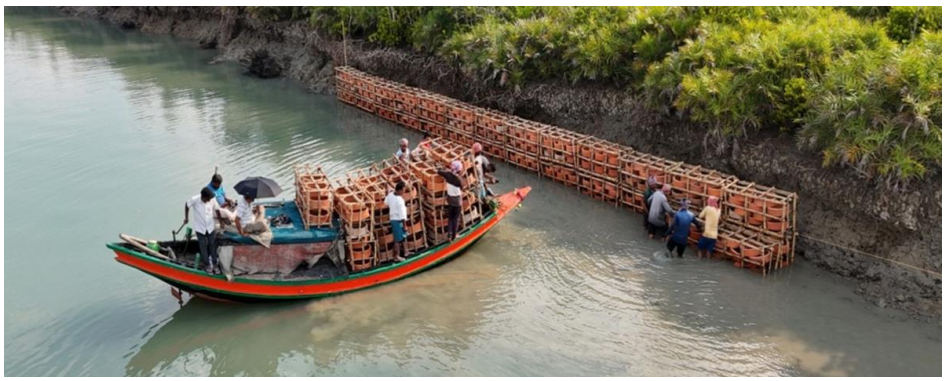
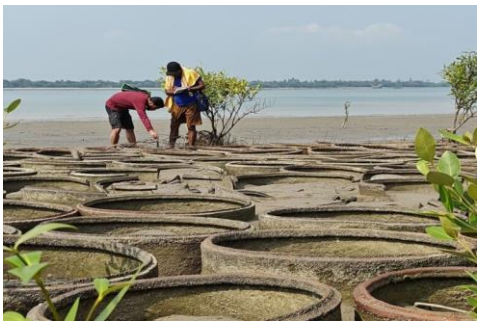
# USING TERRACOTTA RINGS TO PREVENT EROSION FROM THE SEA FOR MANGROVE REGENERATION IN INDIA

*August 2025*



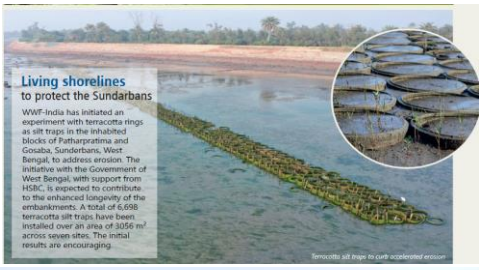
The Mongabay magazine published an article describing how in India the t*erracotta* rings, installed as silt traps along estuarine embankments in the Sundarbans can effectively capture and retain sediment, reducing erosion. The sediment accumulation creates a suitable substrate for mangrove seed settlement and growth, leading to increased natural regeneration.



WWF-India, through the Sundarbans Delta Program, World Wide Fund for Nature has placed thousands of terracotta rings in human-inhabited as well as forested areas of the Sundarban to secure the shoreline. When the high tide comes in, bearing silt, the rings trap the silt, preventing erosion and stabilising elevation.

Anamitra Anurag Danda, Director of the Sundarbans Delta Programme, World Wide Fund for Nature (WWF)-India explains that the Director of the School of Oceanographic Studies at Jadavpur University, came up with a bold idea to install terracotta rings, that have been used since ancient times to line wells and sewage systems and can be easily and locally made. Ancient ring wells, unearthed during archaeological digs, have been used to store water, where they functioned as silt traps to keep sand out and filter water. In this project in the Sundarbans, the concept of silt trapping by the rings has been employed to retain sediments that can naturally reinforce embankments and offset sea level rise.

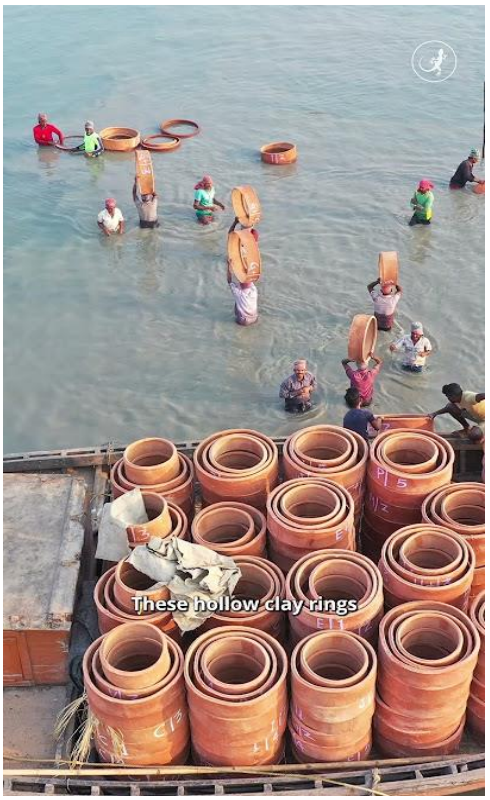
The team also drew inspiration from a project in Bangladesh, which used concrete rings that promoted oyster colonization to form breakwater reefs. These artificial reefs have helped reduce erosion, stabilize the adjacent mudflat, trap sediment, and aid seaward expansion of the area's saltmarsh.



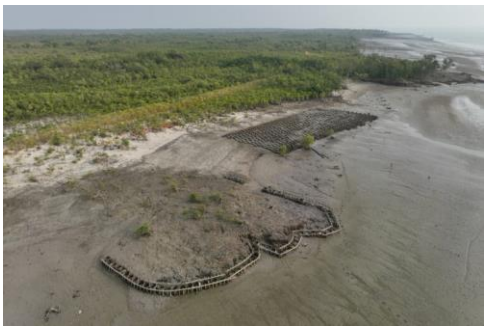

In the Sundarban Biosphere Reserve the terracotta silt trap installations were placed in seven sites: three in the lower estuary and four in the middle estuary between June 2022 and February 2023. All these sites were near human habitations but lacked any vegetation.

Over a 16-month period, these silt traps have had some interesting impacts on the embankments as reported in the Study 2025 in MDPI - Living Shoreline: Preliminary Observations on Nature-Based Solution for Toe-Line Protection of Estuarine Embankments and Mangrove Regeneration that recorded in 2025 observations of the experiment conducted between 2023 and 2024. Field observations indicate that these silt traps contribute to stabilizing the shoreline, mitigating coastal degradation. This nature-based approach offers a cost-effective, scalable strategy for sustainable coastal protection in vulnerable regions.

The Sundarban Biosphere Reserve (SBR) in India encompasses 48 mangrove forest islands and 35 inhabited islands, the latter being protected by nearly 1800 km long earthen embankments. The embankments are often armored by brick or concrete. Human habitation on such islands generally lies at lower elevations relative to high tide levels, exceeding 5.9 m during August. Erected since the 18th century, the embankments make human settlements in the Sundarbans possible by keeping saline water at bay. During tidal cycles, the toe of the embankments often erodes, leading to slope instability and vertical collapse of the protective structure. Currently, the embankments are maintained by the West Bengal Irrigation and Waterways Department. About 90% of the embankments in SBR have a crest height of 2.5–3 m, except for the sea-facing embankments with reinforced concrete that have an elevation of up to 5.75 m [3]. High-intensity weather events, like cyclones, often cause major damage to the embankments.




Toe-line erosion poses significant challenges to estuarine embankments, necessitating the construction of hard engineering structures. While initially effective, these hard defenses deteriorate over time and require continuous investment for upkeep. Moreover, hard engineering structures lack adaptability to changing coastal conditions and can result in the loss of vital intertidal zones crucial for the survival and functioning of biodiversity including aquatic flora and fauna. However, nature-based solutions such as Living Shoreline as a line of protection to the existing embankments offer a more sustainable shoreline management option to address erosion and contribute to the preservation, enhancement and restoration of natural habitats. The Living Shoreline strategy, with artificial oyster reefs, has been used in Bangladesh and in the United States of America.



Following the experiences using these terracotta rings for lining dug wells and soak pits in India since 500–400 BC, the programme estimated that arrangements of large terracotta rings, ranging from two to four feet in diameter and standing at about a foot or two in height, may help save sinking islands in the Sundarbans Biosphere Reserve. On this basis, the programme has installed terracotta silt trap structures at seven sites within the SBR: three at the lower estuary and four at the middle estuary, in front of the embankment around inhabited islands, covering a total area of 3684 $m^2$ These rings, installed in grids measuring 92 metres in length along the embankment, and about 6.5 metres wide along its slope, are silt traps.

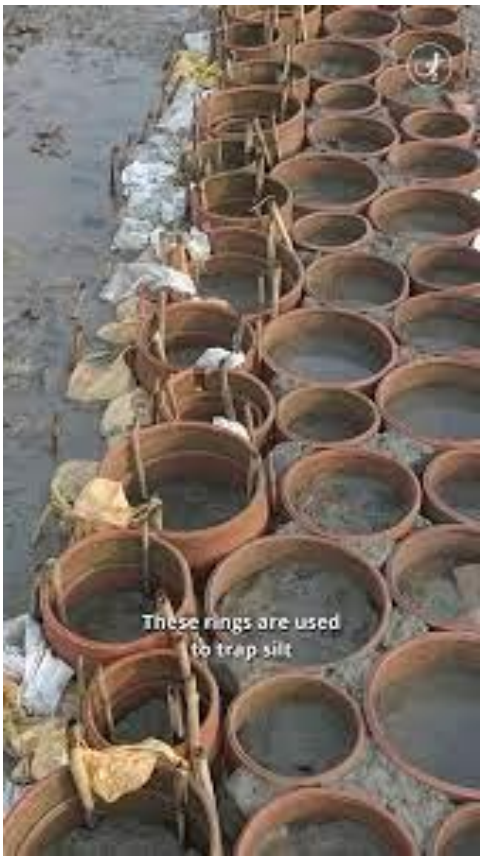
Natural growth of the mangrove saplings was observed across each site. No mangroves were planted in the terracotta rings. Oysters were found colonizing the terracotta rings. The rings have captured and retained sediment, reducing the erosion of the embankment. The net sediment accumulation in these traps was two to three times the rate of annual sea level rise, which makes them an effective and relatively cheap solution to the problem of island sinking in the Sundarbans. As an added bonus, the trapped silt was found to support the growth of local mangrove plants and oysters, raising hopes that these structures could aid mangrove regeneration and form a nature-based living shoreline to protect embankments from toe-line erosion.

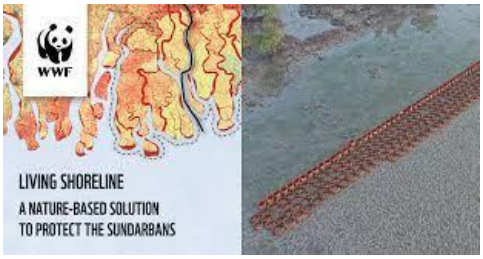
An unexpected but welcome result of this project was the colonisation of the silt traps by natural mangrove vegetation. The sites with sediments rich in clay (sites 3–6) showed natural growth of *Porteresia coarctata*, *Sueda maritima,* and *Avicennia marina*. The best growth was seen in sites 4–6 in the middle estuary. Site 1 was colonised by oysters, predominantly *Saccostrea cucullata*, along with some *Crassostrea cuttackensis*. No colonisation by either mangrove plants or oysters was observed in sites 2 and 7.

The cost of the terracotta silt traps is considerably lower and requires no maintenance. Despite a 6-12% breakage rate of the rings after installation, there is no need to replace these rings as they function just fine within the structures. Now what remains to be seen is if these structures can extend the lifespans of existing embankments, which currently last for an average of 10 years.

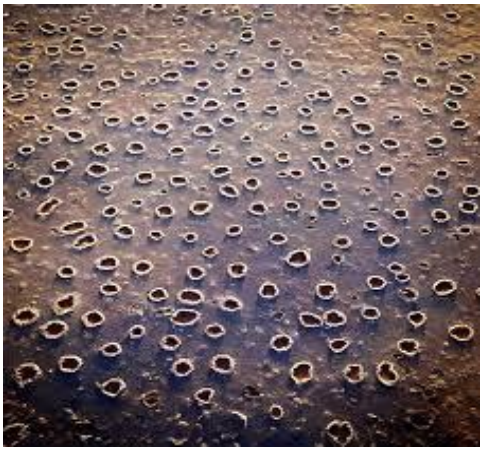
While monitoring of the current silt traps will continue, new ideas for other installations using these silt traps are already being explored. For instance, they created a bamboo frame within which we put in these rings. This could work as an anti-erosion structure. Right now, they have two such installations of bamboo and terracotta rings – one in the lower estuary and another in the middle estuary – with the idea to stop or at least slow down erosion.

The WWF Programme highlights that this is only a pilot study and is still at the very initial stages of validation. Taking into account the results already achieved, longer-term observations are still required to confirm the viability of this model, which also needs to be tested under extreme conditions such as a major cyclone. In the meantime, the initial results are encouraging. This nature-based approach offers a cost-effective, scalable strategy for sustainable coastal protection in vulnerable regions.







**To know more**

Article in india.mongabay.om

Living Shoreline: Preliminary Observations on Nature-Based Solution for Toe-Line Protection of Estuarine Embankments and Mangrove Regeneration. Study 025 in MDPI

Article in sanctuarynaturefoundation.org

Sundarban Biosphere Reserve

Rings of hope in youtube.com

One ring to save them all in Facebook

Clay rings in Facebook

WWF Adaptation Programme in the Sundarban

Article in WWF nature Matters

Biodiversity conservation education in Facebook

Sunderban Biosphere Reserve MAB UNESCO Programme