

Earthquake

Amongst the natural geohazards, earthquakes take the greatest toll of human life in single events, particularly in the less developed countries where buildings and constructions are commonly not specially designed.

Magnification of shock effects where buildings and constructions overlie thick superficial material including liquefiable sands and clays was an important factor e. g. in Mexico City in 1985. In developed countries the financial toll may be extremely high, though the casualties are relatively few; for example, in Los Angeles in 1994, there were 60 fatalities but the damage was estimated at more than \$10 billion. A major earthquake in the nearby Tokyo conurbation of c. 30 million people would affect the entire global economy.

Adapted from: <http://egsp.lyellcollection.org/content/egsp/15/1/309.full.pdf>

Volcanic hazards

Volcanic hazards provide a major threat to many cities and towns: Armero, Columbia was destroyed by a lahar (volcanic mud flow) in 1985, with 23000 fatalities; volcanic ash from Irazu, Costa Rica, caused vast financial loss in 1963-65; and Rabaul, New Britain, had to be entirely evacuated in 1994 because of catastrophic ash falls. Quito, Ecuador, is under constant threat from lahars emanating from Cotopaxi, most of the outlying suburbs being set on historic lahar deposits.

Adapted from: <http://egsp.lyellcollection.org/content/egsp/15/1/309.full.pdf>

Tsunamis

Destructive tidal waves may follow earthquakes or explosive submarine volcanic eruptions, and also large-scale submarine landslides. Towns situated on the Pacific coastlines are particularly prone to tsunamis: in the Sanriku district of Japan 28000 people drowned in a tsunami event in 1896 and 3000 in a 1933 event. Oahu and the big island in Hawaii suffered 159 deaths and damage valued at US\$25 million from a tsunami sourced south of Unimak Island, Alaska, thousands of kilometres away, in 1946. The Chilean earthquake of 1960 caused 61 fatalities in the city of Hilo, Hawaii, and 180 on the Japanese coast.

Adapted from: <http://egsp.lyellcollection.org/content/egsp/15/1/309.full.pdf>

Landslides

Landslides, which may be due to natural causes or triggered by human activities, do not usually cause a great number of fatalities in each event, but taken overall they cause immense financial damage to urban settings throughout the world, annually. There are, however, exceptional very large-scale and catastrophic events, e. g. in the Vaiont Dam disaster in Italian Alps in 1963, 250 million m³ of rock slid into a lake, causing waves 100m high to overtop the dam, drowning 2600 people in the valley below. Hong Kong, where slopes are steep and rainfall is high, is prone to very costly slope failures and landslides. Los Angeles has suffered spectacular and costly landslide damage recently after heavy rainfall.

Adapted from: <http://egsp.lyellcollection.org/content/egsp/15/1/309.full.pdf>

Storms

Storm surges associated with cyclonic storms are also a cause of great loss of life and property. In Bangladesh, in 1970, the densely populated low-lying region of the Ganges delta suffered a storm surge from the Bay of Bengal during a hurricane and between 250000 and 500000 people were killed. A similar disaster occurred in the same

area in 1991 following another cyclonic storm surge, and fatalities were estimated at 139000. Much of the damage was to urban settlements, including cities of Chandpur and Kazipur, which were in danger of washing away.

Adapted from: <http://egsp.lyellcollection.org/content/egsp/15/1/309.full.pdf>

Permafrost

Permafrost in northern Canada and Siberia necessitates very costly building and construction practices. Such natural hazards are always with us, their effects being concentrated and accentuated in the urban setting. They cannot be removed and must be tackled by mitigation procedures (often of limited potential), such as avoidance of urbanization in hazard-prone sites, and emergency warning and preparedness systems. Evacuation of urban populations when severe risk arises is a viable option, but involves a difficult decision for socio-economic reasons: repeated evacuation of homes and property which prove to be groundless means that eventually there will be little or no response from the population when an event takes place. Alerts in 1958 and 1959 for tsunamis in Hawaii, when nothing happened, resulted in widespread disregard of the warning in 1960, when a tsunami event was actually experienced.

Adapted from: <http://egsp.lyellcollection.org/content/egsp/15/1/309.full.pdf>

Urban problems in Eastern and Central Europe

Many industrial cities and towns of the former Soviet Union have severe environmental problems related to neglect of environmental safeguards and planning. Industrialization in the urban setting along the coast of the Baltic Sea has caused extreme environmental damage in the Baltic States, and this pollution, coupled with that from fertilizers, pesticides and sewage, is extending throughout the Baltic. Flooding and land subsidence are also important, the latter problem affecting e. g. Polish Silesia as a result of underground mining. The scale and intensity of such problems is generally greater than in Western Europe.

Adapted from: <http://egsp.lyellcollection.org/content/egsp/15/1/309.full.pdf>

INTENSIVE, RAPID-ONSET GEOHAZARDS	PERVASIVE, SLOW-ONSET GEOHAZARDS
Earthquakes	Peatlands and other compressible soil
Active faults	Permafrost conditions
Volcanic eruption	Subsidence related to mine working

Tsunamis	
Lava	Groundwater pollution
Lahars	Surface water pollution
Landslides	Depletion of the groundwater resource, including loss of recharge
Avalanches	Rising sea levels
Debris flows	Contaminated soils
Rapid subsidence	Saline soils
Flooding	Radon emanation
Storms	Erosion and deposition
Cyclones	Soil loss in coastal situations
Tornadoes	Sea water intrusion
Wildfires related to earthquakes	
Combustions related to hazardous gases such as methane	

Floods

Inundation and flooding as a result of rising sea levels threaten many coastal cities: this may be a combination of natural sea transgression and rise due to global warming, related to anthropogenic causes. The industrial cities of Shanghai, Tianjin and Guangzhou on the coast of China are also threatened.

Adapted from: <http://egsp.lyellcollection.org/content/egsp/15/1/309.full.pdf>

Cause and effect

- ❑ Rising sea levels result in inundation and flooding.
- ❑ Inundation and flooding cause a threat to many coastal cities.
- ❑ Rising sea levels may result from global warming, related to anthropogenic causes.

Conditionals

- If the sea didn't rise, there would be less flooding.
- If there were less inundation and flooding, coastal cities wouldn't be so threatened.
- If people hadn't influenced the climate, the sea wouldn't have risen.

ZERO CONDITIONAL (FACT)

IF + present tense, present tense.

FIRST CONDITIONAL (REAL/LIKELY SITUATION)

IF + present tense, will + infinitive.

SECOND CONDITIONAL (UNREAL/IMAGINARY SITUATION)

IF + past tense, would + infinitive.

THIRD CONDITIONAL (UNREAL/IMAGINARY PAST SITUATION)

IF + past perfect, would + have + past participle.