

Engineering Approaches to Climate – Resilient Land Reclamation

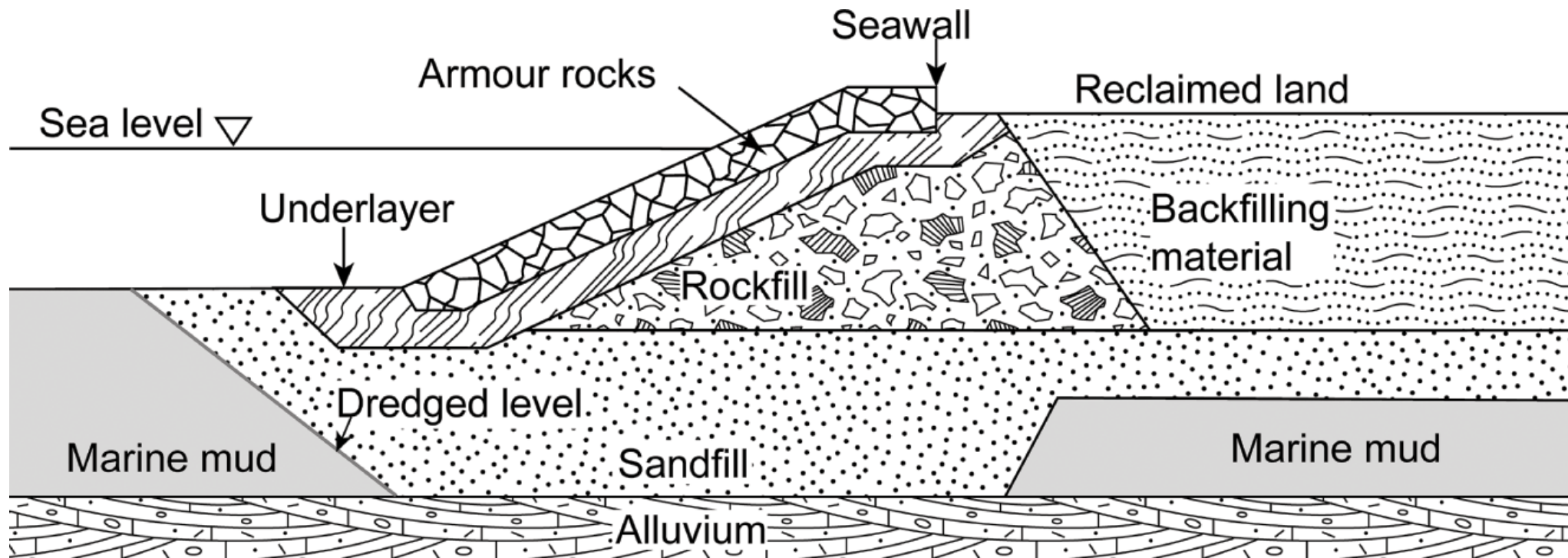
CIENE 9101

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What is Land Reclamation?

Land Reclamation – The process of creating new land from areas that were previously water or unusable terrain



Drivers of Land Reclamation

- Economic expansion
- Population growth
- Rapid urbanization
- Tourism



1985



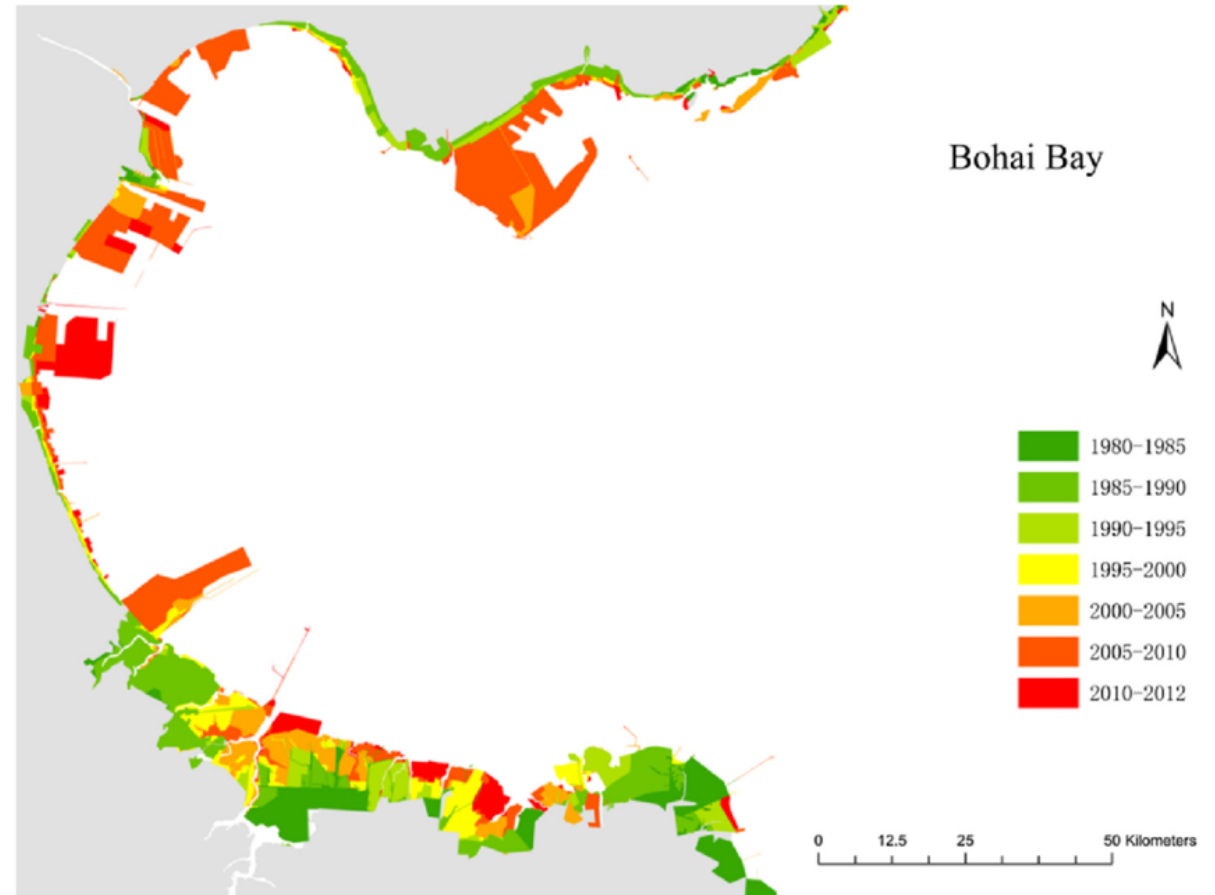
2025

Land Reclamation around the world



Shanghai built up area – expanded more than **fivefold**

Bohai Bay alone accounted for roughly **35% of all reclamation** in China



Conventional Engineering Methods

- Revetments + seawalls
- Hydraulic fill
- Mechanical (dry) fill
- Ground improvement (sand drains, SCP, deep mixing)



Hydraulic Filling

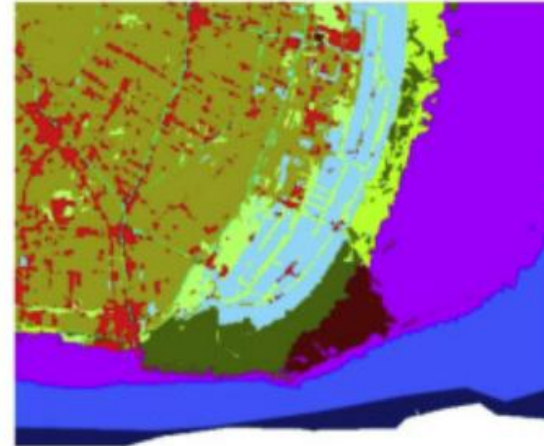


Mechanical filling

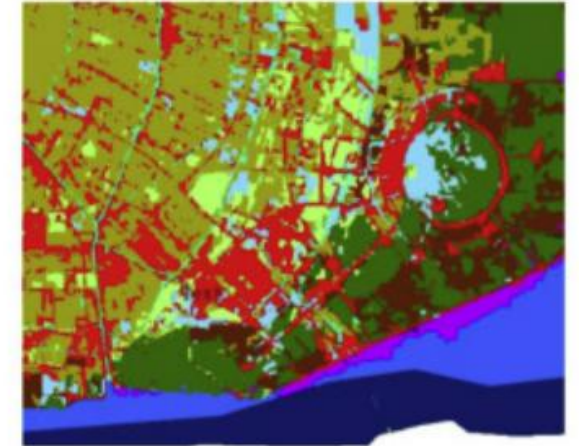


Impact of Land Reclamation

- **Wetland loss** reduces biodiversity
- Benthic habitat destruction
- Fishery decline (e.g., Jakarta case)
- **Forced migration** of species



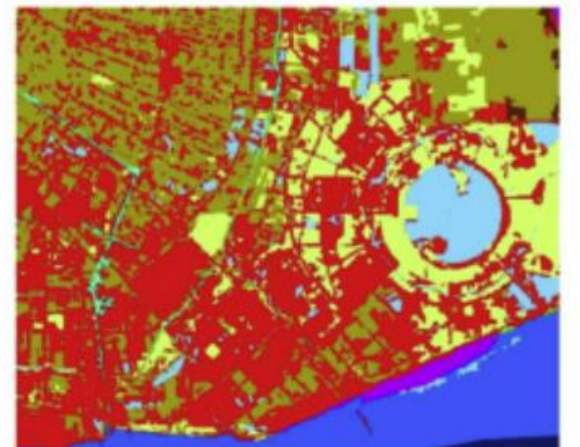
2000



2005



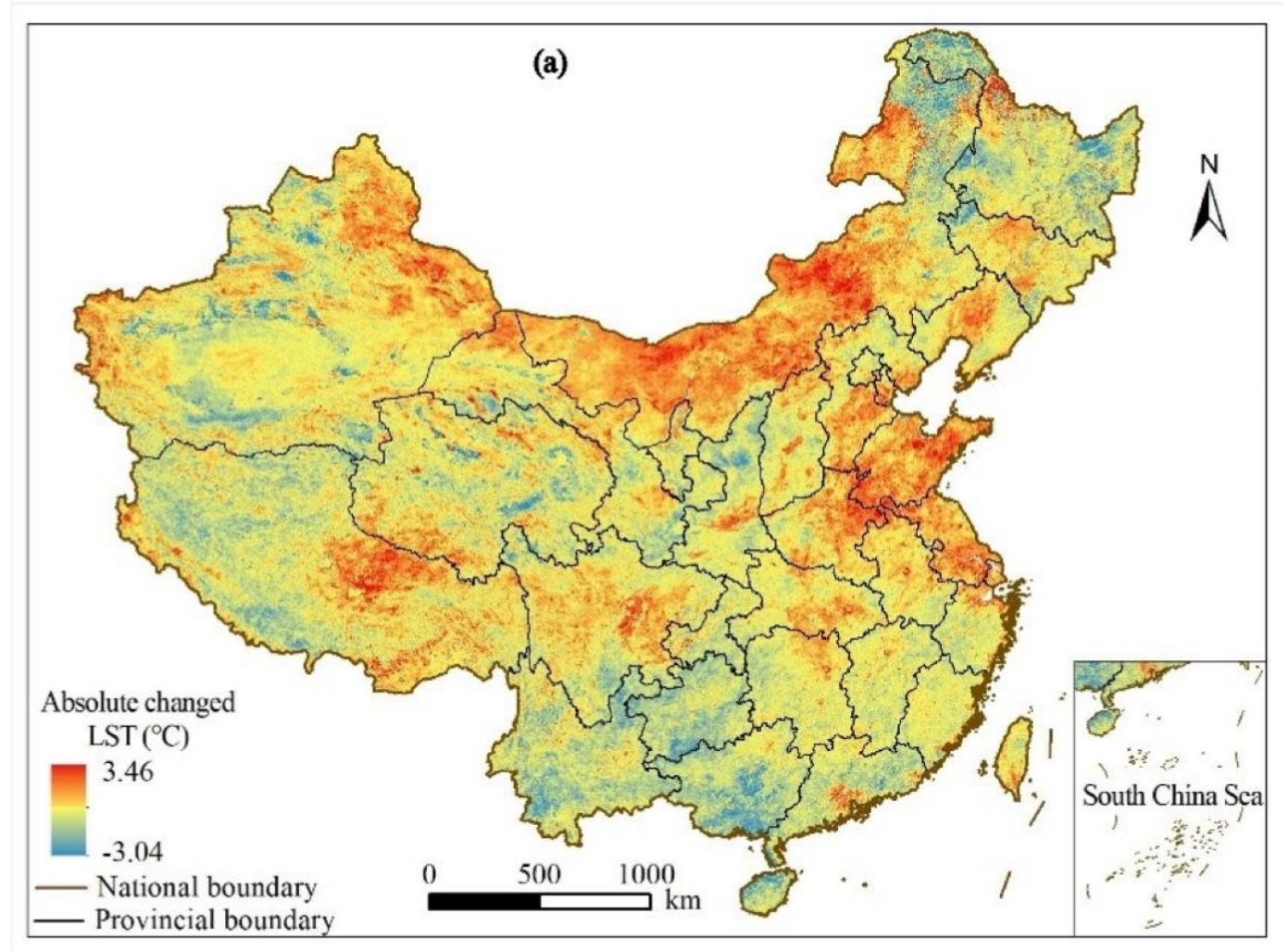
2009



2013

Hydrological and Climate Impacts

- Land Surface Temperature increase
- Changes in sediment transport
- Loss of natural buffers
- Groundwater table rise / salinization



Nature-Based Solutions

Ecosystems – Engineering Methods

- Mangroves as wave attenuators
- Salt marshes trap sediment
- Seagrass – stabilizes seabed
- Oyster reefs – natural breakwaters



Mubarraz Island - UAE

Environmentally Compatible Fill Materials



- **Fine sediments** from Markermeer
- NBS applied

- **Sand ring dikes** used
- Sediments shaped into marshes shallow zones, and habitats



Marker Wadden Project

Framework for Climate – Resilient Land Reclamation

Objectives

- Minimize ecological disturbance
- Maintain hydrology + sediment flow
- Blend NBS with engineering
- Continuous monitoring
- Adaptive management

Regulations

- CZMA (USA), Marine Licence (UK)
- Singapore (MPA dredging rules)
- China's ban on commercial reclamation
- EIA = early detection + mitigation of impacts

Thank you!!

Q&A