Geo Factsheet

Number 62

Hazards: Hurricane Mitch

In November 1998 Hurricane Mitch devastated the countries of Honduras and Nicaragua. It was responsible for thousands of deaths, hundreds of thousands of people being made homeless, outbreaks of disease, economic disruption, and the destruction of vital communication links. Its long-term impact will last long into the next century. This Factsheet examines the nature of Hurricane Mitch, and relates it to several areas of Geography. In particular, it is an excellent example that can be used effectively in essays relating to hazards, climate and meteorology, hydrology (water supplies and flooding), settlement (dangerous sites), agriculture (the disruption of the banana trade), and development (appropriate and inappropriate aid, long-term and short-term aid).

Hazards

A **hazard** is a natural event that threatens both life and property - a **disaster** occurs when the hazard takes place and human life and property are put at risk. A basic distinction can therefore be made between hazards and extreme events in nature (which are not hazards, because people and/or property are not at risk).

Environmental hazards are caused by people's use of dangerous environments. This is partly due to the failure to recognise the potential hazard and act accordingly. Hazards also occur because vulnerable populations (the poor) are forced to live in hazardous environments, such as steep slopes and floodplains. Moreover, the same river that causes floods also brings fertile alluvial material and water. Thus, hazardous environments are also resource-environments and the decision to live in such an area takes into account the risks as well as the perceived riches of the environment.

Hazards are very varied. They include natural and man-made, local and global, subtle (invisible) and intense (highly visible), voluntary, such as smoking, and involuntary, such as tsunami.

Table 1 divides hazards into geophysical ones (climate, meteorological, geological and geomorphological) and biological ones (floral and faunal). Most hazard research has focused upon geophysical hazards, and they are certainly more eye-catching than biological hazards. On the other hand, biological hazards such as bacterial and viral diseases kill more people each year. As the table suggests, almost anything can be a considered a hazard if it puts people's lives and livelihoods at risk.

Table 1. Classification of natural hazards by main causal agents

Geophysical		Biological	
Climate and Meteorological	Geological and Geomorphological	Floral	Faunal
Snow and ice Droughts Floods Frosts Hail Heatwaves Tropical cyclones Lightning and fires Tornadoes	Avalanches Earthquakes Erosion (such as soil erosion and coastal erosion) Landslides Shifting sand Tsunami Volcanic eruptions	Fungal diseases e.g. athlete's foot, Dutch elm disease, wheat stem rust Infestations e.g. weeds, water hyacinth Hay fever Poisonous plants	Bacterial and viral diseases e.g. influenza, malaria, smallpox Infestation e.g. rabbits, termites, locusts Venomous animal bites

Environmental hazards have a number of common characteristics;

- the origin of the hazard is clear and produces distinct effects, such as flooding causing death by drowning
- the warning time is short (although drought is an exception)
- most losses to life and property occur shortly after the environmental hazard - these are often related to **secondary hazards** such as fire and contaminated water
- in some areas, especially ELDCs, the risk of exposure is largely involuntary - normally due to people forced to live in hazardous areas; by contrast in most EMDC's people occupy hazard areas as much through choice as through ignorance or necessity
- the disaster occurs with a scale and intensity that requires emergency response.

It is possible to characterise hazards and disasters in a number of ways:

1. Magnitude
The size of the event e.g. Force 10 on the Beaufort Scale, the maximum height or discharge of a flood, or the size of an earthquake on the Richter Scale.

2. Frequency
How often an event of a certain size occurs. For example, a flood of 1 metre height may occur, on average, every year. By contrast, in the same stream a flood of 2 metres in height might occur only every ten years. The frequency is sometimes called the recurrence interval.

3. Duration
The length of time that the environmental hazard exists. This varies from a matter of hours, such as urban smog, to decades of drought.

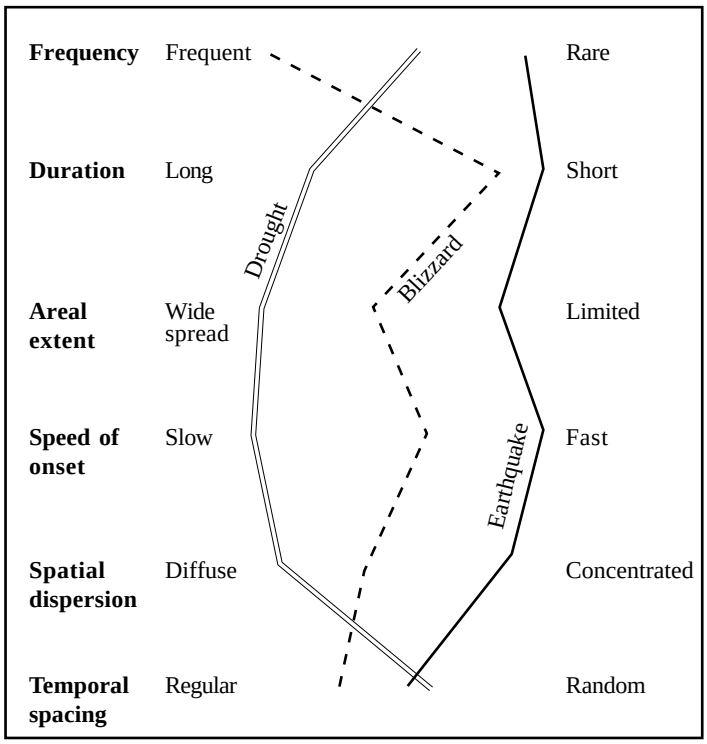
4. Areal extent
The size of the area covered by the hazard. It can range from very small-scale, such as an avalanche chute, to continental (drought).

5. Spatial concentration
The distribution of hazards over space. For example, are they concentrated in certain areas, such as tectonic plate boundaries, coastal locations, valleys and so on.

6. Speed of onset
This is rather like the 'time-lag' in a flood hydrograph. It is the time difference between the start of the event and the peak of the event. It varies from rapid events, such as the **Kobe earthquake**, to slow-time scale events such as drought in the Sahel of Africa.

7. Regularity
Some hazards are regular such as cyclones whereas others are much more random such as earthquakes and volcanoes. Some of these can be shown on a hazard event profile (Fig 1).

Fig 1. Hazard event profile



Hurricanes

Hurricanes (also known as typhoons and cyclones) are violent storms that affect a very large part of the earth's surface (Fig 2). They are a seasonal hazard, peaking between June and November in the Northern Hemisphere, and they pose a major threat to human life, property and economic activities. Because of their impact, and the cost of their destruction, they are monitored intensely by satellite.

Hurricanes bring heavy rainfall, strong winds, high waves and cause other hazards such as flooding and mudslides. High intensity rainfall (as high as 500 mm in 24 hours), causes severe flooding. Their path is erratic; hence it is not always possible to give more than twelve hours notice. This is insufficient for proper evacuation measures especially in developing countries where communications are poor.

Hurricanes develop as **intense low-pressure systems** over tropical oceans. Winds spiral rapidly around a calm central area known as the eye (Fig 3a, Fig 3b overleaf). The diameter of the whole hurricane may be as much as 800 km although the very strong winds, which cause most of the damage, are found in a narrower belt up to 300 km wide. In a mature hurricane pressure may fall to as low as 880-970 millibars. This, and the strong contrast in pressure between the eye and outer part of the hurricane lead to strong gales force winds.

Fig 2. Location and average annual frequency of hurricanes and tropical storms

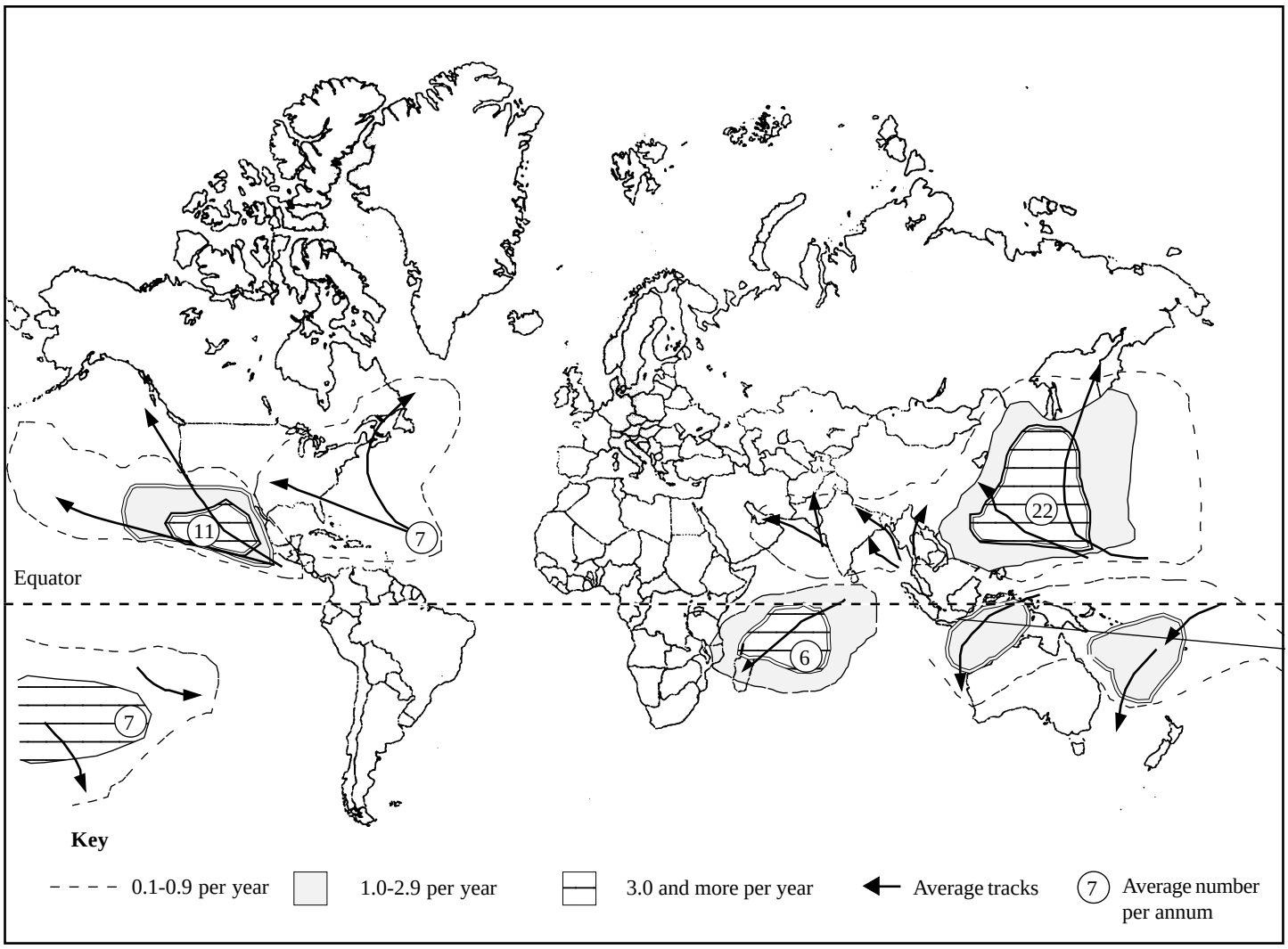


Fig 3a shows a vertical cross section of a hurricaine.

Fig 3a. Cross section of a hurricane

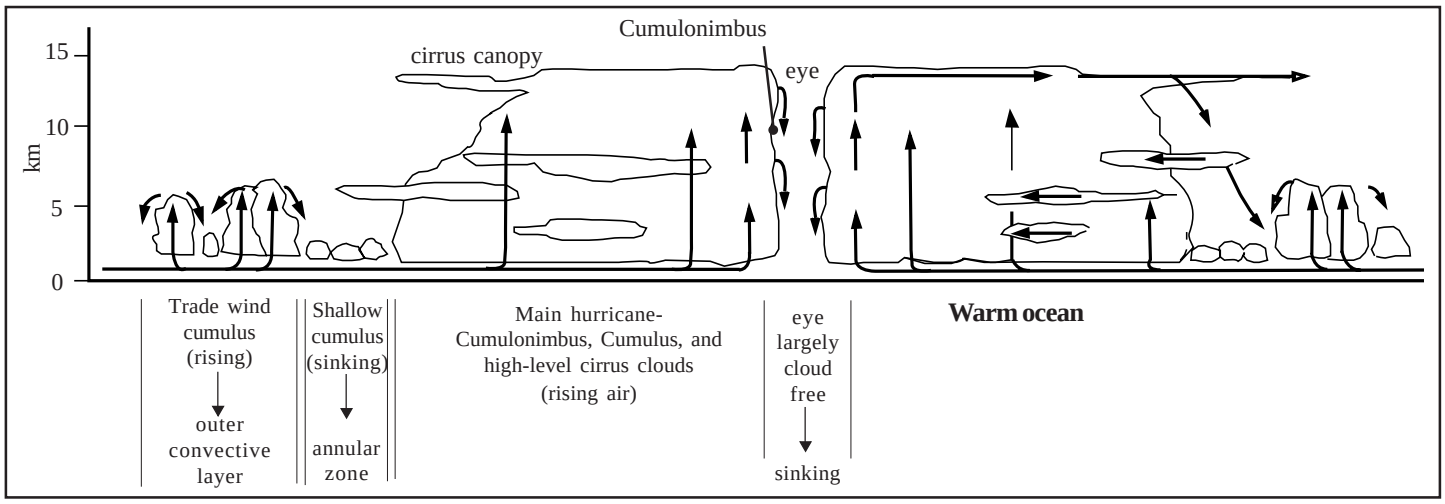
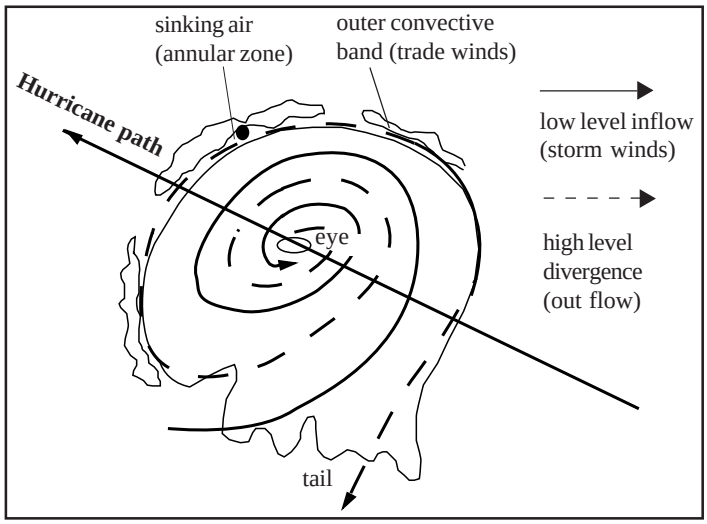


Fig 3b. Shows a plan view of a hurricane with wind directions and main cloud features.

Fig 3b. Plan view of a hurricane



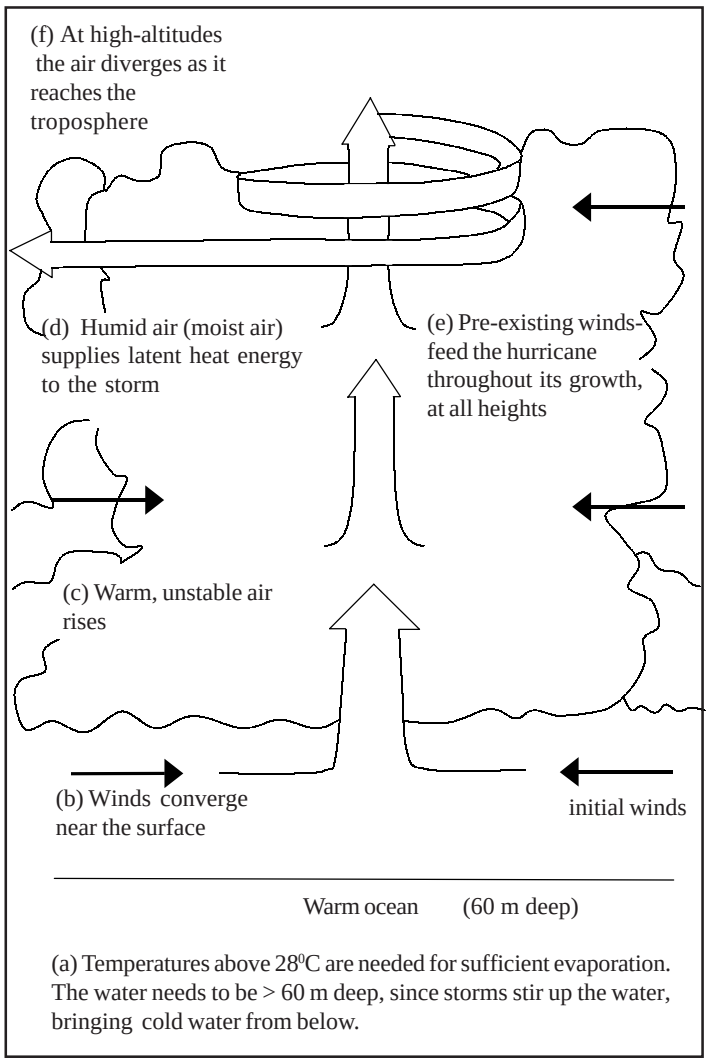
Hurricanes develop as a result of a number of conditions (Fig 4).

- Sea temperatures must be over 27°C (warm water gives off large quantities of heat when it is condensed - this is the heat which drives the hurricane).

- The low pressure area has to be far enough away from the equator so that the Coriolis force (the force caused by the rotation of the earth) creates rotation in the rising air mass - if it is too close to the equator there will be insufficient rotation and a hurricane would not develop.

Exam Hint *- Examiners look for a mix of* ***general processes*** *and* ***specific facts.*** *Far too few candidates make use of* ***sketch maps*** *and* ***diagrams*** *in their answers. Not only are these very useful ways of providing details, they are an excellent way of learning information. The diagrams and map in this unit get information across much more effectively than a long narrative.*

Fig 4. The conditions necessary for a hurricane



(a) Temperatures above 28^{0}C are needed for sufficient evaporation. The water needs to be > 60 m deep, since storms stir up the water, bringing cold water from below.

It is very costly to evacuate an area. It is estimated that the cost of evacuating a 50 km stretch of the US coastline is about $50 million. This is due to losses in business, tourism, and protection measures.

Hurricane Mitch

The hurricane and the loss of life

Mitch had been tracked and predicted by meteorologists. It began in the Caribbean around October 22nd 1998, when Mitch's wind speeds had made weathermen class it among the most violent hurricanes on record. But the winds then slowed. When it hit land, the constant rain was unexpected.

Hurricane Mitch dumped more water over Central America in one week than the region normally gets in a year For example, parts of Honduras experienced over 1000 mm in five days. The deluge filled the cone of the dormant Casita volcano in north-western Nicaragua, causing it to burst through the mountain's side. The resulting mudslide destroyed four villages, burying everything in its path in 6m of mud.

The destruction around Casita was the most spectacular single tragedy inflicted by Hurricane Mitch, but it was not the only one. At its peak, winds of nearly 300 km/hour were recorded. But most of the damage came from nearly a week of heavy, continuous rain, which caused huge floods and many mudslides. Thousands died, hundreds of thousands lost their homes. Bridges, roads, power lines, plantations, crops and cattle were swept away.

In Honduras, the death toll from Hurricane Mitch was over 17, 000. The floods and landslides destroyed whole villages and households as well as whole neighbourhoods of cities. Some towns, such as Santa Rosa de Aguan on the northern coast of Honduras, were completely obliterated. In all, about a third of Hondurans were affected by the flooding. With half the population aged under 25 and infrastructure, including many schools lost, there are very serious consequences. A generation may grow up without much chance of any education.

In Nicaragua up to 1,500 people were killed at the Casita volcano near Chinandega and 600 others had died elsewhere. With hundreds of bodies rotting in the open air, and water supplies and other utilities disrupted, another fear is of epidemics, including malaria and cholera. In Honduras, the swollen Rio Choluteca turned the city centre of Tegucigalpa into a vast lake, and the hillsides were strewn with the wreckage of shanty homes. In all, 800,000 of the country's 5 million inhabitants were made homeless. Crime and insecurity, already widespread before the disaster, increased, and abandoned homes and businesses were looted. Over 200 people were arrested, and many businesses had to be protected by armed guards. Transport links were paralysed. Up to 50 bridges on main highways, along with many minor bridges, were destroyed. These included all those on main roads in and out of the Nicaraguan capital Managua. Hundreds of small villages were cut off entirely, and food shortages occurred rapidly In Managua food prices shot up rapidly.

In addition to the death toll, the economic losses were incalculable. Honduras and Nicaragua, the two countries worst affected, are the poorest in the Americas after Haiti.

A natural or man-made disaster?

Many people believe the scale of damage was caused by human negligence:

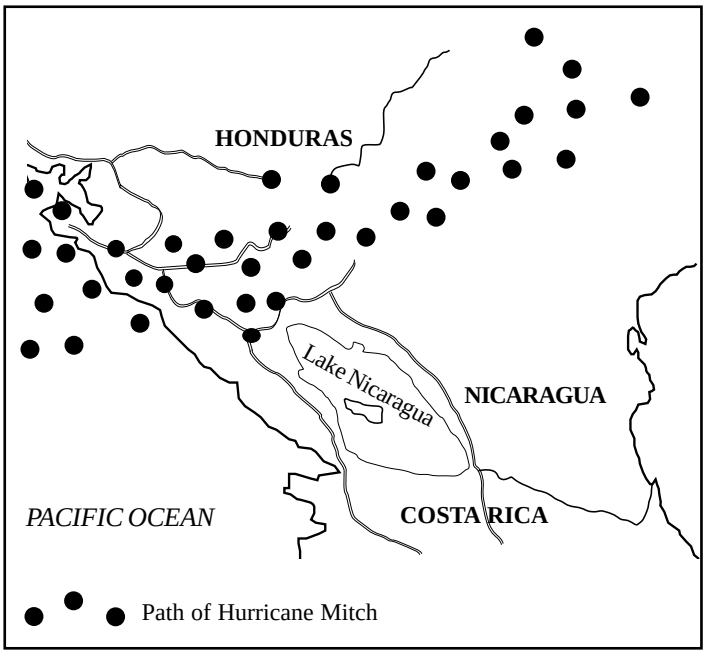
- villages constructed on unstable riverbanks/hill slopes
- failure of 3 dams above Tegucigalpa
- many towns had no storm drains
- deforestation may have increased landslips

The impact on agriculture

Hurricane Mitch was Honduras' worst disaster in more than 100 years and up to 70 per cent of Honduras's economic output has been lost. The production losses to the economy for 1998 and 1999 are estimated to be as high as $1.5 billion (£903m). Almost half the losses in the economy are in the agricultural sector. Coffee, bananas and shrimp are three staples of the economy. Central America produces 10-12 per cent of the world's coffee and Guatemala and Honduras are significant exporters.

Normally the damage caused by hurricanes is associated with coastal areas, thus affecting typical crops of the tropical lowlands such as bananas and sugar cane. However, due to the extended and erratic path throughout Central America (Fig 5), Hurricane Mitch destroyed a much wider piece of the region's vital agricultural base.

Fig 5. The path of Hurricane Mitch.



Central America is the US's biggest source of banana and plantain imports, accounting for $642 million in 1997. With land needing to be rehabilitated, and the plants taking nine months to begin producing fruit, Honduras will be banana-free for most of 1999, leaving a $200 million deficit in exports and a gap in world availability. Europe relies less heavily than the US on bananas from Central America. Its supplies of bananas from many Latin American suppliers are restricted under European rules. Nevertheless, some importers are predicting supply problems. Nicaragua has fared only a little better.

Coffee managers think that at least 20% of its plantations have been smashed. Newer crops such as oranges are said to have been wiped out. In both countries, many small farmers have lost everything.

The problem is increased because the main road links and bridges were destroyed by landslides and washed-away in the floodwaters. Indeed more coffee could be lost due to the destruction of the roads rather than the destruction of the crop. It will prove impossible to transport and export the crop even if it is possible to harvest it.

Sugar was less affected, although the November harvest was delayed. In Honduras, the sugar crop fell by about 40%. By contrast, in Guatemala, which earns over $300 million from sales of sugar, loses were not as great, as this country did not bear the full brunt of the force of the hurricane.

In addition to losses in the main agricultural exports of the region, large losses occurred in soft fruit and vegetables. These were the 'new' crops that Central American countries were increasingly growing, in an attempt to diversify their agricultural export base.

Long-term redevelopment

Honduras and Nicaragua are the poorest countries in Latin America, with gross domestic product per head of less than $700 (£420). Both spend large amounts of their limited export income - which will now be drastically cut by the damage to agriculture - on servicing foreign debt commitments.

The natural disaster is all the more tragic as Honduras and Nicaragua were beginning to show signs of economic growth and inflation was decreasing. Now the countries are even more dependent on aid and development grants than before. In the space of a week, Hurricane Mitch has set back Central America's painful deliverance from poverty and civil war by more than 20 years. The greatest challenge to the politicians, aid agencies and planners is rebuilding the shattered economies of Central America. Honduras and Nicaragua have experienced years of extremely difficult conditions including the Latin American debt disaster of the 1980s, military rule in Honduras, dictatorship in Nicaragua, followed by a revolution, and finally a guerrilla war. Only recently had the two countries begun to recover. Now the future looks bleak.

Aid and politics

There are three main forms of aid.

1. Bilateral aid is the assistance given by one country directly to another country.
2. Multilateral aid is the assistance given by large organisations such as the United Nations (UN) and the World Bank. Many countries provide funds to support the UN, which in turn decides upon the projects to support. These projects are in a large number of countries.
3. Non-government organisations (NGOs) include charities such as Oxfam, Cafod and the Central American Hurricane Appeal. Most of their funds are drawn from public donations and these are used to support mostly small-scale local self-help projects. The main advantages of NGOs is that they are;
   - more flexible
   - less accountable to governments
   - have specialist knowledge and skills.

   But, they have less money.

Aid can also be classified into short-term aid and long-term aid. Short-term aid or emergency relief usually follows a natural disaster, such as a drought or a flood and is provided to keep people alive. By contrast, long-term aid or development aid is provided to improve the long-term standards of living in an area.

While the damage has made it extremely difficult to get coffee, bananas and sugar to ports and markets, governments are more worried about getting food, water and medicine to isolated communities. The World Bank said it would make funds available to support disaster relief efforts.

Both Honduras and Nicaragua have received huge amounts of aid in recent decades. Honduras, for example, received over £6 billion worth of aid. The interest repayments on this are staggering. Honduras is due to pay out $400 million in interest repayments each year. i.e. over $1 million a day! The aid provided by the USA and the UK (some $100 million) would therefore only pay off Honduras's interest charges for about 3 months! With little money coming into the region through exports the countries face bankruptcy, the population faces disaster.

Conclusion

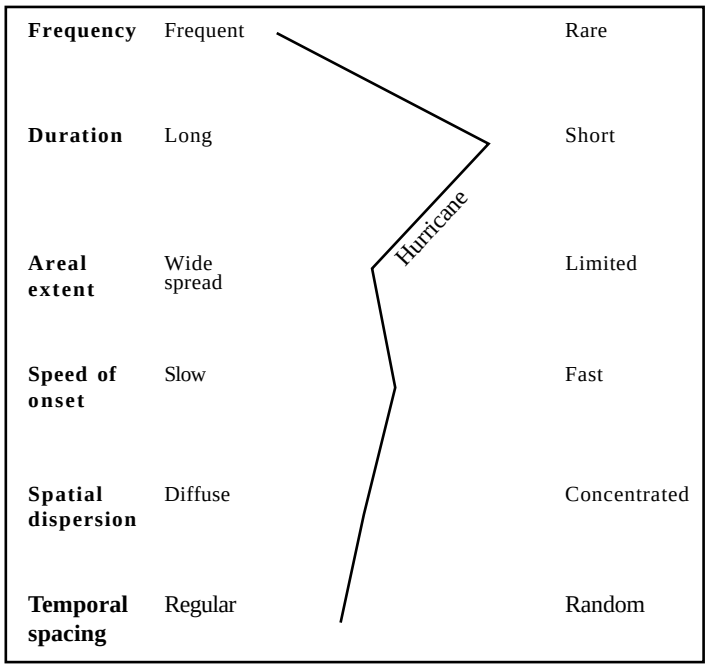
Any disaster involves the interaction of physical and human geography. In most cases, the causes are physical but the impacts are heavily influenced by human factors. As we have seen in this example the impacts are both long-term and short-term, and occur at a variety of **scales** from the individual and household to the global economy.

Practice Question

1. Study Fig 1. on page 2 which shows a hazard event profile for droughts, blizzards, and earthquakes.
   (a) Make a similar diagram for a hurricane.
   (b) One measurement of an environmental hazard has been left out of the diagram. Which one is it? Suggest reasons why it has been left out of the diagram.

Answers

1. (a)



(b) **Magnitude** has been left off the scale. This is because any hazard can range from a very small event (such as earthquakes in the UK) to very large events such as the earthquake in Armenia, Colombia in January 1999.

Essay

How can you classify hazards? (5 marks)

With the use of examples, outline the factors that affect the impact of a named natural hazard. (20 marks)

Suggested plan

A classification such as that in Table 1(Page 1) should be provided with examples of each of the major types of hazards. Named examples of each hazard is an added bonus.

For the main part of the question you are asked about the factors. These include the characteristics of the event (magnitude, frequency, duration, extent, and speed of onset) as well as population density, level of development, existence of emergency services, accessibility, monitoring and prediction of hazards, and vulnerability of populations. These should be discussed in turn with reference to specific examples. In this case this requires a discussion of the nature of the hazards (hurricanes, floods and mudslides) as well as the details from Central America.

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