



KAMARAJ IAS ACADEMY
Only IAS Academy by Grandson of "Perunthalsivam Kamarajar"

Colombia's Major 7.4 Magnitude Earthquake Highlights Seismic Vulnerability of the Pacific Ring of Fire and Andean Region

Published On: 13-08-2026

Recent Developments:

- On **10 August 2026**, a **magnitude 7.4 earthquake** struck western Colombia, with the epicentral area near **San José del Palmar in Chocó Department**.
- Colombian authorities declared a **national state of emergency** following widespread casualties, injuries and structural damage. By **11 August 2026**, reported fatalities had crossed **100**, with hundreds of people injured and rescue operations continuing.
- The earthquake occurred at a depth of roughly **96–107 km**, placing it in the **intermediate-depth earthquake** category according to the standard classification of earthquake focal depths.
- The **Colombian Geological Service** described the event as the strongest earthquake recorded in the country during the **21st century**, highlighting Colombia's significant seismic vulnerability.
- The earthquake affected western and central parts of the country, with strong shaking and damage reported in areas including **Chocó, Risaralda, Valle del Cauca, Caldas and Quindío**.

Why is Colombia Highly Prone to Earthquakes?:

Nazca–South American Plate Convergence:

- Along Colombia's Pacific margin, the oceanic **Nazca Plate** moves beneath the **South American Plate**, generating intense tectonic deformation and seismic activity.
- This **subduction process** causes accumulation and periodic release of tectonic stress, producing earthquakes of varying magnitudes and depths.

Complex Tectonic Setting:

- Colombia lies within a highly deformed region influenced by the interaction of the **Nazca, South American and Caribbean Plates**, together with smaller tectonic blocks such as the Panama and Coiba blocks.
- This complex configuration produces several types of seismicity, including **subduction-related, crustal and intermediate-depth earthquakes**.

Pacific Ring of Fire:

- Colombia lies along the **Pacific margin of South America**, which forms part of the broader **Circum-Pacific seismic and volcanic belt**, commonly known as the **Pacific Ring of Fire**.
- The region is characterised by frequent earthquakes and volcanic activity because of widespread **plate convergence and subduction**.

Kamaraj IAS Academy

Plot A P.127, AF block, 6 th street, 11th Main Rd, Shanthi Colony, Anna Nagar, Chennai, Tamil Nadu 600040

Phone: **044 4353 9988 / 98403 94477 / Whatsapp : 09710729833**

Andean Tectonic Activity:

- Continued convergence between tectonic plates has contributed to the **uplift, folding and deformation of the Andes**, producing numerous faults and zones of accumulated crustal stress.
- Western and central Colombia therefore contain several active or potentially active seismic structures associated with the broader Andean tectonic system.

Intermediate-Depth Earthquakes:

- The recent earthquake occurred at approximately **96–107 km depth**, placing it within the **70–300 km intermediate-depth category**.
- Intermediate-depth seismicity is commonly associated with descending slabs in **subduction zones**, where oceanic lithosphere penetrates into the mantle.
- Earthquake depth provides important information about the geometry and behaviour of a subducting plate and the broader tectonic setting.

High Urban and Infrastructure Exposure:

- Major Colombian cities such as **Cali, Bogotá, Medellín, Pereira and Manizales** lie within or near seismically active Andean regions.
- Earthquake risk depends not only on seismic hazard but also on **population exposure, building vulnerability, infrastructure quality and disaster preparedness**.

Stress Transfer Between Faults:

- Movement along one fault can **redistribute stress** within surrounding rocks and potentially alter the likelihood of movement on nearby faults.
- However, a direct causal relationship between separate earthquakes requires detailed **seismological and geophysical analysis** rather than simple geographic association.

Earthquake Hazard, Risk and Vulnerability:

Hazard:

- **Earthquake hazard** refers to the probability of experiencing potentially damaging ground shaking and associated geological effects in a particular area.
- Colombia's hazard is elevated because of its location near **active plate boundaries, subduction zones and crustal faults**.

Exposure:

- **Exposure** refers to the people, buildings, infrastructure and economic assets located in hazard-prone areas.
- Rapid urbanisation and the concentration of population and infrastructure in seismically active regions can increase potential losses.

Vulnerability:

- **Vulnerability** depends on the quality of buildings, enforcement of seismic building codes, poverty levels, infrastructure resilience and emergency preparedness.
- Therefore, a high-magnitude earthquake does not automatically produce a high-disaster outcome; the final impact depends strongly on **exposure and vulnerability**.

Disaster Risk:

- Disaster risk can be broadly understood through the interaction of **hazard, exposure and vulnerability**, making risk reduction dependent on both geological knowledge and human preparedness.

Pacific Ring of Fire:

About:

- The **Pacific Ring of Fire**, also known as the **Circum-Pacific Belt**, is a horseshoe-shaped zone surrounding the Pacific Ocean that is characterised by frequent **earthquakes and volcanic eruptions**.
- It is one of the world's most active tectonic regions because it contains numerous **convergent plate boundaries and subduction zones**.

Geographical Extent:

- The Ring of Fire extends around the margins of the **Pacific Ocean**, from the western coasts of South and North America through Alaska and the Aleutians to East Asia, Southeast Asia and New Zealand.
- It broadly follows the boundaries of several major tectonic plates surrounding the Pacific Basin.

Global Seismic Significance:

- The **U.S. Geological Survey** estimates that approximately **90% of the world's earthquakes** occur within the broader Ring of Fire region.
- The belt is therefore one of the most important global zones for studying **earthquakes, volcanism, subduction and plate interactions**.

Major Plates:

- Major plates associated with the Ring of Fire include the **Pacific, Nazca, Cocos, Juan de Fuca, North American, Philippine and Australian Plates**, along with several smaller tectonic plates and blocks.

Spatial Distribution:

- The belt extends along the **western margins of North and South America**, through Alaska and the Aleutian Islands, and across East and Southeast Asia towards **New Zealand**.

Major Countries:

- Countries associated with the Ring of Fire include **Chile, Peru, Ecuador, Colombia, Mexico, the United States, Canada, Russia, Japan, the Philippines, Indonesia, Papua New Guinea and New Zealand**.

Cause of Volcanism:

- In many parts of the Ring of Fire, one tectonic plate is **subducted beneath another**, causing the descending slab to interact with the mantle and contribute to magma generation.
- The resulting magma can rise through the crust and produce **volcanic arcs and eruptions**.

Cause of Earthquakes:

- Continuous **plate convergence, subduction, fault movement and tectonic deformation** cause stress to accumulate within the crust.
- Sudden release of this accumulated stress produces seismic waves and earthquakes.

Why the Ring of Fire is Important for UPSC:

Kamaraj IAS Academy

Plot A P.127, AF block, 6 th street, 11th Main Rd, Shanthi Colony, Anna Nagar, Chennai, Tamil Nadu 600040

Phone: **044 4353 9988 / 98403 94477** / Whatsapp : **09710729833**

- The Ring of Fire illustrates the relationship between **plate tectonics, subduction, earthquakes, volcanism, mountain building and tsunami generation**.
- It provides a useful geographical framework for understanding major seismic events in **South America, Japan, Indonesia, Alaska and the western Pacific**.

Types of Earthquakes by Focal Depth:

Shallow-Focus Earthquakes:

- Earthquakes occurring between the surface and approximately **70 km depth** are classified as **shallow-focus earthquakes**.
- They can produce intense surface shaking because their seismic energy originates relatively close to the surface.

Intermediate-Focus Earthquakes:

- Earthquakes occurring between approximately **70 and 300 km depth** are classified as **intermediate-focus earthquakes**.
- The recent Colombian earthquake falls within this category.

Deep-Focus Earthquakes:

- Earthquakes occurring between approximately **300 and 700 km depth** are classified as **deep-focus earthquakes**.
- Such earthquakes are strongly associated with **subducting lithospheric slabs**.

Key Concepts in Earthquake Geography:

Focus or Hypocentre:

- The **focus**, also called the **hypocentre**, is the point beneath the Earth's surface where the earthquake rupture begins.

Epicentre:

- The **epicentre** is the point on the Earth's surface located directly above the earthquake's focus.

Magnitude:

- **Magnitude** measures the size or energy released by an earthquake at its source.
- The magnitude scale is logarithmic, so an increase of one whole magnitude represents approximately **10 times greater wave amplitude and about 31 times more energy release**.

Intensity:

- **Intensity** describes the observed effects of an earthquake at a particular location and can vary substantially from one place to another.
- Unlike magnitude, intensity depends on factors such as **distance from the epicentre, depth, local geology, building quality and ground conditions**.

Earthquake-Related Secondary Hazards:

Landslides:

- Strong ground shaking can destabilise slopes, particularly in mountainous regions such as the **Andes**, causing landslides and rockfalls.

Liquefaction:

- Intense shaking can cause **water-saturated unconsolidated sediments** to temporarily lose strength, producing liquefaction and structural instability.

Tsunami:

- Large undersea earthquakes can displace seawater and generate **tsunamis**, particularly when significant vertical movement of the seabed occurs.
- However, not every earthquake produces a tsunami because generation depends on factors such as **earthquake location, magnitude, depth and seafloor displacement**.

Infrastructure Failure:

- Earthquakes can damage **roads, bridges, hospitals, schools, electricity networks, water systems and communication infrastructure**, complicating rescue and relief operations.

Colombia:

Geographical Location:

- **Colombia** is located in northwestern South America and has coastlines along both the **Pacific Ocean and the Caribbean Sea**.
- Its location gives the country strategic access to both the Pacific and Caribbean maritime regions.

Major Physical Regions:

- The **Andes** extend through western and central Colombia and strongly influence its relief, climate, population distribution and seismic environment.
- The eastern tropical grasslands known as **Los Llanos** form part of the wider **Orinoco Basin**.
- The country also contains important **Amazonian forests, Caribbean lowlands, Pacific rainforests and Andean ecosystems**.

Biodiversity:

- Colombia is recognised as one of the world's **megadiverse countries** and contains exceptionally high species diversity across its varied ecosystems.
- Its biodiversity is supported by the combination of **Andean mountains, tropical forests, Pacific ecosystems, Caribbean environments and Amazonian landscapes**.

Economy and Strategic Importance:

- Colombia has major resources and economic activities including **oil, coal, coffee, agriculture, mining and manufacturing**.
- Its geographical position connects the Caribbean, Central America and South America and gives it strategic importance in regional trade and maritime connectivity.

Coca Cultivation and Cocaine Production:

- Colombia has historically been one of the world's major centres of **coca cultivation and cocaine production**.

- This issue has significant implications for **organised crime, rural development, public security, environmental degradation and international drug-control policy.**

Disaster Management Lessons from the Colombian Earthquake:

Strengthen Seismic Building Codes:

- Earthquake-prone countries require **strict seismic building standards**, effective enforcement and regular safety audits of vulnerable structures.

Risk-Sensitive Urban Planning:

- Urban development should incorporate **seismic hazard maps, fault-zone information, slope stability and local geological conditions.**

Critical Infrastructure Resilience:

- Hospitals, schools, bridges, transport networks, power systems and communication facilities should be designed or retrofitted to remain functional after major earthquakes.

Community Preparedness:

- Regular **earthquake drills, public awareness programmes, emergency kits and evacuation planning** can reduce casualties and improve community resilience.

Early Warning and Monitoring:

- Seismological networks can rapidly detect earthquakes and issue **earthquake early warnings** where sufficient monitoring infrastructure and warning time exist.
- Earthquake early warning does not predict earthquakes in advance; it detects an earthquake after rupture begins and can provide limited warning before stronger shaking reaches distant locations.

Search and Rescue:

- Rapid deployment of **trained search-and-rescue teams, medical units, communication systems and emergency logistics** is essential during the first hours after a major earthquake.

Relevance for India:

Himalayan Seismic Risk:

- India faces significant earthquake risk because the **Indian Plate converges with the Eurasian Plate**, producing active deformation along the Himalayas.
- The Himalayan region is capable of generating major earthquakes because tectonic strain continues to accumulate along active faults and thrust systems.

Northeastern India:

- Northeast India is another major seismic region because of complex interactions involving the **Indian, Eurasian and Burmese tectonic systems.**

Andaman and Nicobar Islands:

- The **Andaman and Nicobar region** lies near active plate boundaries and subduction zones, creating earthquake and tsunami hazards.

Lessons for Indian Urban Planning:

- The Colombian experience reinforces the need for **strict implementation of seismic building codes, earthquake-resistant infrastructure, microzonation, public preparedness and resilient critical services** in Indian cities.

Value Addition for UPSC:

Key Concept:

- **Subduction Zone:** A tectonic setting in which one lithospheric plate descends beneath another, producing earthquakes, volcanic activity and crustal deformation.

Analytical Framework:

- **Plate Convergence ? Subduction ? Tectonic Stress ? Fault Rupture ? Seismic Waves ? Ground Shaking ? Secondary Hazards ? Human and Infrastructure Losses**

Disaster Risk Framework:

- **Risk = Hazard × Exposure × Vulnerability**
- Reducing disaster losses therefore requires simultaneous action on **hazard assessment, exposure reduction, structural resilience and community preparedness.**

Prelims Quick Facts:

- **Country:** Colombia.
- **Recent earthquake:** Magnitude 7.4.
- **Date:** 10 August 2026.
- **Location:** Near San José del Palmar, Chocó.
- **Focal depth:** Approximately 96–107 km.
- **Depth category:** Intermediate-focus earthquake.
- **Major tectonic plates:** Nazca, South American and Caribbean Plates.
- **Major tectonic process:** Subduction and plate convergence.
- **Major mountain system:** Andes.
- **Relevant seismic belt:** Pacific Ring of Fire.
- **Other name:** Circum-Pacific Belt.
- **Approximate share of global earthquakes in the Ring of Fire:** 90%.
- **Colombia's western coast:** Pacific Ocean.
- **Colombia's northern coast:** Caribbean Sea.
- **Eastern grasslands:** Los Llanos.
- **Major basin associated with Los Llanos:** Orinoco Basin.
- **UPSC linkage:** Plate tectonics, earthquakes, subduction, Ring of Fire, disaster management and seismic resilience.