

Uh, We're Running Out of Sand—And It's a Bigger Problem than You Might Think

We mine more sand every year than any other solid material, and scientists warn that we're taking more than the planet can replenish.

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Here's what you'll learn when you read this story:

- Sand is the most extracted solid material on Earth, but its use is far outpacing the natural systems that replace it.
 - A new meta-analysis analyzed 411 studies related to the extraction of river sand—the material of choice as a fine aggregate in concrete—and detailed the eventual material bottlenecks as well as environmental consequences of this industry.
 - Efforts are ramping up to use other materials as concrete aggregate, as well as investigating ways that recycled sand, or even desert sand—often considered too fine for use in concrete—could help alleviate the impact on sensitive river ecosystems.
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Since the dawn of the **Industrial Revolution**, humans have gotten immensely adept at taking more than the world can replenish. Our insatiable hunger for oil, lumber, and other natural resources has degraded the planet to the point where many scientists warn that we're living in the **sixth mass extinction** event in Earth's four billion years of biological history.

Now a new study in **Reviews of Geophysics** confirms the scale of the problem. Reviewing 411 peer-reviewed studies dating back more than 50 years, an international team found that extraction of river sand and gravel—the **fine aggregate in most concrete**—now exceeds natural replenishment rates. In Vietnam, it outpaces it by more than 11 times.

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Of course, this isn't surprising. For years, scientists and environmentalists **have been warning about this unrelenting sand extraction**, which equals roughly 50 billion tons per year, and in May this year, the United Nations issued a report that came to similar conclusions as the new study.

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“Sand is sometimes referred to as the unrecognised hero of development, but its essential role in sustaining the natural services on which we depend is even more overlooked,” said Pascal Peduzzi, director of the UNEP Global Resource Information Database Geneva, **in a press statement**. “Sand is our first line of defense against sea level rise, storm surges, and salination of coastal aquifers—all hazards exacerbated by climate change.”

It's surprising that the Earth could potentially run out of sand, considering the vast expanse of the world's deserts, which contain untold quantities of the stuff. But **desert sand**, eroded by wind, is more difficult to work with than river sand. Matt Kondolf, a geomorphologist at the University of California, Berkeley, **said in 2023** that river sand “needs minimal processing simply by taking it out of the riverbed,” which also makes it economically attractive—but that extraction comes with a high environmental cost.

“Removal of bed material alters channel gradients and flow structure, initiating incision, knickpoint migration, bank instability, and changes in sediment transport and connectivity,” the authors wrote. “Over years to decades, local disturbances accumulate, lowering water levels, modifying flood dynamics, and reducing sediment supply to downstream rivers, deltas, and coasts.”

China, India, and Vietnam rank as the three highest consumers of river sand in the world. According to lead author Dung Duc Tran of Singapore's Nanyang

Technological University (NTU), the Mekong Delta in Vietnam, for example, lost 366 million cubic meters of sand from 2015 until 2022. [ScienceAlert reports](#) that unstable banks along the Mekong resulted in the collapse of 1,800 homes. Meanwhile, China used [more sand in three years](#) than the U.S. used during the entire 20th century.

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However, the new review doesn't focus only on Asia. The authors report that dredging along the Paraná and Tocantins Rivers have altered their flow in Brazil's [Amazon River basin](#), and [mining](#) pits from the early 20th century in France are still permanent lakes in the floodplain of the Seine River.

Thankfully, there are ways that people can still act to reduce the harm caused by sand mining. A 2024 study in [Results of Engineering](#) concluded that recycled and even desert sand, which is more readily accessible, can lessen the demand for river sand by at least 50 percent. Other studies have also analyzed how other potential fine aggregates, including copper slag, quarry dust, foundry sand, and sawdust, [could also be used in concrete mixes](#).

The severity of the problem necessitates action. The impacts “are often more widespread than either the driver or the extent, as they propagate upstream and downstream, affecting regions that may not be directly involved in extraction or consumption,” the authors wrote. “Robust monitoring, harmonized trade statistics