

Impact of landslides in Australia to June 1999

Introduction

In the following discussion the term 'landslide' is used in a very broad sense to include rock falls and topples, flows of solid material, and slow movements of a few tens of centimetres per year. Some incidents of mine subsidence are also included in the damage estimates, although the data are incomplete. Landslides can be either the result of human activity, or else naturally occurring phenomena.

Much of the statistical information in this paper was compiled from AGSO's Australian Landslide Database but, despite sustained efforts at recording landslides, the database is certainly incomplete, and so conclusions drawn from it and any analysis are tentative.

AGSO has made the database accessible via the Worldwide Web at www.agso.gov.au/ngis/locator.html, and would welcome exchange of information on landslides to improve it and keep it current.

Landslides causing injury or death

On 30 July 1997 a landslide with a head scarp on the north western margin of the Alpine Way at Thredbo destroyed two ski lodges and trapped 19 people. Eighteen of these were eventually confirmed dead and one person was rescued alive.

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The death toll exceeds that of the 1989 Newcastle earthquake. However, Thredbo is not an isolated incident.

In Australia, 47 landslides are known to have caused injury or death during the period 1842–June 1999. At least 82 people have been killed by at least 36 landslides. These figures are probably underestimates, as Australian landslides tend to pick people off in ones and twos, events which tend not to be widely reported. An additional 52 people are known to have been injured by landslides.

Almost half (about 20) of the landslides causing injury or death were rock falls/topples. In some cases rocks were inadvertently dislodged by human activities, while in others the rock fall was the result of natural causes.

Thirteen of the 47 landslides involved material falling from cliffs. The cliff event causing the most recorded casualties was the Cowaramup rock fall, Margaret River, WA, of 27 September 1996. Nine people were killed and three injured while attending a primary school surf carnival. During the period January 1996–June 1999,

six out of the 12 landslides causing injury or death involved the fall or topple of a single rock!

The most recent landslide deaths and injuries happened in 1998. In January, a man was injured by a toppling rock on Mt Stuart, Townsville, and a 12 year old boy was killed near Eden, NSW when a hole he and his brother were digging in the beach caved in and buried him.

In April 1998, two boys were injured and had to be taken to different hospitals in separate rescue helicopters when they got buried in a cave-in caused by their tunnelling into a sand cliff at Teewah Beach, north of Noosa, Queensland. In May, two train drivers were killed near Robertson, NSW, when their train capsized after hitting debris from an old railway bridge abutment collapse.

Damage to buildings

Fifty-six landslides are known to have caused damage to over 200 buildings (Michael-Leiba et al, 1997) during the period 1842–June 1999. A number of these were written off, along with the land on which they were built.

The most expensive incident was at Lawrence Vale, Launceston, Tasmania in the 1960s when two adjacent landslides in Tertiary sediments destroyed 35 houses. Land was also written off. The cost is estimated at \$4.6 million in 1999 dollars.

The two most recent incidents in which buildings were destroyed both involved debris flows. In January 1998, a debris flow, triggered by torrential rain on Magnetic Island, Queensland destroyed up to 18 units of the Magnetic Island International Resort. In August 1998, a debris flow from Mt Keira, Wollongong, NSW, destroyed a mine building part way up the mountain and a suburban house in the runout zone.

Both these instances of destruction were by fast moving landslides, but buildings have been, and are currently being, damaged or destroyed by very slow moving landslides with speeds of less than 100 mm per year.

The total direct dollar cost of damage (of which we are aware) to houses and residential land from Australian landslides since 1842 is estimated to be around \$25 million in 1999 currency. Landslide damage is not normally covered by



This small landslide on the Paluma Road, north of Townsville, killed a woms during Tropical Cyclone Justin in March 1997

insurance in Australia, so the human cost in terms of stress to affected property owners is high. One man died of a heart attack after having learnt that his house was being destroyed by a slow moving landslide.

Landslide damage to infrastructure

Hundreds of landslides are recorded as having caused damage to roads, railways or pipelines, and/or to have required stabilisation, and the data are certainly incomplete. There are too few financial data to estimate the cost in dollar terms. However, a gabion wall repair of a small road fill failure at Macquarie Pass, NSW, in February 1997 cost \$250,000 and necessitated road closure for about two weeks.

An expensive example is the Wollongong–Sydney–Brisbane railway, where costs associated with landslide damage are estimated to average \$25 million per year during the period 1989–1996. The costs prior to 1989 are not available.

Damage to agricultural land and crops

Five landslides are mentioned as having caused damage to agricultural land, and we estimate a total loss of \$1.3 million (Michael-Leiba et al, 1997). It is likely that both the number of landslides and the cost are gross underestimates.



This landslide, on Lake Morris Road near Cairns, was triggered by heavy rain in March 1999.

Loss of earnings, productivity, etc.

Losses of productivity, earnings or time caused by landslides include: people's time involved in rescue, evacuation, clearance of debris, and legal action; temporary closure of the Magnetic Island International Resort; land unable to be developed; temporary mine closures; damage to fences; and road and rail closures of up to almost three months. Occasionally, residents have suffered the inconvenience of a road being permanently closed, as in the case of Comet Street–Granadilla Drive in Cairns, where the 1990 Tropical Cyclone Joy caused

a landslide which permanently restricted the connection of these once-continuous streets to a pedestrian walkway. There are too few data to put a dollar figure on these losses.

Conclusions

Although the damage caused by an individual landslide in Australia tends to be more localised than that from a damaging earthquake, landslides have killed more than five times the number of people killed by earthquakes. Thirty-six landslides have caused fatalities, compared with two earthquakes.

Landslides are estimated to have caused at least hundreds of millions of dollars worth of damage in Australia in addition to at least 82 deaths and 52 injuries. Consequently, they are worthy of consideration when identifying geohazards in an area.

Finally, we recommend teaching about the dangers of landslides, particularly rock falls from cliffs and ledges and collapses caused by excavation. The education would be particularly valuable if aimed at primary school children. Hopefully, it may save a few lives as five out of the eight landslides which caused fatalities during the period January 1996–June 1999 involved children aged 13 and under.

References

Michael-Leiba M., Andrews K. and Blong R. (1997), 'Impact of landslides in Australia', *The Australian Journal of Emergency Management* Vol 12 (1), pp 23–25.



This old mine building on Mt Keira was destroyed by a debris flow during the Wollongong floods in August 1998.