

Blue Carbon in Mangroves

Wonderful Wetlands Series: Celebrating
World Environment Day Public Lecture

Ms. Crystle Wee

DHI Water & Environment (Singapore)

5th June 2022

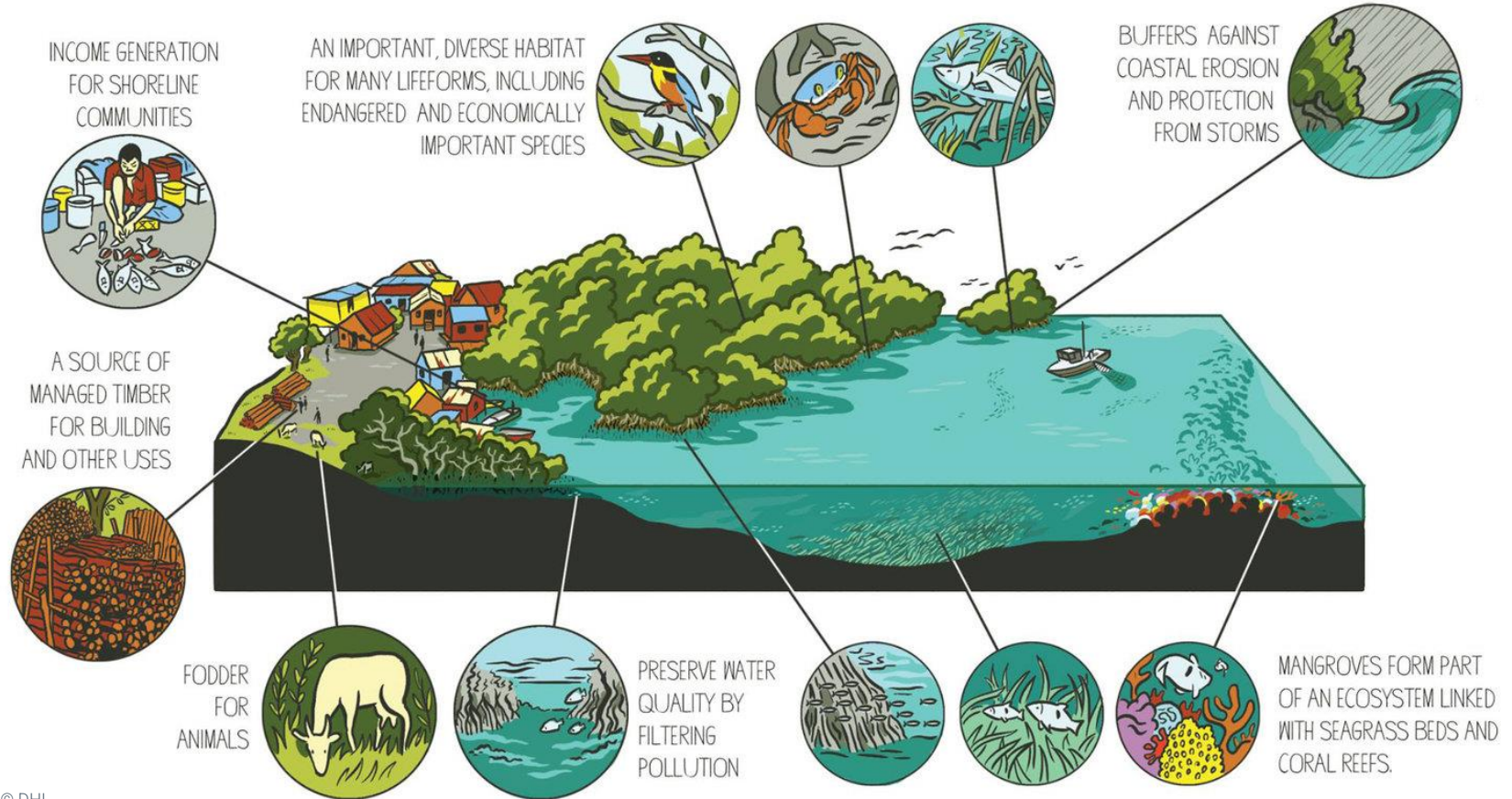


What are Mangroves?

- Mangroves – Tree, shrub, palm or ground fern, generally growing more than 0.5 m in height above mean sea level in the intertidal zone
- Mangroves – Also represents the habitat comprising such trees and shrubs.
- Major mangrove species dominate the community structure and can form pure stands
- Distinct morphological specialization such as aerial roots and vivipary (seedlings that germinated while still on the parent plant)

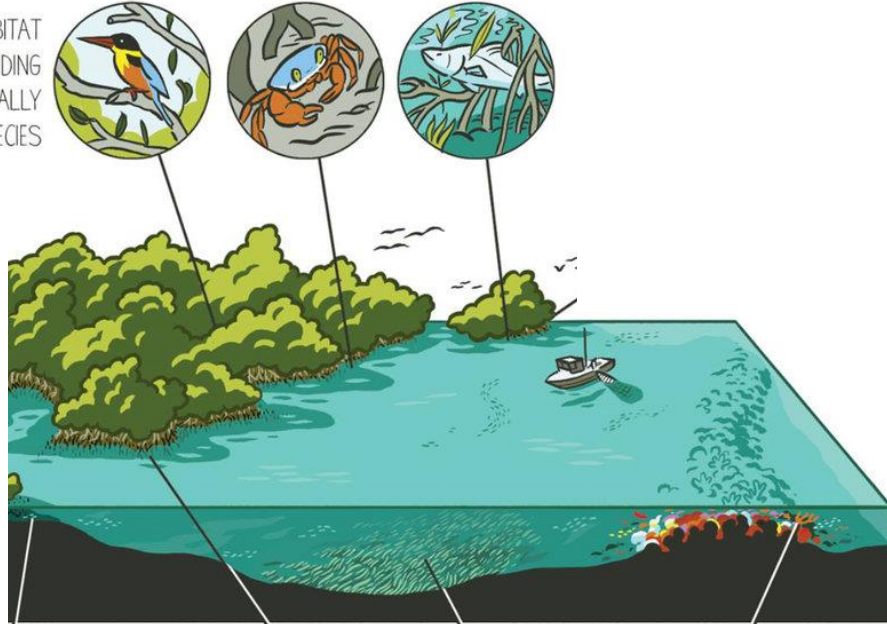


Importance of Mangroves



Importance of Mangroves

AN IMPORTANT, DIVERSE HABITAT
FOR MANY LIFEFORMS, INCLUDING
ENDANGERED AND ECONOMICALLY
IMPORTANT SPECIES

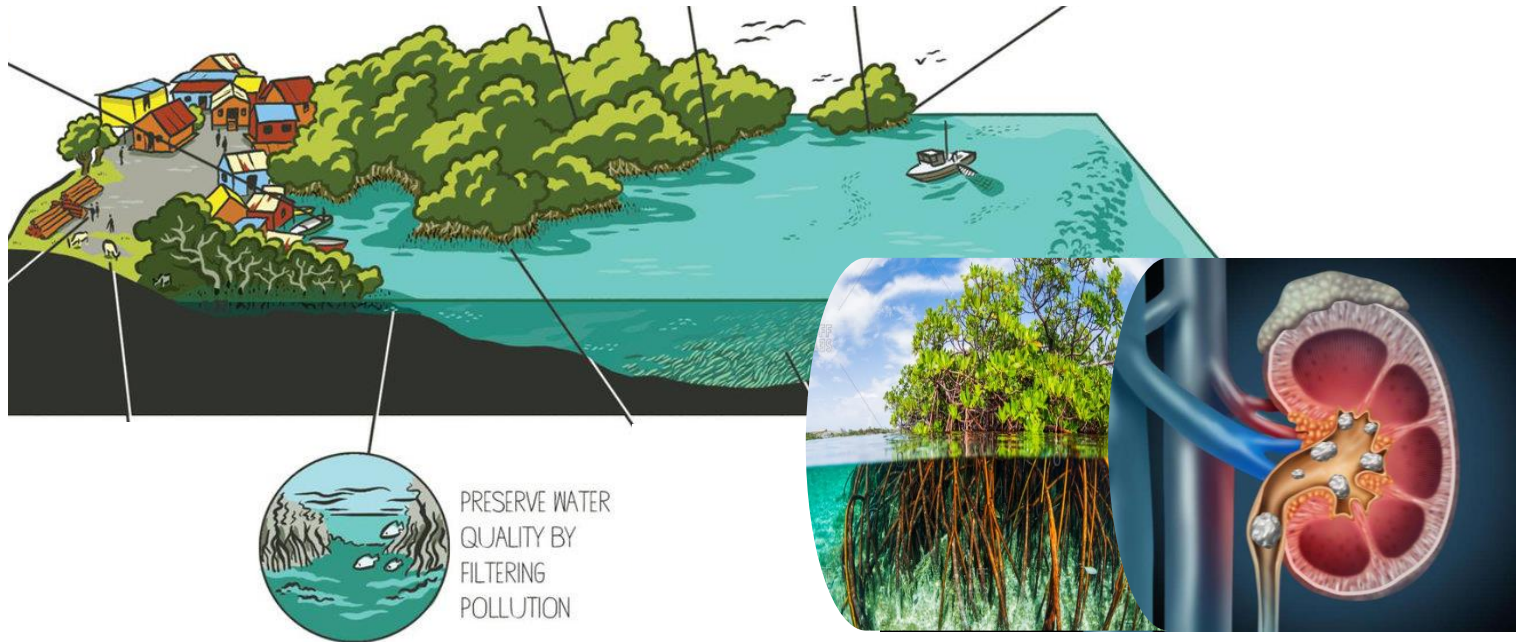


Importance of Mangroves

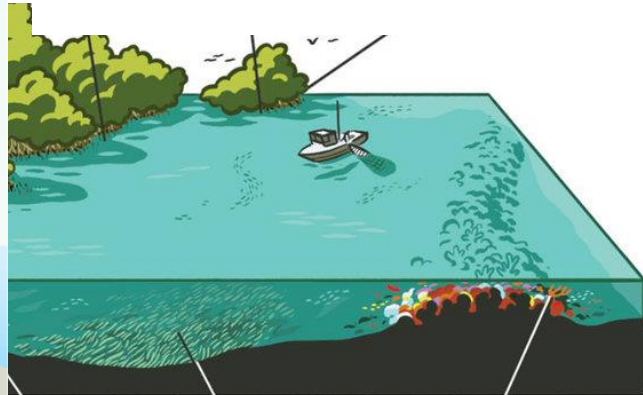
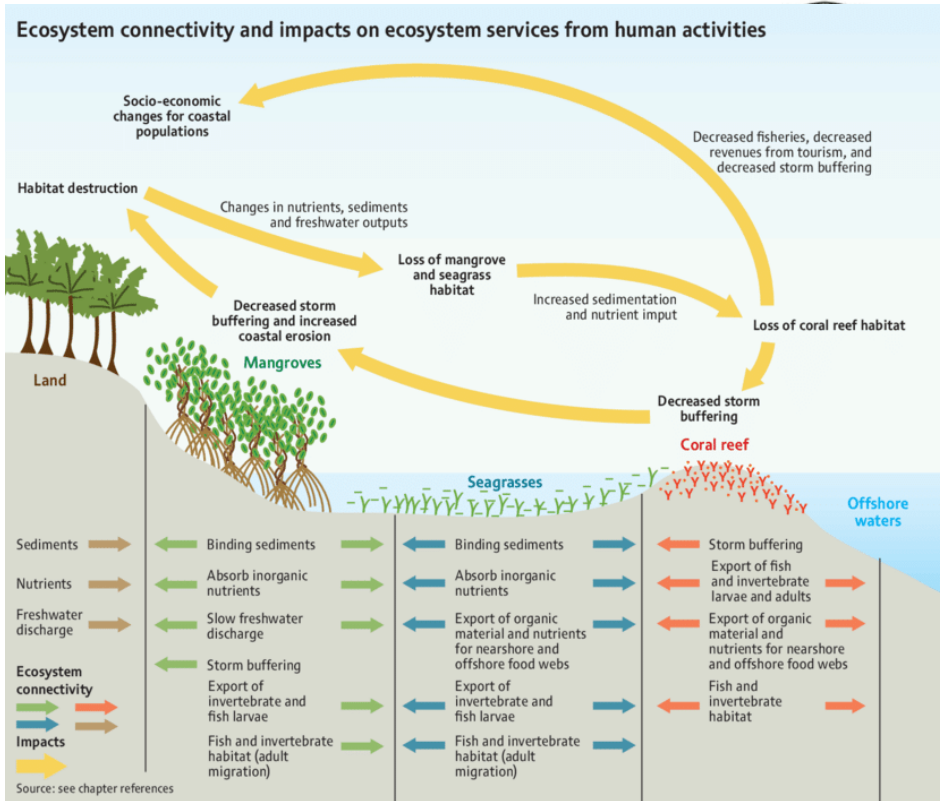
BUFFERS AGAINST
COASTAL EROSION
AND PROTECTION
FROM STORMS



Importance of Mangroves



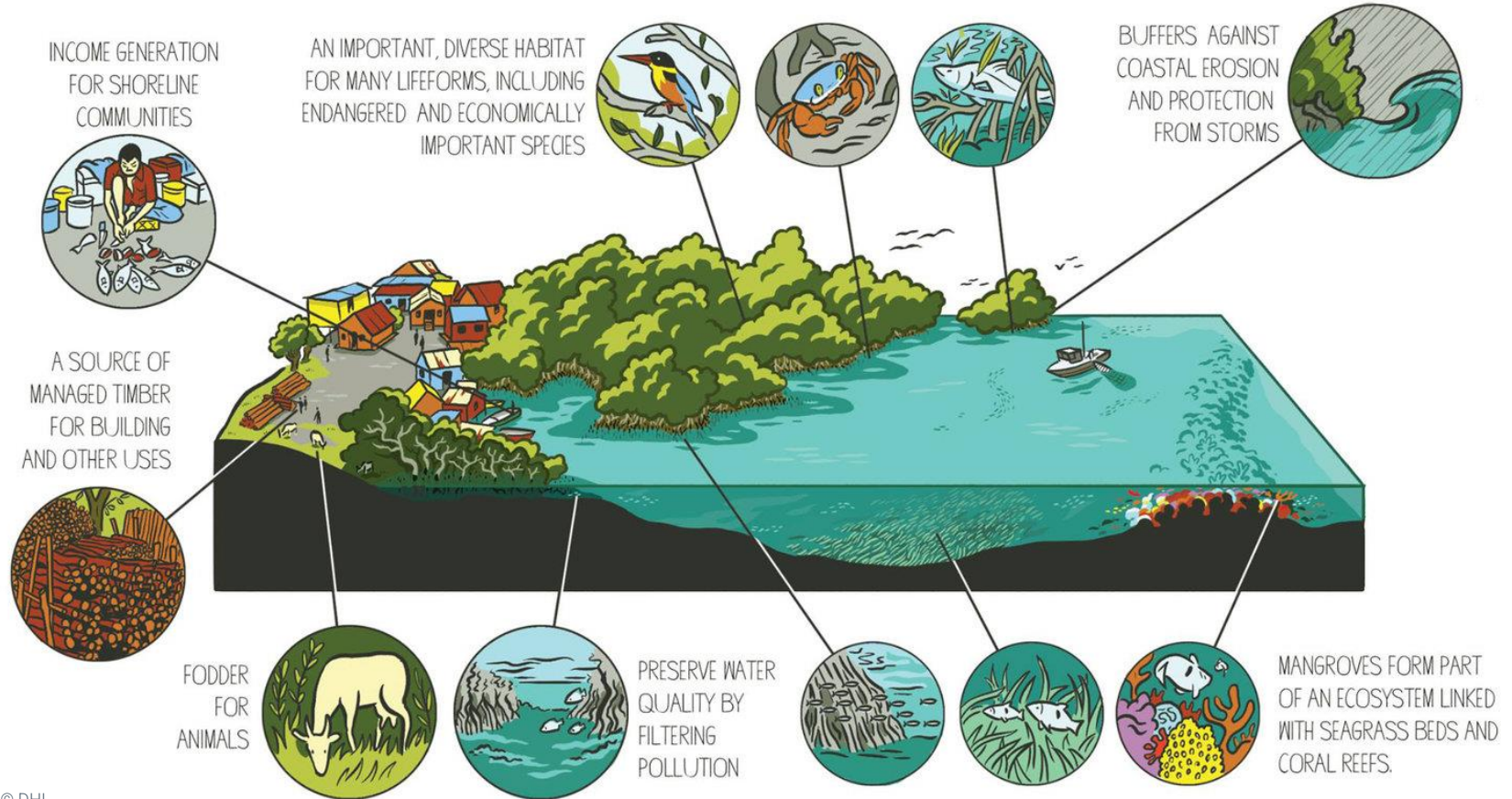
Importance of Mangroves



MANGROVES FORM PART OF AN ECOSYSTEM LINKED WITH SEAGRASS BEDS AND CORAL REEFS.

Graphic © Silvestri & Kershaw (2010) Capturing and Quantifying the Flow of Ecosystem Services

Importance of Mangroves



Insight - Re-carbonising South-East Asia's **blue carbon** ecosystems

Is **Blue Carbon** The Climate Solution We've Been Looking For All Along?

BY [SANDRA PONCE DE LEON](#) ON MAY 26, 2020

AGRICULTURE | COAL | ENERGY TRANSITION | METALS | ENERGY TRANSITION — 25 Oct 2021 | 17:03 UTC

'**Blue carbon**' gains interest in effort against greenhouse gases, but challenges remain




NEWS

Blue carbon focus could sail Indonesia through Paris targets

Mangrove Conservation Can Help Countries Meet **Emissions Reduction Goals**

New research highlights the economic and societal value of protecting coastal forests

 Phys.org

Why we need a **blue carbon** investment roadmap

In his research paper, "Operationalizing marketable blue carbon," published today in One Earth, Professor Macreadie says despite the science...

2 weeks ago



Could **Blue Carbon** Credits Be The Future Of Sustainable Financing?

How Singapore's mangroves can contribute in the battle against **climate change**



 **Matthew Mohan**
@MatthewMohanCNA

05 Sep 2020 06:00AM
(Updated: 04 May 2021 03:39PM)



Blue Carbon is carbon that is removed from the atmosphere by ocean systems

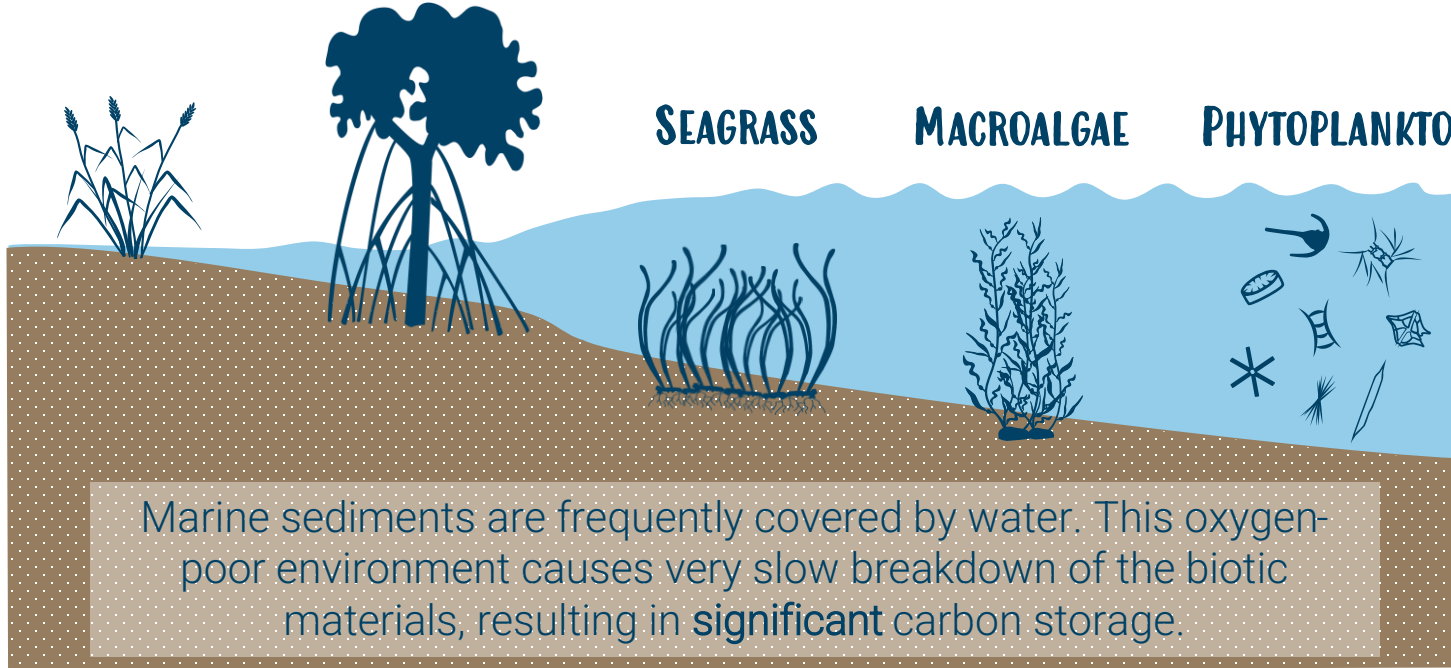
SALT MARSHES

MANGROVES

SEAGRASS

MACROALGAE

PHYTOPLANKTON



In biotic elements...

... and in sediments

Blue Carbon Sources & Storage

SEQUESTRATION

Carbon dioxide in the atmosphere is taken in by trees and plants during the process of photosynthesis.

CO_2 O_2 CO_2

EMISSIONS

Some carbon is lost back to the atmosphere through respiration or oxidation due to land-use changes, the rest is stored in the leaves, branches and roots of the plants.

O_2 CO_2

AUTOCHTHONOUS CARBON

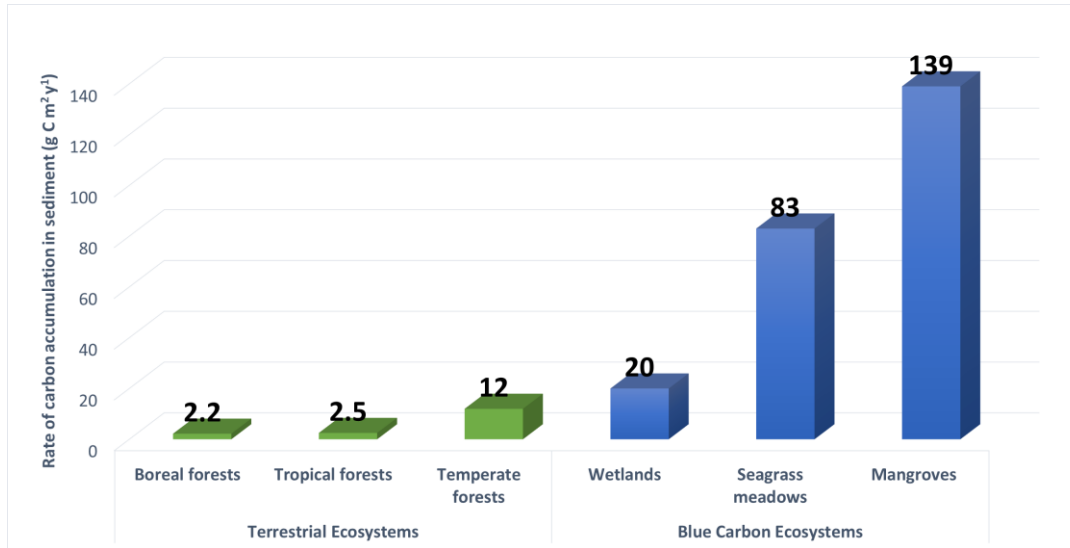
Carbon originating or forming in the system. Dead leaves, branches, and roots containing carbon are **buried in the soil**, which is frequently covered with tidal waters.

ALLOCHTHONOUS CARBON

Carbon originating from further away that **enters the system**, usually via runoff up stream and/or inundation by marine waters.

Comparison of carbon sequestration rates

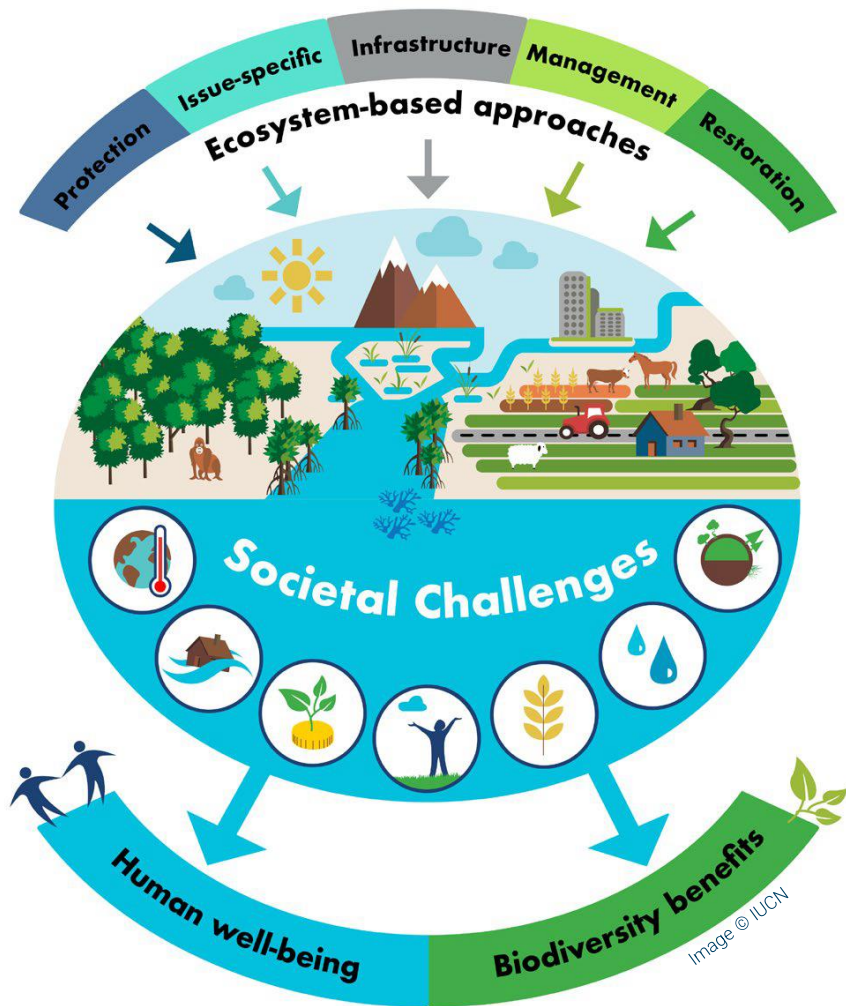
Annual Sediment Carbon Sequestration Rate



Data from Lafolley & Grimsditch (2009)

Marine habitats store more carbon annually compared to terrestrial ecosystems

Mangroves have one of the highest carbon sequestration rates relative to other blue carbon ecosystems



Nature-based Solutions are:
 “... actions to *protect, sustainably manage and restore* natural and modified ecosystems in ways that address societal challenges effectively and adaptively, to provide both *human well-being and biodiversity benefits*”.

IUCN, 2016

Biodiversity Enhancement at the Kingfisher Wetlands

What's new at the Kingfisher Wetlands

Visitors can get up close and personal with wildlife like collared kingfishers and smooth-coated otters.

Kingfisher Wetlands Trail

Creating a seamless trail for visitors to explore and discover its diverse ecosystems, plants and animals.

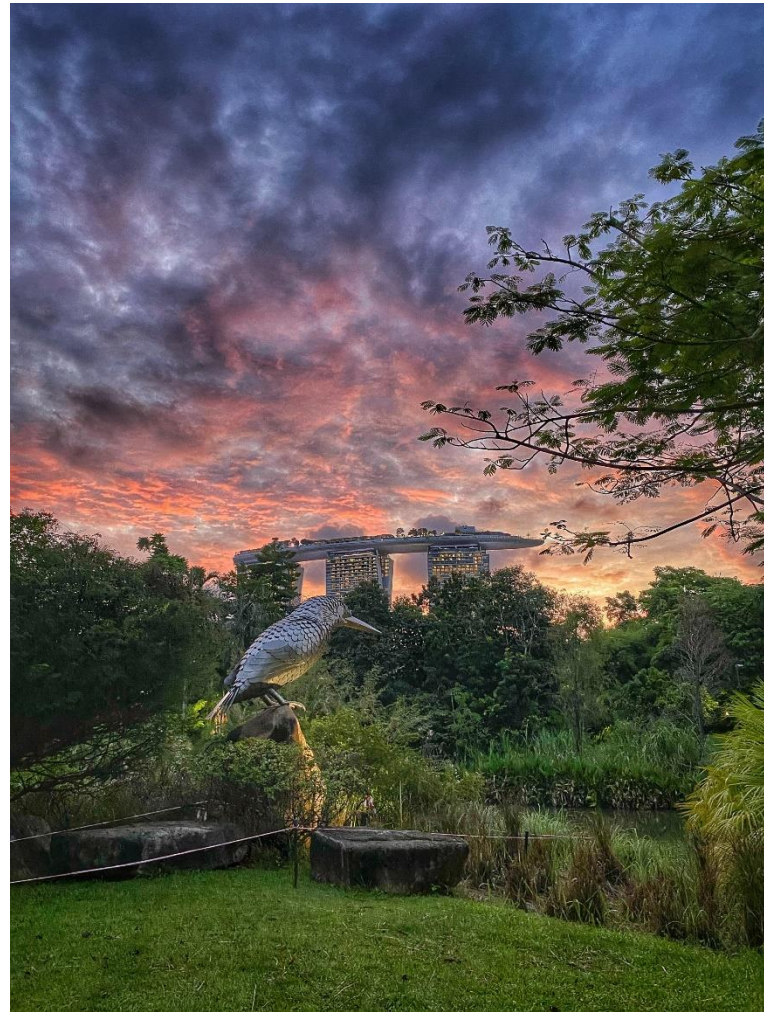


- 1** Two meandering cascades
Linking the two water bodies
- 2** Rock pool and main cascades
- 3** Wildlife lookout

Source: Straits Times

Project Objectives

- Foster a sense of community by **involving the public with the planting and growth of the mangroves** over time.
- **Introduce public to Blue Carbon** and educate them on the potential of utilising coastal ecosystems to sequester carbon.
- Assess the **possibility of scaling up this project** and extending its reach beyond Singapore and into other urban cities in **Southeast Asia**.



Survey works at Gardens by the Bay



Water quality



Sediment quality



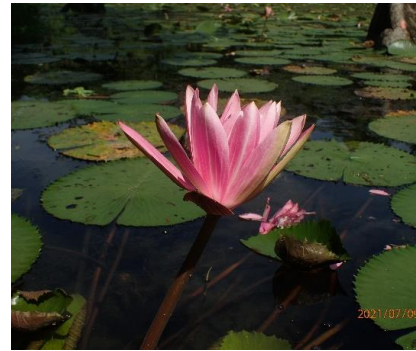
Sediment rate



Terrestrial flora



Terrestrial fauna



Aquatic flora



Aquatic fauna

Blue Carbon Assessment at Gardens by the Bay



Soil gas flux: to measure CO_2 due to autotrophic and heterotrophic activity in the sediment



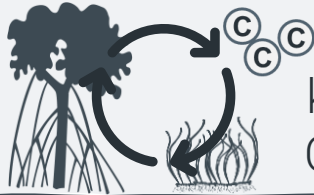
Ecosystem carbon stock: Estimation of aboveground and belowground carbon stock of mangroves using established species-specific allometric equations



Leaf litter trap: Measurements of organic carbon content (autochthonous carbon) in leaf litter

What is DHI doing with Blue Carbon?

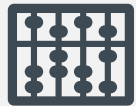
KEY CHALLENGES



Ecological
knowledge & Blue
Carbon Dynamics



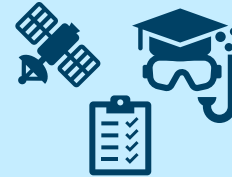
Data paucity &
Site characterisation



Robust quantitative &
numerical approaches

DHI SOLUTIONS

Multidisciplinary team
of marine scientists



Regional Presence &
Experience in SE Asia;
Regional hydrodynamic models

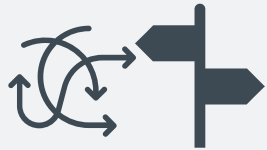


Carbon Sequestration
Modelling & Data
Driven Approaches



What is DHI doing with Blue Carbon?

KEY CHALLENGES



Project approach
& impact tracking



Verification, Validation
& Project Monitoring



Mangrove & seagrass
habitat restoration

DHI SOLUTIONS

Robust, data driven
approaches & Impact
Assessment experience



Extensive Project
Management & Ecological
Monitoring experience



Innovative approaches
and experience in coastal
habitat restoration



Thank you

