Current research efforts on blue carbon in RO Korea

2018. 11. 27.

Young-don, Kim

ydkim@koem.or.kr

KOEM Korea Marine Environment Management Corporation

CONTENTS

Ⅰ. Introduction

- Blue carbon
- Global Trend

Blue Carbon?

Definition & Function of Blue Carbon

Blue Carbon?

- ✓ Carbon storage into marine ecosystem such as coastal vegetations and sediments calls "Blue Carbon"
- ✓ Although the area of marine ecosystem is smaller than that of terrestrial, the total storage of carbon is similar moreover, its rate is up to 50 times faster

Blue Carbon contains 4 marine ecosystem services function

1. Provisioning Materials
2. Regulating Natural Phenomena
3. Supporting Natural Function
4. Rest & Cultural

Terrestrial ecosystem "Green Carbon"

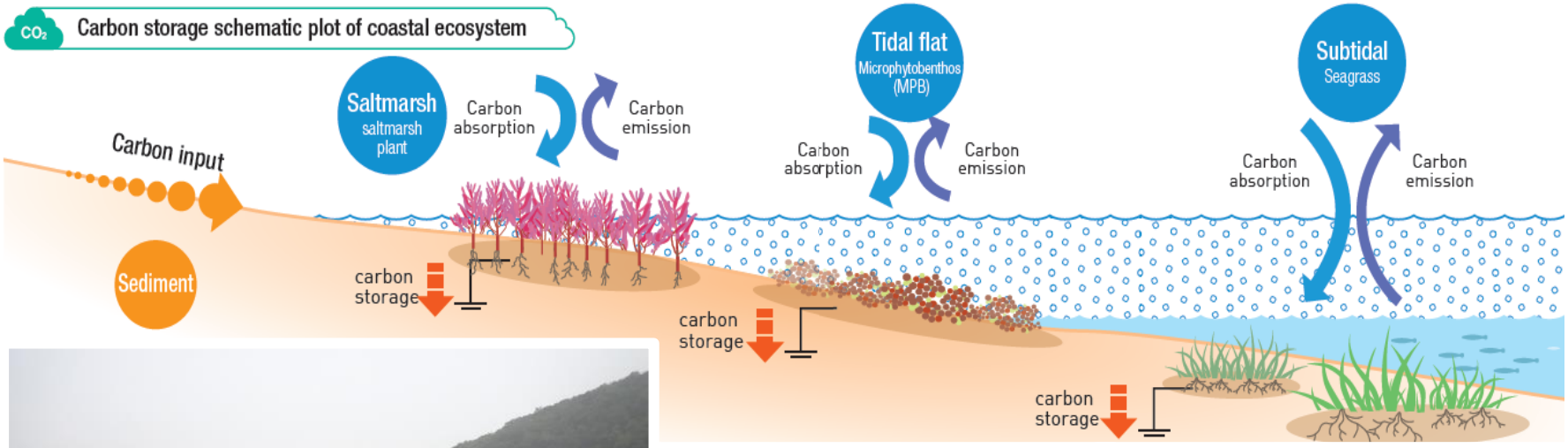
Carbon absorbed into forest ecosystem

Fossil Fuel "Black Carbon"

Carbon emitted from fossil fuels and causes global warming

Blue Carbon?

Carbon Storage Schematic of Blue Carbon

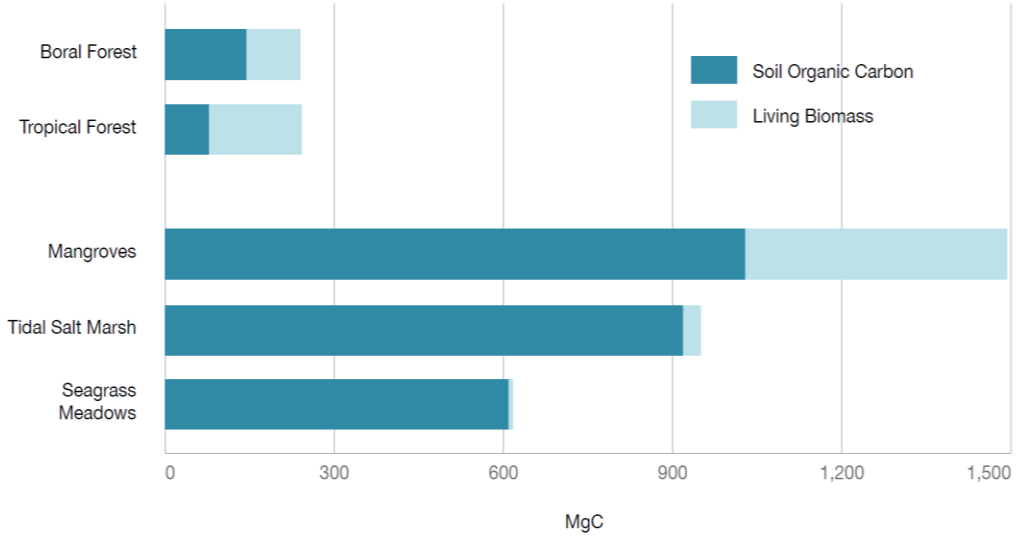


- Potential carbon sources in coastal area:
  Microphytobenthos, salt marsh plant, and sea grass

Carbon Storage Capacity of Blue Carbon

- Tidal flat, and Saltmarsh plant stocks are about **3 times higher** than tropical rain forest stocks
- Stored in soil organic carbon form mainly

- Seagrass stocks are about **2 times higher** than tropical rain forest stocks
- Exist in soil organic carbon form



(Blue Carbon initiative homepage)

Global Distribution Status of Blue Carbon

Mangrove	Mangroves are Mainly Distributed in Tropical Regions such as **Indonesia, Mexico,** and **Brazil**
Saltmarsh	Tidal Flat, and Saltmarsh Mainly Distributed in **Europe, North America**, and **Australia**
Seagrass	**60 Species of** Seagrass **are Distributed in All Coasts Except Antarctica**

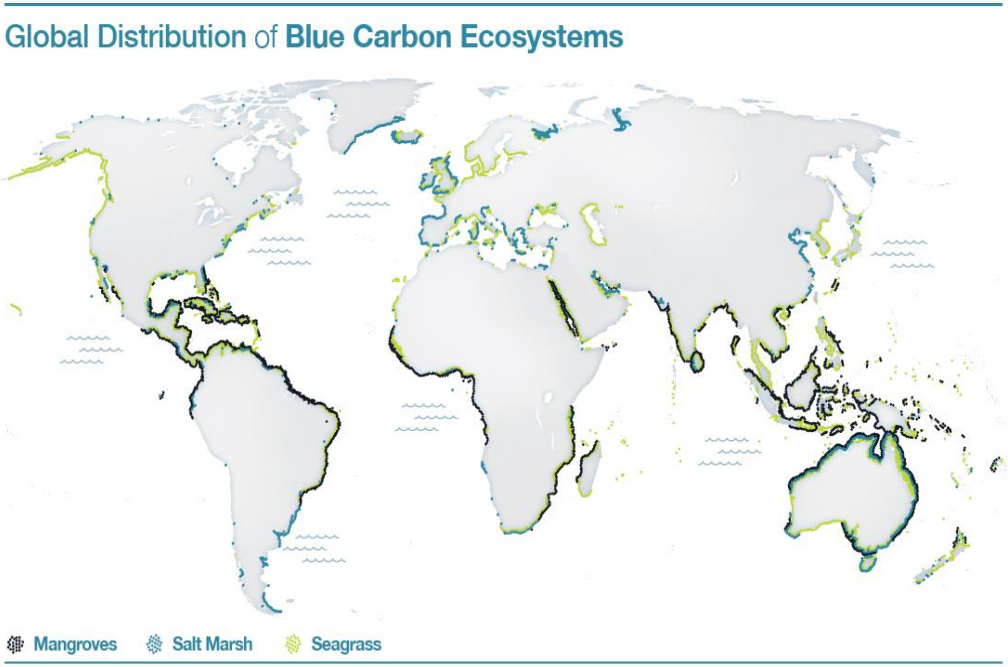
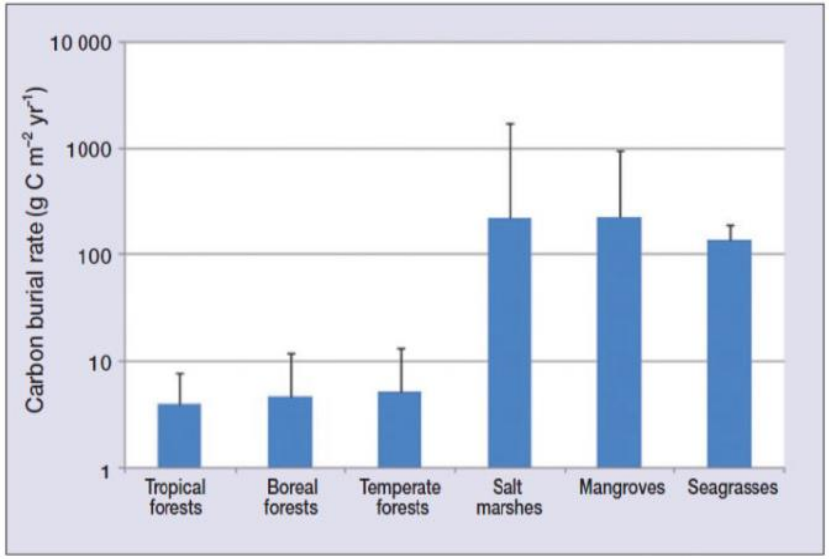


Figure 4. Global distribution of the blue carbon ecosystems

Global Trend

IPCC Special Report on the Ocean and Cryosphere in a Changing Climate(SROCC)



Synopsis of SROCC

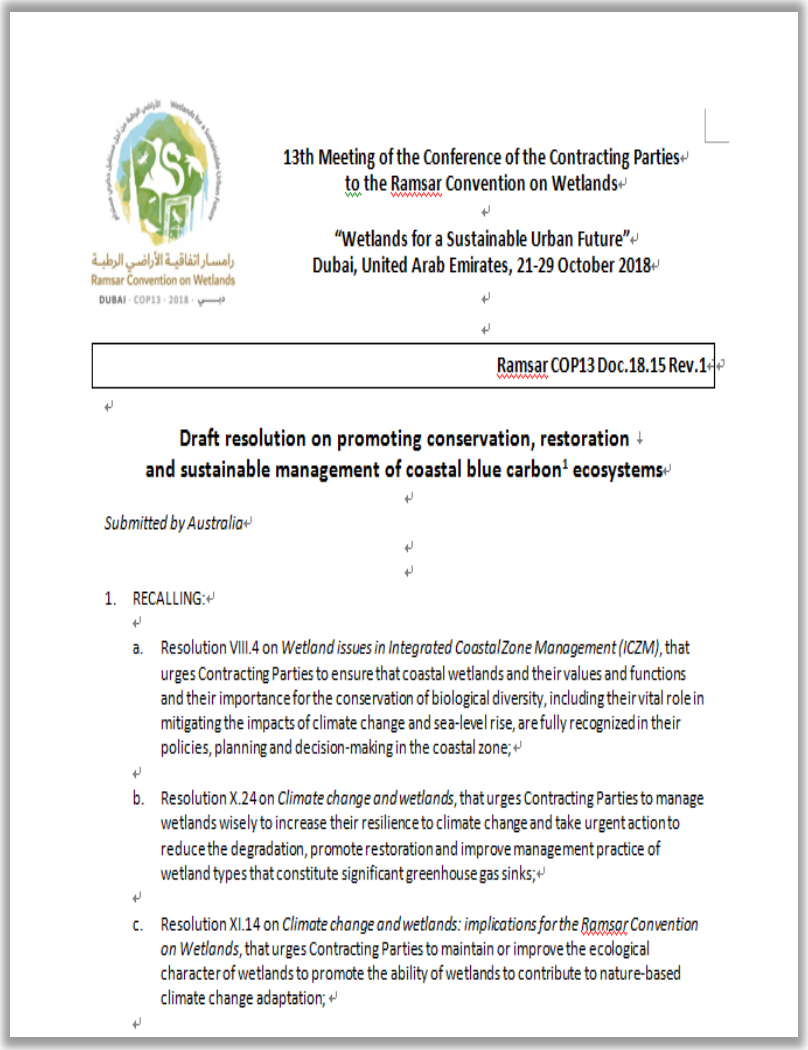
- Decided to publish **SROCC** within cycle of 6th IPCC report in the 43rd session of IPCC ('16.4, Kenya)
- Covering the interrelationships, changes, adaptation , and mitigation measures of the ocean, and cryosphere on climate system (6 chapters)

Main Blue Carbon Contents (Chapter 5)

- Blue carbon occupies less than 0.1% of the surface, but contributes 1~10% of primary ocean production, and 3~30% of marine CO_2
- **151 countries** around the world own blue carbon ecosystem
- 25~50% worldwide damage over past 100 years (decrease 0.2~3% per year)
  → Emit 1.3 ± 0.7GtC/yr
- Blue carbon has variety of benefits such as wave energy absorption, typhoon protection, adaptation (erosion protection), local marine ecosystems health promotion (fishery resources, water quality)

Global Trend

Ramsar Convention



13th Meeting of the Conference of the Contracting Parties
to the Ramsar Convention on Wetlands

"Wetlands for a Sustainable Urban Future"
Dubai, United Arab Emirates, 21-29 October 2018

Ramsar COP13 Doc.18.15 Rev.1

Draft resolution on promoting conservation, restoration and sustainable management of coastal blue carbon[1] ecosystems

Submitted by Australia

1. RECALLING:

   a. Resolution VIII.4 on *Wetland issues in Integrated Coastal Zone Management (ICZM)*, that urges Contracting Parties to ensure that coastal wetlands and their values and functions and their importance for the conservation of biological diversity, including their vital role in mitigating the impacts of climate change and sea-level rise, are fully recognized in their policies, planning and decision-making in the coastal zone;

   b. Resolution X.24 on *Climate change and wetlands*, that urges Contracting Parties to manage wetlands wisely to increase their resilience to climate change and take urgent action to reduce the degradation, promote restoration and improve management practice of wetland types that constitute significant greenhouse gas sinks;

   c. Resolution XI.14 on *Climate change and wetlands: implications for the Ramsar Convention on Wetlands*, that urges Contracting Parties to maintain or improve the ecological character of wetlands to promote the ability of wetlands to contribute to nature-based climate change adaptation;

Ramsar COP13

- Draft resolution on promoting conservation, restoration and sustainable management of coastal blue carbon ecosystems (COP13 Doc.18.15.)

Contents of draft resolution

- AFFIRMS the significant value of coastal wetlands for climate mitigation and adaptation
- Raise awareness of the benefits of costal blue carbon ecosystems and Incentivize actions
- Collect and analyze data, map these ecosystem and make this information publicly accessible

⇒ KOREA clearified unvegetated mudflats as one of blue carbon ecosystems in draft resolution

Global Trend

United States of America—developing the inventory

- All wetlands are recognized as managed lands, mostly consisting of agricultural to tidal marsh transitions with restoration. Both Vegetated Coastal Wetlands and Unvegetated Open Water Coastal Wetlands were included, although sufficient data on seagrasses were not available (Crooks and Beers 2018).

- Accounting for transitions in land-use due to restoration activities (e.g. rewetting) is included. The reporting table (below) shows areas of cropland, grasslands and other land categories converted to coastal wetlands.
- An interagency working group was created to facilitate effective collaboration between government offices and a consultant team responsible for the accounts.
- Coastal wetlands sequester 8.5 $MMTCO_2$ each year, but erosion releases 1–7 $MMTCO_2$ per year (Crooks and Beers 2018).

TO: / FROM:	Forest land (managed)	Forest land (unmanaged)	Cropland	Grassland (managed)	Grassland (unmanaged)	Wetlands (managed)	Wetlands (unmanaged)	Settlements	Other land	Total unmanaged land	Initial area
	(kha)										
Forest land (managed)[2]	292493.19	IE	59.75	3960.58	NA	55.71	NA	417.91	75.35	IE	297062.49
Forest land (unmanaged)[2]	IE	8600.58	NO	IE	IE	IE	IE	NO	IE	IE	8600.58
Cropland[2]	165.32	NA	149721.75	16555.31	NA	345.82	NA	2982.16	679.31	NA	170449.68
Grassland (managed)[2]	678.10	NA	12827.06	303120.28	NA	700.08	NA	3653.28	1108.69	IE	322087.49
Grassland (unmanaged)[2]	IE	IE	NO	IE	25935.60	IE	IE	NO	IE	IE	25935.60
Wetlands (managed)[2]	31.47	NA	127.76	199.15	NA	41272.67	IE	26.17	101.76	IE	41758.97
Wetlands (unmanaged)[2]	IE	NA	IE	IE	NA	IE	IE	IE	IE	IE	IE,NA
Settlements[2]	16.57	NA	90.73	114.04	NA	1.31	NA	35848.47	13.03	IE	36084.15
Other land[2]	95.28	IE	212.50	1048.15	IE	98.06	NA	190.11	20809.09	IE	22453.19
Total unmanaged land [2]	IE	IE	NO	IE	IE	IE	IE	NO	IE	46300.25	46300.25
Final area	293479.93	8600.58	163039.56	324997.51	25935.60	42473.64	IE,NA	43118.10	22787.24	46300.25	971732.41
Net change[4]	-3582.56	0.00	-7410.12	2910.02	0.00	714.67	IE,NA	7033.95	334.05	0.00	0.00

IPBC(2018), wetlands exchange-lessons learned

Global Trend

Australia—Investigating inclusion of a range of activities (extraction)

- Australia has reported coastal wetlands within its GHG inventory, and reported mangroves within its forest category.
- Coastal wetlands are approximately 5% of national carbon stocks in the Forest sector.

- They are examining case studies for a range of activities, e.g. dredging of ports, harbours and marinas maintain navigable passages for boating and shipping and excavation due to canal estate development; and excavation for aquaculture.
- They convened a technical expert panel to provide advice on implementation of *2013 Supplement* for coastal wetlands within national GHG accounts.
- In the future, Australia plans to continue to incorporate new data to improve model values and identify and incorporate new activities to extend activity data coverage.

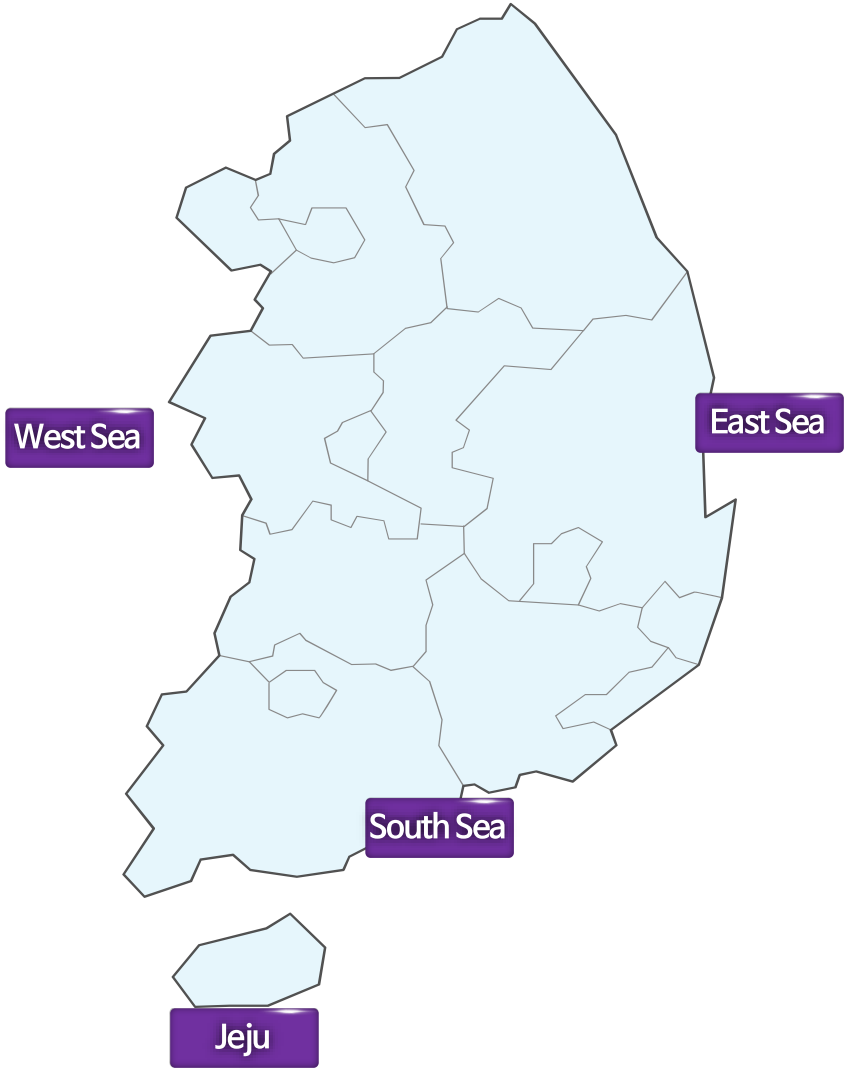
IPBC(2018), wetlands exchange-lessons learned

II. Research Plan

- (Title) Development of Blue Carbon Information System and its Assessment for Management

Blue Carbon R&D

Range of Blue Carbon Study



Time Range

- 2017~2021 (5Years), 9 million US$

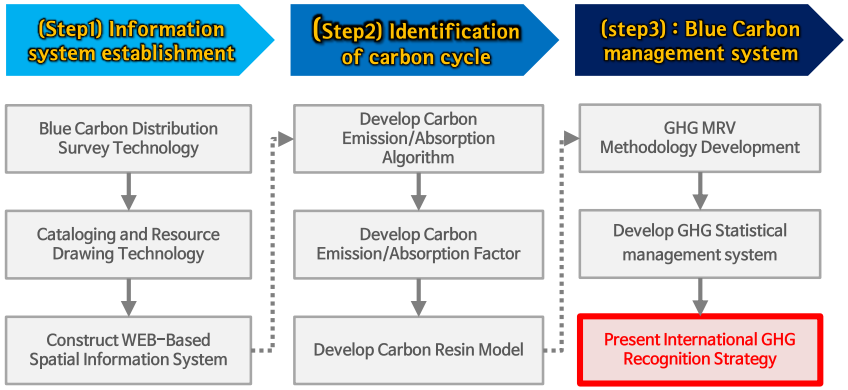
Systematically Promote with
3Steps(Introduction-Diffusion-Settlement)

Space Range

2017
Ganghws Is.,
Garolim Bay,
Suncheon Bay

2018~2021
20sites

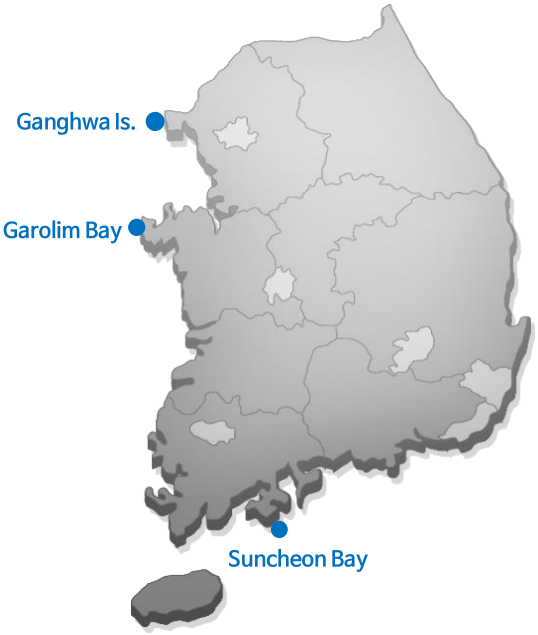
Content Range



Blue Carbon R&D

Annual Survey Plan

Pilot Survey(2017)



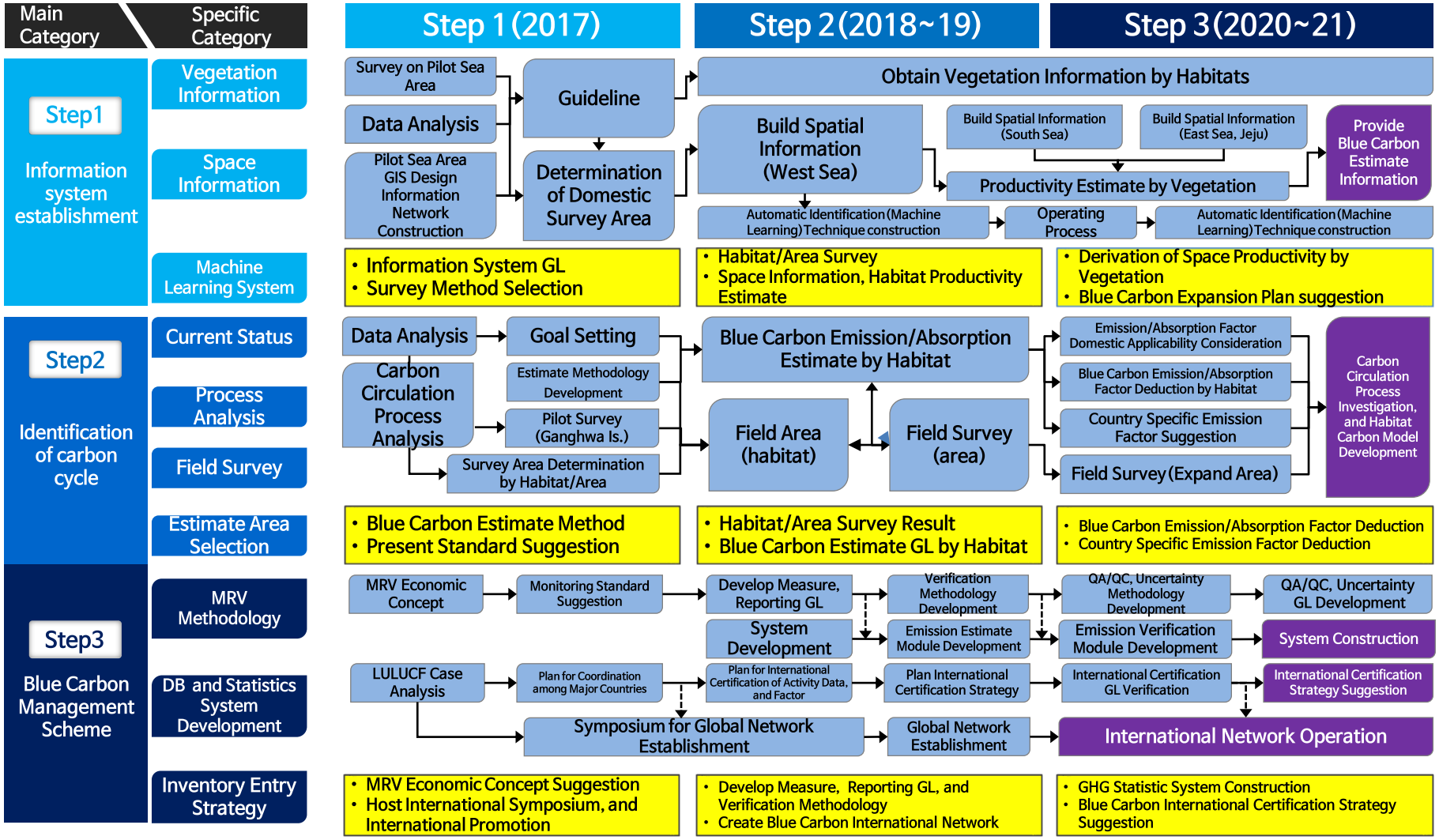
- Investigate Carbon Cycle Process through Domestic, and Foreign Literatures
- Measure Organic Carbon Change by Time Serious in Pilot Survey Area

Practical Survey(2018~2020)

- **Measure, and Analyze Organic Carbon Change by Time Serious in Blue Carbon Area - Carbon Measure, and Analyze in Tidal Flat(20 area), Saltmarsh(18area), and Seagrass(7area)**

Blue Carbon R&D

Roadmap of blue carbon research

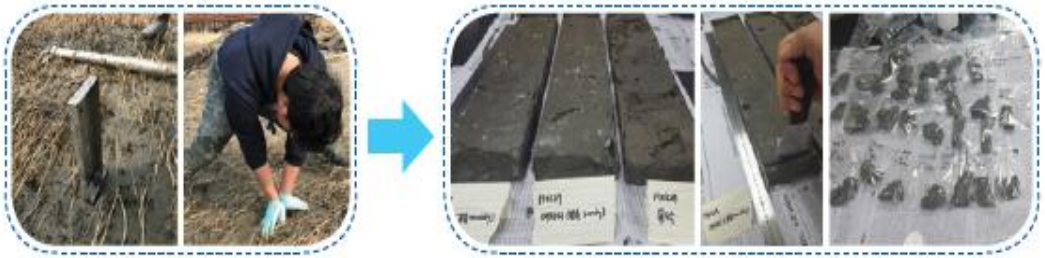


III. Recent Main Result

▪ 2017~ 2018. 11.

How to Estimate

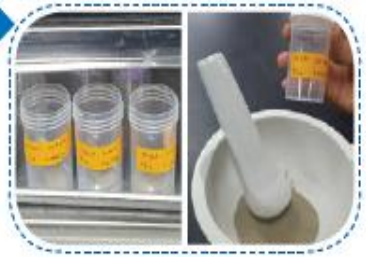
Estimate of Coastal Wetland Carbon Storage



1 Field sampling 1-3m depth coring at field sites

2 Sample separation by depth The sample were cut by depth (1cm)

3 Oven drying Measuring **bulk density** after the oven drying (65℃, 72h)

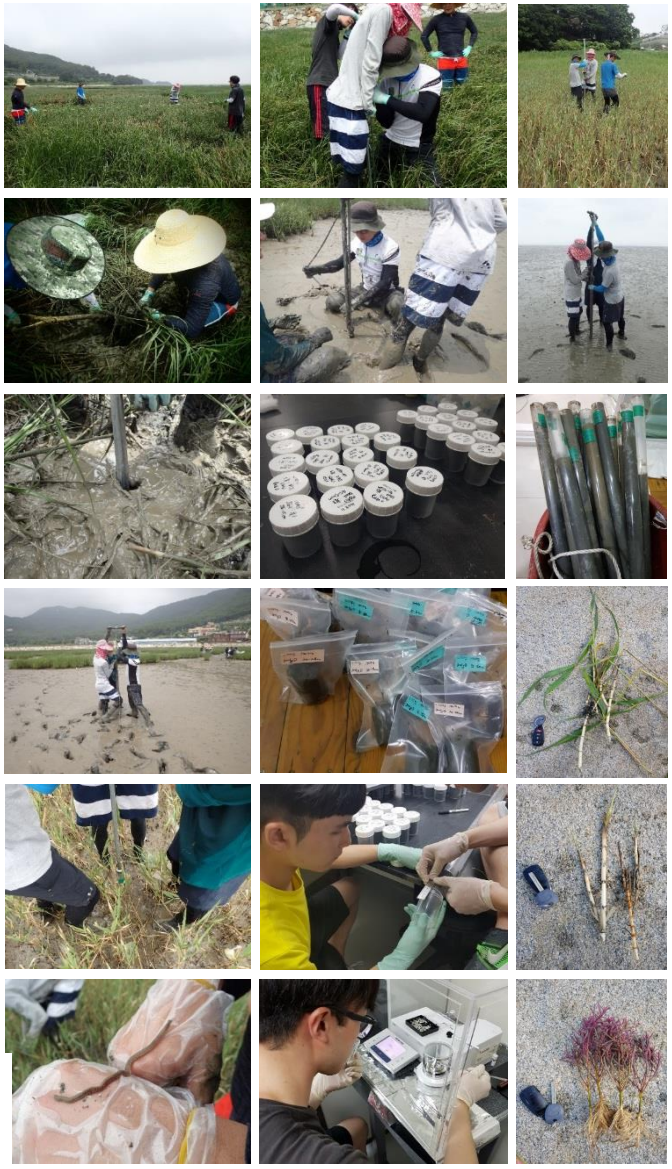


4 Grinding the Dried samples

5-1 High temperature drying Measuring **organic matter(OM)** after drying at 550 ℃, 4h

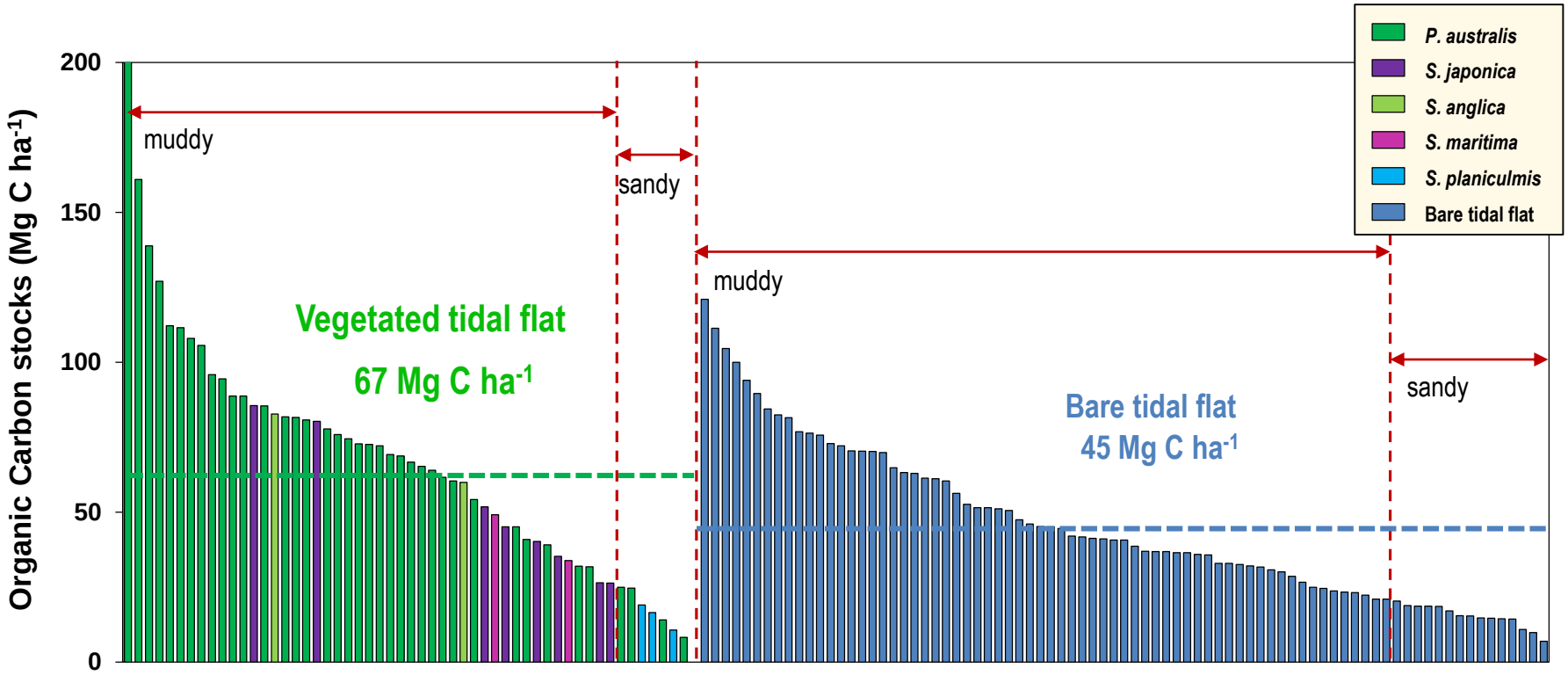
5-2 Freeze-drying Measuring **total organic carbon(TOC)** content after 1M-HCl treatment and freeze-drying for about 12-24 h

*Carbon content(%) and carbon stable isotope ratio in samples

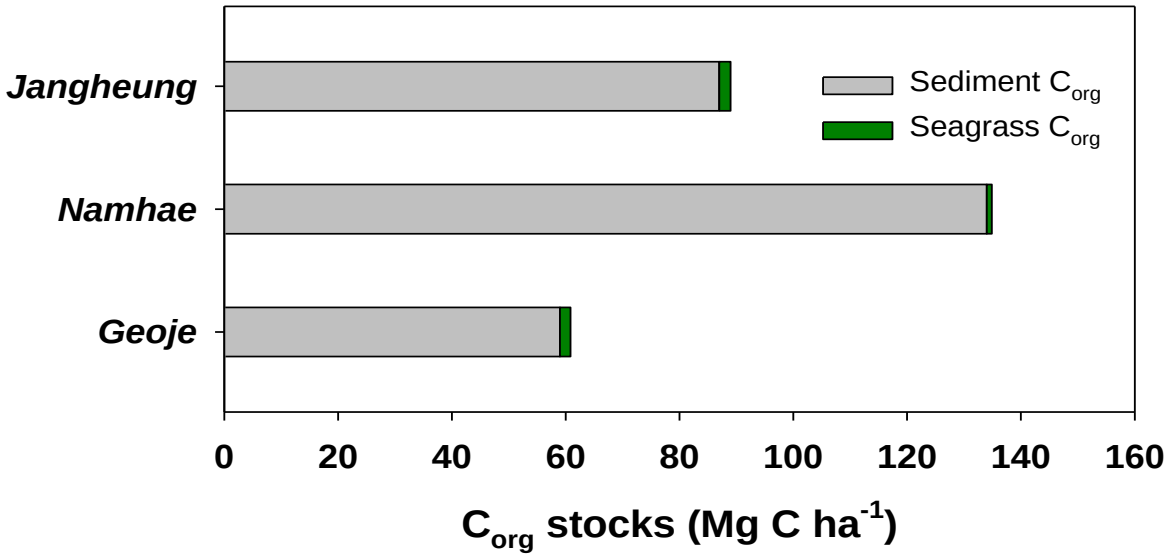


Results of Organic Carbon Storage in Tidal Flat Sediments

- Relatively Higher Organic Carbon Stocks in Vegetated Areas than Mudflat
- Organic Carbon Storage Ability of Vegetated Area is 150% Compared to Non-vegetated Area



Result of Zostera marina meadows

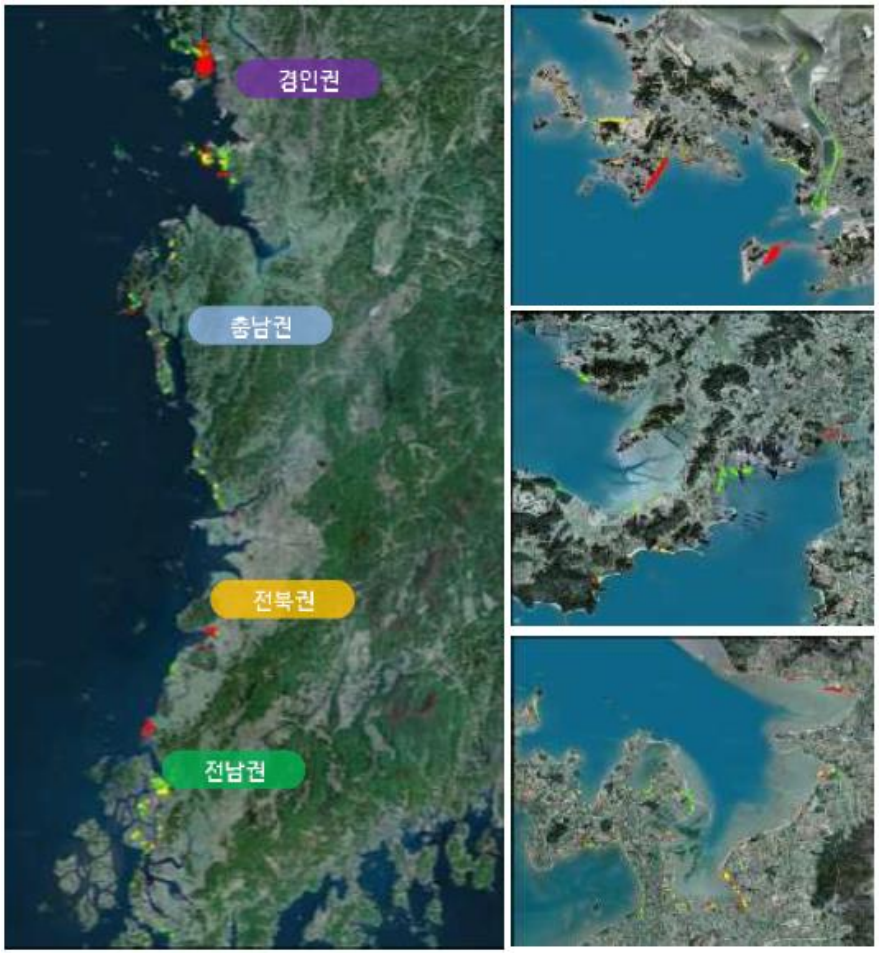


Site	Sediment (Mg C ha^{-1})	Seagrass (Mg C ha^{-1})
Jangheung	87	2.0
Namhae	134	0.9
Geoje	59	1.9

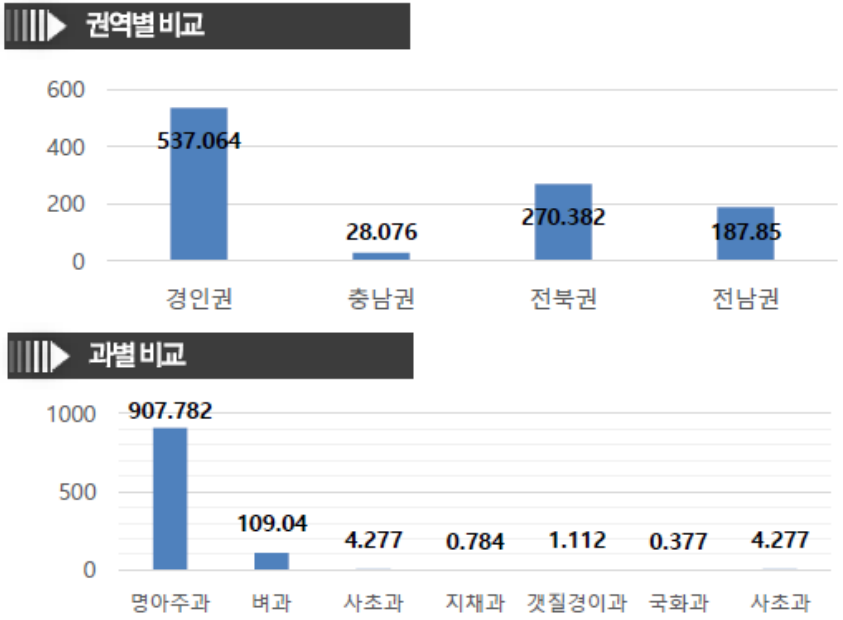
Result

Survey on the Distribution of Saltmarsh in the West Coast

Survey Area of Saltmarsh Distribution



Distribution Estimate Result



구분	경인권	충남권	전북권	전남권	계
명아주과	467.496	5.656	266.242	168.388	907.782
벼과	67.365	20.137	4.134	17.404	109.040
사초과	1.861	2.233	0.004	0.179	4.277
지채과	0.342	0.050	0.002	0.390	0.784
갯질경이과	-	-	-	1.112	1.112
국화과	-	-	-	0.377	0.377
사초과	1.861	2.233	0.004	0.179	4.277
계	537.064	28.076	270.382	187.850	1,023.372

** Estimation through Hyper Spectral Images

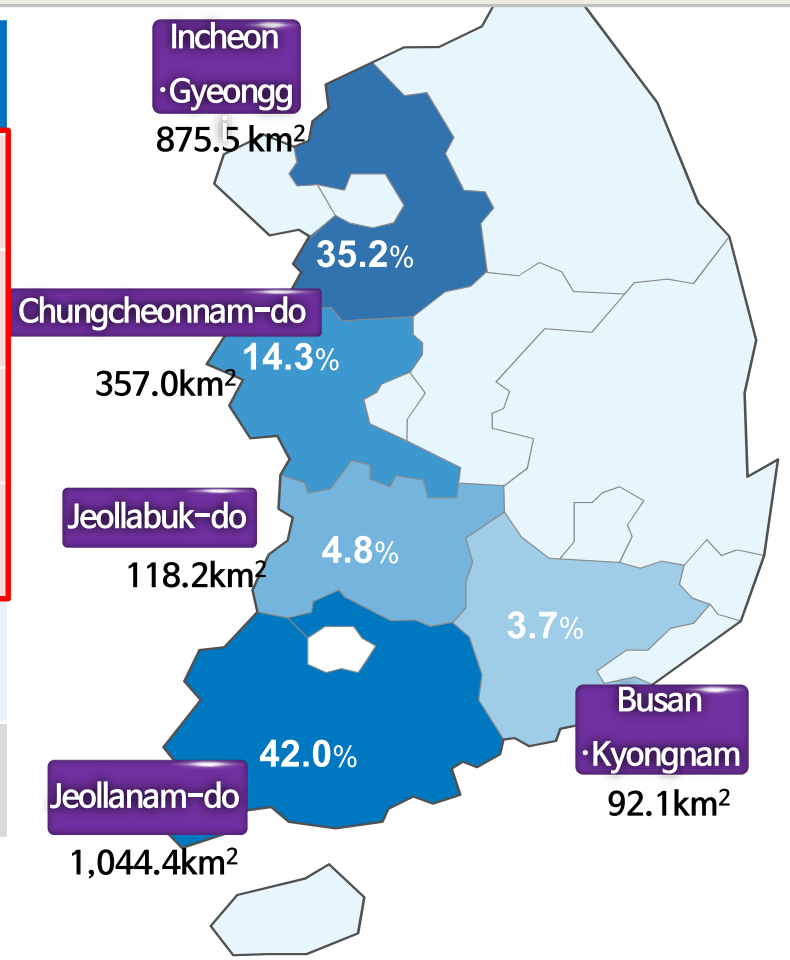
Source) 초분광센서를 활용한 서해안 염생식물 및 잘피숲 조사 현황('16, FIRA)

Result of National Tidal Flat Area Distribution Survey

- Approximately 96.3% (2,395.1 ㎢) of the Total Tidal Flat are Distributed in West Coast Area, and Rest are Located in South Coast
- Area of Mud Flat are Estimated in National Statistic, While Area of Saltmarsh are Not Included in National Statistics

	Area (㎢)	Ratio (%)
Incheon·Gyeonggi	875.5	35.2
Chungcheonnam-do	357.0	14.3
Jeollabuk-do	118.2	4.8
Jeollanam-do	1,044.4	42.0
Busan·Kyongnam	92.1	3.7
Total	2,487.2	100.0

* Ministry of Oceans and Fisheries Statistics (2014)

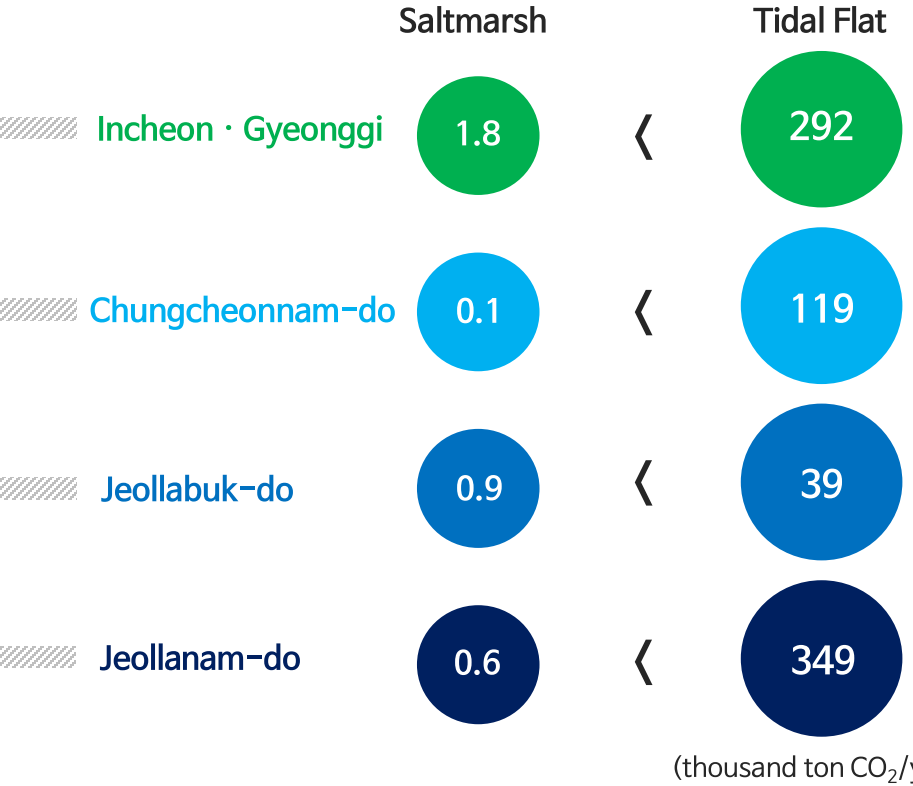


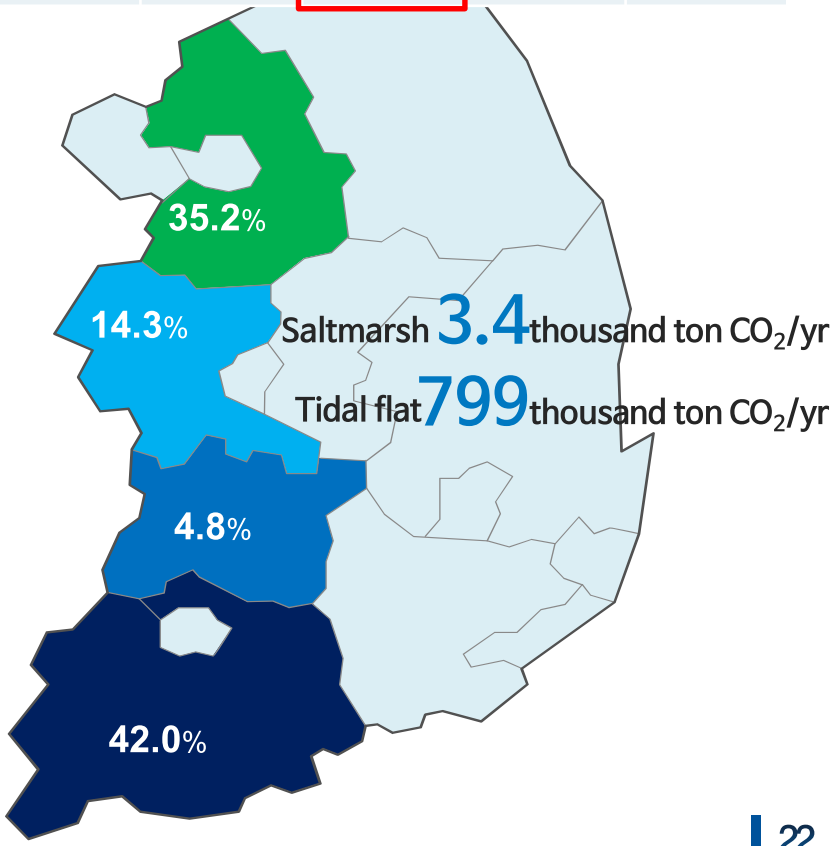
Result

Result of Pilot Survey (West Coast)

	Area (km^2)	Absorption Factor*(TonC/km^2· yr)			Carbon Absorption(Ton C/yr)			CO_2 Absorption(tonCO_2/yr)		
		Average	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum
Saltmarsh	10.2	91.0	465.0	5.0	931	4,757	51	**3,413**	17,442	188
Mudflat	2,395.1	91.0	465.0	5.0	217,954	1,113,722	11,971	**799,165**	4,083,646	43,910

* IPCC 2013 Guideline Factor





Result

Outcome of R&D

Eff. Date: Replaces SOP:

Seoul National University
School of Earth and Environmental
Laboratory of Marine Benthic Ecology

STANDARD OPERATING PROCEDURE

퇴적물 내 유기탄소 및 총질소의 안정동위원소비 및 농도측정

Version 1.0 February 2017

Junsung Noh, Yeunjung Lee, Jong Seong Khim

BENTHOS Lab.
School of Earth and Environmental Sciences
Seoul National University
Republic of Korea
T: (02) 872•6750

SOP

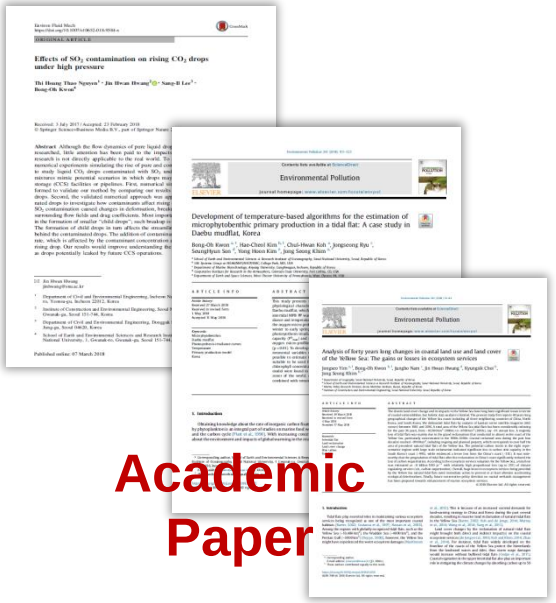
MEASURING, REPORTING, and VERIFICATION GUIDELINE FOR NATIONAL GHG INVENTORY OF COASTAL WETLANDS
연안습지 국가온실가스 통계 산정·검증·보고(MRV) 지침

CATEGORY 산정부문	COASTAL WETLAND 연안습지	CRF CODE	5D

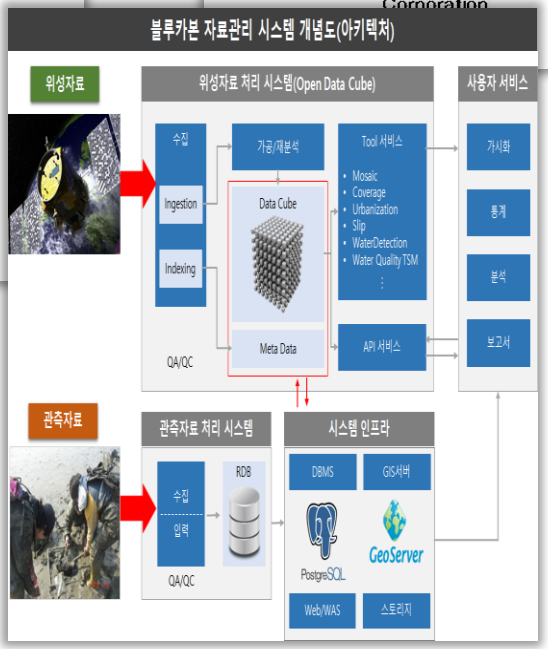
2018.00

Korea Marine Environment Management Corporation

MRV



Academic Paper



Data Base

IV. Challenges and lessons

Challeges &lesssons

Survey location&cycle

▪ What are the criteria to decide a survey location&cycle?

→ We handled this problem in SOP briefly. But, I think that we need more study and field survey.

Activity Data

▪ How do we get past activity data to monitor greenhouse gas?

→ We will study using a satellite photograph next year.

KOEM's event

Blue carbon workshop

UNFCCC COP24 Side event with INTERNATIONAL PARTNERSHIP FOR BLUE CARBON

- **(Date)** 11.Dec.18.
- **(Location)** Korea pavilion, Katowice, Poland
- **(Title)** International updates on blue carbon science and knowledge, international partnership for blue carbon
- **(Objectives)** Sharing International updates on blue carbon research and policy implication


THANK YOU
FOR YOUR ATTENTION