

# Mangrove research works and KPGreen Earth plans



# Global social and political problems



# Coastal community: most affected by global warming climate change



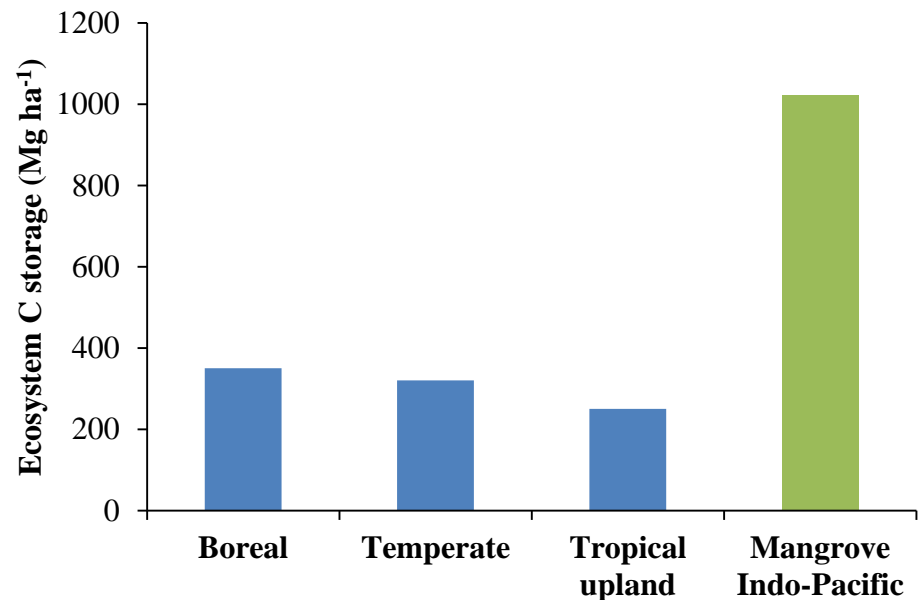
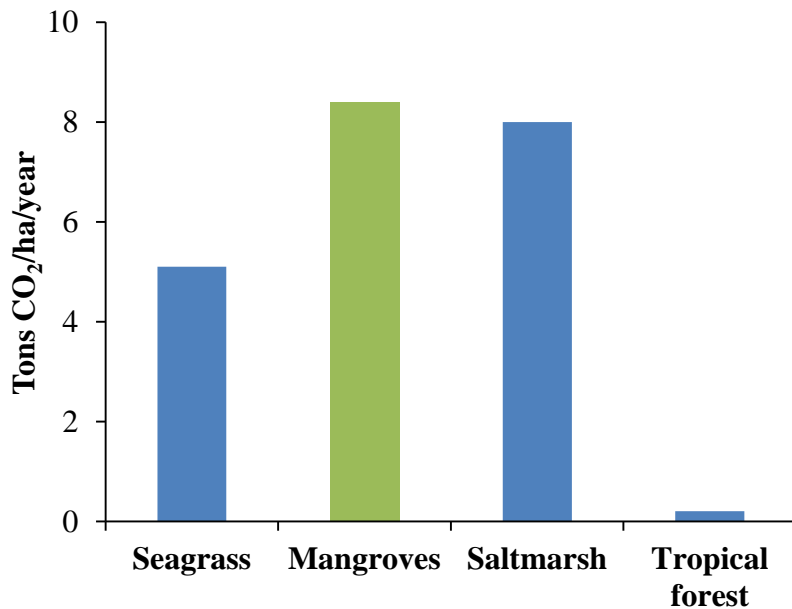
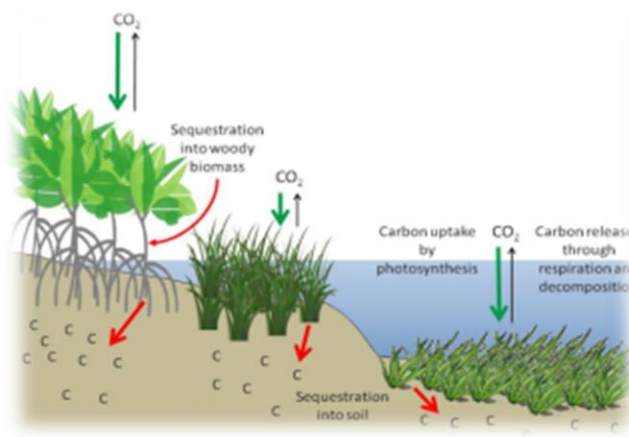
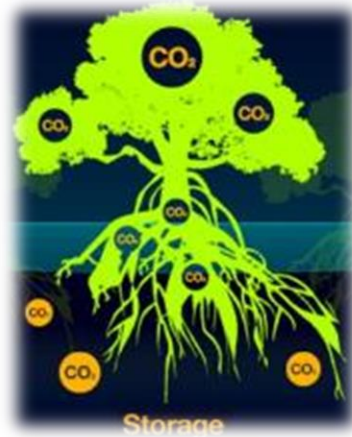
Mangroves protected the coastal community



1. **2004 Asian tsunami**
2. **2013 Typhoon Haiyan (Philippines)**



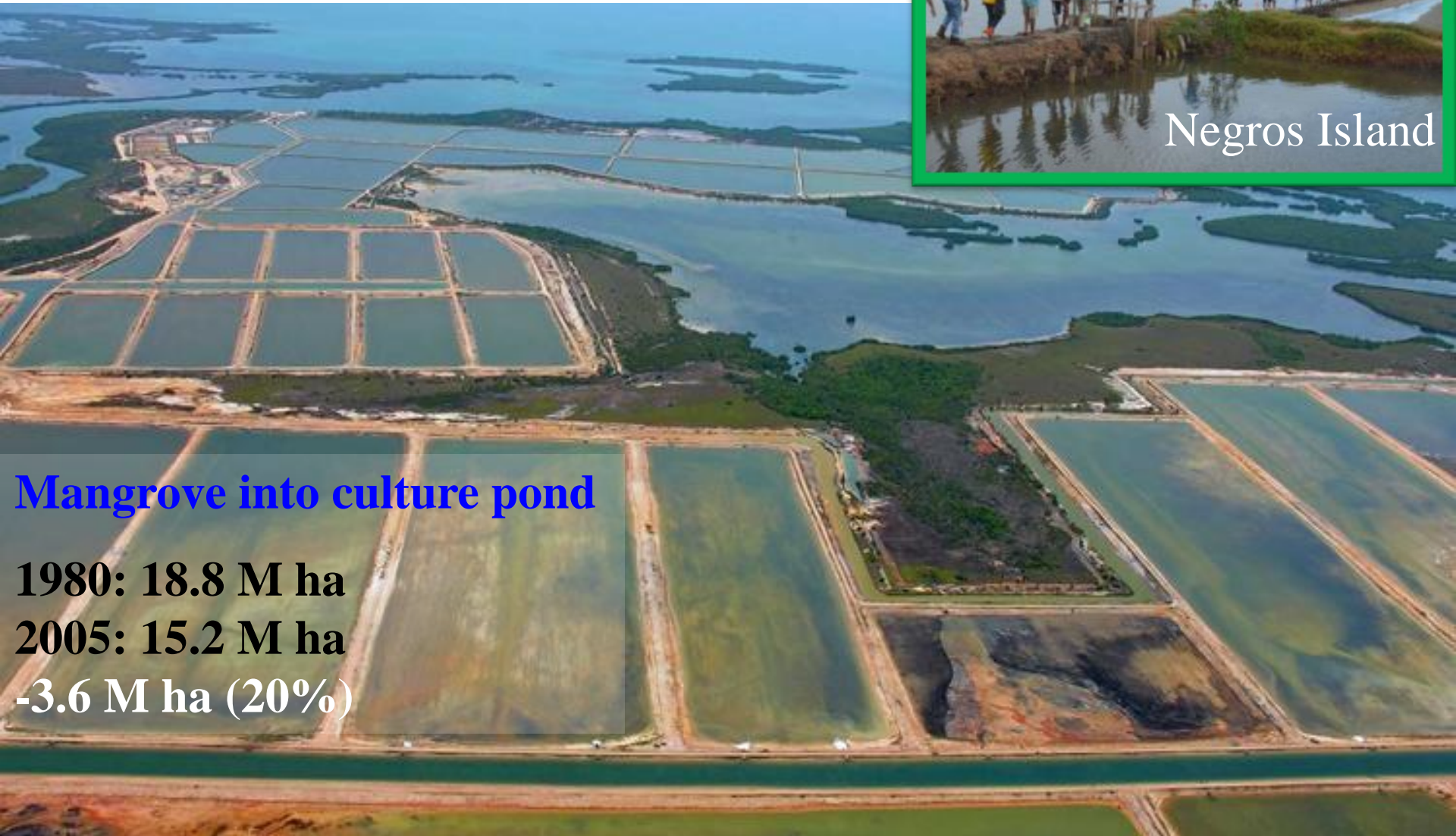
# Mangroves efficiently absorb CO<sub>2</sub> higher than tropical forest



# Mangrove area continue to decline



Negros Island



## Mangrove into culture pond

**1980: 18.8 M ha**  
**2005: 15.2 M ha**  
**-3.6 M ha (20%)**



# Response to mangrove loss: REHABILITATION

## Philippines (2012)

Source: [camarinessur.gov.ph](http://camarinessur.gov.ph)

**Guinness Record (1M)**

## Cambodia

© Kampot Mangrove Group

**Low survival  
(2%)**

## Pakistan (2013)

Source: [www.unep.org](http://www.unep.org)

**Guinness Record (0.8M)**

## Sri Lanka

<http://www.sltcp.org>

**Common: use of  
*Rhizophora sp.***

## India

© PixCove

## Indonesia

From: [poskota.co.id](http://poskota.co.id)

## Malaysia

<http://www.thestar.com.my>



# My research on mangrove oxidative stress (inundation and salinity)

**WHY**

several mangrove rehabilitations were unsuccessful and suffered high mortality?

**WHAT**

is the preference & thresholds of *Rhizophora* species against salinity and inundation?

**WHERE**

is the niche-width of *Rhizophora* species in the intertidal regions? (*suitable for planting*)

**ECOPHYSIOLOGY**



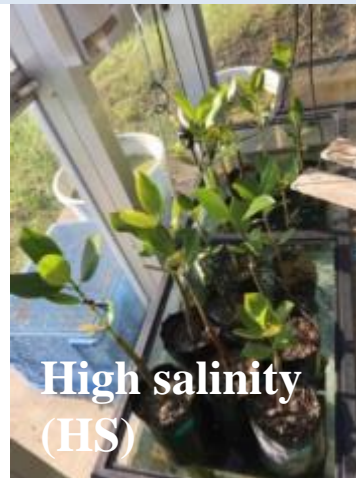
Seedlings were collected  
from Olango Island



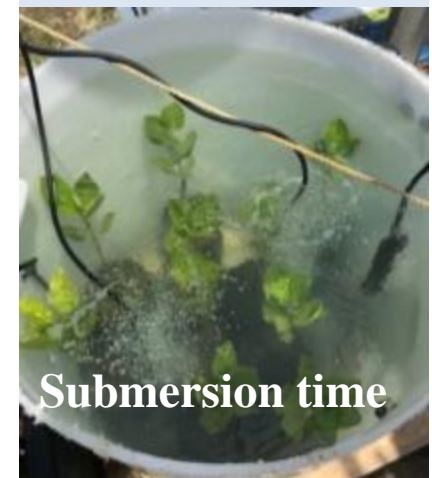
Grown in greenhouse (experiments)



**Experiments: 1) emerged**

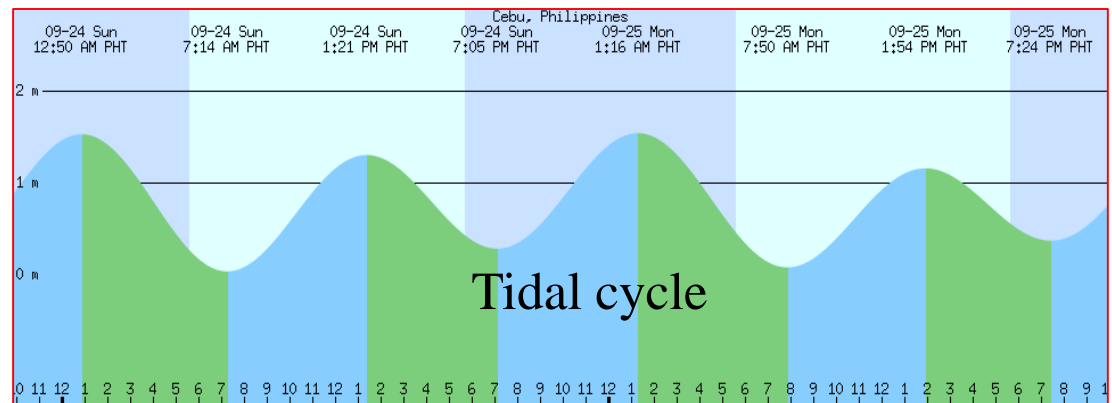
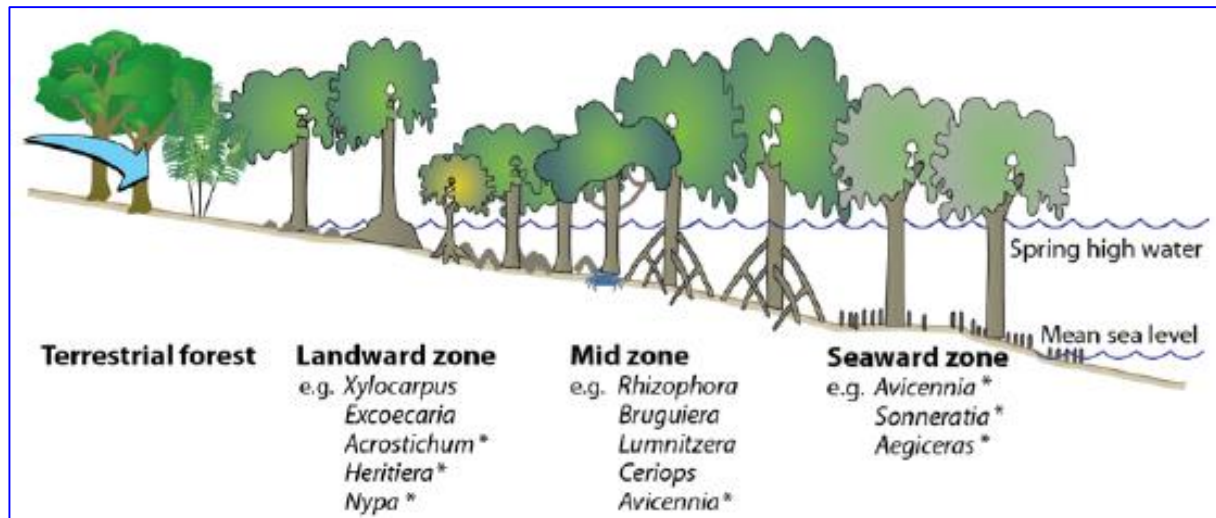


**2) inundated**

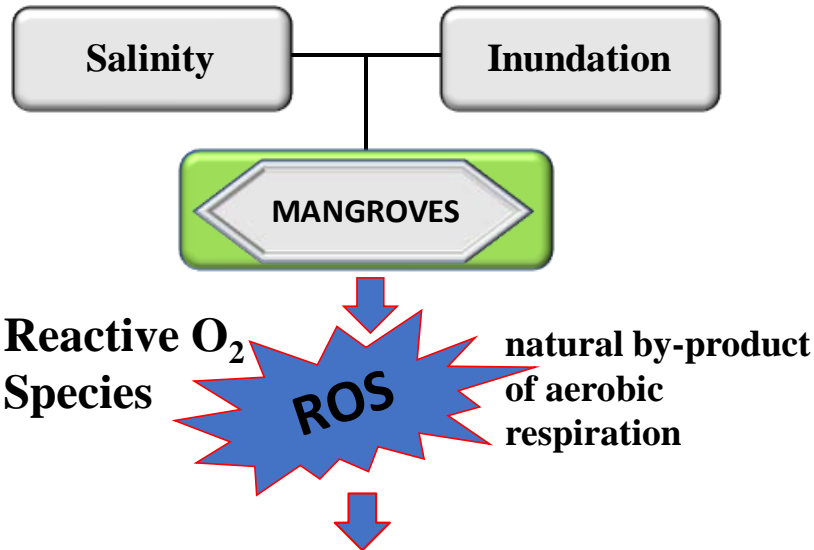




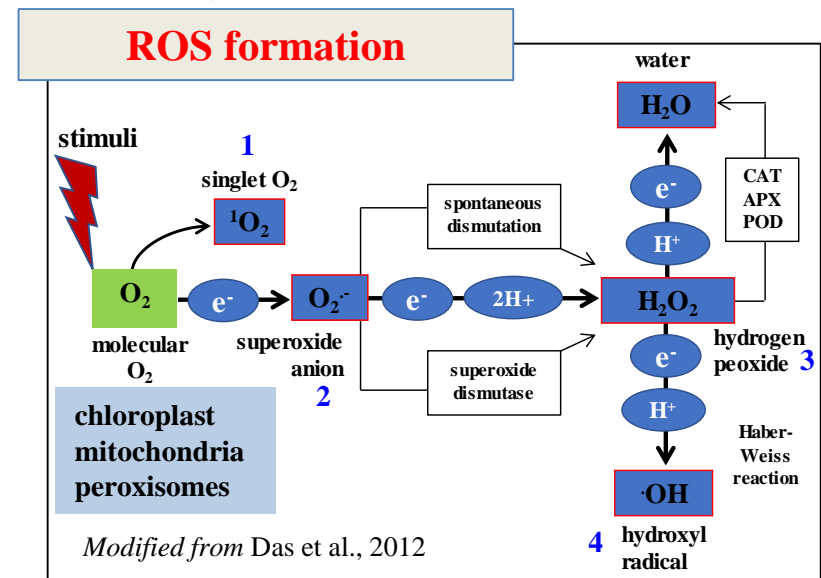
# Simulated the emerged vs. submerged natural condition



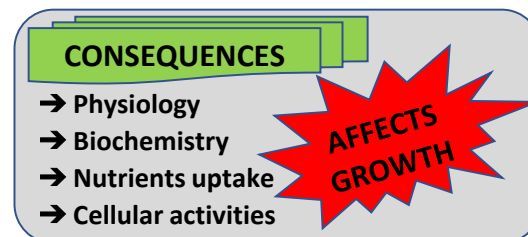
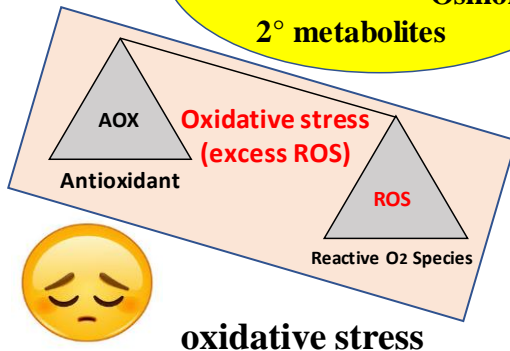
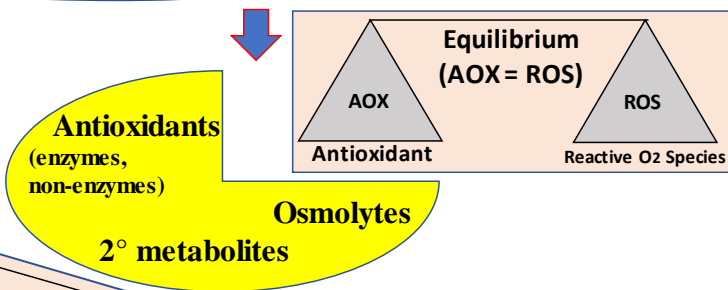
# Background: salinity / inundation and oxidative stress



- ❑ High salinity/inundation dominant stressors (physiological homeostasis)
- ✓ Results to excessive ROS generation

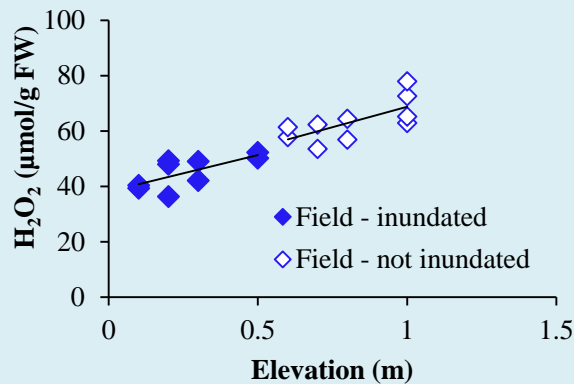


## STRESS IMPACT MITIGATION PLANT DEFENSE SYSTEM

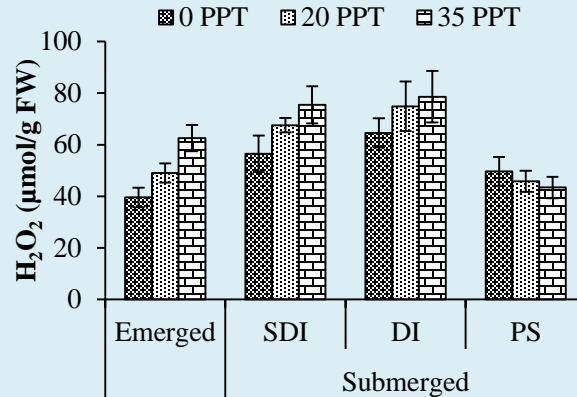




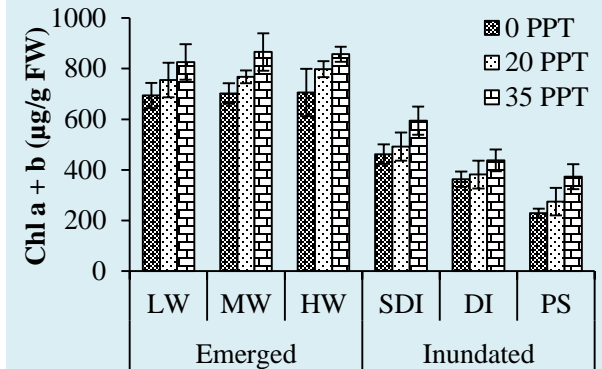
## Indicator of stress against abiotic factor



Highest stress indicator frequently submerged areas

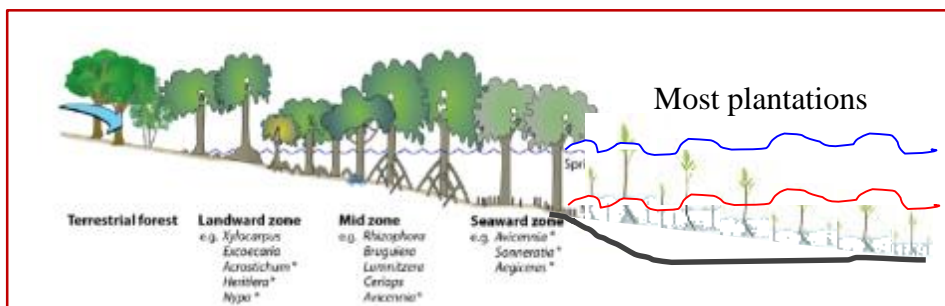
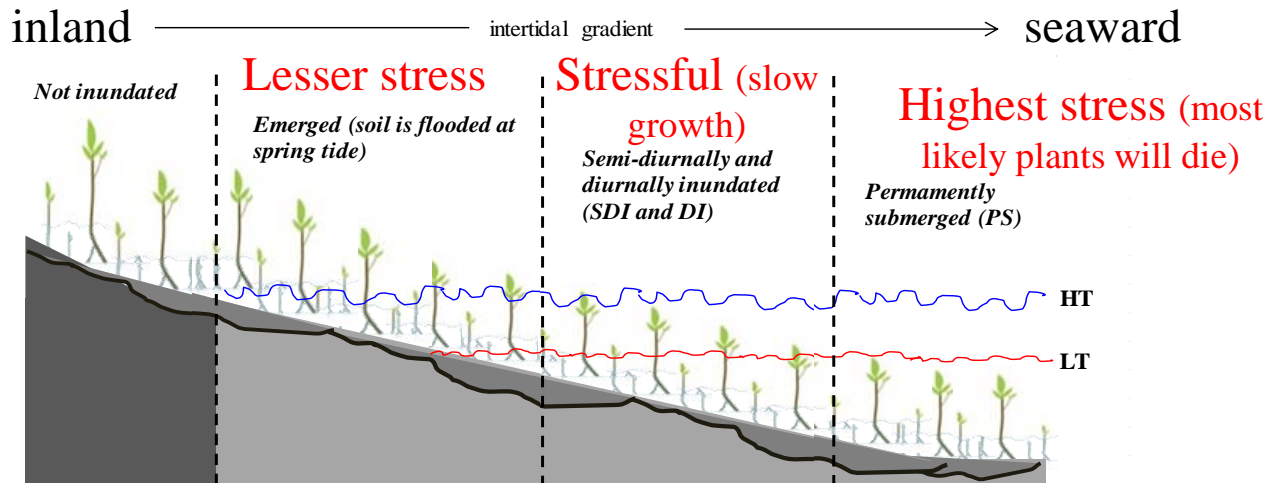


## Pigments (growth)



Low photosynthetic capacity when submerged

## Science-based mangrove rehabilitation applications



## Philippines

Source: camarinessur.gov.ph



## Indonesia

From: poskota.co.id

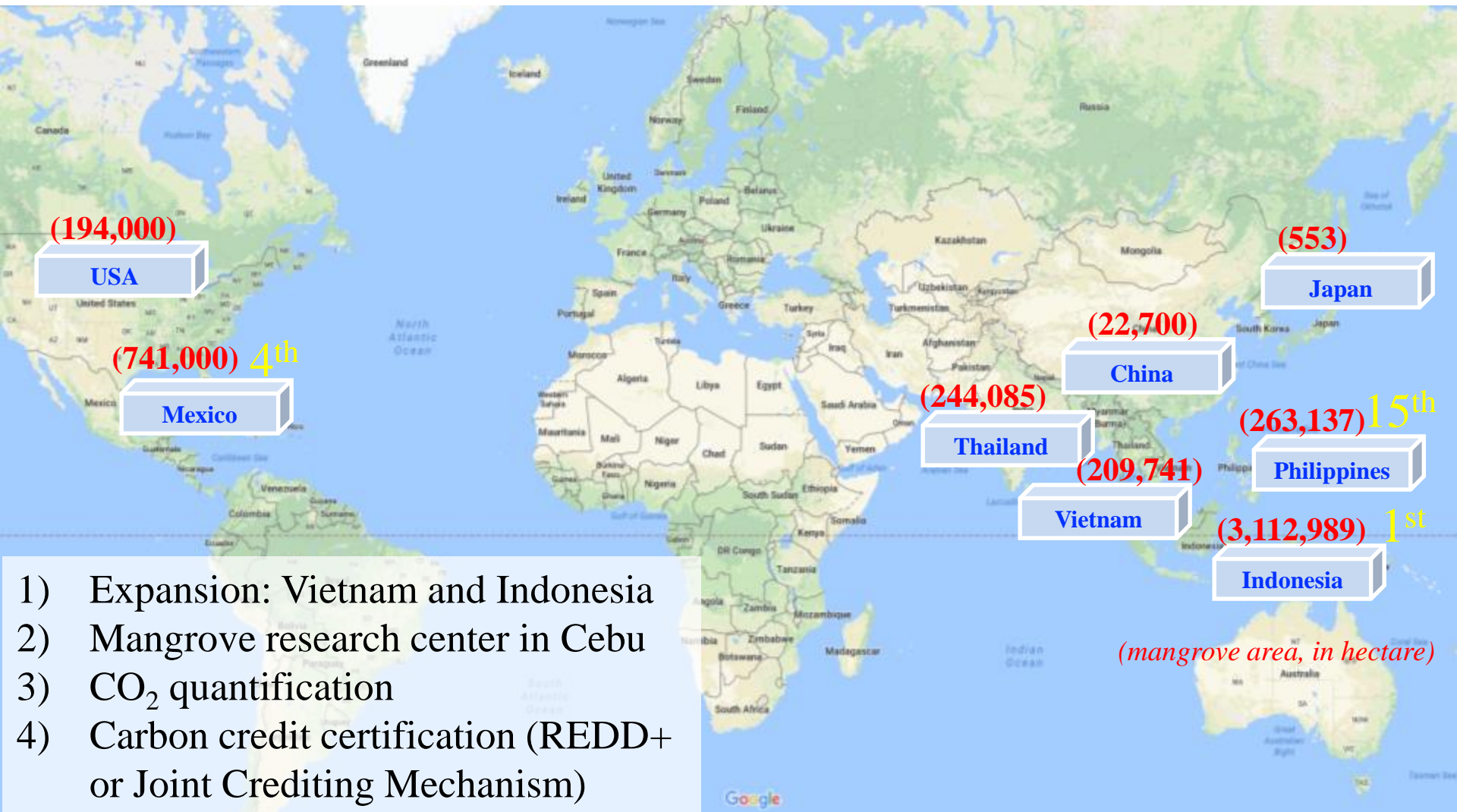
# KPGreen Earth mangrove project in the Philippines

**86% survival**





# Future plans



- 1) Expansion: Vietnam and Indonesia
- 2) Mangrove research center in Cebu
- 3) CO<sub>2</sub> quantification
- 4) Carbon credit certification (REDD+ or Joint Crediting Mechanism)

