAL CODE ch. 12.44 (1980).

145. CAL. GOV'T CODE §§ 66490-66491 (West 1983).

146. CAL. PUB. RES. CODE §§ 21000-21165 (West 1986).

147. *See supra* notes 101-03 and accompanying text.

148. *See* Dallaire, *supra* note 133, at 77.

149. *See* R. FLEMING & F. TAYLOR, *supra* note 8, at 17.

code in 1970, which was quite effective in reducing damage from Tropical Storm Eloise in 1975.[150] Pittsburgh, Pennsylvania, recently adopted a hillslope-development ordinance as part of the city's new subdivision regulations.[151]

In 1964, the International Conference of Building Officials adopted a model grading ordinance.[152] It is a concise, flexible document that specifies minimum standards and encourages the use of qualified experts in investigating, evaluating, and mitigating dangerous slope conditions.[153]

4. *Grading Ordinances Are Not a Panacea*

Although grading ordinances are an effective means of reducing landslide hazards, they do not work without adequate enforcement and inspection procedures.[154] Because the quality of engineering reports varies, local agencies must effectively and consistently review engineering and geologic reports to establish appropriate minimum earthwork-construction standards throughout the community. In addition, governments must hire enough technically competent site inspectors to effectively monitor all active earthwork-construction projects. Further, grading inspectors and technical reviewers need the support of elected officials if they are to make tough decisions and to resist pressure from developers.[155]

Grading ordinances are further limited by their site-specific application, resulting in a piecemeal consideration of hazards. Evaluation of individual sites ignores the cumulative effects of developing many individual parcels[156] and avoids comprehensive investigation of larger geologic processes crossing property boundaries. Site reports do not analyze the subtle effects of individual development projects on the surface-water flow patterns of an area. Nor do they always examine natural hazards that could emanate from nearby properties. Finally, a site-specific approach ignores the effects, often on unstable slopes, of the new roads, storm drains, and utilities that accompany new developments in hillside areas.[157]

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150. *See* C. SCULLIN, *supra* note 127, at 25-27.

151. Telephone interview with Helen Delano, Pa. Geological Survey (Sept. 16, 1986).

152. *See supra* note 128.

153. *See supra* note 131.

154. *See generally* C. SCULLIN, *supra* note 127, at 95-144.

155. Telephone interview with Joseph Cobarrubias, *supra* note 141.

156. Developing many parcels in an area affects rainfall-runoff and infiltration processes, and it can even cause accelerated erosion and streambank destabilization in downstream areas. *See* T. DUNNE & L. LEOPOLD, *supra* note 14, at 693-95. For a discussion of the importance of assessing cumulative runoff and erosion impacts of development, see also Dickert & Tuttle, *Cumulative Impact Assessment in Environmental Planning: A Coastal Wetland Watershed Example,* 5 ENVTL. IMPACT ASSESSMENT REV. 37, 37-39 (1985).

157. Constructing roads, storm drains, and utilities in unstable areas not only requires

Grading ordinances do not even eliminate all the landslide dangers they are designed to mitigate on sites that have complied with the applicable ordinance. Even the most advanced engineering and earthwork practices can at best reduce the probability of slope failures; there will always be some landslides in hillside areas.[158] Furthermore, grading ordinances do nothing to prevent landslides in already developed areas. In sum, even with grading ordinances, some minimal level of landslide damage is unavoidable in hillside communities.

D. Tort Liability as a Deterrent and Source of Compensation

The threat of liability in tort can potentially deter poor construction and hillside-maintenance practices. Some geologists and attorneys believe this deterrent effect may be the best incentive for reducing landslide hazards.[159] Currently, in the absence of coordinated legislative or administrative landslide policies, the threat of tort liability is the de facto policy instrument.

Parties potentially liable for landslide damage include developers, builders, architects, engineers, vendors, realtors, adjoining landowners, and local government agencies.[160] Courts have been increasing the liability of most of these actors. The threat of liability provides an incentive for each of these parties to be more diligent in recognizing and reducing landslide risks to others.

1. Potential Liability of Builders, Architects, and Engineers—Promotes Safer Site Development

In most states, builders of new homes may be liable for latent defects under several theories.[161] Such defects include improperly placed fill[162]

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significant public funding for construction and maintenance but also frequently causes landslides on adjacent properties by undercutting, overloading, or directing runoff onto marginally stable slopes. *See supra* note 119.

158. For instance, although the 1963 Los Angeles grading code dramatically reduced landslide damages, it did not eliminate them. *See supra* note 139.

159. *See, e.g.*, Slosson & Havens, *Liability Question Heats Up Over Hazards . . . Builders/Planners Have Incentive to Mitigate*, 5 W. PLANNER 6 (1984) (this paper was also presented as *Legal Liability: An Incentive for Mitigation* at the Workshop on Natural Hazards Research and Applications (Boulder, Colo., July 1984) and at the FEMA Conference on Legal Issues in Emergency Management (Emmitsburg, Md., Aug. 1984)).

160. *See generally* J. SUTTER & M. HECHT, LANDSLIDE AND SUBSIDENCE LIABILITY §§ 5-8 (1974 & Supp. 1985) (describes parties potentially liable and possible causes of action and remedies under California law).

161. *See infra* notes 162-72 and accompanying text. *See generally* Zipser, *Builders' Liability for Latent Defects in Used Homes*, 32 STAN. L. REV. 607 (1980).

162. *See, e.g.*, Richards v. Powercraft Homes, Inc., 139 Ariz. 242, 678 P.2d 427 (1984) (improper compacting of soil caused cracking of walls and separation of floors from walls); Avner v. Longridge Estates, 272 Cal. App. 2d 607, 77 Cal. Rptr. 633 (1969) (defective subsurface conditions, including inadequate provision for drainage, organic matter beneath fill that decomposed, and insufficient compacting, caused failure of rear slope of lot and settling of lot

and inadequately designed foundations and site drainage.[163] Builders may be found liable for fraudulent concealment[164] and misrepresentation[165] of site conditions. Builder negligence may also be actionable.[166] In recent years, many courts have drawn an analogy between new homes and manufactured products,[167] enabling product-liability theories to be applied to new homes. Thus, in an increasing number of jurisdictions, purchasers of defective homes may seek redress for latent defects, such as unstable subsurface materials, under theories of strict liability[168] and im-

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pad); Johnson v. Healy, 176 Conn. 97, 405 A.2d 54 (1978) (improper fill caused house to settle unevenly).

163. *See, e.g.,* Bethlahmy v. Bechtel, 91 Idaho 55, 415 P.2d 698 (1966) (unsealed irrigation ditch running under lot and garage, combined with a basement of nonwaterproof construction, resulted in water seepage into basement rooms); Chandler v. Madsen, 197 Mont. 234, 642 P.2d 1028 (1982) (settling damage to house caused by presence of water in moisture-sensitive soil and "pooling" of water at one end of house).

164. *See, e.g.,* Barnhouse v. City of Pinole, 133 Cal. App. 3d 171, 183 Cal. Rptr. 881 (1982) (drainage problems that later caused landslide); Cohen v. Vivian, 141 Colo. 443, 349 P.2d 366 (1960) (filled soil); Loghry v. Capel, 257 Iowa 285, 132 N.W.2d 417 (1965) (nondisclosure by builder that home was built on improperly compacted fill); Wolford v. Freeman, 150 Neb. 537, 35 N.W.2d 98 (1948) (fill beneath foundation); Brooks v. Ervin Constr. Co., 253 N.C. 214, 116 S.E.2d 454 (1960) (buried debris); Westwood Dev. Co. v. Esponge, 342 S.W.2d 623 (Tex. Civ. App. 1961) (landfill beneath lots).

165. *See, e.g.,* Massei v. Lettunich, 248 Cal. App. 2d 68, 56 Cal. Rptr. 232 (1967) (misrepresentation as to fill lots that eventually failed); Buist v. C. Dudley DeVelbiss Corp., 182 Cal. App. 2d 325, 6 Cal. Rptr. 259 (1960) (fraudulent misrepresentation of fill, ancient landslide, and subsurface water); Johnson v. Healy, 176 Conn. 97, 405 A.2d 54 (1978) (innocent misrepresentation as to improper fill that later settled); Ramel v. Chasebrook Constr. Co., 135 So. 2d 876 (Fla. Dist. Ct. App. 1961) (misrepresentation of "muck" beneath foundation); *see also* Worthey v. Holmes, 249 Ga. 104, 287 S.E.2d 9 (1982) (rejects doctrine of caveat emptor for new homes, declaring that builder may be liable for latent defects that would have been known to him in the exercise of ordinary care).

166. *See, e.g.,* Conolley v. Bull, 258 Cal. App. 2d 183, 65 Cal. Rptr. 689 (1968) (house constructed upon unstable ground); Baranowski v. Strating, 72 Mich. App. 548, 250 N.W.2d 744 (1976) (house built on unsuitable foundation soil); ABC Builders, Inc. v. Phillips, 632 P.2d 925 (Wyo. 1981) (negligence of builder for not furnishing a safe building location, lot being located at base of unstable slope).

167. The New Jersey Supreme Court stated:

> We consider that there are no meaningful distinctions between Levitt's mass production and sale of homes and the mass production and sale of automobiles and that the pertinent overriding policy considerations are the same.
>
> . . . .
>
> When a vendee buys a development house from an advertised model . . . he clearly relies on the skill of the developer and on its implied representation that the house will be erected in reasonably workmanlike manner and will be reasonably fit for habitation.

Schipper v. Levitt & Sons, Inc., 44 N.J. 70, 91, 207 A.2d 314, 325 (1965); *see also* Kriegler v. Eichler Homes, Inc., 269 Cal. App. 2d 224, 227, 74 Cal. Rptr. 749, 752 (1969); Waggoner v. Midwestern Dev., Inc., 83 S.D. 57, 62, 154 N.W.2d 803, 806 (1967).

168. *See, e.g.,* Avner v. Longridge Estates, 272 Cal. App. 2d 607, 77 Cal. Rptr. 633 (1969) (strict liability for improperly placed fill slope that later failed); *Kriegler,* 269 Cal. App. 2d 224, 74 Cal. Rptr. 749 (home builders subject to strict liability in tort); *Schipper,* 44 N.J. 70, 207 A.2d 314 (builder of mass-produced house could be held liable on theory of strict liability or warranty).

plied warranty.[169] Liability for implied warranty arises whenever the seller holds himself out as a builder-vendor, regardless of whether he is a mass producer.[170] The right to sue for breach of an implied warranty is not limited to the first purchaser of a home.[171] In addition, some courts have extended the doctrine of implied warranty to include land defects[172] such as poorly placed fills or inadequate site drainage.

Architects and engineers are held to a less stringent standard of negligence than builders. The duty of an architect to perform his services with ordinary skill and care in the light of present knowledge was expressed nearly 100 years ago in *Coombs v. Beede*[173] and *Chapel v. Clark*[174] and has been consistently reaffirmed.[175] Numerous cases, many

169. *See, e.g.,* Sims v. Lewis, 374 So. 2d 298 (Ala. 1979) (septic system malfunctioned due to saturation with ground water); Bethlahmy v. Bechtel, 91 Idaho 55, 415 P.2d 698 (1966) (implied warranty of fitness applied to poor surface drainage and flooding of basement); O'Dell v. Custom Builders Corp., 560 S.W.2d 862 (Mo. 1978) (implied warranty that house plans provided by builder were fit for use by owners); Chandler v. Madsen, 197 Mont. 234, 642 P.2d 1028 (1982) (settling damage due to poor drainage); Pioneer Enterprises, Inc. v. Edens, 216 Neb. 672, 345 N.W.2d 16 (1984) (leaks in grain-storage building); Gaito v. Auman, 313 N.C. 321, 327 S.E.2d 870 (1985) (defective air-conditioning system); Waggoner v. Midwestern Dev., Inc., 83 S.D. 57, 154 N.W.2d 803 (1967) (implied warranty applied to groundwater seepage into basement); Evans v. J. Stiles, Inc., 689 S.W.2d 399 (Tex. 1985) (use of faulty brick).

170. *See, e.g.,* Park v. Sohn, 89 Ill. 2d 453, 461, 433 N.E.2d 651, 655 (1982); McDonald v. Mianecki, 79 N.J. 275, 293, 398 A.2d 1283, 1292 (1979).

171. *See, e.g.,* Richards v. Powercraft Homes, Inc., 139 Ariz. 242, 678 P.2d 427 (1984) (privity not required for action on breach of implied warranty of workmanship and habitability when fill was improperly compacted); Barnes v. MacBrown & Co., 264 Ind. 141, 342 N.E.2d 611 (1976) (leaks in basement walls); Gupta v. Ritter Homes, Inc., 646 S.W.2d 168 (Tex. 1983) (excessive settlement of foundation). *But see* Brown v. Fowler, 279 N.W.2d 907 (S.D. 1979) (implied warranty of habitability does not extend to subsequent purchasers; subsequent purchasers, however, may recover from builder on theory of negligence). *See generally* Zipser, *supra* note 161.

172. *See, e.g.,* Hesson v. Walmsley Constr. Co., 422 So. 2d 943 (Fla. Dist. Ct. App. 1982) (implied warranty extends to both house and lot if sold as a package); Briarcliffe West v. Wiseman Constr. Co., 118 Ill. App. 3d 163, 454 N.E.2d 363 (1983) (implied warranty of habitability for vacant common land); *cf.* Degnan v. Executive Homes, 696 P.2d 431 (Mont. 1985) (implied warranty applies to land beneath home only when land is enhanced by the construction, but burden is on builder to show that instability is independent of construction on the land); Beri, Inc. v. Salishan Properties, 282 Or. 569, 580 P.2d 173 (1978) (implied warranty does not extend to unstable conditions of land not caused by builder's work, such as coastal erosion). *But see* Gamble v. Main, 300 S.E.2d 110 (W. Va. 1983) (implied warranty does not extend to adverse soil conditions unknown to builder).

173. 89 Me. 187, 36 A. 104 (1896). The court stated:

> The undertaking of an architect implies that he possesses skill and ability, including taste, sufficient to enable him to perform the required services at least ordinarily and reasonably well; and that he will exercise and apply, in the given case, his skill and ability, his judgment and taste, reasonably and without neglect. But the undertaking does not imply or warrant a satisfactory result. . . . An error of judgment is not necessarily evidence of a want of skill or care, for mistakes and miscalculations are incident to all the business of life.

Id. at 188, 36 A. at 105.

174. 117 Mich. 638, 640, 76 N.W. 62, 62 (1898). The *Chapel* court stated: "The law requires only the exercise of ordinary skill and care in the light of present knowledge." *Id.*

175. *See, e.g.,* Donnelly Constr. Co. v. Oberg/Hunt/Gilleland, 139 Ariz. 184, 187, 677

specifically related to soil-engineering investigations of subsurface and foundation conditions of hillside sites, have held soil engineers to the same standard of care as architects.[176] Under this standard, soil engineers do not warrant results but need only perform according to the established standards of the profession.[177] Soil engineers are rarely found liable in landslide cases, and when liability is established, it is generally premised on inadequate laboratory testing and soil analysis.[178] Although the legal standard has changed little over the years, soil engineers are continually being held to higher levels of care as professional practices reflect increases in knowledge.[179] The increased level of care has improved the design and construction of hillside sites.

P.2d 1292, 1295 (1984); Bayshore Dev. Co. v. Bonfoey, 75 Fla. 455, 459, 78 So. 507, 509 (1918); Mississippi Meadows, Inc. v. Hodson, 13 Ill. App. 3d 24, 26, 299 N.E.2d 359, 361 (1973); Klein v. Catalano, 386 Mass. 701, 719, 437 N.E.2d 514, 525 (1982); City of Mounds View v. Walijarvi, 263 N.W.2d 420, 423 (Minn. 1978); Overland Constructors v. Millard School Dist., 220 Neb. 220, 229, 369 N.W.2d 69, 76 (1985).

176. *See, e.g.*, Gagne v. Bertran, 43 Cal. 2d 481, 489, 275 P.2d 15, 21 (1954) (when a testhole driller failed to identify between four and five feet of fill on plaintiff's lot, the court declared that experts "have a duty to exercise the ordinary skill and competence of members of their profession, and a failure to discharge that duty will subject them to liability for negligence"); Allied Properties v. John A. Blume & Assocs., 25 Cal. App. 3d 848, 102 Cal. Rptr. 259 (1972) (when assessing an engineering firm's design of piers that did not adequately protect small boats from wave damage, the court drew an analogy to medical malpractice, declaring that a profession's standard of care must be based on expert testimony); Bonadiman-McCain, Inc. v. Snow, 183 Cal. App. 2d 58, 70, 6 Cal. Rptr. 52, 60 (1960) ("The engineer's undertaking in respect to the plans he prepares is comparable to that of an architect, which in the absence of a special agreement is not an absolute guaranty that satisfactory results will ensue"); Morrison-Maierle, Inc. v. Selsco, 606 P.2d 1085, 1088 (Mont. 1980) (an engineer "is required to exercise the care and competence expected as a member of his profession").

177. *E.g.*, Swett v. Gribaldo & Assocs., 40 Cal. App. 3d 573, 115 Cal. Rptr. 99 (1974) (soil engineer's function is not to warrant the quality of fill but rather to make tests and give professional advice). Some courts, however, have stated that under certain circumstances engineers impliedly warrant their work. *See* Broyles v. Brown Eng'g Co., 275 Ala. 35, 151 So. 2d 767 (1963) (a specific engineering drainage survey is impliedly warranted to be sufficient for the intended purpose); Audlane Lumber & Builders Supply, Inc. v. D. E. Britt Assocs., 168 So. 2d 333 (Fla. Dist. Ct. App. 1964) (engineer does not warrant the result but warrants that she has exercised her skill according to a certain standard of care); Tamarac Dev. Co. v. Delamater, Freund & Assocs., 234 Kan. 618, 675 P.2d 361 (1984) (in an action against architectural firm for defective grading of a trailer court, the court stated that if a professional contracts and fails to perform a specific result, remedy may be based on either implied warranty or negligence).

178. *See, e.g.*, Shurpin v. Elmhirst, 148 Cal. App. 3d 94, 195 Cal. Rptr. 737 (1983) (soil engineer's duty includes duty to adjacent downslope landowner); Oakes v. McCarthy Co., 267 Cal. App. 2d 231, 249, 73 Cal. Rptr. 127, 137 (1968) (soil engineer negligently supervised and inspected fill that "failed to conform to the prevailing good soils engineering practice of the time"); Luciani v. High, 372 So. 2d 530 (Fla. Dist. Ct. App. 1979) (negligent soil testing); Stanford v. Owens, 46 N.C. App. 388, 265 S.E.2d 617, *appeal denied*, 314 N.C. 670, 336 S.E.2d 402 (1985) (negligent testing and analysis of subsurface materials); Davidson & Jones v. County of New Hanover, 41 N.C. App. 661, 255 S.E.2d 580 (1979) (preparation of soil report).

179. *See* Slosson & Havens, *supra* note 159.

2. *Potential Liability of Sellers and Realtors—Reduces Sales of Defective Properties to Unwitting Buyers*

a. *Liability of Sellers of Used Homes*

In recent years, most courts have abandoned the doctrine of caveat emptor for used home sales and have allowed buyers of defective homes to recover from sellers.[180] Purchasers of used homes with latent defects have less recourse to legal action than buyers of new homes, however, because there is generally no implied warranty in used-home sales.[181] Buyers of defective homes may have causes of action for fraudulent misrepresentation or concealment.[182] In many states, the law goes further and requires vendors to affirmatively disclose dangerous or serious defects;[183] some courts consider silence to be as misleading as a positive misrepresentation.[184] Thus, at a minimum, sellers have a duty to avoid

180. *See, e.g.*, Holcomb v. Zinke, 365 N.W.2d 507 (N.D. 1985) (exception to the rule of caveat emptor in sales of homes when there is passive concealment); Miles v. McSwegin, 58 Ohio St. 2d 97, 388 N.E.2d 1367 (1979) (caveat emptor does not apply to cases of latent defects); Quashnock v. Frost, 299 Pa. Super. 9, 19, 445 A.2d 121, 126 (1982) ("modern judicial trend is away from a strict application of the caveat emptor doctrine and towards the more fair and equitable doctrine requiring disclosure of latent defects which are of a serious and dangerous nature"); Thacker v. Tyree, 297 S.E.2d 885 (W. Va. 1982) (rejects doctrine of caveat emptor for real property sales).

181. *See generally* Zipser, *supra* note 161; *see also* Annotation, *Liability of Vendor of Existing Structure for Property Damage Sustained by Purchaser After Transfer*, 18 A.L.R. 4TH 1168 (1982 & Supp. 1985).

182. *See, e.g.*, Lingsch v. Savage, 213 Cal. App. 2d 729, 735, 29 Cal. Rptr. 201, 204 (1963) ("where the seller knows of facts materially affecting the value or desirability of the property which are known or accessible only to him and also knows that such facts are not known to, or within the reach of the diligent attention and observation of the buyer, the seller is under a duty to disclose them to the buyer"); Ashburn v. Miller, 161 Cal. App. 2d 71, 326 P.2d 229 (1958) (misrepresentation that lot was solid where it consisted of uncompacted fill); Burkett v. J.A. Thompson & Son, 150 Cal. App. 2d 523, 310 P.2d 56 (1957) (vendor and agent concealed fact that house was built on fill); Wilhite v. Mays, 239 Ga. 31, 235 S.E.2d 532 (1977) (vendor did not disclose sewage and drainage problems that occurred during heavy rains); Posner v. Davis, 76 Ill. App. 3d 638, 395 N.E.2d 133 (1979) (vendors actively concealed damage caused by basement flooding and roof leakage); Sigsworth v. Gernon, 465 So. 2d 705 (La. 1985) (concealment of cracks in foundation slab beneath carpet); Groening v. Opsata, 323 Mich. 73, 34 N.W.2d 560 (1948) (misrepresentation of stability of bluff overlooking lake); Davidson v. Rogers, 431 So. 2d 483 (Miss. 1983) (vendor fraudulently concealed foundation defect); Hauck v. Samus, 212 Neb. 25, 321 N.W.2d 68 (1982) (vendors failed to disclose foundation defect of which they knew or should have been aware); Smith v. Bifano, 330 S.W.2d 473 (Tex. Civ. App. 1959) (misrepresentation that foundation had been constructed so as to compensate for underlying soft fill).

183. *See, e.g.*, Quashnock v. Frost, 299 Pa. Super. 9, 17-19, 445 A.2d 121, 125 (1982) ("The modern view . . . holds that where there is a serious and dangerous latent defect known to exist by the seller, then he must disclose such defect to the unknowing buyer or suffer liability for his failure to do so."); Thacker v. Tyree, 297 S.E.2d 885, 888 (W. Va. 1982) ("Where a vendor is aware of defects or conditions which substantially affect the value or habitability of the property and the existence of which are unknown to the purchaser and would not be disclosed by a reasonably diligent inspection, then the vendor has a duty to disclose the same to the purchaser.").

184. A Texas court announced: "where there is a duty to speak, silence may be as mis-

actively concealing poor drainage or foundation settlement, and in many states, this duty extends to affirmative disclosure of hidden defects such as poor fill or slope instability.[185]

The evolution of the law away from caveat emptor in used-home sales has increased the duty of sellers either to repair defects or to incorporate defects into the selling price. As a result of the increased duty of sellers, unstable homesites are less likely to enter the real estate market.

b. Liability of Realtors

In recent years, many courts have held real estate agents and brokers liable in tort for affirmative misrepresentations and nondisclosure of physical defects in property they sell.[186] A few courts have gone further by requiring realtors to reveal facts that they should know are beyond the knowledge of the average buyer.[187]

In a particularly significant 1984 decision, *Easton v. Strassburger,*[188] a California court of appeal upheld a judgment finding real estate brokers liable for failure to investigate and disclose a possible landslide hazard. The sellers failed to inform the buyers or the realtors of two previous landslides and, under comparative negligence, were found sixty-five percent liable for damage to the house and adjacent portions of the property.[189] The court upheld an allocation of five percent of the negligence

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leading as a positive misrepresentation of existing facts." Smith v. National Resort Communities, Inc., 585 S.W.2d 655, 658 (Tex. 1979) (nondisclosure that property was subject to lake inundation easement); *see, e.g.,* Grant v. Wrona, 662 S.W.2d 227 (Ky. Ct. App. 1983) (silence regarding defective floor joists).

185. *See, e.g.,* Buist v. C. Dudley DeVelbiss Corp., 182 Cal. App. 2d 325, 6 Cal. Rptr. 259 (1960) (concealment of fill, ancient landslide, and subsurface water); Cohen v. Vivian, 141 Colo. 443, 349 P.2d 366 (1960) (concealment of filled soil).

186. *See, e.g.,* Lingsch v. Savage, 213 Cal. App. 2d 729, 29 Cal. Rptr. 201 (1963); Chapman v. Hosek, 131 Ill. App. 3d 180, 475 N.E.2d 593 (1985); Josephs v. Austin, 420 So. 2d 1181 (La. Ct. App. 1982); Maples v. Charles Burt Realtor, Inc., 690 S.W.2d 202 (Mo. Ct. App. 1985); Miles v. McSwegin, 58 Ohio St. 2d 97, 388 N.E.2d 1367 (1979). Even if the broker is not sure of the truth or falsity of his assertions, he may be guilty of fraudulent misrepresentation if his statements imply knowledge. *See, e.g.,* Pumphrey v. Quillen, 165 Ohio St. 343, 135 N.E.2d 328 (1956). Even innocent misrepresentations may be adjudged negligent because vendors and realtors are presumed to accurately know the facts about a property. *See* Bevins v. Ballard, 655 P.2d 757 (Alaska 1982); Dugan v. Jones, 615 P.2d 1239 (Utah 1980). *But see* Harrell v. Dodson, 398 So. 2d 272 (Ala. 1981) (agent's misstatement about structural condition was only an innocent statement of opinion in form of sales "puff").

187. *See* Easton v. Strassburger, 152 Cal. App. 3d 90, 199 Cal. Rptr. 383 (1984) (realtor has affirmative duty to conduct an inspection of the property and disclose all facts affecting its value); *Chapman,* 131 Ill. App. 3d 180, 475 N.E.2d 593 (public access to flood maps does not constitute disclosure because such information is not the type the average prospective buyer would research); Gauerke v. Rozga, 112 Wis. 2d 271, 332 N.W.2d 804 (1983) (brokers are liable for misrepresenting facts they normally could be expected to know). *But see* Ozuna v. Delaney Realty, Inc., 600 S.W.2d 780 (Tex. 1980) (flood hazard not a fact that brokers should have known).

188. 152 Cal. App. 3d 90, 199 Cal. Rptr. 383 (1984).

189. *Id.* at 96, 199 Cal. Rptr. at 386.

to the realtors because the realtors had seen "red flags"[190] indicating erosion or settlement problems and, as professionals with "superior knowledge, skills, and experience,"[191] they should have been alert to the signs of soil problems and should have requested a soil investigation.

Because of the recency of *Easton,* the full effect of the decision on real estate practice and decisions of other state courts is unclear.[192] California realtors were concerned by the result in *Easton*[193] because they were uncertain as to how to meet their "affirmative duty to conduct a reasonably competent and diligent investigation."[194] The realtors' concern resulted in the passage of legislation that specifies the standard of care brokers should use in their inspections and disclosures.[195] This concern has also resulted in a disclosure checklist to ensure that sellers disclose all known defects.[196]

In sum, increasing the liability of realtors and sellers of used homes encourages a more thorough disclosure of defects. To sell a home on an unstable hillside, an owner must either stabilize the hillside or reduce the sale price to reflect the hazardous condition. Increased liability of realtors and sellers also helps internalize the costs of slope repair and ensure that unwary buyers do not become burdened with defective or unsafe properties.

3. *Liability of Adjoining Property Owners—Promotes the Reduction of Hazards from Neighboring Lands*

There are three principal causes of action against owners of adjacent property in landslide cases: strict liability, negligence, and nuisance. The physical causes that motivate lawsuits most commonly include removal

190. The realtors saw uneven floors in a guest house on the property and netting placed on a rear slope, and they probably knew that the residence was on fill. *Id.* at 104, 199 Cal. Rptr. at 391.

191. *Id.*

192. *See* Comment, *Expansion of a Real Estate Broker's Duties: Is* Easton v. Strassburger *in Illinois' Future?,* 5 N. ILL. U.L. REV. 97 (1984).

193. *See Seller Beware,* San Francisco Examiner, Aug. 26, 1984, at 1 (Homes section), col. 1; *see also* Hicks, Easton v. Strassburger: *Judicial Imposition of a Duty to Inspect on California Real Estate Brokers,* 18 LOY. L.A.L. REV. 809 (1985); Comment, *Real Estate Brokers Liability for Failure to Disclose: A New Duty to Investigate,* 17 PAC. L.J. 327 (1985). One problem for realtors is that under the California joint-and-several-liability law, realtors, even if only five percent negligent, may incur a larger share of liability if other defendants are judgment proof. *See* American Motorcycle Ass'n v. Superior Court, 20 Cal. 3d 578, 578 P.2d 899, 146 Cal. Rptr. 182 (1978).

194. 152 Cal. App. 3d at 102, 199 Cal. Rptr. at 390.

195. CAL. CIV. CODE § 2079 (West Supp. 1986).

196. A checklist was initially proposed by the California Association of Realtors. Telephone interview with Jack Shelby, Lobbyist for Cal. Ass'n of Realtors (Aug. 23, 1984). A disclosure has since been legislatively mandated. CAL. CIV. CODE § 1102.6 (West Supp. 1986). In addition to disclosure of structural conditions and improvements, the form specifically requires, among other things, disclosure of landfill on the property and problems with settling, slippage, and sliding. *Id.*

of lateral support, diversion of surface waters, and inadequate maintenance of unstable land.

a. Liability for Removal of Lateral Support

Most courts support the common-law absolute right to lateral support of one's land in its natural state.[197] Excavating landowners are absolutely liable to their neighbors for any loss of lateral soil support.[198] There is no absolute right, however, to support for the added weight of structures; building damage due to adjoining excavation is actionable only under the rules of negligence.[199] Many courts have further held that the duty to maintain lateral support runs with the land; consequently, subsequent owners of excavated lands are liable if they fail to continue maintaining slopes and retaining walls.[200]

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197. *See, e.g.,* Blake Constr. Co. v. United States, 585 F.2d 998 (Ct. Cl. 1978) (excavation adjacent to existing building); Gladin v. Von Engeln, 195 Colo. 88, 575 P.2d 418 (1978) (loss of lateral support due to relocation of creek channel); Levi v. Schwartz, 201 Md. 575, 95 A.2d 322 (1953) (roadway excavation adjacent to lot); Gorton v. Schofield, 311 Mass. 352, 41 N.E.2d 12 (1942) (deterioration of retaining wall); Braun v. Hamack, 206 Minn. 572, 289 N.W. 553 (1940) (excavation caused collapse of adjacent lot); Riley v. Continuous Rail Joint Co. of Am., 110 A.D. 787, 97 N.Y.S. 283 (1906) (landslide caused by railroad cut); Hermanson v. Morrell, 252 N.W.2d 884 (N.D. 1977) (excavation along property line in order to enlarge driveway); Williams v. Southern Ry. Co., 55 Tenn. App. 81, 396 S.W.2d 98 (1965) (subsidence of land into 58-year-old railroad cut); Knapp v. Siegley, 120 Wash. 478, 208 P. 13 (1922) (negligent excavation damaged adjacent land); Noone v. Price, 298 S.E.2d 218 (W. Va. 1982) (deterioration of retaining wall caused hill to subside); Schmidt v. Chapman, 26 Wis. 2d 11, 131 N.W.2d 689 (1964) (excavation adjacent to existing building).

198. *See* cases cited *supra* note 197. Liability can extend to excavations on nonadjacent lands as well. Puckett v. Sullivan, 190 Cal. App. 2d 489, 12 Cal. Rptr. 55 (1961) (liability for landslides caused by excavation of nonadjacent property, but liability rested on negligence).

199. *See, e.g., Blake Constr. Co.,* 585 F.2d at 1006; *Braun,* 206 Minn. at 573, 289 N.W. at 554; Sanders v. Schiffer, 46 A.D.2d 536, 537, 363 N.Y.S.2d 676, 678 (N.Y. App. Div. 1975); Schmidt v. Chapman, 26 Wis. 2d 11, 19-20, 131 N.W.2d 689, 695 (1964).

In recent years, several courts have expanded absolute liability for loss of support to natural lands; these courts have held that absolute liability for loss of support covers building damages so long as the soil failed of its own weight and the added weight of the buildings did not contribute to the failure. *See* Gladin v. Von Engeln, 195 Colo. 88, 92, 575 P.2d 418, 421 (1978); Williams v. Southern Ry. Co., 55 Tenn. App. 81, 85, 396 S.W.2d 98, 100 (1965); Simons v. Tri-State Constr. Co., 33 Wash. App. 315, 319, 655 P.2d 703, 706 (1982); Bay v. Hein, 9 Wash. App. 774, 779, 515 P.2d 536, 539 (1973); Noone v. Price, 298 S.E.2d 218, 222 (W. Va. 1982).

200. *See* Urosevic v. Hayes, 590 S.W.2d 77 (Ark. Ct. App. 1979) (absolute duty to support adjacent land included duty to restore retaining wall damaged by lightning); Sager v. O'Connell, 67 Cal. App. 2d 27, 153 P.2d 569 (1944) (negligence of prior owner does not absolve current owner of duty to maintain retaining wall); *Gladin,* 195 Colo. at 88, 575 P.2d at 418 (duty to refurnish lateral support that was removed by previous owner); *Gorton,* 311 Mass. at 358, 41 N.E.2d at 15 ("the burden of providing lateral support to the plaintiff's land in its natural condition is one of continued support running against the servient land"); Salmon v. Peterson, 311 N.W.2d 205 (S.D. 1981) (purchaser of lot with retaining wall had continuing duty to maintain wall); *Noone,* 298 S.E.2d at 218 (owner of 60-year-old retaining wall had duty to ensure continued support of adjacent land in its natural condition). *But see* First Nat'l Bank & Trust Co. v. Universal Mortgage & Realty Trust, 38 Ill. App. 3d 345, 347 N.E.2d 198 (1976) (owner has no duty to restore lateral support that was removed by predecessor in title).

b. *Liability for Unreasonable Diversion of Surface Waters*

Liability for landslide damage may also be imposed under the law of surface waters. Diverted surface waters can cause severe erosion and landslides.[201] In some cases, distinguishing between a sediment-laden surface-water flow and a landslide-triggered mudflow is difficult.[202] If a mudflow is initiated by surface water saturating badly placed fill, injured property owners may have recourse under negligence[203] or nuisance.[204] The law of surface waters regarding the liability of adjoining landowners has evolved over the years.[205] Many jurisdictions have replaced the "common enemy doctrine"[206] and "civil law rule"[207] with the "rule of reasonable use."[208] The rule of reasonable use states that each landowner is entitled to make reasonable use of his land and may alter the

201. *See, e.g.,* Wells v. State Highway Comm'n, 503 S.W.2d 689 (Mo. 1973). This case was decided primarily on the basis of surface-water law, but the court also considered the large amount of sediment deposited by the water flow.

202. *See id.* at 692-93; *see also* Beck v. Director, Fed. Emergency Management Agency, 534 F. Supp. 516 (N.D. Ohio 1982) (slope slippage was a landslide rather than a mudslide or mudflow as defined in flood insurance policy). For a description of FEMA's difficulty in distinguishing "mudslides" from other types of landslides, see generally *infra* notes 271-73 and accompanying text.

203. *See, e.g.,* Sturges v. Charles L. Harney, Inc., 165 Cal. App. 2d 306, 331 P.2d 1072 (1958) (negligence for ignoring grading code in placement of fill and diversion of surface water); Van Dusen v. Dobson, 457 So. 2d 1062 (Fla. Dist. Ct. App. 1984) (liability for placement of fill that raised neighbors' groundwater pressure and damaged pool).

204. *See, e.g.,* Spaulding v. Cameron, 38 Cal. 2d 265, 266, 239 P.2d 625, 627 (1952) (fill that constituted a threat of repeated mud inundations was a nuisance); Sturges v. Charles L. Harney, Inc., 165 Cal. App. 2d 306, 317, 331 P.2d 1072, 1078 (1958) (badly placed fill may be a nuisance).

205. *See generally* Kinyon & McClure, *Interferences with Surface Waters,* 24 MINN. L. REV. 891 (1940) (outlining the development of competing theories governing interferences with surface water flows and arguing for the use of tort concepts rather than the less flexible property concepts that predominate in this area of the law). This article's arguments were succinctly summarized and updated by the California Supreme Court in Keys v. Romley, 64 Cal. 2d 396, 407-08, 412 P.2d 529, 536, 50 Cal. Rptr. 273, 280 (1966). *See also* Butler v. Bruno, 115 R.I. 264, 341 A.2d 735 (1975) (summarizing the competing doctrines relating to surface-water flows).

206. The common enemy doctrine holds that each landowner has an unqualified right to divert surface waters without taking into account the consequences to other landowners. *See* Kinyon & McClure, *supra* note 205, at 898.

207. The "civil law rule" recognizes a servitude of natural drainage: The lower owner must accept drainage onto his land, and the upper owner has no right to alter drainage so as to increase the downstream burden. "[T]he civil law rule . . . is that a person who interferes with the *natural* flow of surface waters so as to cause an invasion of another's interests in the use and enjoyment of his land is subject to liability to the other." *Id.* at 893 (emphasis in original).

208. "A few jurisdictions, finding it undesirable to apply either the civil law or common enemy doctrines in their rigid or extreme forms, have evolved a rule of *reasonable use* which attempts to determine the rights of the parties with respect to the disposition of surface waters by an assessment of all the relevant factors." *Keys,* 64 Cal. 2d at 403, 412 P.2d at 533, 50 Cal. Rptr. at 277 (emphasis in original).

Adopting the rule of reasonable use, the New Jersey Supreme Court stated: "[E]ach possessor is legally privileged to make a reasonable use of his land, even though the flow of surface waters is altered thereby and causes some harm to others, but incurs liability when his harmful

flow of surface water so long as the action is not unreasonable.[209] The rule is flexible: It requires consideration of the unique physical facts of each case. In states adopting the rule, property owners may be liable under theories of nuisance or negligence for landslides caused by unreasonable diversions of surface waters onto neighboring properties.

c. *Liability for Failure to Maintain Unstable Land*

In 1981, the California Supreme Court rendered a decision, *Sprecher v. Adamson Cos.*,[210] substantially increasing the duty of a landowner to neighboring landowners. The court discarded the common-law rule that a landowner has no duty to remedy a natural condition of the land.[211] The plaintiff's residence rested on the lower part of a landslide emanating from an undeveloped 90-acre parcel owned by the defendant. Neither the defendant nor the plaintiff disputed that they knew of the landslide. The plaintiff alleged that the recent movement resulted from defendant's failure to correct the unstable condition. The trial court granted defendant's motion for summary judgment, based on the common-law principle that there is no duty to remedy a natural condition to prevent harm to adjacent properties. The California Supreme Court reversed, concluding that "the distinction between artificial and natural conditions should be rejected."[212] The supreme court remanded the case to the trial court for trial according to the ordinary principles of negligence.[213] The decision, applying a test of reasonableness to owners of natural land, is the landslide law analogy to the surface-water law "rule of reasonable use."

The *Sprecher* decision has been strongly criticized;[214] in fact, no

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interference with the flow of surface waters is unreasonable." Armstrong v. Francis Corp., 20 N.J. 320, 327, 120 A.2d 4, 8 (1956).

The "reasonable use" rule is more flexible but less predictable than the other two doctrines. At least 12 states have adopted this rule. R. TANK, LEGAL ASPECTS OF GEOLOGY 199 (1983). Furthermore, as one court noted:

> [T]oday as we enter the last quarter of the 20th century, no jurisdiction follows the strict requirements of either the common-enemy or the civil-law rule. With the numerous judicial exceptions and modifications that have been appended through the years to the two original concepts, we fail to see how the modern versions of either afford more predictability than the rule of reasonable use.

Butler v. Bruno, 115 R.I. 264, 274, 341 A.2d 735, 741 (1975).

209. *See* cases cited *supra* note 208.

210. 30 Cal. 3d 358, 636 P.2d 1121, 178 Cal. Rptr. 783 (1981).

211. *Id. See generally* Noel, *Nuisances from Land in Its Natural Condition,* 56 HARV. L. REV. 772 (1943).

212. 30 Cal. 3d at 371, 636 P.2d at 1127, 178 Cal. Rptr. at 790.

213. The case was never brought to a second trial because the parties settled for approximately $10,000. Telephone interview with Gary Elster, Attorney for Sprecher (July 19, 1984); Telephone interview with Douglas Beck, Attorney for Adamson Cos. (July 30, 1984).

214. *See generally* Bentley, *Torts—Liability Without Fault—The Beginning of the End of Immunity from Landowner's Liability for Natural Conditions on His Land,* 5 WHITTIER L. REV. 105 (1983); Burcham, Sprecher v. Adamson Companies: *Nonfeasance Immunity Slides by the California Supreme Court,* 16 LOY. L.A.L. REV. 625 (1983); Slosson, Sprecher v. Adamson Companies: *A Critique of the Supreme Court Decision,* 6 REAL PROP. L. REP. 117

other state high courts have yet accepted its holding.[215] Criticisms of the decision center on its imperfect analogy of landslides to decaying trees[216] and the lack of guidance given as to the scope of a landowner's duty.[217] Another problem is that the court selected a poor factual situation to announce this rule, and this has further confused attempts to determine

(1983). *But see* Benham, *Tort Liability: California Abolishes the Landowner's Immunity for Harm Outside the Premises Caused by Natural Conditions,* 1983 S. ILL. U. LAW. J. 247. This paper strongly supports the theory behind the *Sprecher* decision, but does not address the facts of the case.

215. Admittedly, there have been no substantially similar cases in other states. Telephone interview with Richard Norton, Attorney Specializing in Landslides (Aug. 24, 1984); Telephone interview with Michael Richman, Attorney Specializing in Landslides (Sept. 6, 1984). Nor have there been subsequent cases in California that amplify or clarify the *Sprecher* decision. Telephone interview with Richard Norton, *supra*; Telephone interview with Arnold Graham, Los Angeles County Counsel's Office (Aug. 16, 1984).

216. The court's decision rested heavily upon the similarity of cases of decaying or rotting trees at property boundaries. *See Sprecher,* 30 Cal. 3d at 364-65, 636 P.2d at 1124, 178 Cal. Rptr. at 786. The court noted that these cases show "a general trend toward rejecting the common law distinction between natural and artificial conditions." *Id.* at 364, 636 P.2d at 1124, 178 Cal. Rptr. at 786. In many states, despite a general common-law immunity for natural conditions, managers of land have a duty of reasonable care with regard to rotting trees posing hazards to persons adjacent to the property.

The court in *Sprecher,* asserting that landslides are just a variation of the tree exception to immunity, ignored the pronounced differences between the two physical processes—unlike landslides, trees are visible and have definable boundaries. Before the court's balancing test can be used, the landowner must be able to recognize the hazard. Laypeople can recognize decaying trees and cut them down, but experts in geology and engineering are needed to recognize and assess landslides. This difference in identifying tree and landslide hazards is the flaw in the court's argument, and in ignoring this crucial difference, the court failed to provide the additional guidance needed to apply the decaying-tree reasoning to landslide cases. *See* Burcham, *supra* note 214, at 638-39; Slosson, *supra* note 214, at 118. Both Burcham and Slossan criticize the court for failing to see that potential landslides require sophisticated scientific evaluation, whereas decaying trees can be recognized by laypeople.

217. Interview with Judge Coleman Fannin, Contra Costa County Superior Court Judge, in Contra Costa County, California (Dec. 6, 1985). Given the imprecise science of geology and the unpredictable behavior of nonhomogeneous, natural hillslopes, the scope of a landowner's duty is unclear. Also unclear is how aggressively a property owner must investigate a large, superficially stable tract of land and when a "reasonable man" is expected to recognize that there is a need for further investigation.

The duty to inspect undeveloped property holdings is additionally left unguided. Whether there is an affirmative duty to inspect properties acquired by mail and, if there is such a duty, how much of the responsibility for inspecting the properties should be borne by government agencies, are also questions central to the landslide issue, though they are irrelevant to cases of decaying trees. These questions and their implications are insightfully and thoroughly discussed in Slosson, *supra* note 214.

Landslide attorney Richard Norton has suggested some other points of confusion. For example, when a landslide crosses property boundaries, whose responsibility is it? The critical part of most slides is near the bottom, where lack of support can trigger movement. In such a case, whether the uphill owner can rightly be termed responsible is unclear. In addition, what if the landslide is caused by a combination of downhill instability and surface runoff from the uphill owner's property? Finally, will a decision be based primarily on who has the ability to pay for the damage? There is also a temporal aspect to landslides: Because natural landslides often take months or years to evolve, which owner is liable if the property changes hands? Telephone interview with Richard Norton, Landslide Attorney (Sept. 28, 1984).

the precise scope of a landowner's duty.[218] Finally, the *Sprecher* decision troubles public landowners in California[219] because it makes park districts hesitant to accept donations of hillside land[220] and creates uncertainty among public land managers about how to allocate their money for land acquisition and potential litigation costs.[221]

Whether or not other states choose to follow *Sprecher*, the general trend has been for courts to attach greater liability to adjacent landowners for slope-instability problems caused by lack of care in excavations and alterations of surface drainage. In theory, increased liability should encourage more responsible practices among hillside landowners and reduce artificially caused landslides.

4. *Potential Liability of Public Entities—Helps Ensure that Public Actions Do Not Increase Landslide Hazards*

Under certain circumstances, governmental entities may be found liable for actions that cause landslide damage. The common-law doc-

218. From the facts of this case, it is clear that, on balance, the defendant behaved reasonably; in fact, the parties subsequently settled the case before the second trial for a relatively small sum. *See supra* note 213. Nevertheless, a major result of *Sprecher* is that it has brought another player—the owner of adjacent undeveloped land—into the courtroom, and therefore it has increased the costs of legal actions. Interview with Judge Fannin, *supra* note 217; Interview with Don Black, Counsel for East Bay Regional Park District, in Oakland, California (Aug. 3, 1984).

219. For example, the East Bay Regional Park District consists of a number of hilly parks specifically designed to be natural islands within the heavily urbanized California counties of Alameda and Contra Costa. If one were trying to design this park system to maximize public exposure to landslide liability, it would probably look much like the present design.

The California Supreme Court decision in Milligan v. City of Laguna Beach, 34 Cal. 3d 829, 670 P.2d 1121, 196 Cal. Rptr. 38 (1983), when coupled with the *Sprecher* decision, creates a significant duty for public landowners to reduce potential natural landslide hazards that could injure nonusers on adjacent land. Potential liability, however, diminished significantly after the passage of A.B. 3114 in 1984. Act of Sept. 12, 1984, ch. 1071, 1984 Cal. Adv. Legis. Serv. 321 (West) (codified at CAL. GOV'T CODE § 831.25 (West Supp. 1986)). This Act reduces the standard of care for public land managers from the "know or should know" of *Sprecher* to one of "actual notice" of probable damage from land failure. The Act provides that public entities or employees are not liable for off-property damage and injury caused by a land failure of unimproved public property unless (1) the plaintiff suffered substantial physical injury or (2) the public entity or employee "had actual notice of probable damage that is likely to occur" and failed to warn. CAL. GOV'T CODE § 831.25(A), (D) (West Supp. 1986).

220. Interview with Don Black, *supra* note 218. Ironically, the slope instability that makes the land undevelopable is generally the reason for donating such land. In fact, the classic land-use-planning recommendation is to acquire landslide prone and other hazardous lands for open space and recreational purposes. *See, e.g.*, D. ERLEY & W. KOCKELMAN, *supra* note 84, at 24. As an example of this, the slide-prone property of the defendant in the *Sprecher* case was subsequently sold to the state for parkland. Telephone interview with Douglas Beck, *supra* note 213.

221. The decision places park managers in the uncomfortable position of having to balance the public welfare benefits of park acquisition against the highly uncertain public risks and mitigation costs of natural landslides. Interview with Don Black, *supra* note 218. Also, the public land manager's duty to investigate is not adequately guided by the *Sprecher* decision. *See supra* note 217.

trine of sovereign immunity, which protected the government from suit without its consent, has been partly abolished in most states.[222] Generally, governments and their officials are immune from tort liability for discretionary acts involving policy- or planning-level decisions, but they are potentially liable for ministerial or operational acts, which involve defined, mandatory tasks in carrying out policies.[223]

Courts defer greatly to land use planning and permit determinations when deciding whether governmental action is immune.[224] In addition, local governments are generally immune from tort claims resulting from inadequate building or grading inspections.[225] Planning and zoning deci-

222. In 1985, South Carolina abolished its doctrine of state sovereign immunity, noting that 36 other states had also abolished the doctrine in whole or in part. *See* Andrews *ex rel.* McCall v. Batson, 285 S.C. 243, 245, 329 S.E.2d 741, 742 (1985). The *McCall* decision gives a concise historical background of the doctrine, as does the Wisconsin court in Holytz v. City of Milwaukee, 17 Wis. 2d 26, 115 N.W.2d 618 (1962). *See also* Muskopf v. Corning Hosp. Dist., 55 Cal. 2d 211, 359 P.2d 457, 11 Cal. Rptr. 89 (1961), *modified,* 57 Cal. 2d 488, 370 P.2d 325, 20 Cal. Rptr. 621 (1962); Hargrove v. Town of Cocoa Beach, 96 So. 2d 130 (Fla. 1957); Jackson v. City of Kansas City, 235 Kan. 278, 680 P.2d 877 (1984); Pittman v. City of Taylor, 398 Mich. 41, 247 N.W.2d 512 (1976); Pruett v. City of Rosedale, 421 So. 2d 1046 (Miss. 1982). *But see* Duhart v. State, 610 S.W.2d 740 (Tex. 1980) (reaffirms governmental immunity).

223. The United States Supreme Court recognized broad discretionary immunity for governmental functions in Dalehite v. United States, 346 U.S. 15 (1953), and narrowed this immunity in later cases, *e.g.,* Harlow v. Fitzgerald, 457 U.S. 800 (1982). Most states have retained some form of immunity for discretionary governmental actions, but they have repeatedly struggled with the definitions of "discretionary" versus "ministerial" acts. *See, e.g.,* Johnson v. State, 69 Cal. 2d 782, 447 P.2d 352, 73 Cal. Rptr. 240 (1968) (narrow definition of discretionary acts); Rodrigues v. State, 52 Hawaii 156, 472 P.2d 509 (1970) (maintenance of drainage culverts is operational; thus, government is liable for resultant flooding); Ross v. Consumers Power Co., 420 Mich. 567, 363 N.W.2d 641 (1984) (broadens definition of "governmental function," for which there is immunity); Cairl v. State, 323 N.W.2d 20 (Minn. 1982) (discusses discretionary immunity); Kanagawa v. State, 685 S.W.2d 831 (Mo. 1985) (discusses factors to be weighed in distinguishing discretionary from ministerial acts); Burke v. Deiner, 97 N.J. 465, 479 A.2d 393 (1984) (qualified immunity of public officials); Schenkolewski v. Cleveland Metroparks System, 67 Ohio St. 2d 31, 426 N.E.2d 784 (1981) (board of commissioners not immune for exercise of proprietary function when they behave more as a private business than as a government); Chambers-Castanes v. King County, 100 Wash. 2d 275, 669 P.2d 451 (1983) (reaffirms state's narrow definition of discretionary processes).

224. These two tasks are considered high-level policy decisions by most courts in granting discretionary immunity to government. *See supra* note 223.

225. Courts also defer to government decisions regarding law enforcement or building inspections. The usual justification for deferring to the latter is that cities cannot inspect every building; consequently, if liable, cities could be exposed to a flood of lawsuits. *See, e.g.,* Nunn v. State, 35 Cal. 3d 616, 677 P.2d 846, 200 Cal. Rptr. 440 (1984) (delay in promulgating regulations is discretionary and not subject to judicial review); Trianon Park Condominium v. City of Hialeah, 468 So. 2d 912, 919 (Fla. 1985) ("How a governmental entity, through its officials and employees, exercises its discretionary power to enforce compliance with the laws duly enacted by a governmental body is a matter of governance, for which there never has been a common law duty of care"); Siple v. City of Topeka, 235 Kan. 167, 679 P.2d 190 (1984) (neither the city nor its employees are liable for inadequate or negligent inspection); Grogan v. Commonwealth, 577 S.W.2d 4 (Ky.), *cert. denied,* 444 U.S. 835 (1979) (city cannot be held liable for omitting inspection conduct that could have protected life and property). *But see* Morris v. Marin County, 18 Cal. 3d 901, 559 P.2d 606, 136 Cal. Rptr. 251 (1977) (immunity for nonenforcement only applies to discretionary decisions; there is no immunity for failure to

sions are generally not actionable under inverse condemnation,[226] yet under certain circumstances, governments have been found liable for increases in stormwater runoff or slope instabilities resulting from land use planning and permitting decisions.[227] Flood or landslide damages caused by defects in the design or operation of public facilities are more often actionable under inverse condemnation[228] or nuisance.[229]

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perform mandatory duties); Stewart v. Schmieder, 386 So. 2d 1351 (La. 1980) (code requiring architect to certify plans does not relieve city-parish of its duty to examine plans); Hawes v. Germantown Mut. Ins. Co., 103 Wis. 2d 524, 309 N.W.2d 356 (1981) (city and its inspector can be held liable for improper application of building code concerning specific code violations that are easily discoverable).

226. *See, e.g.,* Agins v. City of Tiburon, 447 U.S. 255, 263 (1980).

227. *See, e.g.,* Blau v. City of Los Angeles, 32 Cal. App. 3d 77, 107 Cal. Rptr. 727 (1973) (city could be held liable under inverse condemnation for approving and accepting subdivision improvements that caused landslide); Sheffet v. County of Los Angeles, 3 Cal. App. 3d 720, 84 Cal. Rptr. 11 (1970) (county was liable under inverse condemnation for flood damage resulting from county-approved subdivision); County of Clark v. Powers, 96 Nev. 497, 505, 611 P.2d 1072, 1077 (1980) ("a governmental entity's substantial involvement in the development of private lands which unreasonably injures the property of others is actionable"); Myotte v. Village of Mayfield, 54 Ohio App. 2d 97, 375 N.E.2d 816 (1977) (village liable for flood damage caused by its issuance of building permits). *But see* Ellison v. City of San Buenaventura, 60 Cal. App. 3d 453, 131 Cal. Rptr. 433 (1976) (claim against city for flood damages resulting from approval of plans and issuance of permits is not actionable); Wilson v. Ramacher, 352 N.W.2d 389 (Minn. 1984) (city was immune for planning and permitting, but was potentially liable for flood damage under inverse condemnation); Masley v. City of Lorain, 48 Ohio St. 2d 334, 358 N.E.2d 596 (1976) (city was not liable for increased flow caused by lots and streets, but was liable under inverse condemnation).

228. *See, e.g.,* Holtz v. Superior Court, 3 Cal. 3d 296, 475 P.2d 441, 90 Cal. Rptr. 345 (1970) (even without a showing of negligence, city may be liable under inverse condemnation for damage caused by deliberately planned excavation); Albers v. County of Los Angeles, 62 Cal. 2d 250, 398 P.2d 129, 42 Cal. Rptr. 89 (1965) (county is liable under inverse condemnation for large landslide initiated by county's deliberate placing of fill for public purpose); Souza v. Silver Dev. Co., 164 Cal. App. 3d 165, 210 Cal. Rptr. 146 (1985) (city was potentially liable under inverse condemnation for creek-bank erosion); Marin v. City of San Rafael, 111 Cal. App. 3d 591, 168 Cal. Rptr. 750 (1980) (inverse condemnation action for physical flood damage resulting from deliberate public improvement); Ingram v. City of Redondo Beach, 45 Cal. App. 3d 628, 119 Cal. Rptr. 688 (1975) (negligence of city is irrelevant in inverse condemnation action for flood damages); Pleasant View Util. Dist. v. Vradenburg, 545 S.W.2d 733 (Tenn. 1977) (inverse condemnation was the appropriate cause of action for damages from discharge of wastewater).

229. In general, many states recognize a nuisance exception to governmental immunity. *See, e.g.,* Nestle v. City of Santa Monica, 6 Cal. 3d 920, 496 P.2d 480, 101 Cal. Rptr. 568 (1972); Duffield v. DeKalb County, 242 Ga. 454, 249 S.E.2d 235 (1978); Tadjer v. Montgomery County, 300 Md. 539, 479 A.2d 1321 (1984); Rosario v. City of Lansing, 403 Mich. 124, 268 N.W.2d 230 (1978). *But see* City of Houston v. George, 479 S.W.2d 257 (Tex. 1972) (narrow interpretation of nuisance exception).

Nuisance is specifically a cause of action for flood or landslide damages. *See, e.g.,* Pfleger v. Superior Court, 172 Cal. App. 3d 421, 218 Cal. Rptr. 371 (1985) (inadequate drainage system causing landslide); Barnhouse v. City of Pinole, 133 Cal. App. 3d 171, 183 Cal. Rptr. 881 (1982) (nuisance for inadequate drainage system causing landslide); Reid v. Gwinnett County, 242 Ga. 88, 249 S.E.2d 559 (1978) (nuisance for diverting surface water onto private property); Highview North Apts. v. County of Ramsey, 323 N.W.2d 65 (Minn. 1982) (nuisance for inadequate surface drainage); Sanford v. University of Utah, 26 Utah 2d 285, 488 P.2d 741 (1971) (nuisance for diversion of surface water onto private property).

Thus, courts are unlikely to find cities and counties liable for landslide damages resulting from planning decisions as long as those decisions are well-reasoned, policy-level decisions that consider all of the available information. Liability for inadequate grading or foundation inspections may only be found if there is a breach of mandatory duty.

5. *Tort Liability—Not a Satisfactory Basis for Policy*

Commentators debate whether the tort system effectively deters torts and compensates victims. Although empirical research is sparse, there is a large body of theoretical literature on the function of tort law in modern society. The "law and economics" school generally supports the tort system,[230] hypothesizing that private actions and judicial decisions are based on an implied model of economic efficiency.[231] Deterrence, under the tort theory, assumes that actors will internalize injury costs and that rational, informed actors will seek to prevent accidents to minimize costs.[232] The theory posits that the goal of the tort system is to attain a level of socially "optimal deterrence."[233] Even proponents of this theory, however, admit that in actuality the deterrent effect of tort liability works unevenly.[234]

Many critics of the tort system believe that it never has and never will achieve the stated goals of its proponents.[235] Professor Stephen Sugarman, in a comprehensive review of the many failures of the common-law tort system, asserts that tort law is "failing to promote better conduct, failing to compensate sensibly at acceptable costs, and failing to do meaningful justice to either plaintiffs or defendants."[236] He argues that the goals of compensation and deterrence would be better achieved if the two were uncoupled and treated by separate legal and administrative mechanisms.[237] Sugarman's arguments, based on injury accidents, apply

230. *See generally* Landes & Posner, *The Positive Economic Theory of Tort Law,* 15 GA. L. REV. 851, 851-64 (1981). Major early works that influenced this school include G. CALABRESI, THE COSTS OF ACCIDENTS: A LEGAL AND ECONOMIC ANALYSIS (1970), and Posner, *A Theory of Negligence,* 1 J. LEGAL STUD. 29 (1972).

231. *See* Landes & Posner, *supra* note 230, at 851.

232. *See, e.g.,* Calabresi, *Optimal Deterrence and Accidents,* 84 YALE L.J. 656 (1975).

233. *Id.*

234. *See* G. CALABRESI, *supra* note 230, at 135-97.

235. *See, e.g.,* Sugarman, *Doing Away with Tort Law,* 73 CALIF. L. REV. 558 (1985); Owen, *Deterrence and Desert in Tort: A Comment,* 73 CALIF. L. REV. 665 (1985).

236. Sugarman, *supra* note 235, at 664.

237. Professor Sugarman asserts that comprehensive compensation programs could more effectively deliver benefits to victims, *see id.* at 642-51, and administrative regulatory strategies could more directly reduce undesirable activities, *see id.* at 651-59. "For example, society might try trading five lawyers for a highway engineer and a dangerous-product public information officer. We would not only save money, but we might get better accident prevention to boot." *Id.* at 590-91.

equally well to landslides.[238]

Empirical studies, though few, seem to support criticisms that the tort system inadequately deters unsafe action and insufficiently compensates victims. Studies of automobile accidents,[239] illness and injury[240] have indicated that the tort system is slow, biased, and ineffective in compensating victims. In the case of automobile accidents, Professors Keeton and O'Connell found that the process of determining fault consumed time and money to the detriment of the immediate needs of the victim.[241] As to the deterrent effect of the automobile-accident liability system, a significant recent study[242] of New Zealand's no-fault automobile-insurance system showed that the removal in 1974 of tort liability for personal injury has had no measurable adverse effect on driving habits or injuries.[243] In sum, whether tort liability alone can dependably serve to reduce accidents and compensate victims is unclear.

There are other problems associated with depending upon tort liability to solve the landslide problem. As with automobile accidents,[244] in landslide cases the legal system may be more concerned with allocating responsibility than with compensating victims. Furthermore, for judicial decisions[245] to serve the broader policy function of reducing landslide hazards, they must have a deterrent effect, and there is evidence that this has not been the case.[246]

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238. Interview with Professor Stephen Sugarman, Professor of Law, University of California, Berkeley, in Berkeley, California (Dec. 17, 1985).

239. *See, e.g.,* R. KEETON & J. O'CONNELL, BASIC PROTECTION FOR THE TRAFFIC VICTIM (1965).

240. *See, e.g.,* D. HARRIS, M. MACLEAN, H. GENN, S. LLOYD-BOSTOCK, P. FENN, P. CORFIELD & Y. BRITTAN, COMPENSATION AND SUPPORT FOR ILLNESS AND INJURY (1984) [hereinafter HARRIS & MACLEAN]. This comprehensive study of incapacitated persons in Britain found that the legal system of compensation is biased and inadequate. The study also implied that deterrence is not effective. *See id.* at 20-21, 327-28. For a review of this book, see generally Abel, Book Review, *£'s of Cure, Ounces of Prevention,* 73 CALIF. L. REV. 1003 (1985).

241. R. KEETON & J. O'CONNELL, *supra* note 239, at 1-2. As a solution to the lack of effective compensation, the authors propose a system of compulsory no-fault insurance, under which victims could receive benefits relatively quickly, regardless of fault.

242. Brown, *Deterrence in Tort and No-Fault: The New Zealand Experience,* 73 CALIF. L. REV. 976 (1985).

243. *Id.* at 1002. In fact, accidents, casualties, and fatalities per kilometer traveled have actually declined since 1973. *Id.* at 992-94. Other changes in motoring laws, however, such as lower speed limits and stricter intoxication laws, may be responsible for the decline. *Id.* at 994-96.

244. *See* R. KEETON & J. O'CONNELL, *supra* note 239.

245. *See supra* notes 162-229. Note that these only represent cases in which the victims brought legal action. Decisions that help plaintiffs do not necessarily help other potential victims unless they deter future actions by potential tortfeasors. The percentage of victims that simply bear their own loss is difficult to know. Of British accident victims, less than one-half considered claims, and less than one-third consulted a lawyer. *See* HARRIS & MACLEAN, *supra* note 240, at 62.

246. Based on the authors' experience investigating numerous landslides in the San Francisco Bay Area, there has been no noticeable reduction in damage from slides despite extensive

A significant obstacle to deterrence is the lack of readily available information about landslide hazards.[247] In fact, some theorists see information access as a key determinant in choosing between tort liability and regulation as optimal policy instruments.[248] When private persons have superior knowledge, individual liability is a better system, but regulation is best when the regulator has better information.[249] This theory suggests that as long as landslide information is inaccessible to individuals the tort system is not the best way to reduce landslide hazards.

Finally, dependence on tort liability results in landslide policy that is uncertain and disjointed. Decisions made on a case-by-case basis have the same policy shortcomings as site-specific regulation.[250] One of these shortcomings is that the outcomes of individual tort cases are highly unpredictable.[251] Insurance, which can apply consistent policies over wide areas, is a means of adding certainty to any system of landslide abatement and compensation.

E. Insurance

The use of insurance as a solution to the landslide problem has several potential advantages over other strategies. First, insurance could provide an equitable distribution of costs and benefits. If property owners in landslide hazard areas paid premiums reflecting their actual risk and insurance fully compensated victims, costs and benefits would be equitably distributed. Second, landslide insurance encourages hazard reduction if rates reflect not only the degree of natural hazard but also the quality of structures and other improvements. Insurers could also require property owners to undertake risk-reduction measures before insuring their property.[252] Finally, using insurance to reduce landslide

litigation in recent years. One possible reason is that property owners and small contractors are unaware of court decisions and measures they can take to avoid or reduce landslide hazards. Engineers and large contractors, on the other hand, are familiar with the problem, but many of them save costs by exercising the minimum acceptable level of care, which frequently is that level established by local government building ordinances. On the other hand, in response to their increased liability exposure, local governments, which are in a better position to know the pertinent risks, appear to be slowly but steadily improving ordinances and procedures. *See supra* text accompanying notes 143-47. This trend supports Professor Sugarman's observation that "administrative agencies have already become the dominant force in advancing safety." Sugarman, *supra* note 235, at 651.

247. *See supra* text accompanying notes 43-45.

248. *See, e.g.*, Shavell, *Liability for Harm Versus Regulation of Safety*, 13 J. LEGAL STUD. 357, 359-60 (1984); *see supra* note 246 (regarding the relative effectiveness of deterrence on individual property owners compared to knowledgeable local governments); *see also* Sugarman, *supra* note 235, at 565-67 (deterrence does not work if individuals are ignorant of the law or of the effects of their actions).

249. *See* Shavell, *supra* note 248, at 359-60.

250. *See supra* notes 156-57 and accompanying text.

251. *See* Sugarman, *supra* note 235, at 566.

252. For example, before insuring a parcel, an insurer might require the following: site drainage that efficiently conveys water away from structures; landscaping with plants requiring

hazards appeals to those opposed to excessive government regulation because it depends more on the private market and less on government regulation than the other approaches.[253]

1. Private Landslide Insurance—Limited Availability

While a good solution in theory, private landslide insurance has some drawbacks in application. Private landslide insurance is generally not available in the United States,[254] although some landslide coverage has been included in some limited offerings of earthquake insurance.[255] Even when available, landslide insurance generally covers only the costs of structural repairs and not the cost of permanent slope stabilization because the cost of the latter is too uncertain. Insurers do not offer landslide coverage primarily due to the problem of "adverse selection,"[256] which is the tendency for only those who are in hazardous areas to buy insurance.[257]

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minimal artificial irrigation; inspection of foundation type and depth by a qualified engineer, with repairs if necessary; and inspection and analysis of adjacent slopes by a geologist or soil engineer, and stabilization of those slopes if necessary.

253. Insurance, by requiring residents of hazardous areas to pay the true costs of their risk, provides an economic disincentive to locating in hazardous areas. Conversely, if premium rates are reduced for property owners who take risk-reducing actions, insurance provides an economic incentive for hazard reduction. The use of economic incentives and disincentives is generally more politically acceptable than regulation.

254. *See* COMMITTEE ON GROUND FAILURE HAZARDS, *supra* note 16, at 24. Dr. James Slosson, a former California State Geologist, testified to the California State Assembly that insurers stopped writing landslide policies in California after the intense 1958 storms because insurers thought the policies had become too great a risk. *The Assembly Select Committee, supra* note 105, at 59. Some insurers believe that because landslides, unlike fires, occur in defined areas, home buyers should purchase with knowledge of the home's risk and insurance companies should not be responsible for protecting the homes. Telephone interview with C. Robert Hall, Vice President of the National Ass'n of Independent Insurers (Aug. 22, 1984).

255. *See* Important Questions and Answers About Earthquake, Landslide, Flood, Mudslide Protection You Can't Get Anywhere Else at Any Price (brochure from Emett & Chandler, Los Angeles, Cal., 1984); Chicken Little Might Be Right: Earthquake Coverage (Newsletter No. 8, Dealy, Renton & Assocs., Insurance Brokers, Oakland, Cal., 1984) (both on file with authors). Brokers from these two California companies, which briefly offered landslide coverage in 1984, reported to the authors that landslide insurance is generally too great a risk even at high premiums (annual premiums for these two 1984 offerings for all natural hazards were approximately $200 per $100,000 of coverage, with a $5,000 deductible).

256. *See generally* Abraham, *Efficiency and Fairness in Insurance Risk Classification,* 71 VA. L. REV. 403, 408 (1985). Abraham's article generally describes the economic dynamics of insurance markets, focusing on the costs of insurance-risk classification. He characterizes classification as operating in a tension between risk assessment (probability of loss) and risk distribution (who is affected). Insurers will classify only so long as it is cost effective. Thus, in the case of landslide insurance, insurers would subdivide landslide-prone areas into actuarial zones of relative hazard only if the economic gains exceeded the costs of information and administration. *See also* Hare, *Earthquake Insurance: A Proposal for Compulsory Coverage,* 24 SANTA CLARA L. REV. 971, 977 (1984) (describes the problem of adverse selection in regard to earthquake insurance).

257. This puts insurance companies in a financially uncomfortable position. If they have too many high-risk insureds, they must raise premiums to better reflect the risk. Raising pre-

Although "all risk" homeowner policies typically exclude landslides as a covered risk,[258] California court decisions over the last two decades have made these exclusions virtually unenforceable in that state.[259] How insurers will respond to these decisions is still uncertain; they may issue only named-peril policies, redraft their exclusionary language, or cease issuing homeowner insurance policies in potentially unstable areas.[260] Although other states have not gone as far as California in mandating coverage for excluded causes that run concurrently with covered causes, a number of other state courts have made the enforcement of exclusions more difficult.[261]

2. *Comparison to Flood Insurance Problems*

Landslide insurance shares many of the problems of flood insurance prior to the enactment of the National Flood Insurance Program

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miums, however, will likely exacerbate the problem because the relatively lower risk members of the insurance pool will be paying premiums higher than their actual risk. Incremental increases in premiums will therefore repeatedly drive out all but the highest risks. Ultimately, there will remain a very small group of very high-risk properties for which extremely high premiums are required. Because this type of situation is not financially attractive to insurers, the solution is generally not to offer insurance, as has been the case with landslides.

258. Hare, *supra* note 256, at 975-76 (general discussion of all-risk policies and exclusions for earthquake damage).

259. *See, e.g.*, Safeco Ins. Co. of Am. v. Guyton, 692 F.2d 551 (9th Cir. 1982) (when flooding was an excluded cause, there was coverage because a covered risk—third-party negligence—was a concurrent, proximate cause of the injuries); Sabella v. Wisler, 59 Cal. 2d 21, 377 P.2d 889, 27 Cal. Rptr. 689 (1963) (sewer-pipe rupture that caused improperly placed fill to fail was the "efficient" cause that triggered the event; therefore, there was coverage); Premier Ins. Co. v. Welch, 140 Cal. App. 3d 720, 189 Cal. Rptr. 657 (1983) (relying on *Safeco,* the court held that a landslide partly attributable to an improperly installed subdrain in the fill beneath the house was covered); Strubble v. United Servs. Auto Ass'n, 35 Cal. App. 3d 498, 110 Cal. Rptr. 828 (1973) (under an all-risk policy, the burden is on the insurer to prove noncoverage due to an excluded cause); *see also* Bragg, *Concurrent Causation and the Art of Policy Drafting: New Perils for Property Insurers,* 22 FORUM 385 (1985). Bragg presents an insightful discussion on the dangers of concurrent-causation analysis run rampant and the ease of finding some insured cause that remotely contributed to an injury. *Id.* at 385-91.

260. A more innovative solution would be for insurance policies to specifically allocate payments for those portions of the loss caused by covered risks. *See* Gordon & Crowley, *Earth Movement and Water Damage Exposure: A Landslide in Coverage,* 50 INS. COUNS. J. 426 (1983).

261. *See, e.g.*, Wyatt v. Northwestern Mut. Ins. Co., 304 F. Supp. 781 (D. Minn. 1969) (earth-movement exclusion did not preclude recovery when movement was caused by adjacent excavation); Broome v. Allstate Ins. Co., 144 Ga. App. 318, 241 S.E.2d 34 (1977) (exclusion for damage by subsurface groundwater applied only to natural water and not to leaky pipe; court additionally held that burden of proving exclusion fell on insurer); Anderson v. Indiana Lumbermans Mut. Ins. Co., 127 So. 2d 304 (La. Ct. App. 1961) (damage from expansive clay soils was not from excluded "earth movement" cause, but rather was a "collapse"); Standard Elec. Supply Co. v. Norfolk & Dedham Mut. Fire Ins. Co., 1 Mass. App. Ct. 762, 307 N.E.2d 11 (1973) (allowed coverage when the first cause, subsurface water, was excluded but caused damage that was a covered risk). For a good presentation of recent legal trends toward providing insurance coverage for excluded causes, see generally Bragg, *supra* note 259, at 388; Gordon & Crowley, *supra* note 260, at 421-25.

(NFIP).[262] Floods, like landslides, are natural hazards that occur only in certain landscape settings. Both hazards have a relatively low probability of occurrence at individual sites, but have a high probability of occurrence in regions and states. This leads state and federal agencies providing aid for disasters to question whether specific disasters might have been prevented.[263] Prior to NFIP, private insurers generally did not offer flood insurance.[264] NFIP was enacted partly because flood-related costs were not being internalized by the market and there were no financial disincentives to discourage building on hazardous floodplains.[265] As a result, floodplains were overbuilt and the federal government spent large amounts of money on disaster aid. A similar trend has developed regarding landslides and hillside areas.[266]

Key characteristics, however, distinguish flood hazards from landslide hazards. First, flood hazard zones are easier to identify than landslide hazard zones.[267] Second, flood-prone areas have historically experienced more human settlement than hillside areas.[268] Finally, mitigating flood hazards is easier than mitigating landslide hazards. Flood hazards can be reduced by constructing levees or raising floor elevations and strengthening supports. Landslides, by contrast, are more complex and require unique and frequently expensive solutions for each site. Moreover, reconstruction is easier after floods because only structures

262. National Flood Insurance Act of 1968, Pub. L. No. 90-448, 82 Stat. 572 (codified as amended at 42 U.S.C. §§ 4001-4128 (1982 & Supp. III 1985)). This program, initiated in 1968, makes flood insurance available through the Federal Insurance Administration (FIA). Flood insurance is available, however, only in communities that pass certain floodplain development regulations. *See* 42 U.S.C. § 4012; *see also* Platt, *The National Flood Insurance Program: Some Midstream Perspectives,* 42 J. AM. INST. PLANNERS 303 (1976). *See generally* Holmes, *Federal Participation in Land Use Decisionmaking at the Water's Edge—Floodplains and Wetlands,* 13 NAT. RESOURCES LAW. 351 (1980).

263. *See supra* text accompanying note 48; *see also* SENATE COMM. ON BANKING AND CURRENCY, 89TH CONG., 2D SESS., INSURANCE AND OTHER PROGRAMS FOR FINANCIAL ASSISTANCE TO FLOOD VICTIMS: A REPORT FROM THE SECRETARY OF THE DEP'T OF HOUSING & URBAN DEV. TO THE PRESIDENT, AS REQUIRED BY THE SOUTHEAST HURRICANE DISASTER RELIEF ACT OF 1965 (PUB. L. NO. 89-3.39, 89TH CONG-1 H.R. 11,539, NOV. 8, 1965) 35 (Comm. Print 1966) [hereinafter A REPORT FROM THE SECRETARY] (discusses the dilemma of providing federal flood disaster aid with no accompanying method of discouraging floodplain development).

264. A REPORT FROM THE SECRETARY, *supra* note 263, at 99. Insurance companies avoided flood insurance because they believed the actuarial information was lacking and there was a lack of interest among property owners, except for those owners in the most hazardous areas. *See supra* note 256.

265. *See, e.g.,* A REPORT FROM THE SECRETARY, *supra* note 263, at 90. For a discussion of the economics of NFIP, see generally D. DAMIANOS & L. SHABMAN, LAND PRICES IN FLOOD HAZARD AREAS: APPLYING METHODS OF LAND VALUE ANALYSIS (Virginia Water Resources Research Center Bulletin No. 95, 1976).

266. FEMA alone annually spends an estimated $20 million in landslide assistance. *See supra* note 77.

267. *See supra* notes 12-14 and accompanying text.

268. In recent years, however, the limited availability of urban lands for residential development coupled with the demand for homes with views has increased hillside development.

must be repaired or rebuilt. Following a landslide, however, the slope must be stabilized before reconstruction can begin.

3. *Public Insurance Programs for Earth-Movement Damages*

Property owners in many areas would benefit from some form of public insurance program for earth movement. The following are examples of existing public insurance programs for specific types of earth movement.

a. *Mudslide Coverage under NFIP*

In December 1969, Congress amended NFIP to include coverage of "mudslides."[269] Little controversy surrounded the amendment, which was enacted in response to the dramatic damage that occurred in southern California in early 1969.[270] Unfortunately, the amendment, by failing to include a technical definition of the term "mudslide," has created a great deal of confusion.[271] In effect, it has added a subclass of landslides to the flood insurance program without clearly defining that subclass.

The Federal Emergency Management Agency (FEMA), which is charged with NFIP administration, has been unable to implement an effective mudslide insurance program largely because of technical difficulties in mapping mudslide hazard zones.[272] These technical difficulties

269. Housing and Urban Development Act of 1969, Pub. L. No. 91-152, § 409, 83 Stat. 379, 397 (1969) (codified at 42 U.S.C. §§ 4001(f), 4121(b) (1982)). Mudslides were included simply by broadening the definition of "flood" to include inundation from mudslides that are proximately caused by accumulations of water on or under the ground. 42 U.S.C. § 4121(b).

270. The report of the House Committee on Banking and Currency, H.R. REP. No. 539, 91st Cong., 1st Sess. (1969), contains little discussion and no dissenting views on this amendment. The Committee adopted this amendment largely in response to media coverage of the 1969 damage, particularly dramatic photographs in the *National Geographic* of the effects of the storm on Glendora, which lies at the base of the San Gabriel Mountains. Telephone interview with Joseph Flynn, FEMA Assistant General Counsel (Apr. 23, 1985); *see also* NATIONAL RESEARCH COUNCIL, SELECTING A METHODOLOGY FOR DELINEATING MUDSLIDE HAZARD AREAS FOR THE NATIONAL FLOOD INSURANCE PROGRAM 6 (1982).

271. *See* NATIONAL RESEARCH COUNCIL, *supra* note 270, at 6-8. The term "mudslide" is technically inaccurate; geologists generally use the terms "mud flood" and "mudflow." *Id.* at 15-17. Because *mud floods* were already covered by NFIP, the National Research Council inferred that Congress must have intended to add *mudflow* insurance coverage. *Id.* at 8, 11. The problem is that a mudflow is a type of landslide, rather than flood, and it is not always easy to distinguish a mudflow from other types of landslides. *Id.* at 8 n.7.

272. FEMA has not even published any mudslide hazard maps. *Id.* at 1. Demarcating mudslide hazard zones is a key first step toward implementing a mudslide insurance program. Following hazard-zone delineation, FEMA would determine actuarial risk and establish premiums for each zone. *See* 44 C.F.R. § 59.1 (1985) (mudslide hazard areas to be designated Zone M on the Flood Insurance Rate Map). Hazard zone identification is also a prerequisite to specifying land-management regulations required as a condition for community participation in the insurance program. *See* 42 U.S.C. §§ 4101-4102 (1982 & Supp. III 1985). For example, in communities with designated M Zones on the Flood Insurance Rate Map, NFIP regulations require local governments to adopt a grading ordinance similar to that in the Uniform Building Code, *see supra* note 128. *See* 44 C.F.R. § 60.4(b) (1985).

include delineating hazardous portions of the landscape, similar to flood hazard mapping, and distinguishing mudflows from other types of landslides.[273]

Failure to resolve the mudslide-insurance problem has created difficulties for FEMA. Although FEMA has not designated mudslide areas, the Standard Flood Insurance Policy[274] provides for coverage of mudslides as a type of "flood."[275] Sophisticated property owners in hillside areas are purchasing this insurance because the low premiums reflect their location in a zone of low flood hazard and no mudslide-reduction measures are required by the policy.[276] As more property owners become aware of this bargain, it could prove very costly to the federal government.[277] FEMA has generally been firm about denying claims involving homes that settle or are undermined and paying only claims involving damages from wet landslides.[278] FEMA, however, has failed

273. In 1973, the Federal Insurance Administration (FIA) asked the National Research Council of the National Academy of Sciences (NAS) to recommend a method for delineating *mudslide-prone* areas. The resulting NAS report concluded that it would be most practical to generally delineate *landslide* susceptible areas. NATIONAL RESEARCH COUNCIL, METHODOLOGY FOR DELINEATING MUDSLIDE HAZARD AREAS 3 (1974). FIA did not implement this methodology, but instead asked NAS in 1981 to evaluate a mudslide-hazard methodology used by the Los Angeles County Flood Control District (LACFCD). NATIONAL RESEARCH COUNCIL, *supra* note 270, at ix. The subsequent NAS study concluded that the LACFCD methodology would not be appropriate for transfer to other locations. *Id.* at 21-22. Furthermore, the latter study echoed the 1974 report in stating that it is difficult to separate mudflow hazards from landslide hazards. *See id.* at 30. The study also suggested that a landslide-susceptibility-mapping approach could serve the purposes of NFIP-required mudslide hazard identification. *See id.*

274. FEDERAL INSURANCE ADMINISTRATION, STANDARD FLOOD INSURANCE POLICY TEXT (Oct. 1983).

275. *Id.* at art. II—Definitions.

276. *See supra* note 272.

277. As of September 1984, FIA had paid approximately 350 claims for mudflow losses and had denied approximately 900 claims, which the administration judged to be the result of other forms of landslides. Letter from David L. Cobb, Senior Marketing Officer at FIA, to Robert B. Olshansky (Sept. 24, 1984) (on file with authors). Although this is a very small number of claims compared to the 73,000 flood insurance claims in fiscal year 1983, *see id.*, there is reason to believe that the number of flood policies in hillside areas will increase as property owners become aware of the hazard and learn by word-of-mouth about flood insurance coverage of mudslides. Thus, FEMA fears that it is de facto covering landslides. Memorandum from George Jett, General Counsel to FEMA, to Gloria Jimenez, Federal Insurance Administrator (Jan. 26, 1981) (on file with authors). In the January 1982 northern California storm, for example, there were approximately 200 claims for mudslide damage. Telephone interview with Joseph Flynn, FEMA Assistant General Counsel (Sept. 19, 1984). A significant number of homeowners high on the Big Rock Mesa slide, in Malibu, have purchased flood insurance policies. Telephone interview with Arthur Zeizel, Program Manager, Hydrogeology, FEMA (Sept. 4, 1984). Many of them have made claims for mudslide damages, but FEMA has denied all of these claims. Telephone interview with Joseph Flynn, FEMA Assistant General Counsel (May 7, 1986).

278. Telephone interview with Joseph Flynn, FEMA Assistant General Counsel (Sept. 19, 1984). Over the past few years, FEMA has been involved in costly litigation in an attempt to firmly establish the limits of mudslide insurance coverage in the flood insurance policy. Many actions are pending, but only three cases have been litigated to a conclusion. *Id.* In the most

to establish specific guidelines for determining the type of mudslide damage that is covered; the costs of paying claims, therefore, have been high and unpredictable because FEMA depends on the individual discretion of claims adjusters to determine if a claim is covered.[279]

One possible solution to the mudslide-insurance dilemma would be to add all types of landslides to NFIP. Such a bill was introduced in the House of Representatives in 1981.[280] FEMA opposed the bill as too costly and difficult to administer: The bill would have immediately added landslide coverage to the nearly two million existing policies, and a new mapping program would have had to begin immediately.[281] Partly as a result of this opposition, the bill was never reported out of committee.

b. Landslide Insurance in Other Countries—New Zealand and France

New Zealand has complete landslide insurance coverage, providing "landslip" insurance under the Earthquake and War Damage Act of 1944.[282] The Act, which originally provided only earthquake and war-damage coverage, was amended to cover damage from storms, floods, volcanic eruptions, and landslides.[283] The Act adds these categories of coverage to all fire insurance policies by means of a surcharge that is paid

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significant of these, Beck v. Director, Fed. Emergency Management Agency, 534 F. Supp. 516 (N.D. Ohio 1982), the court decided that a saturated slope that slipped away from a house was not covered by the flood insurance policy because the house was never inundated by either water or mud. *Id.* at 518.

279. In fact, it seems likely that claims adjusters in the field, with no specific guidance, would tend to be liberal in approving claims. "We believe, based on the recorded litigation involving this issue which represents only a small portion of total claims, that many persons are, in fact, recovering under the current flood policy language for nonseismic landslide. The expense of such litigation alone justifies a more comprehensive approach." Memorandum from G. Jett, *supra* note 277.

280. H.R. 1531, 97th Cong., 1st Sess. (1981). This bill, introduced by Representative Goldwater from southern California, proposed to add landslides to the existing structure of NFIP and to retroactively provide coverage to 1980.

281. FEMA, FEMA Position on H.R. 1531 (Apr. 28, 1981) (unpublished memorandum submitted to the House Subcommittee on Housing and Community Development, Committee on Banking, Finance and Urban Affairs) (on file with authors). This memorandum notes that merely adding "landslides" to the definition of floods, with no accompanying regulations, would provide no incentive to avoid or reduce landslides and would cost FIA approximately $200 million per year in claims. Providing landslide coverage could even encourage construction in landslide-prone areas. In addition, FEMA stated that a costly landslide-mapping program and a regulatory infrastructure would need to be created.

The memorandum concluded that the only effective way to cover landslides would be for a comprehensive program to identify hazard areas, develop land-management regulations, and require insurance to be purchased by all property owners in designated hazard zones. *Id.* at 2. These conditions are not unique for landslide insurance; in fact, they address the general problems of moral hazard and adverse selection in natural hazard insurance. *See infra* notes 301-06 and accompanying text.

282. 6 R.S. 207 (New Zealand 1980 Reprint).

283. The Earthquake and War Regulations 1984, 1984/71, § 21 (New Zealand 1984).

into a national fund.[284] In 1984, coverage was extended to include not only damage to structures but also debris removal and the value of the land itself.[285] The Earthquake and War Damage Commission, which administers the program, is empowered to set higher premiums in high-risk areas and to refuse payment for damage to poorly maintained properties.[286] In practice, however, the Commission is unable to enforce building codes or restrict development in high-hazard areas because it is under political pressure to pay virtually all claims no matter how spurious the claim or how foreseeable the disaster.[287]

In 1982, France began an insurance program to cover floods, landslides, earthquakes, and avalanches as part of an overall natural hazard reduction program.[288] Insurance is funded by a mandatory nine-percent surcharge on all property insurance policies.[289] Although there is no premium differentiation between hazard zones, the moral hazard issue is addressed by the program's overall emphasis on hazard zone identification and land use regulations.[290]

c. *State Insurance Programs for Specific Types of Earth Movement*

Pennsylvania operates a mine-subsidence insurance program for property owners in designated anthracite-coal, bituminous-coal, and clay-mine regions.[291] The program covers structural losses caused by subsidence from past or present mining.[292] Since the program began in

284. *Id.*

285. The Earthquake and War Damage (Land Cover) Regulations 1984, 1984/144, § 5 (New Zealand 1984).

286. O'Riordan, *The New Zealand Natural Hazard Insurance Scheme: Application to North America,* in NATURAL HAZARDS: LOCAL, NATIONAL, GLOBAL 217 (G. White ed. 1974).

287. *Id.* at 218. O'Riordan recommends the following changes if such a scheme is ever adopted in the United States or Canada: Provide public information on the coverage limitations, have adequate technical personnel, house the program in the same agency of government that enforces building and zoning regulations, and divert a portion of the revenues to continued research on hazard forecasting and mitigation. *Id.*

288. *See* Simeon, *Plan d'Exposition aux Risques,* NAT. HAZARDS OBSERVER, May 1985, at 8.

289. *Id.*

290. *Id.* It will be interesting to compare in a few years this program's performance to that of New Zealand's program. If regulations are well enforced, such programs could potentially reduce landslide and flood damages to the extent that equity of costs is no longer a major issue. If payouts are only for damages that could not have reasonably been prevented or avoided, justifying the nationwide funding mechanism is easier. Another strength of this insurance program is its all-hazard aspect, which covers damages to a broader geographic range of property than does single-hazard insurance.

291. PA. STAT. ANN. tit. 52, §§ 3201-3241 (Purdon 1966 & Supp. 1985). Currently, the annual premium for $100,000 of residential coverage in an anthracite area is $91. *See* Mine Subsidence Insurance Sales Office, Who Needs Mine Subsidence Insurance (no date) (on file with authors) (pamphlet).

292. PA. STAT. ANN. tit. 52, § 3204.

1961, approximately 800 claims, totalling $3.5 million, have been paid.[293]

Illinois began a mine-subsidence insurance program in 1979.[294] In contrast to Pennsylvania's program, Illinois established a reinsurance fund and required all property insurers to make mine-subsidence insurance available.[295] Coverage is automatically included in policy renewals in thirty-four counties comprising the mining areas, and coverage is optionally available in all other counties.[296]

Florida's Department of Insurance requires all homeowner insurance policies to offer coverage of sinkholes,[297] which have been a serious problem in Florida; there have been approximately 1,000 sinkholes in Florida over the past twenty-five years.[298] A Florida statute further requires that sinkhole insurance for all structures and their contents be made available.[299]

4. Insurance Alone Is Not a Solution

In a 1980 report, the Comptroller General of the United States concluded that insurance is the most efficient and equitable method of providing disaster assistance.[300] The Comptroller General recognized two problems, however, that reduce the efficiency and desirability of disaster insurance: adverse selection and moral hazard.[301] Adverse selection refers to the tendency for only those in the most hazardous areas to purchase insurance. This tendency can be a problem for insurance companies because when only high-risk property is insured, an unusually

293. Letter from Philip Zullo to Robert B. Olshansky (Aug. 29, 1984). In 1984, there were 22,075 policies in force. *Id.* Over the first seven months of 1984, the fund received $740,803 from premiums and paid out $143,620 in claims. *Id.*

294. ILL. REV. STAT. ch. 73, §§ 1065.401-1065.413 (Supp. 1985). The policy specifically excludes earthquakes, landslides, volcanic eruptions, and collapse of storm and sewer drains and rapid-transit tunnels. *Id.* § 1065.402.

295. *Id.* § 1065.404.

296. *See* Illinois Fairplan Ass'n, Now You Can Insure Your Properties Against the Peril of Mine Subsidence (no date) (on file with authors). Rates are $16 to $18 for $100,000 of coverage. *See* Illinois Mine Subsidence Insurance Fund Bulletin No. 6 (July 29, 1981) (on file with authors). The 34 counties with automatic coverage have greater than one percent of their land area undermined.

297. *See* Beck, *The Sinkhole Problem in Florida,* 2 GROUND FAILURE 14 (1985).

298. *Id.* at 14.

299. FLA. STAT. ANN. § 627.706 (West 1984).

300. COMPTROLLER GENERAL OF THE U.S., FEDERAL DISASTER ASSISTANCE: WHAT SHOULD THE POLICY BE? REPORT TO THE CHAIRMAN AND RANKING MINORITY MEMBER, SENATE COMMITTEE ON THE BUDGET, UNITED STATES SENATE iii (1980) [hereinafter COMPTROLLER GENERAL]. Insurance is not only geographically equitable, because those in hazardous areas pay for their own risk, it is also more equitable among income groups than the current system of disaster loans. *See id.* This is because victims who receive disaster loans can deduct both their losses and interest payments from their taxable income. *See infra* note 325. As a result, under progressive taxation, "[t]he government bears a larger proportion of the losses of higher income individuals than for lower income individuals, thus subsidizing the rich relatively more than the poor." COMPTROLLER GENERAL, *supra,* at iii.

301. *Id.* at iv.

high percentage of policies will result in claims, and this threatens the solvency of the insurance fund. Adverse selection is currently a major obstacle to the offering of private landslide insurance.[302]

Adverse selection can be mitigated by government intervention and regulation. The flood-insurance experience has demonstrated that adverse selection can be reduced by requiring insurance coverage in designated hazard areas.[303] Such mandatory coverage ensures that people other than those in the highest risk zones purchase the insurance, thereby ensuring the continued solvency of the insurance fund. Furthermore, for low-probability risks such as landslides and floods, insurance must be mandatory even for those in the highest hazard zones because people tend to ignore these risks.[304]

Moral hazard is the tendency for insured persons to reduce their care and thus change the probabilities upon which the premiums were based. Moral hazard, in contrast to adverse selection, is a problem in any kind of disaster assistance program.[305] If people expect a government agency to compensate them, they tend to become complacent in their degree of care. Moral hazard regarding landslide insurance, however, could be lessened by requiring local planning, zoning, and grading regulations as a condition of insurance availability.[306]

In sum, insurance can equitably provide funds to compensate for landslide damage that will inevitably occur even where there are strict land use and grading controls. For insurance to be an effective solution, though, a comprehensive government landslide insurance fund is needed, or alternatively, some other form of government intervention is needed to induce or require private insurers to cover landslides. Controls on building, development, and property maintenance would need to accompany mandatory insurance. Insurance and appropriate government intervention can operate together, each filling a need not served by the other, and each improving the performance of the other in reducing landslides and compensating victims.

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302. *See supra* text accompanying note 256.

303. *See* COMPTROLLER GENERAL, *supra* note 300, at 16 (adverse selection can be mitigated by having actuarially sound, compulsory insurance); *cf.* Hare, *supra* note 256, at 991 (reaching the same conclusion in regard to earthquake insurance); FEMA Position on H.R. 1531, *supra* note 281 (in regard to adding landslide insurance to NFIP). *See generally* Platt, *supra* note 262, at 305 (briefly describes history of NFIP).

304. *See* H. KUNREUTHER, *supra* note 45, at 235-41.

305. *See* COMPTROLLER GENERAL, *supra* note 300, at 22.

306. This would be analogous to the land use regulations required under NFIP. *See* 44 C.F.R. § 59.22 (1985), 42 U.S.C. § 4012(c) (1982), *amended by* 42 U.S.C. § 4012 (Supp. III 1985). This element of NFIP has not been very successful, however, due to limited enforcement at the local level as well as poor monitoring of local development activity by FEMA. *See generally* U.S. GENERAL ACCOUNTING OFFICE, RECOMMENDATIONS FOR IMPROVING THE NATIONAL FLOOD INSURANCE PROGRAM 7, 12-13 (1979).

F. Assessment Districts—As a Means of Financing Landslide Repairs

Special assessment districts are an equitable and effective means of funding the costs of landslide-mitigation work and landslide-damage repairs. Assessment districts provide a way for property owners to finance their own repairs and fund repairs to landslide-damaged public roads and utilities by requiring the users of the common facilities to pay the cost of repairs.[307] Assessment districts also help prevent landslide damage by providing for cooperative analysis and repair of areawide landslide phenomena that transcend property boundaries, joint endeavors that might not otherwise occur because of the divergent interests of property owners. Assessment districts can be established not only in landslide-damaged areas but also in slide-prone areas prior to slope movement. Unlike insurance, which only helps after landslides occur, assessment districts can promote regular maintenance, monitoring, and preventive actions. Finally, assessment districts can provide communities that have grading ordinances with a means of reducing hazards that predate ordinance adoption.

1. Example—Geologic Hazard Abatement Districts in California

California has provided for local formation of "geologic hazard abatement districts" (GHADs),[308] which are special assessment districts formed specifically to abate actual or threatened landslides, land subsidence, soil erosion, or other natural or unnatural movements of land or earth.[309] GHADs, acting as independent political subdivisions of the state, have extensive powers to raise money and implement projects.[310] Either local governments or neighboring property owners may initiate the formation of GHADs.[311]

To date, only three GHADs have been formed. The first, and most active, is the Abalone Cove Landslide Abatement District, in Rancho

307. This approach is used by Los Angeles County to repair large landslides that damage roads. Because the County is required to repair public roads, it must initially pay the costs of slope stabilization, even for extensive landslides that affect large areas of private property. The County, however, is then able to establish improvement districts so that all of the users of the road can divide the repair cost. Interview with Arthur Keene, Los Angeles County Geologist (Mar. 24, 1986).

308. *See* 1979 Cal. Stat. 1118 (codified at CAL. PUB. RES. CODE §§ 26500-26601 (West Supp. 1986)).

309. CAL. PUB. RES. CODE § 26507 (West Supp. 1986). The lands in the district may be contiguous or noncontiguous, *id.* § 26530, so long as they all benefit from the approved construction, *id.* § 26534.

310. *Id.* §§ 26570-26581.

311. Proceedings may be initiated by either a petition signed by owners of 10% of the real property in the proposed district or by resolution of the local legislative body. *Id.* § 26550.5. The application is accompanied by a "plan of control" prepared by a certified engineering geologist. *Id.* §§ 26509, 26553, 26558(b). Hearings are then held, and if owners of greater than 50% of the assessed valuation of the proposed district object to district formation, the process is abandoned. *Id.* § 26566.

Palos Verdes, Los Angeles County. This district was formed in January 1981 to abate a landslide affecting over 100 homes scattered over 600 acres.[312] So far, the action to stabilize the slide has consisted of constructing wells and water diversions to remove subsurface water; these efforts have greatly slowed earth movement.[313] The second GHAD, formed in 1982, is also located in Rancho Palos Verdes, in the Klondike Canyon area,[314] and was established to abate a landslide similar to though smaller than the Abalone Cove slide. The most recent GHAD was formed in 1985 near Danville, Contra Costa County.[315] Unlike the others, this GHAD was not formed to abate an existing landslide, but to establish a mechanism to support regular maintenance of drainage systems and to provide timely repairs of any slope failures.[316] The formation of a GHAD was attempted for Mt. Washington in Los Angeles,[317] but was rejected by homeowners.[318] A proposed GHAD is currently under study in Kensington, Contra Costa County.[319]

2. *Evaluation of Assessment Districts*

Although assessment districts seem to be an effective means of deal-

312. *See* Letter from Tom Bandy, Executive Director, Abalone Cove Landslide Abatement District, to Robert B. Olshansky (Sept. 10, 1984) (on file with authors). There are 25 homes on the 80-acre landslide, and 75 homes uphill from the landslide are also within the district. Interview with Dr. Perry Ehlig, Geologist, Abalone Cove Landslide Abatement District, in Rancho Palos Verdes, California (Mar. 29, 1986). The enabling legislation was specifically written to allow area residents to form the Abalone Cove district. Telephone interview with Judy Smith, Assistant to State Sen. Beverly (July 19, 1985) (Sen. Beverly sponsored the original bill).

313. *See* K. Dyda, Progress Report No. 3 (Abalone Cove Landslide Abatement District, Jan. 1984) (on file with authors).

314. *See* Klondike Canyon Ground Movements, Chronology of Events (City of Rancho Palos Verdes, no date); K. Dyda, Klondike Canyon Geologic Hazard Abatement District, A Progress Report (June 1, 1982) (both on file with authors).

315. *See* Board of Supervisors of Contra Costa County, Cal., Res. 85/289 (June 4, 1985) (approving formation of a geologic hazard abatement district, Canyon Lakes, Sub. 6384, Danville-San Ramon area).

316. Although the Canyon Lakes GHAD is a pioneer in using a GHAD for preventive maintenance, its plan of control has been severely criticized for being too vague. *See, e.g.*, Letter from Todd Nelson to Daniel J. Curtin (June 25, 1985) (on file with authors) (expresses opinion that Canyon Lakes Plan of Control should not be used as a model for other GHADs). Other sources in county and state governments have expressed concern that the Canyon Lakes GHAD, with its general plan of control, is possibly a strategy by the developer to evade liability for future landslides.

317. *See* LEIGHTON & ASSOCIATES, MT. WASHINGTON GEOLOGIC HAZARD ABATEMENT DISTRICT GEOTECHNICAL INVESTIGATION REPORT (July 15, 1981).

318. Interview with Richard Lung, Leighton & Associates, in Irvine, California (Aug. 17, 1984). The property owners were unwilling to pay the entire cost of needed slope repairs.

319. *See* Blakemont Property Owners Ass'n, Request for Proposal (Aug. 31, 1984) (on file with authors). An engineering geologist is currently studying the slide and preparing a plan of control for a district that would include approximately 100 property owners. Telephone interview with Monica Ambose, Attorney for Blakemont Property Owners Ass'n (Aug. 30, 1985); Telephone interview with Albert Slendebroek, Resident of Blakemont Slide Area (Oct. 25, 1985).

ing with landslide problems, property owners wishing to form districts face many obstacles. First, landslide abatement is expensive;[320] therefore, owners of expensive properties generally are more willing than owners of lower value properties to bear the costs of repairs.[321] Second, many property owners prefer to find some means of having the government pay the full costs of repairs rather than funding the costs themselves through an assessment district. Third, reaching an initial agreement among a large group of property owners and finding the means to finance the preliminary investigation necessary for district formation is difficult. Finally, although a major advantage of assessment districts is that they promote cooperation and significantly reduce litigation, the use of the districts does not necessarily replace litigation as a means of compensation.[322] Assessment districts may actually facilitate litigation because the district is an organized entity that can more easily afford the expense of legal action than can individual property owners.[323]

Despite their drawbacks, assessment districts remain specialized instruments that can be used to equitably provide for timely repairs of landslide damage and pay for preventive measures. Assessment districts are particularly appropriate for repairing problems in hillside areas developed prior to the adoption of grading codes. Local governments can use a combination of grading codes and assessment districts to reduce hazards in both new and existing developed areas. Furthermore, assessment districts can also finance preventive measures, and they can be tailored to the particular landslide problem of each district. Their primary limitation is that they are politically difficult to form, requiring a consen-

320. The Abalone Cove Landslide Hazard Abatement District has spent several hundred thousand dollars, *see* Letter from Tom Bandy, *supra* note 312, and the authors estimate that repair of the Blakemont slide, in Kensington, will require at least $100,000 to $200,000. Consequently, each homeowner can generally expect to pay $1,000 to $10,000 to abate a large slide in a low-density residential area.

321. This was the reason for rejecting the district on Mt. Washington, which is not a wealthy area. Interview with Richard Lung, *supra* note 318. The inability of property owners to pay full costs, however, need not necessarily prevent district formation; because of the pooling of information, contributions from public agencies and utility districts can help defray costs and lead to a solution that is cost effective for all parties. Such an approach is being used to fund preparation of the plan to control the Blakemont landslide. Telephone interview with Todd Nelson, Contra Costa County Geologist (Mar. 3, 1986).

322. For example, California's enabling statute expressly permits GHADs to sue and be sued. *See* CAL. PUB. RES. CODE § 26574(a) (West Supp. 1986). Alternatively, GHAD members can still individually bring suit. For example, 40 property owners in the Abalone Cove Landslide Hazard Abatement District have filed suit against Los Angeles County regarding sewer facilities that they believe triggered a slide. Telephone interview with Tom Bandy, Executive Director, Abalone Cove Landslide Hazard Abatement District (Apr. 24, 1986). This case has not yet gone to trial, and the parties are attempting to negotiate a settlement.

323. Conversely, property owners may hesitate to form GHADs for fear that GHADs will reduce the potential for successful litigation, i.e., property owners might fear that their assumption of the responsibility for full repair implicitly reduces the liability of both the developer and local government and, therefore, limits their options should they later decide to pursue legal action.

sus of local government and property owners and a clear agreement on the financing mechanism.

G. *Hazard Mitigation as Condition of Disaster Aid*

One method governments can use to reduce their expenditures on landslide-related disaster aid is to require hazard-mitigation measures as a prerequisite to disaster-aid eligibility. Section 406 of the Disaster Relief Act of 1974[324] attempts to reduce the federal government's increasing disaster-aid costs[325] by requiring that jurisdictions receiving aid take steps to evaluate and mitigate natural hazards.[326] The implementing regulations require local aid recipients to evaluate natural hazards, develop land use plans, and set standards for construction practices.[327]

Although section 406 is a powerful tool by which the federal government can induce state and local officials to mitigate landslide risks, getting state and local governments to implement their landslide-mitigation plans after disaster aid has been paid can be difficult. Even if mitigation plans have been carried out inadequately, FEMA would probably not withhold aid following future disasters.[328] Regardless of whether FEMA

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324. 42 U.S.C. §§ 5121-5202 (1982)).

325. The federal government's share of all postdisaster recovery costs rose from 1% in 1953 to 70% by the mid-1970's. *See* A. SORKIN, ECONOMIC ASPECTS OF NATURAL HAZARDS 146 (1982). For a discussion of the evolution of federal disaster policy from crisis response (pre-1930's), to comprehensive disaster relief programs (increasing since the 1930's), to regulatory requirements for hazard mitigation (since the late-1960's), see generally Clary, *The Evolution and Structure of Natural Hazard Policies,* 45 PUB. ADMIN. REV. 20 (1985). The federal government pays for disasters not only through direct assistance but also through tax deductions for property losses. Taxpayers may partially deduct casualty losses from earned income. *See* I.R.C. §§ 165(i), (k) (1986). In addition, they may also deduct interest payments for relief loans. *See id.* § 163. The Comptroller General of the United States has estimated that tax transfers alone reduce the percentage of disaster losses borne by residential victims to 64.7% of total losses and commercial victims to 19.2%. COMPTROLLER GENERAL, *supra* note 300, at 45. For landslide losses, the federal government's share via tax transfers is particularly large because the losses are not generally covered by other means, such as insurance. *See supra* notes 254-55 and accompanying text.

326. 42 U.S.C. § 5176 (1982) provides in part:

> As a further condition of any loan or grant made under the provisions of this chapter, the State or local government shall agree that the natural hazards in the areas in which the proceeds of the grants or loans are to be used shall be evaluated and appropriate action shall be taken to mitigate such hazards, including safe land-use and construction practices, in accordance with standards prescribed or approved by the President after adequate consultation with the appropriate elected officials of general purpose local governments, and the State shall furnish such evidence of compliance with this section as may be required by regulation.

327. 44 C.F.R. §§ 205.400-205.411 (1985). After a disaster, a federal-state aid agreement is drawn up, providing for future hazard mitigation by establishing (1) a federal-state survey team to assess the damage and identify major hazards and (2) a planning team to recommend appropriate hazard-mitigation measures, such as structural improvements, land-use regulations, and changes in construction standards. *Id.* §§ 205.403-205.407.

328. Telephone interview with Larry Zensinger, 406 Program Manager, FEMA (May 22, 1985). Mr. Zensinger reported that FEMA's approach consists mostly of "encouragement" and "cajoling." The approach does not always work, but Mr. Zensinger stated that it has had

can always get governments to carry out landslide-mitigation measures, section 406 serves to educate state and local officials and encourage them to pursue landslide-mitigation measures.

Whether or not section 406 is enforced, some local incentive for landslide reduction still exists because direct federal aid under the 1974 Act does not fully cover all landslide losses. FEMA's official policy on aid for landslide disasters is that, regarding damage to public facilities, such as sewer and water systems and roads,[329] it will perform emergency work[330] and will restore manmade facilities,[331] but will not permanently stabilize a landslide.[332] FEMA has struggled with the dilemma of how to spend disaster funds not only to aid victims but also to encourage mitigation of future damages. With respect to landslides, FEMA has wavered between a liberal policy of paying for stabilization[333] and reconstruction of public infrastructures, which does little to discourage development in hazardous areas, and a strict policy of only allowing emergency repairs,

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a fairly good success rate. He noted that FEMA recently began a computerized program to track specific mitigation elements, so it is now easier to monitor and enforce their completion. Furthermore, though FEMA would not turn down a future disaster request by a noncomplying jurisdiction, it might refuse certain kinds of assistance if the expense clearly could have been avoided by previously promised mitigations.

329. *See* 42 U.S.C. § 5172 (1982) (defines "public facility" and provides for federal aid to restore damaged public facilities).

330. 44 C.F.R. § 205.74(c)(4) (1985) (provides that emergency landslide-related work immediately following the disaster is eligible for FEMA reimbursement. "Examples are debris removal, simple drainage measures, and emergency repairs to damaged public facilities. Permanent stabilization of a landslide is not attainable usually by such emergency measures").

331. 44 C.F.R. § 205.75(a)(17) (1985) provides:

> Section 402 of the Act [codified at 42 U.S.C. § 5172] provides for restoration of damaged or destroyed facilities which are man-made features or improvements. The site is the owner's responsibility. Permanent stabilization of a landslide area can be quite costly and may not produce the desired results. When the Regional Director determines that no practicable alternative exists, he may decline to provide such grant assistance for restoration of facilities within the slide area. Permanent work to stabilize a landslide is not eligible.

332. *Id.* If a feasibility study finds a questionable site to be stable, "the Regional Director may approve the most cost effective method of restoring the facility to perform its predisaster function." Letter from Samuel W. Speck, Associate Director, FEMA, to Regional Directors of FEMA (Mar. 21, 1984) (on file with authors). If a site is found to be unstable, the applicant must generally fund the stabilization before reconstruction assistance is provided. *Id.*

Much of FEMA's concern about the issue of funding landslide stabilization stems from the experience of the Federal Disaster Assistance Administration (FDAA), FEMA's predecessor, in the 1978 Bluebird Canyon landslide in Laguna Beach, California. *See generally* W. SPANGLE & ASSOCIATES, LAND USE PLANNING AFTER EARTHQUAKES D9-D14 (1980). As a result of this landslide, which destroyed 22 homes and threatened 25 others, FDAA provided funds for "emergency" stabilization, primarily to protect adjacent properties. FDAA placed itself in the difficult position of trying to approve funding of stabilization plans that were just good enough for emergency purposes, but not for home reconstruction on the slide. *See id.* at D11-D12. After work was completed, however, the consulting engineers declared that the area was safe enough for reconstruction of the homes, and the City of Laguna Beach immediately began to accept applications for building permits. Thus, in essence, FDAA spent considerable sums of money to reconstruct private property, and this is generally against its policies.

333. *See supra* note 332.

which has the unfortunate effect of leaving many people homeless and with heavily damaged property.[334]

Federal disaster aid as a policy tool does not appear to encourage landslide hazard reduction. Unfortunately, disaster aid has become a routine means of addressing natural hazards, although most of the other strategies detailed in this Comment probably reduce hazards more effectively. For example, land use planning and grading codes more directly reduce hazards, and insurance and assessment districts provide more equitable distribution of costs and economic incentives for hazard reduction. Disaster aid could help reduce landslide hazards more effectively if aid restrictions promoted better local land use planning and grading ordinances.

III

PROPOSAL—A COORDINATED STRATEGY

As noted at the beginning of this Comment, there are few state and federal programs for landslide hazard reduction and victim compensation, and there are virtually no official policy statements on landslide hazards.[335] Furthermore, the programs and policies that exist are not coordinated with one another. This Section proposes a comprehensive approach to landslide hazard abatement and landslide damage compensation, based on legislation at either the federal or state level. Essentially, this Comment proposes using all of the above-described policy tools to address various aspects of the landslide problem and coordinating their strengths and weaknesses to achieve a more efficient and workable result.[336]

This proposal consists of a short-term strategy to provide compensation for landslide damage and a long-term strategy to reduce future damage. Compensation should be provided by insurance, which would cover damage to existing structures and probably would reduce litigation. A

334. FEMA has wavered in its interpretation of the 1980 regulations. The most recent directive stating FEMA's landslide-repair policy was handed down in Mr. Speck's March 1984 letter. *See supra* note 332. It reversed the earlier directives of May 3 and July 26, 1983, which had set narrower conditions for landslide aid. The 1984 policy change released several million dollars to be used for disasters that had occurred since 1980. FEMA Revises Guidance on Landslide Disaster Assistance, FEMA Press Release No. 84-35 (Mar. 21, 1984).

335. *But see* 42 U.S.C. § 4001 (1982) (congressional findings and declarations of purpose). The clearest official statement regarding landslides is in the findings and declarations of California's Landslide Hazard Identification Program, CAL. PUB. RES. CODE §§ 2670-2688 (West 1984). This statute states in part: "Areas subject to landslide and other slope instability hazards should be identified and . . . cities and counties are encouraged to develop land use management policies and regulations to prevent or minimize those hazards to protect the public health and safety." *Id.* § 2671(b).

336. "The greatest need . . . is not for new knowledge or new engineering methods but for more effective implementation of the capabilities we have today. To achieve this will require focused, national leadership that today is almost totally lacking." COMMITTEE ON GROUND FAILURE HAZARDS, *supra* note 16, at 3.

legislated insurance program would also serve an educational function by focusing attention on the landslide problem. The primary long-term means of reducing landslides should be land use planning and grading codes supported by continuing landslide-research programs and complemented by insurance and assessment districts. The following text describes the comprehensive approach in more detail and concludes with a discussion of the legal issues expected to remain after such an approach is implemented.

A. Short-Term Strategy—Compensation

Compensation is the aspect of the landslide problem that can be addressed most immediately. Landslide victims should be compensated efficiently and equitably.[337] Insurance is potentially the most equitable means of compensation because insurance programs can be structured to ensure that those at risk pay the costs reflecting their actual risk.[338] Insurance is also a faster means of compensation than the torts system. To satisfy efficiency and equity, however, insurance must be mandatory and linked to hazard reduction.[339] Insurance could be provided by either state or federal programs, or states could require private insurers to offer landslide insurance coverage. Assessment districts can also be used to finance landslide repairs.

1. Proposal—National Landslide Insurance Coverage

This Comment proposes that Congress create a national landslide insurance fund accompanied by a program for mapping landslide hazard zones and determining actuarial rates. Coverage should be mandatory for landslide-prone properties. One way to require coverage is to link it to federally subsidized mortgages. This would be much like the NFIP requirement of flood insurance for properties having federally subsidized mortgages in flood hazard areas.[340] The federal landslide-insurance program should be administered through NFIP because NFIP is established and has goals similar to those of the landslide insurance program. Sim-

337. Compensation should be efficient so that landslides do not unnecessarily burden the economy; it must be equitable so that all taxpayers do not subsidize the hazards assumed by hill dwellers. In his 1980 evaluation of disaster aid policies, the United States Comptroller General used as primary criteria equity and efficiency of compensation. *See* COMPTROLLER GENERAL, *supra* note 300, at 15-18.

338. *See generally supra* notes 252-306 and accompanying text.

339. The mandatory aspect is necessary to address adverse selection, while requirements for hazard reduction address the problem of moral hazard. *See generally supra* notes 300-06 and accompanying text.

340. In 1973, NFIP was amended to prohibit financial institutions from extending federally subsidized mortgage loans to properties in flood hazard areas that are in communities not participating in the program. Flood Disaster Protection Act of 1973, Pub. L. No. 95-128, tit. III, §§ 703(a), (b), 91 Stat. 1144, 1144-45 (1977) (codified at 42 U.S.C. §§ 4003(a)(4), 4106(b) (1982)).

ply adding a brief amendment to NFIP to create a landslide program, however, as was done for mudslides[341] and attempted for landslides,[342] would be a mistake.[343]

Landslide characteristics are sufficiently different from those of floods that separate regulations are needed for landslide insurance. First, because scientists know less about landslide hazard zones and considerable expense is required to gain site-specific knowledge, the landslide-mapping program cannot be as precisely prescribed as the flood-mapping program. A landslide-mapping program must be tailored to the terrain and dominant type of landslide process in the area under study. Second, engineering mitigation measures are more complex for landslides than for floods. While flood-hazard-mitigation measures center on more universal means, such as waterproofing, strengthening structures, and raising the elevation of structures, landslide hazard mitigation consists of designing site-specific means to increase slope stability.[344] Third, because property insurance usually pays no more than the value of structures, expensive slope stabilization projects go unfunded, and many landslide-damaged homes cannot be rebuilt on the original sites.[345] Finally, FEMA would need to hire landslide experts capable of coordinating a program involving the complex physical processes of landslides.

Although the federal government might object to the landslide insurance program because it would require expensive mapping,[346] program initiation need not await detailed hazard mapping. The program could begin with simple zonation designating all hillsides as landslide areas, and these general zones could be refined later.[347]

Initially, political expediency probably would require optional rather than mandatory insurance. Although optional insurance ignores the problems of adverse selection and moral hazard, it would serve to

341. *See supra* note 269.

342. *See supra* note 280.

343. For a discussion of the problems that followed the amendment of NFIP to include coverage of mudslides, see *supra* notes 269-79 and accompanying text.

344. Depending on the individual site, landslide-proofing measures could range from simple surface-drainage requirements to large slope-reconstruction projects. *See generally* Gedney & Weber, *Design and Construction of Soil Slopes,* in LANDSLIDES: ANALYSIS AND CONTROL, *supra* note 5, at 172.

345. Not paying for the full costs of rebuilding on landslide sites, while adversely affecting the insured property owners, results in a public benefit because reoccupation of highly unstable areas is reduced.

346. A FEMA position paper expressed this objection. *See supra* note 281.

347. USGS has outlined the costs and procedures for performing such a phased mapping of landslide hazards in the United States. *See Methods and Costs, supra* note 77, at B7-B11. Even generalized hazard zones can supply the basis for insurance classification. Sufficient scientific information currently exists to set actuarial rates over such generalized zones. Moreover, historic records of landslide frequencies over large hillside areas could be the basis of initial rates. The point of collecting insurance premiums from those in designated hazard areas is to provide a more equitable method of compensation.

introduce the program to property owners, realtors, insurers, lenders, and local planning agencies. The program should provide for a gradual phasing-in of additional elements, including mandatory coverage for property owners in participating communities, drainage-improvement requirements as a condition of insurance benefits,[348] land use and grading regulations for new construction,[349] and more detailed hazard-zonation studies.[350]

At first, if the program were optional, the problems of adverse selection and moral hazard would prevent the program from being self-supporting.[351] Additionally, political necessity would probably require the government to offer subsidized rates to preexisting structures, as is done under NFIP.[352] The costs of implementing such an initial program, however, probably would not be overwhelming,[353] and the income generated by premiums would begin to alleviate the current major federal cost burden.[354] In addition, even if insurance were optional, lenders might require landslide insurance as a condition of mortgage loans in landslide hazard zones, and such a practice might encourage enough policy sales to make the program self-supporting.

Although much of this national landslide insurance proposal is similar to NFIP, additional provisions would be necessary because of the unique character of the landslide problem. First, the program should contain local and state cost-sharing provisions.[355] Such provisions would relieve FEMA of some of the implementation burden and would help

348. This is similar to a building-code requirement in New Zealand's landslide insurance program that has met political resistance. *See* O'Riordan, *supra* note 286, at 217-18.

349. As in NFIP, these requirements would apply only to communities choosing to participate in the program. *See* 42 U.S.C. § 4002(b)(3) (1982). Under the proposed model, communities that choose not to adopt the required ordinances would not be eligible for landslide insurance coverage for property owners within their jurisdiction. They would also become ineligible for federal disaster aid. NFIP has such a provision. Telephone interview with Gloria Goble, Training Officer, Federal Insurance Administration (May 8, 1986). Consequently, there would be strong incentives for landslide-prone communities to participate in the program.

350. As the other regulations are implemented, the program would become more financially self-supporting. It would then be able to provide funds for more detailed mapping and refined zonation. These studies would likely begin in areas that generate the most claims.

351. Both of these problems reduce the efficiency of landslide insurance by disproportionately encouraging owners of high-risk property to purchase insurance. *See supra* notes 300-06 and accompanying text.

352. *See* 42 U.S.C. § 4015 (1982 & Supp. III 1985).

353. A generalized nationwide landslide-hazard assessment would cost approximately $1 million. *See supra* note 77. Such an assessment would identify areas with steep slopes or existing landslide problems. *See Methods and Costs, supra* note 77, at B-7.

354. FEMA alone spends approximately $20 million per year in landslide aid. Interview with Arthur Zeizel, *supra* note 77.

355. For example, states could pay part of the administrative costs, and the costs could be apportioned according to the number of policies purchased in each state. Local communities could also be required to pay a proportionate share of these costs. Such provisions would appeal to Congress, which would probably be unwilling to fund the entire program.

educate local agencies about landslides and ways that they can reduce hazards. If local agencies assumed part of the program costs, they would learn the high costs of geologically insensitive land use planning.[356] In addition, a cost-sharing program that allocated costs to communities according to the degree of their landslide hazard would help distribute program implementation costs more equitably. Second, to address the moral hazard problem, landslide insurance policies should have large deductibles[357] to provide an incentive to property owners to reduce minor earth-movement problems.[358] Large deductibles also would simplify program administration and reduce administrative and payment costs by eliminating small claims.

In sum, federal landslide insurance coverage would be a feasible and effective means of compensating landslide victims. As implementation progressed, the program would become more equitable and aid landslide reduction as well. The major impediments to establishing such a program are the initial cost and the burden of persuading Congress that landslides are a national problem requiring federal action.

2. *Alternative Proposal—State Insurance Programs*

Although national landslide insurance is preferable, state landslide insurance or state-mandated private insurance constitute sound alternatives.[359] If Congress fails to establish a national program, these alternatives will probably be attractive to landslide-prone states, such as California, Pennsylvania, Utah, and Washington. States could require private insurers to offer earth-movement coverage.[360] To appeal to a wide population and provide a large insurance pool,[361] coverage should apply to all forms of earth movement, including settlement and damage from expansive soils.[362] States could help allay insurer fears of large losses by creating a reinsurance fund financed by a percentage of the pre-

356. For estimates of local costs, see *supra* text accompanying notes 28-29.

357. A reasonable deductible would probably be between $5,000 and $15,000. This could be used to repair relatively minor slope-movement damage, and it would be affordable for most homeowners. Such a deductible would be large enough, however, to encourage site-drainage improvements. *See infra* note 358.

358. Improvements might include better roof drains, redesign of site drainage, installation of wells, reduction of landscape irrigation, and regular maintenance of surface drains.

359. State landslide insurance programs could be modeled after the earth-movement programs in Illinois (private insurers required to offer mine-subsidence policies in designated zones, backed by state reinsurance fund), Pennsylvania (state mine-subsidence insurance fund, private insurers required to offer polices in designated zones), or Florida (private insurers required to offer sinkhole insurance). *See supra* notes 291-99 and accompanying text.

360. An excellent model is the recent California requirement that all property insurance policies contain an offer of earthquake insurance coverage. *See* CAL. INS. CODE § 10081 (West Supp. 1985).

361. A larger insurance pool spreads the risk over a greater population and improves the ability of insurers to pay out claims and remain solvent after major disasters.

362. These are clay soils that expand when wet and shrink when dry. They can cause

miums of all earth-movement policies.[363] Insurers could set rates within state-set limits. Private insurers could also help reduce landslide hazards by offering premium reductions to property owners who undertake hazard-mitigation measures.

States, alternatively, could initiate state insurance programs similar to the proposed federal insurance program. Under such a program, states could designate hazard zones and require landslide insurance for all properties within those zones. One potential drawback to state programs is funding: States might be unwilling to appropriate money for administrative and mapping costs.[364] Under a mandatory program, however, premiums from insured properties might be sufficient to cover administrative and mapping costs.

3. *Assessment Districts—For Specific Landslide-Problem Areas*

In conjunction with state or federal insurance programs, assessment districts should be used for specific landslide-prone areas. All landslide-prone states should enact legislation similar to California's[365] to enable formation of such districts. Assessment districts provide a more direct means of financing slope stabilization and reconstruction as well as paying for preventive measures in potentially unstable areas. If Congress enacts a national insurance program, states should be required to pass legislation enabling local formation of assessment districts as a condition of participation in the program.[366] Property owners in assessment districts should have smaller landslide insurance premiums and higher deductibles, so the hazardous area encompassed by the district would not threaten the stability of the insurance fund. In effect, assessment districts would act as local self-insurance districts in areas of particularly high hazard.

B. Long-Term Strategy—Landslide Hazard Reduction

Obviously, the best way to reduce the monetary and public safety costs of landslides is to reduce landslide occurrences. This process will take many years, however, because many houses have been built in land-

considerable damage to foundations and are commonly found throughout the United States. *See generally* F. CHEN, FOUNDATIONS ON EXPANSIVE SOILS (1975).

363. The former head of the Federal Insurance Administration, Robert Hunter, has suggested this approach for landslide insurance. Telephone interview with Robert Hunter, National Insurance Consumer Organization (Nov. 1, 1985). The reinsurance companies could encourage hazard reduction by monitoring procedures for property inspection to determine rates or deny coverage. *Id.*

364. The federal government, on the other hand, should be more willing to finance these costs because the federal government bears the major share of disaster costs when serious landslide-triggering storms occur.

365. *See supra* note 308.

366. *See supra* notes 307-23 and accompanying text.

slide-prone areas. The remainder of this Comment suggests some of the most effective means for reducing landslide hazards to new construction. These means include hazard mapping and research, grading codes, and land use planning. These approaches, as explained below, complement the economic incentive of landslide insurance.

1. Hazard Mapping and Technical Research

Landslide-hazard-mapping programs and research into landslide mechanisms should be increased to provide the technical support necessary for the various policy strategies. To be effective, insurance and engineering measures depend on both continued research and the dissemination of landslide hazard information. Funding for landslide research should be provided by state legislatures and by Congress. Insurance programs could help support research and mapping efforts through a surcharge on landslide insurance premiums. In addition, contributions from FEMA for mapping and research programs should be cost effective in the long run because of the eventual reduction in the amount paid out in disaster aid.[367]

2. Local Grading Codes

Local grading codes are the simplest, most effective means of reducing hazards to new developments.[368] Any state or federal landslide-reduction program should either require or contain inducements for the adoption and implementation of local grading ordinances. Even in the absence of an insurance program, however, landslide-prone states should establish guidelines for grading codes and require local adoption and enforcement. Because enforcement, historically, has been a problem with some grading codes,[369] new codes should be established according to stringent guidelines, and they should have explicit procedures to ensure effective implementation.[370] Such codes should have strict engineering requirements, but should also establish engineering review boards to allow variances in appropriate cases.

3. Local Land Use Planning

Local land use plans are statements of long-term policy; consequently, they should strive to reduce landslide hazards. Local governments must begin to consider the long-term public costs of hillside development. As knowledge of landslide processes increases, local plans and policies must prohibit development in recognized unstable areas. If

367. FEMA annually spends approximately $20 million in landslide disaster aid. *See supra* note 77.

368. *See generally supra* notes 127-58 and accompanying text.

369. *See* C. SCULLIN, *supra* note 127, at 14-15.

370. *See supra* text accompanying notes 154-55.

hillside areas are to be developed, only those areas adjacent to existing developed areas should be built upon in order to minimize potential impacts on roads and utilities.[371] Land use plans should also call for strict grading codes. As with grading codes, state and federal agencies should provide incentives to encourage local agencies to consider landslide hazards in their land use plans. Land use planning should also be a prerequisite to community participation in public insurance programs, and it should continue to be required as a condition of receiving disaster aid.[372]

C. Prognosis—Legal Issues Under the Proposal

A coordinated program of landslide compensation and reduction should lead to decreased litigation. Providing compensation reduces the incentive to pursue landslide damage claims. Under a coordinated landslide program, less emphasis would be placed, and fewer resources expended, on finding a financially solvent tortfeasor and determining the precise cause of the damage. If widespread landslide insurance coverage were provided, the cases filed would largely be subrogation cases.

Legislative statements of government policy should help clarify the grounds for government liability in landslide cases. Legislation for landslide reduction should explicitly and implicitly define the ministerial duties of government officials regarding landslide hazards.[373] Liability could then be found against the government for not meeting those duties. Then, litigation would be used primarily to improve the implementation of policy and the enforcement of regulations rather than as a de facto uncoordinated policy instrument.[374]

CONCLUSION

Landslides are a chronic hazard to public safety and property, and thus far, public policies have failed to deal with the hazard effectively. This Comment has demonstrated the nationwide scope of landslide hazards, the lack of coordinated programs for reducing these hazards and compensating victims, and the unacceptability of continuing to depend on litigation as the major de facto policy instrument. In addition, this Comment has explored a range of policy approaches and, although each approach was found to be wanting in some respect, recommends combining these approaches to effectively reduce landslide damages and compensate victims.

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371. *See supra* text accompanying notes 119-20.

372. This is similar to NFIP. *See supra* note 262.

373. In addition, statutory statements of policy would create guidelines for discretionary decisions. *See, e.g.*, CAL. PUB. RES. CODE § 2671(b) (West 1982).

374. *See also* Sugarman, *supra* note 235, at 653 (idea of "torts as a partner" to regulatory systems).

Landslides could be reduced and victims compensated by means of a coordinated strategy consisting primarily of insurance in the short term and land use regulations supported by increased research and mapping efforts in the long term. Insurance and regulation, if properly designed and implemented, would complement and reinforce one another, and together they could significantly and effectively reduce the landslide problem in the United States.