

# PARTNERSHIPS FOR REDUCING LANDSLIDE RISK

## Assessment of the National Landslide Hazards Mitigation Strategy

Committee on the Review of the National Landslide Hazards Mitigation Strategy  
Board on Earth Sciences and Resources  
Division on Earth and Life Studies  
NATIONAL RESEARCH COUNCIL  
*OF THE NATIONAL ACADEMIES*

# Executive Summary

Landslides occur in all geographic regions of the nation in response to a wide variety of natural conditions and triggering processes that include storms, earthquakes, and human activity. Landslides in the United States constitute a serious hazard that cause substantial human and financial losses, estimated to average 25 to 50 deaths annually and to cost approximately \$1 billion to \$3 billion per year. In addition to direct and indirect financial losses, landslides cause significant environmental damage and societal disruption. Primarily because individual landslides usually affect limited local areas and individual landowners, damage resulting from landslide hazards has not generally been recognized as a problem of national importance and has not been addressed on a national basis. The absence of a coordinated, national approach to mitigating the detrimental effects of landslides has resulted in a reduced ability of state and local government agencies to apply the important lessons learned, often at considerable expense, in other parts of the country.

As a result of a congressional directive, the U.S. Geological Survey (USGS) addressed the need for a national approach by preparing the National Landslide Hazards Mitigation Strategy (Spiker and Gori, 2000).<sup>1</sup> The proposed strategy describes in broad overview the nine major components, ranging from basic research activities to improved public policy measures and enhanced mitigation, considered as the essential elements, required to address the hazards arising from landslides at a national level. The National Research Council was asked to review this proposal, with the charge given in Box ES 1.

## **BOX ES 1 – STATEMENT OF PURPOSE**

In response to a request from the U.S. Geological Survey, an ad hoc committee established under the auspices of the Board on Earth Sciences and Resources will provide advice regarding the optimum approaches and strategies that could be applied to implement federal-state-local-private partnerships to mitigate the effects of landslides and other ground failures. The study committee will:

- Assess the approach described in USGS Open-File Report 00-450, National Landslide Hazards Mitigation Strategy, comment on the federal-state-local-private partnership concept described in that report, and evaluate whether all the appropriate partners that should be involved in a national landslide hazard mitigation strategy are identified. This assessment should be provided in the form of a brief interim report.
- Consider the potential roles for each of the federal, state, local, and private sectors, and provide advice regarding implementation and funding strategies to stimulate productive, effective, coordinated partnerships.

As part of its analysis, the committee will provide an overview of research priorities required to support the activities of each sector.

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<sup>1</sup> A modified version of this report, with the same title, was recently published as USGS Circular 1244 (Spiker and Gori, 2003).

The review committee established to address this charge received input from a wide variety of interested parties during its information-gathering meetings –from federal agencies, state agencies, local jurisdictions, private companies, and the academic community. Based on this input and its own collective experience, the committee was particularly cognizant both of the diversity of issues associated with the national landslide problem that arise from regional considerations and of the considerable variations in institutional capability and responsibility at regional and local levels. It is this range of capabilities, and the widespread demand at the local level for tools and information to address this national problem that present such a clear argument for the coordination and assistance that would be provided by a national program for landslide hazards mitigation. **The committee agrees that a national approach to the mitigation of landslide hazards is needed and considers that the nine components briefly described in the USGS proposal are the essential elements of a national landslide hazard mitigation strategy.**

Responsibility for the problems posed by landslides, and for the solutions to those problems, is widely shared among different levels of government and among different stakeholders at each level. This shared responsibility emphasizes the role of the partnerships that will be required to develop and implement a national landslide hazards mitigation strategy. A key starting point for considering landslide partnerships is the recognition that for a national policy to be effective, it must shape not only federal actions but also those of state and local governments, and ultimately those of private landowners. **The committee agrees that a national landslide hazards mitigation strategy should be based on partnerships involving federal, state, local, and nongovernmental entities.**

The description of the components of the national landslide hazards mitigation strategy proposed by the USGS is brief and requires a more complete discussion of the comparative importance of each element. The committee concludes that any analysis and discussion of the proposed national strategy should include a sense of priorities, and accordingly, the commentary and recommendations presented in the following paragraphs are designed to convey the committee's priorities for a national program:

**The committee recommends that a national strategy for landslide loss reduction promotes the use of risk analysis techniques to guide loss reduction efforts at the state and local level.** Because the state of the art of landslide risk analysis is evolving, further development of risk analysis methods, and documentation and dissemination of their use, are important components of the research and application program for a national landslide strategy. Use of risk analysis for guiding appropriate choice of landslide loss reduction tools should be an important element of the technical assistance and outreach programs provided to state, local, and nongovernmental entities.

**The National Landslide Hazards Mitigation Program must play a vital role in evaluating methods, setting standards, and advancing procedures and guidelines for landslide hazard maps and assessments.** National landslide hazard information gathering and mapping should be undertaken as a component of the proposed partnerships. The program must establish standards and procedures for the collection, long-term management, and maintenance of this information. Metadata<sup>2</sup> must be associated with all data collected under accordance with National Spatial Data Infrastructure protocols. Hazard zonation mapping must be developed for multiple mapping scales by utilizing the best available technologies and accurate, high-resolution terrain information.

**In order to provide tools for landslide hazard mitigation, it will be necessary to conduct basic research on monitoring techniques and on aspects of landslide process**

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<sup>2</sup> Metadata refers to information about data (e.g., information describing data source, date collected, method of collection, etc.)

**mechanics.** An integrated research program is recommended in which intensive field studies are used to (1) improve site and laboratory characterization techniques; (2) develop new field monitoring methods; (3) obtain greater understanding of failure and movement mechanisms; and (4) develop and test models to predict failure timing location, and ultimate mass displacement. Studies of debris flows, bedrock slides, and submarine landslides deserve greatest attention. Innovative remote-sensing technologies are now offering researchers the possibility of rapid and detailed detection and monitoring of landslides. Additional support to exploit these new technologies and develop practical tools for a broad user community is needed.

**Improved education and awareness of landslide hazards and mitigation options, for decision-makers, professionals, and the general public, must be primary components of a national landslide hazard mitigation program.** Collecting and disseminating information on landslide hazards to federal, state, and local governmental agencies and non-governmental organizations, planners, policy makers, and private citizens in a form useful for planning and decision making is critically important for an effective mitigation program. Education and awareness partnerships will be most effective if implemented at the outset of the program. If the national landslide hazard mitigation program is to materialize, then broad-based acceptance, participation, and support are essential for its success.

**The committee agrees that substantially increased funding will be necessary to implement a national landslide hazards mitigation program.** The committee considers that the figure of \$20 million, presented in the USGS proposal as the amount required to support an enlarged Landslides Hazards Program within the USGS, would provide an adequate basis for the initial stages of a national strategy with a 10-year target for achieving substantial loss reduction goals. However, the committee considers that over the course of the program, the distribution of funds should progress from an initial emphasis on research, development of guidelines, and start-up to the later widespread implementation of landslide risk reduction measures through various partnership programs. The committee considers that additional increases – to annual funding of \$35 million for years 4-6 and \$50 million for years 7-10 and beyond – will be required to support these later parts of the program. The committee recognizes the reality that national budgetary considerations will determine the total annual funding provided to implement the strategy and emphasizes that it is the distribution of total available funding among the program's different components that is of paramount importance for an appropriately balanced national program.

**The committee commends the USGS for undertaking the important initial steps toward a comprehensive national landslide hazards mitigation strategy. The committee recommends that the USGS – in close partnership with other relevant agencies – produce the implementation and management plans that will provide the practical basis for an effective national strategy that can be applied at the local level.**