US Army Corps of Engineers®

UNIVERSITY OF GEORGIA
Institute for Resilient Infrastructure Systems

Engineering With Nature®

Engineering With Nature
Translating Modeling -> Design -> End-Users

Matthew V. Bilskie

Assistant Professor, College of Engineering
University of Georgia

Overview

Landscape Architectural Design	Design Standards & Communication	Computational Modeling

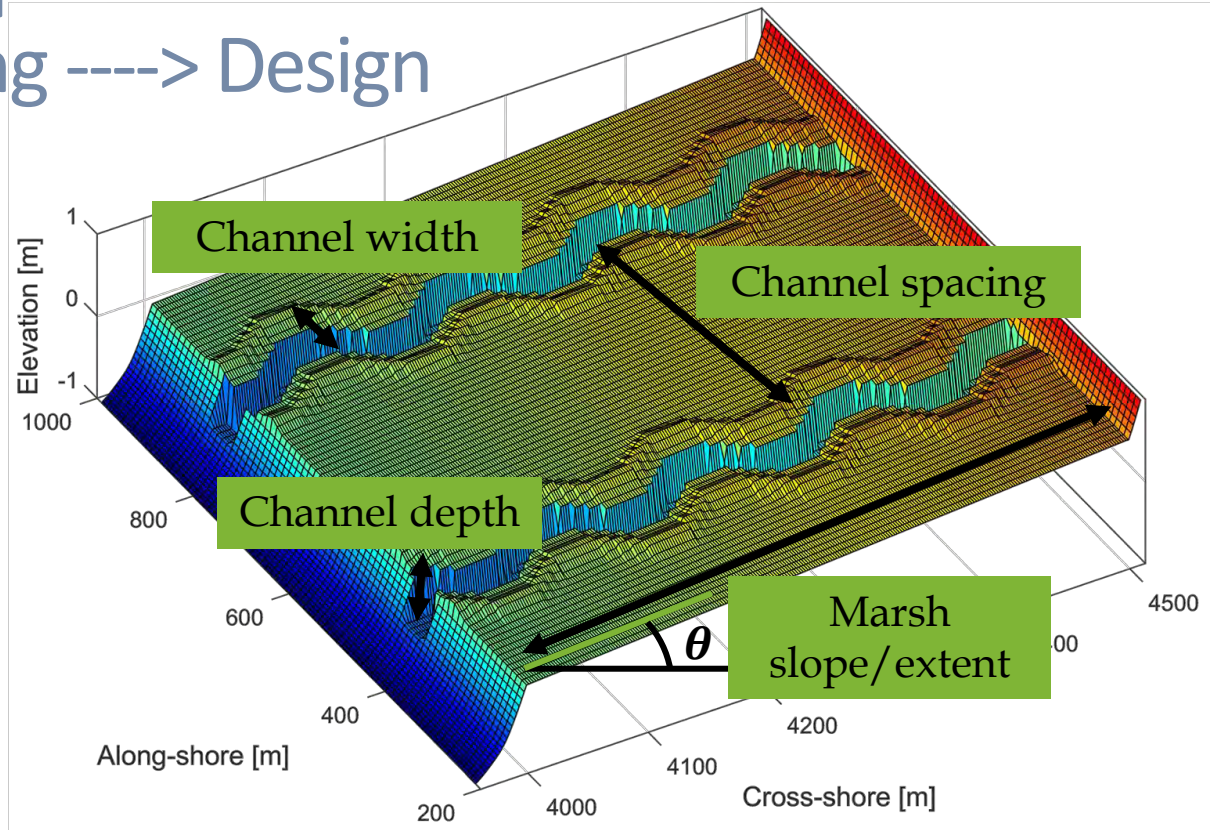
Translation

- Modeling----> Design
- Design ----> End-Users

Source: Duck's Unlimited

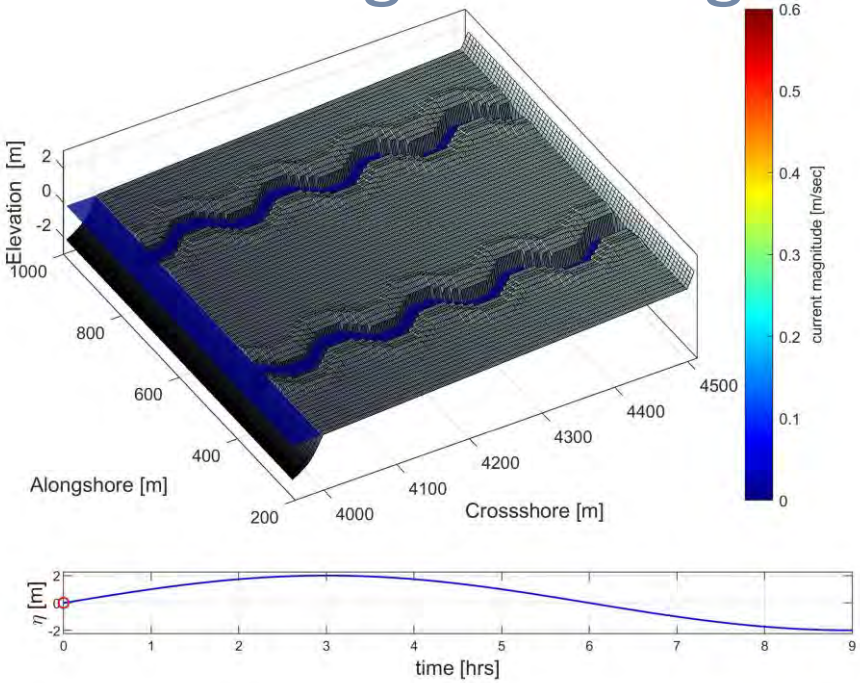
Example

Modeling ----> Design



Example

Modeling ----> Design



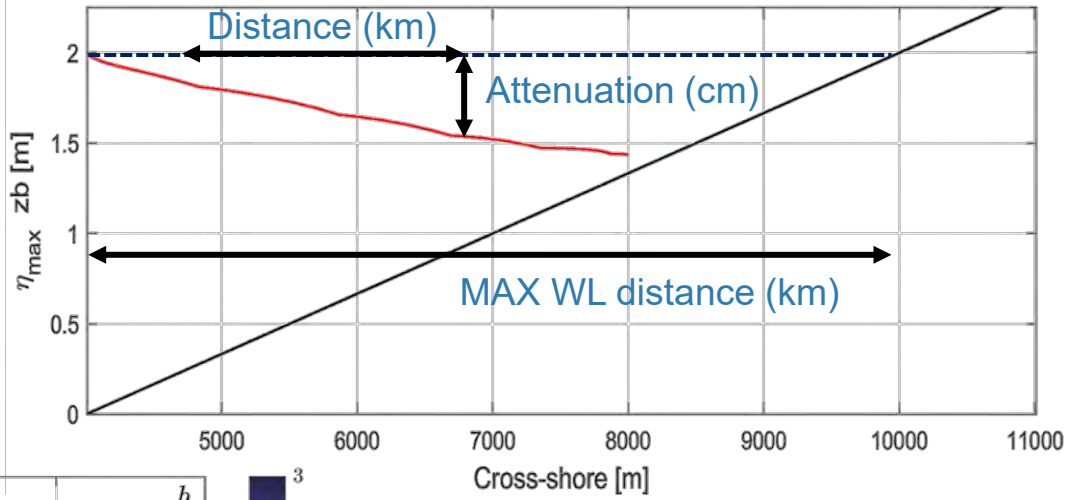
- Marsh vegetation impedes flow
- Marsh vegetation exists on land & land itself attenuates flow
- Tidal creeks promote tidal exchanges (flood & ebb)

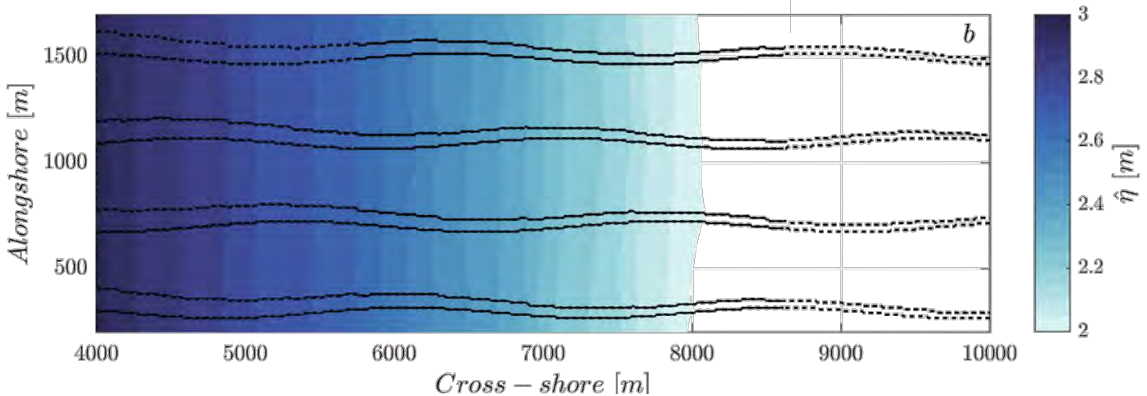
Attenuation Metrics

$$Channel\ ratio\ (cr) = \frac{Channel\ area\ (m^2)}{Total\ marsh\ area\ (m^2)}$$

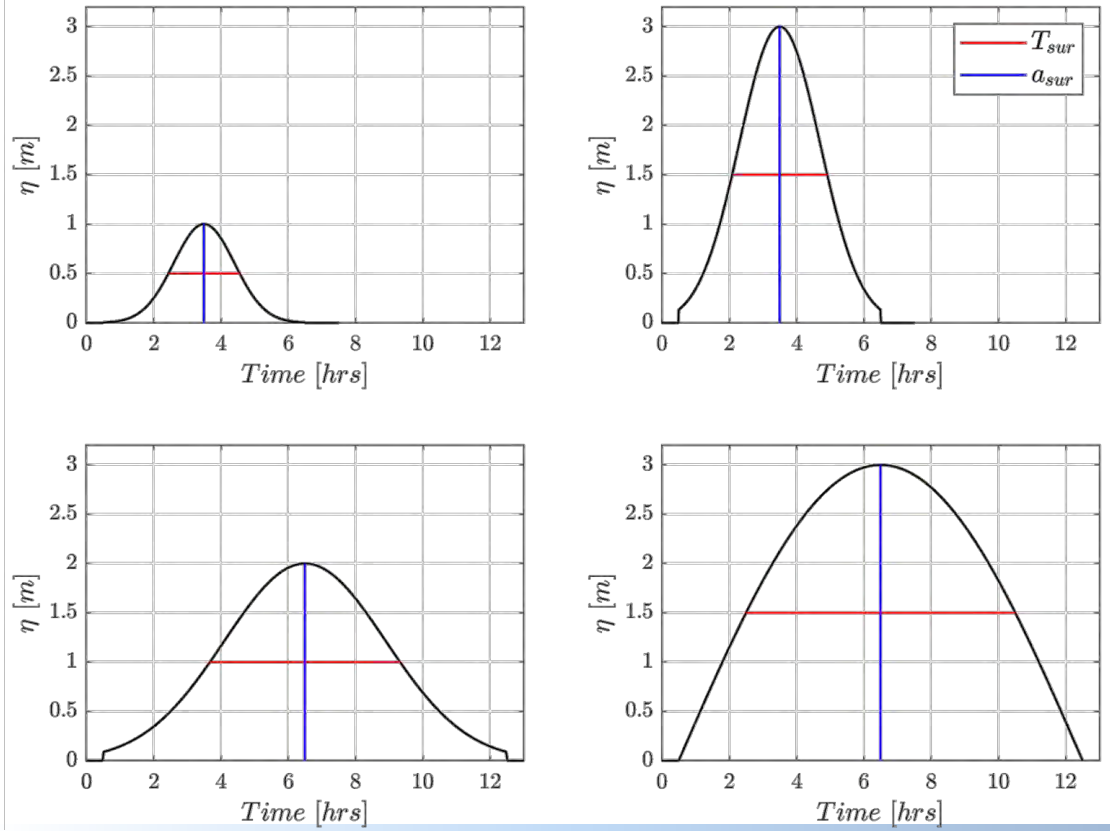
$$Attenuation\ rate\ [cm/km] = \frac{Attenuation\ (cm)}{Distance\ (km)}$$

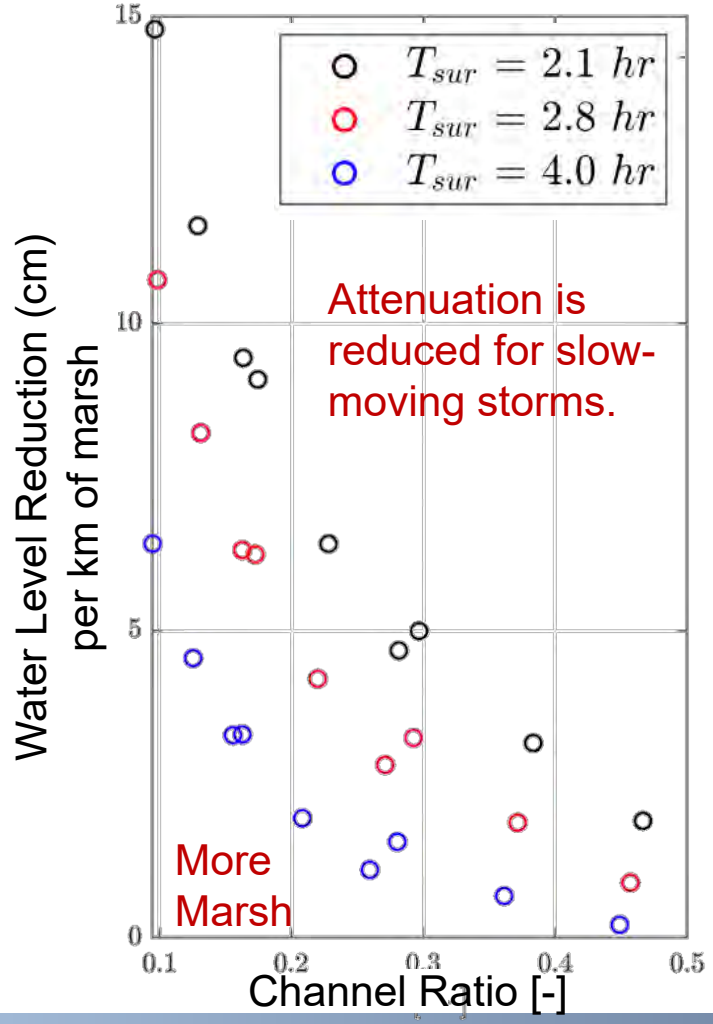
$$Relative\ Inundation\ dist\ [\,] = \frac{Inundation\ distance\ (km)}{MAX\ WL\ distance\ (km)}$$



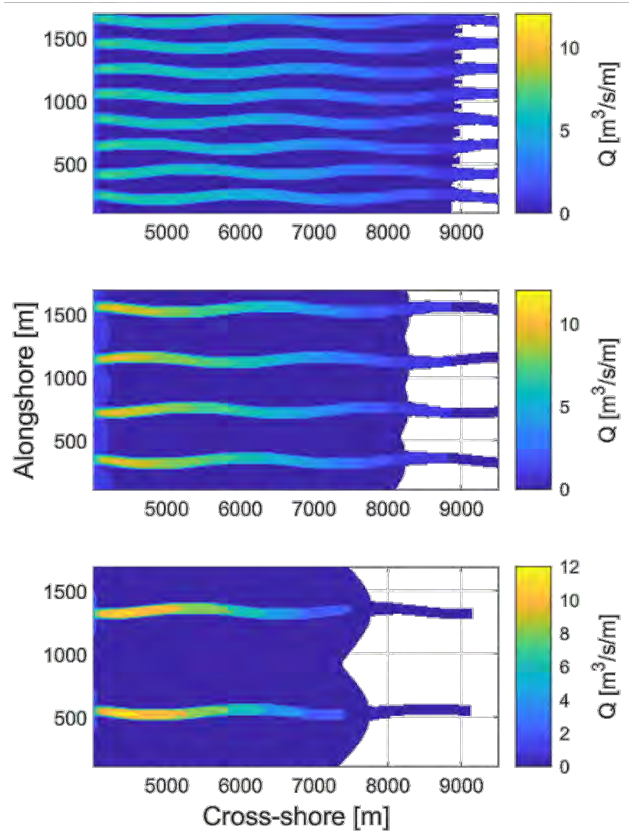


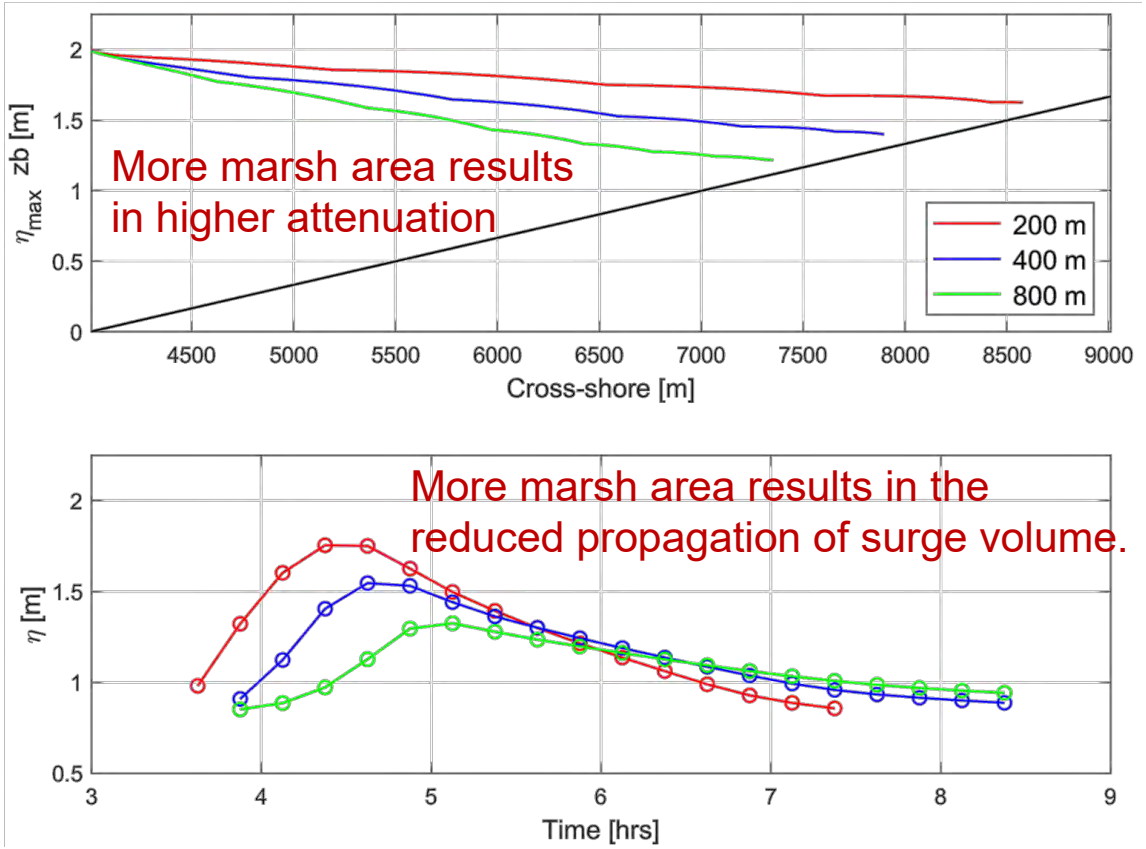
Storm Profiles





Channel Geometry

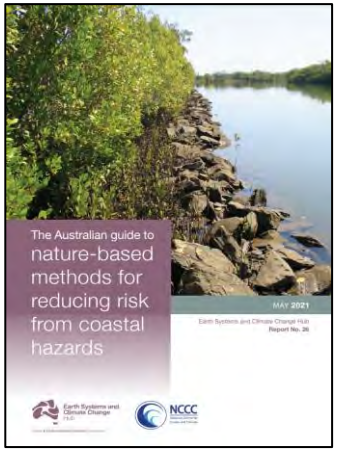


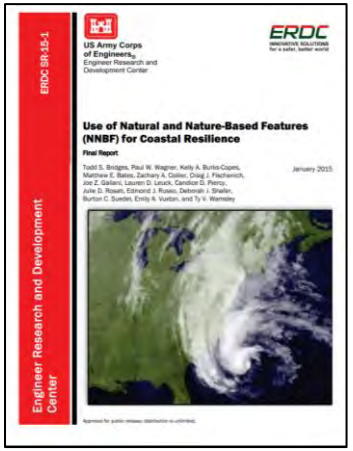


Communication to End-Users

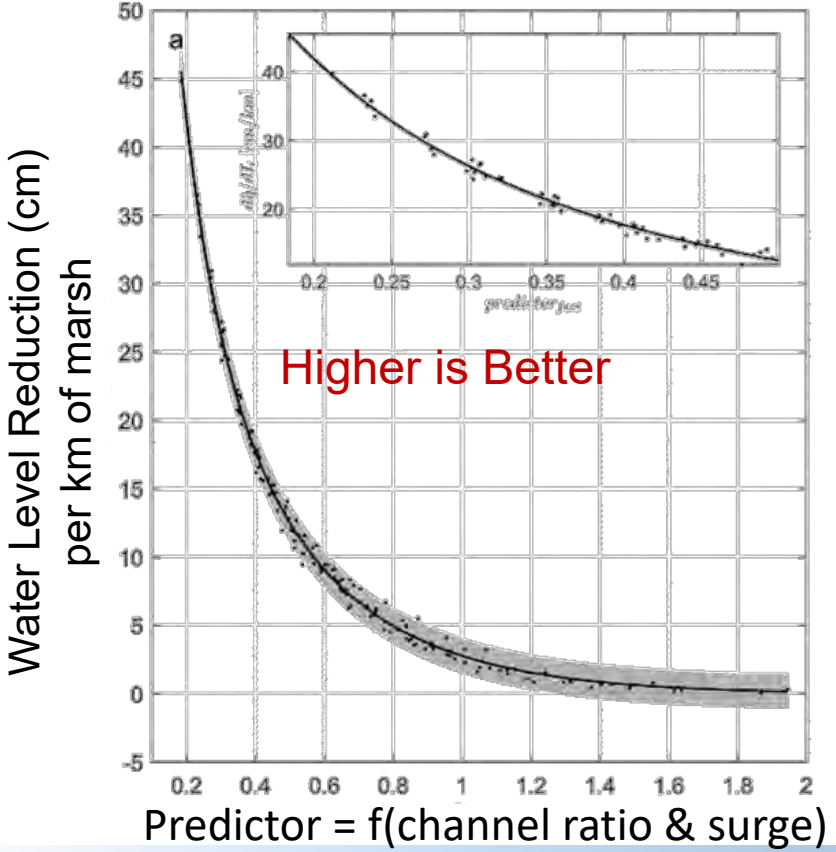
Authors	Data source	Surge type	Wetland type	Location	Length of attenuation (km)	Attenuation rate (cm.km^{-1})
1. Lovelace 1994 in Wamsley et al. 2010	Field	Hurricane Andrew, 1992	Marsh/open water	Louisiana, USA	37	4.4 to 4.9
2. In Stark et al. 2015, calculated from figures in Van der Molen, 1997	Field	Tides	Tidal flat/marsh channel	Massachusetts, USA	–	−2.0 to 11.0
3. Krauss et al. 2009	Field	Hurricane Charley, 2004	Marsh/mangrove	Florida, USA	5.5	9.4 to 15.8
4. Krauss et al. 2009	Field	Hurricane Wilma, 2005	Marsh/mangrove	Florida, USA	14	4.0 to 6.9
5. McGee et al. 2006, Wamsley et al. 2010	Field	Hurricane Rita, 2005	Marsh	Louisiana, USA	–	10.0
6. Mc Gee et al. 2006, Wamsley et al. 2010	Field	Hurricane Rita, 2005	Marsh	Louisiana, USA	–	25.0
7. McGee et al. 2006, Wamsley et al. 2010	Field	Hurricane Rita, 2005	Marsh	Louisiana, USA	–	4.0
8. Mc Gee et al. 2006, Wamsley et al. 2010	Field	Hurricane Rita, 2005	Marsh	Louisiana, USA	–	7.7
9. Zhang et al. 2012	Modeling	Hurricane Wilma, 2005	Mangrove	Louisiana, USA	6–30	40 to 50
10. Zhang et al. 2012	Modeling	Hurricane Wilma, 2005	Mangrove/open water	Louisiana, USA	6–30	20
11. Stark et al. 2015, evaluated from figures	Field	Tides and storm surge	Marsh platform, edge of a small stream	Netherlands	~0.15	−2 to 70
12. Stark et al. 2015, evaluated from figures	Field	Tides and storm surge	Marsh platform, edge of a small stream	Netherlands	~0.1	−2 to 60
13. Stark et al. 2015, evaluated from figures	Field	Tides and storm surge	Marsh platform, edge of the main stream (~100 m wide)	Netherlands	~0.05	25 to 65

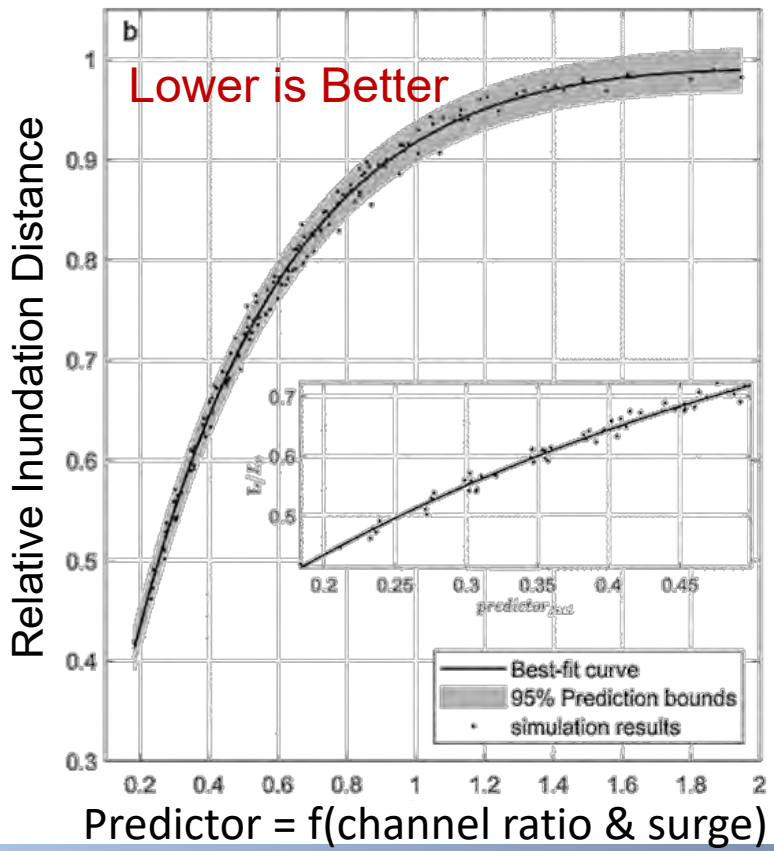
(Paquier et al., 2017)





Towards Design Standards…





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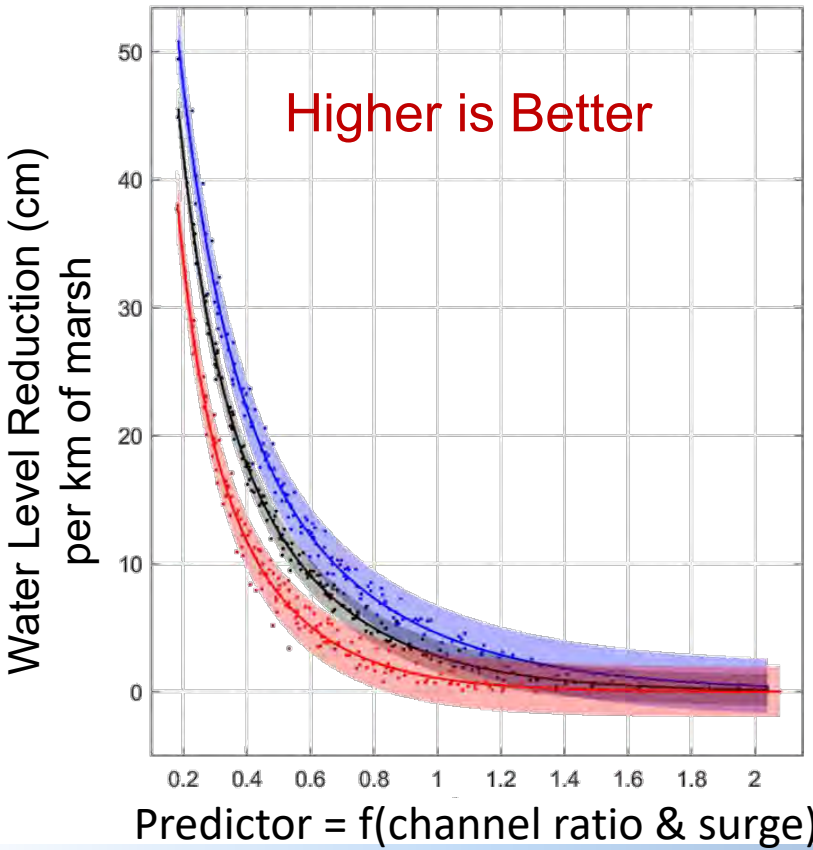
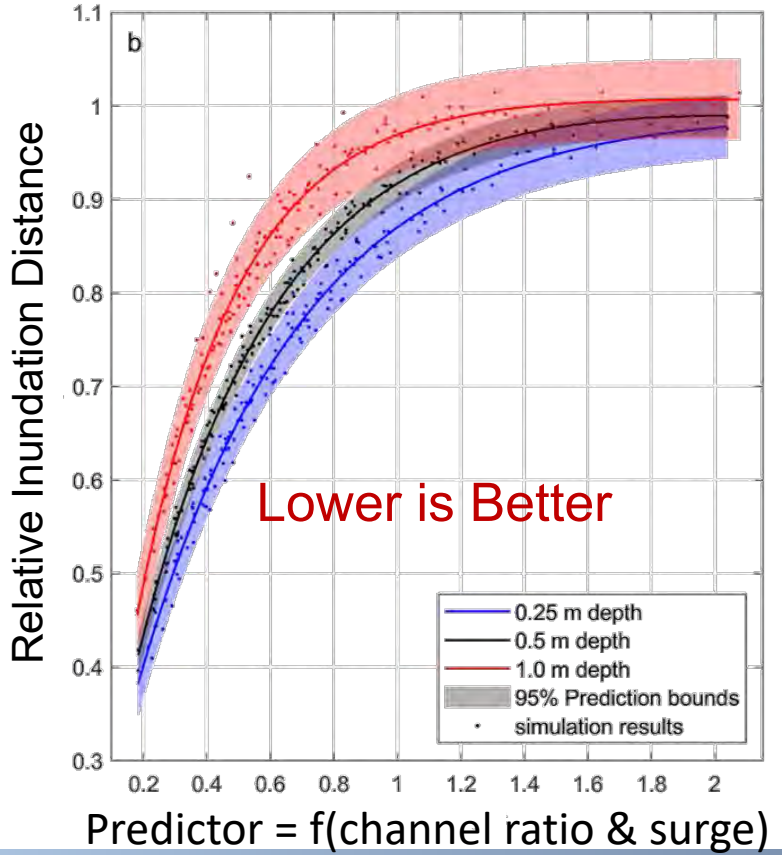
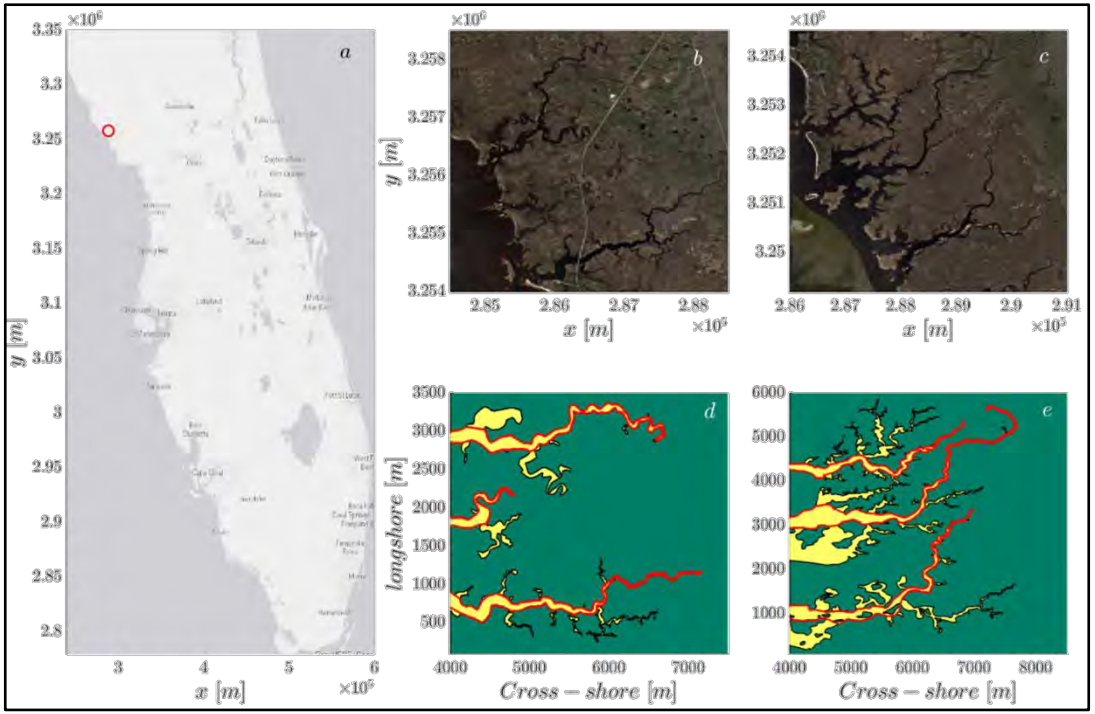
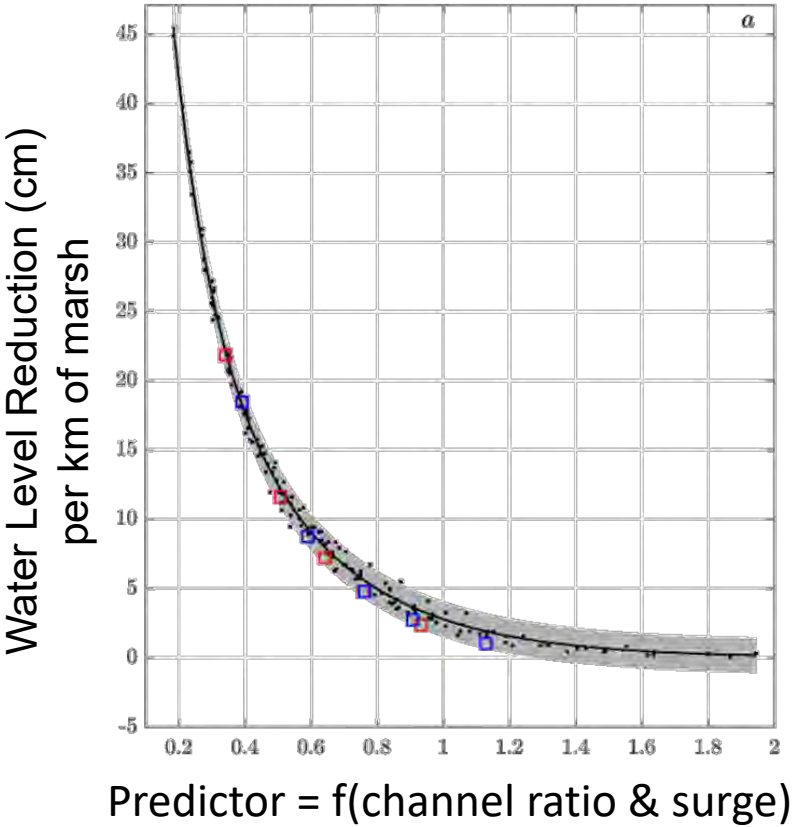




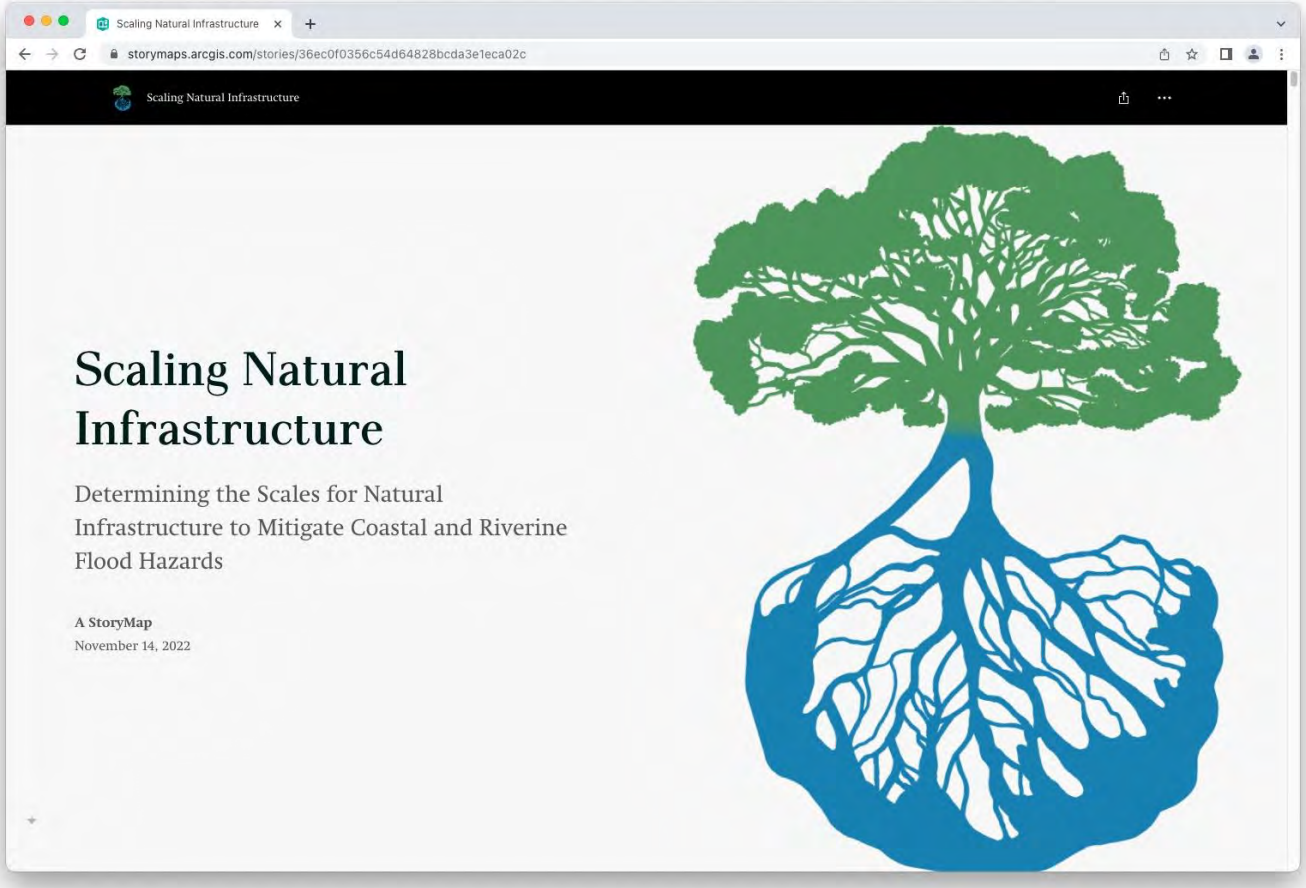
Does it match natural marshes?





ArcGIS Story Maps

- FREE!
- Create and share maps within a narrative
- Maps, pictures, videos, text, etc.
- ScalingNaturalInfrastructure.com
  - Works best in Google Chrome



Live Demo: ScalingNaturalInfrastructure.com

Any Questions?

Please email: mbilskie@uga.edu

University of Georgia
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Go Dawgs!