

URBAN LANDSLIDE HAZARD IN RIO DE JANEIRO

by John Rutter



Figure 2: Rio de Janeiro, 'The marvellous city'

Source: Wikimedia Commons; photo by Jens Hausherr

MASS MOVEMENT is the geographical term that refers to the downhill movement of rock debris and soil due to the force of gravity. It often depends on water acting as a lubricant, making the debris slippery and easier to move. In wet weather this process can cause landslides – fast movements of earth which take place on steeper slopes and often occur with very little warning (Figure 1). They are particularly common during periods of heavy rain when the topmost layer of surface material becomes saturated and extremely heavy and can move downhill very quickly and dramatically.

Landslides are a natural hazard and may have no effect on people.

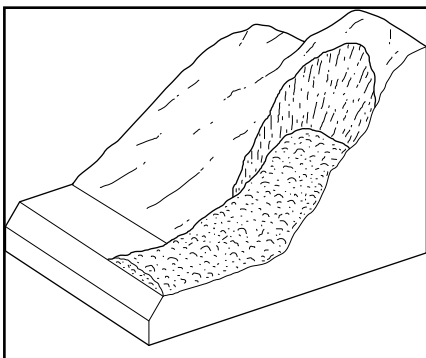


Figure 1: Landslide

However, when they take place in urban areas they have the potential to cause disaster. On the edges (and sometimes in the centres) of many major cities in developing countries, where huge numbers of people are migrating to take advantage of the opportunities offered by rapid development, uncontrolled housing built on hillsides poses a particular problem. Studying how landslides affect these urban areas illustrates the importance of the relationship between people and their environment – a fundamental concept in geography. This unit uses case study examples from recent events in Rio de Janeiro to show the causes, effects and aftermath of these geographical processes.

The 'marvellous city' of Rio de Janeiro

Rio de Janeiro (Figure 2), *Cidade Maravilhosa* ('Marvellous City'), is Brazil's second largest city (after São Paulo) and, with over 7 million people, is the 26th largest in the world. For nearly 200 years it was the capital of the country, before being supplanted by Brasilia in 1960. It is the country's premier tourist attraction and millions of people visit each year, attracted to

sights such as the statue of Christ the Redeemer, the spectacular carnival, and the world-famous Copacabana beach. Visitor numbers are set to soar over the next few years as the city hosts the world's two biggest sporting events – the 2014 FIFA World Cup and the next Olympic Games in 2016.

Many tourists are also attracted by the excellent climate (Figure 3). It is tropical and temperate with temperatures averaging between 25 and 30°C. Rainfall can be relatively high, at around 1,200 mm a year (compared with around 900 mm for Manchester). The majority of the rain falls between December and March and it can be very heavy – increasing the risk of landslides.

The attractions of jobs in the tourism sector, and other industrial opportunities, have led to a big increase in migration into the city over the last 20 years. These 'pull' factors have combined with reduced opportunities for economic success in the countryside and with initially high (although now decreasing) population growth. As can be seen from Figure 2, there is not a lot of room for all

	Temperature (°C)	Precipitation (mm)
January	26.4	114.1
February	26.7	105.3
March	26.4	103.3
April	24.9	137.4
May	23.4	85.6
June	22.0	80.4
July	21.9	56.4
August	22.3	50.5
September	22.1	87.1
October	23.1	88.2
November	24.4	95.6
December	25.5	169.0

Figure 3: Climate data for Rio de Janeiro, Brazil

Source: World Meteorological Organisation/Hong Kong Observatory

these immigrants to build houses. Many have been forced to take land on the steep hillsides in and around the city, leading to the growth of the favelas.

Living on the edge – life in a favela

Rio has seen a huge growth in its population over the last 60 years, from just over 2 million inhabitants to 7 million and increasing (Figure 4). While this type of urban growth is not unusual for developing countries, especially in South America, what is unusual about Rio is the lack of available land on which to build. Figure 2 shows a city hemmed in by the sea on one side and by hills and mountains on the others. Despite this, many people come to the city each year to escape from poverty in the countryside. Sometimes this migration is increased by major disasters such as the drought in north-east Brazil in the 1970s, but there has also been a constant stream of people who are attracted by the ‘bright lights’ of the big city and who merely want to try to make a better life for themselves and their families.

These immigrants often arrive in the city with few possessions, and

have nowhere to go. They are pushed onto the poorest-quality land that nobody else can find an economic use for. In Rio, these areas are the steep hillsides in the centre and on the outskirts of the built-up area. Here, the shanty towns (known as ‘favelas’) have developed to house the poorest sections of society. Over 1 million of Rio’s inhabitants live in these areas of informal housing. The most famous favela is Rocinha, which is home to between 150,000 and 300,000 people, although nobody really knows for sure. Settling in houses made of cardboard, wood, corrugated iron and whatever else they can find, the very worst land has the only building plots available. Often it is very steep and, of course, susceptible to landslides when the heavy rains of the summer months start to fall.

‘A sea of mud’ – the 2010 disaster

‘The situation is extremely critical. Don’t leave your homes, don’t take your children to school until we can better evaluate the situation.’

Eduardo Paes,
city mayor of Rio de Janeiro,
April 2010

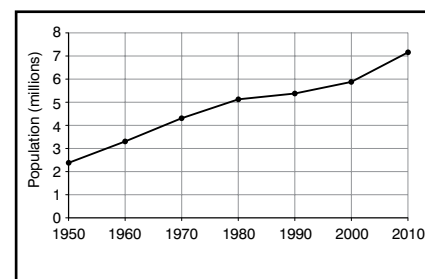


Figure 4: Population growth in Rio de Janeiro, 1960–2010

On the afternoon of 5 April 2010, the combination of poorly built accommodation, steep hillsides and torrential rain caused the first in a series of disastrous landslides that killed hundreds of people. Over a period of 24 hours, almost 250 mm of rain fell (equivalent, according to the Brazilian TV station Globo, to 300,000 Olympic-sized swimming pools). It was the heaviest downpour in almost 50 years and the state governor, Sergio Cabral, said the storms were the worst in the city’s history.

While roads were flooded and sewers overflowed in the northern and central parts of the city, there were much worse effects in the favelas lodged precariously on the steep hillsides. Removal of the protective vegetation to allow building to take place had exposed the loose (unconsolidated) soil. On top of this, poorly constructed buildings were put up. Some of these were several storeys high – Brazilians can make money by building their home and then renting their roof space for somebody else to come along and do the same on top of them. The weight of these multi-storey buildings had added to the instability of the slopes. Areas covered by tarmac also provided fast run-off for the heavy rainfall, channelling water down the slopes.

As these human and physical factors combined, the resulting destruction was inevitable. In many areas, tonnes of mud and debris crashed down the hillsides, burying people in their own homes. In Niteroi, across the

bay from the main city, at least 50 homes were swept away by a landslide and more than 200 people lost their lives. Most tragically, a nursery for children was amongst the buildings destroyed.

After a disastrous few days the authorities took stock and found that around 4,000 families were homeless and up to 10,000 were still living in high-risk areas. At least 70,000 aid packages containing food, clothing and medical supplies were distributed to those in need but there were also calls for much more long-term solutions such as providing decent homes for the urban poor. Fearful of bad publicity in advance of the forthcoming World Cup and Olympic Games, the government announced a re-housing programme for those worst affected and asked for over £100 million in funds from the Brazilian government.

The rich also suffer – the 2011 disaster

Despite the wake-up call given by the 2010 mudslides, worse was to follow less than a year later. This time the mountains just to the north of Rio were the location, as the equivalent of one month's rainfall fell in a little over 24 hours between 11 and 12 January 2011. Over 900 people were killed in the mud and debris flows that came hurtling down sheer granite cliff faces, burying and destroying hundreds of homes below. Among the victims were more than 400 people in the town of Nova Friburgo (Figure 5), around 380 in Teresopolis, and dozens more in Petropolis. More than 13,500 people were also left homeless after the mudslides had passed. This time there was little doubt in the minds of the national politicians that poor building controls and illegal squatter settlements were to blame for the number of people who died.

One difference between the landslides of 2011 and those of



Figure 5: Landslide damage in Nova Friburgo

Source: Wikimedia Commons; photo by Valtair Campanato/ABr

2010 was the number of people from Brazil's more affluent classes who were affected. The towns to the north of Rio are popular tourist resorts for rich city dwellers and many have second homes there, or hire them during the summer months from December through February. In direct contrast to the previous landslides, which almost exclusively affected the urban poor, many of those who were killed or lost property and possessions in 2011 were considerably better off – showing that geographical processes make no concession to wealth.

Rescue organisations were considerably quicker to react in January 2011 than they had been eight months previously. More than 800 emergency workers were on the scene soon after the disaster, setting up rescue shelters (Figure 6) and handing out emergency packs, while the Brazilian Navy also set up well-equipped field hospitals to care for the survivors. National organisations were joined by international rescue teams that had been involved in the aid response to the Haitian earthquake of January 2010. However, with the destruction of roads and bridges and the lack of electricity and communication lines (blocked by the mud and debris flowing off the hillsides), rescue attempts were severely hampered. As with most disasters, from earthquakes



Figure 6: Rescue shelter for landslide victims in Teresopolis

Source: Wikimedia Commons; photo by Vladimir Platonow/ABr

through to hurricanes, the affected areas were also left with a lack of clean drinking water, and widespread concerns that waterborne diseases would take hold and spread rapidly through the weakened survivors.

Threats for the future

If anything good came out of the disasters of 2010 and 2011 it was the promise from the Brazilian government that the issue of poor-quality housing would be addressed in the country's major cities. Many commented that the deaths were 'more man-made than natural' and politicians were forced to take much more account of those suffering from urban poverty in their future planning. Although it is too early to see the effects of these promises taking hold, Brazil has a huge public image to maintain in this respect as the world's sporting spotlight falls on the country over the next few years.

Activities

1 Write a definition of mass movement.

2 Copy and complete the following paragraph explaining how landslides happen:

Mass movements often depend on _____ acting as a _____, making the debris _____ and easier to move. In wet weather, _____ are often the result of this process. These are _____ movements of earth which take place on _____ slopes and often occur with very little _____. Landslides form a natural _____ but may have no effect on humans except when they take place in _____ areas when they have the potential to be disastrous.

3 Make a larger copy of the blank sketch map of Brazil shown in Figure 7 and, using an atlas, add the following cities and other features:

- Rio de Janeiro, São Paulo, Brasília, Recife, Manaus
- the Mato Grosso and Pantanal
- the course of the Amazon river
- the area covered by the Amazon rainforest.

Extension exercise: Using the internet, find out more about the features listed above and add some brief details to your sketch map.



Figure 7: Brazil

4 Using the information shown in Figure 3, construct a climate graph showing the average weather conditions found in Rio de Janeiro.

5 Make a copy of Figure 1, but ‘customise’ your diagram to show how such processes could have occurred in Rio de Janeiro (add sketched details of the housing and other features such as roads that may have contributed to the effects, and labels to explain the events).

6 Use the information in Figure 8 to construct a bar chart showing the number of people migrating into Rio de Janeiro from other parts of Brazil.

7 Report writing exercise
Using all the information from this unit and from the activities you have completed above, write a report detailing the background to the Rio landslides, how they occurred, their effects, and the contribution to the disaster made by human changes to the environment. You should aim to write between one and two A4 pages and use diagrams to illustrate your work.

8 ICT extension
Investigate another landslide from around the world that has resulted in a significant loss of life or damage to property. Some, such as the Yungay disaster of 1970, have resulted in the deaths of many thousands of people. Prepare a brief synopsis of your chosen landslide and present it to other members of the class.

9 Discussion
As a class, discuss the following statement:

‘Natural disasters are an inevitable consequence when humans try to change the natural environment.’

From (city)	Number
Belem	4,936
Fortaleza	5,591
Recife	6,142
Salvador	7,844
Belo Horizonte	9,041
São Paulo	23,894
Curitiba	3,883
Porto Alegre	7,892

Figure 8: Numbers migrating to Rio de Janeiro, 1985–2000

Source: www.scielo.br/scielo.php?pid=S0103-40142006000200017&script=sci_arttext&ctlng=en

10 Fieldwork exercise
Working in groups, head out into your local area to see if you can find examples of landslides, or susceptible areas where they could happen in the future. This will be easier if your school is in the countryside but even in town it is possible to find examples if you look on steep slopes and at the sides of rivers. Try to estimate the damage that would be caused if a landslide took place.