

NTU researchers to help mining companies source sand sustainably in South-east Asia



The Mekong Delta is predicted to run out of sand in just over a decade. PHOTO: AFP



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SINGAPORE – To reduce the ecological impact of sand extraction in South-east Asia, researchers in Singapore have come up with a way to monitor the scale of sand mining, so it can be done sustainably.

Scientists from Nanyang Technological University have developed the first monitoring system that quantifies the exact scale and extent of illegal sand mining, starting with the Mekong Delta.

The delta, primarily in southern Vietnam, is continually shaped as the vast network of Mekong River waterways leading to the South China Sea deposit sediment that form fertile land banks.

But the area is facing the fallout of intense sand extraction over the years.

Using publicly available satellite data, the monitoring system zooms in on sand mining ships and correlates this data with measurements of how much the riverbed has sunk during an initial field survey by the NTU team, which is a relatively low-cost method compared with on-site surveillance of the whole delta region.

The researchers found that around 53 million cubic metres of sand had been extracted from the Vietnamese Mekong Delta in 2022 – more than double the amount of around 20 million cu m declared by mining companies.

“We were also able to determine the locations where the available supply of sand is less than the amount being mined, which essentially causes the riverbank to sink and eventually collapse,” said Assistant Professor Edward Park, who led the research project.

“The monitoring system was designed to be low-cost and to track sand mining regularly, so that it could be used by the Vietnamese authorities to quickly detect the presence of illegal sand mining and roll out the required enforcement measures,” he told The Straits Times.

With sand being stripped from its riverbed, coastal and riverbank erosion is rampant in the Mekong Delta, causing homes to crumble and livelihoods – from fishing to farming – to disappear.

Sediment plumes from dredging can suffocate fishes, while increasingly cloudy waters could prevent sunlight from entering the water, reducing the rate of photosynthesis by aquatic plants and hence the amount of dissolved oxygen in the river vital for aquatic life, said Dr Park.

The Mekong is the “rice bowl” of Vietnam, but as the riverbed sinks and water levels fall, so does the occurrence of natural flooding crucial for irrigating the many agricultural fields in the delta.

River sand tends to be coarser and more angular, and is crucial for construction projects, whereas sea sand has finer grains like powder, and is typically needed for land reclamation works.

Vietnam banned exports of sand in all forms in 2017 to meet its high domestic demand. But the amount of sand dredged still puts a strain on the available supply.

Sand exports have also been banned in countries like Cambodia and Thailand, but illegal sand mining continues to be rampant, as it is easy to evade detection and is a lucrative business, said Dr Park.

To help mitigate the ecological impacts of sand mining, Dr Park and his team are currently creating a sustainable sand harvesting map that pinpoints locations around the Mekong Delta where more sand is naturally deposited on the riverbed.

Such areas can potentially be designated by the authorities as legal mining sites, as the socio-environmental impact would be relatively lower, he added.

The map will also showcase ecologically damaging or potentially vulnerable areas, said Dr Park.

“Mining companies and the local authorities do not currently have access to such data, making it difficult for them to measure the ecological impacts of their sand mining operations,” he added.

The research team eventually hopes to expand the sand harvesting map to include all major river deltas in South-east Asia, particularly the sand mining hot spots such as the Ayeyarwady River in Myanmar, the Red River in Vietnam and many other rivers in Borneo and Malaysia.

“We intend to share our findings with the different governments in the region, including Singapore, to help ensure that sand for developmental needs is sourced sustainably moving forward,” said Dr Park.

The sand harvesting map could also come in handy for Singapore’s plans to reclaim some 800ha of land off East Coast Park, to create Long Island to mitigate inland flooding and rising sea levels due to climate change.

As a rough estimate, around 240 million tonnes of sand would be needed for the reclamation works, said Professor Chu Jian from NTU’s School of Civil & Environmental Engineering.



The sand harvesting map could also come in handy for Singapore's plans to reclaim some 800ha of land off East Coast Park. ST PHOTO: LIM YAOHUI

MPs had asked in Parliament on Jan 9 where the sand will be sourced from, and for the Government to make public its sand procurement framework for the project.

Singapore imported most of its sand from Malaysia in 2021 (54.6 million tonnes) and 2022 (43.1 million tonnes), World Bank data shows. It also imported sand from Myanmar and the Philippines.

In response to queries, the ministry reiterated its “longstanding approach” to sand procurement, which includes expecting suppliers to meet the prevailing local rules and regulations, including environmental protection laws, of the source country.

“Our agencies overseeing reclamation projects will check and ensure that the necessary environmental related approvals from the source countries are in order, before contractors are allowed to commence sand imports,” it added.

MND said that it is also looking for ways to improve its sand procurement, such as by sharing Singapore’s best practices for environmental impact assessments and monitoring, with source countries and sand suppliers, and encouraging the adoption of these practices.

“However, we acknowledge that the primary responsibility for monitoring, ensuring compliance and carrying out enforcement measures rest with the relevant countries, and we respect the authority and jurisdiction of other countries,” it said.

Prof Chu said that instead of solely relying on imported sand for reclamation, other sources could be considered, such as by dredging marine sediments, like marine clay, from the East Coast area. A preliminary study done by NTU’s Centre for Urban Solutions had found this to be potentially viable.

Singapore has also turned to empoldering, which involves building a sea wall around an area to be reclaimed from the sea, then draining the water using pumps. Using recycled construction debris could also help alleviate the demand for sand in the construction sector.

Researchers from NTU have also been developing methods to use other sand alternatives for reclamation, such as by repurposing incineration ash from Semakau Landfill. Small amounts of ash will be trialled for land reclamation works as part of the mega Tuas Port project, and to create new industrial land around the Northern Tuas Basin.