

EARTHQUAKE RISK IN BANGLADESH

PASSAGE ONE

Background

A major earthquake can devastate any populated area. Imagine that earthquake in an enormous, densely populated city where most structures are poorly built on soft soil. A city already threatened by floods, sea level rise, and shifting river channels. These are the very real dangers facing Dhaka, the capital of Bangladesh. Large earthquakes are part of the region's history, but are much less frequent than floods. Most people in Dhaka have not experienced a major earthquake and the city is unprepared for such a disaster.

Today, a team of scientists is investigating the active geology behind earthquakes in Bangladesh. The project is led by Michael Steckler and Leonardo Seeber from Columbia University's Lamont-Doherty Earth Observatory, and includes international and local scientists in seismol-

ogy, structural geology, sedimentology, river systems, and geophysics. By studying the region's past and present geological events, they hope to provide information that will help people prepare for future earthquakes.

Bangladesh: A Land of Extremes

Bangladesh is a small country in south Asia, bordered mostly by eastern India. Its geography makes it unlike any other place on Earth. As Steve Goodbred describes it, "Bangladesh is the land of superlatives."

The **world's largest mountain range**, the Himalayas, rise to the north of Bangladesh. Three great rivers — the Brahmaputra, Ganges and Meghna — flow from the Himalayas and other nearby mountain ranges and merge in Bangladesh.



Bangladesh is a country in South Asia bordered by India, Bhutan, and Myanmar. It sits on the Bay of Bengal and its capital city, Dhaka, is located in the Bengal Delta. ©AMNH / Google Earth

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Background

These rivers deposit huge amounts of mud and sand, or sediment, to form the **world's largest delta**. Bangladesh is also one of the **rainiest places on Earth**. During monsoon season, heavy rainfall and river flows can flood up to two-thirds of the country. The delta is mostly flat and close to sea level, so rivers quickly overflow and river islands form and disappear. But there are benefits to these floods. They flow into rice paddies for next year's crop and turn low-lying fields into busy fisheries for the season.

Finally, Bangladesh is the **most crowded place on Earth**. More than 160 million people, a population half the size of the United States, live in an area less than 2 percent the size of the U.S. And a large number of people live in huge cities, like the capital city of Dhaka.



As the crowded city streets of Dhaka illustrate, Bangladesh is the eighth most populous country in the world with over 160 million citizens. ©AMNH

Dhaka: Danger Zone

"This area has had big earthquakes in the past," explains Seeber. "The consequences were dramatic, but not as dramatic as they might be now when more than one quarter of the population is concentrated in huge cities." And nowhere are people more concentrated than in Dhaka, which averages 45,000 people per square kilometer. With more than 13 million people, it is one of the world's most crowded and fastest-growing cities. As its population grows, Dhaka is expanding quickly. "The city has grown out very fast, like a mushroom," says seismologist Humayun Akhter. "The buildings are mostly brick masonry, non-engineered, and mostly unplanned."

Many of these new buildings, bridges, and roads are not built to withstand earthquakes – especially on the soft, wet delta sediment. In places like Dhaka, earthquakes can cause solid sediments to liquefy. This "liquefaction" would destroy much of city's construction. And like the rest of Bangladesh, the capital is vulnerable to flooding. If an earthquake sparked a tsunami, or caused rivers to overflow, flooding could devastate the city. "Dhaka now probably stands in the highest risk cities among the other great cities in the world," explains Akhter.

Scientists and officials in Bangladesh hope to update and enforce building codes, educate the public about how to prepare for earthquakes, and train rescue workers. They want to prepare surrounding areas, especially where people rely on rivers for agriculture. A major earthquake could shift a river's course, causing massive, widespread destruction.

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Background**Forces Beneath Bangladesh**

Much of the region's geography is shaped by what's happening beneath the surface —between the tectonic plates that make up Earth's crust. Bangladesh is one of the **most tectonically active regions** in the world. It sits where three tectonic plates meet: the **Indian Plate**, the **Eurasian Plate**, and the **Burmese Plate**.

As the **Indian Plate** moves gradually northeast, it is slowly colliding with the **Eurasian Plate**, causing the Himalayas to rise. Active faults are found along this boundary, particularly the 300km-long Dauki fault that borders northern Bangladesh. Here, the large Shillong Plateau is slowly folding over the Indian Plate. "This fault system is probably the focus of our attention," says Leonardo Seeber. "It's still a rather subtle system, it's brand new, and yet it's extremely important because it is the closest, actually, to Bangladesh." To the east, the **Burmese Plate** pushes west against (and over) the Indian Plate. As these plates collide, rocks fold and buckle to form the hills and valleys of the Burma Arc.

Of course, active faults such as those in the north and east of Bangladesh can also be destructive. "The intersection between these two systems can generate huge earthquakes," says Seeber. The devastating 2004 earthquake and tsunami in Sumatra occurred along the boundary between the Indian and Burmese plates. Scientists predict a major earthquake closer to Bangladesh is only a matter of time.



The tectonic plates in this region of South Asia collided 55 million years ago along the boundary between India and Nepal and created the Tibetan Plateau and the Himalaya Mountains, just north of Bangladesh and surrounding countries. The Dauki Fault sits at the junction of the Indian and Eurasian Plates. ©AMNH

STOP AND THINK**BASED ON THE TEXT:**

1. What factors lead to the likelihood of a major earthquake in Bangladesh?
2. What are some of the societal implications of a large earthquake in this area?

LOOKING AHEAD:

3. What data should scientists collect in order to support their claim that a large earthquake may occur near Dhaka?
4. What methods do you think they should use to collect data?