
EAS Congress 2015
Workshop 3.2 Future of Coastal Cities

Blue Carbon challenges of FutureCity Yokohama

November 19th, 2015

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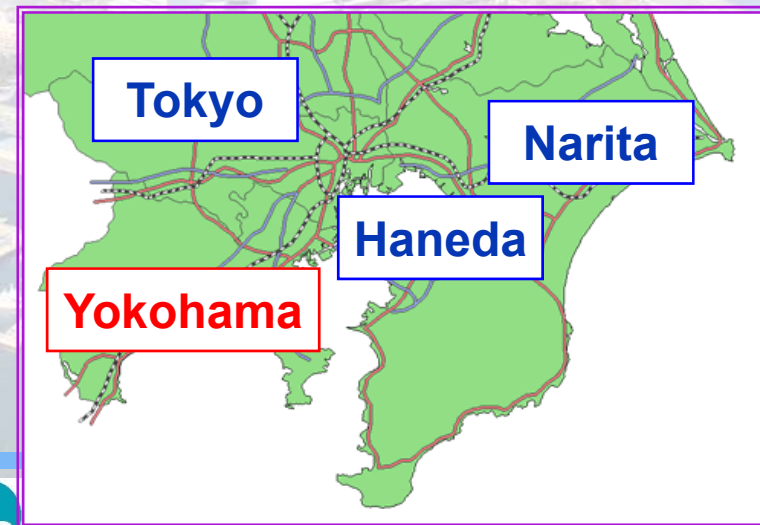
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About Yokohama



- International port city
 - Opening of port of Yokohama in 1859
- Population: approx. 3.7 million
 - Largest city in Japan
- GDP: approx. 12.8 trillion JPY
 - (approx. 110 billion USD)
- 21 minutes from Haneda Airport (Tokyo)
- Rapid growth and urbanization



~ Challenges that have been overcome in the past ~

1859 Yokohama Port Opening

When opening: There was only a small village of 100 huts

After opening: Yokohama became the international gateway of Japan



1923 The Great Kanto Earthquake

Although Yokohama suffered devastating,
the backbone of the current city was formed out of its reconstruction.

1945 Bombing of Yokohama

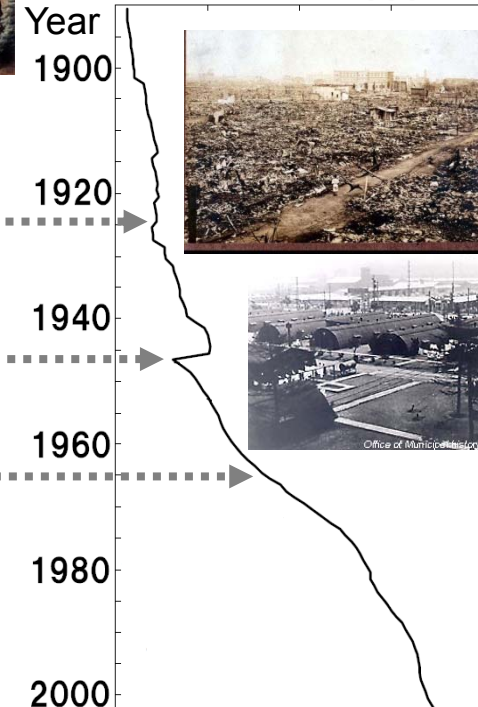
Takeover the pivotal part of the city by the U.S. military

1965~ High-growth period

Population concentration ⇒ unregulated sprawl ⇒ **Rapid deterioration
of the living environment**

Population (10,000 persons)

0 100 200 300



"5 Great War" and "6 Big Business" of Yokohama

5 Great War: Garbage, Environmental destruction, Water resources, Road traffic, Public land

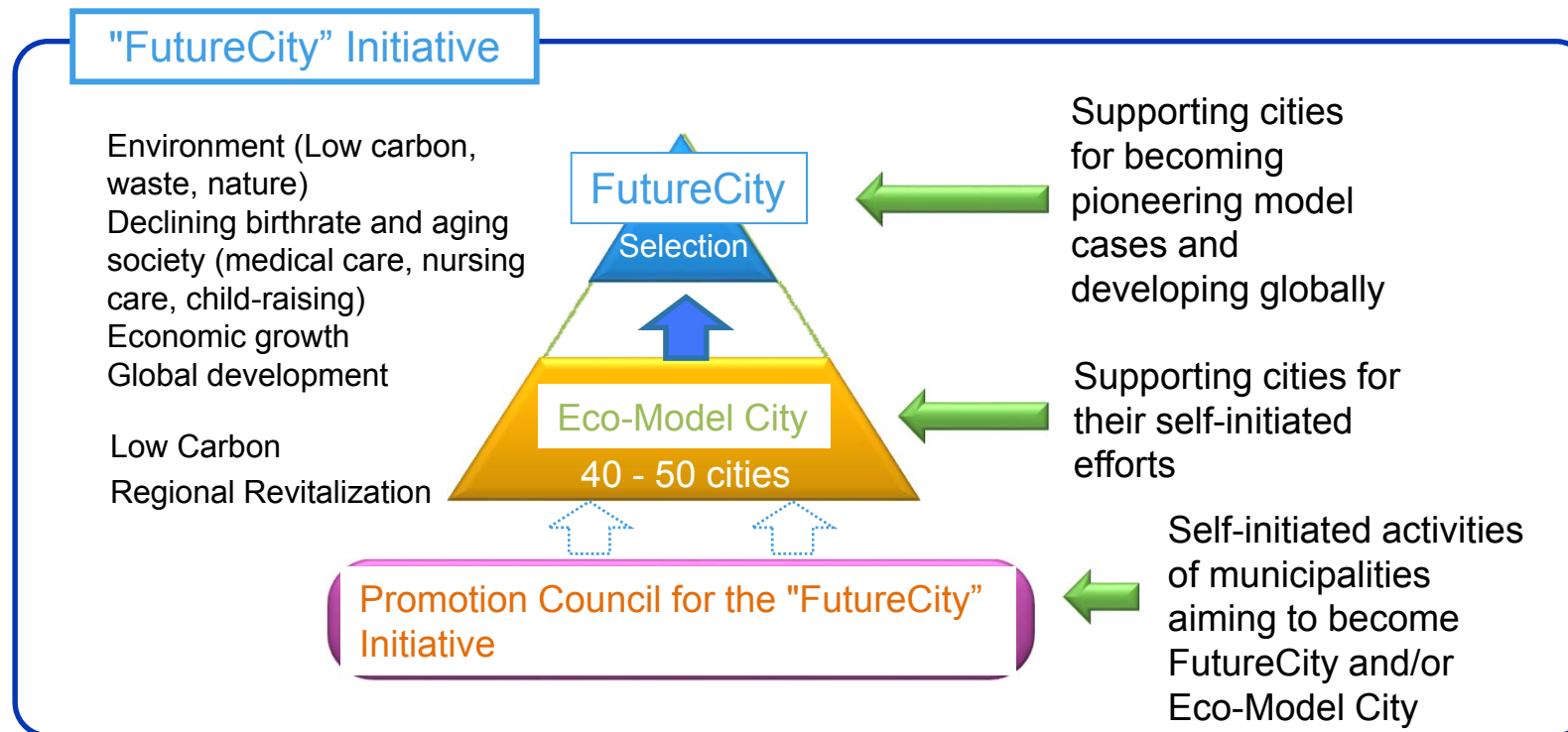
6 Big Business: Strengthening of the urban area (Minato Mirai 21. etc), Construction of Bay Bridge

FutureCity

- Sustainable city at higher levels in environmental, social and economic perspectives.
- **11 cities and areas were selected in 2011** with the basic concept of creating a city with new people-friendly and environment-friendly values to address super-aging of the society

Eco-Model City

- Low Carbon Cities to support the foundation of "FutureCity" Initiative
- **Total of 20 cities (13 cities in 2008 and 7 cities in 2011)** was selected as cities and areas to challenge pioneering efforts with high targets aiming to realize Low Carbon society by measures such as drastic reduction of greenhouse gas emissions.



* Non-members of the Promotion Council can apply for the Eco-Model City.

Source: Documentation on "FutureCity" Initiative, Regional Revitalization Office, Cabinet Secretariat

In 1950: Yokohama international port city construction act enacted.

In 2007: Basic Act on Ocean Policy enacted.

In 2013: New Basic Plan on Ocean Policy formulated.

<Efforts by the City of Yokohama>

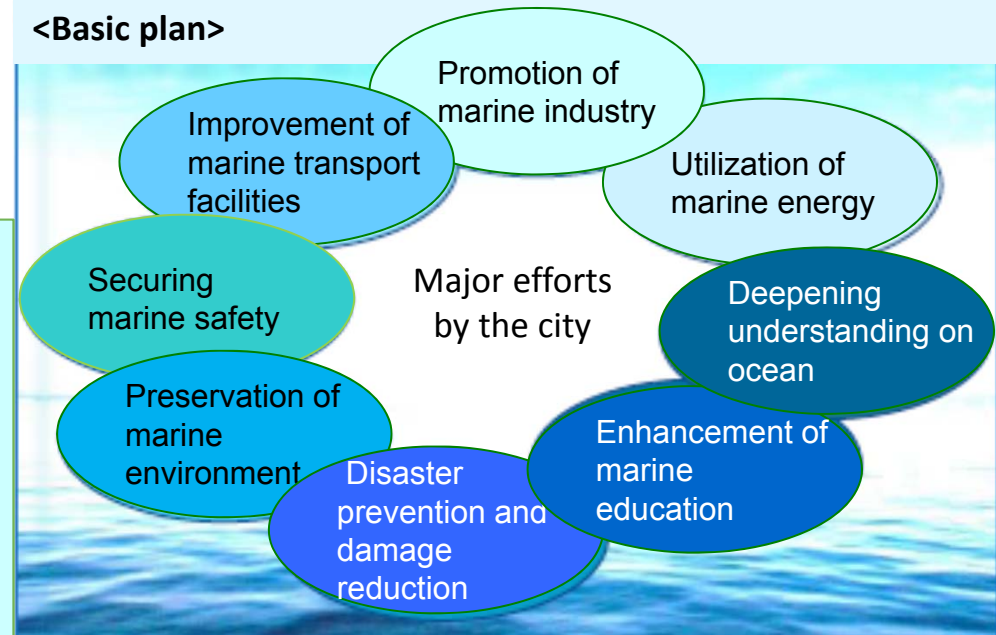
- ◆ Efforts for marine environment preservation
- ◆ Further development of efforts as Ocean City through measures such as ocean education

Basic Act on Ocean Policy

Aiming to realize a new oceanic State with the followings in mind:

- ◆ The ocean is indispensable for maintaining the lives of the living beings including mankind
- ◆ Peaceful and positive development and use of the oceans
- ◆ Conservation of the marine environment

<Basic plan>



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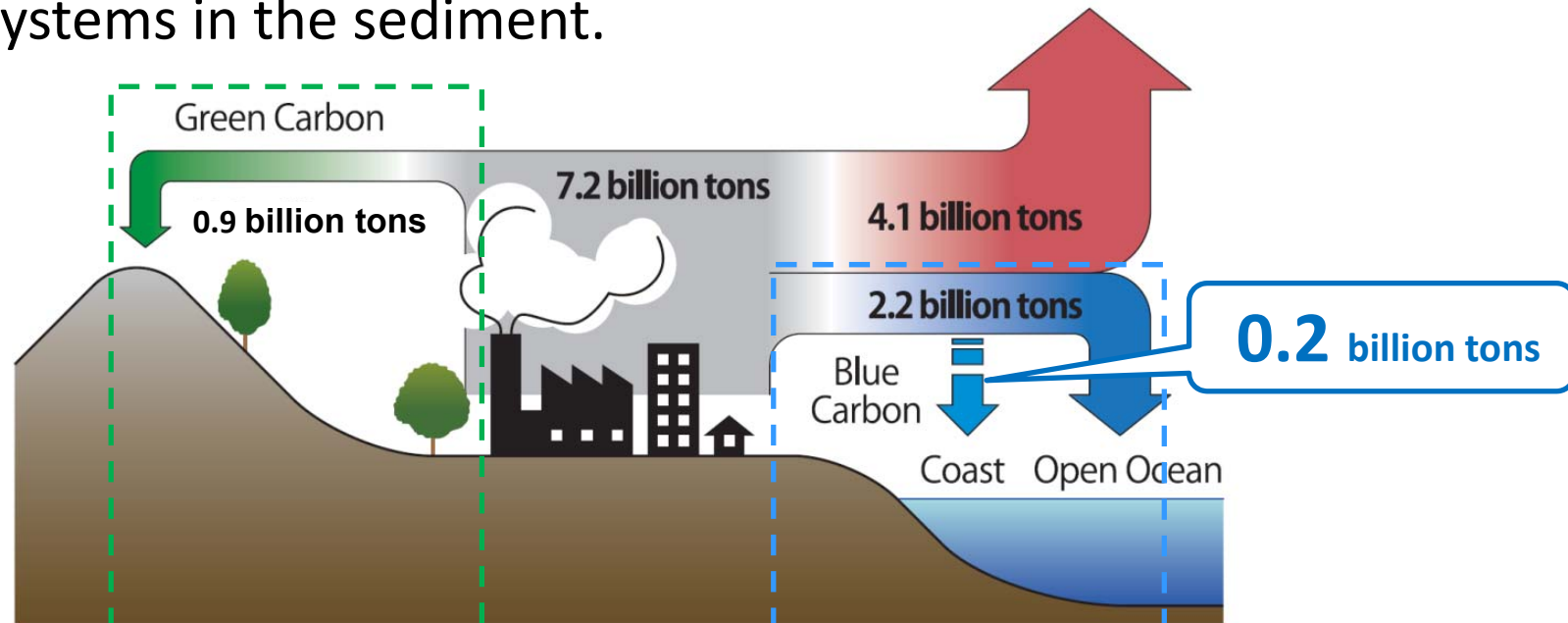
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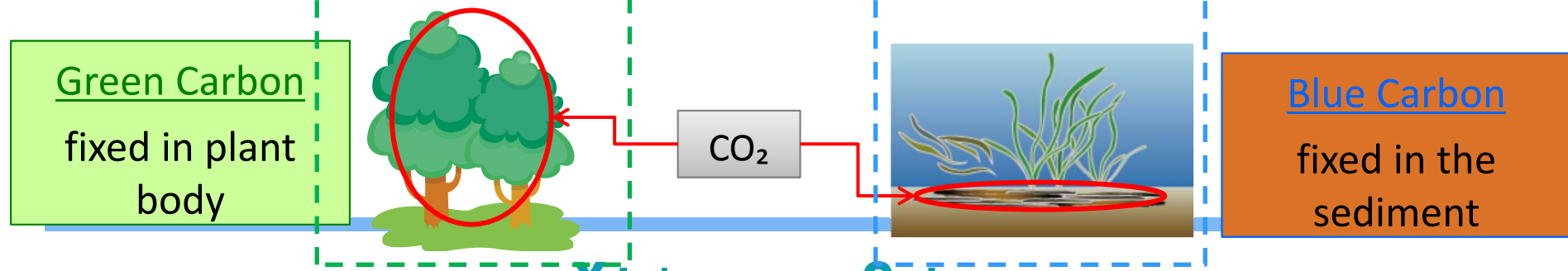
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What is “Blue Carbon” ?

- **“A carbon captured by ocean and coastal ecosystems”.**
- It is said that 0.2 billion ton carbon is fixed annually by coastal ecosystems in the sediment.



Source: Creating from IPCC 4th Assessment Report



* The number shown in above : Quantity of carbon per year

Expectations

UNEP developed the report “Blue Carbon” in 2009

⇒ Visibility of Blue Carbon has increased

The SBSTA proposed,

“Blue Carbon” to be discussed in islands countries.

⇒ **Blue carbon is expected as new carbon sink***



Challenges

Scientific knowledge about quantity of CO₂ fixation is lacking.

⇒ Non-approved method in the Kyoto Protocol

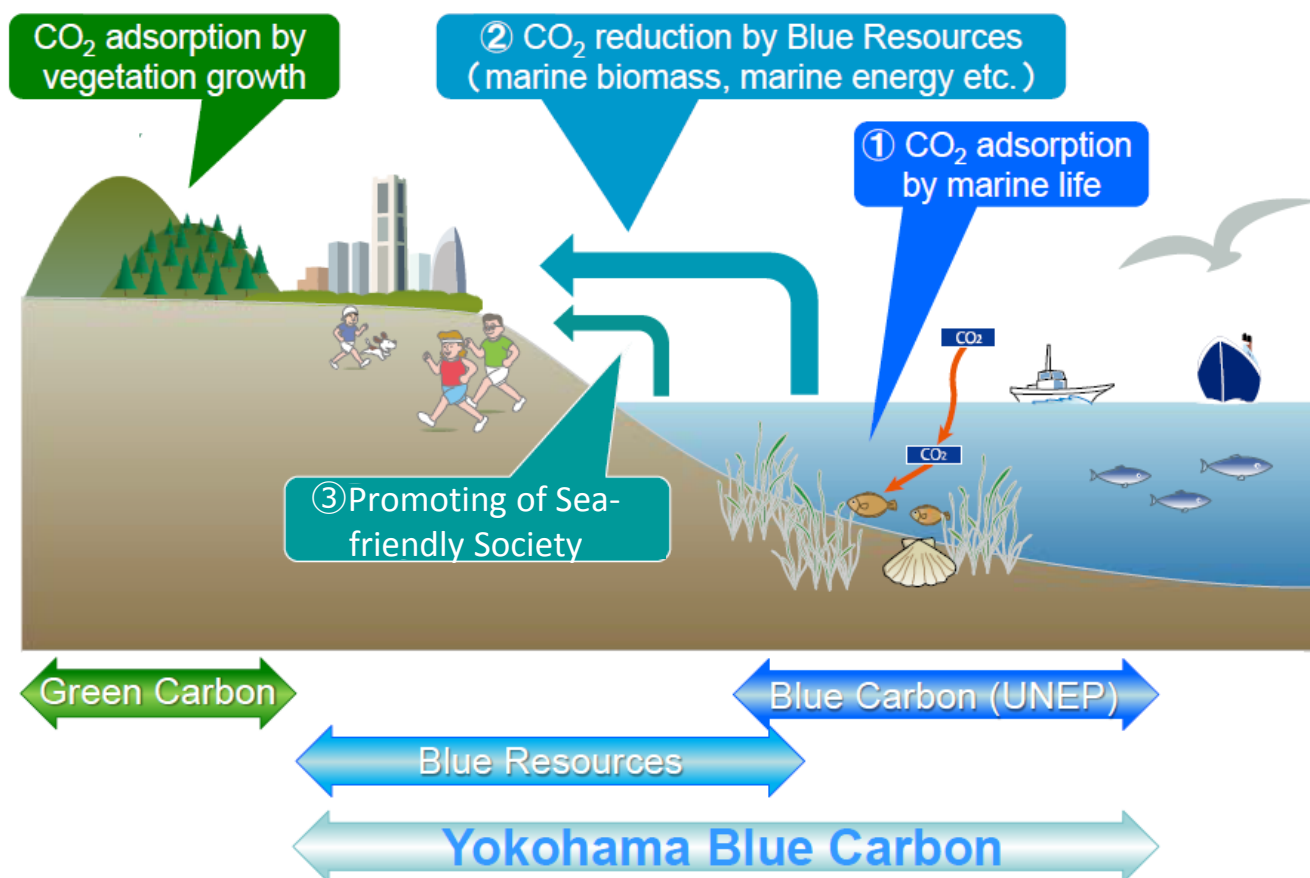
⇒ **Action to increase the quantity of CO₂ fixation by Blue Carbon hasn't been promoted.**

* Tokoro et al., 2013

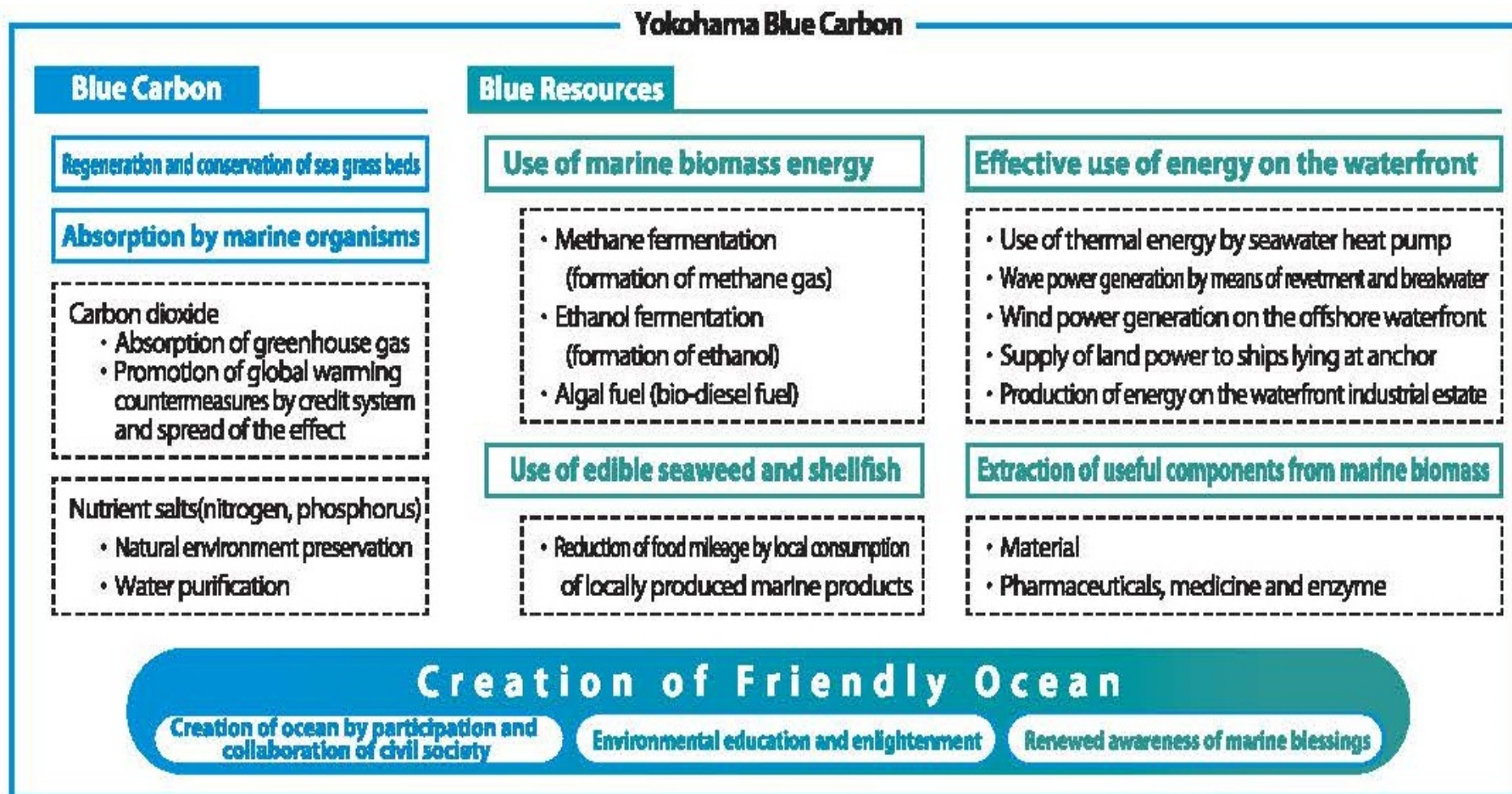
Yokohama Blue Carbon Project (YBCP)

= Blue Carbon + **Blue Resources***

+ **Promoting of Sea-friendly Society**



* Utilization of marine biomass and marine energy



① Application of local rules

- The City of Yokohama should proactively support environmental activities in the city.
- However, measurement and monitoring methods of greenhouse gases are not yet established.
 - ➡ ☆ We will promote the world's first measures in Yokohama promptly.
 - ☆ By utilizing Yokohama's local rules (as simple as possible while introducing latest knowledge), create and utilize carbon credit.
 - ➡ ☆ At the same time, by constantly monitoring the effects of measures, acquire scientific proof of the effects.
 - ☆ Review the rules flexibly when appropriate.

② Promoting participation of citizens

- To further develop this project, understanding and cooperation from participating citizens and companies are essential.
 - ➡ ☆ Explaining simply greenhouse gas fixation and reduction mechanisms in the project to deepen understanding.
 - ☆ Increasing opportunities for citizens to participate in creation and utilization of carbon credit.

③ Co-benefit assessment

- It is important to offer co-benefit so that the project is differentiated from other carbon credit projects and participants will purchase credits from this project.
 - ➡ ☆ Assessment of various values such as improvement in water purification and biodiversity.

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Targets for Yokohama Blue Carbon

Global advantage

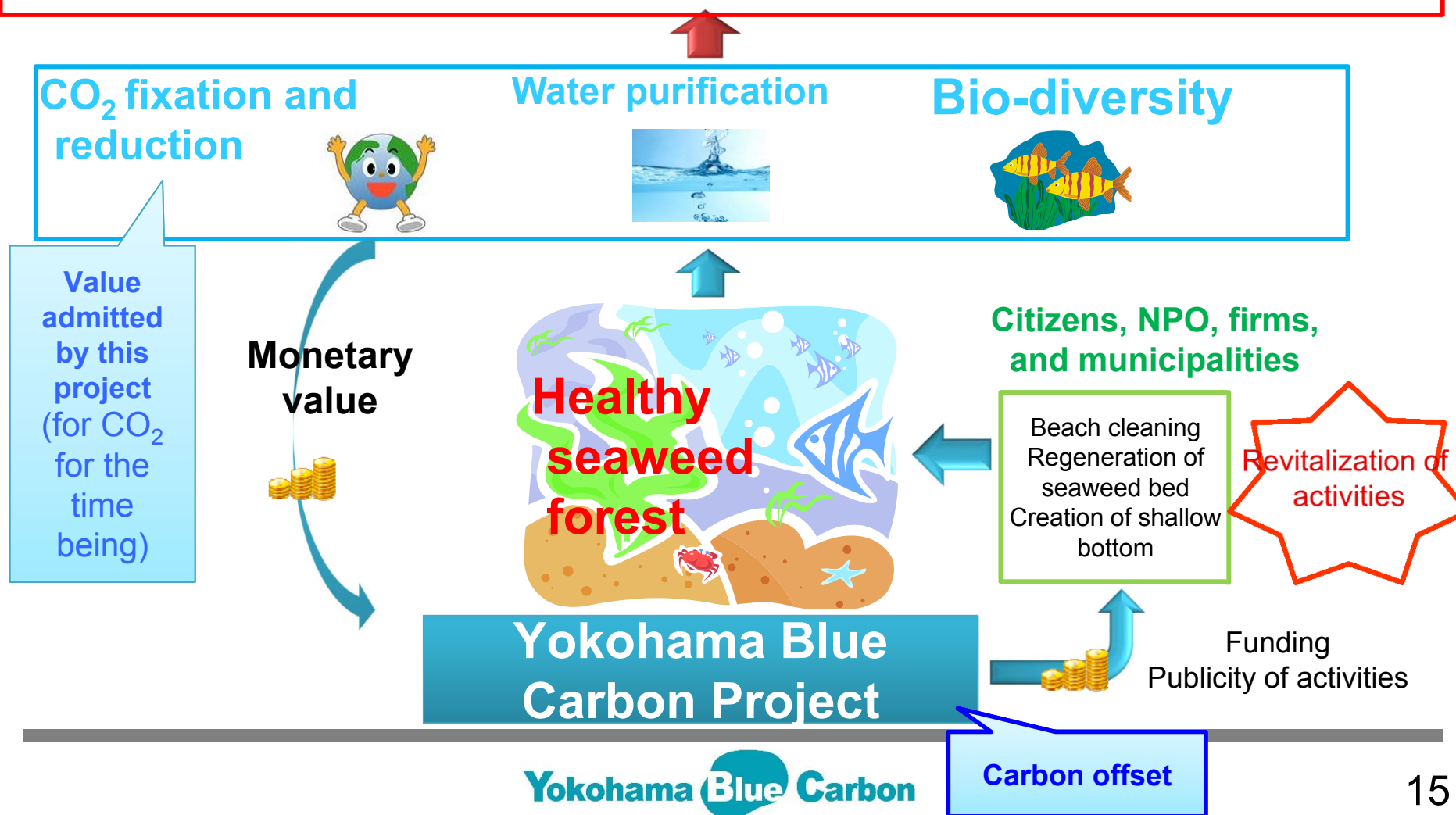
Prevention of global warming
Sustainable future

Yokohama's advantage

Establishment as "Ocean City"
Economic effects in the city

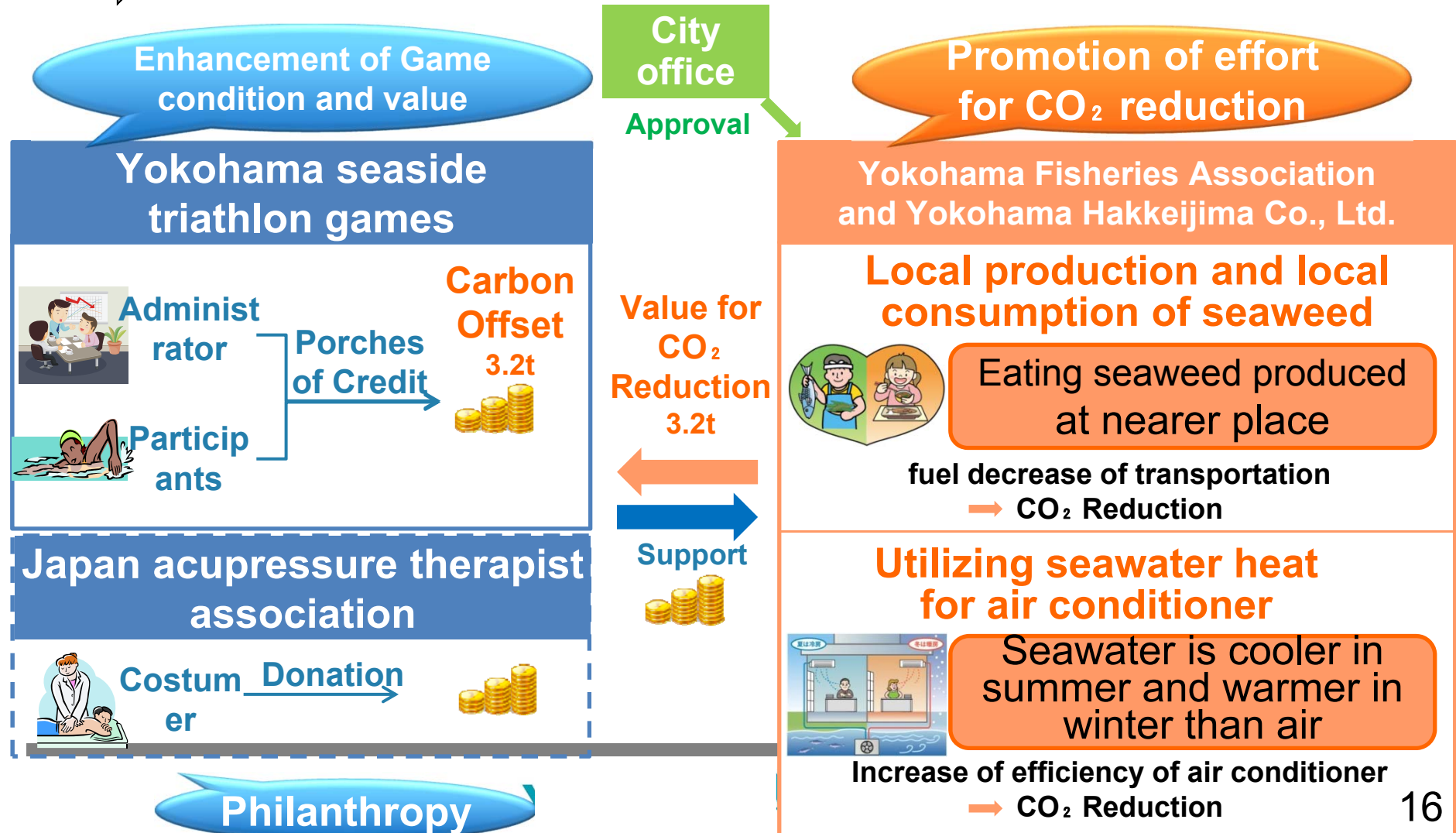
Yokohama citizens' advantage

Improved pride for the city
People-friendly ocean



Yokohama City approved CO₂ reduction by **Blue Resources**

→ **Carbon-offset** of the Triathlon Games



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- In 2014, the main topics of experiment is CO2 reduction from Blue Resources.
- In 2015, the city examined the means of calculating quantities of **CO2 fixation from Blue Carbon (reviving eelgrass bed)**, which is the core of the YBCP.

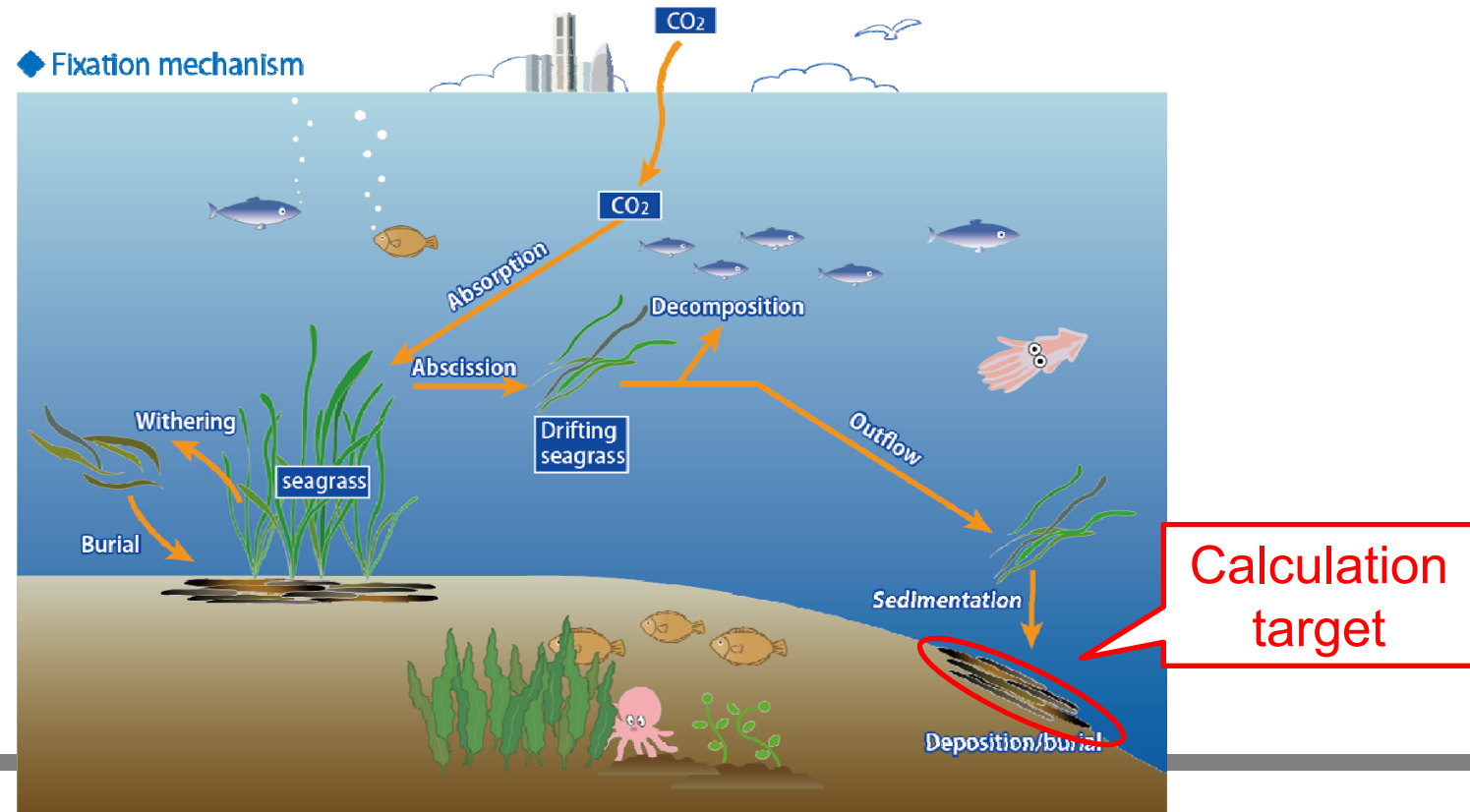


A NGO has revived eelgrass bed since 2003 at
Yokohama Sea park

⇒Evaluating quantity of CO₂ fixation by the eelgrass bed



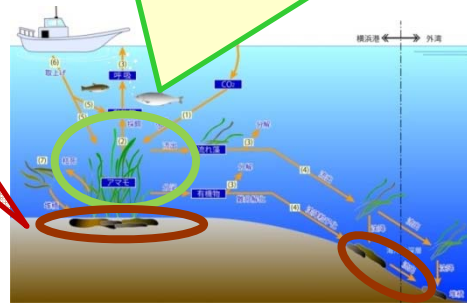
- **“Accuracy”** of quantity of CO₂ fixation and **“Easiness”** of monitoring for citizens is important for methodology.
- It is **difficult to monitor quantity of CO₂ fixation in the sediment directly**
⇒ We developed a **new and simple estimation methodology**



Mechanism of Carbon Fixation

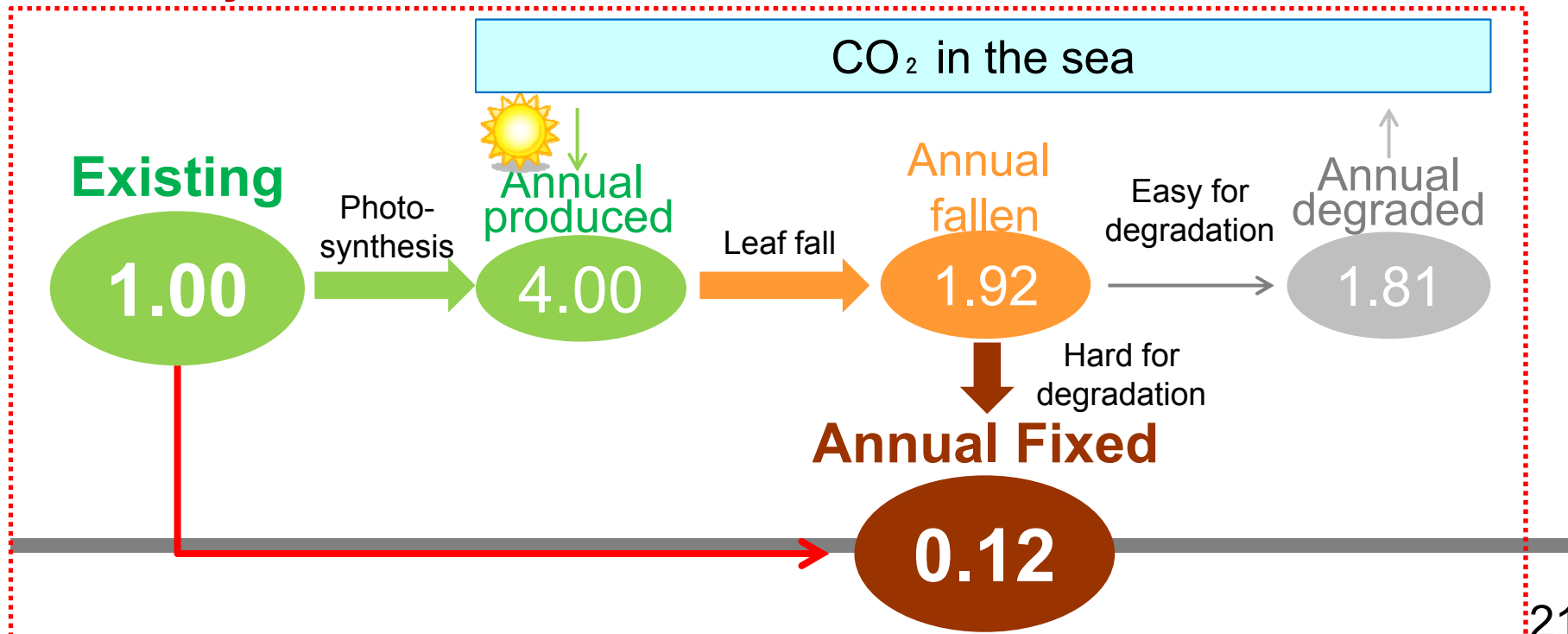
$$\text{CO}_2 \text{ fixation (kg-CO}_2\text{/y)} = \text{Carbon existing in plants (kg-CO}_2\text{)} \times 0.12 (/y)$$

Difficult for monitoring
(deep sea)

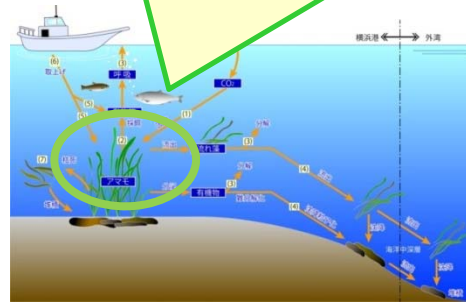


Easy for monitoring
(shallow sea)

Carbon cycle made from literature data



$$\text{CO}_2 \text{ fixation (kg-CO}_2\text{/y)} = \text{Carbon existing in plants (kg-CO}_2\text{)} \times 0.12 (/y)$$



= Area (m²)

→ Distribution Survey + Aerial Photo

× unit wet-weight (kgWW/m²)

→ Unit wet-weight Survey

× (1- water content ratio)

× Carbon content of eelgrass (kg-C/kgDW)

→ Literature data

× 44 / 12 (kg-CO₂/kg-C)

(1) Aerial Photography

taken by Unmanned aerial vehicle (UAV)



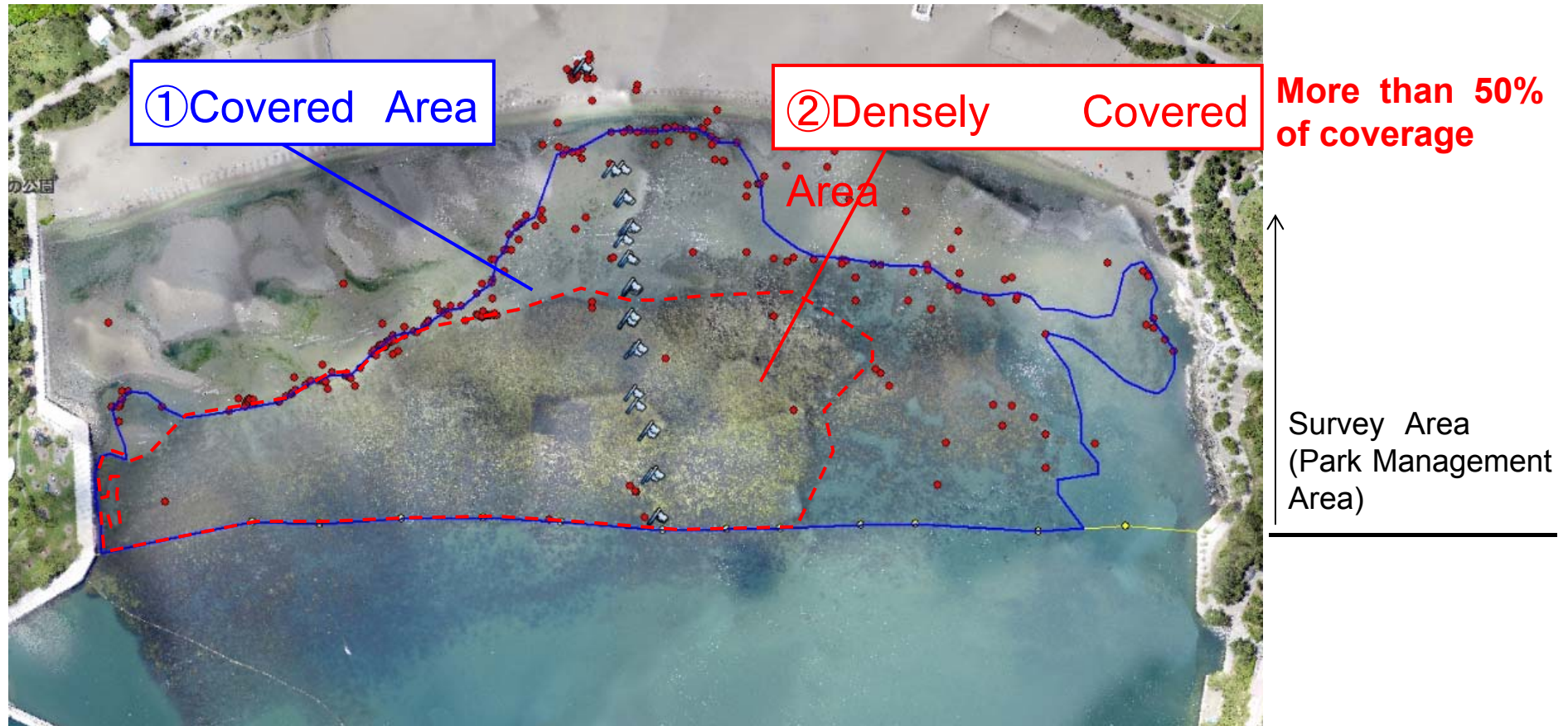
(3) Unit wet-weight Survey



(2) Distribution Survey

with citizens by smartphones





Legend

- : The Plots of smartphone survey by citizens
- : The locations of unit wet-weight survey

- Although the difference of area was large, **that of CO₂ fixation was little**.

	Items	Unit	Result		B/A
			(A) Covered Area	(B)Densely Covered Area	
Measured data	Area	m ²	67,205	51,289	76%
	Unit Wet-weight *	kgWW/m ²	1.175	1.440	123%
	Wet-weight *	kgWW	78,966	73,855	94%
Literature data	Water content ratio	-	0.842		
	Carbon content ration of eelgrass body	kg-C/ kgDW	0.323		
	Coefficient of CO ₂ fixation	/year	0.12		
	Quantity of CO ₂ fixation in above seabed Sea Park eelgrass bed *	t-CO ₂ /year	1.7	1.6	94%

- We considered which method is more suitable
- Evaluation criteria is established from point of view that **citizens can survey continuously**.
- **Method (B) is more suitable.**

	(A) Covered Area	(B) Densely Covered Area
Easiness of survey	× (difficult for citizens)	○
Cost of survey	× (photography by UAV)	○
Easiness of determining covered area	× (consideration for porosity)	○
Quantity of CO2 fixation	○	○
Comprehensive evaluation	×	○

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Achievements

- A world-first practical scheme to promote CO₂ fixation by Blue Carbon is implemented in Yokohama City.
- In social experiment, we quantify CO₂ reduction by “Blue Resources” and CO₂ fixation by “Blue Carbon”.
- Citizens and companies joined the scheme and carbon offset of Triathlon Games was done.

Challenges

- For the full-scale practice in near future, accuracy of quantity of CO₂ fixation by Blue Carbon need to be enhanced.
- More citizens and companies should join YBCP and YBCP should be independent from Yokohama city government economically.