

## Introduction

A landslide is defined as the movement of a mass of rock, earth, or debris down a slope. Landslides comes under the classification of mass movement. There are many classification schemes for mass movement, but the classification proposed by Varnes (1978) adopted here is elaborated on in Annex 1 of this report. The definition and nomenclature of landslides and a method for reporting a landslide, as suggested by the Commission on Landslides of the International Association of Engineering Geology (IAEG), is given in Annex 2 of this report.

The Himalayas, including Jammu and Kashmir, Himachal Pradesh, Garhwal, Kumaon, Sikkim, the Darjeeling Hills, Arunachal, and the northeastern hill states of Nagaland, Mizoram, Manipur, and Meghalaya, are where the rate of incidence of landslides ranges from high to very high in India. In Peninsular India, the Western Ghats and Nilgiris have high to moderate landslide incidence rates, whereas the Eastern Ghats and the Vindhyan range show low landslide incidence rates. In many cases, landslides occur as a result of other natural hazards like earthquakes, floods, and cloudbursts, bringing catastrophe and destruction. It has been observed that the frequency and intensity of landslides have increased substantially in the last five decades. This increase is mainly attributed to two main causes: deforestation and human activities. The Himalayas have gradually lost a lot of their forest cover in the last hundred years due to exploitation for timber. All the hill states have been opened up for development through road construction and major engineering projects. All these construction activities have intensified the destabilisation of slopes and, added to this, the population pressure has resulted in degradation of the physical environment. According to this author's estimate, in India the cost of restoration work and the associated economic losses due to landslides can be conservatively estimated at IRs 200 crore (2 billion) per annum.

The damage to property and loss of lives are enormous when cumulative figures are taken of all the landslides in the country. The 20th July 1970 flash flood, caused by the damming of the Alaknanda River by a landslide and the subsequent outburst of the dam, wiped out the hamlet of Belakuchi, killing 55 persons and flooding a widespread area downstream up to the town of Srinagar. The Tista, Jalghaka, and Diama rivers of northern Bengal were flooded in 1975 due to landslides, leaving about 4,500 people homeless. In northern Sikkim, the landslides in 1983 caused extensive damage to roads and bridges, killed 35 villagers, and washed away a labour camp. In Jammu and Kashmir, landslides continued to damage the road, causing blockades for several days in 1971, 1972, 1973, 1975, 1977, 1979, and 1986. The Jhakri landslide in the Sutlej Valley, on 25th February, 1993; the Kaliasaur landslide in Alaknanda Valley, on 19th September, 1989; and frequent landslides on the Mussoorie bypass and at Kathgodam-Almora are major landslide events. From 1978 to 1979, 200 landslides were recorded in the Western Ghats and again, in 1983, a large stretch of road was damaged in the Western Ghats. Twenty-five lives were lost in the 1st July (1993) landslide in Itanagar, Arunachal Pradesh, and 40 in the 5th August (1993) landslide in Kalimpong, West Bengal. Available records show that a total of 600 persons were killed by landslides from 1975 to 1995. In the Nilgiri Hills and Western Ghats in southern India, about 100 persons have been killed and about 600 families rendered homeless during the last two decades. More recently, in September 1995, 80 persons were buried alive by a landslide in Kulu Valley, Himachal Pradesh.