

## Hazardous Earth: Earthquakes in Japan and Nepal



### Earthquake in a Developed Country: Tohoku, Japan 2011



On the **11<sup>th</sup> March 2011**, a **9.0 magnitude earthquake** struck 70km from the coast of Sendai Bay, severely affecting the **region of Tohoku** and the city of Sendai.

The earthquake was the most powerful recorded earthquake in Japan's history and was the **costliest natural disaster in history**.

A **huge tsunami followed the earthquake**, devastating the east coast of Japan, namely the **nuclear meltdown in Fukushima**.

Japan is a **developed country**, with a GDP of **4.97 trillion USD (2018)**.



(Source: [www.britannica.com/event/Japan-earthquake-and-tsunami-of-2011](http://www.britannica.com/event/Japan-earthquake-and-tsunami-of-2011))



### Earthquake in a Developing Country: Nepal 2015



On the **25<sup>th</sup> April 2015**, a **7.8 magnitude earthquake** hit Nepal, followed by **several severe aftershocks** in the months after. The original earthquake's **epicentre** was around **80km away from Nepal's capital, Kathmandu**.

The earthquake originated only **15km below the surface**, meaning it was felt **very strongly** on the surface.

**Huge avalanches and landslides** were triggered in the **The Himalayas** which run through Nepal.

Damage from the earthquake extended **hundreds of kilometres** into Pakistan, Tibet and India.

Nepal is a **developing country**, with a GDP of **29.04 billion USD (2018)**.



(Source: [www.britannica.com/topic/Nepal-earthquake-of-2015](http://www.britannica.com/topic/Nepal-earthquake-of-2015))

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## Impacts of Earthquakes in Contrasting Areas

### Impacts in Japan



Developed country

#### Primary impacts

- Damage and deaths (around 700 people) from the earthquake itself were low despite the **large magnitude of the earthquake**.
- Estimated cost of **USD\$235 billion** - the costliest natural disaster in history.
- Around **30 homes and buildings** were destroyed and **1000** were damaged.
- **Two nuclear power stations** suffered fractures, causing their shut down and loss of power.
- An oil refinery was set on fire due to **damaged gas pipes**.
- Roads and railways were badly damaged, including the **Tohoku motorway**.
- The **Fujinuma Dam failed** and collapsed after the earthquake, washing away 5 houses and killing at least 4 people.
- Minor **liquefaction** of the ground caused by shaking, leading to damage of roads and infrastructure.



*The Fujinuma Dam's empty reservoir.*

(Source: [ChiefHira/wiki](#))

#### Secondary impacts

- **A huge tsunami** with waves up to **40 metres** (131ft) **high** in some places **devastated** the eastern coast of Japan following the earthquake.
- **15,900 people died, 2600 missing**, and 6150 were left injured, mainly due to the **tsunami**.
- **450,000 people were left homeless** and many more were left without a job after **120,000 buildings** were completely destroyed.
- **Fukushima Daiichi** nuclear power plant was very badly damaged. The plant suffered **nuclear meltdowns and explosions**, causing **radioactive contamination** in the area and a mass evacuation. 4 years later people were still not allowed to return to the area surrounding the power plant.



*Devastation in a coastal region of Tohoku.*

(Source: [The Asahi Shimbun/Getty Images](#))



*Fukushima Daiichi power plant following the nuclear meltdown.*

(Source: National Geographic)



## Impacts in Nepal



Developing country

### Primary impacts

- **9,000 killed** and **20,000 injured**.
- **8 million people** affected ( $\frac{1}{3}$  of Nepal's population).
- An estimated **3 million people left homeless** after homes were destroyed.
- **7,000 schools destroyed**, and **50% of all shops destroyed**, leading to food and supply shortages.
- **Power, water and communications** were severely affected.
- **1.4 million people** were urgently in need of food, water and shelter.
- The cost of damage was estimated at around **USD\$5 billion**.
- Many **historical sites and landmarks** were damaged or destroyed.



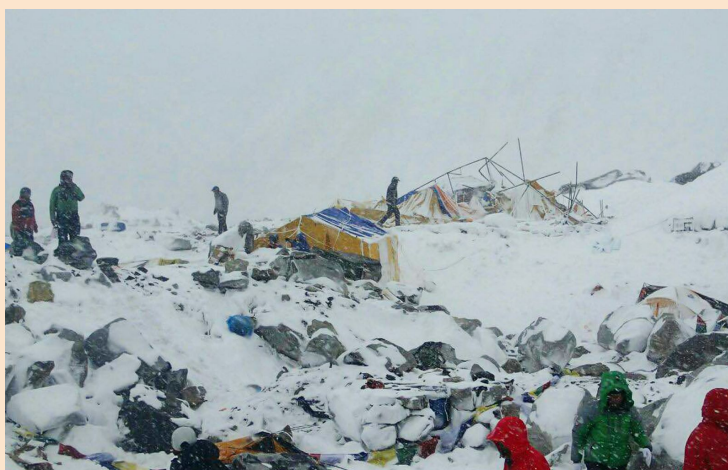
(Source: [ReSurge International](https://www.reurge.com/))



(Source: [www.ctvnews.ca/world/nepal-earthquake-before-and-after](http://www.ctvnews.ca/world/nepal-earthquake-before-and-after))

### Secondary impacts

- **Landslides and avalanches** triggered by the ground shaking, causing widespread damage to **infrastructure**, blocking **roads** and trapping people under **snow and rubble**.
- The avalanches on **Mount Everest** killed at least **19 people**, and avalanches elsewhere left hundreds missing.
- Landslides **blocked rivers**. For example, the **Kali Gandaki River** was blocked by a landslide, and many people had to be evacuated in case of **flooding**.
- There was no tsunami as the earthquake started on **land**.



*Base camp on Mount Everest.* (Source: [National Geographic](https://www.nationalgeographic.com/))



## Management of Earthquakes in Contrasting Areas

Due to their contrasting levels of wealth and preparedness, Japan and Nepal had different short-term and long-term strategies to respond to the earthquake.

### Short-term relief in Japan

**Tsunami warnings** were issued by the Japan Meteorological Agency **three minutes** after the earthquake. Modelling and forecasting technology allowed scientists to predict where the tsunami would hit after the earthquake.

Within hours of the **tsunami hitting the coast**, **rescue workers** and around **100,000** members of the **Japan Self-Defence Force** were dispatched to help in the search and rescue operations.

Some people were rescued quickly from under rubble with the help of sniffer dogs. However, much of the search and rescue teams focused on recovering bodies washing up on shore following the tsunami.



Japanese Ground Self-Defense Force, Ōfunato. (Source: [Matt Dunham/AP](#))

Japan received help from the **US military**, and **international search and rescue teams** were sent from New Zealand, Australia, South Korea, China and India. Many areas were **covered** in debris and mud following the tsunami so were difficult to access in the earlier stages of relief.

**Hundreds of thousands of people** who had lost their home or were evacuated used temporary shelters set up in schools and other public buildings.

A large number of evacuees came from the exclusion zone surrounding the Fukushima nuclear power plant. Many people were **quickly put into temporary accommodation** or **relocated to other areas**.



After the Fukushima Daiichi nuclear meltdown, those who were in the area had their **radiation levels checked and health monitored** to ensure they did not receive dangerous exposure to radiation. An example of this can be seen on the right.

Many evacuees were given **iodine tablets** to stop radiation poisoning.



(Source: [Reuters / Kim Kyung-Hoon](#))



## Short-term relief in Nepal

For the first **24-hours** after the incident, there was **no aid sent to the affected area**. The **isolated location** and **poor transport links** made it difficult for aid organisations to reach the area quickly.

Within a few days, **international aid** arrived from the **UK, India and China**. They brought search and rescue teams, **medical support and essential supplies**. Over **£87 million** in aid was raised by donations.

Nepal relied heavily on international aid as the country did not have funds for disaster relief.



RAF aircraft loaded with aid supplies sent from Britain. (Source: [Steve Lympany/MOD](#))

**Half a million tents** were provided after the earthquake, many from **UNICEF**. These tents provided shelter for the **homeless**, and were also used as temporary classrooms and healthcare facilities as the **strong aftershocks** prevented people from using buildings.



Tents used as emergency shelters after the Nepal earthquake. (Source: [UNICEF](#))

**With help from international aid, field hospitals** were set up as hospitals were extremely overcrowded with casualties.

China sent a **62-person search and rescue team** after initial search and rescue efforts in Nepal were slow (see image to the right).

**Helicopters** were used for **search, rescue and supply distribution**. Those left stranded by avalanches were rescued by helicopter, and **communities** cut off by severe landslides were given vital supplies.



(Source: [© Stringer China / Reuters](#))

**Social media** was used as a means of communication for those affected. Facebook introduced a **safety check feature** after the earthquake which allowed people to mark themselves as 'safe' to family and friends.

**300,000** people fled from the capital, Kathmandu, to seek shelter elsewhere, e.g. with family.



## Long-term Responses to Earthquake Hazards

### Planning



#### Japan

- **Earthquake drills** every year in schools and also held in workplaces.
- **Emergency services** are specially trained in earthquake response methods.
- **Government funding** and policies for future earthquake hazards.

#### Nepal

- In 2015, there was very little **earthquake response planning** in Nepal despite it being one of the most **disaster prone countries in the world**.
- Programmes have been set up on a **community level** to train people how to respond to earthquakes, as they are usually the first ones on the scene.

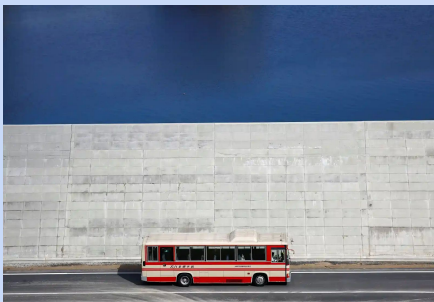
### Preparation



- Buildings are designed to be **“earthquake proof”**, built to withstand huge tremors (e.g. deep foundations, strong and flexible frames, gas immediately shuts off to stop gas leaks and fires). Around **87% of buildings in Tokyo** are built to be “earthquake proof”.



- Larger **sea walls** have been constructed along the coasts in an attempt to **block tsunami waves** from reaching inland.



(Source: [www.theguardian.com](http://www.theguardian.com))

- Earthquake and tsunami warning alerts are sent to **every smartphone in Japan** and widely broadcast on television.
- Many people have **earthquake survival kits** in their homes, containing first aid kits, bottled water, survival tools, radio etc.

- Rebuilding is taking place in Nepal, making buildings **more resistant to earthquakes** whilst also preserving the unique **heritage** of the area.

However, many of the buildings are being rebuilt as **one storey homes** to make them ‘earthquake proof’, which is not appropriate for larger families.

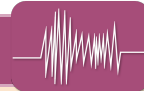


*Poku, Ramechhap: the home owner has built a one room, one storey ‘earthquake-safe’ building next to their old, damaged house to access the GoN housing reconstruction grant. They continue to live in the old house because the new one is too small for the family. Photo Credit: Subash Karki/BBC Media Action*

- The recovery and preparedness process has had major **community involvement**, ensuring they are involved with rebuilding, education and hazard response training.
- **Community-led planting** of vegetative barriers to **stabilise hillslopes** and reduce the risk of landslides has taken place.



## Prediction



- There is currently no sound technology to predict earthquakes, but there is technology in Japan that can predict the areas where an earthquake will hit.
- **Buoys in the ocean** detect offshore earthquakes and **predict the areas most at risk**, sending alerts to those areas that an earthquake is incoming and they should seek immediate cover.
- **Tsunamis** can be quickly predicted in Japan using data from the **magnitude and location** of the earthquake, prioritising areas for evacuation. Tsunami prediction in Japan is thought to be **80 to 90% accurate** at predicting the level of damage in an area.
- Although earthquakes cannot be predicted, the **probability** (chance) of an earthquake occurring can be calculated using **historical data and modelling**. A large scale earthquake was already **overdue** in Nepal before 2015, but there were not effective strategies to prepare.
- **Landslides and glacial flooding events** that are triggered by earthquakes can be modelled and predicted to identify **high risk areas** that are likely to suffer in the next event. Nepalese authorities have had issues with **implementing building restrictions** in these areas, as they are usually ignored.

