Sediment improvement and submerged plant restoration improves reconstruction of urban lake ecosystem

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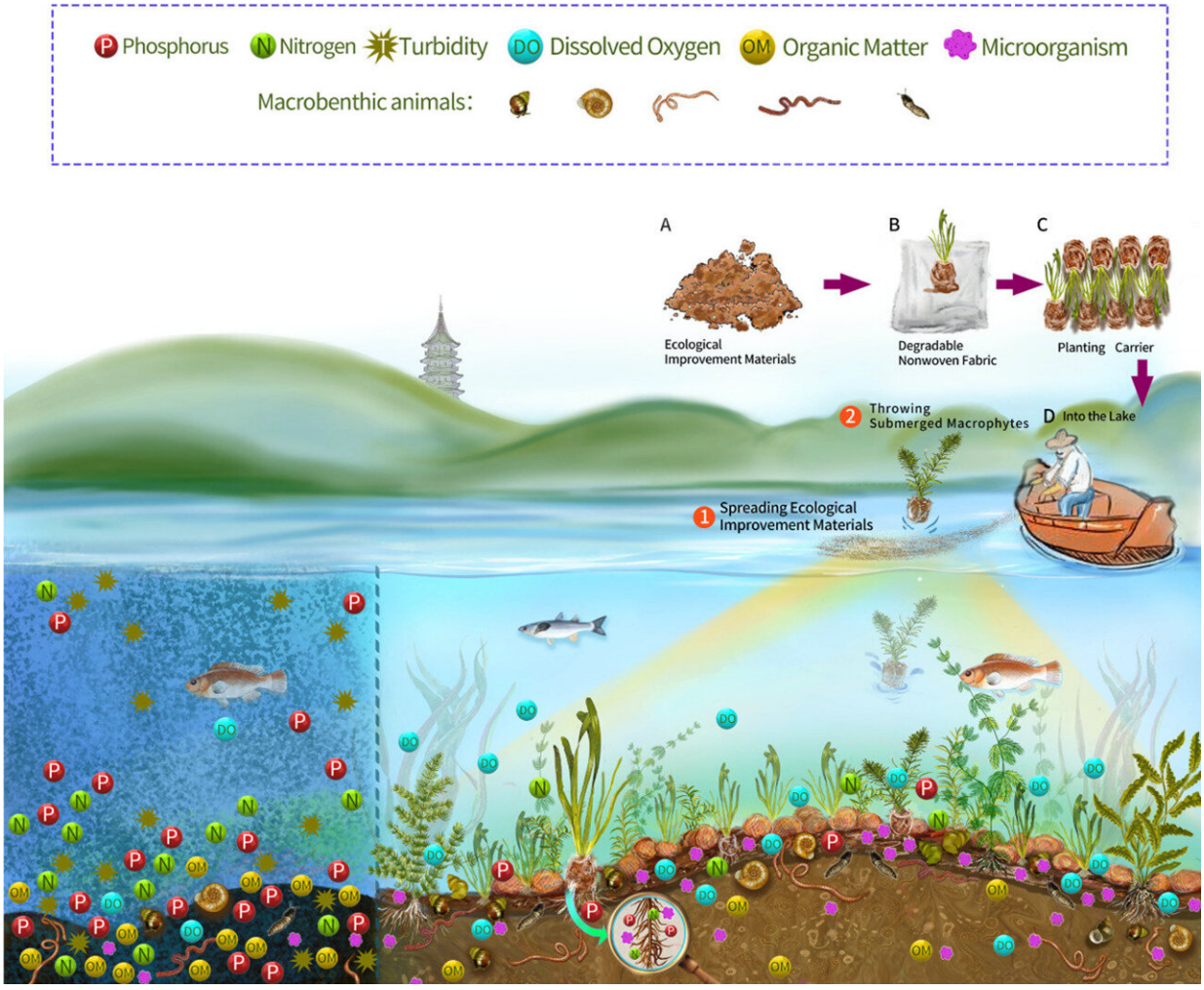

Sediment Improvement and Submerged Plant Restoration project schematic diagram. Credit: IHB

West Lake, located in the southwest of Hangzhou city and listed as a UNESCO World Heritage site in 2011, is a typically shallow and eutrophic lake that faces an issue of "incense ashes sediment."

Floating and soft sediment layers at the bottom of the West Lake contain high level of nitrogen, phosphorus nutrients, and organic matter. As they resemble incense ash, they are commonly referred to as "incense ash sediment," making it difficult for submerged macrophytes to colonize and propagate. Developing a sediment and ecological restoration method for the "incense ashes sediment" of heavy eutrophication urban lakes is a scientific and technical challenge.

A research group led by Prof. Wu Zhenbin from the Institute of Hydrobiology (IHB) of the Chinese Academy of Sciences found that the restoration project on West Lake they conducted improved sediment conditions, facilitated the growth of submerged macrophytes, and sped up the restoration and reconstruction of the lake ecosystem. This study was published in *Science of The Total Environment*.

The ecological restoration project aims to improve sediment and restore submerged plants. The long-term effects of this project are being investigated over a six-year period.

The researchers developed ecological improvement materials and applied them to improve the sediment condition. The results of their experiments showed that the materials could inhibit sediment disturbance, adsorb sediment nutrients, decrease sediment organic matter (OM), and improve the colonization and propagation of submerged macrophytes.

"The sediment total phosphorus (TP) decreased from 2.94 mg/g in 2015

to 1.33 mg/g in 2020, and the sediment organic matter decreased from 27.44% in 2015 to 8.08% in 2020. Furthermore, the ecological restoration project successfully restored the submerged macrophytes in the lake," said Prof. Zhang Yi, a professor from IHB.

Besides, the researchers examined how the ecological restoration project affected the diversity of both the sediment microbial community and the benthic macroinvertebrate community. The results showed that the ecological restoration project could increase the Margalef index and Simpson index of the benthic community from 3.06 and 0.41 to 4.76 and 0.62, respectively.

This study suggests that this ecological restoration method could be applied to the long-term management of shallow eutrophic lakes and slow-flow water channels, especially for special sediments with heavy pollution that make submerged plants difficult to grow.

More information: Zisen Liu et al, Long-term study of ecological restoration in a typical shallow urban lake, *Science of The Total Environment* (2022). DOI: 10.1016/j.scitotenv.2022.157505

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