

## Natural Disasters: How can we improve?

### Fact Sheet

#### Lesson 1: Earthquakes don't kill people. Buildings do! (conceptualising vulnerability)

#### Starter

#### Earthquakes don't kill people. Buildings do!

$$\text{RISK} = \frac{\text{HAZARDS} \times \text{VULNERABILITY}}{\text{CAPACITY TO COPE}}$$

**Vulnerability** is a key concept for hazard and disaster studies. The vulnerability of a population is a function of demographic and socio-economic factors, and of a community's preparedness and ability to deal with a hazard event when it occurs. There are many reasons why some populations – or some sectors of a population – are more vulnerable to hazards than others. And proximity to a natural hazard (for instance living on an active fault line or in a cyclone belt) is only one aspect the disaster equation.

The disaster equation is a useful teaching tool as it immediately flags up to students the fact that human factors constitute more than half of the risk. Vulnerability and people's capacity to cope feature, along with the hazard event itself, as three elements of the disaster equation.

Architecture for Humanity is a non-governmental organisation (NGO) whose work features throughout this scheme of work. They have produced a short film that uses the slogan "Earthquakes don't kill people. Buildings do!" This film can be played to students as a starter activity to help them focus on the key issues and concepts.

#### Specification advice

**Edexcel, OCR, AQA, WJEC and IB** centres will all be investigating natural hazards and disasters as either a compulsory or popular option topic. Some Specifications restrict study to tectonic hazards (OCR, AQA, WJEC); Edexcel and IB prescribe a wide range of natural hazards for investigation.

#### Teaching tip

The disaster equation can be presented to students at the very start of the lesson. The short film produced by Architecture for Humanity will help consolidate understanding that risk modelling has both physical and human elements. View the film at: <http://www.youtube.com/watch?v=bxn5bT7G7Os>  
NB. THE LYRICS CONTAIN SWEARING

## Main activity

### (1) Understanding vulnerability

#### Case study: Haiti earthquake 2010

The 2010 Haiti earthquake struck on 12 January. The 7.0 earthquake event was centred very close to Port-au-Prince, the capital city. The proximity of the event to a highly populated area was the first key factor that led to a natural **hazard** event resulting in a major **disaster**: an estimated three million people were affected to some degree by the earthquake; the Haitian Government estimated 230,000 people dead, 300,000 injured and 1,000,000 more made homeless. Around 300,000 buildings collapsed or were severely damaged. Destruction of the cargo piers in Port-au-Prince prevented aid from arriving by sea, which hindered the recovery.

The Haiti earthquake is one of the worst **geophysical** disaster events in living memory, although its longer-term effects are even now still not fully apparent. Haiti additionally suffers from a range of **hydro-meteorological** hazards such as hurricanes and floods (as well as resulting mudslides), making it a 'disaster hotspot'. People who lost their homes during the earthquake will now suffer exposed vulnerability to these other hazards in the months, or even years, before they are properly re-housed.

Conditions for survivors only improved very slowly after the earthquake. 500,000 survivors were still sleeping rough mid-way through 2010, while another half million remained crowded into makeshift refugee camps. In the early weeks and months after the earthquake, torrential rain battered the makeshift survivor camps, soaking the rough shelters made of bed sheets that had become home to hundreds of thousands of people in Port-au-Prince. As people struggled to rebuild their lives without insurance or financial assets of their own to help them, it sent a clear message to the world that poverty - and a general lack of preparedness and poor building construction standards - were also important factors that explained the severity of the earthquake's impact on Haiti.

Was long-term damage also done to Haiti's economic development? 50% of the population are under-20. In theory, this should provide the country

#### Key terms

**Hazard** A physical event or process with the potential to harm human life, welfare or assets.

**Disaster** The realisation of a hazard that brings harm to human society.

**Geophysical hazard** A hazard formed by tectonic / geological processes (such as earthquakes, volcanoes, mass movements).

**Hydro-meteorological hazard** A hazard formed by hydrological processes (floods) and / or atmospheric processes (such as storms, drought and bushfires).

**Vulnerability** A high risk combined with an inability of people to cope with a natural hazard event

**Vulnerable group** A subsection of the population who are highly likely to suffer the worst effects of a natural disaster e.g. the elderly, or in some societies women and children.

The Millennium Development Goals (MDGs) are eight specific goals to be met by 2015 that aim to combat extreme poverty across the world.

- Eradicate extreme poverty and hunger
- Achieve universal primary education
- Promote gender equality and empower women
- Reduce child mortality
- Improve maternal health
- Combat HIV and AIDS, malaria and other diseases
- Ensure environmental sustainability
- Develop a global partnership for development

These goals were created at the UN Millennium Summit in New York in 2000. The Millennium Declaration, adopted by the world leaders, promised to: 'free all men, women, and children from the abject and de-humanizing conditions of extreme poverty.'

(Declaration adopted by 189 nations & signed by 147 heads of state.)

**Box 1: Millennium Development Goals (MDGs)**

with a **demographic dividend** – a young, motivated workforce that could be highly attractive to investors. It is one reason why China and India have attracted so much **foreign direct investment (FDI)** in recent decades. However, young people need to possess literacy and numeracy skills and so education is vitally important. This is the reason why education is one of the Millennium Development Goals (MDGs) (Box 1). But Haiti lost 25% of its schools during the recent earthquake: they will take up to four years to rebuild. As a result, education of an entire generation has been interrupted - and Haiti's demographic dividend may not materialise.

**'Unnatural' disasters**

Barbara Stocking, Chief Executive of Oxfam, believes that while hazards may be natural, many disasters are 'unnatural' in the sense that they do not have to happen. It is *human* factors that often make disasters lethal by increasing people's vulnerability. The 2004 Asian tsunami struck two war zones, washing away lethal land mines whose location is now unknown. This human factor means that the tsunami event could still be causing casualties in decades to come.

**Teaching tip**

There are many online resources that students can independently research investigating human vulnerability during the Haiti earthquakes. Here are a couple of starting points:  
<http://www.guardian.co.uk/world/2010/jan/29/haiti-quake-generations-un-decades>

Watch reconstruction film at:  
<http://vimeo.com/10679645>

**Key terms**

**Demographic dividend** A rise in the rate of economic growth due to a rising share of working age people in a population.

**Foreign direct investment (FDI)** Investment (such as factory-building or store construction) provided by a transnational corporation (TNC) to a country.

## (2) An important human factor: gender

From Bangladesh to Aceh, 75-80% of people killed by many recent disasters in Asia have been women and girls. This makes females a **vulnerable group** of people. There are many reasons why this is the case, including:

- Women may be more confined to the house in some societies
- Women may lose their lives while protecting their children
- Women in some societies may be more likely to drown during flooding due to a lack of swimming ability

### Specification advice

The **IB Specification** requires knowledge of the MDGs and of gender inequalities as part of P1 studies. There are plenty of themes in this scheme of work that can be used to support teaching of these areas in addition to hazards for P2.

**Teaching tip** As an extra activity, ask students to identify a range of vulnerable groups. Below are some groups they may identify, and the reasons why.

Vulnerable group	Special considerations (reasons it may be hard to get warnings to vulnerable groups)
<i>Blind or visually impaired</i>	Must be able to hear hazard warnings. May not watch television or be able to see rising waters.
<i>Deaf or hard of hearing</i>	Must be able to see hazard warnings. May not listen to radio or be able to hear sirens or door-knocking.
<i>Impaired mobility</i>	Must receive warnings well in advance of a hazard striking, as additional time is needed to evacuate.
<i>Elderly</i>	May be hard of hearing or suffer from reduced mobility or sight. More likely not to own devices such as mobiles, or even television and telephone in some cases.
<i>Low income earners and the homeless</i>	More likely not to own more expensive communication devices such as mobiles and in extreme cases television and telephone, so harder to warn.
<i>Migrants / minorities</i>	May not understand warnings if they do not speak the local language well.

**Why do “vulnerable groups” need to be identified?** Hazard risk is not spread evenly through a population, as the catastrophic flooding of New Orleans by Hurricane Katrina in 2005 showed. Certain groups are especially vulnerable to the effects of natural hazards. The elderly, the disabled and low-income earners are often hard to contact, lack their own transport and may therefore be unable to flee. Low-income earners – many of whom are also elderly and disabled – are also more likely to lack insurance and to be poorly prepared for a hazard such as flooding. To be fully effective, hazard prevention schemes must recognise that society is not homogenous: *people are not all the same*. At their best, hazard prevention schemes recognise the varying needs of different social groups.

Source: S. Oakes (2006)

### (3) What is the global disaster vulnerability trend?

Every decade that passes, fewer lives are lost to disasters but economic costs become higher: this is the big global picture. Disaster death reduction is a clear trend in recent decades, especially in relation to hydro-meteorological hazards such as flooding, cyclones and drought. For instance: 300,000 Bangladeshi people were killed by Cyclone Bhola in 1971; but just 3,000 were killed by Cyclone Sidr in 2007 (a comparable event).

Reasons for this improvement include:

- Better early warning systems
- Improved knowledge of how people should react to warnings (e.g. moving their food stores to higher ground when a flood is forecast so that there is less risk of famine in the post-event period)

Earthquakes were still very deadly in the first decade of the 21st century. The most deadly disasters of the 'noughties' included the Indian Ocean earthquake-triggered tsunami, which hit several countries in Asia (2004) leaving 226,408 dead and the Sichuan earthquake in China (2008), causing the deaths of 87,476 people. 73,338 people were also killed in the earthquake in Pakistan (2005). Yet even for geophysical hazards, where very little warning – or less reliable warning – can be given, progress has been made in saving lives for comparable events. According to the figures released by CRED in Geneva, a total of 3,852 disasters killed more than 780,000 people globally over the past ten years. However, nearly as many as this were killed by one single earthquake and its after-effects back in 1976 when the Tangshan, China 7.8 earthquake reputedly killed 650,000 people.

It is a different story for financial losses though. Despite all of the efforts made by NGOs and relief effort agencies, many people are still poorly prepared for hazard events and have rising amounts of property to lose. According to the same CRED data, the financial costs of those 3,852 disasters was a minimum of US\$960 billion shared by two billion people. Each year, rising numbers of people are adversely affected (though non-

#### Specification advice

The **Edexcel** course requires knowledge of disaster trends: notably, the fact that "Trends show that the number of people killed is falling, whereas the number affected, and the economic losses, are escalating."

#### Teaching tip

Try to be careful when teaching about disasters and their impacts not to over-exaggerate the claim that 'lives are lost in LEDCs but money is lost in MEDCs'. There are a number of reasons why students should move on from this generalisation about the effects of natural hazards:

- With the rise of the **BRICS** and **NICs**, the binary distinction between MEDC / LEDC is increasingly unhelpful to students
- The number of lives lost to hazards in both developing and emerging economies has fallen, as the examples of Bangladesh and China show
- Assets are increasing for people in BRICs and NICS and the financial losses experienced in countries like China and India is increasing

#### Key terms

**BRICs** The emerging economies of Brazil, Russia, India and China.

**NICs (newly industrialised countries)** These include the 'Asian Tigers': Hong Kong, Singapore, Taiwan and South Korea.

lethally) by disasters on account of rising affluence on a planetary scale. Consider the following statements carefully:

- **One billion** This is the number of poor people alive today who are highly vulnerable to natural hazards.
- **Two billion** This is the number of people who will become 'powered up' in the next decade as electricity reaches more and more communities in emerging economies (such as Brazil, India and China) and developing nations. Financial losses are set to sky-rocket as the value of infrastructure in hazard-prone places rises and rises.
- **Four billion** This is the estimated size of an emerging 21<sup>st</sup> Century 'global middle-class' who will have sufficient money to help pay for health and education for their children. These are people who will all have plenty of material possessions. Will the insurance industry be able to compensate so many people for hazard losses in the future?
- **Twice as many houses** Twice as many housing structures as have ever been built throughout history up to this point in time will be erected during the coming century. Many will be damaged at some point by natural hazards. If they are not properly built to withstand local hazards, then the lives lost in some events could start to increase again as a result. Experts are worried about poor people crowding into vulnerable megacities such as Mexico City, Manila, Dhaka and Mumbai.
- **The 'over-developed world'** This term is used by some academics in developing countries to criticise the way people in developed nations have pursued the acquisition of material wealth and possessions up to a point where they have become extremely financially vulnerable to natural hazards – as well as threatening their own sustainability due to over-consumption of resources. For instance, the losses experienced in the USA due to Hurricane Katrina amounted to a staggering \$100 billion!

## Plenary

### Can earthquakes be predicted?

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The following item was broadcast on BBC Radio 4 'Material World' (July 2010):

"Six of Italy's top seismologists could face charges of manslaughter after failing to give a warning before the deadly 6.3 earthquake that struck the central Italian city of L'Aquila on 6 April 2009. The indictment has outraged experts around the world, who note that earthquakes cannot be predicted and who say that the Italian government neglected to enforce building codes that could have reduced the toll." Professor Ian Main from Edinburgh University explains to the radio audience that it is impossible to accurately predict all earthquakes. However, a 'swarm' of small earthquakes can sometimes be detected in the run-up to a major earthquake; and this was the case in Italy in 2009.

But:

- Only around 1 in 100 swarms is actually followed by a magnitude 6 earthquake or larger; 99% of the time they are not.
- Many major earthquakes are not preceded by a swarm.
- Therefore swarms are a pretty poor indicator of an impending event.
- So should a warning *a/ways* be issued and an evacuation staged when a swarm is detected? What would the costs and risks be of issuing 99 false alarms to the public? What are your views?

#### Teaching tip

This is interesting way to end the lesson. However, you will need to **leave at least ten minutes if you want to listen to the downloaded programme as well as debate the issues** (or the questions could instead be used as a follow-up homework assignment). Listen to the programme at:

<http://www.bbc.co.uk/programmes/b00t0g9w> (start listening at time-code: 16:22)