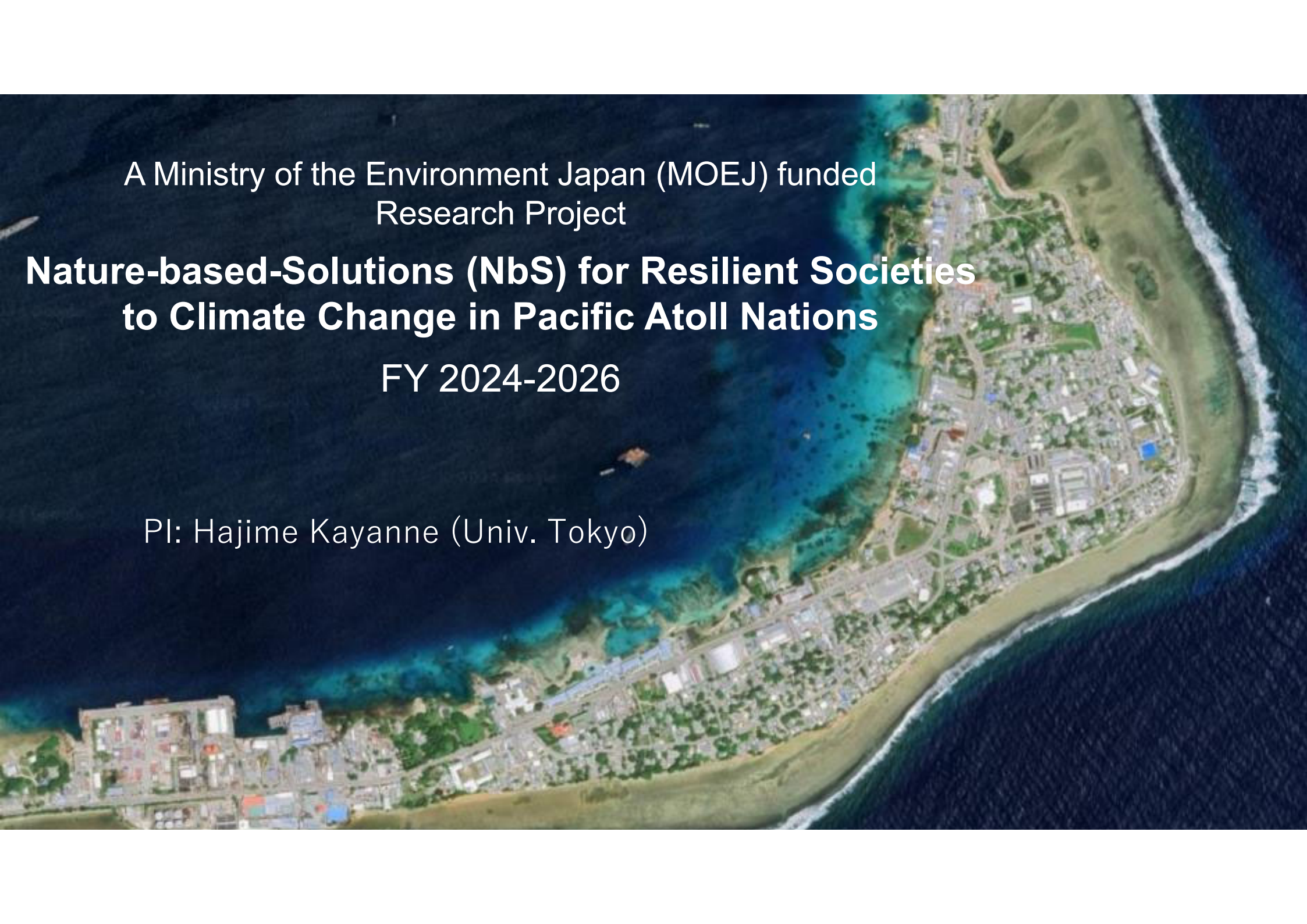


An aerial photograph of a coastal town, likely in a Pacific Atoll Nation, showing a dense cluster of buildings along a sandy beach. The water is a vibrant turquoise near the shore, transitioning to deep blue further out. The town is built on a narrow strip of land, with a small inlet or lagoon visible on the left side.

A Ministry of the Environment Japan (MOEJ) funded
Research Project

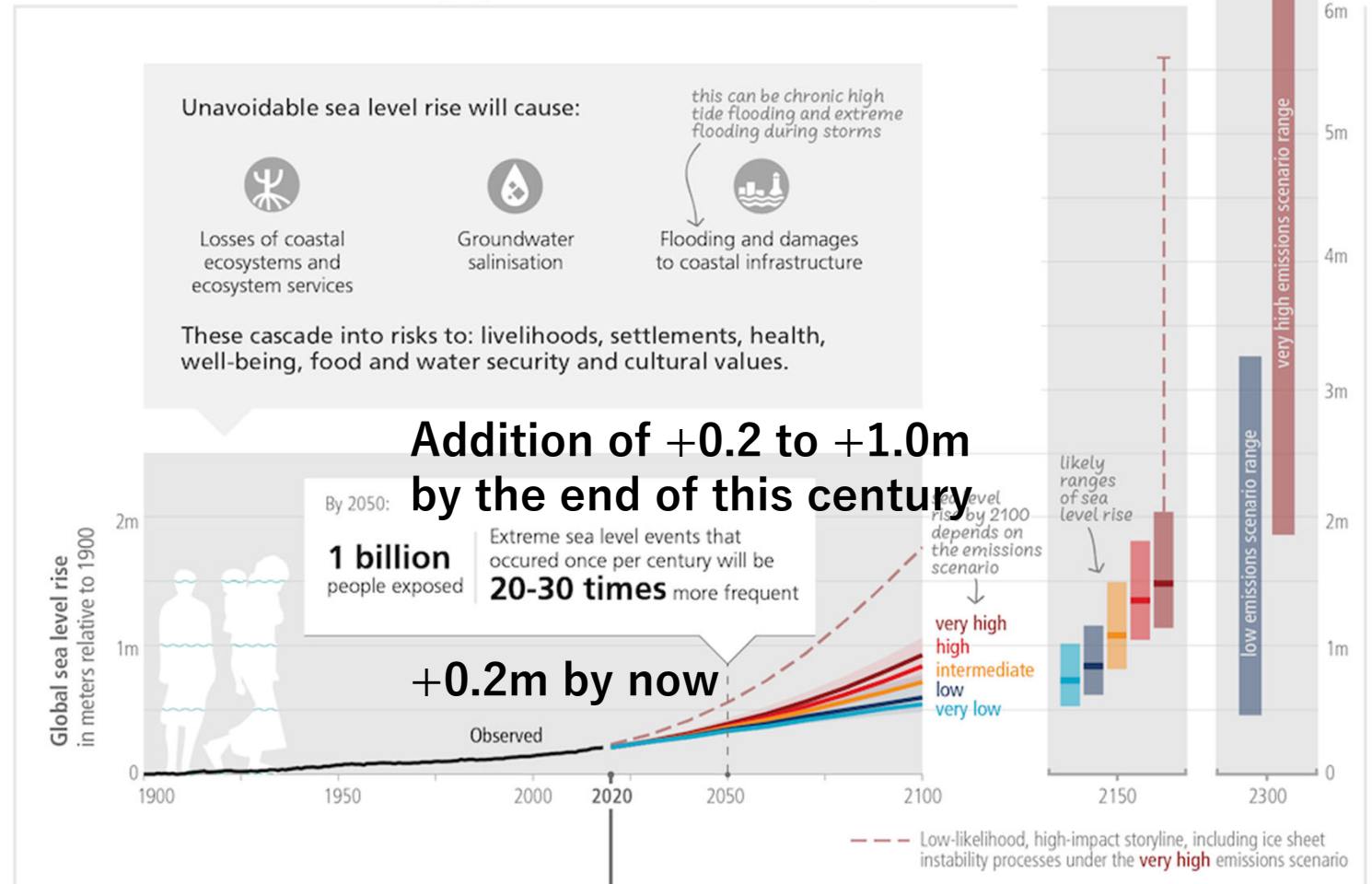
**Nature-based-Solutions (NbS) for Resilient Societies
to Climate Change in Pacific Atoll Nations**

FY 2024-2026

PI: Hajime Kayanne (Univ. Tokyo)

Sea level rise will continue for millennia, but how fast and how much depends on future emissions

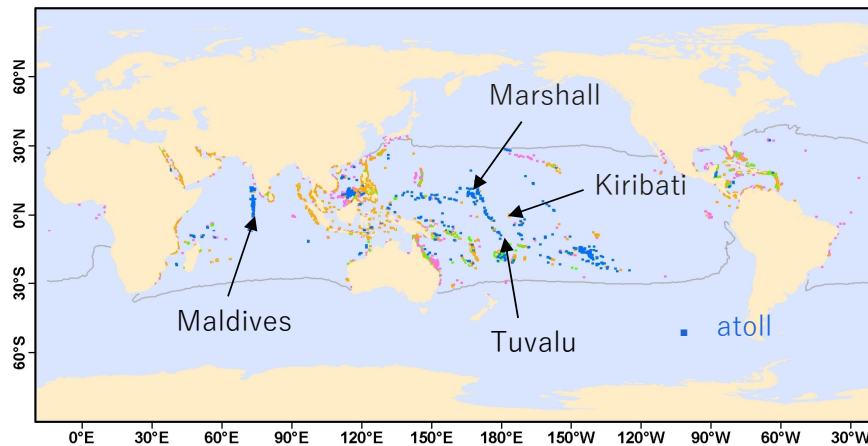
a) Sea level rise: observations and projections 2020-2100, 2150, 2300 (relative to 1900)



Distribution of atolls

Number of atolls

Pacific Ocean	392				
Micronesia	88	Polynesia	107	Melanesia	29
SE Asia	114	Australia	54		
Indian Ocean	67				
Central	41	West	25	Middle East	1
Atlantic Ocean	23				
N. Caribbean	4	W. Caribbean	15	E. Caribbean	4
計	482				

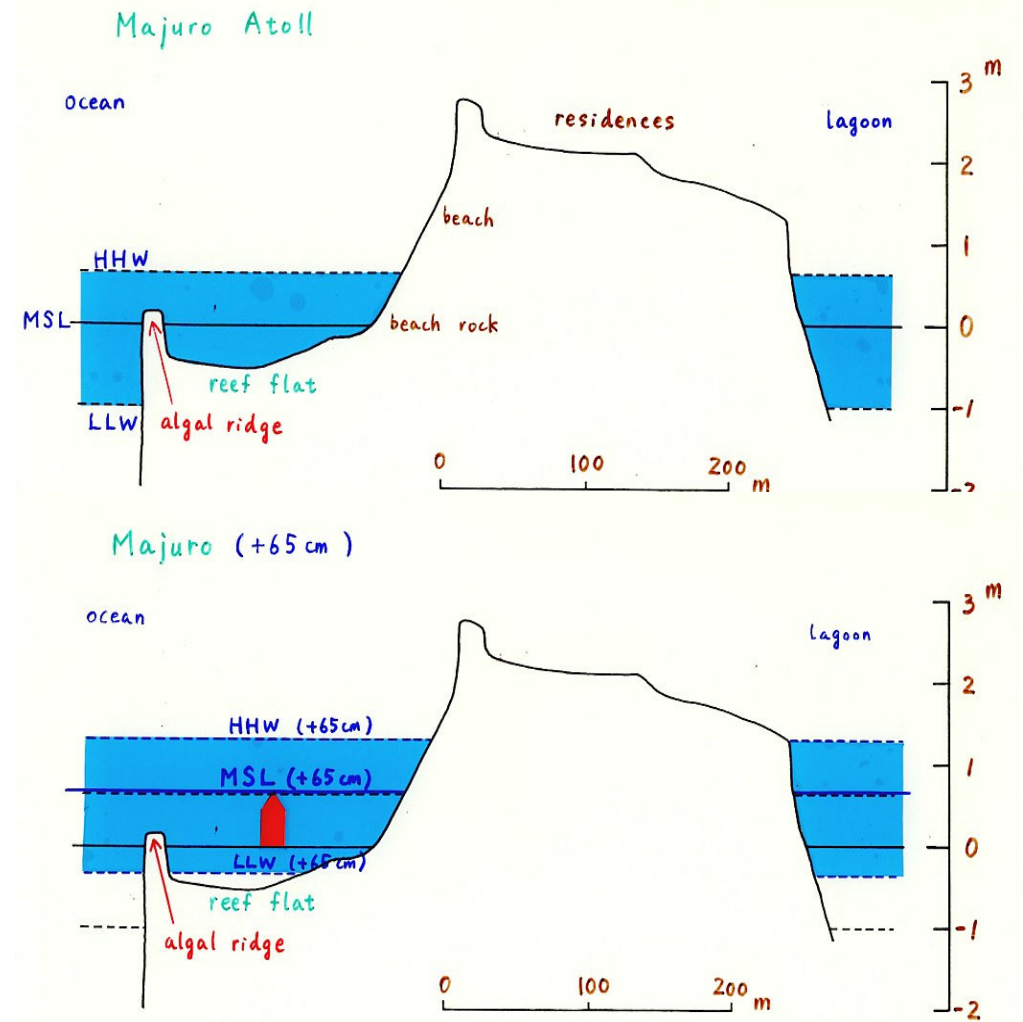


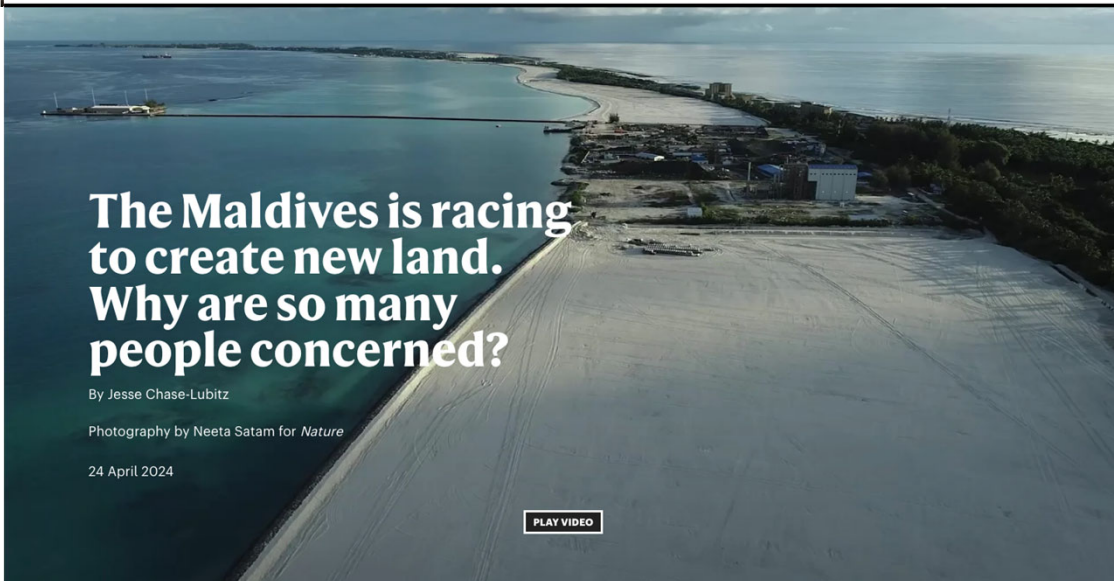
Number of atolls Population (10 thousand)

Pacific Ocean		
Federated States of Micronesia	30(29)	13.3
Republic of the Marshall Islands	28(20)	6.8
Tuvalu	6(5)	1.1
Republic of Kiribati	26(14)	9.2
Cook Islands	8(6)	2
French Polynesia	79(43)	24.9
Indian Ocean		
Republic of Maldives	22(22)	30.1
Total		87.4



Atoll island under threat







coral reef



coral gravels

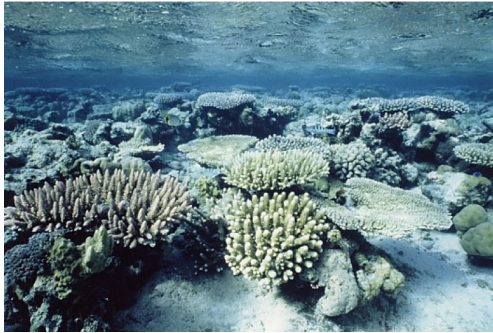


foraminifera sand



**Atoll islands are formed
by organisms**

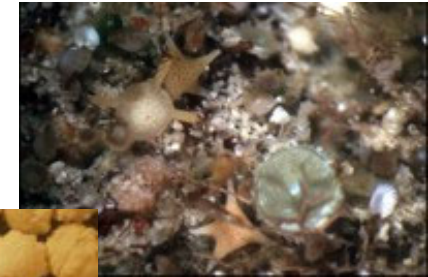
Cross section of Laura Is.



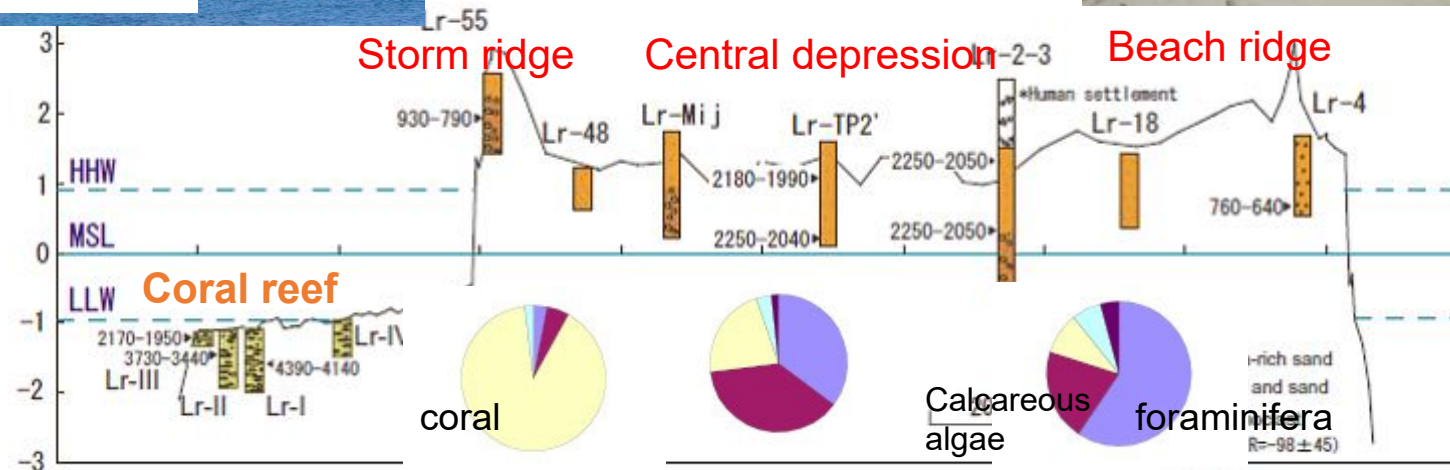
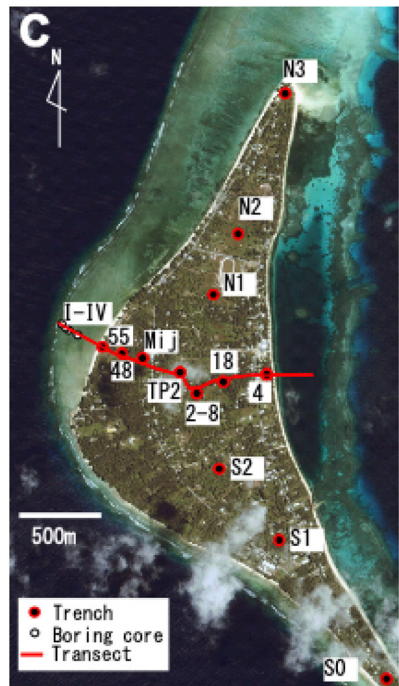
Coral gravels



Foraminifera sand

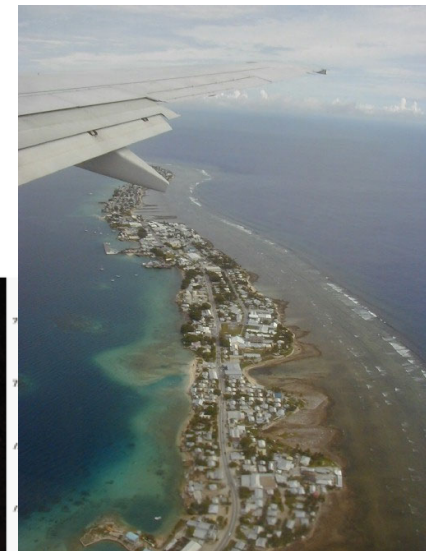
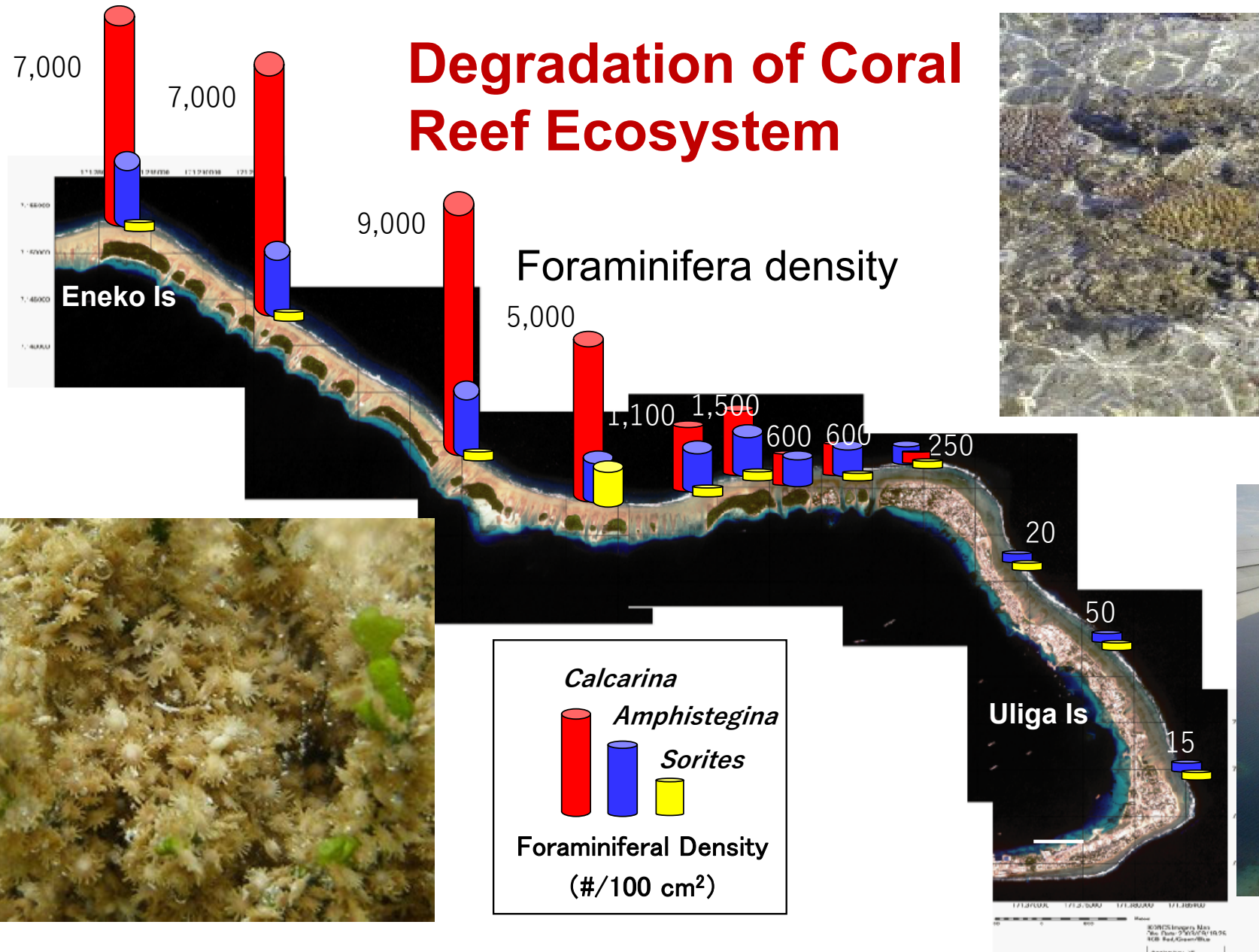


Coral reef



Kayanne et al.
(2007)

Degradation of Coral Reef Ecosystem





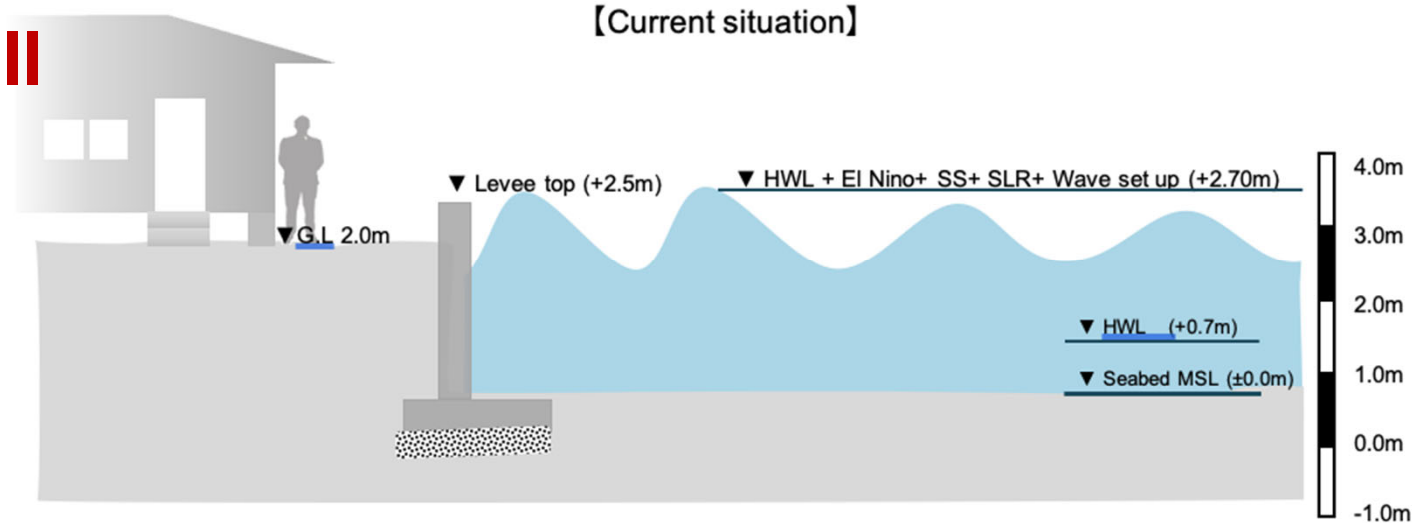
Tuvalu

Majuro



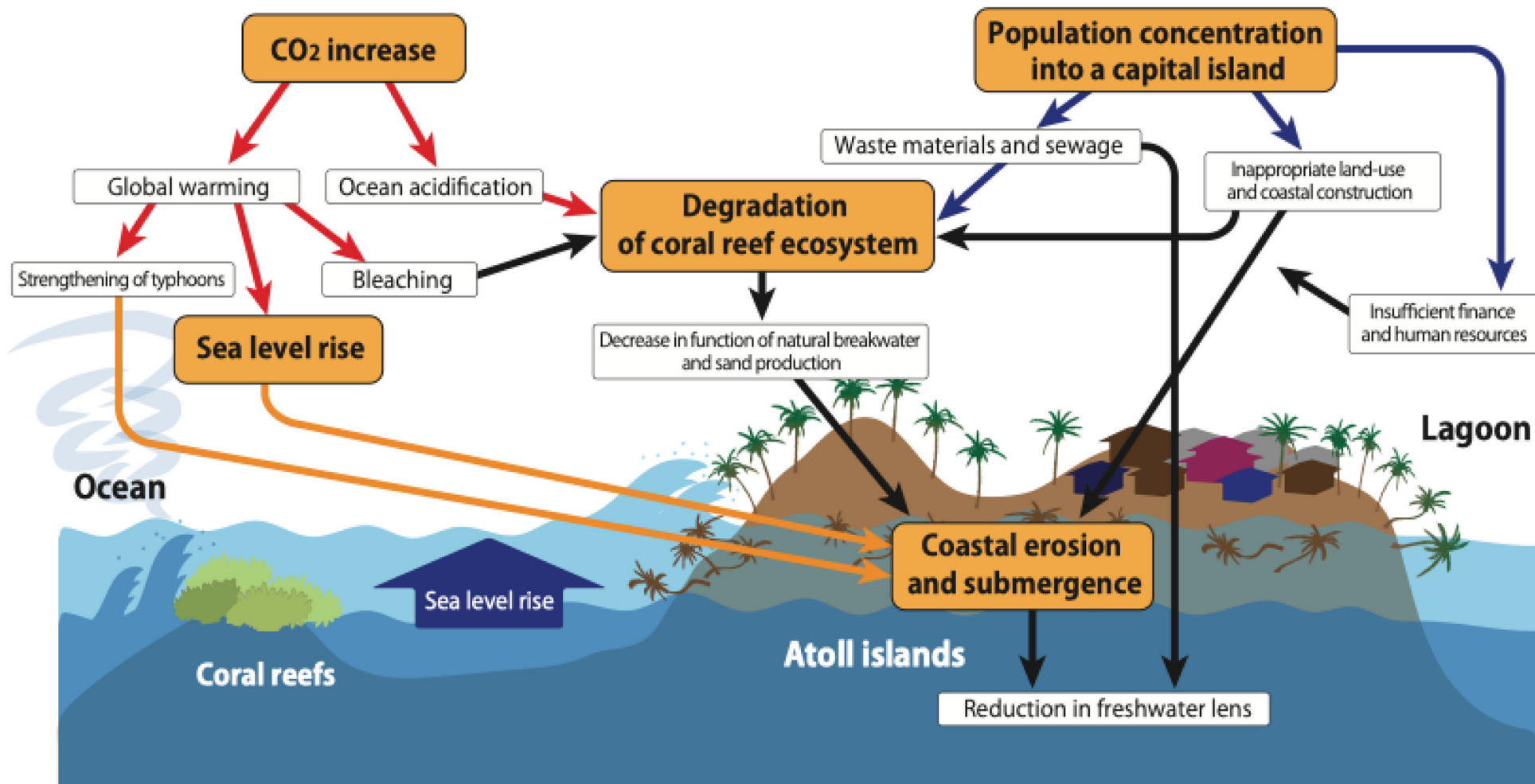
Vertical seawall

Waves break at the vertical seawall, turning the site from sedimentation to erosion, causing beach loss



Global environmental change

Globalization of socio-economics



Combination of 1 NbS Engineering, 2 Ecosystem restoration, and 3 Social measures

General image of the project

Packaging of NbS adaptive measures

<NbS Social measures>

- Land use planning, Institution, Wastewater and Solid waste management etc.

=>Dr. Naya Sena

<Ecosystem Conservation and Restoration>

- Coral reef and Foraminifera restoration and conservation
- Coral breeding and nursery etc.

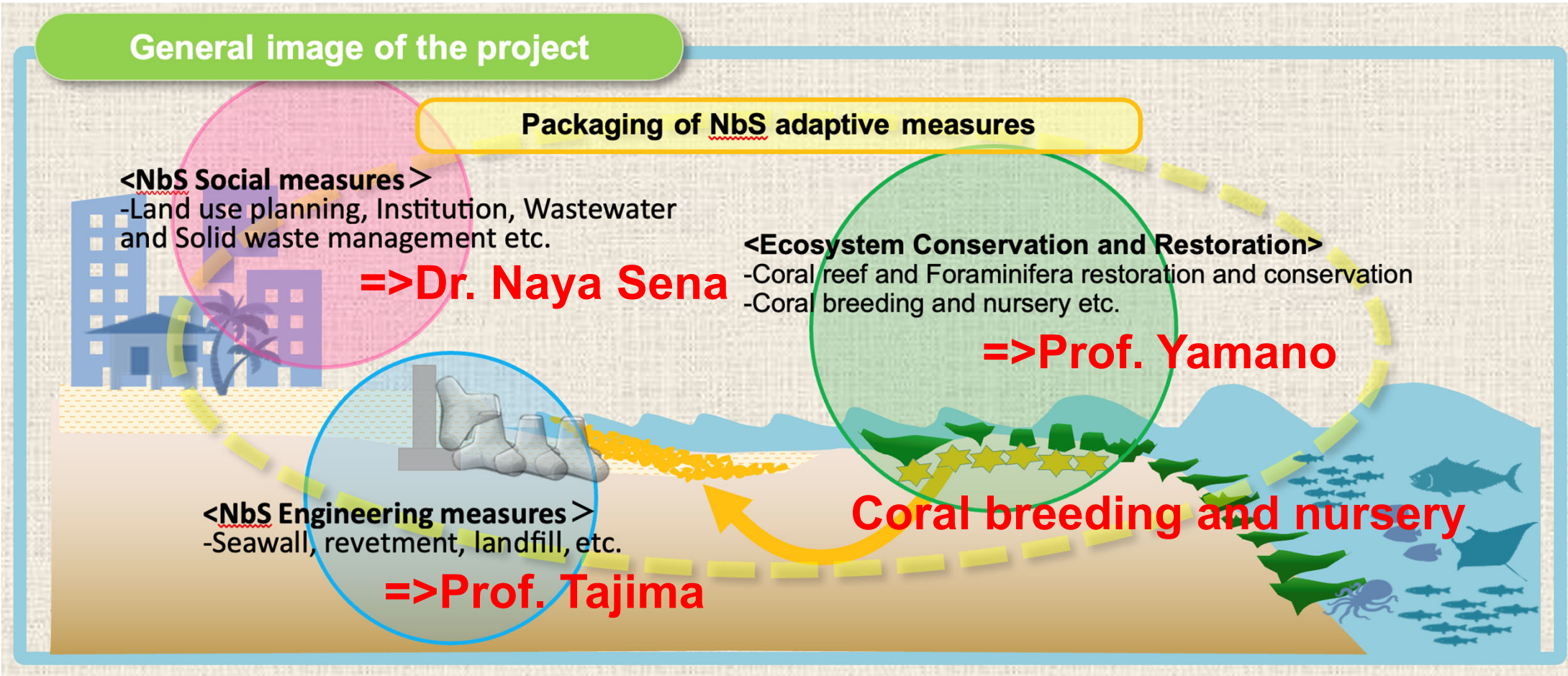
=>Prof. Yamano

<NbS Engineering measures>

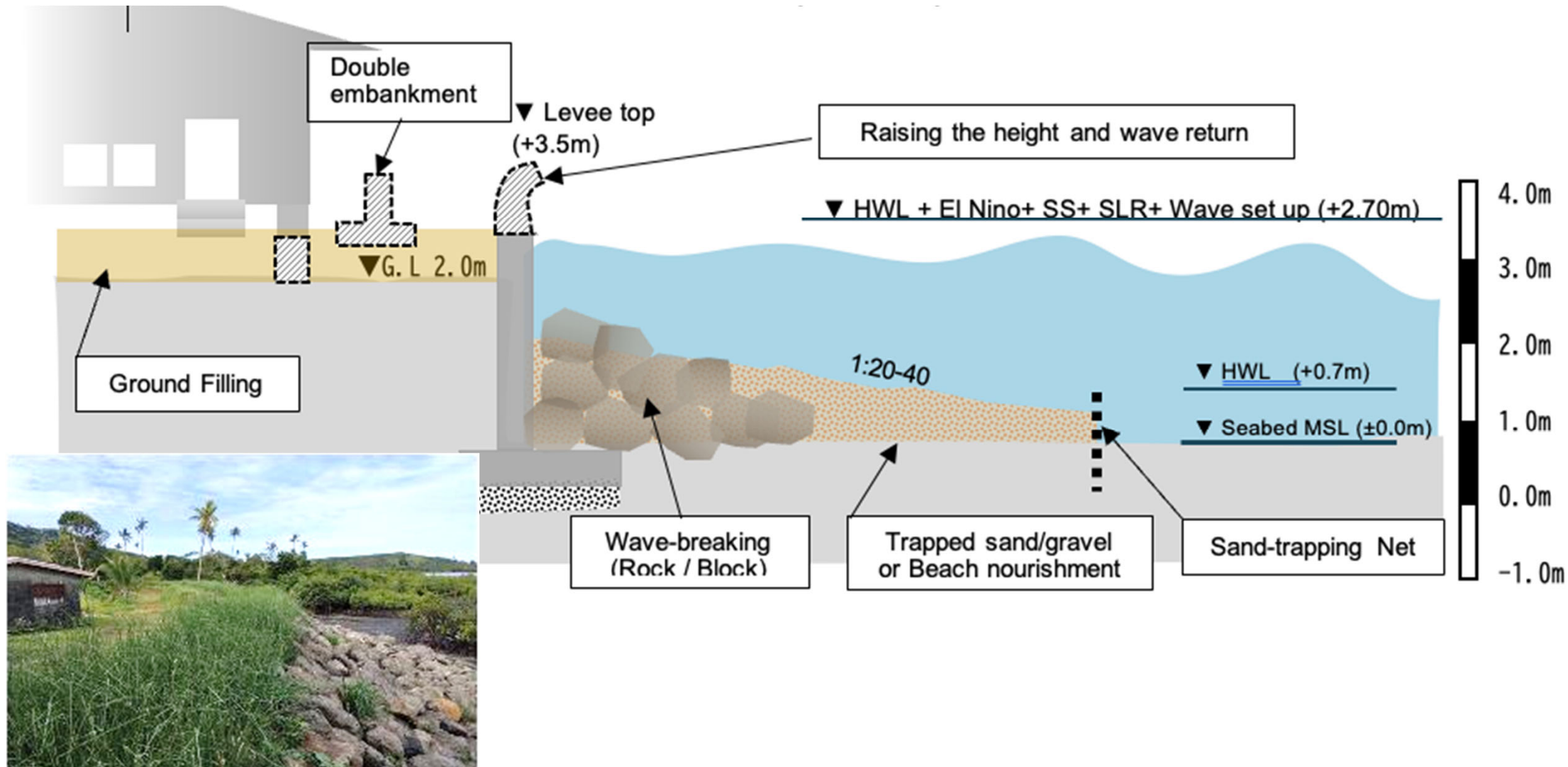
- Seawall, revetment, landfill, etc.

=>Prof. Tajima

Coral breeding and nursery



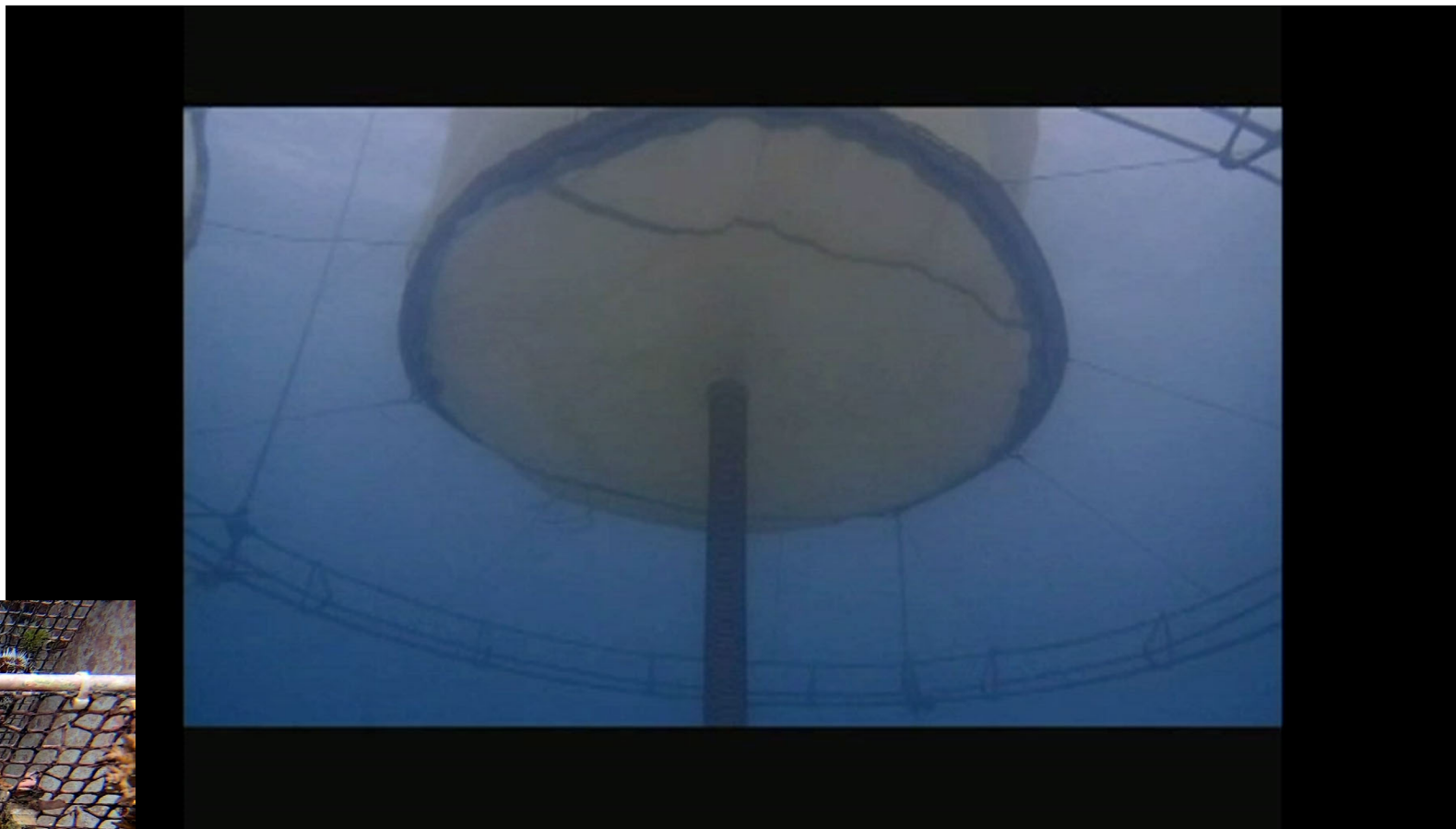
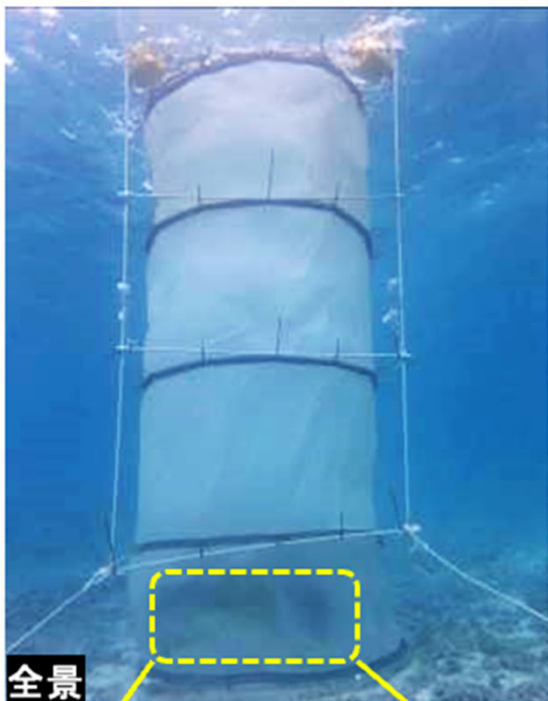
Engineering NbS coastal protection



Beach nourishment



Coral breeding and nursery

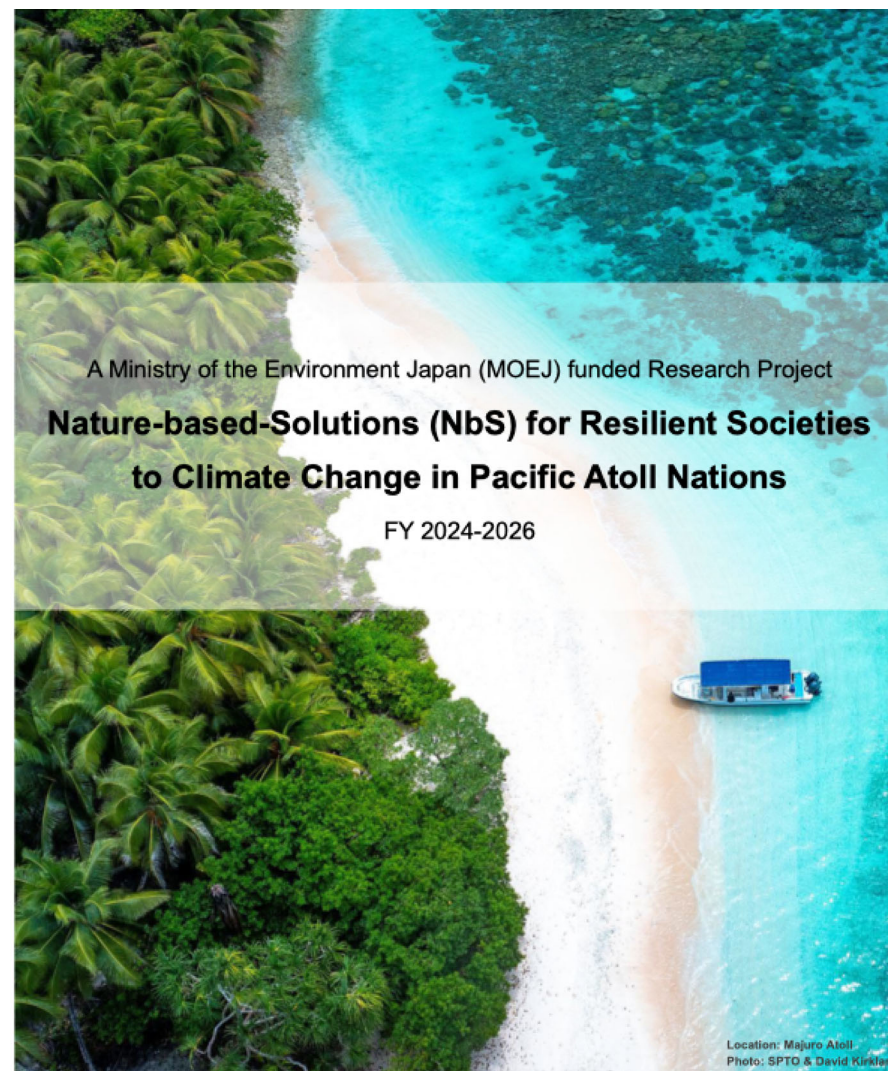


Naha, Okinawa

Fig. 6

wave-dissipating blocks





Artcivil Inc.