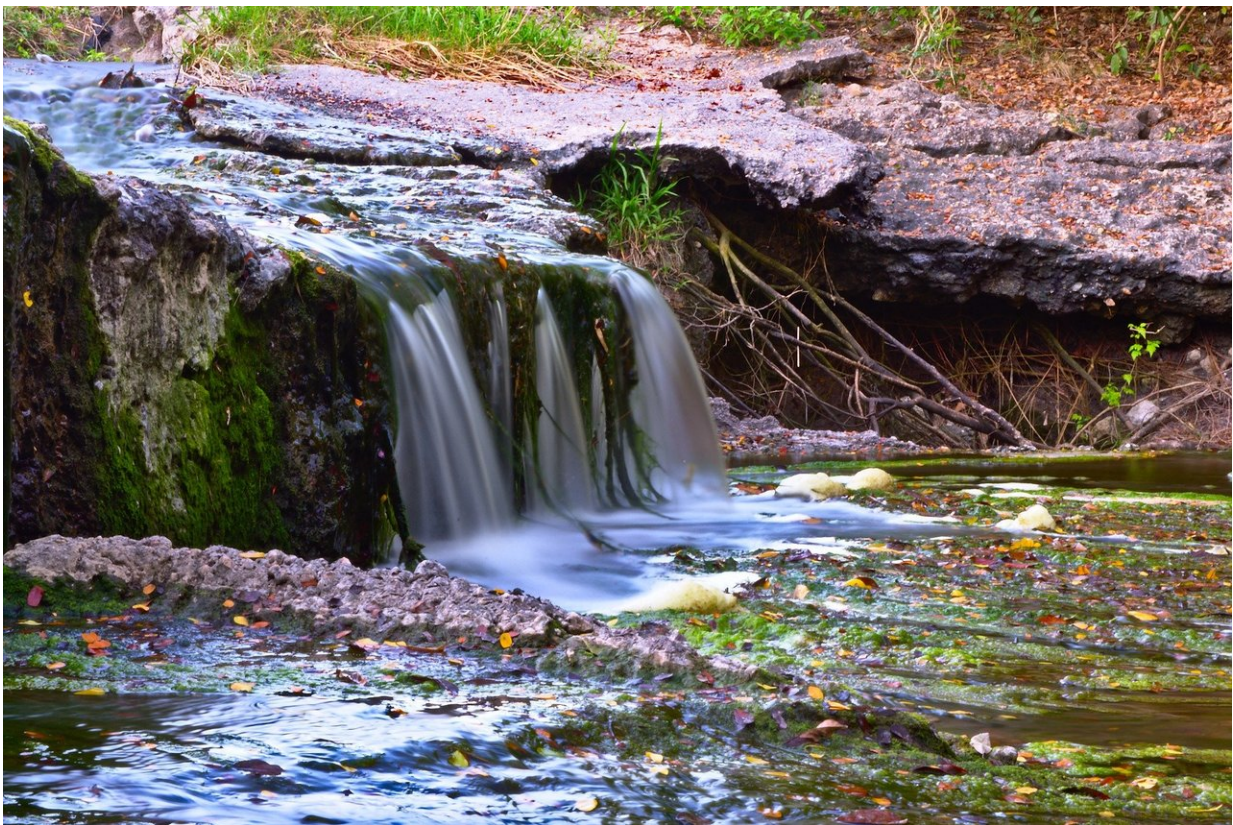


Humans have converted at least 250,000 acres of estuaries to cities and farms in last 35 years, study finds

April 9 2024, by Rebecca Dzombak



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Worldwide over the past 35 years, dams and land reclamation activities have converted 250,000 acres of estuary—an area roughly 17 times the

size of Manhattan—to urban land or agricultural fields, with most land conversion and estuary loss in rapidly developing countries, a new study finds. The findings could help developing countries avoid problems faced by countries that have already lost or degraded their estuaries.

The study is [published](#) in the journal *Earth's Future*.

Estuaries—wetland ecosystems where freshwater rivers meet saline ocean waters—are gateways connecting land and sea. They provide habitat for wildlife, sequester carbon, and serve as hubs for transport and shipping. People have been molding estuaries to fit their needs for thousands of years, and now, some countries are paying the price. Estuary degradation and loss can lower [water quality](#), shrink and fragment critical habitats, and remove coastlines' protection from storms.

"Estuary change is really interesting, especially in the 20th century, because estuaries have been altered by humans by the construction of estuarine dams and land reclamation," said Guan-hong Lee, a geoscientist at Inha University in South Korea who led the study. "When humans modify estuaries, the consequences for land loss are surprisingly huge."

Many developed countries, such as the Netherlands and Germany, have already modified or lost large areas of urban estuaries. Countries with significant modifications to their estuaries could serve as a warning of sorts for developing countries, and acting soon to conserve estuaries is an opportunity to protect developing countries' environmental and [economic benefits](#), Lee said.

Estuary loss for urban gain

Using Landsat remote sensing data from 1984 to 2019, the researchers

identified 2,396 estuaries around the world that were large enough to measure with satellite imagery (those with mouths wider than 90 meters or 295 feet). Nearly half (47%) of these large estuaries are in Asia; the dataset includes estuaries on all major land masses except Antarctica and Greenland. The team also identified land-use changes, including [land conversion](#) and dam building.

The researchers then measured the change in estuarine surface area and compared those changes to where land reclamation and dam building had occurred.

For the studied estuaries, between 1984 and 2019, humans converted 1,027 square kilometers (397 square miles, or 250,000 acres) of estuary to urban or agricultural lands in a process called land reclamation, the study found. Land reclamation, which can include drying land and adding sediment to build land, accounted for 20% of estuary loss. Globally, humans altered 44% of the estuaries with dams and/or land reclamation, the study found.

Economics of estuary development

The researchers compared countries' gross income per capita to land reclamation and estuary area to explore the relationship between estuary gain or loss and economic development. They also analyzed historical maps of high-income countries to find evidence of earlier estuary alteration and included 8 case studies of low-, middle-, and high-income countries' estuary loss.

Middle-income countries lost the most estuarine area during the study period, and almost 90% of all [land reclamation](#) (921 square kilometers, or 356 square miles) occurred there, too.

"As a country is transitioning to middle-income, they tend to increase

development," Lee said.

High-income countries lost little estuary area over the study period. In most cases, that's because [estuary](#) alteration occurred decades earlier when they were in developing, middle-income statuses, Lee said. In those countries today, the focus has moved from development to environmental conservation efforts—attempts to undo the [environmental damage](#) that estuarine development caused.

The findings highlight the opportunities developing countries have to minimize the negative environmental and economic impacts of degraded estuaries while balancing their own economic and development needs, Lee said.

More information: Nathalie W. Jung et al, Economic Development Drives Massive Global Estuarine Loss in the Anthropocene, *Earth's Future* (2024). [DOI: 10.1029/2023EF003691](https://doi.org/10.1029/2023EF003691)

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