

# **Prospects and challenges of environmental DNA (eDNA) metabarcoding in mangrove restoration in Southeast Asia**

## **ABSTRACT**

Species detection using environmental DNA (eDNA) is a biomonitoring tool that can be widely applied to mangrove restoration and management. Compared to traditional surveys that are taxa-specific and time-consuming, eDNA metabarcoding offers a rapid, non-invasive and cost-efficient method for monitoring mangrove biodiversity and characterising the spatio-temporal distribution of multiple taxa simultaneously. General guidelines for eDNA metabarcoding are well-established for aquatic systems, but habitat-specific guidelines are still lacking. Mangrove habitats, as priority ecosystems for restoration in Southeast Asia, present unique prospects and challenges in these regards. Environmental DNA metabarcoding can be used to (1) track functional recovery in ecological restoration, (2) prioritise conservation areas, (3) provide early warning for threats, (4) monitor threatened taxa, (5) monitor response to climate change, and (6) support community-based restoration. However, these potential applications have yet been realized in Southeast Asia due to (1) technical challenges, (2) lack of standardised methods, (3) spatio-temporal difficulties in defining community, (4) data limitations, and (5) lack of funding, infrastructure and technical capacity. Successful implementation of eDNA metabarcoding in mangrove restoration activities would encourage the development of data-driven coastal management and equitable conservation programs. Eventually, this would promote Southeast Asia's shared regional interests in food security, coastal defence and biodiversity conservation.