

What contribution can
geographers make to
moderate the impact
of natural hazards ...



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Traditionally, the term 'natural hazard' was an easy concept to define. It referred to any event with its origins in natural phenomena, such as earth movements or weather, which caused human suffering in the form of life-loss, injury or economic hardship. Almost all disasters were seen as natural – earthquakes, famine, floods and hurricanes, for instance – often with implications of divine judgement or ill fate, but only rarely was human culpability suggested. More recently, however, the idea that disasters may be partially human-induced has been proposed – with considerable vehemence in the case of many environmental movements.

For instance, the deforestation of steep slopes in the Himalayas, is now widely-accepted as a cause of an increased frequency of landslides, and has even been suggested as the cause of flooding as far away as Bangladesh. Today, therefore, although the name 'natural' hazards remains, the human component is being shown to be of increasing importance. The human interaction with hazards is of crucial importance in another way as well, since a distinction must be drawn between a 'hazard' (which is, the natural phenomenon itself) and a 'disaster', which is the negative impact of a hazard on people. Indeed, according to White (1977), the human component is of paramount importance: 'By definition, no natural hazard exists apart from human adjustment to it.

' In effect, a 'disaster' cannot actually occur, unless there are people present to feel its negative impacts. In this way, the number of disasters is often said to be increasing owing to the rising global population, and, in particular, the fact that this forces more people into living in vulnerable environments.

When the impact of natural hazards is put in perspective, however, the effect

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which it has on humans can seem minimal – worldwide there are more deaths from car accidents than from natural hazards (Varley, 1994), and a simple lack of primary healthcare in many countries is almost certainly the world's biggest killer. From a strict cost assessment, one might argue that society should let nature take its course, and put its resources into minimising medical risks and everyday accidents. ' (Lundgren, 1988: 761)

This Marxist perspective on hazard management is, in my opinion, an important one to consider, as it can interact with already-existing development programmes.

That is not to diminish the direct impact of the hazard itself, however. For the area which is hit, the effects (both economically and in human terms) can be devastating. Estimates of the economic costs of natural hazards for the United States of America alone, vary from \$5 to 10 billion per annum (Rossi et al. , 1983).

The ultimate decision, which I will be debating in the essay, therefore, is whether to tackle the issue of natural hazards from a technological standpoint – trying to find solutions to the physical consequences of a disaster – or whether it should be approached from a social point-of-view, by looking at the underdevelopment issue, which theoretically makes people more vulnerable. At the moment, most disaster-prevention techniques used are on the technical side. This is probably partly because the hazard itself provides a more easily-identifiable target for assistance, than opening the can of worms of development issues. The Developed World, where most of the funding originates, is also far more enthusiastic about spending on research programmes which might ultimately be of benefit to them, than <https://assignbuster.com/what-contribution-can-geographers-make-to-moderate-the-impact-of-natural-hazards-essay/>

improving primary healthcare in a remote region of Africa. Linked to this is the prestige involved in disaster research and relief, which outweighs more mundane development projects. However, in the eyes of the public, who ultimately have a say in how public and private funds are spent, the idea that natural disasters and development issues are inter-related has been propagated, as a way to increase donations, as the economically-downtrodden are seen as being dealt a final blow by nature; but how accurate is this image? Disasters and Development Issues Many authors writing on the issue of 'natural' disasters are writing from a Marxist perspective (O'Keefe and Watts, for instance).

The underlying suggestion being that hazard events become disasters more commonly in a setting of underdevelopment and poverty, than in the Developed World. This Marxist theory follows four main lines of argument: 1) exploitation of the Third World increases the frequency of natural disasters, as socio-economic conditions and the physical environment deteriorate; 2) the poorest classes suffer the most; 3) disaster relief maintains the status quo; and 4) measures to prevent or minimise the effects of disasters which rely on high-tech solutions, reinforce the conditions of underdevelopment, exploitation and poverty (Bryant, 1991). These viewpoints aim to, 'take the naturalness out of natural disasters' (O'Keefe et al. 1976: 1) by emphasising human responsibility (and especially that of the rich North). The new assertion is that disasters do not simply happen, but are caused (Oliver-Smith, 1994).

In many respects this is an appropriate stance to take. The frequency of disasters has not increased considerably over the past twenty years, and yet <https://assignbuster.com/what-contribution-can-geographers-make-to-moderate-the-impact-of-natural-hazards-essay/>

human and material losses have; this, it can be argued, is a response to increasing poverty and domination in less-developed countries. Furthermore, hazards of similar severity often have dramatically differing impacts in the Developed, compared with the Developing World (O'Keefe et al. 1976). For instance Cyclones Tracy and Fifi of 1974 were of similar intensity - each destroying about 80% of the buildings in their separate impact zones.

However, Tracy killed only 64 people when she hit Darwin, Australia, while Fifi killed more than 8000 in the Honduras. The term ' classquake' has been coined for such a phenomenon, since the Guatemalan earthquake of 1975 (Oliver-Smith, 1994), illustrating the differing impacts which natural hazards can have on different sectors of the population. The vulnerability of people living in the hazard's impact zone is, therefore, of great importance.

However, in my opinion, it is inaccurate to judge this vulnerability along class lines alone (as Marxists would wish), since vulnerability is a far more complex issue than this, dependent on a particular group's lifestyle, their health, their access to information, their degree of preparedness and even local customs (Cannon, 1994). While it is true that these factors do align according to class divisions in many cases, the suggestion that socialism will alleviate suffering from natural hazard events, is erroneous. Some of the worst disasters this century have occurred in Socialist countries - for instance, the Chinese famine of 1959 to 1961 caused 26 million premature deaths; induced by the introduction of unsuitable new forms of collective ownership and the ' Great Leap Forward', both policies of the Communist regime (Cannon, 1994).

The issue of vulnerability is, therefore, a complex one, but one which is of obvious relevance to this question, which is really asking how vulnerability can be reduced. I would argue that risk is an inherent part of a natural hazard and one which can be little changed, but the impacts of a natural hazard can be moderated in two main ways, as stated above. Firstly, there are the technological solutions, which tend to ignore the human issues - these are popular with Capitalists as they prevent the need for complex social change. From the Marxist perspective, physical solutions are seen as ignoring the real problem; instead what is needed is widespread social equality or the situation is going to get progressively worse. I will, therefore, argue these opposing theoretical cases for the moderation of natural hazards, using the example of earthquakes, as representative of any hazard.

Physical Solutions to Earthquake Hazards

These tend to be high-tech and approach the problem with one of four aims: stopping the event from occurring, reducing its intensity, warning people of its approach or possible future occurrence or, increasing the resistance of the area liable to be affected.

Of all natural hazards, earthquakes and volcanoes release the greatest amount of energy in the shortest possible time - their destructive potential is huge. On average, earthquakes kill 10, 000 people and cause US\$ 400 million worth of property damage, per annum; although these figures can be far higher in any one year - the 1976 earthquake in Tangshan, China, for instance, killed 250, 000 (Bryant, 1991). Fires are a common event after earthquakes, and frequently cause the majority of deaths. For instance, the fires which followed the Tokyo earthquake of 1923 were on the same scale

as the Great Fire of London, 1666 (Bryant, 1991), causing most of the deaths. Another hazard associated with earthquakes are the huge tidal waves, or tsunamis, which they sometimes initiate, often triggered by the huge pressure changes which occur near the epicentre (the point from which the earthquake is initiated). Earthquakes, usually occur on, or near, plate boundaries and represent the release of energy when two plates shift position relative to one another.

For instance, the San Andreas Fault, California, (a transform plate margin - Figure 1) has been active since the Jurassic age - the two plates having moved 550 km past each other since this period. In some cases, however, earthquakes represent the release of stresses built up in other ways. For instance, the area between Tibet and Korea forms an important earthquake region, but lies up to 1000km from the nearest plate boundary. In this case, it is the continuing passage of India northwards into the continent of Asia, which has set up the stresses. Glacial deloading has also been held responsible for earthquakes, for instance in the region of the Canadian Shield. Indeed, earthquakes can occur anywhere in the world (making them a good case study) - an earthquake in the supposedly aseismic area of New South Wales, Australia in 1989, for instance, killed 12 people and caused A\$1000 million of damage.

The building of some dams (notably the Hoover Dam, USA, built in 1935) has also been shown to increase the frequency of earthquakes, possibly because water is able to penetrate bedrock and lubricate slippage. Mining and fluid disposal have also been held responsible for increasing seismic activity

(Bryant, 1991). Despite intense research into tectonics, few possibilities of <https://assignbuster.com/what-contribution-can-geographers-make-to-moderate-the-impact-of-natural-hazards-essay/>

preventing, or even reducing, the intensity of earthquakes have emerged. Those which have been tried have shown little success. For instance, injections of fluid into the San Andreas fault have been used to try to help the plates slip past one another smoothly.

It is hard to tell how effective this has been, as no-one really knows how many earthquakes (if any) it has prevented or reduced. What is certain, however, is that the area is still prone to earthquakes, as was demonstrated in 1989 when an earthquake destroyed the Marina area of San Francisco. It is obviously impossible to divert an earthquake elsewhere (as has been attempted with cyclones, for instance); overall, it seems that technology has been largely unsuccessful in finding a solution to earthquakes. As with most natural hazards, people must 'learn to live with them'. In this respect, however, technology has made some great leaps forward in two directions: firstly, predicting the event and, thereby allowing people to take cover or other precautionary steps; and secondly, reinforcing cities against the onslaught of an earthquake.

The identification of tectonically-hazardous areas has been attempted for many years. As early as AD132 the Chinese were taking basic measurements (Bryant, 1991) and numerous other historical accounts exist of the events themselves. One of the most useful techniques, therefore, has been collecting this information to attempt to calculate recurrence intervals of earthquakes for each region. The study of records has enabled the production of 'seismic maps' which show the areas of greatest risk.

For instance, according to such calculations, it has been forecast that California is overdue for a shock of over 7 on the Richter Scale (which measures the intensity of earth movements), which has potentially devastating consequences, considering the degree to which the area is now built-up (Bryant, 1991). In addition to this information, triangulation stations have now been set up in many areas to enable the measurement of gross movements in the earth's crust. Laser equipment is also being increasingly used, to measure tiny changes across fault zones (again, research on the San Andreas fault is in the forefront of this technology). The traditional geographical skills of mapping and statistical analysis are, therefore, proving very important when it comes to analysing the spatial distribution of tectonic risk.

Several monitoring bodies have now been set up to analyse this information and produce warnings; for instance, the Pacific Tsunami Warning Center in Hawaii and the Earthquake Research Institute in Tokyo (Bryant, 1991). Forecasting can also be assisted by precursor events which commonly occur before a major earthquake. There has been considerable success in interpreting these signals to allow an area to be evacuated prior to a large earthquake. These precursors include: smaller shocks which frequently occur prior to a major event, often in a ring round the future epicentre forming a Mogi Doughnut; the fluctuation of groundwater levels in wells and strange weather or animal behaviour have also been suggested as heralding an earthquake.

The Chinese have had the greatest success in predicting earthquakes. In 1975, the city of Haicheng became the first city to be evacuated prior to an <https://assignbuster.com/what-contribution-can-geographers-make-to-moderate-the-impact-of-natural-hazards-essay/>

earthquake, and during the 1970s, four out of five of China's major earthquakes were predicted early enough to allow the area to be evacuated. In other cases, however, a false prediction has led to costly evacuation procedures coming to nothing. Once a seismic map has been produced for an area, infrastructure can be tailored to suit the degree of risk from earthquakes. Earthquake regulations now guide construction of buildings in many cities at risk, Tokyo, for instance, and new materials and architectural designs are constantly being tested to try to make cities as safe as possible. In the Developed World, at least, buildings are being rebuilt to withstand stronger shocks, dams reinforced and land-use zoning used to prevent, for instance, the building of nuclear power plants on faultlines.

These measures have experienced varying degrees of success. For instance, a large section of the upper deck of the Nimitz Freeway in Oakland collapsed in San Francisco's 1989 earthquake, despite being built to conform to earthquake regulations and doubt has been cast over the siting of Los Angeles' new Diablo Canyon nuclear power plant, which is within 5km of an active faultline (Bryant, 1991). As far as the Developing World is concerned, a shortage of cash frequently prevents the implementation of safety precautions, leaving many cities open to disaster. For instance, Mexico City is particularly prone to earthquakes, as the city is founded on a dry lake bed, which consists of unconsolidated sediments - it has been shown that unconsolidated ground can amplify shockwaves by up to six times. However, few building regulations exist or are implemented. The 1985 earthquake, led to the destruction of 10% of buildings (Bryant, 1991).

In this way, physical solutions to the problems caused by earthquakes have been attempted, and some have shown limited success. Overall, however, people must still learn to live with earthquakes if they have settled in a tectonically-hazardous environment. So perhaps the best solution is the Marxist one of reducing the vulnerability of the people living in earthquake-zones by reducing social inequality. Social Reform as a Method of Moderating the Damage Caused by Earthquakes The first point which must be made in such a discussion is that not all earthquake zones affect the economically-disadvantaged.

The distribution of earthquakes is dependent almost purely on physical conditions, to a greater extent than almost any other natural hazard and so it is possible easily to compare the impacts of similar events on two people of differing socio-economic status. In purely economic terms, the wealthy often suffer greater losses, for the simple reason that they have more to lose. However, they also have the financial capacity, and frequently insurance as well, to help them quickly to recover from earthquake damage. For instance, Rossi et al.

1983) found, in a survey of 13, 000 American households, that most had returned to 'normal' life within a month of the event. Help was available to them in the form of insurance, government assistance, aid from organisations like the Red Cross, and neighbours, friends and family. However, Rossi et al. did find that race affected the extent of financial burden suffered. Financial gaps were calculated for white and non-white families, by totalling the expenditure which repairs required in excess of what the family could afford.

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Non-whites were found to have a financial gap of, on average, \$2400 more than their white counterparts. This illustrates the localised inequalities which are frequently suffered between different groups of disaster victims. For a family in the Developing World, insurance is almost certainly out of the question, and the overstretched government budget is likely to have little excess to spend on disaster relief. In this respect, it would seem that already-disadvantaged disaster victims do suffer proportionally more. The alleviation of poverty would seem to be an effective way of reducing suffering from disasters, as well as improving overall conditions.

The practical problems of solving underdevelopment issues are immense, however, and so, as Parker (1992) points out, it is important not to allow this fact to become a 'policy impasse', preventing any action from being taken at all: 'If disaster vulnerability is a consequence of poverty, reducing disaster vulnerability would require the eradication of poverty - very desirable, but not likely to be achieved in the short term. In the short term, therefore, there is perhaps a role for technological solutions. The other side of this argument suggests that people live in a state of underdevelopment because of the natural hazards which beset their country. Bangladesh, for example, is affected again and again by flooding and tropical cyclones. In 1960 to 1970, alone, Bangladeshis suffered 13 cyclones. The net result is that Bangladesh's development funds are repeatedly used for emergency relief.

In the year 1988 to 1989, for instance, the development budget was cut by 45% to pay for reparative measures (Brammer, 1990). This form of

environmental determinism is somewhat unhelpful, however, as again, it <https://assignbuster.com/what-contribution-can-geographers-make-to-moderate-the-impact-of-natural-hazards-essay/>

discourages a search for effective solutions to the problem. If social problems are to provide any solution to the alleviation of suffering from natural hazards, it is important to change our emphasis from the ' extreme events' themselves, to include the societal and human-environmental relations that ' prefigure' disaster (Hewitt, 1983). For instance, this might involve rehousing projects, to move people to less vulnerable areas, as in many cities shanty towns can be found lining riverbanks, where they are prone to flood, or on steep slopes, where landslides are common. If food security could be increased and surpluses stored, this would again be beneficial in a disaster scenario, if crops were destroyed.

Similarly, primary healthcare is a useful preventative measure, improving people's overall fitness, to give them more resilience to disasters when they do strike. In the case of earthquakes, in particular, several practical measures could be implemented. People living on unconsolidated ground should be moved, as the movement of unconsolidated soil particles can amplify earth tremors in the event of an earthquake, although this is not always possible - the moving of the whole of Mexico City, for instance, is obviously not practical. Investment could go towards reinforcing buildings, as the poverty-stricken frequently live in unstable and dangerous housing (although, conversely, the poorest members of society living in self-built housing may actually be at an advantage, as their building materials are usually light and flimsy and, therefore, collapse easily without causing injury). Poverty can also increase vulnerability in the months after a disaster as the poor have no resources in reserve to draw upon in times of hardship. Aid must, therefore, be targeted specifically at those in most need - the

provision of basic building materials, for instance, or seed and farming implements to allow people to feed themselves once again.

It is almost certainly true that the disadvantage are forced into a far more difficult situation than those who have other resources to draw upon. The provision of assistance for these people is, therefore, crucial. However, psychologically at least, the effects of a disaster do not discriminate between rich and poor and so it is important not to separate out 'innocent victims' from the total population. In reality it is largely a case of 'being in the wrong place at the wrong time'. Ideally, the alleviation of poverty would have far-reaching positive effects in the reduction of earthquakes and other natural disasters.

However, it is perhaps impractical and unfair to suggest that aid, or even sympathy, should be distributed along class lines. Conclusion It rapidly becomes apparent that the moderation of the impact of natural hazards is not a simple question of ways to prevent a physical event from occurring. Instead, it involves a complex discussion of socio-economic and political factors. In this respect, geographers are vital for their skills of integrating the physical and social arguments. Unfortunately, as population densities increase, often in those areas most at risk - for instance along river valleys, prone to flooding, or in coastal regions, prone to cyclones - the stakes get higher and higher.

It is, therefore, of great importance to continue to study ways of alleviating the suffering caused by these events, as well as ways of reducing vulnerability. However, I think that it is certainly true that, in the end, the

greatest suffering will be reduced by looking more carefully at issues of global inequality. If all the money which had been invested in prestigious projects like lubricating the San Andreas fault had been invested in primary health care in Mexico, the number of lives saved would, without a doubt, have been immeasurably higher. Once again, however, political factors dominate the decision-making process, and so the most logical solution is not implemented.