Mitigating wave-induced erosion with vegetation on breached Delta wetlands levees

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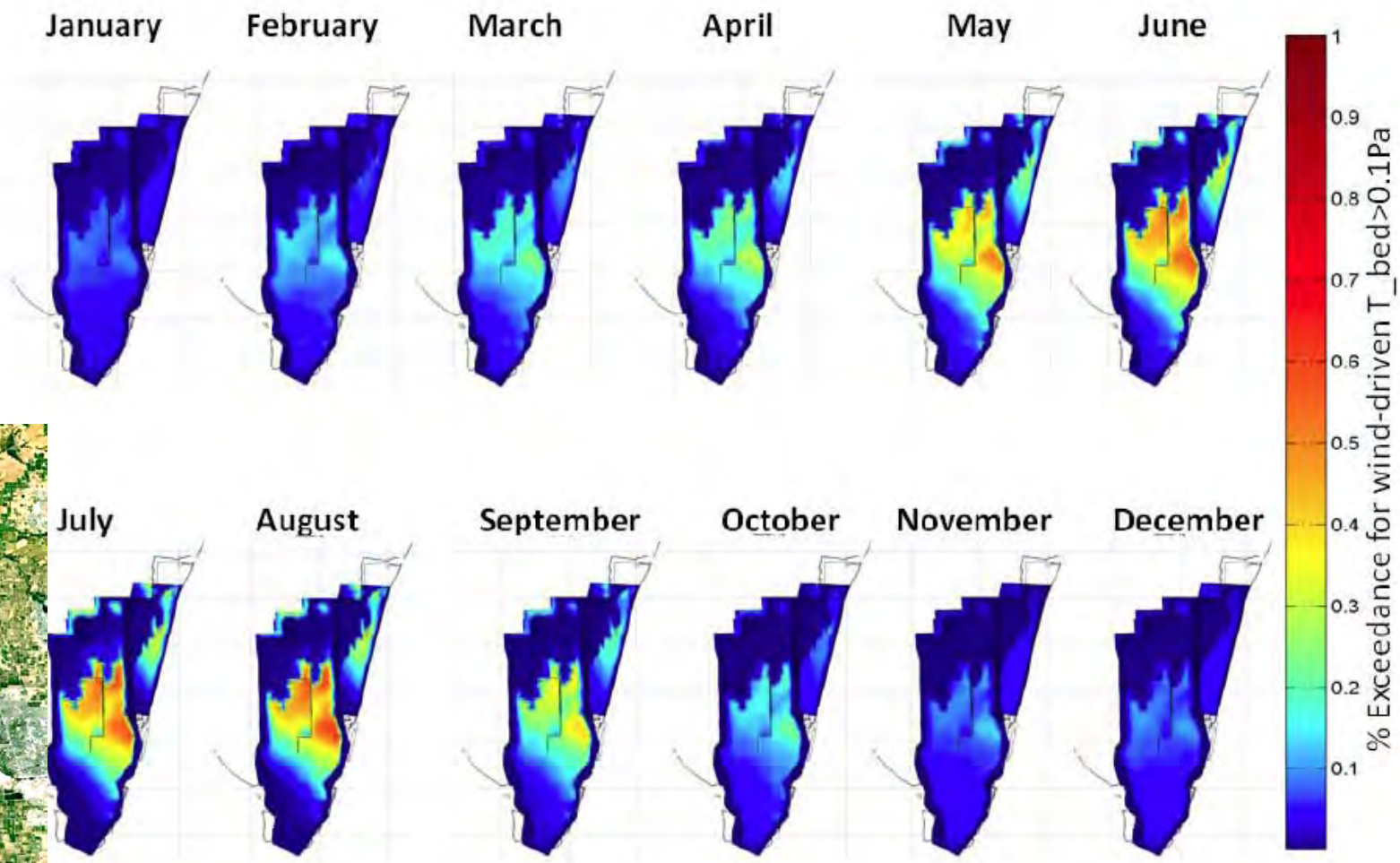
Franks Tract Levee Erosion

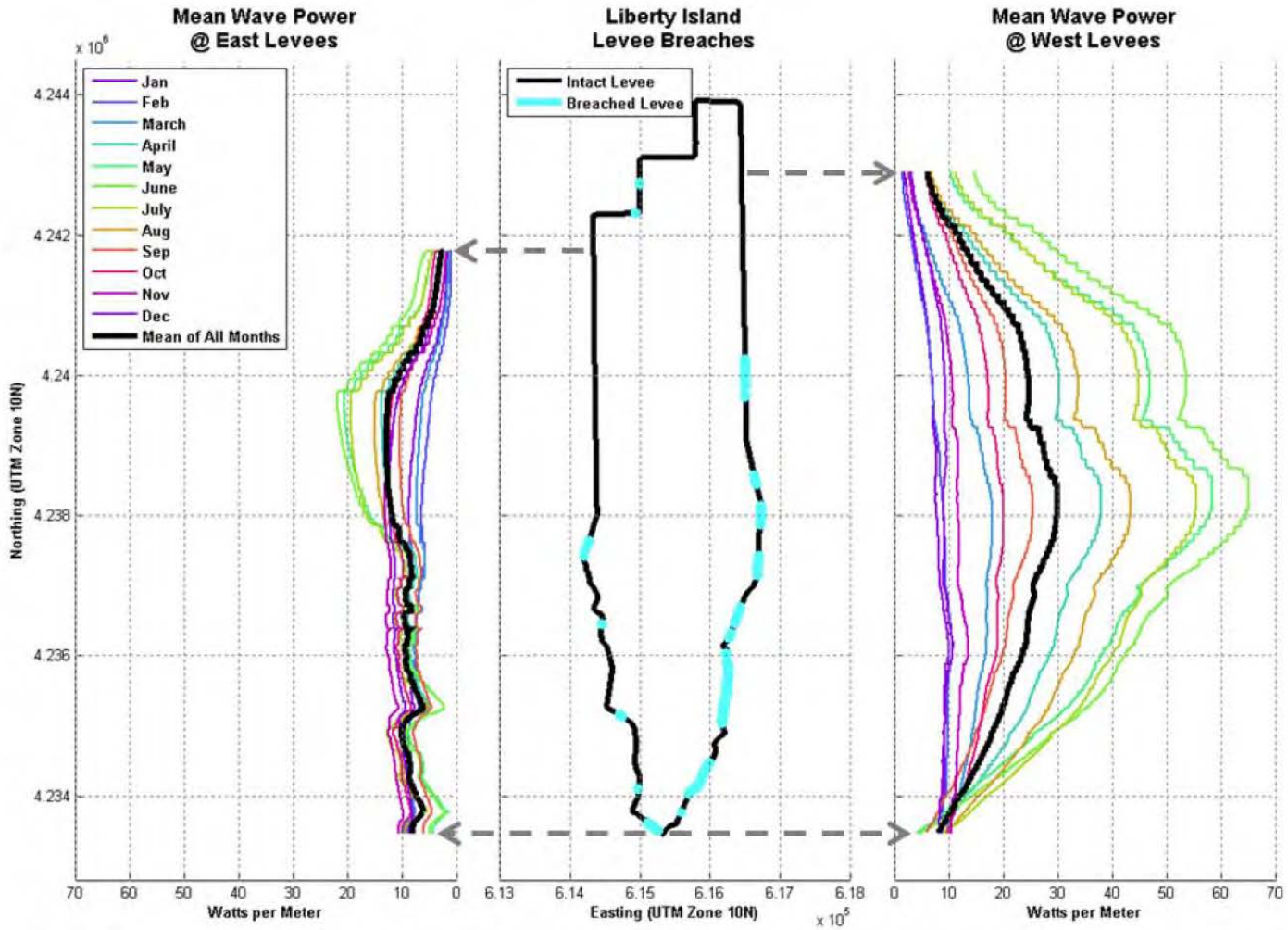
1939

2010

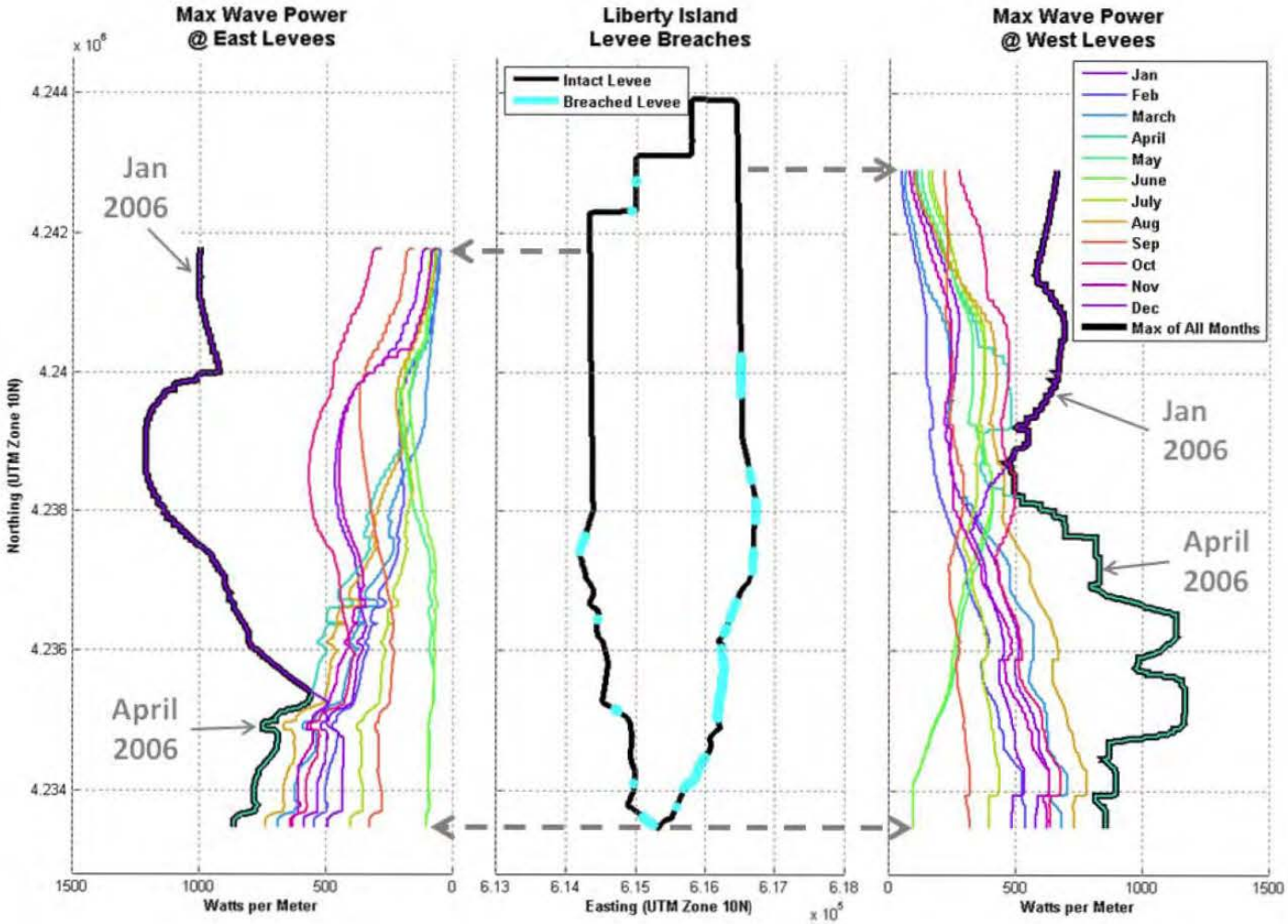
Liberty Island – Monthly Wave-induced Bed Shear Stress



Monthly Wave Power And Levee Erosion



Maximum Wave Power And Levee Erosion



Vegetation Expansion Site 1

2002

Vegetation Expansion Site 1

2002

2014

Vegetation Expansion Site 2

2002

2007

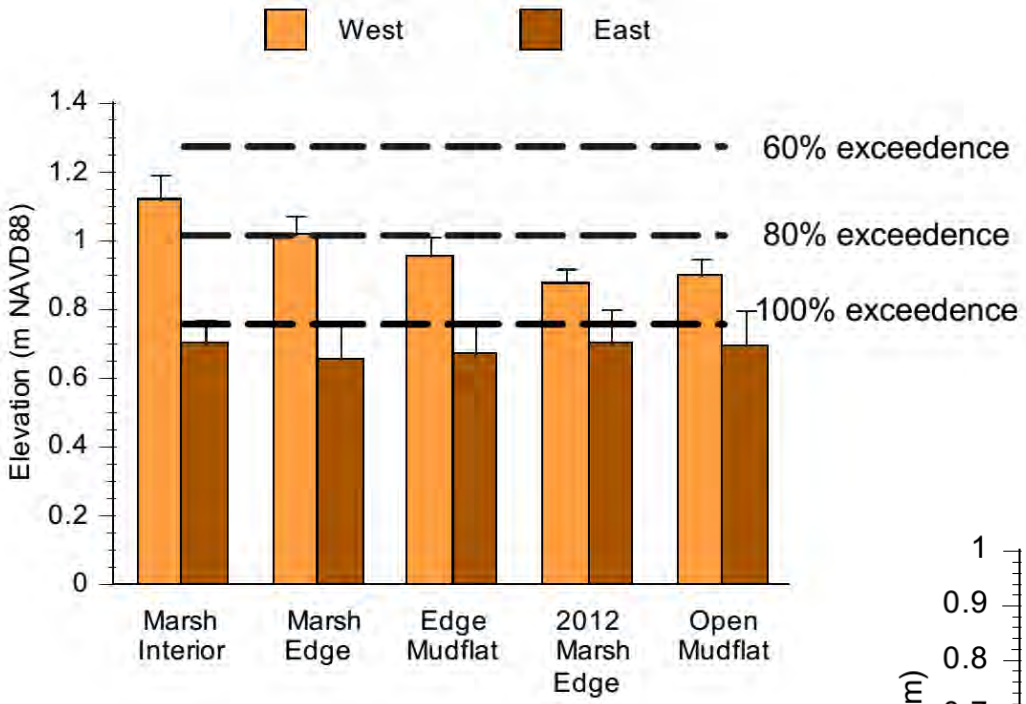
2014

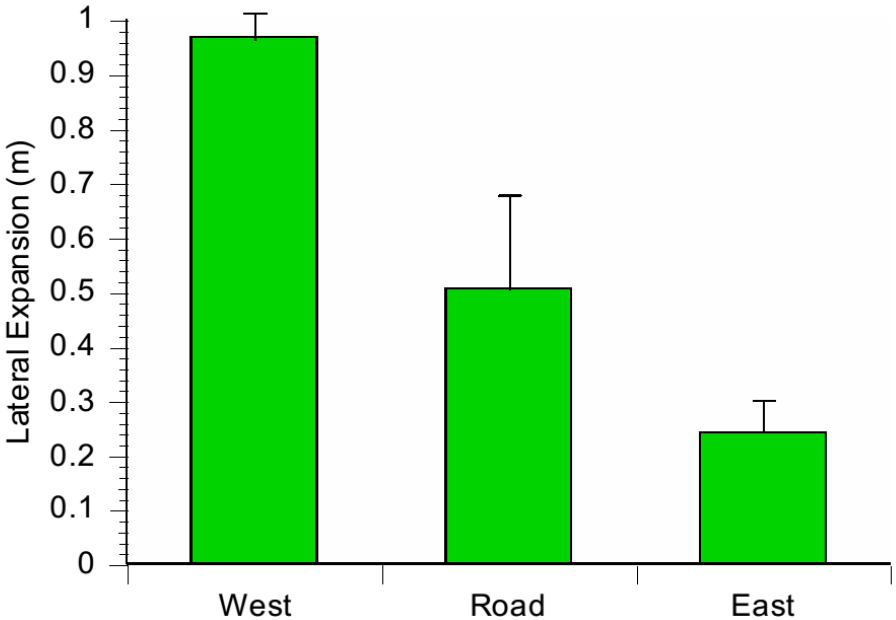
Vegetation Expansion Site 3

2002

2014

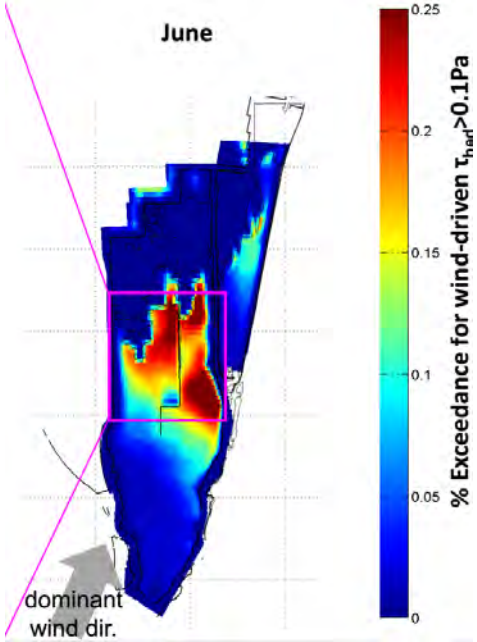
Vegetation Establishment and Expansion

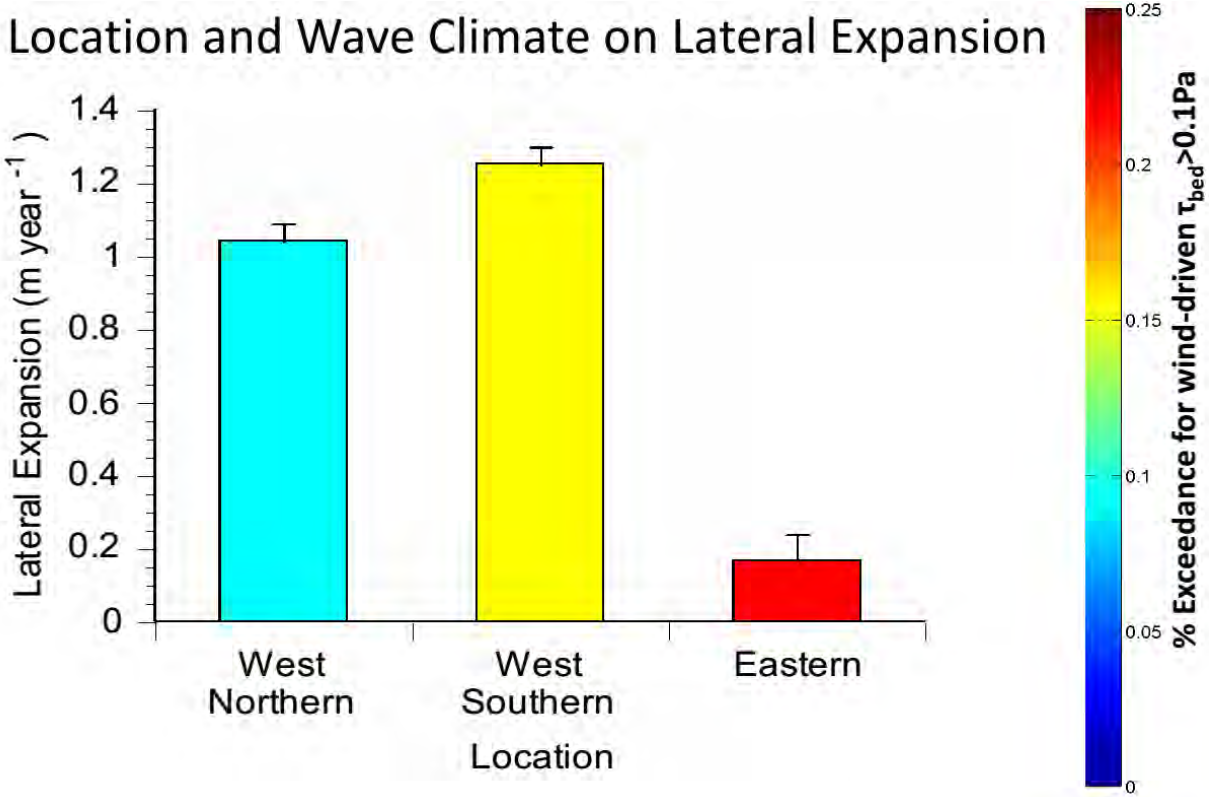




Source: Hester et al.

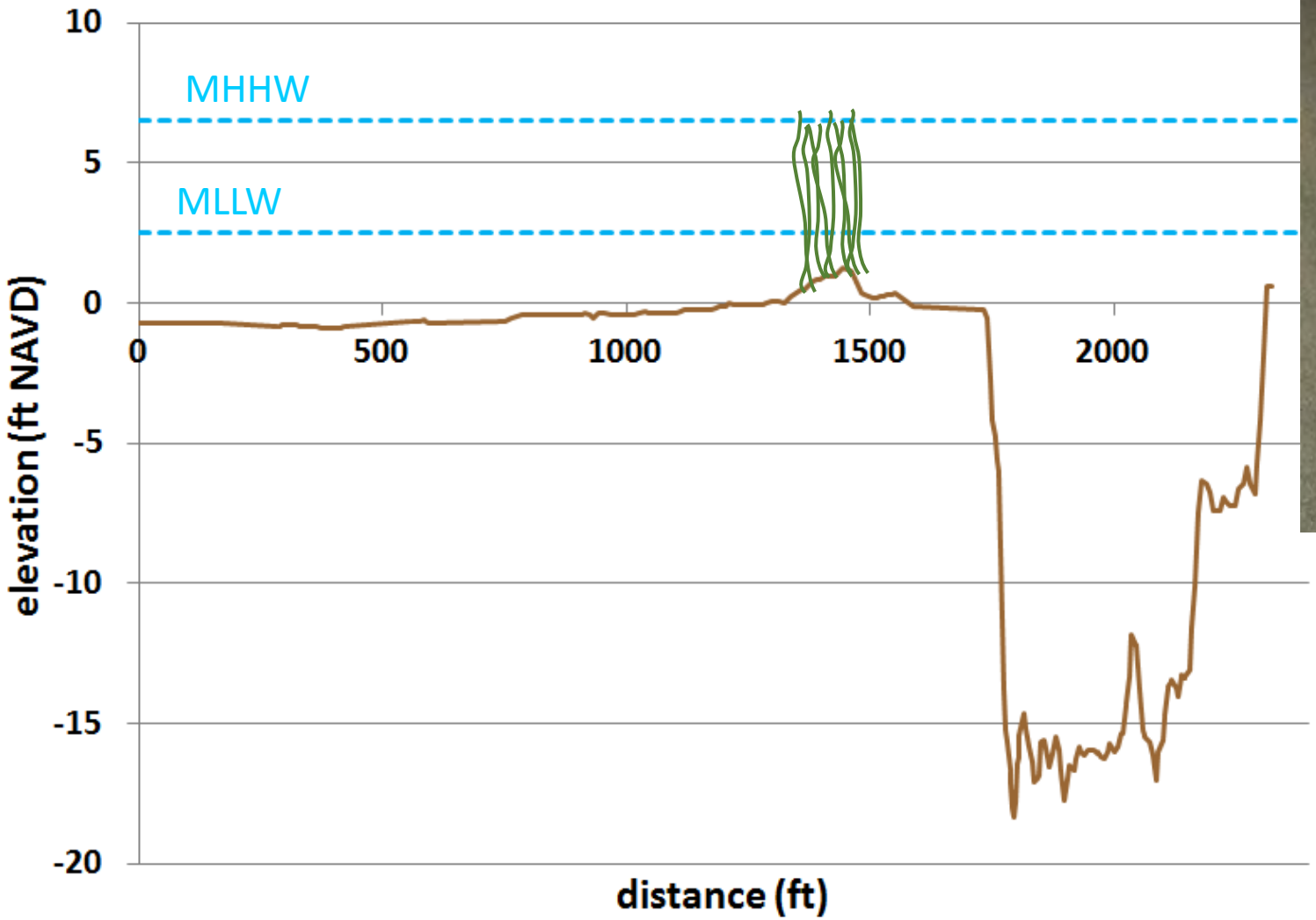
Lateral Expansion vs Wave Climate



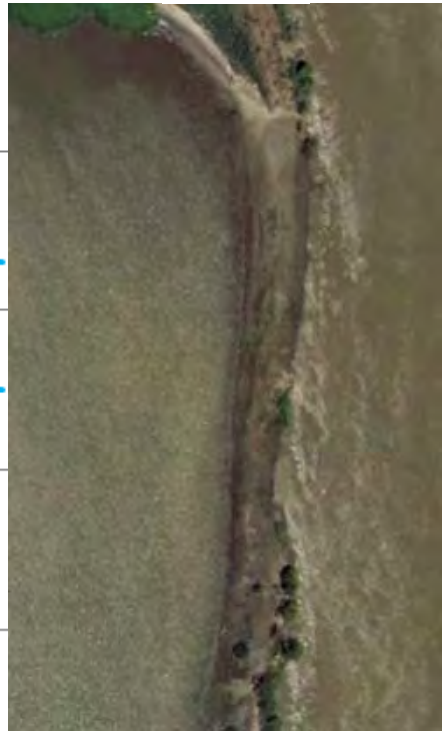


Source: Hester et al.

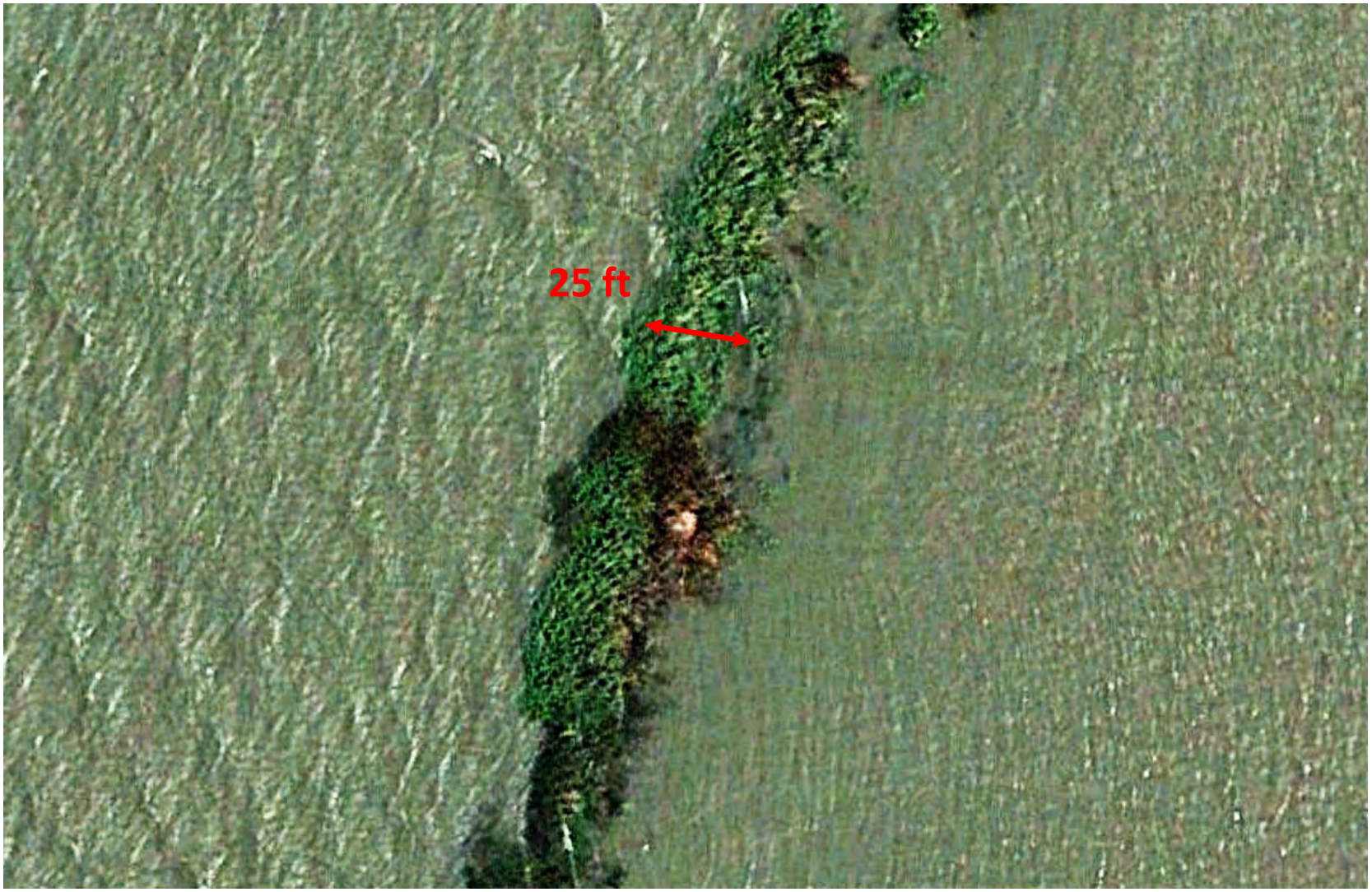
Levees Degrade, not Disappear



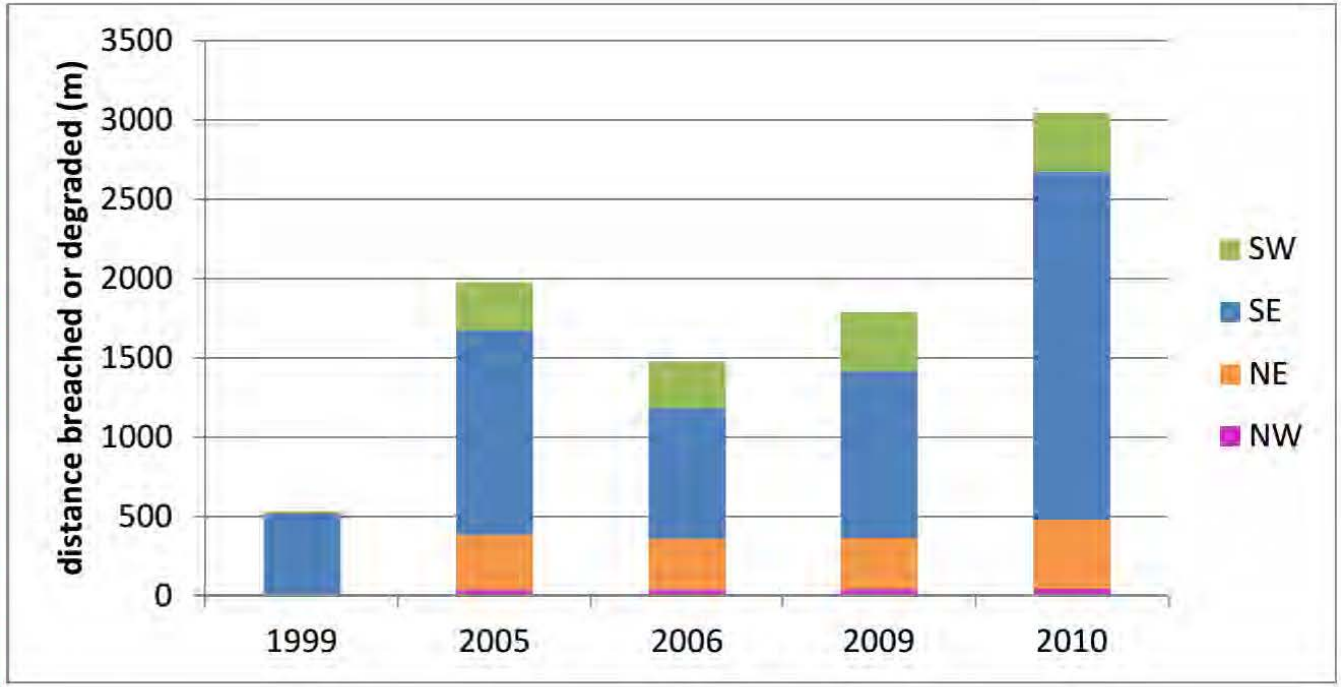
2007

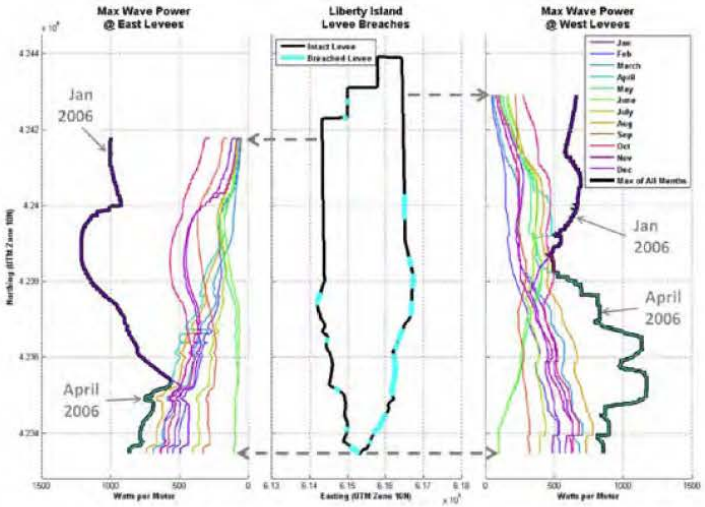


Wave Attenuation by Vegetation



Site-wide Levee Assessment

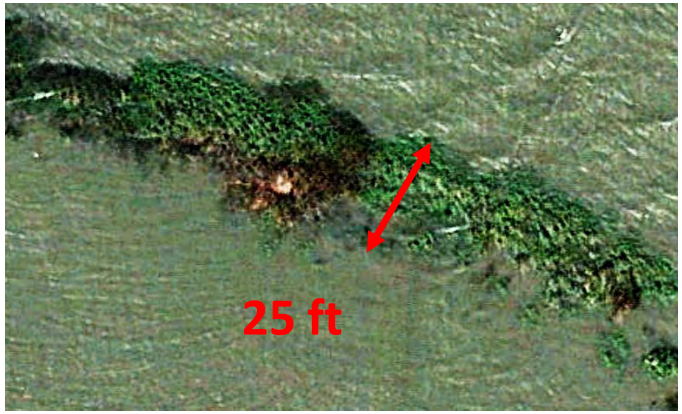
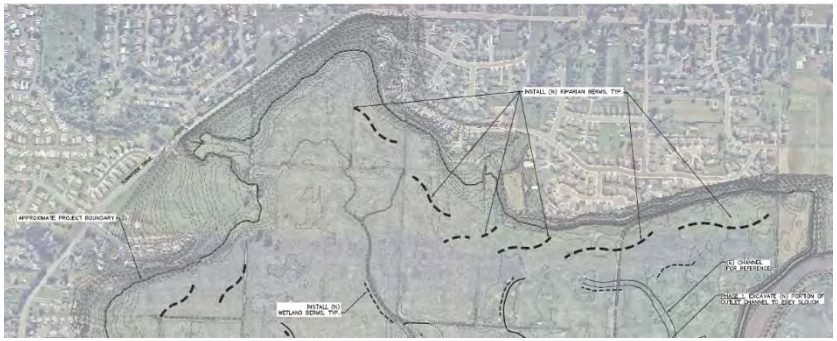




Other Benefits of Horizontal Levees

- Lower cost
  - Versus riprap @ $1-2k per linear ***foot,*** i.e. $5-10M/mile
- Resilient to sea level rise
  - Vegetation encourages sediment accretion
- Provides habitat
  - Vertical slope provides a range of habitat opportunities

Design Menu

The Veggie Vegetarian through and through Liberty Island, The Delta, CA	
The Widebody Extra wide for comfort Liberty Island, The Delta, CA	
The Abu Dhabi Constructed offshore islands USACE Restoration @ Qwuloolt, Marysville, WA	

Design Menu

The Pillar Point Like Half Moon Bay, use a headland for shelter Liberty Island, The Delta, CA	
The Mark Spitz Vegetated shoulders along levee trapezoid Petaluma Marsh, Petaluma, CA	
The Moose & Rocko Riprap planted with vegetation, for extra security Waite Ranch, Florence, OR	

Next Steps

- Monitor and model existing degraded levees
- Pilot site-specific options from design menu at existing restoration sites, e.g. Liberty Island
- Consider design options for large-scale restoration

Thanks to:

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- Eddie Divita

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- Mark Hester (UL)

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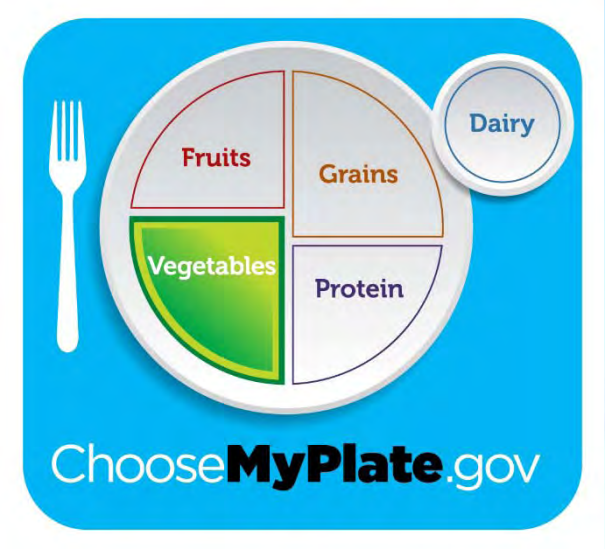
- Dave Schoellhamer



Funding

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