Amazon River

The **Amazon River** (US: /ˈæməzɒn/; Portuguese: *rio Amazonas*, Spanish: *río Amazonas*) in South America is the largest river by discharge volume of water in the world, and the longest or second-longest river system in the world, a title which is disputed with the Nile.[5][23][n 4]

The headwaters of the Apurímac River on Nevado Mismi had been considered, for nearly a century, the Amazon basin's most distant source until a 2014 study found it to be the headwaters of the Mantaro River on the Cordillera Rumi Cruz in Peru.[28] The Mantaro and Apurímac rivers join, and with other tributaries form the Ucayali River, which in turn meets the Marañón River upstream of Iquitos, Peru, forming what countries other than Brazil consider to be the main stem of the Amazon. Brazilians call this section the Solimões River above its confluence with the Rio Negro[29] forming what Brazilians call the Amazon at the Meeting of Waters (Portuguese: *Encontro das Águas*) at Manaus, the largest city on the river.

The Amazon River has an average discharge of about 215,000–230,000 m^3/s (7,600,000–8,100,000 cu ft/s) —approximately 6,591–7,570 km^3 (1,581–1,816 cu mi) per year, greater than the next seven largest independent rivers combined. Two of the top ten rivers by discharge are tributaries of the Amazon river. The Amazon represents 20% of the global riverine discharge into oceans.[30] The Amazon basin is the largest drainage basin in the world, with an area of approximately 7,000,000 km^2 (2,700,000 sq mi).[5] The portion of the river's drainage basin in Brazil alone is larger than any other river's basin. The Amazon enters Brazil with only one-fifth of the flow it finally discharges into the Atlantic Ocean, yet already has a greater flow at this point than the discharge of any other river in the world.[31][32] It has a recognized length of 6,400 km (4,000 miles) but according to some reports its length varies from 6,575–7,062 km (4,086–4,388 mi).[33][34][35]

Amazon River
Rio Amazonas*, *Río Amazonas

Satellite image of the Amazon Delta

Amazon River and its drainage basin

Native name	*Amazonas* (Portuguese)
Location	
Country	Peru, Colombia, Brazil
Cities	Iquitos (Peru); Leticia (Colombia); Tabatinga (Brazil); Tefé (Brazil); Itacoatiara (Brazil) Parintins (Brazil); Óbidos (Brazil); Santarém (Brazil); Almeirim (Brazil); Macapá (Brazil); Manaus (Brazil)

Etymology

The Amazon was initially known by Europeans as the Marañón, and the Peruvian part of the river is still known by that name, as well as the Brazilian state of Maranhão, which contains part of the Amazon. It later became known as Rio Amazonas in Spanish and Portuguese.

The name Rio Amazonas was reportedly given after native warriors attacked a 16th-century expedition by Francisco de Orellana. The warriors were led by women, reminding de Orellana of the Amazon warriors, a tribe of women warriors related to Iranian Scythians and Sarmatians[36][37] mentioned in Greek mythology. The word Amazon itself may be derived from the Iranian compound * ha-maz-an- "(one) fighting together"[38] or ethnonym * *ha-mazan-* "warriors", a word attested indirectly through a derivation, a denominal verb in Hesychius of Alexandria's gloss "ἁμαζακάραν· πολεμεῖν. Πέρσαι" ("*hamazakaran*: 'to make war' in Persian"), where it appears together with the Indo-Iranian root * *kar-* "make" (from which Sanskrit *karma* is also derived).[39]

Other scholars claim that the name is derived from the Tupi word *amassona*, meaning "boat destroyer".[40]

History

Geological history

Geological studies suggest that for millions of years, the Amazon River flowed in the opposite direction – from east to west. Eventually the Andes Mountains formed, blocking its flow to the Pacific Ocean and causing it to switch directions to its current mouth in the Atlantic Ocean.[41]

Physical characteristics	
Source	Apurímac River, Mismi Peak
• location	Arequipa Region, Peru
• coordinates	15°31′04″S 71°41′37″W
• elevation	5,220 m (17,130 ft)
Mouth	Atlantic Ocean
• location	Brazil
• coordinates	0°42′28″N 50°5′22″W[1]
Length	3,750 km (2,330 mi)[2][3]
	(*Amazon–Ucayali–Tambo–Ené–Apurímac* 6,400 km (4,000 mi) – 6,500 km (4,000 mi)[4][n 1]
	(*Amazon–Marañón* 5,700 km (3,500 mi)[2]
Basin size	(*with Tocantins*)
	6,743,000 km^2 (2,603,000 sq mi)[8]–7,000,000 km^2 (2,700,000 sq mi)[5][9]
	(*5,956,000–6,112,000 km^2 without Tocantins*[10][9])
Width	
• minimum	700 m (2,300 ft) (Upper Amazon); 1.5 km (0.93 mi) (Itacoatiara, Lower Amazon)[11]
• average	3 km (1.9 mi) (Middle Amazon); 5 km (3.1 mi) (Lower Amazon)[11][12]
• maximum	10–14 km (6.2–8.7 mi) (Lower Amazon);[11][13] 340 km (210 mi) (estuary)[14]
Depth	
• average	15–45 m (49–148 ft) (Middle Amazon); 20–50 m (66–164 ft) (Lower Amazon)[11]
• maximum	150 m (490 ft) (Itacoatiara); 130 m (430 ft) (Óbidos)[11][12]
Discharge	
• location	Amazon Delta
• average	(*with Tocantins*)
	(Period: 2003–2015) 230,000 m^3/s (8,100,000 cu ft/s)

Pre-Columbian era

During what many archaeologists called the *formative stage*, Amazonian societies were deeply involved in the emergence of South America's highland agrarian systems. The trade with Andean civilizations in the terrains of the headwaters in the Andes formed an essential contribution to the social and religious development of higher-altitude civilizations like the Muisca and Incas. Early human settlements were typically based on low-lying hills or mounds.

Shell mounds were the earliest evidence of habitation; they represent piles of human refuse and are mainly dated between 7500 BC and 4000 BC. They are associated with ceramic age cultures; no preceramic shell mounds have been documented so far by archaeologists.[43] Artificial earth platforms for entire villages are the second type of mounds. They are best represented by the Marajoara culture. Figurative mounds are the most recent types of occupation.

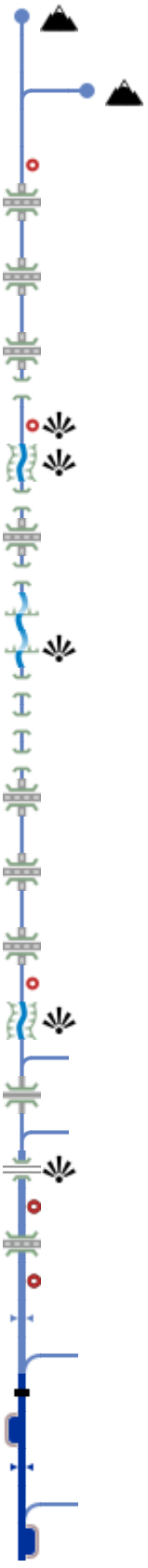
There is ample evidence that the areas surrounding the Amazon River were home to complex and large-scale indigenous societies, mainly chiefdoms who developed towns and cities.[44] Archaeologists estimate that by the time the Spanish conquistador De Orellana traveled across the Amazon in 1541, more than 3 million indigenous people lived around the Amazon.[45]:24–25 These pre-Columbian settlements created highly developed civilizations. For instance, pre-Columbian indigenous people on the island of Marajó may have developed social stratification and supported a population of 100,000 people. To achieve this level of development, the indigenous inhabitants of the Amazon rainforest altered the forest's ecology by selective cultivation and the use of fire. Scientists argue that by burning areas of the forest repeatedly, the indigenous people caused the soil to become richer in nutrients. This created dark soil areas known as *terra preta de índio* ("Indian dark earth").[45]:25 Because of the terra preta, indigenous communities were able to make land fertile and thus sustainable for the large-scale agriculture needed to support their large populations and complex social structures. Further research has hypothesized that this practice began around 11,000 years ago. Some say that its effects on

	[8][15][16][n 2]
• minimum	180,000 m^3/s (6,400,000 cu ft/s)
• maximum	340,000 m^3/s (12,000,000 cu ft/s)
Discharge	
• location	Near mouth
• average	(*without Tocantins*) 206,000–215,000 m^3/s (7,300,000–7,600,000 cu ft/s)
	[10][15][16]
Discharge	
• location	Santarém
• average	(Period: 1971–2000) 191,624 m^3/s (6,767,100 cu ft/s)[19]
• minimum	(Period: 1998–2023) 82,160 m^3/s (2,901,000 cu ft/s)[18]
• maximum	(Period: 1998–2023) 298,400 m^3/s (10,540,000 cu ft/s)[18]
Discharge	
• location	Óbidos
• average	(Period: 1903–2023) 165,829.6 m^3/s (5,856,220 cu ft/s)[20][n 3]
• minimum	(Period: 1903–2023) 95,000 m^3/s (3,400,000 cu ft/s)[20]
• maximum	(Period: 1903–2023) 260,000 m^3/s (9,200,000 cu ft/s)[20]
Discharge	
• location	Manacapuru
• average	(Period: 1997–2015) 105,720 m^3/s (3,733,000 cu ft/s)[22]
Basin features	
River system	**Amazon River**
Tributaries	
• left	Marañón, Nanay, Napo, Ampiyaçu, Putumayo, Japurá, Badajós, Manacapuru, Rio Negro, Urubu, Uatumã, Nhamundá, Trombetas, Maicurú, Curuá, Paru, Jari

forest ecology and regional climate explain the otherwise inexplicable band of lower rainfall through the Amazon basin.[45]:25

• right	Ucayali, Jandiatuba, Javary, Jutai, Juruá, Tefé, Coari, Purús, Madeira, Paraná do Ramos, Tapajós, Curuá-Una, Xingu, Pará, Tocantins, Acará, Guamá

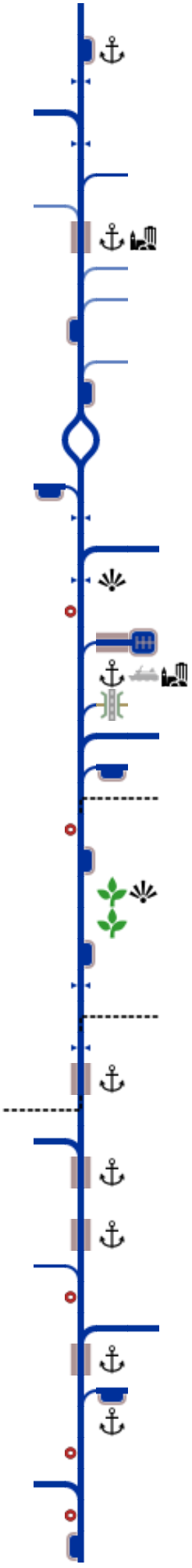
Amazon summary route map



km

6575 Source, Andes, Nevado Mismi
Hornillos River
6500 Apurímac River
Apurímac River
6455 Ruinas Maria Fortaleza
6440 Machu Puente
(Hacienda Puente Central)
6426 Puente del Este
bridge
6413 Santo Domingo bridge
6370 Puente Asunción bridge
6350 Queshuachaca (inca suspension footbridge)

6320 Puente Pongoña bridge
6260 Puente Pillpinto bridge
6230 Puente Cusibamba
6220 Cataratas
de Tincoc
6210 Puente Tincoc bridge
6190 Puente Huajachaca bridge
6175 Puente Churac bridge
6160 Puente Kutuctay
bridge
6140 Puente Huallpachaca
(P. Wallpachka) bridge
6100 Puente Cunyac bridge and gauging station
6090 Baños Termales de Cconoc
Cañon del Apurímac
6090 Pachachaca River
6081 Puente Pasaje bridge
6078 Pampas River
6035 Puente San Ignacio suspension footbridge
5978 Lechemayo gauging station
5905 Kimbiri, Puente San Francisco bridge
5890 Sivia zoológico
Apurímac River
5844 Mantaro River
Start of navigation
5840 Puerto Ene marina
Ené River
5664 Perené River
5660 Puerto Prado,



Puerto remolino marina
5505 Atalaya marina
Tambo River
5505 **Urubamba River**
Ucayali River
5080 Pachitea River
4990 Tamaya River
4939 **Pucallpa** mooring
4850 Aguaytía River
4690 Pisqui River
4620 Contamana marina
4570 Cushabatay River
4520 Orellana marina
4190 Canal de Puinahua (outflow)
4000 Canal de Puinahua (inflow)
3963 Tapiche River and Requena marina
Ucayali River
3837 **Marañón River**
Amazon River
3740 Tamshiyaçu gauging station
3700 Itaya River,
Iquitos mooring
3690 Nanay River and bridge
3596 **Napo River**
3490 Pebas mooring, Ampiyaçu River

Peru
Colombia

3220 Caballococha gauging station
3205 Puerto Nariño mooring
3190 Amacayacu National Park border,
3180 Colombia
3145 Letícia mooring
Amazon River

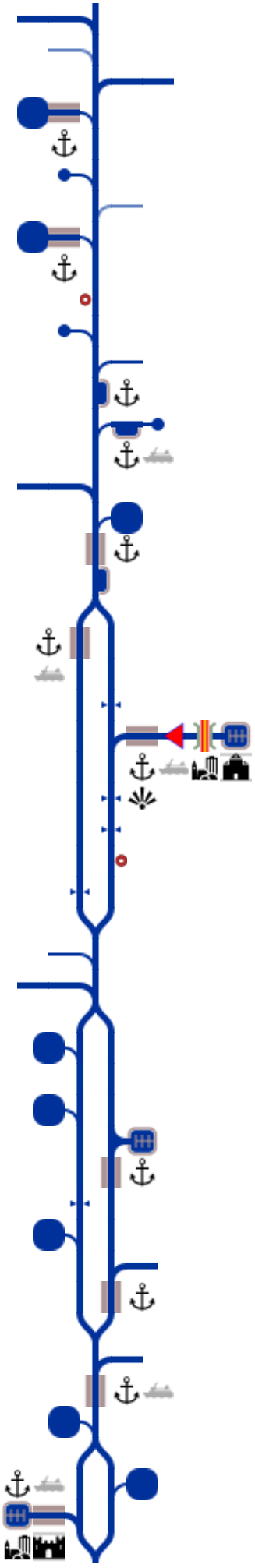
Colombia
Brazil

3144 Tres Fronteras (Peru, Colombia, Brazil border)
Solimões River
3143 Tabatinga mooring

Peru
Brazil

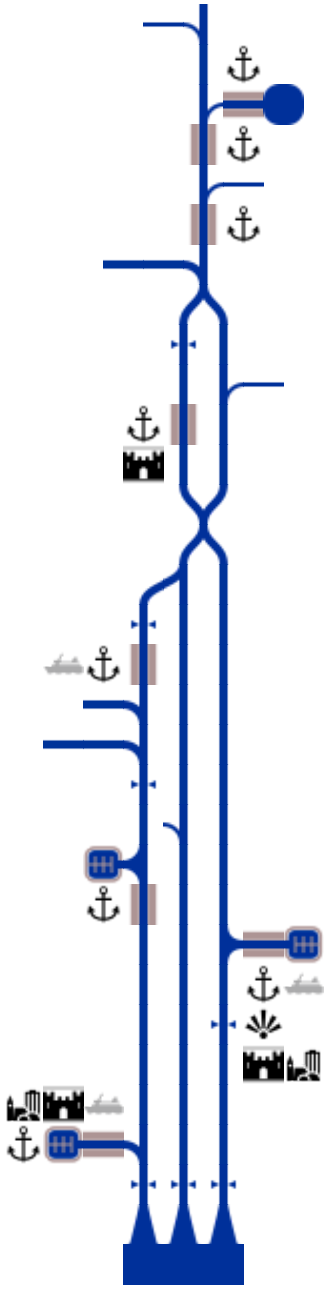
3128 **Javary River**
3128 Benjamin Constant mooring

2882 São Paulo de Olivença mooring and terminal
2870 Jandiatuba River
2750 Vargem Grande gauging station
2730 **Putumayo River**
2717 Santo Antônio do Içá mooring
2690 Tonantins River,
Tonantins mooring
2535 Xibeco gauging station
2530 **Jutaí River**
2450 Quality Resort Aracatuba
2341 Fonte Boa mooring



2330 **Juruá River**
2170 Uarini River
2130 **Japurá River**
2106 Tefé River, Lago Tefé,
Tefé mooring
2050 Lago Caiambé
1980 Paraná Copeá
1907 Coari River, Lago de Coari
Coari mooring
1900 Itapeua gauging station
1870 Lago Mamiá
1790 Badajós River
1735 Codajás mooring
1683 Lago Anori,
Anori mooring and ferry
1660 **Purús River**
1539 Manacapuru River, Lago Cabaliana,
Manacapuru mooring
1490 Iranduba mooring
1442 Paraná do Careiro (outflow)
1442 Careiro,
Careiro da Várzea-Manaus Ferry
Solimões River
Rio Negro, Rio Negro Bridge,
Manaus, Port of Manaus and ferry
1437 Encontro das Águas
Amazon River
1415 Jatuarana gauging station
1395 Paraná do Careiro
(inflow)
1318 Igapó-Açu River
1298 **Madeira River**
1298 Tupinambarana
Canumã River,
Lagoa do Laranjal
Abacaxis River, Lagoa do Tomás
1256 Itacoatiara,
mooring and terminal
Paraná do Urariá
Maués Açu River
1108 Paraná de Urucará, Uatumã River, Urubu River
996 Parintins mooring
980 Paraná do Ramos
843 **Trombetas River**, Nhamundá River
824 Óbidos mooring and gauging station
756 Lago Grande do Curuai

Curuá River, Lago Itandéua
704 **Tapajós River**,
Port of Santarém, **Santarém**



625 Curuá Una River
625 Monte Alegre terminal
Maicuru River, Lago Grande de Monte Alegre
552 Prainha mooring
448 Paru River
444 Almeirim mooring and terminal
350 **Xingu River**
330 Ilha Grande de Gurupá
330 Forte de Santo Antônio de Gurupá
315 Jari River
310 Gurupá mooring
295 Fort of Santo Antônio do Gurupá
250 Ilha Grande de Gurupá
250 Amazon Delta

230 Furo do Tajapuru, Furo do Breves
Breves mooring
211 Pará River
211 **Tocantins River**
Rio Pará
190 Anajás River
190 Porto de Vila do Conde,
Barcarena, Pará mooring and terminal
150 Port of Santana
Santana-Belém Ferry
137 Marco Zero Monument
Fortaleza de São José de Macapá, **Macapá**
135 Forte de Presépio,
Guamá River, **Belém** port and ferry
Marajó Bay, Canal do Sul, Canal du Norte
0 Estuário do Rio Amazonas
Atlantic Ocean

Note:
Distances are in kilometers, rounded to the nearest kilometer.

Many indigenous tribes engaged in constant warfare. According to James S. Olson, "The Munduruku expansion (in the 18th century) dislocated and displaced the Kawahíb, breaking the tribe down into much smaller groups ... [Munduruku] first came to the attention of Europeans in 1770 when they began a series of widespread attacks on Brazilian settlements along the Amazon River."[46]

Topography of the Amazon River Basin

Arrival of Europeans

Old drawing (from 1879) of Arapaima fishing at the Amazon River. The arapaima has been on Earth for at least 23 million years.[42]

In March 1500, Spanish conquistador Vicente Yáñez Pinzón was the first documented European to sail up the Amazon River.[47] Pinzón called the stream *Río Santa María del Mar Dulce*, later shortened to *Mar Dulce*, literally, *sweet sea*, because of its freshwater pushing out into the ocean. Another Spanish explorer, Francisco de Orellana, was the first European to travel from the origins of the upstream river basins, situated in the Andes, to the mouth of the river. In this journey, Orellana baptized some of the affluents of the Amazonas like Rio Negro, Napo and Jurua. The name Amazonas is thought to be taken from the native warriors that attacked this expedition, mostly women, that reminded De Orellana of the mythical female Amazon warriors from the ancient Hellenic culture in Greece (see also Origin of the name).

Amazon tributaries near Manaus

Exploration

Gonzalo Pizarro set off in 1541 to explore east of Quito into the South American interior in search of *El Dorado*, the "city of gold" and La Canela, the "valley of cinnamon".[48] He was accompanied by his second-in-command Francisco de Orellana. After 170 km (106 mi), the Coca River joined the Napo River (at a point now known as Puerto Francisco de Orellana); the party stopped for a few weeks to build a boat just upriver from this confluence. They continued downriver through an uninhabited area, where they could not find food. Orellana offered and was ordered to follow the Napo River, then known as *Río de la Canela* ("Cinnamon River"), and return with food for the party. Based on intelligence received from a captive native chief named Delicola, they expected to find food within a few days downriver by ascending another river to the north.

Samuel Fritz's 1707 map showing the Amazon and the Orinoco

De Orellana took about 57 men, the boat, and some canoes and left Pizarro's troops on 26 December 1541. However, De Orellana missed the confluence (probably with the Aguarico) where he was searching supplies for his men. By the time he and his men reached another village, many of them were sick from hunger and eating "noxious plants", and near death. Seven men died in that village. His men threatened to mutiny if the expedition turned back to attempt to rejoin Pizarro, the party being over 100 leagues downstream at this point. He accepted to change the purpose of the expedition to discover new lands in the name of the king of Spain, and the men built a larger boat in which to navigate downstream. After a journey of 600 km (370 mi) down the Napo River, they reached a further major confluence, at a point near modern Iquitos, and then followed the upper Amazon, now known as the Solimões, for a further 1,200 km (746 mi) to its confluence with the Rio Negro (near modern Manaus), which they reached on 3 June 1542.

Regarding the initial mission of finding cinnamon, Pizarro reported to the king that they had found cinnamon trees, but that they could not be profitably harvested. True cinnamon (*Cinnamomum Verum*) is not native to South America. Other related cinnamon-containing plants (of the family *Lauraceae*) are fairly common in that part of the Amazon and Pizarro probably saw some of these. The expedition reached the mouth of the Amazon on 24 August 1542, demonstrating the practical navigability of the Great River.

In 1560, another Spanish conquistador, Lope de Aguirre, may have made the second descent of the Amazon. Historians are uncertain whether the river he descended was the Amazon or the Orinoco River, which runs more or less parallel to the Amazon further north.

Portuguese explorer Pedro Teixeira was the first European to travel up the entire river. He arrived in Quito in 1637, and returned via the same route.[49]

From 1648 to 1652, Portuguese Brazilian *bandeirante* António Raposo Tavares led an expedition from São Paulo overland to the mouth of the Amazon, investigating many of its tributaries, including the Rio Negro, and covering a distance of over 10,000 km (6,200 mi).

Masked-dance, and wedding-feast of Ticuna Indians, engravings for Bates's 1863 *The Naturalist on the River Amazons*

In what is currently in Brazil, Ecuador, Bolivia, Colombia, Peru, and Venezuela, several colonial and religious settlements were established along the banks of primary rivers and tributaries for trade, slaving , and evangelization among the indigenous peoples of the vast rainforest, such as the Urarina. In the late 1600s, Czech Jesuit Father Samuel Fritz, an apostle of the Omagus established some forty mission villages. Fritz proposed that the Marañón River must be the source of the Amazon, noting on his 1707 map that the Marañón "has its source on the southern shore of a lake that is called Lauricocha, near Huánuco." Fritz reasoned that the Marañón is the largest river branch one encounters when journeying upstream, and lies farther to the west than any other tributary of the Amazon. For most of the 18th–19th centuries and into the 20th century, the Marañón was generally considered the source of the Amazon.[50]

Scientific exploration

Early scientific, zoological, and botanical exploration of the Amazon River and basin took place from the 18th century through the first half of the 19th century.

- Charles Marie de La Condamine explored the river in 1743.[51]
- Alexander von Humboldt, 1799–1804
- Johann Baptist von Spix and Carl Friedrich Philipp von Martius, 1817–1820
- Georg von Langsdorff, 1826–1828
- Henry Walter Bates and Alfred Russel Wallace, 1848–1859
- Richard Spruce, 1849–1864

Post-colonial exploitation and settlement

Henry Walter Bates was most famous for his expedition to the Amazon (1848–1859).

The Cabanagem revolt (1835–1840) was directed against the white ruling class. It is estimated that from 30% to 40% of the population of Grão-Pará, estimated at 100,000 people, died.[52]

The population of the Brazilian portion of the Amazon basin in 1850 was perhaps 300,000, of whom about 175,000 were Europeans and 25,000 were slaves. The Brazilian Amazon's principal commercial city, Pará (now Belém), had from 10,000 to 12,000 inhabitants, including slaves. The town of Manáos, now Manaus, at the mouth of the Rio Negro, had a population between 1,000 and 1,500. All the remaining villages, as far up as Tabatinga, on the Brazilian frontier of Peru, were relatively small.[53]

On 6 September 1850, Emperor Pedro II of Brazil sanctioned a law authorizing steam navigation on the Amazon and gave the Viscount of Mauá (Irineu Evangelista de Sousa) the task of putting it into effect. He organised the "Companhia de Navegação e Comércio do Amazonas" in Rio de Janeiro in 1852; in the following year it commenced operations with four small steamers, the *Monarca* ('Monarch'), the *Cametá*, the *Marajó* and the *Rio Negro*.[53][54]


Amazonas state

At first, navigation was principally confined to the main river; and even in 1857 a modification of the government contract only obliged the company to a monthly service between Pará and Manaus, with steamers of 200 tons cargo capacity, a second line to make six round voyages a year between Manaus and Tabatinga, and a third, two trips a month between Pará and Cametá.[53] This was the first step in opening up the vast interior.

The success of the venture called attention to the opportunities for economic exploitation of the Amazon, and a second company soon opened commerce on the Madeira, Purús, and Negro; a third established a line between Pará and Manaus, and a fourth found it profitable to navigate some of the smaller streams. In that same period, the Amazonas Company was increasing its fleet. Meanwhile, private individuals were building and running small steam craft of their own on the main river as well as on many of its tributaries.[53]

On 31 July 1867, the government of Brazil, constantly pressed by the maritime powers and by the countries encircling the upper Amazon basin, especially Peru, decreed the opening of the Amazon to all countries, but they limited this to certain defined points: Tabatinga – on the Amazon; Cametá – on the Tocantins; Santarém – on the Tapajós; Borba – on the Madeira, and Manaus – on the Rio Negro. The Brazilian decree took effect on 7 September 1867.[53]

Thanks in part to the mercantile development associated with steamboat navigation coupled with the internationally driven demand for natural rubber, the Peruvian city of Iquitos became a thriving, cosmopolitan center of commerce. Foreign companies settled in Iquitos, from where they controlled the extraction of rubber. In 1851 Iquitos had a population of 200, and by 1900 its population reached 20,000. In the 1860s, approximately 3,000 tons of rubber were being exported annually, and by 1911 annual exports had grown to 44,000 tons, representing 9.3% of Peru's exports.[55] During the rubber boom it is estimated that diseases brought by immigrants, such as typhus and malaria, killed 40,000 native Amazonians.[56]

Amazon Theatre opera house in Manaus built in 1896 during the rubber boom

Metropolitan Cathedral of Santarém, in Santarém, Brazil

The first direct foreign trade with Manaus commenced around 1874. Local trade along the river was carried on by the English successors to the Amazonas Company—the Amazon Steam Navigation Company—as well as numerous small steamboats, belonging to companies and firms engaged in the rubber trade, navigating the Negro, Madeira, Purús, and many other tributaries,[53] such as the Marañón, to ports as distant as Nauta, Peru.

By the turn of the 20th century, the exports of the Amazon basin were India-rubber, cacao beans, Brazil nuts and a few other products of minor importance, such as pelts and exotic forest produce (resins, barks, woven hammocks, prized bird feathers, live animals) and extracted goods, such as lumber and gold.

Iglesia Matriz in Iquitos, Peru

20th-century development

Since colonial times, the Portuguese portion of the Amazon basin has remained a land largely undeveloped by agriculture and occupied by indigenous people who survived the arrival of European diseases.

Four centuries after the European discovery of the Amazon river, the total cultivated area in its basin was probably less than 65 km^2 (25 sq mi), excluding the limited and crudely cultivated areas among the mountains at its extreme headwaters.[57] This situation changed dramatically during the 20th century.

Wary of foreign exploitation of the nation's resources, Brazilian governments in the 1940s set out to develop the interior, away from the seaboard where foreigners owned large tracts of land. The original architect of this expansion was president Getúlio Vargas, with the demand for rubber from the Allied forces in World War II providing funding for the drive.

In the 1960s, economic exploitation of the Amazon basin was seen as a way to fuel the "economic miracle" occurring at the time. This resulted in the development of "Operation Amazon", an economic development project that brought large-scale agriculture and ranching to Amazonia. This was done

through a combination of credit and fiscal incentives.[58]

However, in the 1970s the government took a new approach with the National Integration Program (PIN). A large-scale colonization program saw families from northeastern Brazil relocated to the "land without people" in the Amazon Basin. This was done in conjunction with infrastructure projects mainly the Trans-Amazonian Highway (*Transamazônica*).[58]

The Trans-Amazonian Highway's three pioneering highways were completed within ten years but never fulfilled their promise. Large portions of the Trans-Amazonian and its accessory roads, such as BR-317 (Manaus-Porto Velho), are derelict and impassable in the rainy season. Small towns and villages are scattered across the forest, and because its vegetation is so dense, some remote areas are still unexplored.

Manaus, the largest city in Amazonas, as seen from a NASA satellite image, surrounded by the dark Rio Negro and the muddy Amazon River

Many settlements grew along the road from Brasília to Belém with the highway and National Integration Program, however, the program failed as the settlers were unequipped to live in the delicate rainforest ecosystem. This, although the government believed it could sustain millions, instead could sustain very few.[59]

City of Manaus

With a population of 1.9 million people in 2014, Manaus is the largest city on the Amazon. Manaus alone makes up approximately 50% of the population of the largest Brazilian state of Amazonas. The racial makeup of the city is 64% pardo (mulatto and mestizo) and 32% white.[60]

Floating houses in Leticia, Colombia

Although the Amazon river remains undammed, around 412 dams are in operation on the Amazon's tributary rivers. Of these 412 dams, 151 are constructed over six of the main tributary rivers that drain into the Amazon.[61] Since only 4% of the Amazon's hydropower potential has been developed in countries like Brazil,[45]:35 more damming projects are underway and hundreds more are planned.[62] After witnessing the negative effects of environmental degradation, sedimentation, navigation and flood control caused by the Three Gorges Dam in the Yangtze River,[45]:279 scientists are worried that constructing more dams in the Amazon will harm its biodiversity in the same way by "blocking fish-spawning runs, reducing the flows of vital oil nutrients and clearing forests".[62] Damming the Amazon River could potentially bring about the "end of free flowing rivers" and contribute to an "ecosystem collapse" that will cause major social and environmental problems.[61]

Course

Origins

The Amazon was thought to originate from the Apacheta cliff in Arequipa at the Nevado Mismi, marked only by a wooden cross.

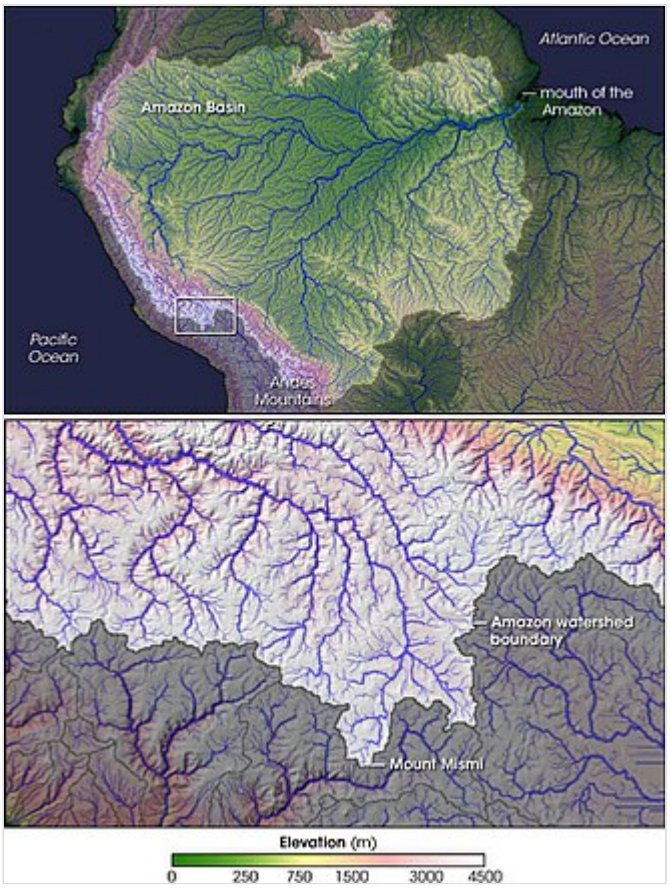
The most distant source of the Amazon was thought to be in the Apurímac river drainage for nearly a century. Such studies continued to be published even as recently as 1996,[63] 2001,[64] 2007,[25] and 2008,[65] where various authors identified the snowcapped 5,597 m (18,363 ft) Nevado Mismi peak, located roughly 160 km (99 mi) west of Lake Titicaca and 700 km (430 mi) southeast of Lima, as the most distant source of the river. From that point, Quebrada Carhuasanta emerges from Nevado Mismi, joins Quebrada Apacheta and soon forms Río Lloqueta which becomes Río Hornillos and eventually joins the Río Apurímac.

A 2014 study by Americans James Contos and Nicolas Tripcevich in *Area*, a peer-reviewed journal of the Royal Geographical Society, however, identifies the most distant source of the Amazon as actually being in the Río Mantaro drainage.[28] A variety of methods were used to compare the lengths of the Mantaro river vs. the Apurímac river from their most distant source points to their confluence, showing the longer length of the Mantaro. Then distances from Lago Junín to several potential source points in the uppermost Mantaro river were measured, which enabled them to determine that the Cordillera Rumi Cruz was the most distant source of water in the Mantaro basin (and therefore in the entire Amazon basin). The most accurate measurement method was direct GPS measurement obtained by kayak descent of each of the rivers from their source points to their confluence (performed by Contos). Obtaining these measurements was difficult given the class IV–V nature of each of these rivers, especially in their lower "Abyss" sections. Ultimately, they determined that the most distant point in the Mantaro drainage is nearly 80 km farther upstream compared to Mt. Mismi in the Apurímac drainage, and thus the maximal length of the Amazon river is about 80 km longer than previously thought. Contos continued downstream to the ocean and finished the first complete descent of the Amazon from its newly identified source (finishing November 2012), a journey repeated by two groups after the news spread.[66]

After about 700 km (430 mi), the Apurímac then joins Río Mantaro to form the Ene, which joins the Perene to form the Tambo, which joins the Urubamba River to form the Ucayali. After the confluence of Apurímac and Ucayali, the river leaves Andean terrain and is surrounded by floodplain. From this point to the confluence of the Ucayali and the Marañón, some 1,600 km (990 mi), the forested banks are just above the water and are inundated long before the river attains its maximum flood stage.[53] The low river banks are interrupted by only a few hills, and the river enters the enormous Amazon rainforest.

The Upper Amazon or Solimões

Although the Ucayali–Marañón confluence is the point at which most geographers place the beginning of the Amazon River proper, in Brazil the river is known at this point as the *Solimões das Águas*. The river systems and flood plains in Brazil, Peru, Ecuador, Colombia, and Venezuela, whose waters drain into the *Solimões* and its tributaries, are called the "Upper Amazon".



Nevado Mismi, formerly considered to be the source of the Amazon

The Amazon proper runs mostly through Brazil and Peru, and is part of the border between Colombia and Peru. It has a series of major tributaries in Colombia, Ecuador and Peru, some of which flow into the Marañón and Ucayali, and others directly into the Amazon proper. These include rivers Putumayo, Caquetá, Vaupés, Guainía, Morona, Pastaza, Nucuray, Urituyacu, Chambira, Tigre, Nanay, Napo, and Huallaga.

At some points, the river divides into anabranches, or multiple channels, often very long, with inland and lateral channels, all connected by a complicated system of natural canals, cutting the low, flat *igapó* lands, which are never more than 5 m (16 ft) above low river, into many islands.[67]

From the town of Canaria at the great bend of the Amazon to the Negro, vast areas of land are submerged at high water, above which only the upper part of the trees of the sombre forests appear. Near the mouth of the Rio Negro to Serpa, nearly opposite the river Madeira, the banks of the Amazon are low, until approaching Manaus, they rise to become rolling hills.[53]


Marañón River in Peru

The Lower Amazon

The Lower Amazon begins where the darkly colored waters of the Rio Negro meets the sandy-colored Rio Solimões (the upper Amazon), and for over 6 km (3.7 mi) these waters run side by side without mixing. At Óbidos, a bluff 17 m (56 ft) above the river is backed by low hills. The lower Amazon seems to have once been a gulf of the Atlantic Ocean, the waters of which washed the cliffs near Óbidos.

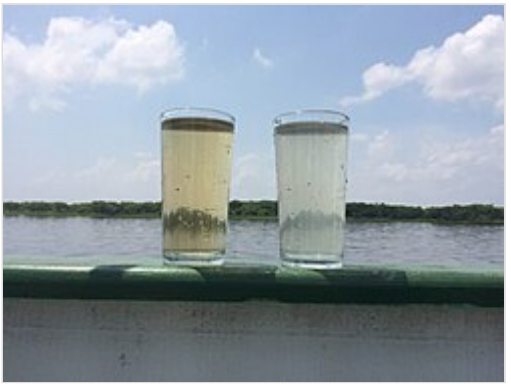

Amazon River near Iquitos, Peru

Only about 10% of the Amazon's water enters downstream of Óbidos, very little of which is from the northern slope of the valley. The drainage area of the Amazon basin above Óbidos city is about 5,000,000 km^2 (1,900,000 sq mi), and, below, only about 1,000,000 km^2 (390,000 sq mi) (around 20%), exclusive of the 1,400,000 km^2 (540,000 sq mi) of the Tocantins basin.[53] The Tocantins River enters the southern portion of the Amazon delta.

Meeting of Waters; the confluence of Rio Negro (blue) and Rio Solimões (sandy) near Manaus, Brazil

In the lower reaches of the river, the north bank consists of a series of steep, table-topped hills extending for about 240 km (150 mi) from opposite the mouth of the Xingu as far as Monte Alegre. These hills are cut down to a kind of terrace which lies between them and the river.[67]

On the south bank, above the Xingu, a line of low bluffs bordering the floodplain extends nearly to Santarém in a series of gentle curves before they bend to the southwest, and, abutting upon the lower Tapajós, merge into the bluffs which form the terrace margin of the Tapajós river valley.[68]



Water samples of the Solimões (right) and Rio Negro (left)

Mouth

Belém is the major city and port at the mouth of the river at the Atlantic Ocean. The definition of where exactly the mouth of the Amazon is located, and how wide it is, is a matter of dispute, because of the area's peculiar geography. The Pará and the Amazon are connected by a series of river channels called *furos* near the town of Breves; between them lies Marajó, the world's largest combined river/sea island.

Satellite image of the mouth of the Amazon River, from the north looking south

If the Pará river and the Marajó island ocean frontage are included, the Amazon estuary is some 325 km (202 mi) wide.[69] In this case, the width of the mouth of the river is usually measured from Cabo Norte, the cape located straight east of Pracuúba in the Brazilian state of Amapá, to Ponta da Tijoca near the town of Curuçá, in the state of Pará.

A more conservative measurement excluding the Pará river estuary, from the mouth of the Araguari River to Ponta do Navio on the northern coast of Marajó, would still give the mouth of the Amazon a width of over 180 km (112 mi). If only the river's main channel is considered, between the islands of Curuá (state of Amapá) and Jurupari (state of Pará), the width falls to about 15 km (9.3 mi).

The plume generated by the river's discharge covers up to 1.3 million km^2 and is responsible for muddy bottoms influencing a wide area of the tropical north Atlantic in terms of salinity, pH, light penetration, and sedimentation.[30]

Lack of bridges

There are no bridges across the entire width of the river.[70] This is not because the river would be too wide to bridge; for most of its length, engineers could build a bridge across the river easily. For most of its course, the river flows through the Amazon Rainforest, where there are very few roads and cities. Most of the time, the crossing can be done by a ferry. The Manaus Iranduba Bridge linking the cities of Manaus and Iranduba spans the Rio Negro, the second-largest tributary of the Amazon, just before their confluence.

Dispute regarding length


River taxi in Peru

While debate as to whether the Amazon or the Nile is the world's longest river has gone on for many years, the historic consensus of geographic authorities has been to regard the Amazon as the second longest river in the world, with the Nile being the longest. However, the Amazon has been reported as being anywhere between 6,275 km (3,899 mi) and 6,992 km (4,345 mi) long.[6] It is often said to be "at least" 6,400 km (4,000 mi) long.[5] The Nile is reported to be anywhere from 5,499 to 7,088 km (3,417 to 4,404 mi).[6] Often it is said to be "about" 6,650 km (4,130 mi) long.[24] There are several factors that can affect these measurements, such as the position of the geographical source and the mouth, the scale of measurement, and the length measuring techniques (for details see also List of rivers by length).[6][7]

In July 2008, the Brazilian Institute for Space Research (INPE) published a news article on their webpage, claiming that the Amazon River was 140 km (87 mi) longer than the Nile. The Amazon's length was calculated as 6,992 km (4,345 mi), taking the Apacheta Creek as its source. Using the same techniques, the length of the Nile was calculated as 6,853 km (4,258 mi), which is longer than previous estimates but still shorter than the Amazon. The results were reached by measuring the Amazon downstream to the beginning of the tidal estuary of *Canal do Sul* and then, after a sharp turn back, following tidal canals surrounding the isle of Marajó and finally including the marine waters of the *Río Pará* bay in its entire length.[65][27] According to an earlier article on the webpage of the National Geographic, the Amazon's length was calculated as 6,800 km (4,200 mi) by a Brazilian scientist. In June 2007, Guido Gelli, director of science at the Brazilian Institute of Geography and Statistics (IBGE), told London's Telegraph Newspaper that it could be considered that the Amazon was the longest river in the world.[26] However, according to the above sources, none of the two results was published, and questions were raised about the researchers' methodology. In 2009, a peer-reviewed article, was published, concluding that the Nile is longer than the Amazon by stating a length of 7,088 km (4,404 mi) for the Nile and 6,575 km (4,086 mi) for the Amazon, measured by using a combination of satellite image analysis and field investigations to the source regions.[6] According to the Encyclopædia Britannica, the final length of the Amazon remains open to interpretation and continued debate.[5][27]

Watershed

The Amazon basin, the largest in the world, covers about 40% of South America, an area of approximately 7,050,000 square kilometres (2,722,020 sq mi). It drains from west to east, from Iquitos in Peru, across Brazil to the Atlantic. It gathers its waters from 5 degrees north latitude to 20 degrees south latitude. Its most remote sources are found on the inter-Andean plateau, just a short distance from the Pacific Ocean.[71]

The Amazon River and its tributaries are characterised by extensive forested areas that become flooded every rainy season. Every year, the river rises more than 9 m (30 ft), flooding the surrounding forests, known as *várzea* ("flooded forests"). The Amazon's flooded forests are the most extensive example of this habitat type in the world.[72] In an average dry season, 110,000 km^2 (42,000 sq mi) of land are water-covered, while in the wet season, the flooded area of the Amazon basin rises to 350,000 km^2 (140,000 sq mi).[69]

The quantity of water released by the Amazon to the Atlantic Ocean is enormous: up to 300,000 m^3/s (11,000,000 cu ft/s) in the rainy season, with an average of 209,000 m^3/s (7,400,000 cu ft/s) from 1973 to 1990.[73] The Amazon is responsible for about 20% of the Earth's fresh water entering the ocean.[72] The river pushes a vast plume of fresh water into the ocean. The plume is about 400 km (250 mi) long and between 100 and 200 km (62 and 124 mi) wide. The fresh water, being lighter, flows on top of the seawater, diluting the salinity and altering the colour of the ocean surface over an area up to 2,500,000 km^2 (970,000 sq mi) in extent. For centuries ships have reported fresh water near the Amazon's mouth yet well out of sight of land in what otherwise seemed to be the open ocean.[32]

Despite this, the Atlantic has sufficient wave and tidal energy to carry most of the Amazon's sediments out to sea, thus the Amazon does not form a significant river delta. The great deltas of the world are all in relatively protected bodies of water, while the Amazon empties directly into the turbulent Atlantic.[29]

There is a natural water union between the Amazon and the Orinoco basins, the so-called Casiquiare canal. The Casiquiare is a river distributary of the upper Orinoco, which flows southward into the Rio Negro, which in turn flows into the Amazon. The Casiquiare is the largest river on earth that links two major river systems, a so-called bifurcation.

Discharge

Average discharge at the estuary; Period from 2003 to 2015: 7,200 km^3/a (230,000 m^3/s)[74][75]

Year	(km^3)	(m^3/s)	Year	(km^3)	(m^3/s)
2003	6,470	205,000	2010	6,464	205,000
2004	6,747	214,000	2011	7,378	234,000
2005	6,522	207,000	2012	7,513	238,000
2006	7,829	248,000	2013	7,288	231,000
2007	7,133	226,000	2014	7,674	243,000
2008	7,725	245,000	2015	6,657	211,000
2009	8,200	260,000			

Amazon Delta

Water discharge of the Amazon with Tocantins River. Complete series from starting 1920.

Average discharge (10^3 m^3/s)

Year	Discharge	Year	Discharge
2015	210.9	1967	231
2014	243.2	1966	237
2013	230.9	1965	232
2012	238.1	1964	218
2011	233.8	1963	240
2010	204.8	1962	220
2009	260	1961	229
2008	244.8	1960	207
2007	226	1959	236
2006	248.1	1958	229
2005	206.7	1957	210
2004	213.8	1956	230
2003	205	1955	233
2002	214	1954	238
2001	216	1953	234
2000	234	1952	223
1999	212	1951	227
1998	149	1950	230
1997	201	1949	213
1996	212	1948	228
1995	195	1947	210
1994	240	1946	222
1993	218	1945	192
1992	156	1944	220
1991	218	1943	208
1990	198	1942	200
1989	230	1941	203
1988	200	1940	208
1987	180	1939	229
1986	208	1938	200
1985	240	1937	188
1984	270	1936	183
1983	186	1935	215
1982	236	1934	230
1981	202	1933	200

1980	190	1932	214
1979	224	1931	190
1978	233	1930	209
1977	232	1929	201
1976	239	1928	208
1975	242	1927	220
1974	242	1926	202
1973	224	1925	210
1972	238	1924	222
1971	235	1923	210
1970	220	1922	219
1969	211	1921	224
1968	210	1920	200
Source:[76][77][74][75]			

Monthly average discharge (m^3/s)

Month	Discharge	
	Amazon	Pará
January	126,100	7,300
February	177,100	14,200
March	186,300	18,200
April	201,300	28,700
May	236,600	38,700
June	275,600	40,500
July	296,900	32,600
August	288,500	14,500
September	262,500	6,100
October	227,000	2,500
November	118,800	1,000
December	82,400	1,000
Average	*206,600*	*17,100*
Source:[78]		

Santarém

Water discharge of the Amazon River at the Santarém gauging station.

Average, minimum and maximum discharge (1998/01/01—2024/12/31)

Year	Discharge (m^3/s)		
	Min	Mean	Max
1998	69,202	*175,218*	278,306
1999	73,921	*182,266*	270,080
2000	73,306	*171,899*	275,060
2001	67,300	*173,517*	268,820
2002	92,711	*207,186*	296,805
2003	100,473	*182,767*	252,626
2004	100,986	*184,880*	265,644
2005	67,464	*172,411*	280,340
2006	91,126	*192,500*	301,860
2007	73,256	*192,715*	309,478
2008	101,146	*198,128*	316,669
2009	76,598	*204,920*	303,192
2010	72,101	*172,255*	255,208
2011	65,803	*155,030*	256,798
2012	50,070	*194,883*	323,680
2013	55,108	*206,295*	305,526
2014	151,997	*235,390*	338,905
2015	70,119	*261,580*	378,767
2016	69,995	*230,788*	367,296
2017	104,111	*223,193*	352,935
2018	95,376	*262,946*	386,022
2019	96,260	*260,664*	382,840
2020	72,955	*234,725*	388,213
2021	94,903	*262,264*	376,740
2022	101,693	*259,902*	405,999
2023	46,130	*217,551*	370,109
2024	48,898	*198,627*	350,570
Source: *The Flood Observatory*[79][18]			

Óbidos

Water discharge of the Amazon River at the Óbidos gauging station. Complete series from starting 1903.

Average, minimum and maximum discharge (m^3/s)

Year	Min	*Mean*	Max	Year	Min	*Mean*	Max
2023	61,000	*154,988*	333,700	1962	92,800	*167,864*	245,100
2022	77,200	*162,990*	375,200	1961	77,800	*153,577*	221,400
2021	106,700	*177,000*	353,800	1960	99,300	*161,502*	230,300
2020	92,800	*170,912*	344,800	1959	103,000	*159,604*	231,900
2019	87,900	*162,810*	352,300	1958	73,700	*153,243*	234,300
2018	92,300	*180,232*	336,200	1957	84,200	*156,814*	227,200
2017	93,300	*181,025*	352,100	1956	123,700	*160,720*	236,100
2016	87,600	*159,308*	347,500	1955	80,100	*166,970*	252,700
2015	120,400	*186,731*	355,300	1954	94,400	*173,000*	253,300
2014	113,000	*196,940*	321,700	1953	90,600	*189,070*	394,000
2013	117,400	*193,573*	301,200	1952	94,100	*158,150*	317,000
2012	87,900	*192,292*	370,000	1951	101,900	*161,110*	283,000
2011	80,600	*176,523*	242,800	1950	78,200	*166,078*	368,000
2010	77,100	*165,902*	254,000	1949	116,700	*171,323*	356,000
2009	85,800	*198,590*	291,040	1948	78,400	*159,946*	288,000
2008	87,700	*193,072*	280,800	1947	109,200	*165,500*	213,000
2007	95,500	*174,068*	278,600	1946	93,700	*172,012*	283,000
2006	88,400	*184,690*	279,200	1945	88,200	*148,566*	244,000
2005	72,800	*161,830*	273,500	1944	96,800	*174,608*	309,000
2004	86,400	*165,096*	218,500	1943	88,200	*161,866*	260,000
2003	90,400	*170,802*	248,000	1942	93,200	*154,500*	236,000
2002	93,700	*177,493*	265,400	1941	86,800	*156,379*	231,000
2001	74,400	*175,527*	257,000	1940	119,000	*157,708*	213,000
2000	87,900	*181,146*	258,500	1939	126,000	*174,625*	281,000
1999	75,300	*185,737*	299,700	1938	94,000	*154,412*	257,000
1998	75,000	*149,382*	268,200	1937	82,800	*143,237*	212,000
1997	72,400	*169,129*	265,800	1936	81,900	*139,133*	212,000
1996	108,600	*180,190*	251,200	1935	82,500	*169,612*	299,000
1995	74,600	*151,499*	259,300	1934	129,000	*173,166*	292,000
1994	106,000	*200,335*	296,000	1933	83,600	*154,658*	256,000
1993	106,000	*181,290*	262,000	1932	93,400	*165,096*	260,000
1992	91,800	*138,555*	194,600	1931	88,500	*146,354*	230,000
1991	82,500	*169,444*	248,000	1930	98,400	*158,679*	243,000
1990	83,400	*167,368*	235,000	1929	86,600	*156,037*	276,000
1989	120,000	*206,941*	346,000	1928	92,600	*151,000*	284,000

1988	92,300	*165,547*	228,000	1927	119,600	*159,940*	231,900
1987	92,200	*164,552*	231,000	1926	70,700	*111,513*	151,400
1986	125,000	*182,247*	244,000	1925	96,000	*171,547*	250,800
1985	113,000	*159,840*	190,000	1924	95,500	*142,416*	202,900
1984	105,000	*173,350*	259,000	1923	91,500	*178,802*	246,300
1983	86,100	*140,892*	179,000	1922	129,000	*187,619*	279,200
1982	96,100	*186,200*	302,000	1921	93,000	*174,784*	268,900
1981	88,300	*149,806*	191,000	1920	116,900	*175,452*	255,200
1980	91,200	*142,473*	176,000	1919	88,700	*148,443*	209,000
1979	91,500	*169,696*	267,000	1918	103,000	*170,543*	260,200
1978	115,300	*178,293*	257,000	1917	94,400	*136,835*	215,600
1977	119,700	*176,834*	269,000	1916	70,100	*144,984*	213,800
1976	95,400	*192,734*	327,000	1915	86,700	*159,604*	235,700
1975	106,000	*197,545*	307,000	1914	94,600	*171,882*	253,600
1974	131,600	*193,870*	280,000	1913	131,000	*178,132*	252,700
1973	123,000	*179,537*	250,000	1912	112,500	*135,047*	185,700
1972	109,000	*182,624*	264,000	1911	83,200	*159,710*	232,100
1971	121,400	*187,121*	288,000	1910	102,000	*154,024*	237,100
1970	84,500	*163,232*	239,000	1909	76,400	*170,095*	274,800
1969	89,200	*156,720*	210,000	1908	102,100	*176,793*	267,700
1968	113,000	*148,220*	202,000	1907	84,600	*140,184*	224,800
1967	89,000	*162,506*	227,000	1906	69,600	*142,194*	202,200
1966	87,300	*143,868*	207,400	1905	93,500	*141,524*	203,900
1965	85,400	*144,650*	215,600	1904	93,300	*174,561*	262,500
1964	103,500	*136,612*	202,300	1903	82,800	*148,220*	230,000
1963	72,800	*141,190*	226,800				
Source:[75][77][74]							

Monthly average discharge (1968–2022)

Month	Discharge (m^3/s)
January	137,749
February	163,264
March	186,036
April	206,989
May	220,717
June	221,055
July	209,765
August	186,655
September	149,159
October	112,032
November	102,544
December	114,746
Source:[80]	

Itacoatiara

Water discharge of the Amazon River at the Itacoatiara gauging station.

Average, minimum and maximum discharge (1998/01/01—2024/12/31)

Year	Discharge (m^3/s)		
	Min	**Mean**	**Max**
1998	41,312	*139,002*	240,396
1999	64,130	*171,662*	288,869
2000	52,870	*161,345*	261,176
2001	30,670	*157,286*	256,627
2002	67,979	*164,171*	252,425
2003	82,556	*149,274*	228,998
2004	66,183	*139,926*	223,929
2005	57,598	*145,002*	258,383
2006	61,265	*168,975*	268,108
2007	74,679	*161,393*	238,839
2008	71,572	*168,065*	259,841
2009	59,298	*166,100*	275,544
2010	53,715	*128,035*	215,638
2011	42,192	*129,710*	230,293
2012	29,489	*172,103*	291,537
2013	51,341	*172,201*	286,872
2014	85,599	*192,462*	324,191
2015	66,094	*221,843*	339,832
2016	41,063	*167,746*	311,494
2017	60,218	*205,382*	329,771
2018	65,629	*202,838*	316,291
2019	96,549	*227,078*	340,215
2020	44,698	*214,586*	352,671
2021	85,862	*236,885*	354,795
2022	56,758	*214,763*	337,412
2023	38,496	*173,676*	304,336
2024	27,088	*156,907*	297,641
Source: *The Flood Observatory*[79][18]			

Monthly average discharge (2008–2021)

Month	Discharge (m^3/s)
January	122,910
February	146,170
March	170,972
April	185,403
May	198,166
June	200,022
July	190,811
August	170,101
September	133,948
October	99,706
November	93,029
December	103,054
Source:[80]	

Sediment load

Sediment load (S - 754 x 10^6 ton/year) at Óbidos gauge station (period from 1996 to 2007).

Year	S	Year	S
1996	672	2002	802
1997	691	2003	832
1998	652	2004	807
1999	732	2005	797
2000	692	2006	742
2001	787	2007	842
Source:[81]			

Flooding

Not all of the Amazon's tributaries flood at the same time of the year. Many branches begin flooding in November and might continue to rise until June. The rise of the Rio Negro starts in February or March and begins to recede in June. The Madeira River rises and falls two months earlier than most of the rest of the Amazon river.

The depth of the Amazon between Manacapuru and Óbidos has been calculated as between 20 and 26 m (66 and 85 ft). At Manacapuru, the Amazon's water level is only about 24 m (79 ft) above mean sea level. More than half of the water in the Amazon downstream of Manacapuru is below sea level.[82] In its lowermost section, the Amazon's depth averages 20 to 50 m (66 to 164 ft), in some places as much as 100 m (330 ft).[83]

NASA satellite image of a flooded portion of the river

The main river is navigable for large ocean steamers to Manaus, 1,500 km (930 mi) upriver from the mouth. Smaller ocean vessels below 9000 tons and with less than 5.5 m (18 ft) draft can reach as far as Iquitos, Peru, 3,600 km (2,200 mi) from the sea. Smaller riverboats can reach 780 km (480 mi) higher, as far as Achual Point. Beyond that, small boats frequently ascend to the Pongo de Manseriche, just above Achual Point in Peru.[67]

Annual flooding occurs in late northern latitude winter at high tide when the incoming waters of the Atlantic are funnelled into the Amazon delta. The resulting undular tidal bore is called the *pororoca*, with a leading wave that can be up to 7.6 m (25 ft) high and travel up to 800 km (500 mi) inland.[84][85]

Geology

The Amazon River originated as a transcontinental river in the Miocene epoch between 11.8 million and 11.3 million years ago and took its present shape approximately 2.4 million years ago in the Early Pleistocene.

The proto-Amazon during the Cretaceous flowed west, as part of a proto-Amazon-Congo river system, from the interior of present-day Africa when the continents were connected, forming western Gondwana. 80 million years ago, the two continents split. Fifteen million years ago, the main tectonic uplift phase of the Andean chain started. This tectonic movement is caused by the subduction of the Nazca Plate underneath the South American Plate. The rise of the Andes and the linkage of the Brazilian and Guyana bedrock shields, blocked the river and caused the Amazon Basin to become a vast inland sea. Gradually, this inland sea became a massive swampy, freshwater lake and the marine inhabitants adapted to life in freshwater.[86]

Eleven to ten million years ago, waters worked through the sandstone from the west and the Amazon began to flow eastward, leading to the emergence of the Amazon rainforest. During glacial periods, sea levels dropped and the great Amazon lake rapidly drained and became a river, which would eventually become the disputed world's longest, draining the most extensive area of rainforest on the planet.[87]

Paralleling the Amazon River is a large aquifer, dubbed the Hamza River, the discovery of which was made public in August 2011.[88]

Protected areas

Name	Country	Coordinates	Image	Notes
Allpahuayo-Mishana National Reserve	Peru	3°56′S 73°33′W		[89]
Amacayacu National Park	Colombia	3°29′S 72°12′W		[90]
Amazônia National Park	Brazil	4°26′S 56°50′W		[91]
Anavilhanas National Park	Brazil	2°23′S 60°55′W		[92]

Flora and fauna

Flora

Fauna

More than one-third of all known species in the world live in the Amazon rainforest.[93] It is the richest tropical forest in the world in terms of biodiversity.[94] In addition to thousands of species of fish, the river supports crabs, algae, and turtles.

The tambaqui, an important species in Amazonian fisheries, breeds in the Amazon River.

Mammals

Along with the Orinoco, the Amazon is one of the main habitats of the *boto*, also known as the Amazon river dolphin (*Inia geoffrensis*). It is the largest species of river dolphin, and it can grow to lengths of up to 2.6 m (8.5 ft). The colour of its skin changes with age; young animals are gray, but become

pink and then white as they mature. The dolphins use echolocation to navigate and hunt in the river's tricky depths.[95] The *boto* is the subject of a legend in Brazil about a dolphin that turns into a man and seduces maidens by the riverside.[96]


Amazon river dolphin

The tucuxi (*Sotalia fluviatilis*), also a dolphin species, is found both in the rivers of the Amazon basin and in the coastal waters of South America. The Amazonian manatee (*Trichechus inunguis*), also known as "seacow", is found in the northern Amazon River basin and its tributaries. It is a mammal and a herbivore. Its population is limited to freshwater habitats, and, unlike other manatees, it does not venture into saltwater. It is classified as vulnerable by the International Union for Conservation of Nature.[97]

The Amazon and its tributaries are the main habitat of the giant otter (*Pteronura brasiliensis*).[98] Sometimes known as the "river wolf," it is one of South America's top carnivores. Because of habitat destruction and hunting, its population has dramatically decreased. It is now listed on Appendix I of the Convention on International Trade in Endangered Species (CITES), which effectively bans international trade.[99]

Reptiles

The anaconda is found in shallow waters in the Amazon basin. One of the world's largest species of snake, the anaconda spends most of its time in the water with just its nostrils above the surface. Species of caimans, that are related to alligators and other crocodilians, also inhabit the Amazon as do varieties of turtles.[100]


The green anaconda is the heaviest and one of the longest known extant snake species.

Birds

Fish

The Amazonian fish fauna is the centre of diversity for neotropical fishes, some of which are popular aquarium specimens like the neon tetra and the freshwater angelfish. More than 5,600 species were known as of 2011, and approximately fifty new species are discovered each year.[94]:308[45]:27 The arapaima, known in Brazil as the *pirarucu*, is a South American tropical freshwater fish, one of the largest freshwater fish in the world, with a length of up to 4.6 metres (15 ft).[101] Another Amazonian freshwater fish is the arowana (or *aruanã* in Portuguese), such as the silver arowana (*Osteoglossum bicirrhosum*), which is a predator and very similar to the arapaima, but only reaches a length of 120 cm (47 in). Also present in large numbers is the notorious piranha, an omnivorous fish that congregates in large schools and may attack livestock. There are approximately 30 to 60 species of piranha. The candirú, native to the Amazon River, is a species of parasitic fresh water catfish in the family Trichomycteridae,[102] just one of more

than 1200 species of catfish in the Amazon basin. Other catfish 'walk' overland on their ventral fins,[45]:27–29 while the kumakuma (*Brachyplatystoma filamentosum*), aka *piraiba* or "goliath catfish", can reach 3.6 m (12 ft) in length and 200 kg (440 lb) in weight.[103]

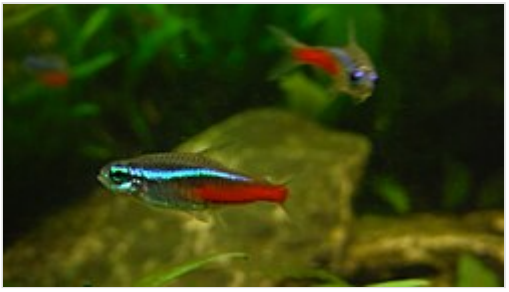
The electric eel (*Electrophorus electricus*) and more than 100 species of electric fishes (Gymnotiformes) inhabit the Amazon basin. River stingrays (Potamotrygonidae) are also known. The bull shark (*Carcharhinus leucas*), a euryhaline species which can thrive in both salt and fresh water, has been reported as far as 4,000 km (2,500 mi) up the Amazon River at Iquitos in Peru.[104]

Characins, such as the piranha species, are prey for the giant otter, but these aggressive fish may also pose a danger to humans.

Butterflies

Microbiota

Freshwater microbes are generally not very well known, even less so for a pristine ecosystem like the Amazon. Recently, metagenomics has provided answers to what kind of microbes inhabit the river.[105] The most important microbes in the Amazon River are Actinomycetota, Alphaproteobacteria, Betaproteobacteria, Gammaproteobacteria and Thermoproteota.



The neon tetra is one of the most popular aquarium fish.

Challenges

The Amazon River serves as a vital lifeline for more than 47 million people in its basin and faces a multitude of challenges that threaten both its ecosystem and the indigenous communities dependent on its resources. According to the Office of the United Nations High Commissioner for Human Rights (OHCHR), the Yanomami, a tribe of approximately 30,000, struggles to preserve their land, culture, and traditional way of life due to encroaching illegal gold miners, malnutrition, and malaria. Meanwhile, in 2022, the region's severe drought, has led to a devastating increase in water temperatures, reaching 39.1 degrees Celsius, causing the demise of 125 Amazon river dolphins.[106] This event displays the deteriorating environmental conditions and indicates the increasing vulnerability of the river's ecosystem. In recent years, the Amazon River has experienced historically low water levels, the lowest in over a century. Brazil, the primary custodian of this invaluable natural resource, grapples with the challenges of mitigating the effects of this drought on communities and ecosystems, further emphasizing the urgency of sustainable environmental management and conservation efforts.[107]

Major tributaries

The Amazon has over 1,100 tributaries, twelve of which are over 1,500 km (930 mi) long.[108] Some of the more notable ones are:

- Branco
- Casiquiare canal
- Caquetá
- Huallaga
- Putumayo (or Içá River)
- Javary (or Yavarí)
- Juruá
- Madeira
- Marañón
- Morona
- Nanay
- Napo
- Negro
- Pastaza
- Purús
- Tambo
- Tapajós
- Tigre
- Tocantins
- Trombetas
- Ucayali
- Xingu
- Yapura

Solimões, the section of the upper Amazon River

Aerial view of an Amazon tributary

List of major tributaries

The main river and tributaries are (sorted in order from the confluence of Ucayali and Marañón rivers to the mouth):

Left tributary	Right tributary	Length (km)	Basin size (km^2)	Average discharge (m^3/s)
Upper Amazon (Confluence of Ucayali and Marañón rivers - Tabatinga)				
Marañón		2,112	364,873.4	16,708
	Ucayali	2,738	353,729.3	13,630.1
	Tahuyo	80	1,630	105.7
	Tamshiyaçu	86.7	1,367.3	86.5
Itaya		213	2,668	161.4
Nanay		483	16,673.4	1,072.7
	Maniti	198.7	2,573.6	180.4
Napo		1,075	103,307.8	7,147.8
Apayaçu		50	2,393.6	160.9
	Orosa	95	3,506.8	234.3
Ampiyaçu		140	4,201.4	267.2
Chichita		48	1,314.2	87.7
	Cochiquinas	49	2,362.7	150.2
	Santa Rosa	45	1,678	101.5
Cajocumal		58	2,094.9	141.5
Atacuari		108	3,480.5	236.8
Middle Amazon (Tabatinga - Encontro das Águas)				
	Javary	1,056	99,674.1	5,222.5
	Igarapé Veneza		943.9	58.3
Tacana			541	35.5
Igarapé de Belém			1,299.9	85.4
Igarapé São Jerônimo			1,259.6	78.2
	Jandiatuba	520	14,890.4	980
	Igarapé Acuruy		2,462.1	127.1
Putumayo		1,813	121,115.8	8,519.9

Tonantins			2,955.2	169.2
	Jutai	1,488	78,451.5	4,000
	Juruá	3,283	190,573	6,662.1
	Uarini		7,195.8	432.9
Japurá		2,816	276,812	18,121.6
	Tefé	571	24,375.5	1,190.4
	Caiambe		2,650.1	90
Parana Copea			10,532.3	423.8
	Coari	599	35,741.3	1,389.3
	Mamiá		5,514	176.2
Badajos		413	21,575	1,300
Igarapé Miuá			1,294.5	56.9
	Purus	3,382	378,762.4	11,206.9
Paraná Arara			1,915.7	78.2
	Paraná Manaquiri		1,318.6	52.9
Manacapuru		291	14,103	559.5
Lower Amazon (Encontro das Águas - Gurupá)				
Rio Negro		2,362	714,577.6	30,640.8
Prêto da Eva			3,039.5	110.8
	Igapó-Açu	500	45,994.4	1,676.5
	Madeira	3,380	1,322,782.4	32,531.9
Urubu		430	13,892	459.8
Uatumã		701	67,920	2,290.8
	Canumã, Paraná do Urariá	400	127,116	4,804.4
Nhamundá, Trombetas		744	150,032	4,127
Curuá		484	28,099	470.1
	Lago Grande do Curuaí		3,293.6	92.7
	Tapajós	1,992	494,551.3	13,540
	Curuá-Una	315	24,505	729.8

Maicurú		546	18,546	272.3
	Uruará		4,610.2	104.8
Jauari			5,851	108.3
	Guajará		4,243	105.6
Paru de Este		731	39,289	970
	Xingu	2,275	513,313.5	10,022.6
Igarapé Arumanduba			1,819.9	50.8
Jari		769	51,893	1,213.5
Amazon Delta (river mouth to Gurupá)				
Braco do Cajari			4,732.4	157.1
	Pará	784	84,027	3,500.3
	Tocantins	2,639	777,308	11,796
Atuã			2,769	119.8
	Anajás	300	24,082.5	948
Mazagão			1,250.2	44.4
Vila Nova			5,383.8	180.8
Matapi			2,487.4	81.7
	Acará, Guamá	400	87,389.5	2,550.7
Arari			1,523.6	80.2
Pedreira			2,005	89.9
	Paracauari		1,390.3	67.9
Jupati			724.2	32.6

[109][110][111][112][113][19]

List by length

1. 6,400 km (4,000 mi)[5] (6,275 to 7,025 km (3,899 to 4,365 mi))[6] – Amazon, South America
2. 3,250 km (2,019 mi) – Madeira, Bolivia/Brazil[114]
3. 3,211 km (1,995 mi) – Purús, Peru/Brazil[115]
4. 2,820 km (1,752 mi) – Japurá or Caquetá, Colombia/Brazil[116]
5. 2,639 km (1,640 mi) – Tocantins, Brazil[117]
6. 2,627 km (1,632 mi) – Araguaia, Brazil (tributary of Tocantins)[118]

7. 2,400 km (1,500 mi) – Juruá, Peru/Brazil[119]
8. 2,250 km (1,400 mi) – Rio Negro, Brazil/Venezuela/Colombia[120]
9. 1,992 km (1,238 mi) – Tapajós, Brazil[121]
10. 1,979 km (1,230 mi) – Xingu, Brazil[122]
11. 1,900 km (1,181 mi) – Ucayali River, Peru[123]
12. 1,749 km (1,087 mi) – Guaporé, Brazil/Bolivia (tributary of Madeira)[124]
13. 1,575 km (979 mi) – Içá (Putumayo), Ecuador/Colombia/Peru
14. 1,415 km (879 mi) – Marañón, Peru
15. 1,370 km (851 mi) – Teles Pires, Brazil (tributary of Tapajós)
16. 1,300 km (808 mi) – Iriri, Brazil (tributary of Xingu)
17. 1,240 km (771 mi) – Juruena, Brazil (tributary of Tapajós)
18. 1,130 km (702 mi) – Madre de Dios, Peru/Bolivia (tributary of Madeira)
19. 1,100 km (684 mi) – Huallaga, Peru (tributary of Marañón)

List by inflow to the Amazon

Rank	Name	Average annual discharge (m^3/s)	% of Amazon
	Amazon	209,000	100%
1	Madeira	31,200	15%
2	Negro	28,400	14%
3	Japurá	18,620	9%
4	Marañón	16,708	8%
5	Tapajós	13,540	6%
6	Ucayali	13,500	5%
7	Purus	10,970	5%
8	Xingu	9,680	5%
9	Putumayo	8,760	4%
10	Juruá	8,440	4%
11	Napo	6,976	3%
12	Javari	4,545	2%
13	Trombetas	3,437	2%
14	Jutaí	3,425	2%
15	Abacaxis	2,930	2%
16	Uatumã	2,190	1%

See also

Geography portal

- Amazon natural region, in Colombia
- Peruvian Amazonia in Peru

Notes

1. The length of the Amazon River is usually said to be "at least" 6,400 km (4,000 mi),[5] but reported values lie anywhere between 6,275 and 7,025 km (3,899 and 4,365 mi).[6] The length measurements of many rivers are only approximations and differ from each other because many factors determine the calculated river length, such as the position of the geographical source and the mouth, the scale of measurement, and the length measuring techniques (for details see also List of rivers by length).[6][7]
2. Multiannual average discharge 220,800–223,700 m^3/s (7,800,000–7,900,000 cu ft/s)[9][17]
3. (Period: 1971–2000) 173,272.6 m^3/s (6,119,060 cu ft/s)[19] (Period: 1928–1996) 176,177 m^3/s (6,221,600 cu ft/s)[21] (Period: 01/01/1997–31/12/2015) 178,193.9 m^3/s (6,292,860 cu ft/s)[22]
4. The Nile is usually said to be the longest river in the world, with a length of about 6,650 km (4,130 mi),[24] and the Amazon the second longest river in the world, with a length of at least 6,400 km (4,000 mi).[5] In 2007 and 2008, some scientists claimed that the Amazon has a length of 6,992 km (4,345 mi) and was longer than the Nile, whose length was calculated as 6,853 km (4,258 mi).[25][26] A peer-reviewed article, published in 2009, states a length of 7,088 km (4,404 mi) for the Nile and 6,575 km (4,086 mi) for the Amazon, measured by using a combination of satellite image analysis and field investigations to the source regions.[6] According to the Encyclopædia Britannica, as of 2020, the length of the Amazon remains open to interpretation and continued debate.[5][27]

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- A photographic journey up the Amazon River from its mouth to its source (http://jordibusque.com/en/story/amazonas/CF0646-DSC_5912.jpg#/CF0646-DSC_5912.jpg)
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