

What are river deltas, and why are they important?

By Caryl-Sue, National Geographic on 09.14.17

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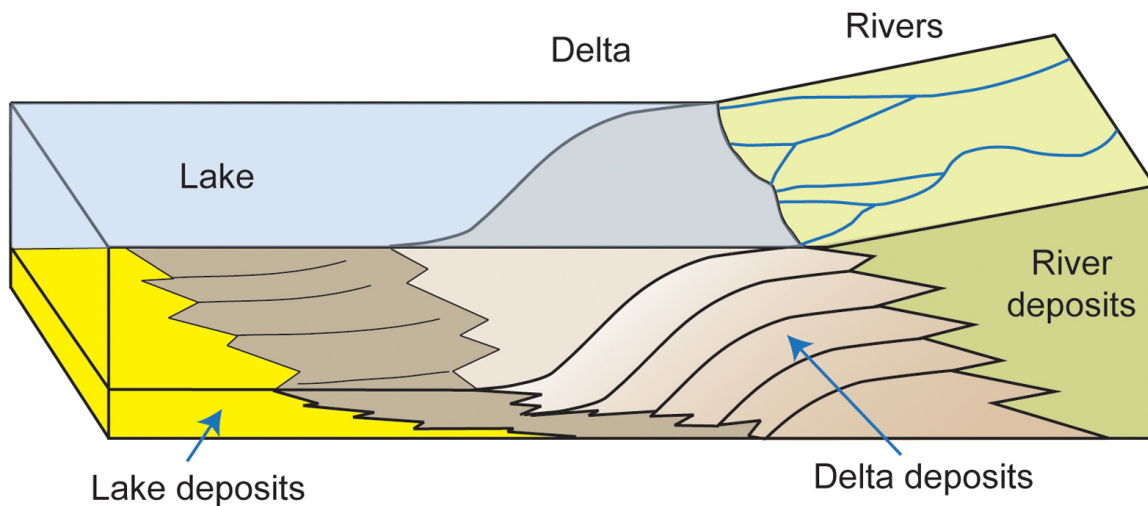
The delta of the Dvina River, which flows into the White Sea in Russia. Photo by: NASA.

Deltas are wetlands that form as rivers empty their water and sediment into another body of water, such as an ocean, lake or another river. Deltas can also empty into land, although this is less common.

A river moves more slowly as it nears its mouth, or end. This causes sediment, solid material carried downstream by currents, to fall to the river bottom.

The slowing velocity of the river and the build-up of sediment allows the river to break from its single channel as it nears its mouth. Under the right conditions, a river forms a deltaic lobe. A mature deltaic lobe includes a distributary network — a series of smaller, shallower channels, called distributaries, that branch off from the mainstem of the river.

In a deltaic lobe, heavier, coarser material settles first. Smaller, finer sediment is carried farther downstream. The finest material is deposited beyond the river's mouth. This material is called alluvium or silt. Silt is rich in nutrients that help microbes and plants — the producers in the food web— grow.



As silt builds up, new land is formed. This is the delta. A delta extends a river's mouth into the body of water into which it is emptying.

A delta is sometimes divided into two parts: subaqueous and subaerial. The subaqueous part of a delta is underwater. This is the most steeply sloping part of the delta, and contains the finest silt. The newest part of the subaqueous delta, farthest from the mouth of the river, is called the prodelta.

The subaerial part of a delta is above water. The subaerial region most influenced by waves and tides is called the lower delta. The region most influenced by the river's flow is called the upper delta.

This nutrient-rich wetland of the upper and lower delta can be an extension of the river bank, or a series of narrow islands between the river's distributary network.

Like most wetlands, deltas are incredibly diverse and ecologically important ecosystems. Deltas absorb runoff from both floods (from rivers) and storms (from lakes or the ocean). Deltas also filter water as it slowly makes its way through the delta's distributary network. This can reduce the impact of pollution flowing from upstream.



Deltas are also important wetland habitats. Plants such as lilies and hibiscus grow in deltas, as well as herbs such as worts, which are used in traditional medicines.

Many, many animals are indigenous to the shallow, shifting waters of a delta. Fish, crustaceans such as oysters, birds, insects, and even apex predators such as tigers and bears can be part of a delta's ecosystem.

Not all rivers form deltas. For a delta to form, the flow of a river must be slow and steady enough for silt to be deposited and build up. The Ok Tedi in Papua New Guinea is one of the fastest-flowing rivers in the world. It does not form a delta as it becomes a tributary of the Fly River. (The Fly, on the other hand, does form a rich delta as it empties into the Gulf of Papua, part of the Pacific Ocean.)

A river will also not form a delta if exposed to powerful waves. The Columbia River in Canada and the United States, for instance, deposits enormous amounts of sediment into the Pacific Ocean, but strong waves and currents sweep the material away as soon as it is deposited.

Tides also limit where deltas can form. The Amazon, the largest river in the world, is without a delta. The tides of the Atlantic Ocean are too strong to allow silt to create a delta on the Amazon.

There are two major ways of classifying deltas. One considers the influences that create the landform, while the other considers its shape.

Influence

There are four main types of deltas classified by the processes that control the build-up of silt: wave-dominated, tide-dominated, Gilbert deltas, and estuarine deltas.



In a wave-dominated delta, the movement of waves controls a delta's size and shape. The Nile delta (shaped by waves from the Mediterranean Sea) and Senegal delta (shaped by waves from the Atlantic Ocean) are both wave-dominated deltas.

Tide-dominated deltas usually form in areas with a large tidal range, or area between high tide and low tide. The massive Ganges-Brahmaputra delta, in India and Bangladesh, is a tide-dominated delta, shaped by the rise and fall of tides in the Bay of Bengal.

Gilbert deltas are formed as rivers deposit large, coarse sediments. Gilbert deltas are usually confined to rivers emptying into freshwater lakes. They are usually steeper than the normal flat plain of a wave-dominated or tide-dominated delta. This type of delta was first identified by the geologist Grove Karl Gilbert, who described mountain streams feeding ancient Lake Bonneville. (Utah's Great Salt Lake is the only remnant of Lake Bonneville.)

Estuarine deltas form as a river does not empty directly into the ocean, but instead forms an estuary. An estuary is a partly enclosed wetland that features a brackish water (part-saltwater, part-freshwater) habitat. The Yellow River forms an estuary, for instance, as it reaches the Bohai Sea off the coast of northern China.

Shape

The term delta comes from the uppercase Greek letter delta (Δ), which is shaped like a triangle. Deltas with this triangular or fan shape are called arcuate (arc-like) deltas. The Nile River forms an arcuate delta as it empties into the Mediterranean Sea.

Strong waves make a cuspate delta a pointed, tooth-shaped version of the arcuate. The Tiber River forms a cuspate delta as it empties into the Tyrrhenian Sea near Rome, Italy.

Not all deltas are triangle-shaped. A bird-foot delta has few, widely spaced distributaries, making it look like a bird's foot. The Mississippi River forms a bird-foot delta as it empties into the Gulf of Mexico.

Inverted deltas look like the opposite of a classic arcuate delta. The distributary network of an inverted delta is inland, while a single stream reaches the ocean or other body of water. The delta of the Sacramento-San Joaquin River in northern California is an inverted delta. The rivers and creeks of the Sacramento and San Joaquin distributary networks meet in Suisun Bay, before flowing to the Pacific Ocean through a single gap in the Coast Range, the Carquinez Strait.



Inland deltas, which empty into a plain, are extremely rare. The Okavango delta in Botswana is probably the most well-known—and so unusual it is recognized as one of the "Seven Natural Wonders of Africa." Water from the Okavango River never reaches another body of water. The delta spreads water and silt across a flat plain in the Kalahari Desert before being evaporated.

An abandoned delta forms as a river develops a new channel, leaving the other to dry up or stagnate. This process is called avulsion. Avulsion occurs when the slope of a channel decreases and the sediment buildup increases. These forces allow the channel to overflow its banks or levees and find a steeper, more direct route to the ocean or other body of water. The process of avulsion in deltaic lobes is called delta switching. Over time, delta switching can create entirely new deltaic lobes. Delta switching has resulted in seven or eight distinct deltaic lobes of the Mississippi River over the past 5,000 years.

Deltas And People

Deltas are incredibly important to the human geography of a region. They are important places for trade and commerce, for instance.

The booming city of Vancouver, Canada, sits on the delta of the Fraser River as it empties into the Strait of Georgia, part of the Pacific Ocean. The Fraser delta helps make Vancouver one of the busiest, most cosmopolitan ports in the world, where goods from the interior of Canada are exported, and goods from around the world are imported.

The Pearl River Delta, sometimes called the Delta of Guangdong, is another heavily urbanized river delta. The Pearl River delta is one of the fastest-growing centers of China's economy. The Pearl River delta includes both of China's two special administrative regions, the former British colony of Hong Kong and the former Portuguese colony of Macau. Hong Kong and Macau are welcoming to western business, and provide an entryway to the Chinese market. The Pearl River delta region is growing so quickly, it frequently experiences labor shortages as immigrants from the Chinese interior settle in the area, seeking a better life and higher wages.

Deltas have a rich accumulation of silt, so they are usually fertile agricultural areas. The world's largest delta is the Ganges-Brahmaputra delta in India and Bangladesh, which empties into the Bay of Bengal. Bangladesh sits almost entirely on this delta, and about two-thirds of the population live and work there. Fish, other seafood, and crops such as rice and tea are the leading agricultural products of the delta.

Similarly, the inverted delta of the Sacramento and San Joaquin Rivers in northern California is one of the most agriculturally rich areas in the U.S. The soil supports crops from asparagus to zucchini, wine grapes to rice.

Disappearing Deltas

Extensive river management threatens deltas. River management involves monitoring and administering a river's flow (often through the use of dams). River management increases the amount of land available for agricultural or industrial development, and controls access to water for drinking, industry and irrigation.

Engineers and government officials must consistently debate the interests of agriculture, industry, the environment, and citizen safety and health when putting delta wetlands at risk.



River management in Egypt has radically altered the way land is farmed around the Nile delta, for instance. Construction of the Aswan Dam in the 1960s reduced annual flooding of the delta. This flooding had distributed silt and nutrients along the banks of the Nile. Today, Egypt is much more reliant on fertilizers and irrigation. The Nile delta is also shrinking as a result of the Aswan Dam and other river management techniques. Without silt and other sediments to fortify it in a prodelta, the waves of the Mediterranean Sea are eroding the delta faster than the Nile can replace it.

In the United States, dams on the Colorado River nearly prevent it from reaching its delta on the Sea of Cortez, Mexico. The ecosystem (what was once the world's largest desert estuary) has been reduced to a fraction of its former area, and many indigenous species are vulnerable, threatened or endangered.

Finally, decades of river management prevent the Mississippi River from naturally flowing through its delta wetlands. Like the Nile delta, the Mississippi delta is also eroding. Between 1990 and 2000, the Mississippi River Delta lost 62 square kilometers (24 square miles) of wetlands per year — that's about one football field of mud washed into the Gulf of Mexico every 38 minutes. This situation contributed to the devastation caused by Hurricane Katrina in 2005.

Quiz

1 "Deltaic lobes" is a key term in the article.

How does the author refine the meaning of this term over the course of the article?

- (A) through the use of a neutral tone, followed by a pessimistic tone
- (B) through the use of descriptions that include figurative language
- (C) through scientific studies of the importance of their shape and size
- (D) through explanations of processes that affect their development

2 Read the sentence from the section "Disappearing Deltas."

The ecosystem (what was once the world's largest desert estuary) has been reduced to a fraction of its former area, and many indigenous species are vulnerable, threatened or endangered.

What does the verb "reduced" convey in the sentence?

- (A) a sense of inevitability
- (B) a sense of control
- (C) a sense of vulnerability
- (D) a sense of necessity

3 Who would find the images in the article MOST helpful? Why?

- (A) someone studying the classification of various deltas, because they show examples of different delta formations
- (B) someone studying the effects of river management on delta formation, because they show changes over a period of time
- (C) someone studying the ecosystems of various deltas, because they provide examples of plants that thrive in the fertile sediment
- (D) someone studying how the flow rate of water affects sediment build-up, because they demonstrate the process of avulsion

- 4 Which image in the article BEST depicts the effects of humans on deltas?
- (A) first image
 - (B) fourth image
 - (C) fifth image
 - (D) sixth image