

The role of ecosystems and ecosystem services in food, water, and energy security

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Ecosystem Services: Benefits people get from ecosystems

Examples of benefits:

1. Protection from storms and erosion
2. Fisheries (recreational and commercial)
3. Recreation & tourism
4. Water filtration
5. Carbon sequestration and storage (coastal wetlands)
6. Cultural services
7. Habitat for other species

Ecosystem Services and the Food-Water-Energy Nexus?



Example 1: Natural & Hybrid Infrastructure

Gray (Built) Infrastructure

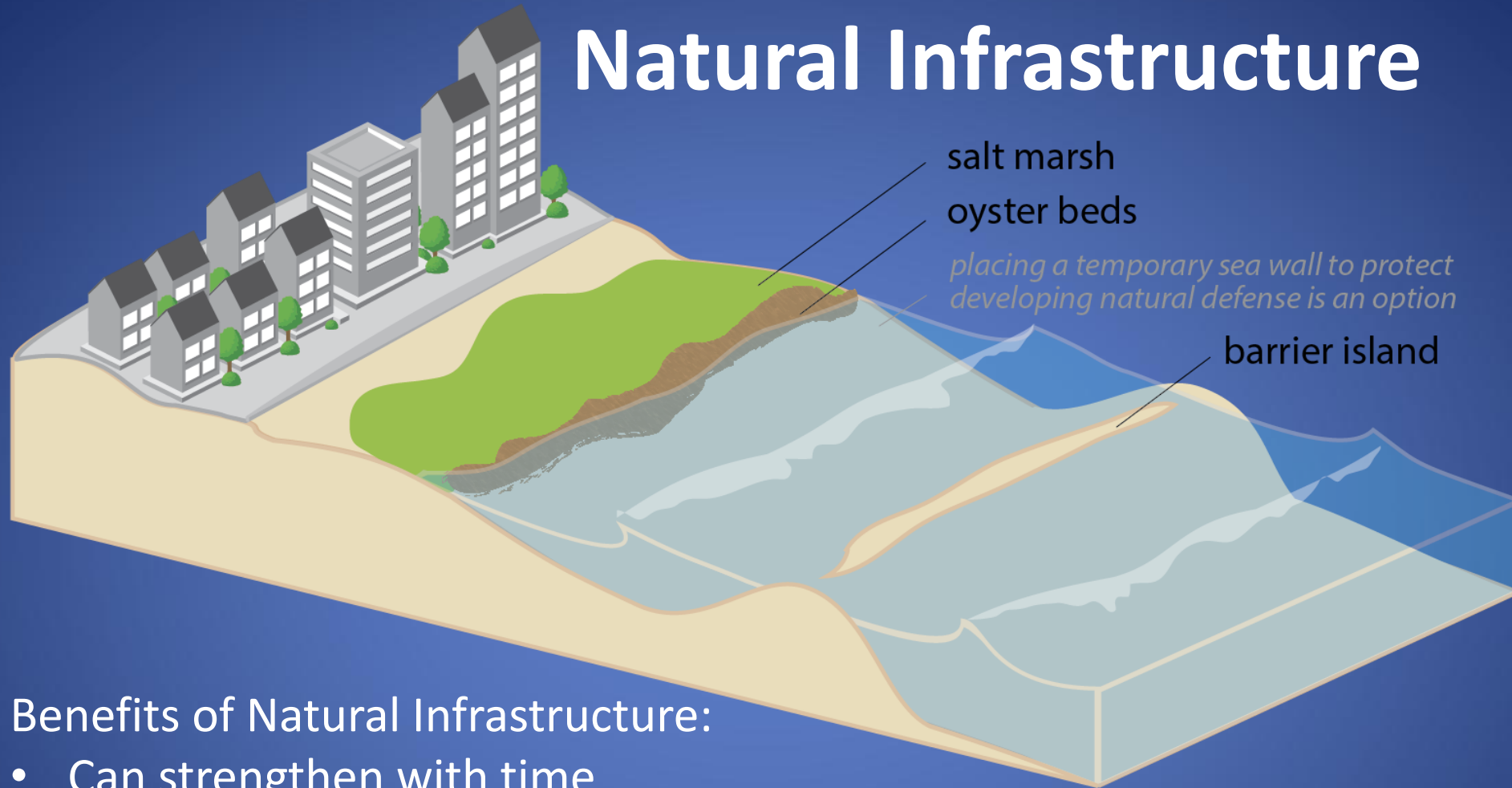


Natural Infrastructure



- Reduce wave energy and erosion and decrease flood extent and area
- Wetlands prevented \$625 million of damages in Super Storm Sandy

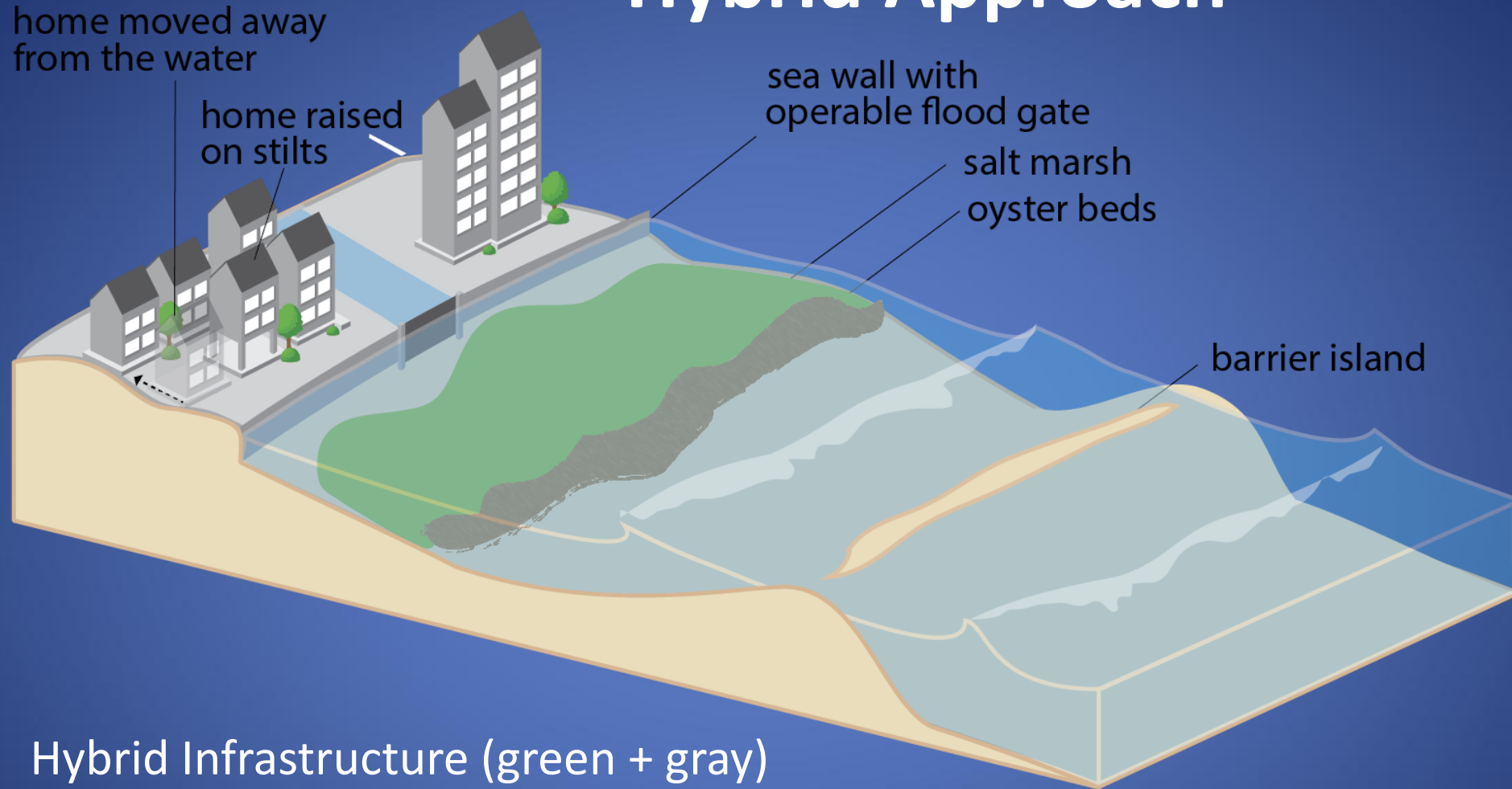
Natural Infrastructure



Benefits of Natural Infrastructure:

- Can strengthen with time
- Can be self-maintaining and has the potential for self-repair after storms
- Can grow and keep pace with sea level rise
- Can be more cost-effective
- **Provides benefits all the time**

Hybrid Approach



Hybrid Infrastructure (green + gray)

- Can combine strengths of green and gray
- Can use green to protect gray to extend the lifetime or reduce costs

Rebuild By Design: “Big U” Project Provides Climate Adaptation and Recreational Opportunities

- Hard and soft infrastructure with recreational benefits
- Actual Implementation: East Side Coastal Resilience Project
- Integrate flood protection into community, improve water access
- Berms and flood walls or barriers



Rebuild By Design: "Big U" Project Provides Climate Adaptation and Recreational Opportunities



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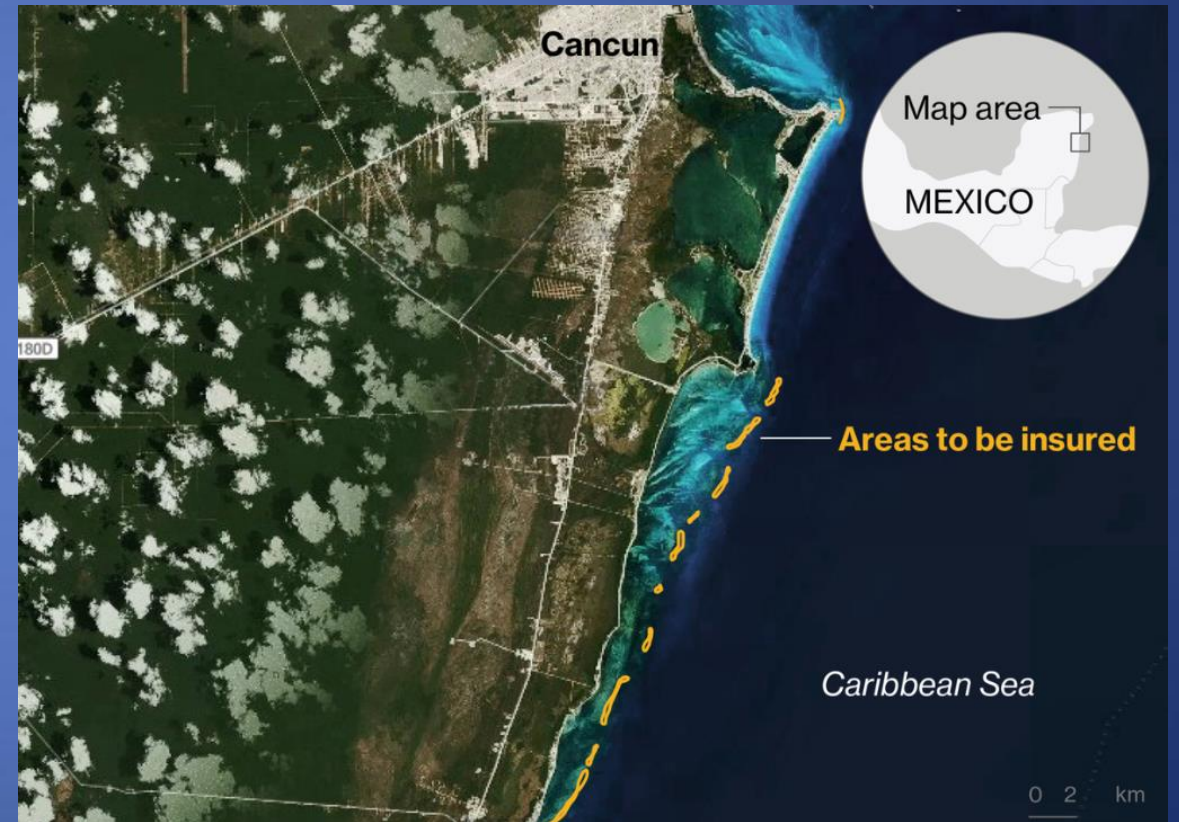
NEW YORK CITY DEPT.
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NEW YORK CITY MAYOR'S
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COMMUNITY BOARD PROJECT UPDATE
EAST SIDE COASTAL RESILIENCY PROJECT
MARCH 28, 2018

20th Street Park Entry
Preliminary Review - Closed B-21

Value of Coastal Natural Infrastructure: What if we protected our natural infrastructure with insurance the way we do our built...?



Can we do this for other coastal ecosystems?

Example 2: Nature/Biodiversity and Human Health

- New evidence suggests important connections between biodiversity and human health and well-being

Biodiversity
WE ARE ALL IN THIS TOGETHER



Exposure to Nature Improves Human Health



Reduces stress, blood pressure



Improves mood, self-esteem, energy, pleasure



Improves recovery from surgery



Decreases prevalence of asthma, anxiety

Chronic Diseases and Biodiversity



- Allergy: response to exposure to too much bad stuff
 - Allergy: *lack* of exposure to microbes → hyper-responsiveness to bioparticles
 - Microbe-rich environments confer health benefits especially to children
 - “Biodiversity” or “Hygiene” hypothesis
 - Loss of macrodiversity → loss of microdiversity → changes in human microbiota and results in variety of disorders
- (Hanski et al. 2012, Rook 2010, Strachan 1989)

Biodiversity or Hygiene Hypothesis

Exposures during human evolution

Helminths

Gut and non-gut (blood)

Ectoparasites

Fleas, lice, mites, ticks

Carrier states

Salmonella, hepatitis A virus, *H. pylori*, TB, toxoplasma

Microbiota of other humans:

skin, gut, airway, oropharyngeal, genitourinary

Microbiota of natural

environment: animals, soil, air, plants (rhizosphere, phyllosphere)

- Our bodies must learn not to attack:
 - Self
 - Harmless molecules in air (pollen)
 - Gut contents

(Rook 2013)

Finland Adolescent Study

- Analyzed land-use types within 3km radius of homes
- Kids with allergies
 - Lower diversity of habitats
 - Fewer kinds of good bacteria on their skin which have an allergy protective effect (Hanski et al. 2012)
- **Loss of contact with diverse natural world is making us sick**



Conservation Magazine

Protecting and restoring healthy ecosystems is good for people and the environment and will help ensure sustainable food-energy-water systems into the future.





Thank you!

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