



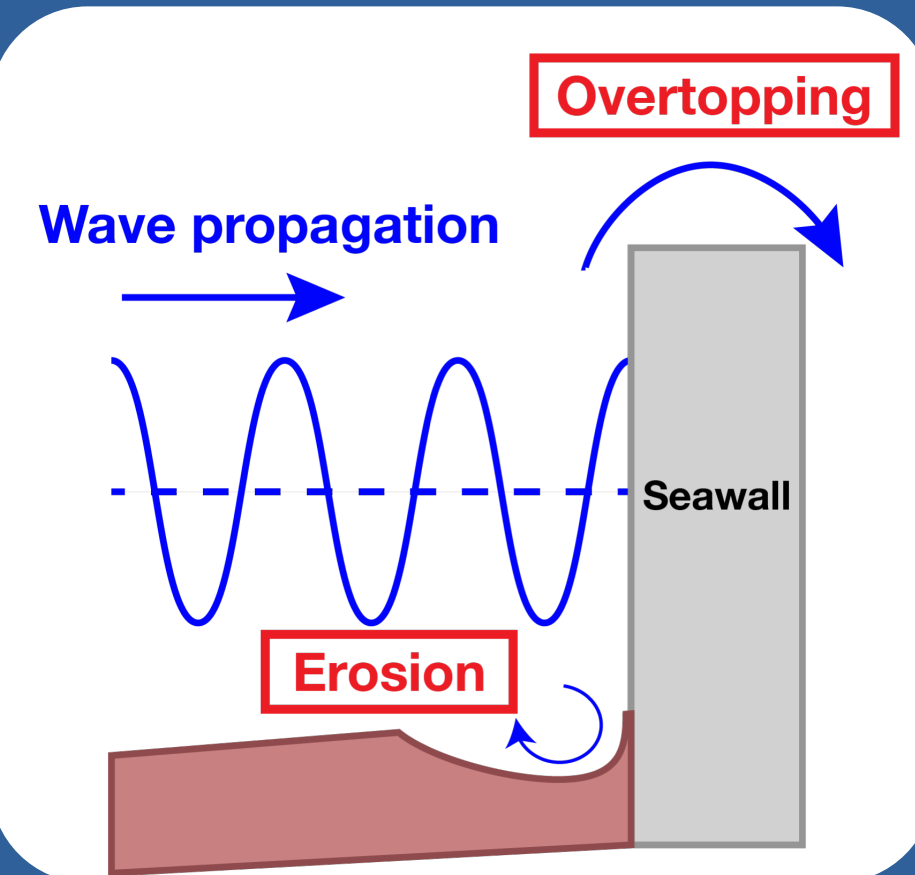
Nature based solutions for coastal defense: Wave attenuation and economic analysis of marsh-fronted seawalls

In Him (Ernie) Lee, Dr. Heidi Nepf

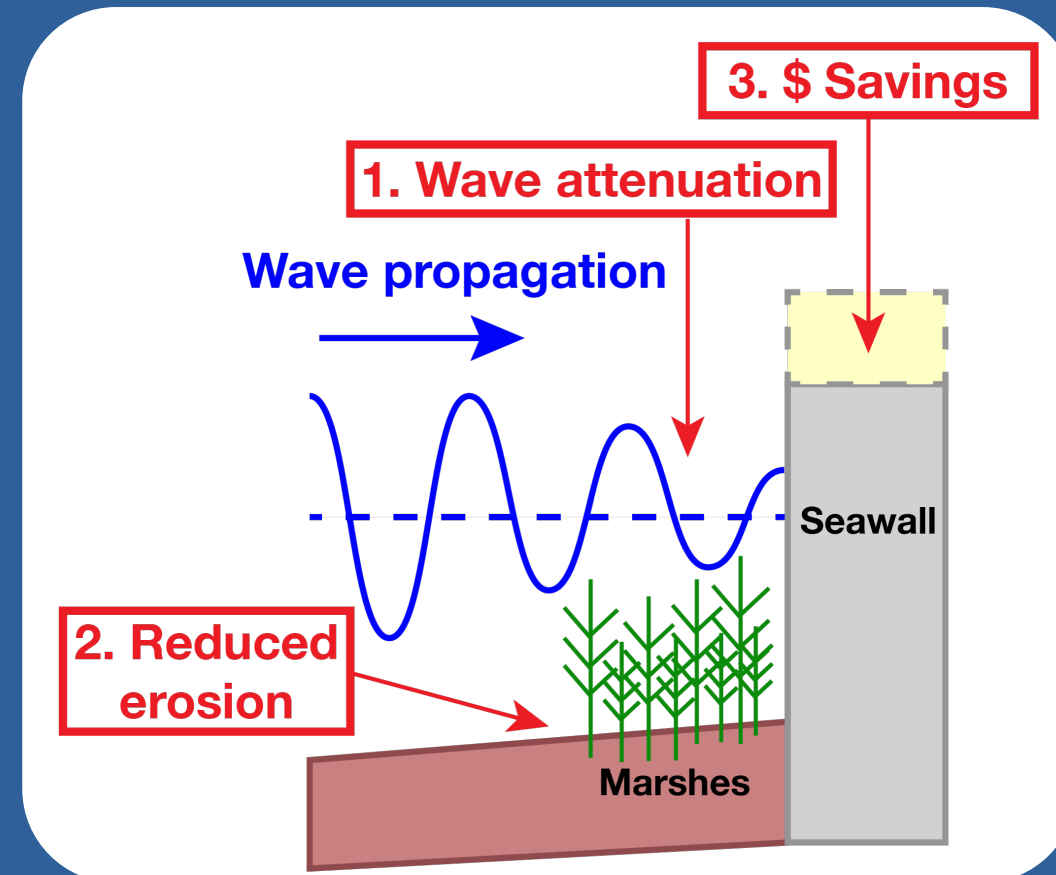
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Motivation

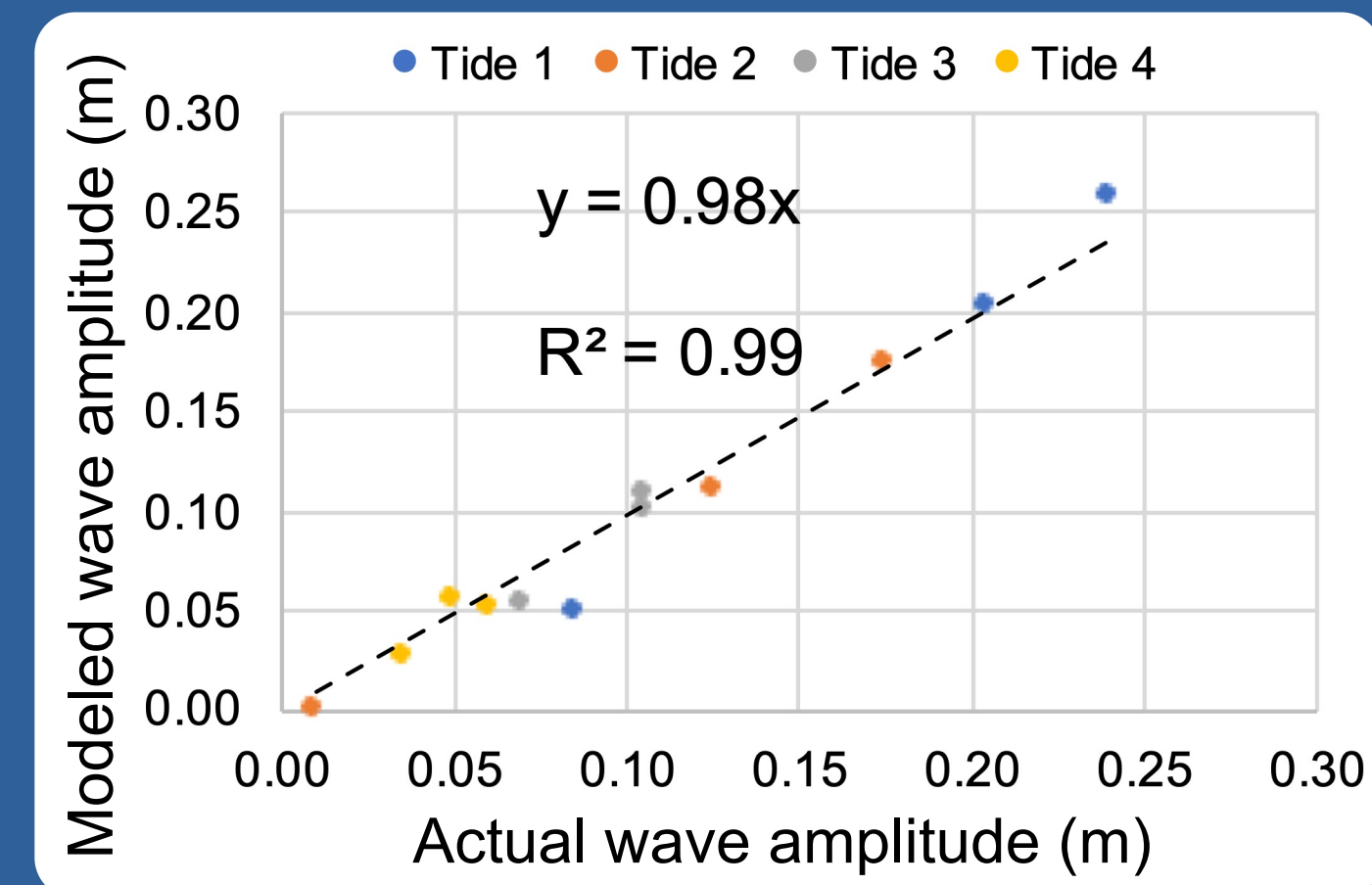
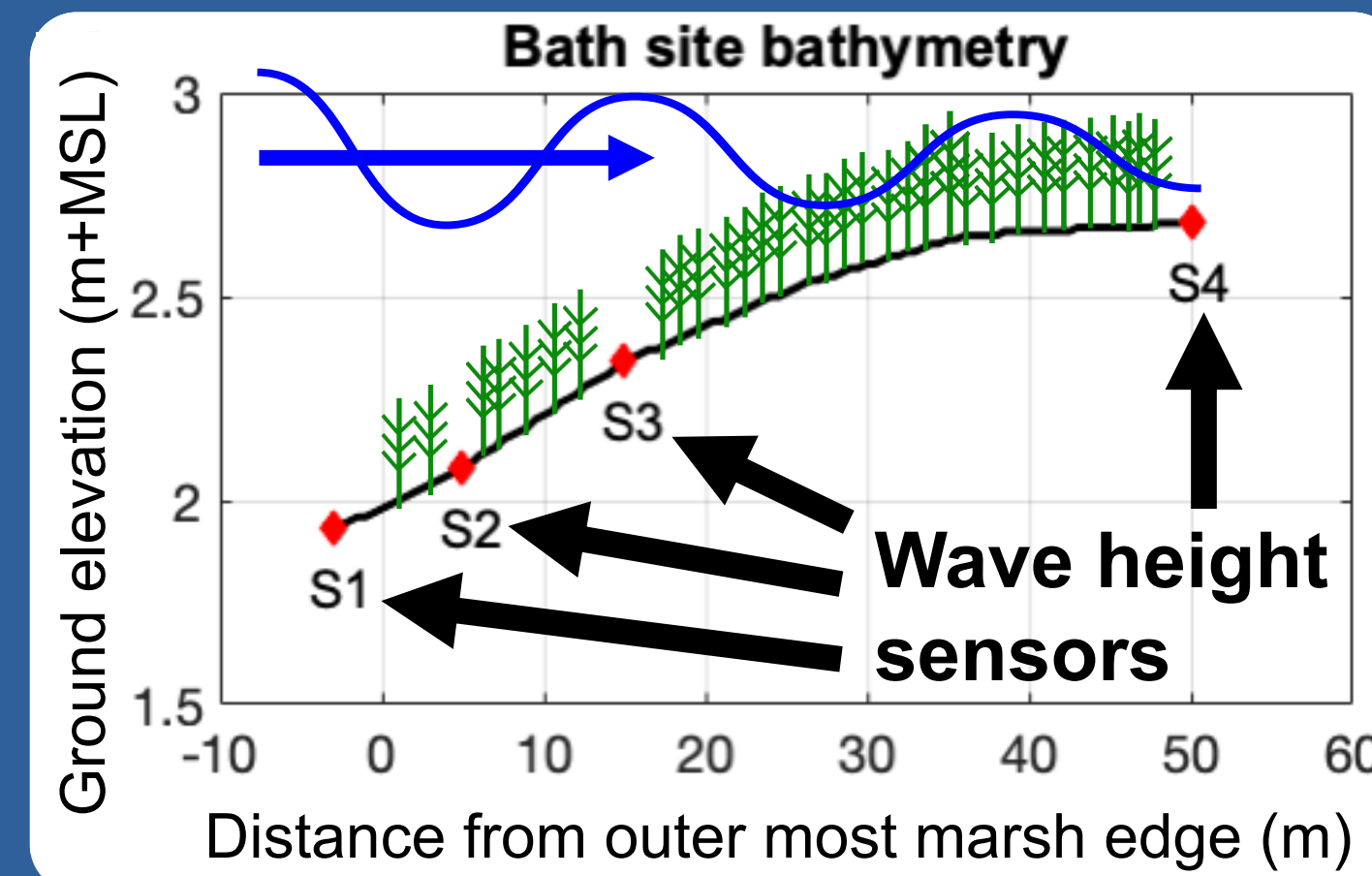
Gray Infrastructure



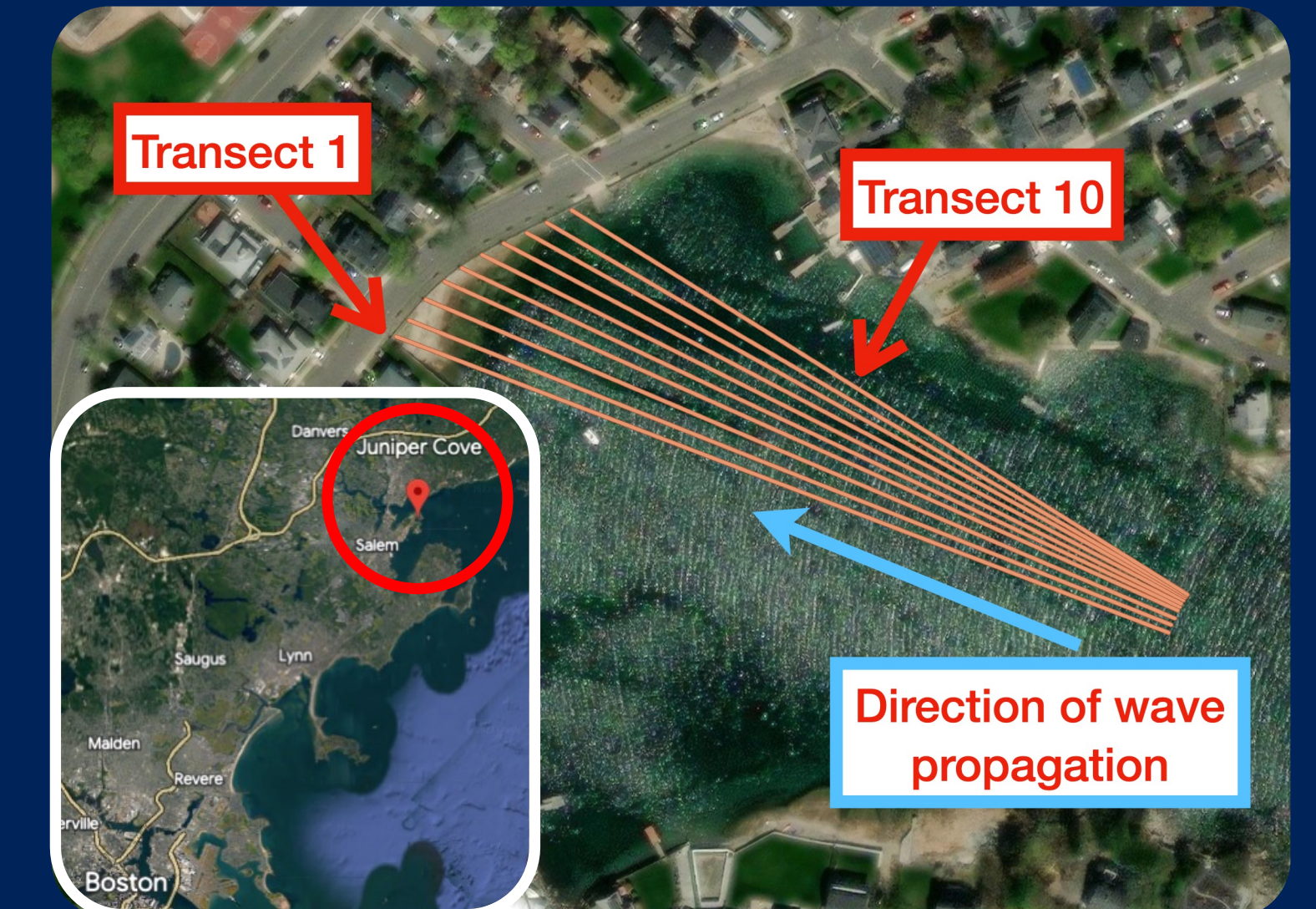
Hybrid Infrastructure



1D Wave Model Validation



Juniper Cove Case Study



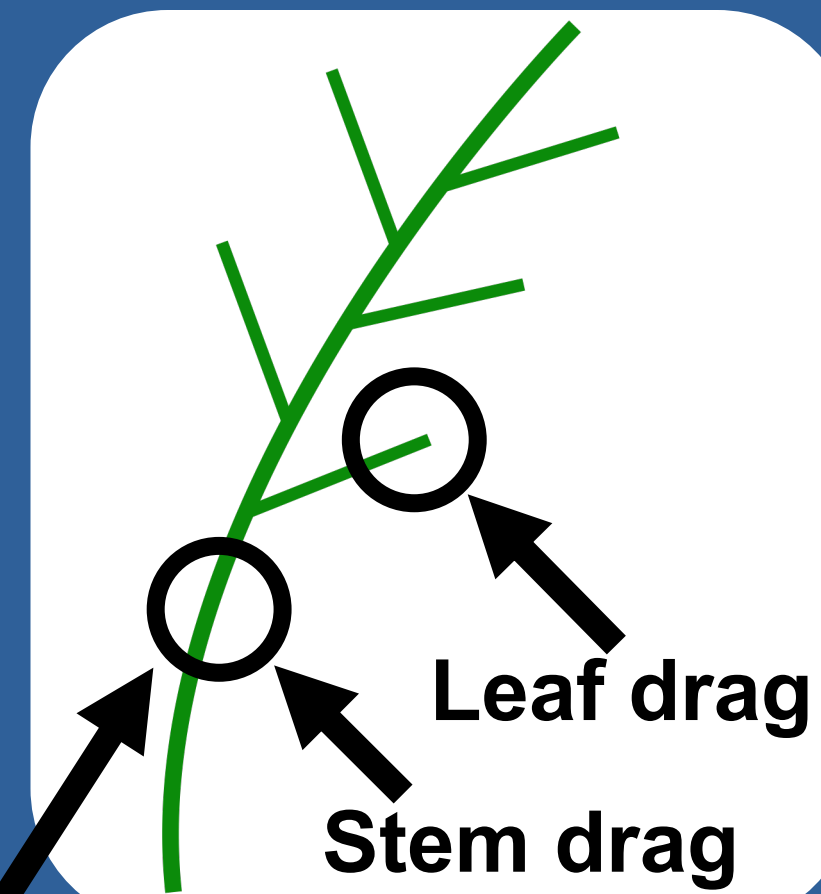
1D Wave Attenuation Model

Inputs

Offshore wave parameters

Vegetation morphology and rigidity

Site bathymetry



4 Mechanisms affecting waves propagation

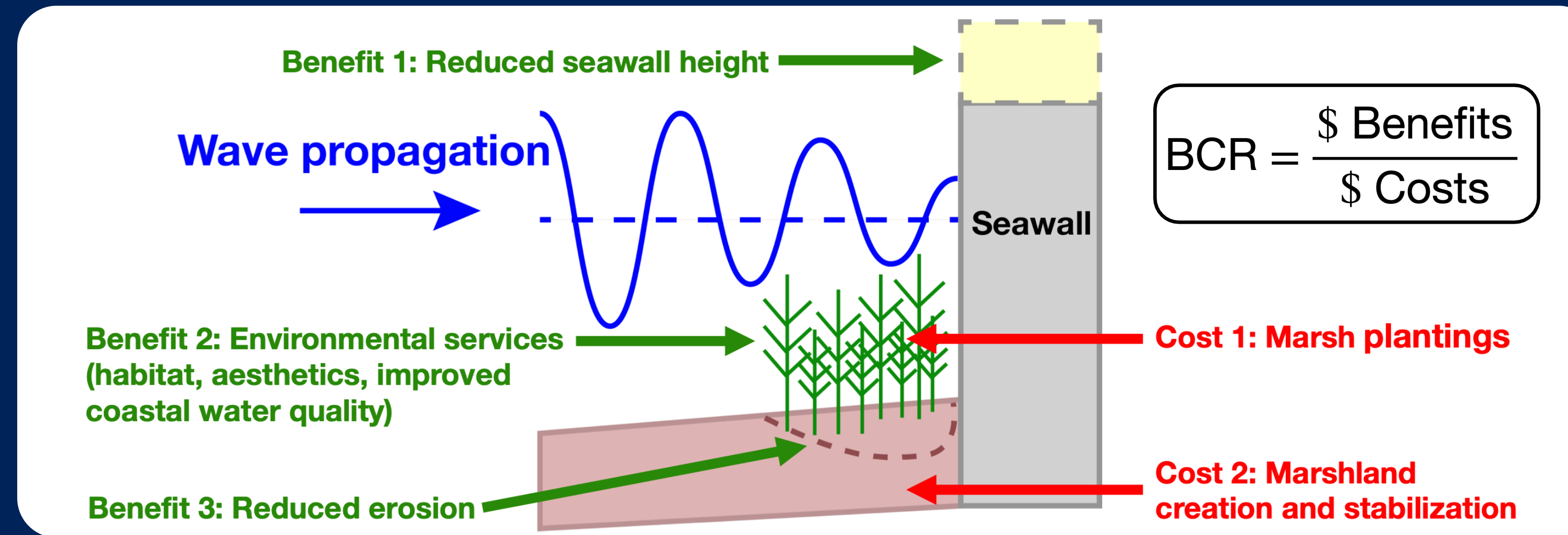
1. Wave breaking, K_{br}

2. Vegetation drag, K_v

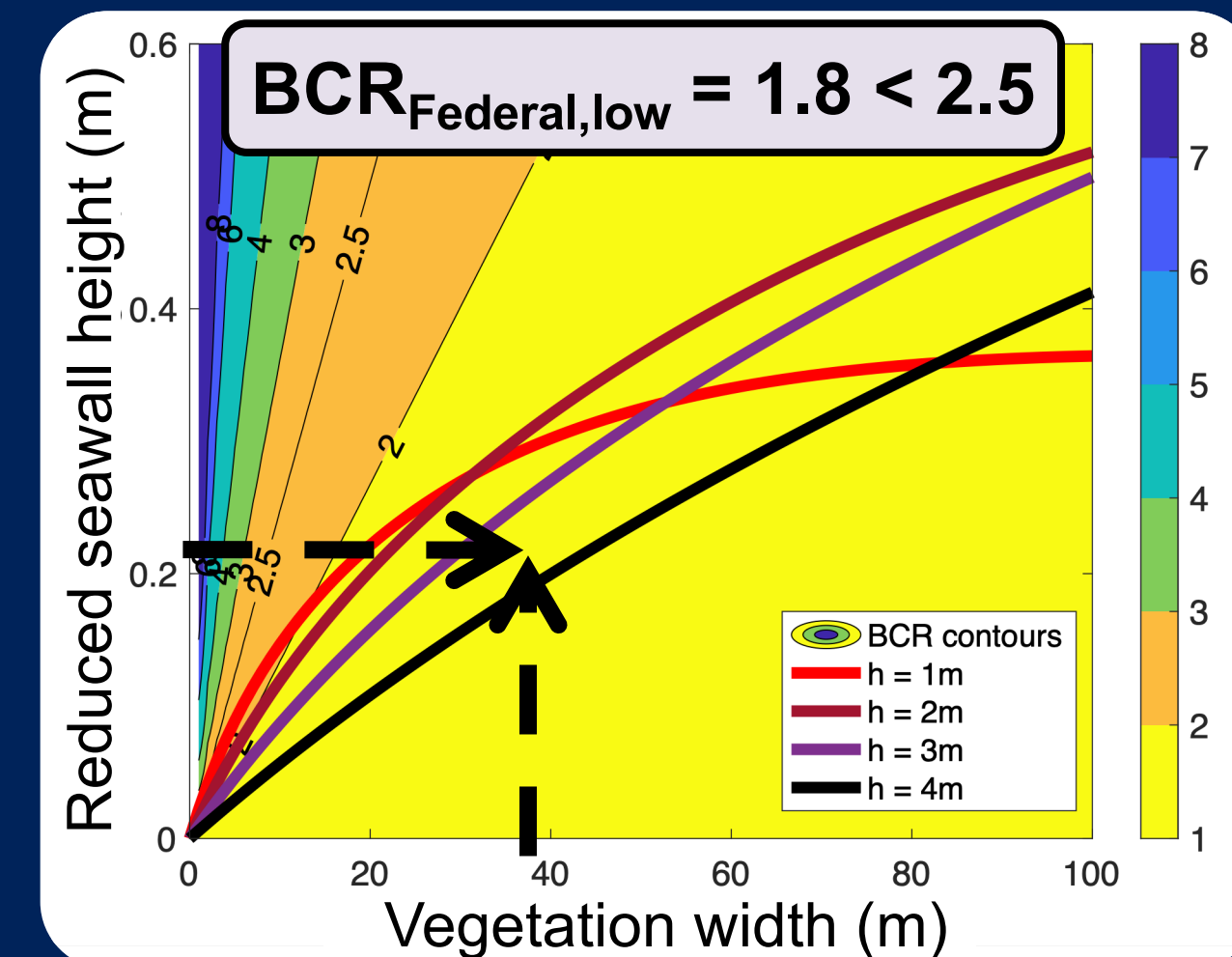
3. Shoaling, K_{sh}

4. Bed friction, K_{bed}

Benefit-Cost Analysis



$$BCR = \frac{\$ \text{ Benefits}}{\$ \text{ Costs}}$$



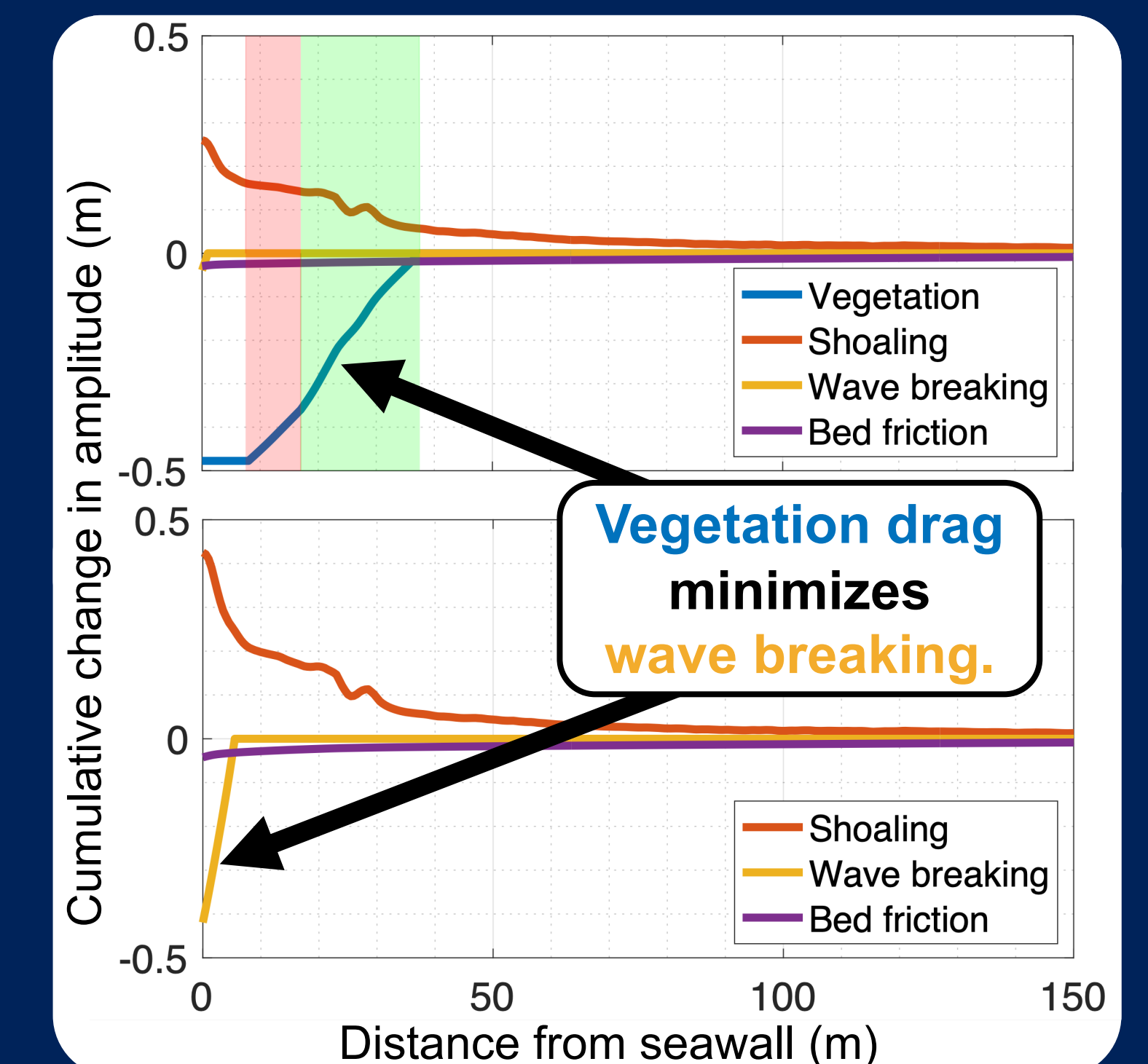
Design tool:

For 30 m marsh with 2 m water depth at seawall.

0.27 m seawall reduction.

∴ Not qualify for federal funding.

e.g. Transect 3 at 50-year storm



Vegetation can reduce wave amplitude by 13% – 60%.

∴ Even short width of marsh (20 to 40 m) can have significant effects.