



One of the rabbitfish responsible for severely degrading algal forests in the eastern Mediterranean. (Credit: [Roberto Pillon](#))

how human activities have helped spread non-native species in the Mediterranean. While the canal provides a highway for marine migration, alien species don't have to make the journey alone and many hitch a ride on shipping vessels, either on their hulls or in their ballast water, bringing new species to far stretches of the Mediterranean Sea. Some 300 species have made it to the Med as stealthy passengers and have established themselves around the sea's major ports and harbours.

The Red Sea isn't the only source of alien species. Around the world, ships shift cargo and vast volumes of oil from one coast to another and with each journey they carry the risk of introducing a new species when they come into port. One such hitchhiker is the [invasive Australian grape algae](#), which smothers local algae

communities and is now widely established along the Mediterranean coast.

Humans are aiding the spread of alien species further through aquaculture, where species are brought to a new site as commodities and contaminants, though this route makes up a much smaller contribution than shipping and the Suez. And while measures are in place to reduce the risk of alien species introduction, preventing the spread of yet more invasives in the sea is an impossible task. As the climate warms, conditions in the Med will be even better for Lessepsian migrants, so the problem – considered to be one of the greatest biogeographic changes on the planet – is set to worsen.

When we look back at the fossil record, we can see where species originated, expanded and increased their range – changes that have happened over hundreds to millions of years. If we were to look back at our impact on the planet, even in the last century alone, we would see astounding shifts in species, not only in the ocean, but also on land. Together with the collapses brought about by hunting, fishing, habitat change and more, this record is worthy of the name Anthropocene.

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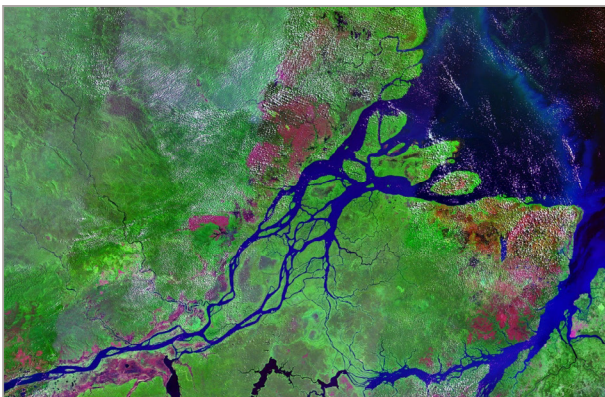
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The Amazon and the Anthropocene

The Amazon rainforest covers seven million square kilometres of the Earth's surface. It contains 2,000 different species of birds and mammals, 40,000 plant species, and around 2.5 million insect species. It is surely one of Earth's few remaining natural paradises.

Or is it? Many natural landscapes, including the Amazon rainforest, are readily romanticised in the popular imagination. But by the 1970s we had begun to realise that human activity in the Amazon is not just a recent phenomenon; the Amazon isn't as pristine as we



Satellite image of mouths of the Amazon River in Brazil. (Credit: [NASA](#))

had supposed. According to Anna Roosevelt, Professor of Anthropology at the University of Illinois in Chicago, and others, the Amazon was home to as many as five million people in AD1500 and [evidence of human presence](#) extends back at least 13,000 years.

The start of the Anthropocene epoch is much debated: some scientists believe it should coincide with the start of the Industrial Revolution, whilst others suggest an Early Anthropocene, beginning thousands of years previously. However, a growing body of evidence from the Amazon would seem to imply that human impacts can be traced back a long way – evidence that would therefore support the Early Anthropocene hypothesis. So how do we know about these human activities?

Two lines of evidence are crucial: the soil and the trees themselves. So-called anthropic black soils are, in essence, buried rubbish dumps from former settlements. They tend to consist of ash, fish bones, manure, excrement and burnt plant materials, [resulting in a nutrient and carbon-rich soil](#). Fragments of pottery have confirmed that these soils are of human origin. Some of the best studies [have conducted](#) detailed stratigraphic analysis of these soils and their surrounding horizons, analysing artifacts from individual layers and dating the sediments to build up a complete history of occupation.



Geoglyphs on deforested land at the Fazenda Colorada site in the Amazon rainforest. (Credit: [Sanna Saunaluoma](#))

Furthermore, they appear to be widespread: [as much as ten percent of Amazonia](#) may be covered by anthropic black soils.

The second clue is more subtle. The first human inhabitants of the Amazon, the Paleoindians, are thought to have been foragers, eating fish from the rivers and fruits and nuts from the trees. But when populations began to settle they would cut wood and discard seeds in the vicinity of their settlement. Over time this would have changed the make-up of the forest, [producing small concentrations](#) of palm groves and fruit trees. The Amazonian rainforest is [traditionally thought to](#) be very diverse such that individual trees in any one particular species are widely spaced. Therefore, concentrations of a specific species are very noticeable. Some of the groves that were created at prehistoric settlements are still intact today and are now major resources. However, the extent of these anthropic forests isn't known and a major challenge for future research is to map their distribution across the entire Amazon basin since doing so would give an indication of the extent of human settlement.

Since the first sedentary sites around 9,000 years ago, there are numerous other indications of large human communities in the

Amazon. The oldest of these is from the Faldas de Sangay culture in Ecuador: between 1400 and 2700 years ago an urban-scale development of soil mounds and connecting roads existed in the middle of the western Amazon jungle. The requisite anthropic black soils [have been discovered](#) on the tops of the mounds along with fine art, pottery, sculptures and tools. Meanwhile, at Marajo Island, right at the mouth of the Amazon River, more than 400 earth mounds [have been discovered](#) over an area of 20,000 square kilometres and are up to 1300 years old. Discoveries like these came as a real surprise: until lately it [had been thought](#) the soil quality throughout much of the Amazon was too poor to support static societies of any great size, but these and other major earthworks would seem to suggest otherwise.

The most curious signs of human habitation, though, are features called geoglyphs, large-scale designs etched into the ground. The Nazca Lines, in the Nazca Desert of southern Peru, are probably the most famous example. But in the dense jungle of the Amazon, it is only recently that whole series of geometric shapes have been revealed due to the ongoing deforestation. Now, hundreds of these enigmatic structures have been discovered hidden beneath the canopy. One of the clearest is at Fazenda Colorada in the state of Acre on the western tip of Brazil. A giant circle, diamond, and square were dug into the ground more than a thousand years ago. Their purpose is much debated in the academic literature, but it [has been suggested](#) that they might serve a religious or political function.

The research that has accumulated over the last few decades is incontrovertible: the Amazon is not the untouched, exotic paradise we thought it was. Furthermore, the long history of human habitation in the Amazon indicates that people in former ages were able to live in the forest, changing its composition and structure in a way that was compatible with its survival. Perhaps we ought to be trying to do the same?

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Reference

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No black-and-white issue: how dark aerosols affect the icy heights of the Himalayas

More than a billion people depend on water that runs off from the glaciers of the Himalayas for drinking water, irrigation and hydroelectric power. However, the pressures placed on this enormous water resource by anthropogenic climate change are still surprisingly poorly understood. The importance of better quantifying the effects of human-made changes and their future impacts is clear: not only do more people depend directly on the ice in Earth's 'Third Pole' than that in Greenland or Antarctica, [the complex topography](#)

of the Himalayas also means that it is impossible to extrapolate from relatively few studies to a larger scale.

An aerosol known as black carbon – droplets or particles of soot suspended in the atmosphere – is of particular concern. A by-product of the incomplete combustion of fossil fuels, it is [the most light-absorbing aerosol](#) we know. Emissions of black carbon have skyrocketed over the last 250 years, coinciding with the beginning of