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Blue Carbon: Improving Data Applied to IPCC Emission Factors and Carbon Markets

Capacity change in organic carbon storage in intertidal flat during drainage after reclamation: Case study in Saemangeum, Korea

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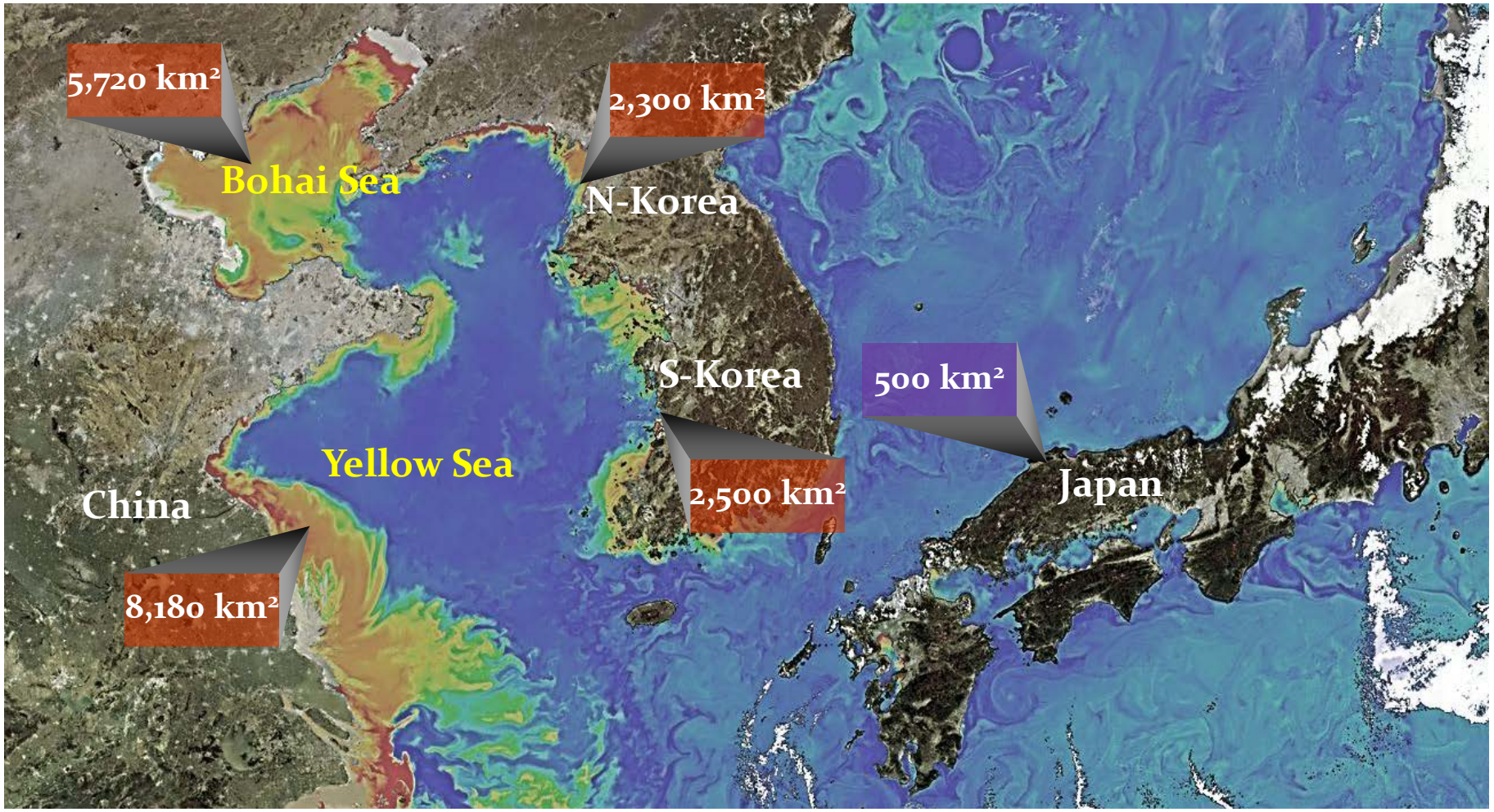
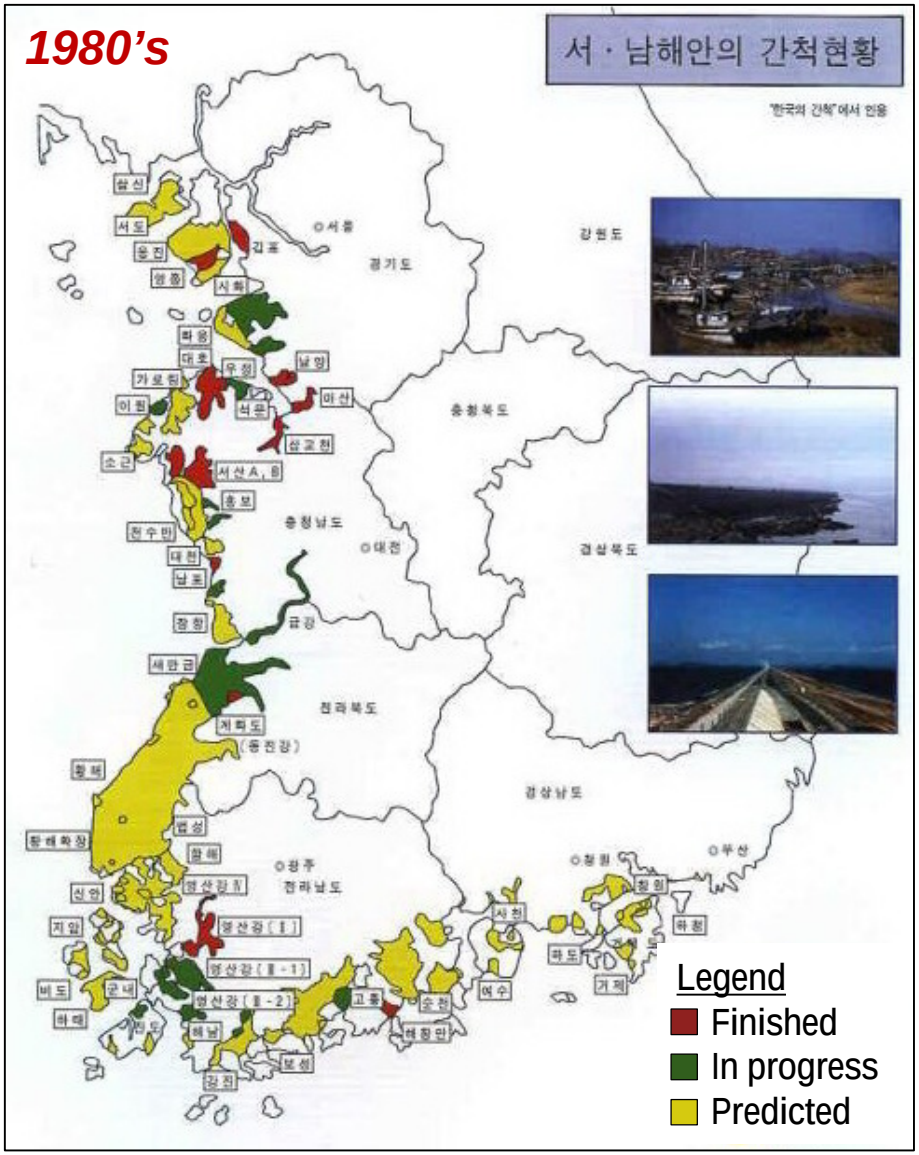
서울대학교 해양저서생태학연구실

1. Introduction: Tidal flats in Yellow Sea

Total area of Tidal Flats in the East Asia: ~19,000 km²
(*cf.* Wadden Sea: ~4,700 km² or Australian Mangroves: ~11,500 km²)

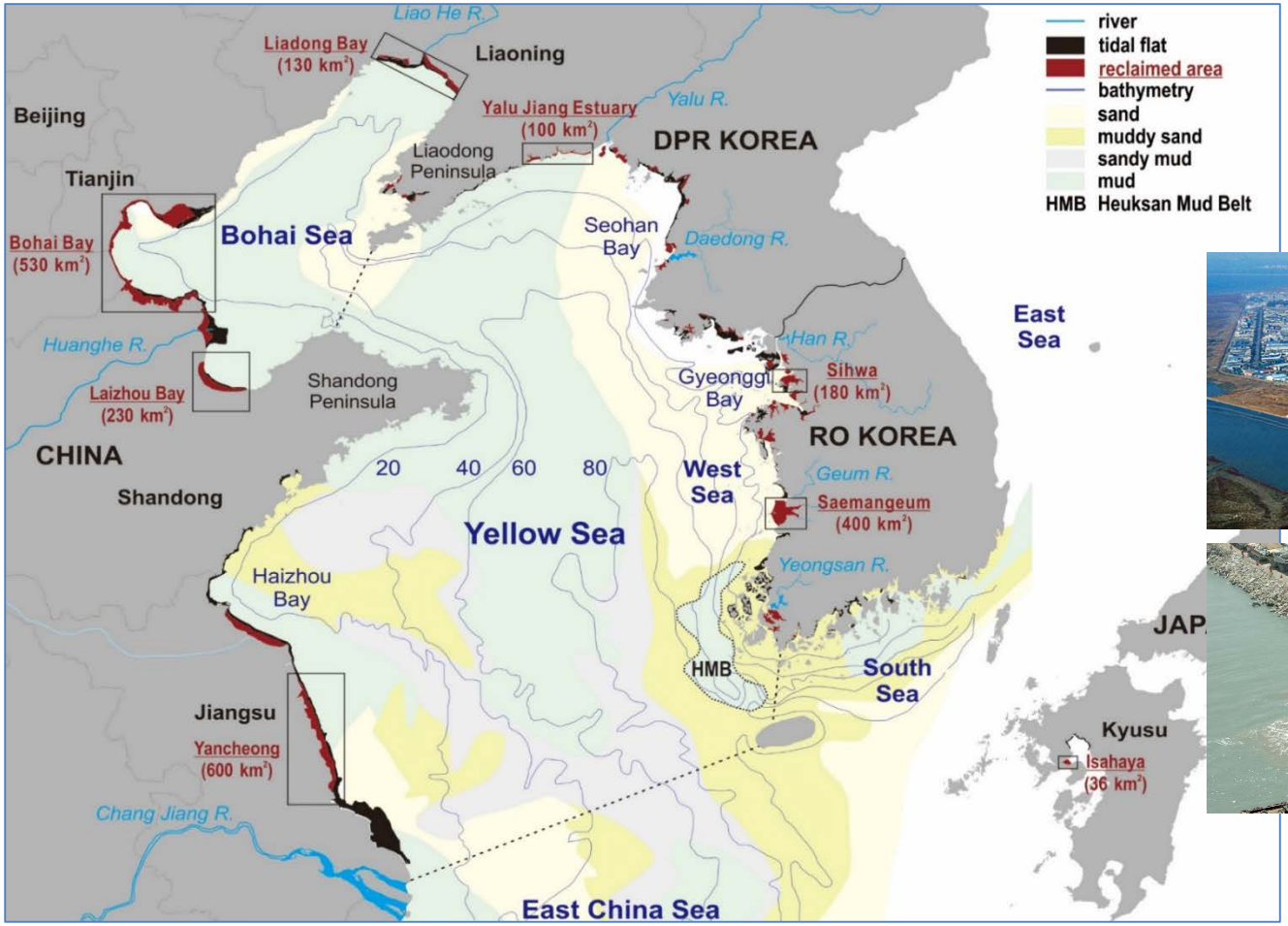


1. Introduction: Unthinkable… mistake



1. Introduction: It is currently underway

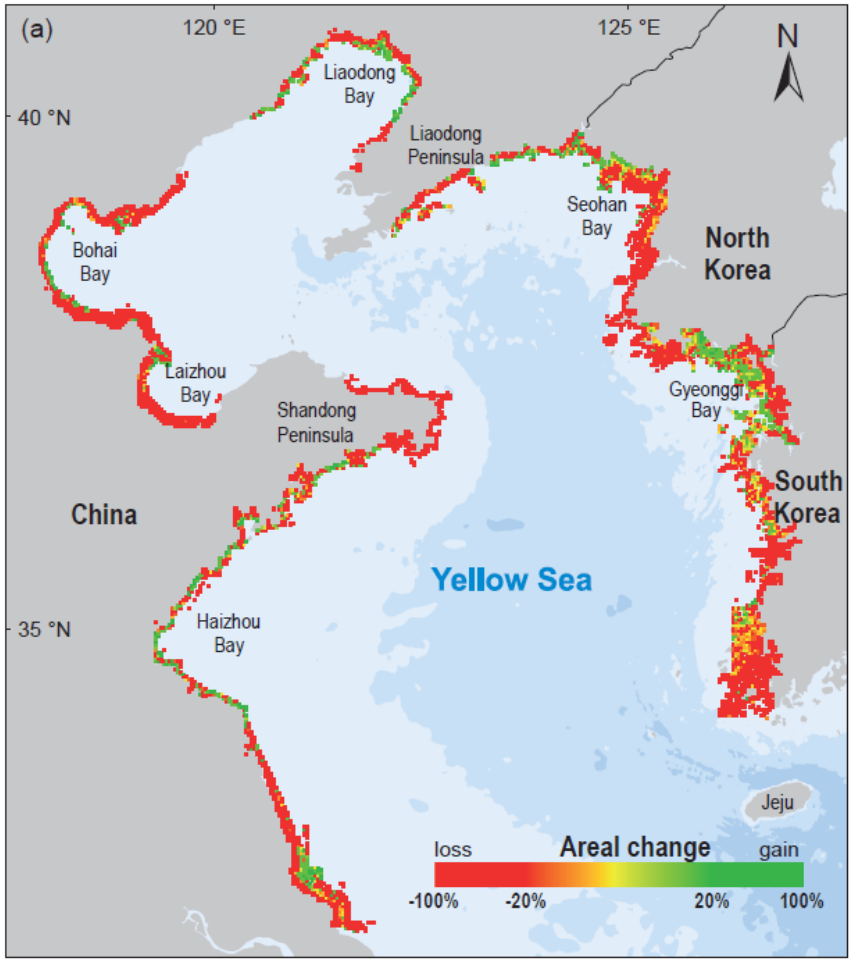
Continuing significant issues on the coastal pollution of the Yellow Sea
Embayment system plus Grand reclamation in China and Korea

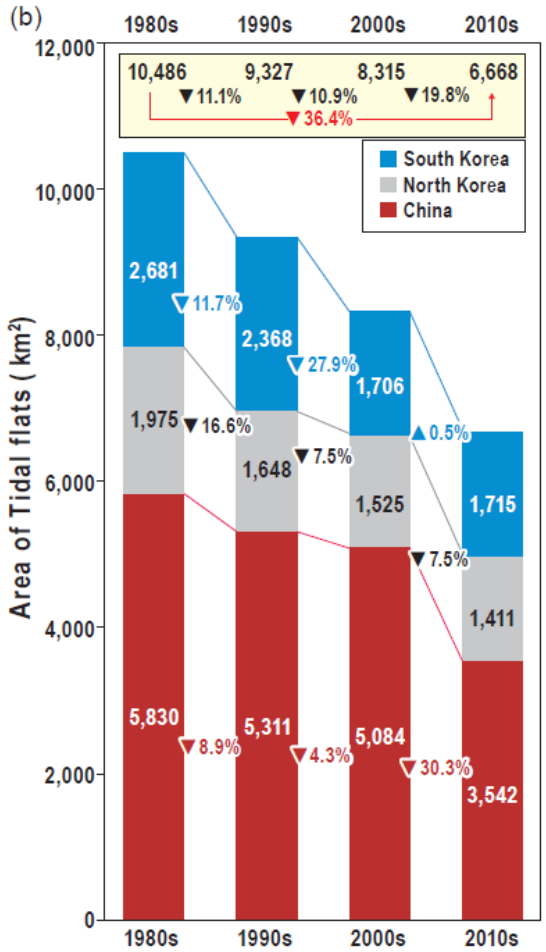


Koh et al. 2014,
Ocean Coast Manage

1. Introduction: Reclamation history

Long-term perspectives: Continuing significant issues on the coastal pollution plus organic carbon loss in coastal sediment

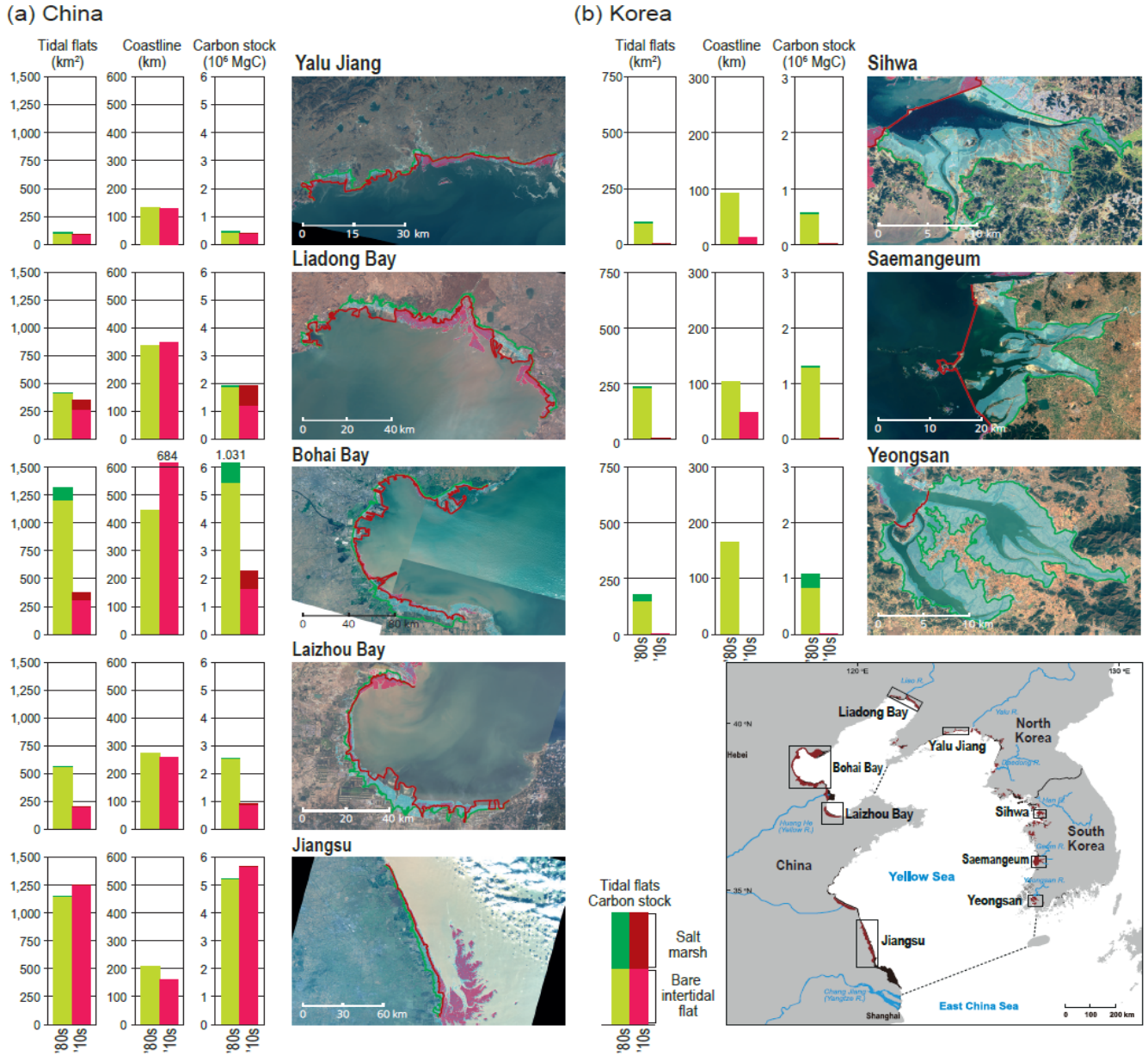




Carbon Loss??

Yim et al. 2018,
Environ Pollut (submitted)

1. Introduction: Carbon loss of the Yellow Sea



This study

Reclaimed tidal flats (n=3)

Drainage

(vs. Tidal flat) Organic carbon loss??

Yim et al. 2018,
Environ Pollut (submitted)

2. Materials and Methods

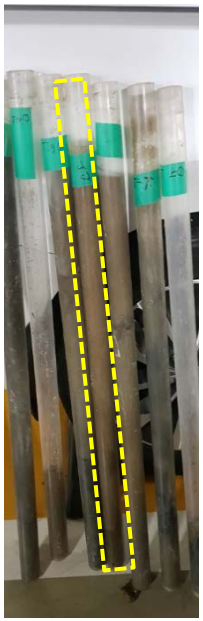
► Sampling areas (in this study)

2. Materials and Methods

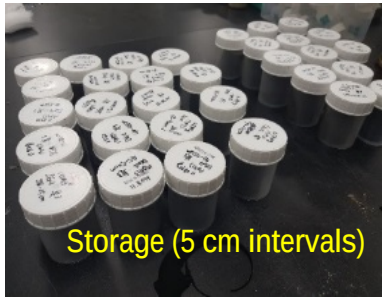
► Sampling methods & analysis

Sampling

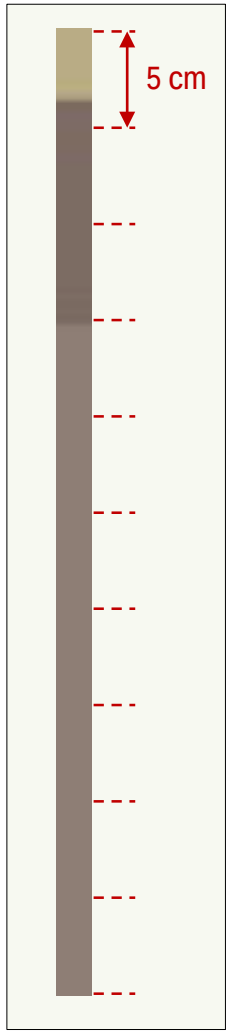
Sediment core



Cut in 5 cm intervals



Example (50 cm)



- After coring, the samples have to seal with a cap or a sealing tape to minimize biodegradation by microbe

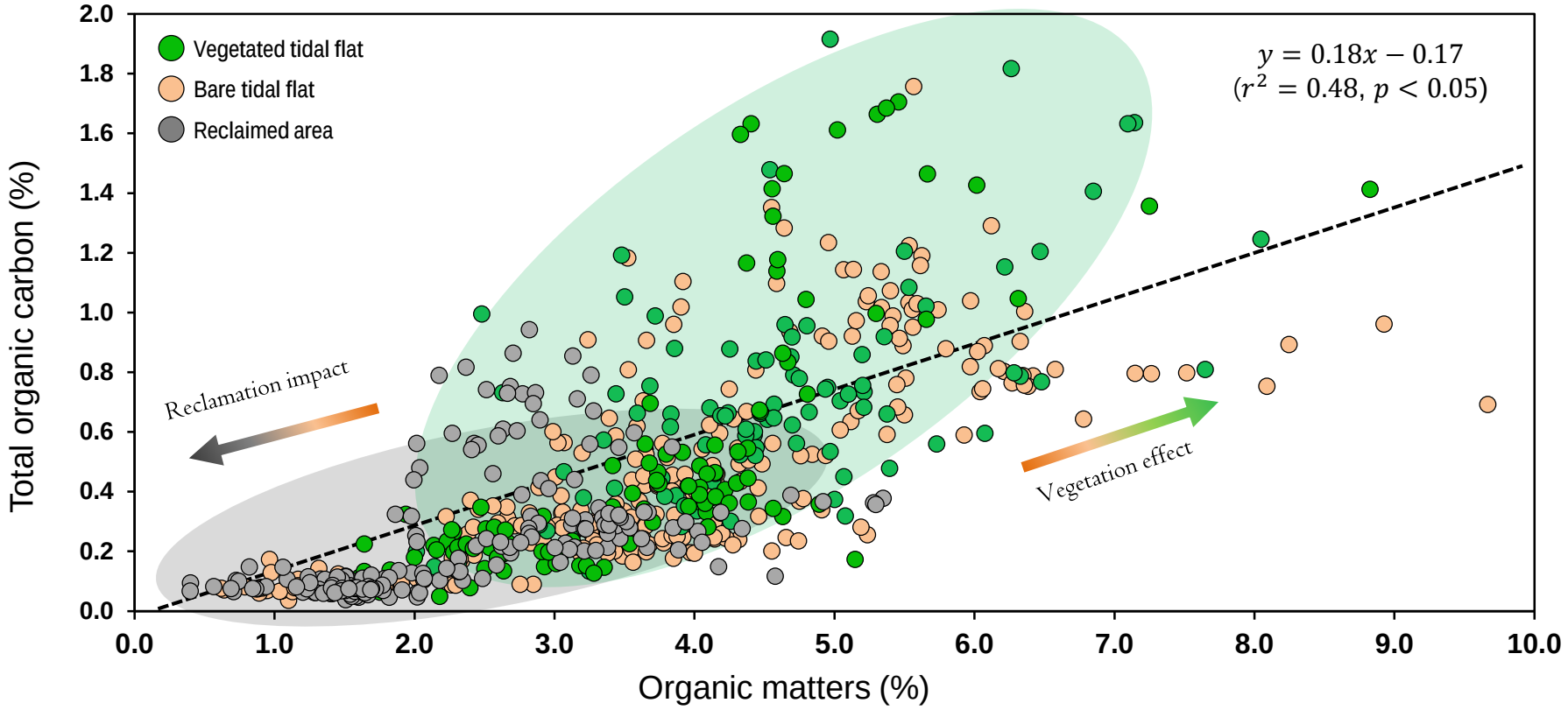
Analysis:

1) Bulk density, 2) Water contents,
3) Mud contents, 4) Organic matters, 5) TOC,
6) TN, and 7) $d^{13}C$

2. Materials and Methods

3. Results and discussion

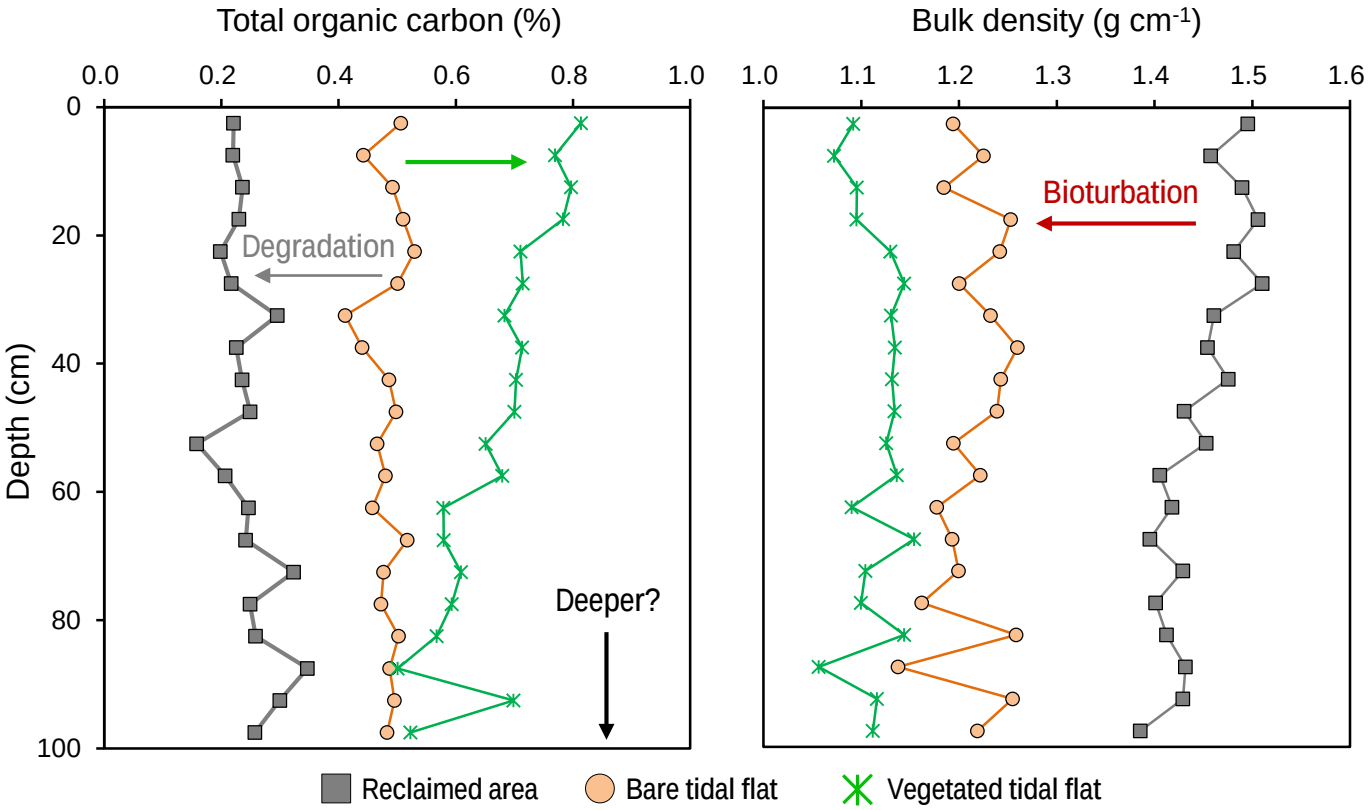
► Relationship between organic matter & organic carbon



- TOC & OC: Vegetated tidal flat > Bare tidal flat (unvegetated) >> Reclaimed area
- Significant relationship: 0.18*OM=TOC (ref.: Nobrega et al., 2015, 0.27*OM=TOC)

3. Results and discussion

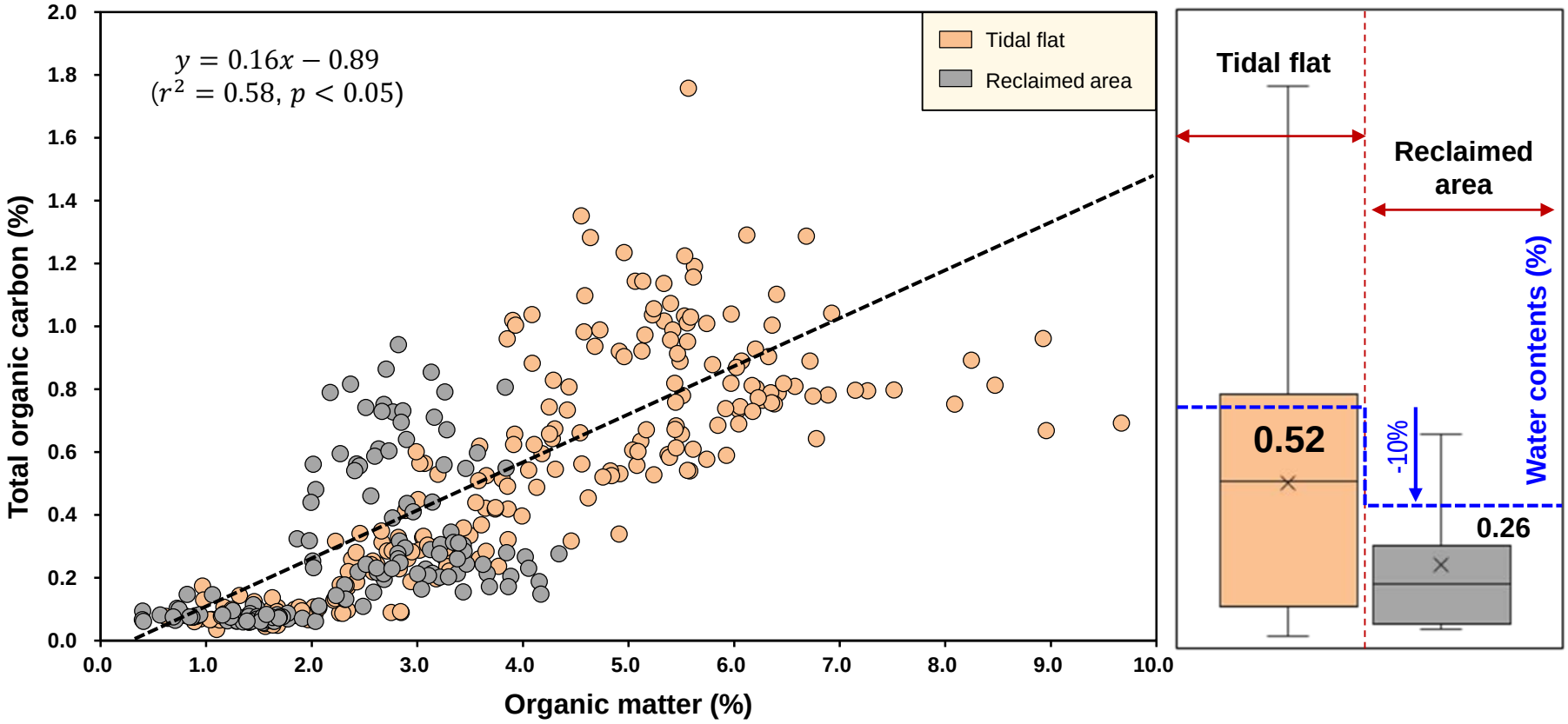
► Comparison of TOC & bulk density, by sediment depth



- Higher TOC and lower bulk density found in vegetated area → Bioturbation
- TOC in the reclaimed area showed lower value by possible microbial activities

3. Results and discussion

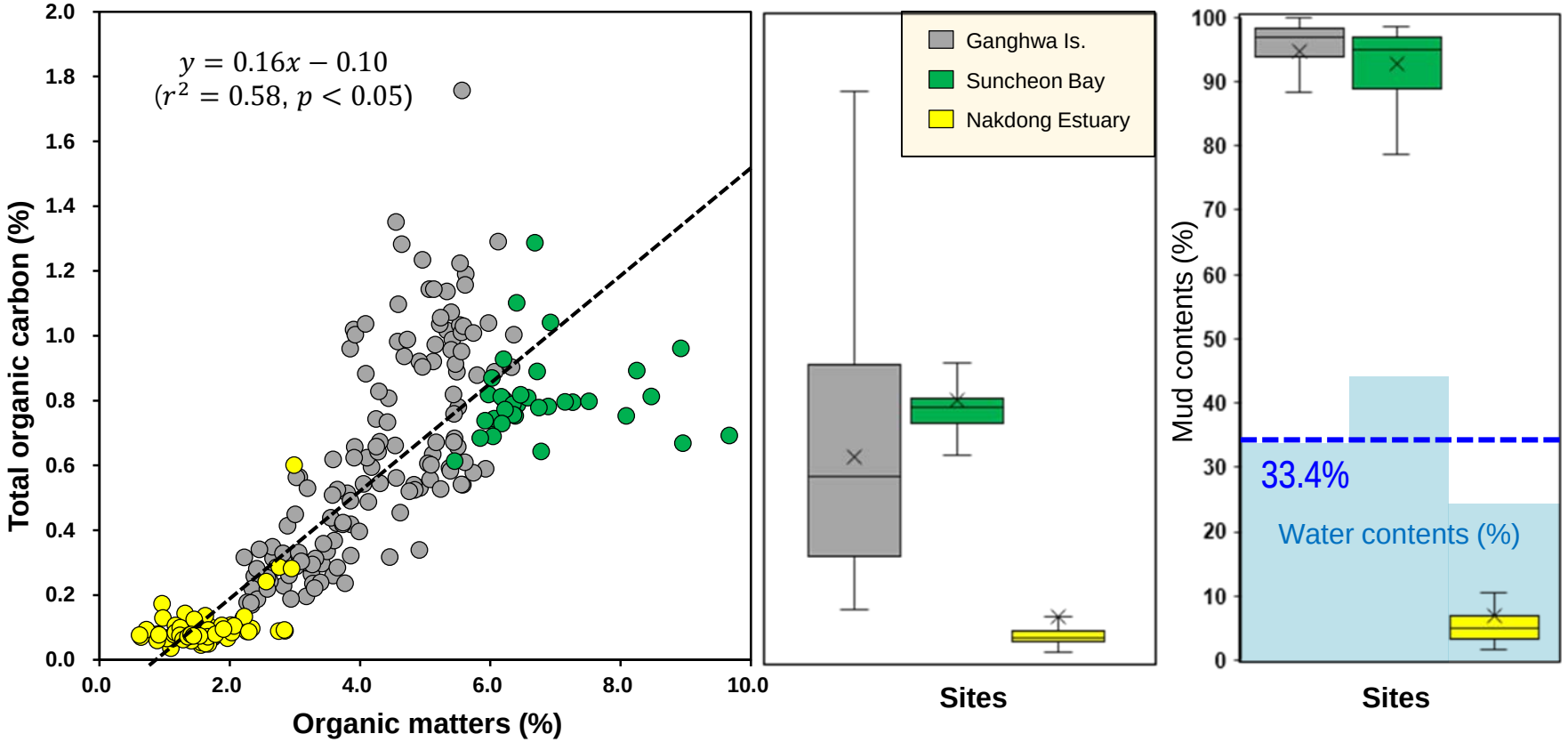
► TOC between tidal flats and reclaimed areas



- After drainage, water contents (WC) in sediment seem to diminish approximately 10%
- Reclamation had caused significant TOC loss in sediment, that accounts for almost half

3. Results and discussion

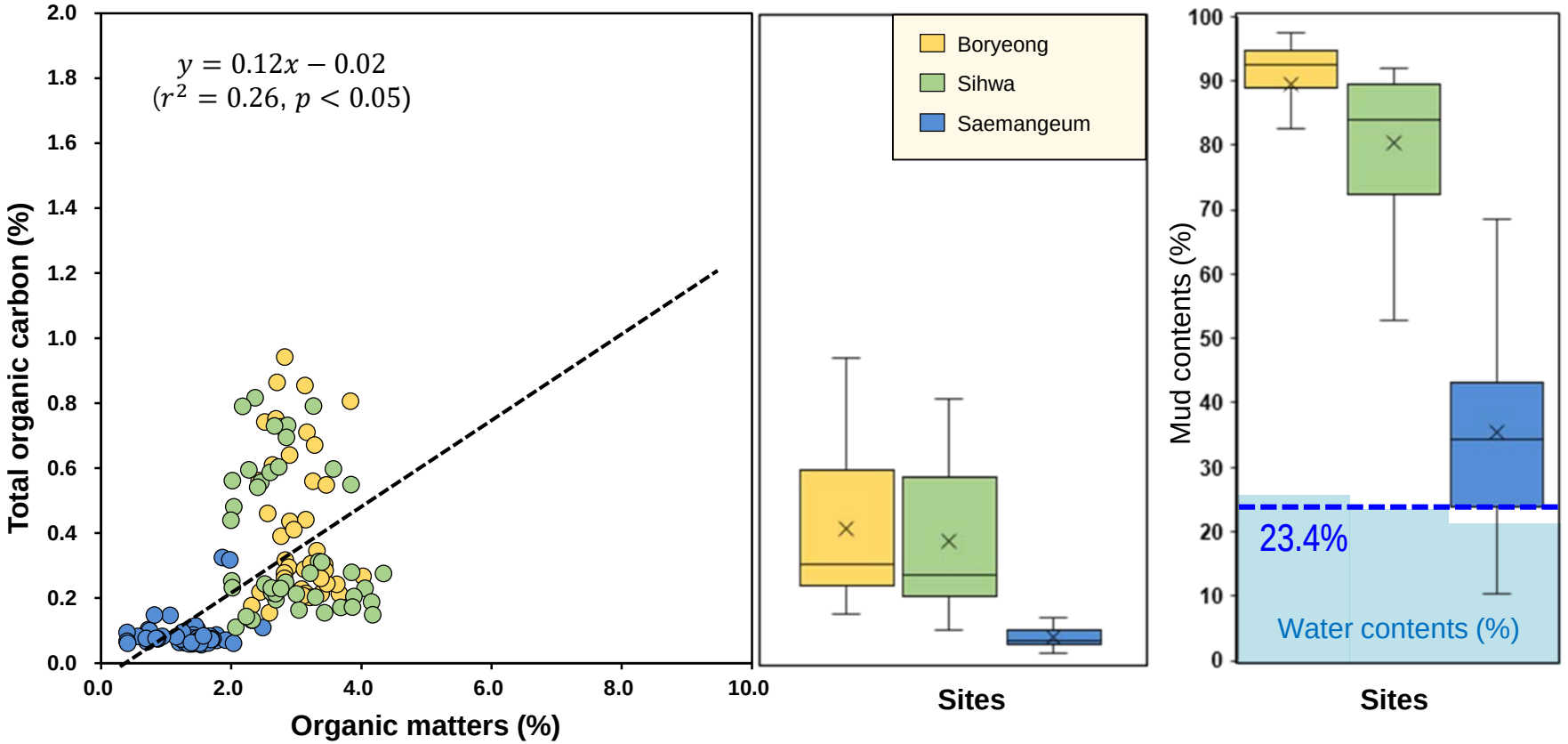
► Spatial variation of TOC with sediment properties in tidal flats



- Higher TOC and organic matters (OM) found in muddy sediments
- Relatively, lower TOC, organic matters, and water contents observed in sandy sediment

3. Results and discussion

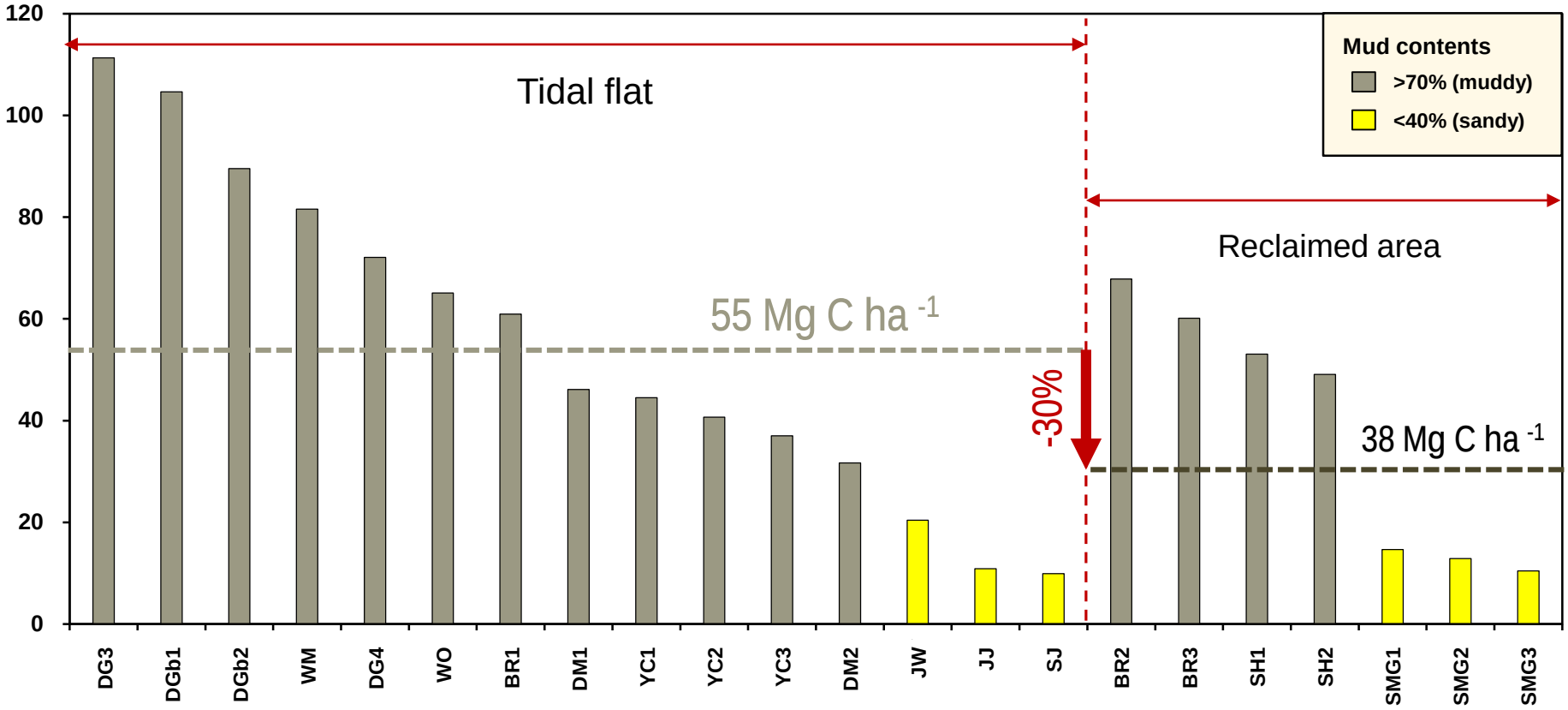
► Spatial variation of TOC with sediment properties in reclaimed areas



- Generally, low TOC, OM, and WC found in reclaimed areas
- Saemangeum, as sandy sediment, showed lowest values of TOC, OM, and WC

3. Results and discussion

► Average TOC stocks



- Relatively, tidal flats were stored much more TOC than reclaimed areas, and the loss of organic carbon in reclaimed sediment was approximately estimated 30% of total stocks

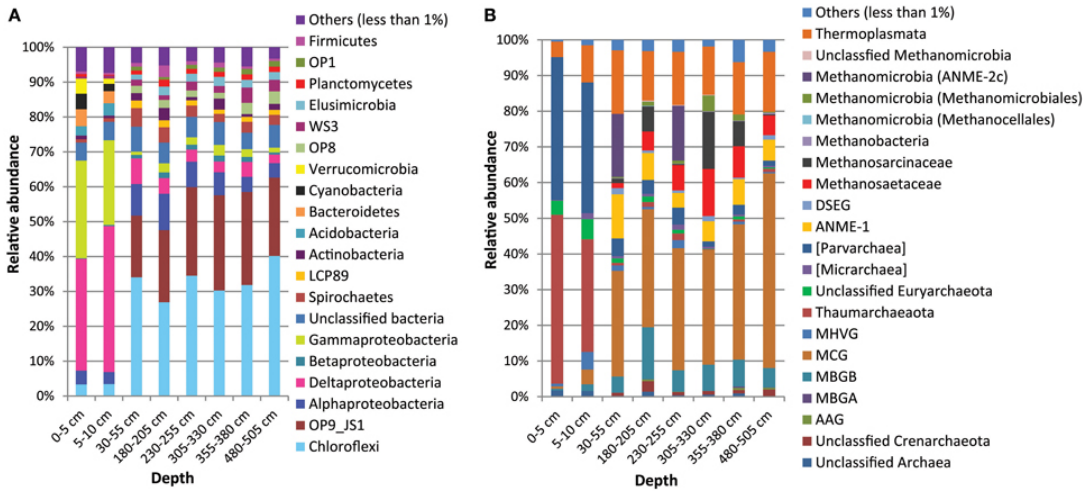
4. Further study

► *More details for degradation of TOC over time (temporal gradient?)*

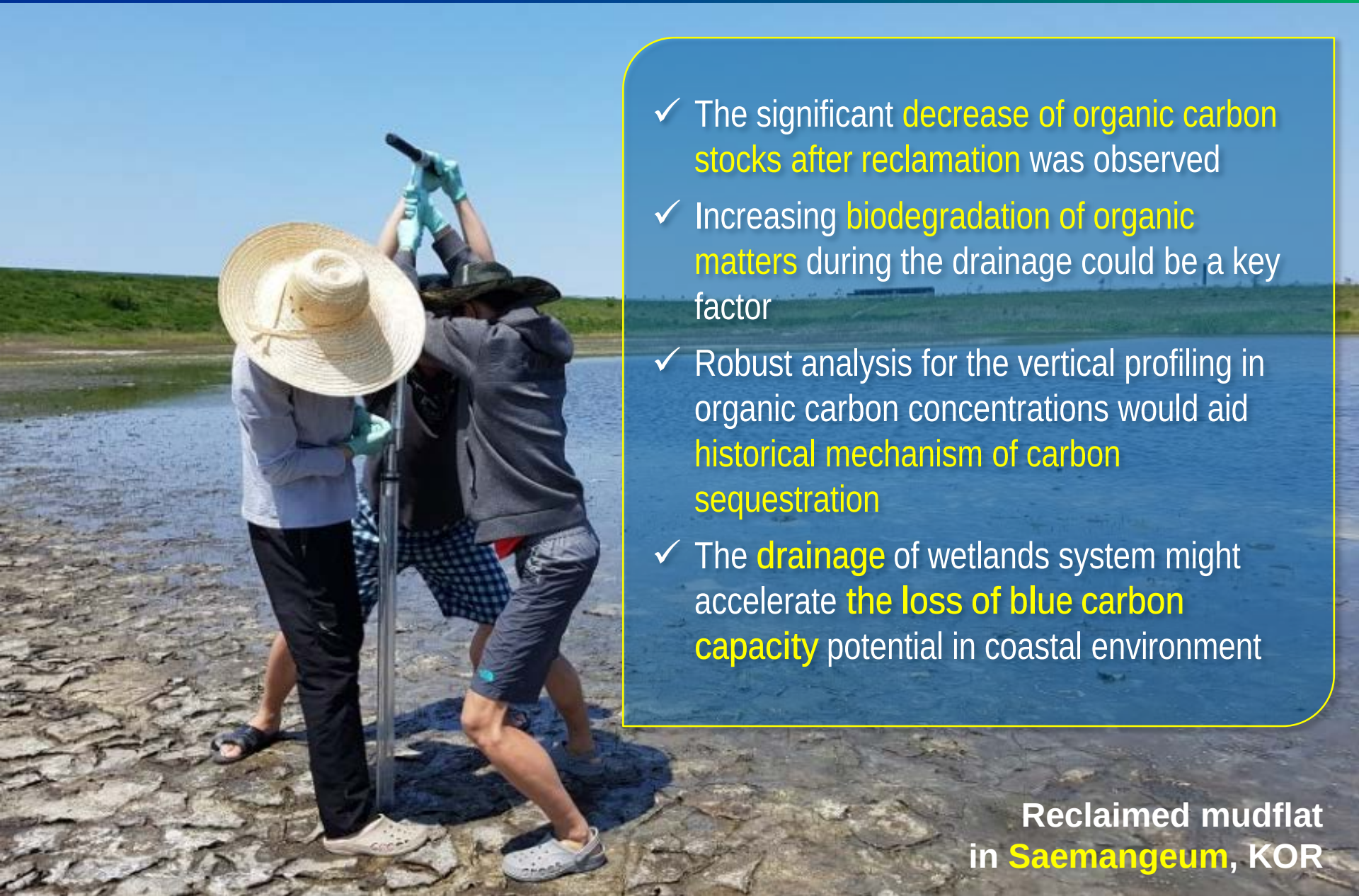
► *Biodegradation by microbial communities*

Communities and Organic Matter Composition in Surface and Subsurface Sediments of the Helgoland Mud Area, North Sea

Oni et al. 2015, *Front Microbiol*



5. Summary



- ✓ The significant decrease of organic carbon stocks after reclamation was observed
- ✓ Increasing biodegradation of organic matters during the drainage could be a key factor
- ✓ Robust analysis for the vertical profiling in organic carbon concentrations would aid historical mechanism of carbon sequestration
- ✓ The drainage of wetlands system might accelerate the loss of blue carbon capacity potential in coastal environment

Reclaimed mudflat in Saemangeum, KOR

THANK YOU
for your attention

Prof. **Jong Seong Khim**

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