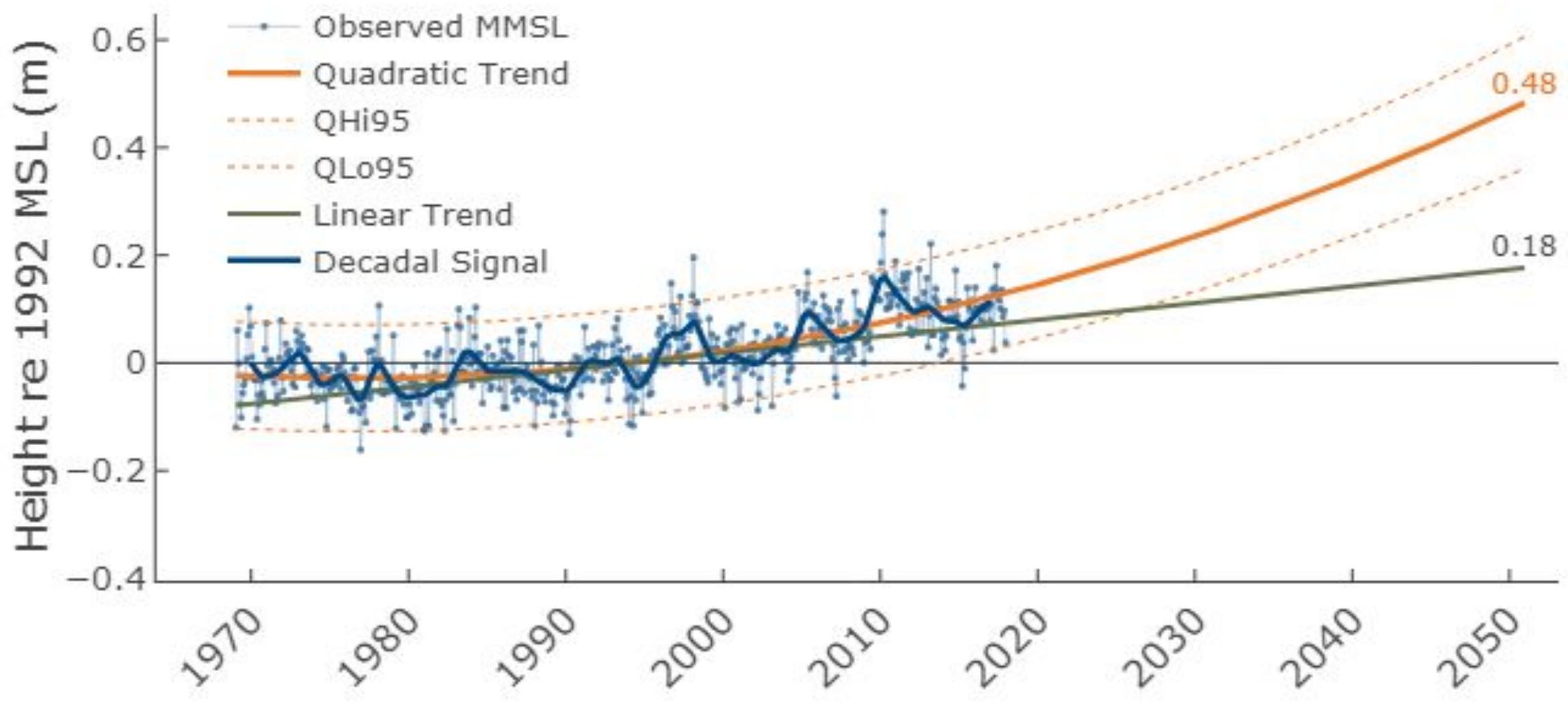


HOW WILL WE ADAPT TO SEA LEVEL RISE?

Peter M. Hanrahan, CPESC

Everett J. Prescott, Inc.

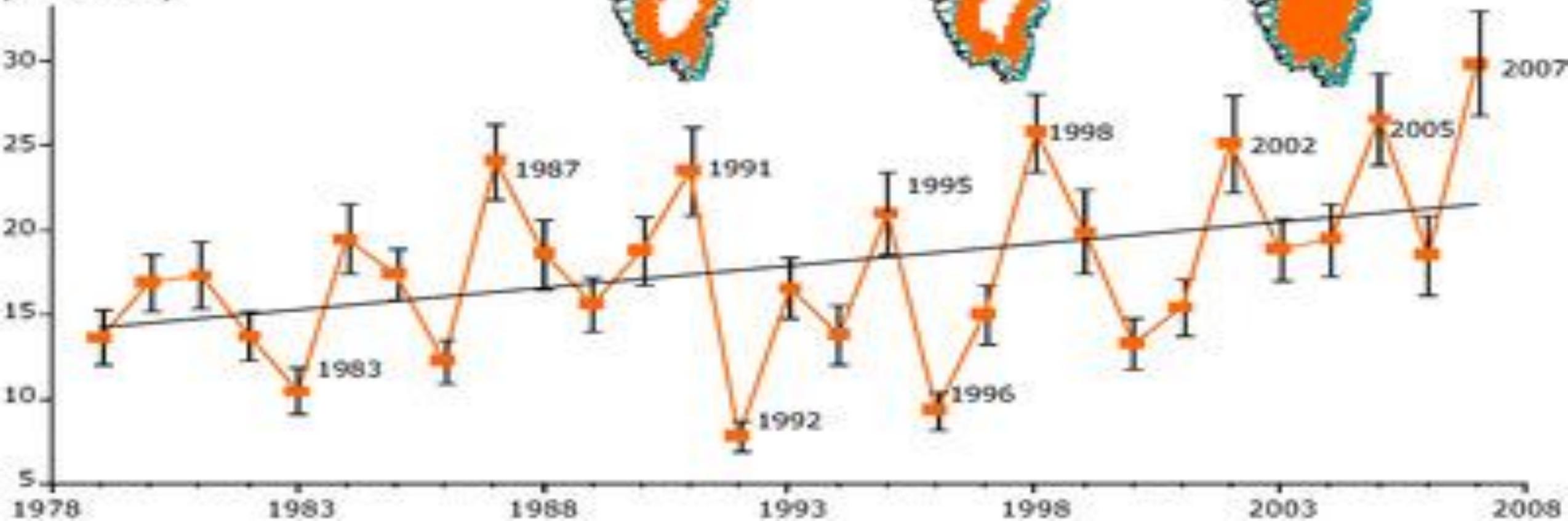
Boston, MA



Total melt area
April-October



Cumulated melt area
(million km²)

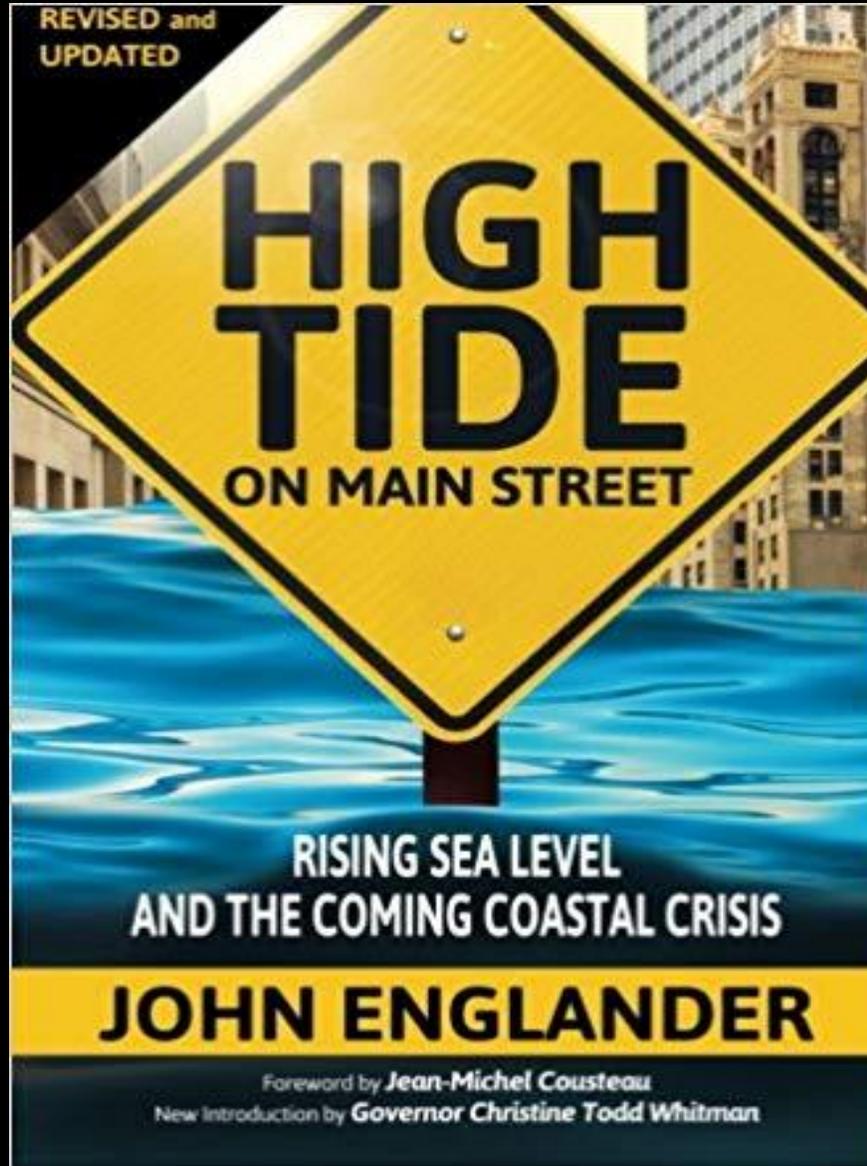


SEA LEVEL RISE REPORT BANNED

- In 2012 the North Carolina legislature banned the use of a report completed by the North Carolina Coastal Resources Commission
- The report predicted significant sea level rise possible by the year 2100
 - Report was tagged “short-sighted”
- Action by the legislature tagged as “a ban against science”

**LONGYEARBYEN,
NORWAY**





INTELLIGENT
ADAPTATIO
N





GARRETT GRAVES

Metro Boston DikeLANDS Concept



\$30-50 BILLION?



\$10 BILLION

- RESILIENCE STRATEGY**
- UNMITIGATED 2050s 100-YEAR FLOOD RISK
 - INTERIM FLOOD PROTECTION MEASURES (IFPM)
 - PROJECTS ADJACENT TO LMC STRATEGY







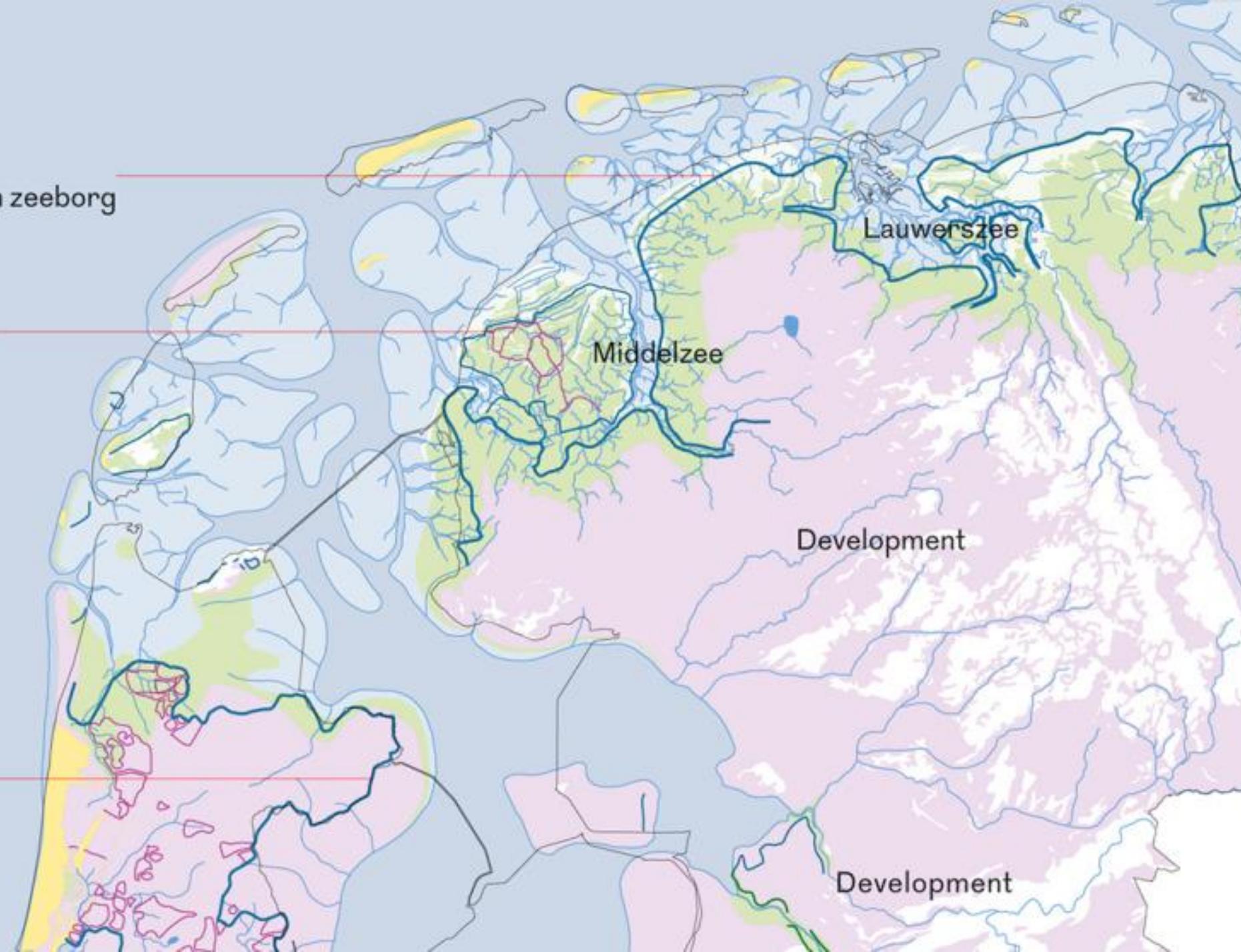


700-1200 AD

Construction zeeborg

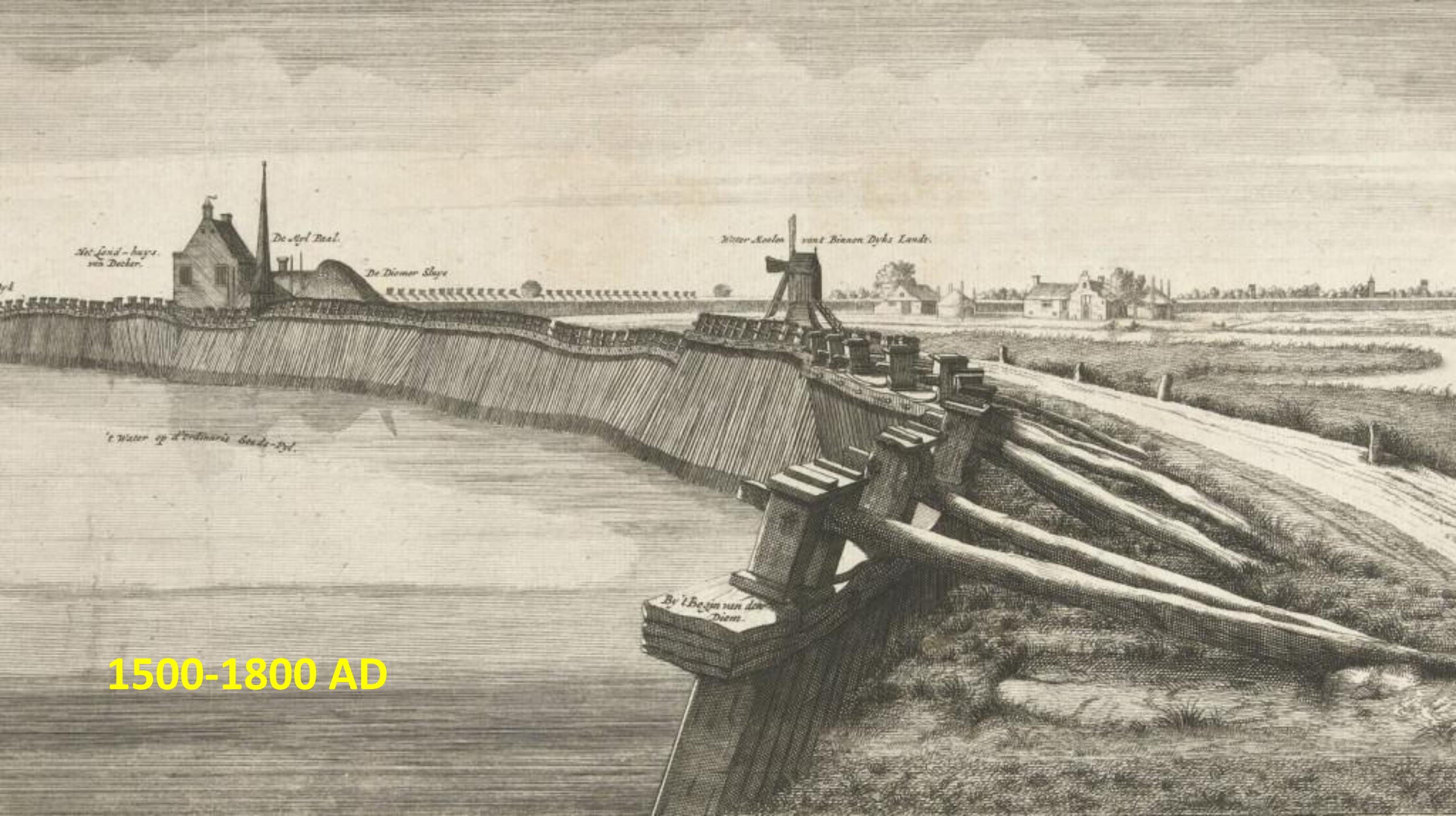
Early polders

Westfrieze Omringdijk



1200-1500 AD





Het Land-huys
van Decker.

De Nyl Baal.

De Diemer Sluys

Water-Moolen van Binnen Dyks Landt.

t Water op 't ordinair Gede-tyl.

By 't Begin van den
Diem.

1500-1800 AD



1800-1950 AD

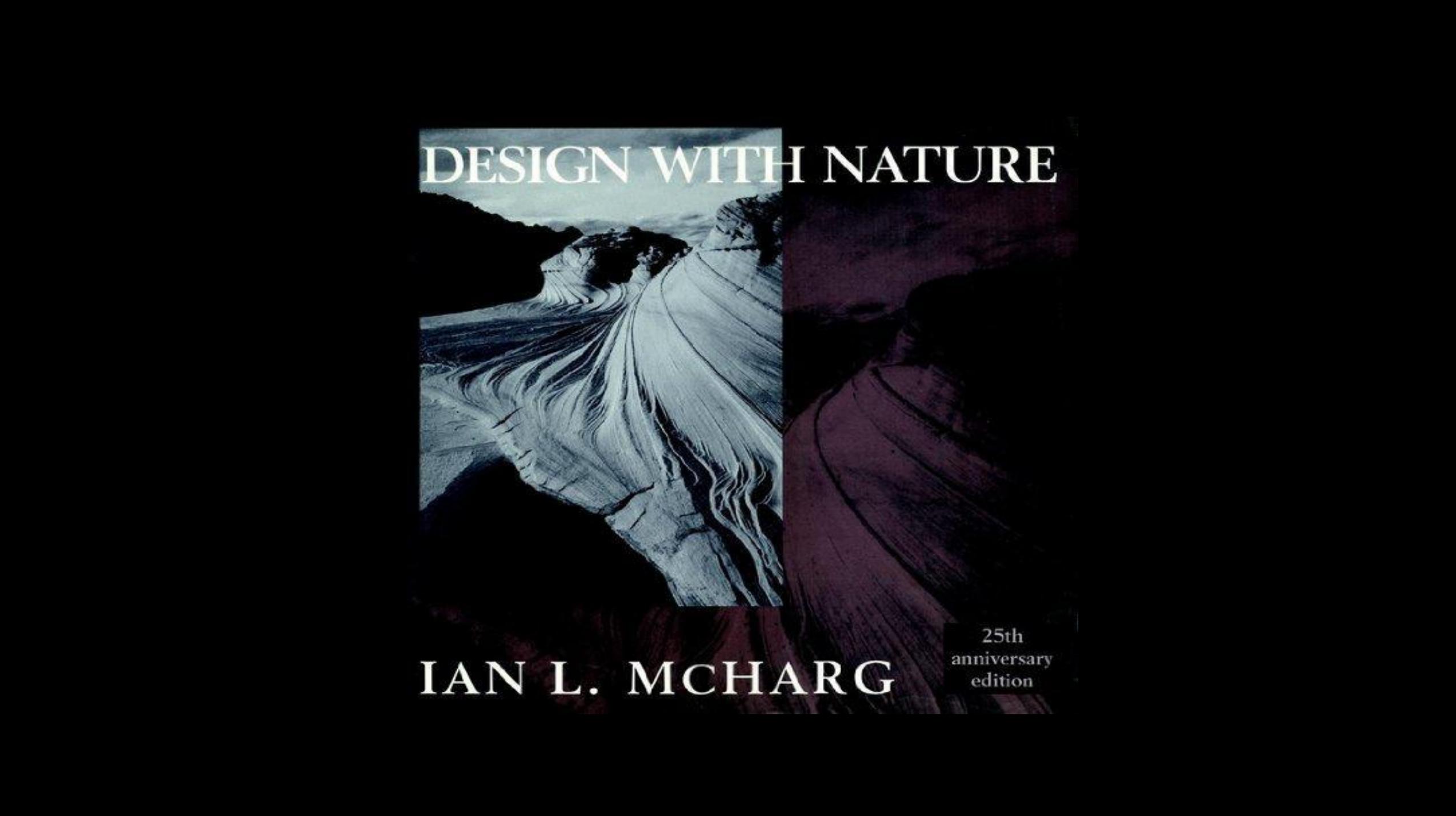


1950-1985 AD

1985-Present





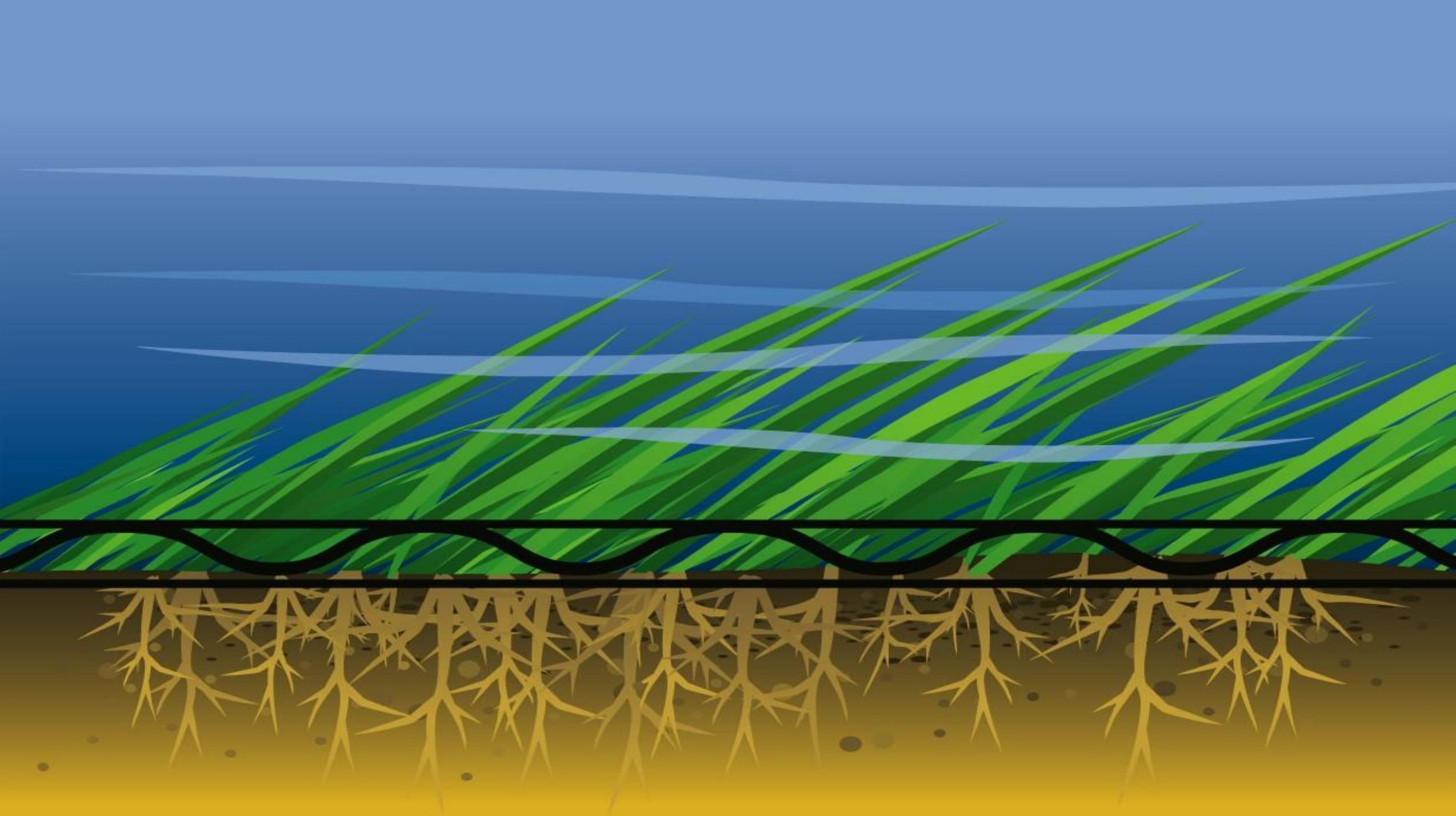


DESIGN WITH NATURE

IAN L. MCHARG

25th
anniversary
edition







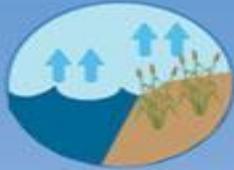


LIVING SHORELINES SUPPORT RESILIENT COMMUNITIES

Living shorelines use plants or other natural elements—sometimes in combination with harder shoreline structures—to stabilize estuarine coasts, bays, and tributaries.



One square mile of salt marsh stores the carbon equivalent of **76,000 gal of gas** annually.



Marshes trap sediments from tidal waters, allowing them to **grow in elevation** as sea level rises.



Living shorelines improve **water quality**, provide fisheries **habitat**, increase **biodiversity**, and promote **recreation**.



Marshes and oyster reefs act as natural **barriers** to waves. **15 ft** of marsh can **absorb 50%** of incoming wave energy.



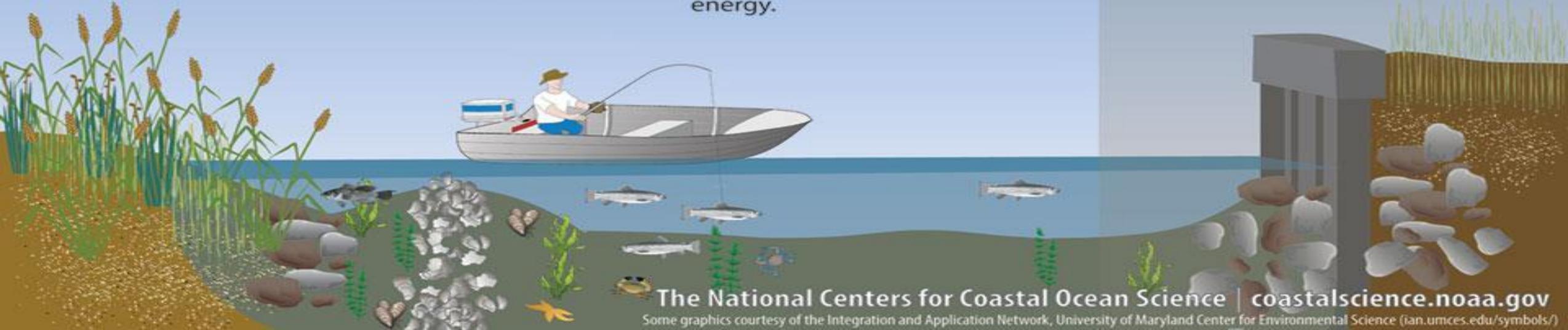
Living shorelines are **more resilient** against storms than bulkheads.



33% of shorelines in the U.S. will be **hardened** by **2100**, decreasing fisheries habitat and biodiversity.



Hard shoreline structures like **bulkheads** prevent natural marsh migration and may create seaward **erosion**.





A wide, shallow body of water is shown, with a long, narrow breakwater made of tall, green grasses floating across it. The grasses are densely packed and appear to be blowing in the wind. In the background, there are several houses and utility poles under a cloudy sky.

**FLOATING
BREAKWATERS**



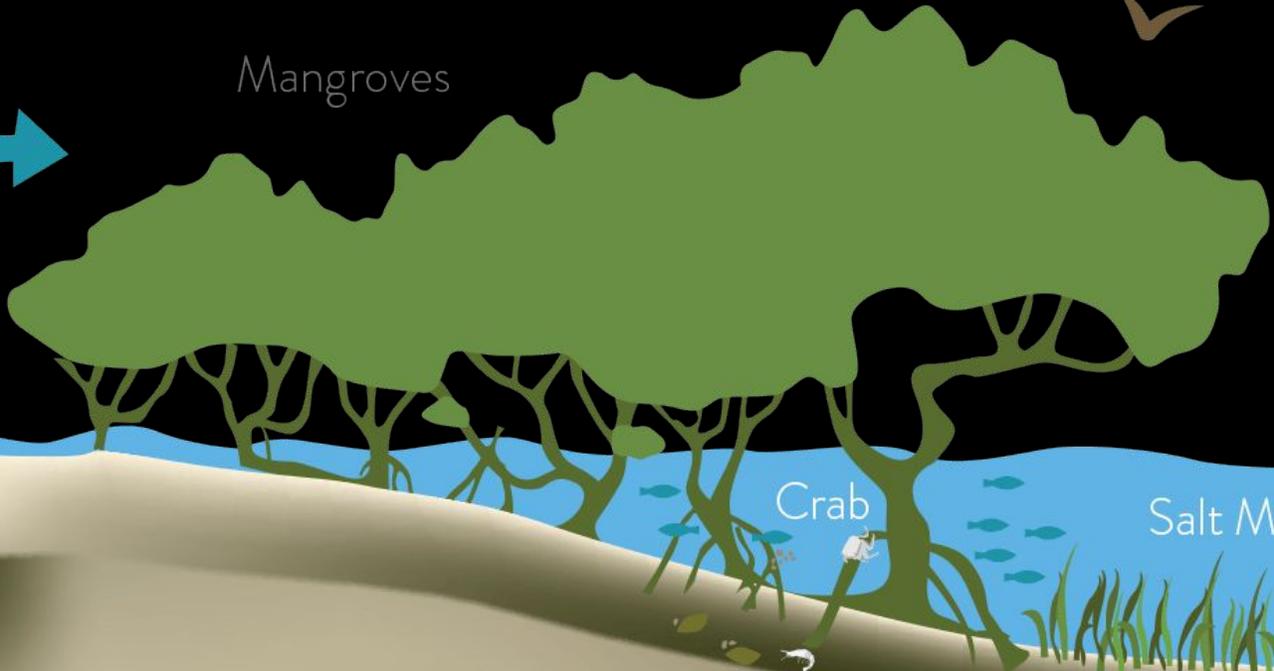
Rainfall Runoff
(nutrients)



Animals



Mangroves



Birds



Humans



Crab



Salt Marsh Grasses



Large Fish



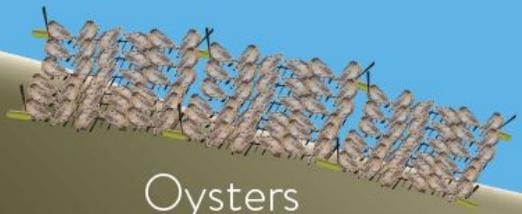
Shrimp



Small Fish

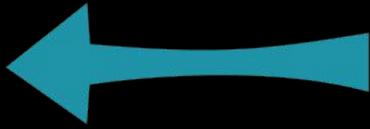


Oysters



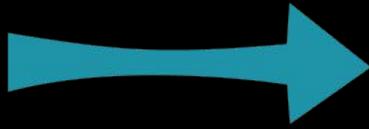
Brings:

Sediments, Larvae,
Phytoplankton, and
Large Fish



FLOOD

EBB



Takes Out:

Sediments, Detritus,
Nutrients, and
Larvae









HOW TO ADAPT?

**ADAPTATION TOOL KIT: SEA-LEVEL RISE AND COASTAL LAND USE
GEORGETOWN CLIMATE CENTER**

Jessica Grannis

2011

PLANNING INTELLIGENT ADAPTATION

- ZONING AND PLANNING
- FLOODPLAIN REGULATIONS
- BUILDING CODES AND RESILIENT DESIGNS
- SETBACKS AND BUFFERS
- SET CONDITIONS ON DEVELOPMENT

PLANNING INTELLIGENT ADAPTATION

- REBUILDING RESTRICTIONS
- SELECTIVE HARD ARMORING
- SOFT ARMORING
- LIMIT DEVELOPMENT IN AT RISK AREAS
- ACQUISITIONS AND BUYOUTS
- CONSERVATION EASEMENTS



Du