Topic 5
Hazards

The concept of hazard in a geographical context

1 The relief phase includes the immediate response, where the focus is on saving lives and property. Teams such as Médecins sans Frontières arrive from outside the immediate area to help with search, rescue and care operations. Urgent medical supplies, rescue equipment, clothing and food may be brought in.

2 The rehabilitation phase may last for several months. It is where efforts are made to restore physical and community structures, at least temporarily.

The reconstruction phase is when permanent changes are introduced to restore the quality of life and economic stability to the pre-disaster level or better. This can also include mitigation and preparedness — reducing vulnerability.

3 Characteristic human responses include:

- Fatalism: people view hazards as natural events that are accepted as inevitable. They stay within a hazardous area, e.g. those living in the shadow of volcanoes. San Salvador volcano, in El Salvador, has more than 500,000 people living within 10 km of its summit.
- Prediction, adjustment/adaptation and mitigation: people see that they can prepare for, and therefore survive, events and so stay within a hazardous area, e.g. those living in San Francisco, California. Building design and regulations have meant that people feel relatively safe despite the fact that they live in an earthquake-prone area.

4 A good example for this would be the way in which responses to tsunamis were handled differently in the Indian and Pacific Ocean basins. There had not been a major tsunami for many years in the Indian Ocean and there was little or no infrastructure to warn surrounding countries. This contrasts with the tsunami warning system in the Pacific Ocean. People too were unaware of the precursor events to a tsunami. Thus when the sea receded below low-tide mark, people ventured onto the shoreline rather than move away.

According to Figure 5.2, several things happen after an event. There is the immediate response followed by recovery. The time taken depends on the location of the event. Following this there has to be the willingness and infrastructure to create systems of prevention, mitigation and preparation. Once these plans are complete, unless there is the political will to maintain watchfulness, human nature tends to make people forget. Once a generation has passed, the collective memory is poor.

Plate tectonics

5 **a** Oceanic crust is the uppermost layer of the oceanic portion of a tectonic plate. The crust overlies the solidified and uppermost layer of the mantle. Oceanic crust is the result of erupted mantle material originating from below the plate, cooled and, in most instances, modified chemically by seawater. This occurs mostly at mid-ocean ridges, but also at scattered hot spots, and also in rare but powerful occurrences known as flood basalt eruptions. It is primarily composed of rocks that are rich in iron and magnesium. It is relatively thin, generally less than 10 km thick, and has a mean density of about 2.9 g/cm^3. It is also very young, seldom more than 200 million years old.

b The continental crust is the layer of igneous, sedimentary and metamorphic rocks that forms the continents and the areas of shallow seabed close to their shores, known as continental shelves. This layer is sometimes called sial because its bulk composition is of silica- and aluminium-based minerals. At depth there is a reasonably sharp contrast between the more silica-rich upper continental crust and the lower continental crust, which is more basic in character.

The average density of continental crust is about 2.7 g/cm^3, less dense than oceanic crust. At 25–70 km, continental crust is considerably thicker than oceanic crust. About 40% of Earth's surface is currently occupied by continental crust. It makes up about 70% of the volume of Earth's crust.

c The asthenosphere is a zone of the Earth's mantle lying beneath the crust. It is thought to be much hotter and more fluid than the lithosphere. It extends from about 100 km to about 700 km below Earth's surface. It is malleable, 'lubricating' the undersides of crustal plates.

d The mantle is the second layer of the Earth. It is the largest layer, taking up 84% of the Earth. It is composed of silicates of iron and magnesium, sulphides and oxides of silicon and magnesium. It is about 2,900 km thick. The average temperature of the mantle is 3,000°C. The temperature becomes hotter with depth.

e The core, the Earth's deepest layer, is a solid iron ball, about 2,400 km in diameter. Although this inner core is white hot, the pressure is so high the iron cannot melt. Scientists believe the core contains sulphur and nickel, plus smaller amounts of other elements. Estimates of its temperature vary, but it is probably somewhere between 5,000 and 7,000°C.

Above the inner core is the outer core, a shell of liquid iron. This layer is cooler but still very hot, perhaps 4,000 to 5,000°C. It too is composed mostly of iron, plus substantial amounts of sulphur and nickel. It creates the Earth's magnetic field and is about 2,300 km thick.

6 Mantle convection is the theory that there are hot zones deep in the Earth that set off convection currents in the mantle and that it is these currents that drive lithospheric plate movement. The upward limb of the convection cell causes constructive plate boundaries, whereas the downward limbs cause destructive plate boundaries. There has been a lot of debate recently as to both the nature of the convection currents and whether they actually exist at all. Other theories such as ridge push and slab pull are gaining prominence.

7 In the ridge push theory, molten magma that rises at a mid-ocean ridge is very hot and heats the rocks around it. As the asthenosphere and lithosphere at the ridge are heated, they expand and become elevated above the surrounding sea floor. This elevation produces a slope down and away from the ridge. Because the rock that forms from the magma is very hot at first, it is less dense and more buoyant than the rocks farther away from the mid-ocean ridge. However, as the newly formed rock ages and cools, it becomes denser. Gravity then causes this older, denser lithosphere to slide away from the ridge, down the sloping asthenosphere. As the older, denser lithosphere slides away, new molten magma wells up at the mid-ocean ridge, eventually becoming new lithosphere. It is thought that the cooling, subsiding rock exerts a force on spreading lithospheric plates that could help drive their movements. This force is called ridge push.

With the slab pull theory, at a subduction boundary, one plate is denser and heavier than the other plate. The denser, heavier plate begins to subduct beneath the plate that is less dense. The edge of the subducting plate is much colder and heavier than the mantle, so it continues to sink, pulling the rest of the plate along with it. The force that the sinking edge of the plate exerts on the rest of the plate is called slab pull. Currently, many scientists consider slab pull to be a much stronger factor than ridge push or mantle convection in driving plate movements.

8 Diagram a shows that a hot spot occurs under a part of the thick continental crust. It causes upward movement of the crust and results in crustal fracturing. This fracturing allows some basaltic lava to reach the surface. This begins to force apart the crust on either side of the hot spot. As the two sections of crust move apart, a series of reverse faults causes collapse of the central area of activity, resulting in a rift valley (diagram b).

The continual creation of new crust forces the two sides of the rift valley apart until eventually oceanic water floods in to form a narrow linear sea (diagram c). The sea eventually widens into an ocean with a central ridge on either side of a rift valley (diagram d).

9 Low-silica lavas are low in viscosity. This means that they are able to flow relatively easily. If the eruption is above the surface of the sea then it results in sheet lavas and shield volcanoes. Under the sea it results in pillow lavas.

10 Earthquakes occur where masses of rock move relative to one another. Movement is not uniform and often the masses become 'stuck'. This builds up tension within the rocks, which is released when there is movement. This energy release takes the form of an earthquake.

In both these boundaries, an oceanic plate is being subducted. That plate is grinding and getting stuck against either a piece of continental crust or another oceanic plate.

Continued sticking and then release means that earthquakes of varying depths occur, following the downward moving plate into the mantle below.

11 The crustal portion of the subducting slab contains a significant amount of surface water, as well as water contained in hydrated minerals within the seafloor basalt. As the subducting slab descends to greater and greater depths, it progressively encounters greater temperatures and greater pressures, which cause the slab to release water into the mantle wedge overlying the descending plate. Water has the effect of lowering the melting temperature of the mantle, thus causing it to melt. The magma produced by this mechanism varies from basalt to andesite in composition. It rises upwards to produce a linear belt of volcanoes parallel to the oceanic trench. The chain of volcanoes is called an island arc. If the oceanic lithosphere subducts beneath an adjacent plate of continental lithosphere, then a similar belt of volcanoes will be generated on continental crust.

There are a variety of volcanic eruptions. The lava is intermediate between acid and basic. One of the most common types is andesite lava. The eruption varies depending on the amount of gas trapped in the lava.

The huge quantities of seawater taken down with the subducting plate become dissolved within the magma. At a later stage, when the magma rises, the water returns to its gaseous form and increases the volume of the magma, making the eruptions explosive. This produces phenomena such as pyroclastic flows and ash clouds. Some of the most explosive eruptions ever noted have happened at this type of plate margin. Examples are: Mt St Helens, Mt Pinatubo, Mt Tambora and Krakatoa. The resultant volcanoes range from strato-volcanoes to calderas.

12 Because both plates are of similar densities, neither continental plate could be subducted below the other. This causes the continental crust to thicken due to folding and faulting by compressional forces. The continental crust here is twice the average thickness, at around 75 km. The thickening of the continental crust marked the end of volcanic activity in the region as any magma moving upwards would solidify before it could reach the surface. The Himalayas are still rising by more than 1 cm per year as India continues to move northwards into Asia, which explains the occurrence of shallow focus earthquakes in the region today.

13 At conservative margins, plates slide past each other, so that the relative movement is horizontal. Lithosphere is neither created nor subducted, and while conservative plate margins do not result in volcanic activity, they are the sites of extensive shallow focus earthquakes, occasionally of considerable magnitude. Instead of the plates slipping past each other, they tend to stick. When sufficient pressure builds up, one plate is jerked forward, sending shockwaves to the surface. An example is the San Andreas fault.

14 A few active volcanoes do exist in locations well away from any plate margin. These are volcanic hot spots. The best known example of an oceanic hot spot is the chain of Hawaiian Islands. Iceland is unique in that it is a hot spot but is located on a mid-ocean ridge. As their name suggests, these are points where molten material from the mantle breaks through the rocks of the Earth's crust to reach the surface. They are caused by convectional plumes of very hot magma in the mantle which burn through the crustal rocks to reach the surface.

The important point to understand is that the plume is stationary. The point where the hot material breaks out of the mantle and onto the surface stays in the same place. However, where it reaches the surface changes with time, because plates move. Above the hot spot a volcano forms and grows and grows until the plate carries it away. Once the volcano has been carried away and no longer sits over its hot spot, it loses its source of magma. A new volcanic cone begins to form on top of the hot spot.

All the Hawaiian islands are volcanic. The nearest land is over 3,000 km away. The islands lie on top of the Pacific plate, which is moving north-westwards by about l0 cm a year. Volcanic activity today only takes place in the southeast corner of the island chain on the big island, called Hawaii. Mauna Loa is a huge volcano. It rises 9,000 m from the floor of the Pacific Ocean to its summit, which is 4,170 m above sea level. At its ocean base, it is over 90 km wide.

The magma comes from the mantle, it is very hot and as it is basalt it has a low viscosity. The activity now seems to be focused increasingly on the southeast part of the island where Kilauea has been active for over 150 years.

Volcanic hazards

15 There is a ring of volcanoes around the Pacific Ocean (the Ring of Fire). This shows where subduction is taking place. On the eastern side of the Pacific it is at an ocean/continent boundary and in the west it is an island arc type of boundary. Subduction and melting lead to eruptions. In the centre of the Pacific there are hot-spot volcanoes such as Hawaii. There are some volcanoes in the centre of continents such as the Yellowstone Caldera, which are also found over hot spots. There is a line of volcanoes down the centre of the Atlantic that marks the Mid-Atlantic Ridge, a constructive boundary. It includes Iceland and Tristan da Cunha. Another group can be found in the Great Rift Valley of eastern Africa, a putative constructive plate margin.

16 Answers depend on the examples chosen.

Pyroclastic flows contain a high-density mix of hot lava blocks, pumice, ash and volcanic gas. They move at very high speed down volcanic slopes, typically following valleys. Most pyroclastic flows consist of two parts: a lower (basal) flow of coarse fragments that moves along the ground, and a turbulent cloud of ash that rises above the basal flow. Ash may fall from this cloud over a wide area downwind from the pyroclastic flow.

Pyroclastic flows form in different ways:

- Collapse of eruption column: during a highly explosive eruption, the column ejected upwards into the atmosphere cools and can become too cool and dense to maintain upward momentum.
- 'Boiling over' from eruptive vent: during an explosive eruption, material is erupted without forming a high plume and rapidly moves downslope.
- Collapse of lava domes or flows: the fronts of lava flows or domes can become so steep that they collapse due to gravitational force.

With rock fragments ranging in size from ash to boulders that travel across the ground at speeds typically greater than 80 km/h, pyroclastic flows knock down, shatter, bury or carry away nearly all objects and structures in their path. The extreme temperatures of rocks and gas inside pyroclastic flows, generally between 200°C and 700°C, can ignite fires and melt snow and ice.

Pyroclastic flows vary considerably in size and speed, but even relatively small flows that move less than 5 km from a volcano can destroy buildings, forests and farmland. On the margins of pyroclastic flows, death and serious injury to people and animals may result from burns and inhalation of hot ash and gases.

Pyroclastic flows generally follow valleys or other low-lying areas and, depending on the volume of rock debris carried by the flow, they can deposit layers of loose rock fragments to depths ranging from less than 1 m to more than 200 m.

Pyroclastic flows can also lead to secondary hazards, especially flooding and lahars by:

- eroding, melting and mixing with snow and ice, thereby sending a sudden torrent downstream
- damming or blocking streams in volcanic valleys, which may create lakes behind the blockage that eventually overtop and erode the blockage, producing a rush of water and volcanic material downstream
- increasing the rate of stream runoff and erosion during rainstorms due to the creation of an easily eroded landscape with sparse vegetation

Seismic hazards

17 The vast majority of earthquakes are found along plate margins, although there are exceptions — e.g. northeast Brazil. Constructive plate margins have shallow earthquakes, caused by rising magma forcing its way to the surface. At destructive margins the earthquakes vary in depth. This is because they are caused by friction along the Benioff zone, which gets increasingly deeper as one moves away from the surface plate boundary. There are many shallow and intermediate depth earthquakes below the collision zone of the Himalayas where there is no subduction. Transform faults result in shallow earthquakes.

18 Answers depend on the hazard chosen.

Earthquake liquefaction or ground failure is a loss of strength that causes otherwise solid soil to behave temporarily as a viscous liquid. The phenomenon occurs in water-saturated unconsolidated soils affected by seismic S waves (secondary waves), which cause ground vibrations during earthquakes. Poorly drained fine-grained soils such as sandy, silty and gravelly soils are the most susceptible to liquefaction. Granular soils are made up of a mix of soil and pore spaces. When an earthquake shock occurs in waterlogged soils, the water-filled pore spaces collapse; this decreases the overall volume of the soil. This process increases the water pressure between individual soil grains, and the grains can then move freely in the watery matrix. This substantially lowers the soil's resistance to shear stress and causes the mass of soil to take on the characteristics of a liquid. In its liquefied state, soil deforms easily, and heavy objects such as structures can be damaged from the sudden loss of support from below.

19 The seismic gap theory states that, if there have been large earthquakes on an active (but unbroken) fault's neighbouring faults in the past, then it is the most likely next location for an earthquake. A frequently cited example of a seismic gap being filled was the magnitude 7 Loma Prieta earthquake of 1989. Unfortunately, it is not a precise forecasting tool. There has been a great earthquake expected on the Tokai fault south west of Tokyo for several decades but so far it has not occurred.

Storm hazards

20 The main parts of a tropical cyclone are the rain bands, the eye and the eyewall. Air spirals in towards the centre in an anticlockwise pattern in the northern hemisphere (clockwise in the southern hemisphere) and out of the top in the opposite direction. In the very centre of the storm, air sinks, forming an 'eye' that is mostly cloud-free.

The eye

The hurricane's centre is a relatively calm, generally clear area of sinking air and light winds that usually do not exceed 24 km/h and is typically 32–64 km across. An eye will usually develop when the maximum sustained wind speeds go above 119 km/h and is the calmest part of the storm.

At round 119 km/h the strong rotation of air around the cyclone balances inflow to the centre, causing air to ascend about 16–32 km from the centre, forming the eyewall.

The eyewall

The eyewall consists of a ring of tall thunderstorms that produce heavy rains and usually the strongest winds. Changes in the structure of the eye and eyewall can cause changes in the wind speed, which is an indicator of the storm's intensity. The eye can grow or shrink in size, and double (concentric) eyewalls can form.

In intense tropical cyclones, some of the outer rain bands may organise into an outer ring of thunderstorms that slowly moves inwards and robs the inner eyewall of its needed moisture and momentum. During this phase, the tropical cyclone is weakening.

Eventually the outer eyewall replaces the inner one completely and the storm can be the same intensity as it was previously or, in some cases, even stronger.

Rain bands

These are curved bands of clouds and thunderstorms that trail away from the eyewall in a spiral fashion. These bands are capable of producing heavy bursts of rain and wind, as well as tornadoes. There are sometimes gaps in between spiral rain bands where no rain or wind is found.

If one were to travel between the outer edge of a hurricane to its centre, one would normally progress from light rain and wind, to dry and weak breeze, then back to increasingly heavier rainfall and stronger wind, over and over again, with each period of rainfall and wind being more intense and lasting longer.

21 The most frequent occurrence of tropical cyclones is in the western North Pacific. Tropical cyclones in the western North Pacific and the North Atlantic can have tracks that extend to very high latitudes. Storms following these long tracks generally undergo extratropical transition. The North Indian Ocean (Bay of Bengal and Arabian Sea) is bounded by land to the north and the eastern North Pacific is bounded by cold water to the north. These environmental features limit the lifetimes of storms in these regions.

Southern hemisphere tropical cyclones are generally weaker than storms in the North Pacific and Atlantic basins.

Tropical cyclones do not form very close to the equator and do not ever cross the equator.

22 Early warning systems give people time to move to places of safety. The majority of deaths and injuries during and in the immediate aftermath of a cyclone are caused either by drowning or by being hit by flying debris. Evacuation to concrete shelters raised above the floodwater or inland away from the coast (and the dangers of storm surge) would only be possible if there were time to move people. There are inherent dangers associated with moving large numbers of people but these would be far outweighed by the increased protection. Bangladesh has over 400 cyclone shelters and in 2007 over 3 million people were evacuated to safety before cyclone Sidr reached land. This reduced the immediate death toll (from drowning and trauma) considerably.

23 The best approach is to look at examples of contrasting tropical storms.

In low-lying regions such as Bangladesh tropical cyclones cause storm surges that travel far inland. These destroy homes and poison soils. In mountainous countries such as the Philippines, rainfall, landslides and river flooding play a much bigger role.

Economic development could be exemplified by the contrasting responses to tropical storms from an HIC and an LIC.

Fires in nature

24

Factor	**Impact on wildfire**
Vegetation type	A wide variety of vegetation catches fire easily. Some has evolved to need wildfire in order to germinate. Grasses which may wilt during periods of drought are very susceptible, as are most species of tree. Fires and natural ecosystems are often closely linked, particularly Mediterranean climate regions and the savannah grasslands. Fire can clear vegetation and aid new seed germination, stimulate the growth of certain plants and rid an area of insects and some parasites. Some species are pyrophytic in that they can withstand fire through some mechanism such as resistant bark, for example the baobab tree. In Australia, plants such as *banksia* need fire for their woody fruit to open and thus regenerate.
Fuel characteristics	The fuel has to be of sufficient quantity and dry enough to burn. Climate affects the frequency and duration of droughts, during which the vegetation and litter has an opportunity to accumulate and dry out. Climate also affects the type of vegetation that will grow in an area and the rate at which litter can be produced.
Climate	Wildfires are common in climates that are sufficiently moist to allow the growth of vegetation but feature extended dry, hot periods. Such places include the vegetated areas of Australia and southeast Asia, the veld in southern Africa, the forested areas of the USA and Canada, and the Mediterranean basin. Global warming may increase the intensity and frequency of droughts in many areas, creating more intense and frequent wildfires.
Recent weather conditions	Temperature, relative humidity, precipitation and wind speed independently influence wildfire spread rates and intensities. The alignment of multiple weather extremes, such as the co-occurrence of hot, dry and windy conditions, leads to the most severe fires
Fire behaviour	Important aspects of fire behaviour are as follows: • Torching: movement of a surface fire up into tree crowns; the precursor to crowning • Crowning: active fire movement through the tree canopy • Fire whirl: result of an upward-spinning column of air that carries flames, smoke and embers aloft; whirls often form in heavy fuels on the lee (downwind) side of ridges and, in extreme conditions, can be powerful enough to twist off entire trees • Spotting: when glowing embers are lofted up and ahead of the main fire front, igniting multiple spot fires that then feed back into the main fire front to create very extreme and dangerous fire conditions

25 In the case of natural fires, lightning is by far the main cause. Climate will affect the frequency of electrical storms, particularly one in which there is hardly any rainfall.

In the USA, arson, escaped debris burns, campfires and engine sparks are the most common types of human-related ignitions. Over the past few decades, several of these ignition sources have become less common. Cigarettes used to frequently provide the spark that would set off a wildfire, but since the early 1970s there has been a 90% reduction on federal lands in this ignition source. The drop is probably related to the fact that fewer people today are smoking than 30 years ago.

26 Answers depend on the example chosen. You need to have a clearly located example. For your example you need to be able to quote a range of impacts (area destroyed, number of trees damaged, houses destroyed etc.). You will also need to have details of the human responses and then some measure of their success.

Exam-style questions (AS)

1 *Allow 1 mark for each valid point with additional marks for developed points. (3 marks)*

Similar to other forms of risk management, the management of wildfire risks begins with an assessment of the probability of a wildfire event and the susceptibility of highly valued resources and assets to wildfire. Strategic risk management in the wildfire context involves many complicating factors, including, but not limited to the following:

- Many wildlands are historically predisposed to periodic fire.
- Wildfire is a dynamic ecological process that has contributed to the development of many ecosystems.
- Wildfire is a spatial process: fuel continuity is critical in fire spread, and burned areas may be considerable distances from the ignition point.
- Many communities have developed within or adjacent to fire-prone ecosystems; these communities vary widely in their levels of wildfire exposure and susceptibility.
- Sociopolitical expectations regarding wildland fire management and community fire protection may not be realistic under current and expected future conditions.

2 *AO3: Level 2 (4–6 marks); Level 1 (1–3 marks)*

Afghanistan: $d = -3$; $d^2 = 9$

Japan: $d = 6$; $d^2 = 36$

$R_S = 0.358$

This falls well out of an acceptable significance level. We can conclude that the chances of there being a correlation between the number of disasters a country experiences and the amount of damage caused is not statistically acceptable. This is almost certainly due to the level of development that each country has attained.

3 *AO1, AO2: Level 3 (7–9 marks); Level 2 (4–6 marks); Level 1 (1–3 marks)*

Answers should concentrate on the explosiveness of a volcano, which is linked to the nature of the magma and its tectonic location. This then has to be combined with the proximity of the volcano to human settlement and/or infrastructure.

For example, the eruption of Eyjafjallajökull in Iceland in 2010 occurred under a glacier, but was also an ash eruption. The ash did minor damage to local farms but had a major effect on transatlantic air routes.

4 *AO1, AO2: Level 4 (16–20 marks); Level 3 (11–15 marks); Level 2 (6–10 marks); Level 1 (1–5 marks); Level 0 (0 marks)*

Your answer depends on the hazards to which you apply it. Whichever you choose, you should make clear what occurs during the stages of pre-disaster, relief, rehabilitation and reconstruction. Because the question asks you to assess the extent, then it would be best to choose two disasters, one which has followed the model, e.g. Bangladesh and its management of cyclones, and one which has parts absent, e.g. the 2010 Haiti earthquake.

Exam-style questions (A-level)

5 *AO2, AO3: Level 2 (4–6 marks); Level 1 (1–3 marks)*

There is clear correlation between spring/summer temperatures and wildfire frequency. There are spikes in both temperature and frequency in 1988, 1994, 2000 and 2003.There are dips in frequency when the temperature averages at below 14°C.

The correlation between the timing of spring snowmelt is less clear. In 1975 there is a clear link between the very late snowmelt and fire frequency, as there is in 1993. For much of the rest of the time there is correlation but it almost seems to have a time lag of a year. The higher the temperatures, the earlier the spring melt correlates directly with the length of the fire season.

6 *AO1, AO2: Level 3 (7–9 marks); Level 2 (4–6 marks); Level 1 (1–3 marks)*

Your answer depends on the example chosen. You must be able to give details of how the risk was managed and then link it to the damage that was caused.

7 *AO1, AO2: Level 3 (7–9 marks); Level 2 (4–6 marks); Level 1 (1–3 marks)*

Plate tectonics is the theory that Earth's outer shell is divided into several plates that glide over the mantle, the rocky inner layer above the core. The plates act like a hard and rigid shell compared to Earth's mantle. This strong outer layer is called the lithosphere. The plates move relative to one another and form broadly four different kinds of boundary.

You need to link each of the named features to its appropriate plate boundary and then state how that fits into the theory of plate tectonics.

8 *AO1, AO2: Level 4 (16–20 marks); Level 3 (11–15 marks); Level 2 (6–10 marks); Level 1 (1–5 marks); Level 0 (0 marks)*

Your answer depends on the example chosen. A good example might be the Philippines or Los Angeles. You will have to look at each specific hazard in turn, describing the causes and its associated risks. Then you have to account for the fact that although it is a risky environment, people still live there, prepared to take the risks that are presented.