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New Zealand Qualifications Authority

## Scholarship 2025 Geography

### RESOURCE BOOKLET

Refer to this booklet to answer the questions for Scholarship Geography.

Check that this booklet has pages 2–23 in the correct order and that none of these pages is blank.

**YOU MAY KEEP THIS BOOKLET AT THE END OF THE EXAMINATION.**

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## EXTREME NATURAL EVENTS IN A GLOBAL CONTEXT

### Temporal trends

#### Trend in the number of natural disasters, 1900–2019



**Figure 1:** Global natural disaster trends, 1900–2019. Includes drought, earthquakes, volcanic activity, mass movement (dry), storms, floods, landslides, wildfires, and extreme temperatures.

Data captured between 1900 and 2019 by the Institute for Economics and Peace reveal an increase from 39 natural disaster incidents in 1960 to 396 in 2019. Flooding is the most common natural disaster since 1990. From 1990 to 2019, a total of 9,924 natural disasters occurred globally, of which 42% were floods. Storms including cyclones, hurricanes, tornadoes, blizzards, and dust storms, followed and accounted for 30% of the total natural disasters in this time period. Together, floods and storms account for 72% of the disasters that have occurred since 1990.

## Global deaths from disasters, 1900–2020

**Figure 2:** Global deaths from disasters. The size of the bubble represents the estimated annual death toll. The largest years are labelled with the total figures, alongside large-scale events that contributed to the majority – although usually not all – of these deaths.

In the 20th century, it was common to have years when the death toll was in the millions. This was usually the result of major droughts or floods. Often these would lead to famines. Improved food security, resilience to other disasters, and better national and international responses mean that the world has not experienced death tolls of this scale in many decades. Famines today are usually driven by civil war and political unrest.

In most years, the death toll from disasters is now in the range of 10,000 to 20,000 people. In the most fatal years, which tend to be those with major earthquakes or cyclones, this can reach tens to hundreds of thousands.

### 2023: In just one year

Natural calamities and harsh weather dominated news headlines in 2023. Seismic tremors, massive floods, raging wildfires, unrelenting droughts, landslides, cyclones, and storms hit around the world, killing and displacing tens of thousands of people.



**Figure 3:** Drinking water supplies have plunged to their lowest level since 1990 due to extreme drought in Catalonia. Here, a man walks on the cracked ground of the Baells reservoir, in the village of Cercs, in the Berguedà region, Spain, on 14 March, 2023.

**Figure 4:** Rescuers and relatives sit in front of collapsed buildings after flooding caused by Storm Daniel, in Derna, Libya, on 18 September, 2023.

The Horn of Africa – only slowly emerging from a devastating drought that left millions hungry – also experienced heavy rainfall and floods linked to the El Niño weather phenomenon. The flash floods in November killed dozens of people and caused large-scale displacement in Kenya, as well as Somalia and Ethiopia.

On the other hand, record droughts caused river levels to fall and other water bodies to dry up across various parts of the world, including the Amazon rainforest. Scientists say these kinds of extreme weather events will become more common and more severe as the Earth warms.

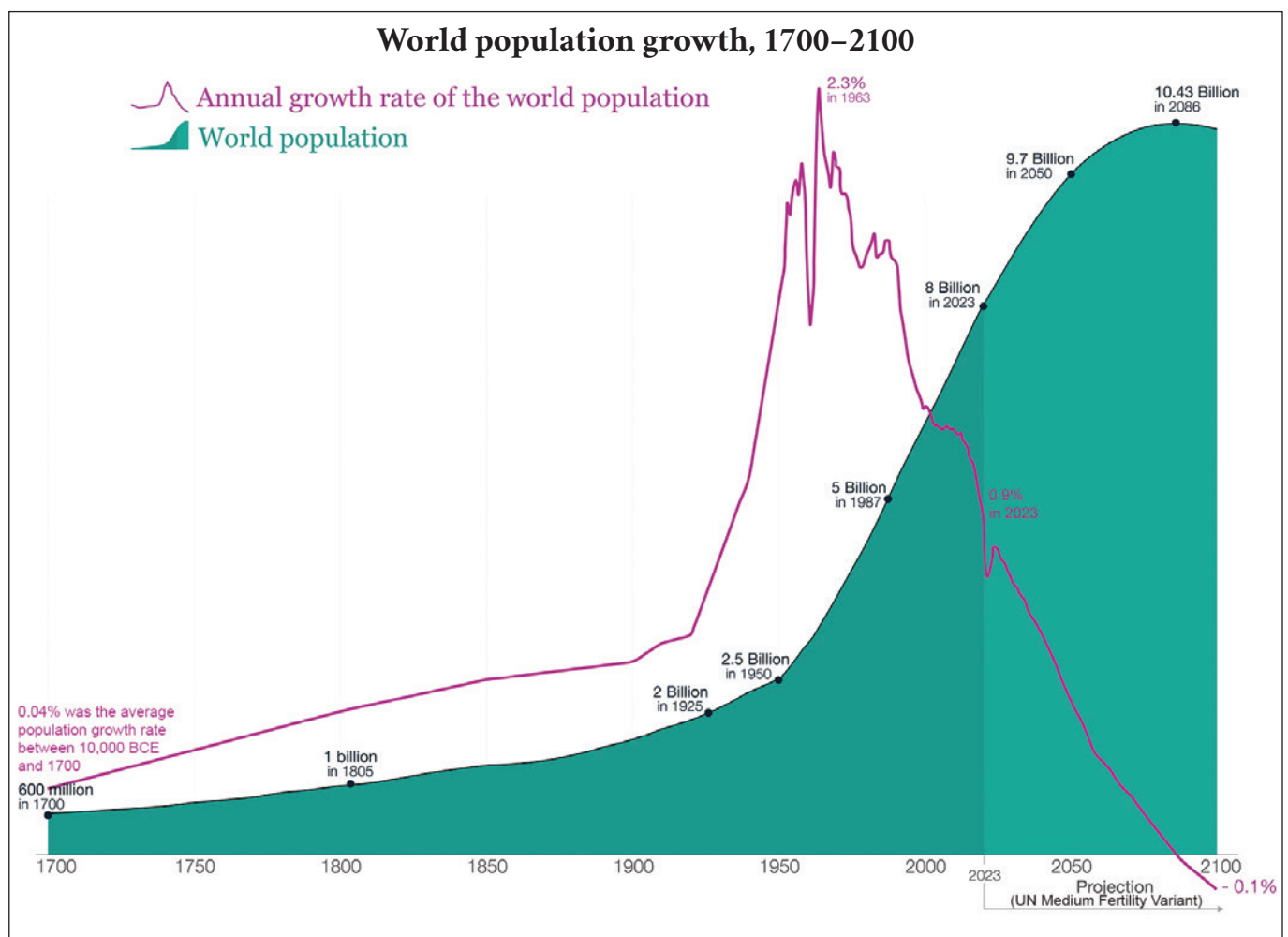
## Population growth and distribution

Population growth and distribution, especially increased population density and urbanisation, increase vulnerability to disasters. Nearly 80% of the United States' population resides in urban areas, resulting in increasing population concentration in coastal communities and flood-prone areas. Congestion, limited escape routes, dense infrastructure, and poverty add to the vulnerability.

Cities and countries in other regions of the world face similar problems. For example, researchers argue that in countries such as China, urban earthquakes are more dangerous because of the density of the infrastructure. The growth of coastal populations also raises important concerns about increased human exposure to coastal flooding, hurricanes, and tsunamis.

Population density affects how damaging a disaster will be; an earthquake that strikes a city will do more harm than one that impacts a small town.

The United Nations Office for Disaster Risk Reduction (UNDRR) emphasises that human actions such as deforestation, urbanisation, and inadequate infrastructure worsen the impacts of events like floods, earthquakes, and storms.



**Figure 5:** World population growth.

### Extreme weather events

The global surface temperature has increased by about 1 °C since the 1850s. And according to the Intergovernmental Panel on Climate Change (IPCC), this warming has been indisputably caused by human influence.

As the global temperature has risen, the frequency of extreme weather events has increased along with it. Heatwaves, droughts, and extreme rainstorms used to happen once in a decade on average, but now:

- heatwaves are 2.8 times more frequent
- droughts are 1.7 times more frequent
- extreme rainstorms are 1.3 times more frequent.



**Figure 6:** The increase in frequency of catastrophic climate events.

**Case study: North America**

**Figure 7:** The cost of United States weather and climate disasters, 1980s to 2024.



**Case study: Afghanistan desertification**

Once covered in lush forest, Afghanistan has lost the majority of its trees, which now occupy only 1.5% of the country's landmass, according to Rajendra Aryal, country representative for the United Nations' food agency.



**Figure 8:** Bamyan, Afghanistan.




According to figures from the International Organization for Migration (IOM), nearly 1.2 million people in Afghanistan have been forced from their homes by natural disasters such as floods and droughts since 2012.

### **Spatial pattern of risk from extreme natural events**

The *World Risk Report*, which is published each year, looks at the risks of natural disasters. The model used in the report takes into consideration the exposure of countries to natural disasters, but also their ability to cope and deal with such events. The end result is a World Risk Index that ranks 171 countries based on the risk that natural disasters can pose.

North America and Europe generally rank as significantly low on the list. In 2016, visualised on the facing page, the United States had a risk level of 3.87% while Canada had a level of 3.14%.

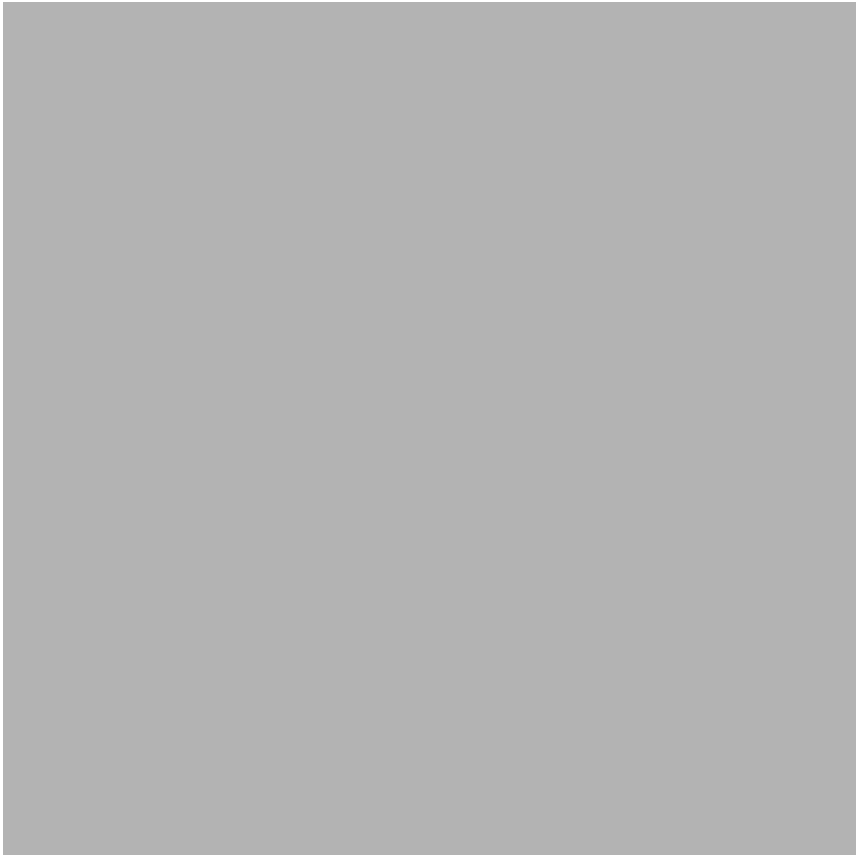





**Figure 9:** Visualisation of the World Risk Index, 2016.

### Plate tectonics

Certain types of natural disasters are more likely to occur in specific geographic regions. Earthquakes and volcanic eruptions are most frequent near tectonic plate boundaries. An especially active boundary exists between the Indo-Australian and Eurasian plates.



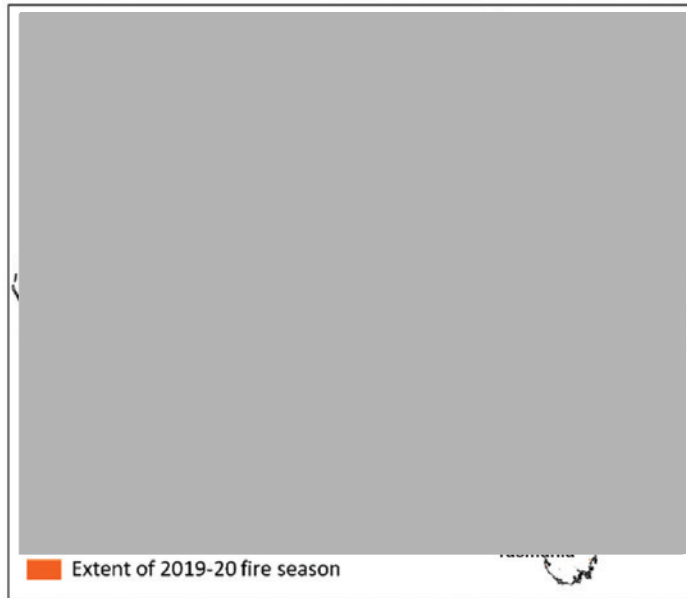
**Figure 10:** Pacific Ring of Fire, the belt of active volcanoes, volcanic arcs, and tectonic plate boundaries that frame the Pacific Ocean.



**Figure 11:** The yearly frequency (bar graph) and cumulative frequency (line graph) of earthquakes of magnitude 6 or greater in the Japanese archipelago and surrounding areas.

## Australian bushfire emergencies

The massive geographic scale and severity of the 2019–2020 Black Summer bushfires form part of a confirmed trend of worsening fire weather and larger, more intense wildfires caused by climate change. It has sparked growing interest in building sustainability into fire risk management and the landscape.



**Figure 12:** Extent of the 2019–20 Black Summer fire season.

The 2019–2020 Australian bushfire season, from September 2019 to February 2020, was catastrophic in scale and impact – both for people and for nature. It caused 33 deaths, of which nine were firefighters; destroyed 3,094 houses; and burned over 17 million hectares (ha), including 210,606 ha of land on Kangaroo Island and 90,000 ha of national park in South Australia. Nearly 3 billion animals were impacted by the blazes.

Aboriginal people have used fire to manage forested landscapes for millennia and the practice helped reduce bushfire risk in the past. Yet their knowledge and perspectives have not been incorporated into forest fire management and recovery. Indigenous people should be supported to rekindle cultural fire practices in forests and non-Indigenous fire managers should, with consent from Aboriginal people, incorporate these practices into policies governing fire management and recovery.

### Asia vulnerability

In 2023, vulnerable countries were disproportionately impacted by natural hazards. One major climatic hazard is drought, which affects agriculture and its contribution to the economy of most Southeast Asian countries – up to 25% of the GDP in countries such as Cambodia and Myanmar. Recent estimates suggest that droughts represent 60% of the total annual average losses from all disasters in the region.

In 2022, economic losses due to disasters relating to floods exceeded the average for the 2002–2021 period. The most significant losses of this type were in Pakistan (over USD15 billion), followed by China (over USD5 billion), and India (over USD4.2 billion). Economic losses in 2022 associated with droughts were the next largest category, causing USD7.6 billion in damages (mainly in China); this exceeded the 2002–2021 average (USD2.6 billion) by nearly 200%.

Natural hazards affecting Asia, 2022

**Figure 13:** Asia natural hazard statistics, 2022.

## The children of Typhoon Yagi

In September 2024, floods and landslides triggered by Typhoon Yagi ravaged Vietnam, Myanmar, Laos, and Thailand, affected nearly 6 million children and compromised their access to clean water, education, healthcare, food, and shelter – pushing already marginalised communities deeper into crisis. The most vulnerable children and families face the most devastating consequences of the destruction left behind typhoons such as Yagi.



Children in East Asia and the Pacific are exposed to multiple, overlapping climate and environmental hazards, facing these threats six times more often than their grandparents did. The intensifying frequency and compounding effects of climate-related hazards erode children's coping strategies, deepen inequality, and harm their potential to thrive.



**Figure 14:** Cleaning up a kindergarten in Vietnam after Typhoon Yagi.

## Responsibility

To counteract the consequences of these climatic events, disaster risk governance for prevention, mitigation, preparedness, response, recovery, and rehabilitation is necessary at the regional, national, and global levels.

The Sendai Framework for Disaster Risk Reduction 2015–2030 (Sendai Framework) was the first major agreement of the post-2015 United Nations development agenda and provides member states with concrete actions to protect development gains from the risk of disaster. It works hand in hand with the other 2030 Agenda agreements, including the Paris Agreement on climate change and ultimately the Sustainable Development Goals.

### **Seven targets of the Sendai Framework**

The seven global targets of the Sendai Framework will significantly contribute to the achievement of the Sustainable Development Goals.

**Figure 15:** Sendai Framework targets.



### **Cyclone Preparedness Programme early warning system**

With the implementation of Disaster Risk Reduction (DRR) initiatives such as that of Bangladesh's Cyclone Preparedness Programme (CPP), a programme jointly run by the government of Bangladesh and the Bangladesh Red Crescent Society (BDRCS), the communities of the coastal areas in Bangladesh have become more aware of the need to go to safe shelters during emergencies, have understood the significance of early warning, and learned to pay heed to advice from CPP and youth volunteers.



**Figure 16:** People resting at a cyclone shelter in Bangladesh.

## Technological solutions

Technological advancements have allowed society to enhance capacity to prepare for, respond to, and recover from the aftermath of natural disasters.

The terms ‘remote sensing’, ‘radars’, and ‘satellite imaging’ refer to technologies that let people learn more about the Earth’s surface and atmosphere from a distance.



**Figure 17:** Technology for natural disaster mitigation.



### Flood Early Warning Early Action System – Indonesia

The Flood Early Warning Early Action System (FEWEAS) was developed through a collaboration between the Indonesian Red Cross (PMI) and Bandung Institute of Technology (ITB).

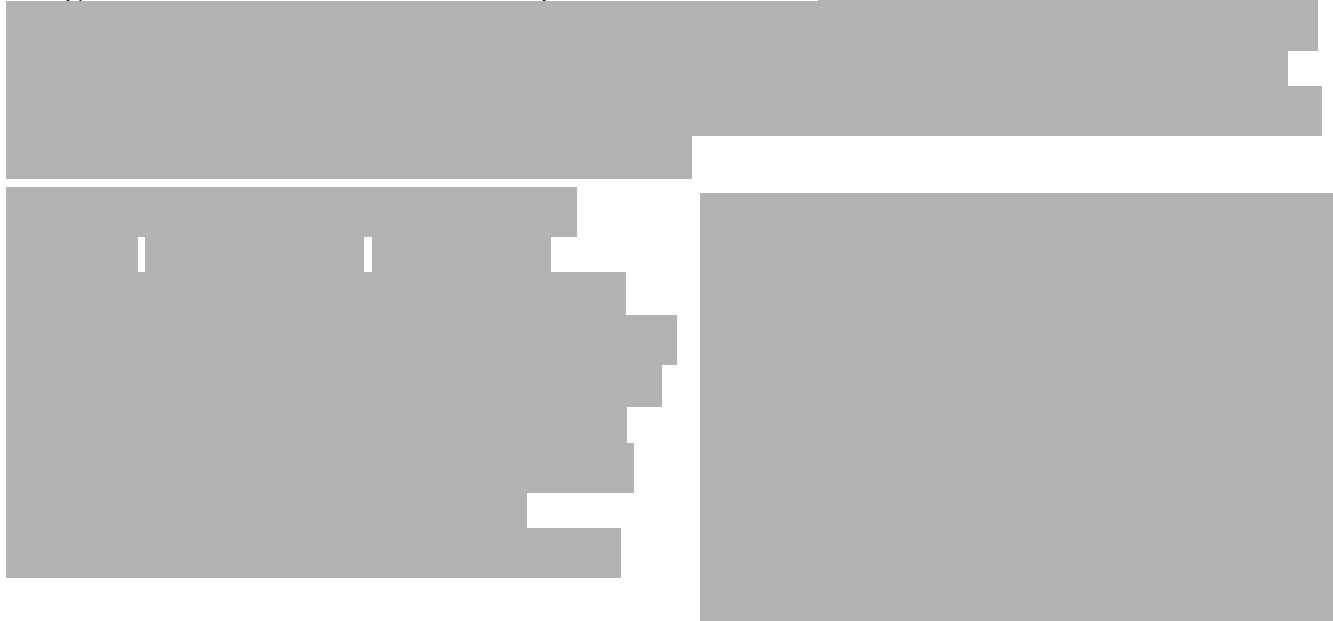


**Figure 18:** Example implementation of a Flood Early Warning Early Action System.

While the app provides flood alerts and updates to the community through smartphones, the communities and community-based action teams can update their response, upload photos, videos, and relevant information to further inform response actions.

### Disaster-proof construction – California

In natural-disaster-prone areas across the United States, homeowners are building houses designed to withstand a multitude of possible calamities.

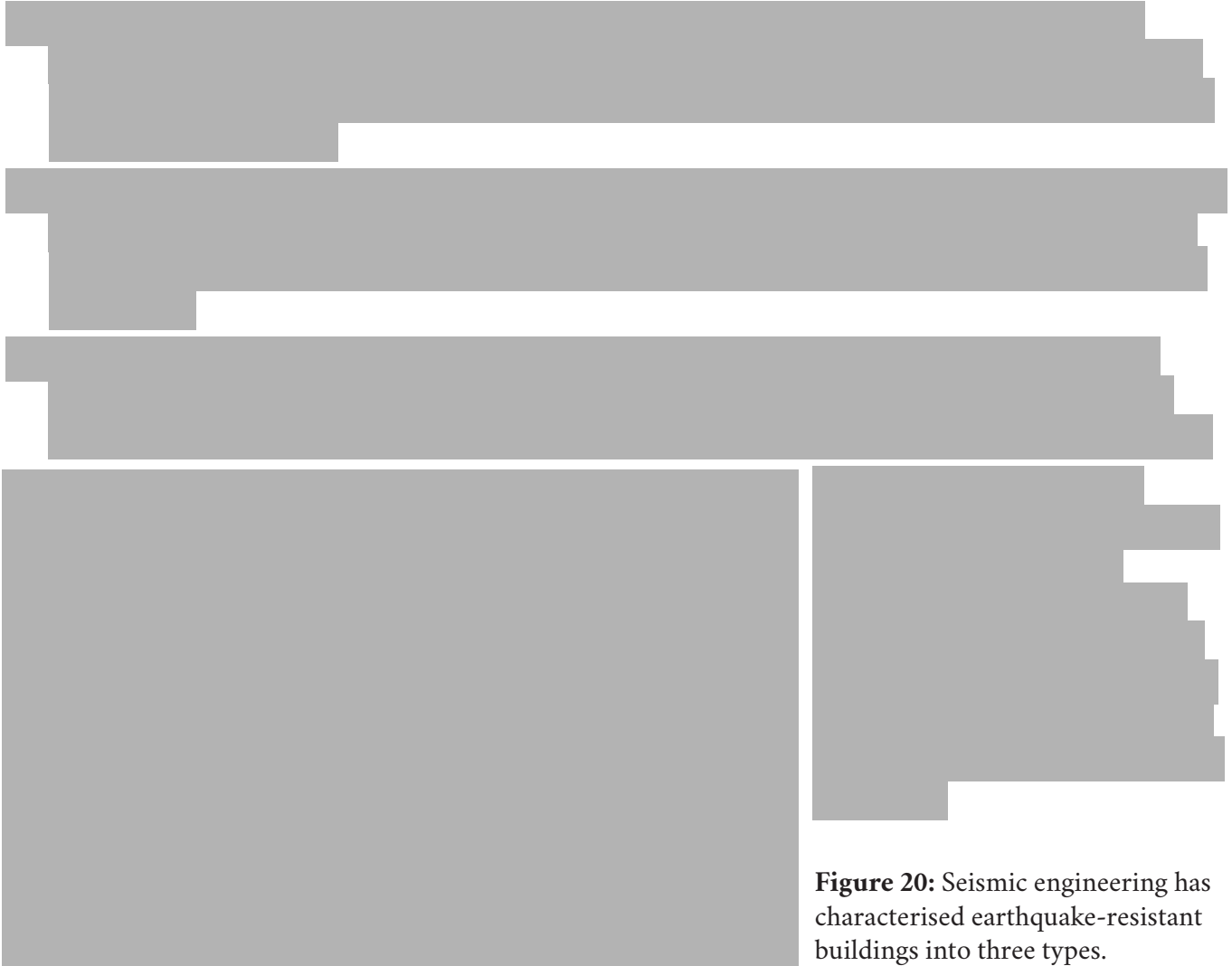


**Figure 19:** The Q Cabin, made largely of non-combustible materials.

## Earthquake-proofing building solutions

### Earthquake-resistant buildings – Japan

Due to Japan's position on the Ring of Fire, a seismic hotspot, Japanese engineers' skill in designing earthquake-proof buildings is a necessity. Seismic engineering has characterised earthquake-resistant buildings into three types, and although not legally required, Japan recommends and encourages using these standards to increase building seismic performance.



**Figure 20:** Seismic engineering has characterised earthquake-resistant buildings into three types.

### Base isolation devices

Base isolators are designed to absorb energy and induce a damping effect on a building during an earthquake. They separate the structure from its foundation, reducing movement during the quake due to their flexibility.

Such systems are able to reduce shaking by five times.




**Figure 21:** A seismic base isolator.

## Nature-based solutions

### Integrated coastal community resilience and disaster risk reduction – Indonesia

Worsening erosion has affected the ecology and increased the vulnerability of coastal communities in Demak, central Java. The Indonesian Red Cross has mobilised communities via community-based action teams to restore the ecosystem through mangrove planting and to implement alternative livelihood-generation to improve community resilience.



**Figure 22:** Local residents plant mangroves at the government's conservation site in the Teluknaga area in the northern part of Jakarta.

### **Indigenous fire management – the Kimberley, Australia**

In the last 25 years, with the introduction of native title and the recognition that Western fire prevention methods have not been working effectively, there has been a reinvigoration of traditional fire management in the Kimberley and all across northern Australia.



**Figure 23:** Minyawu Miller, an elder in the Punmu Aboriginal Community, lights fires in the Great Sandy Desert in Australia.

## Acknowledgements

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