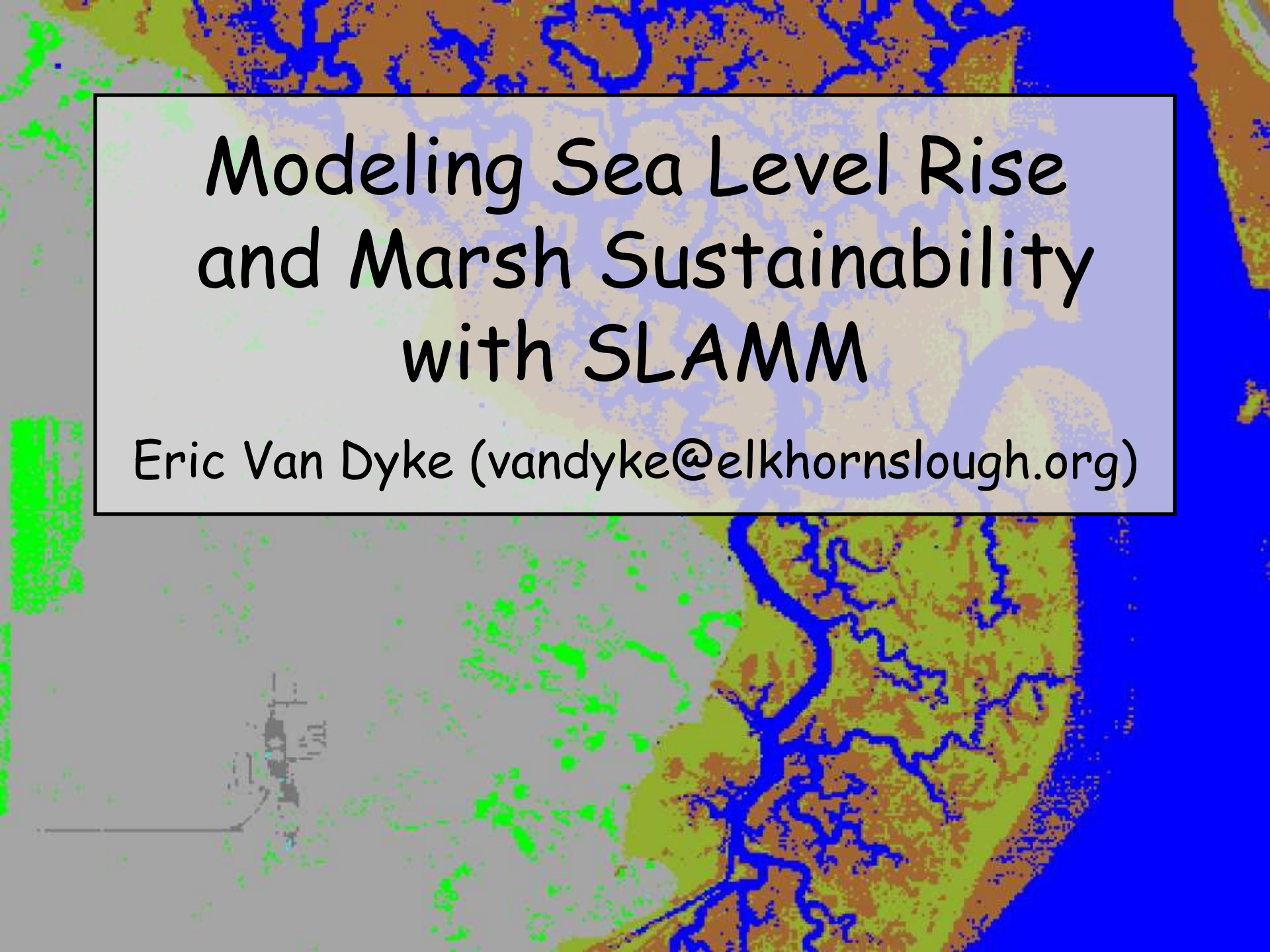

Modeling Sea Level Rise and Marsh Sustainability with SLAMM

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Washington, DC 20460

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EPA

Greenhouse Effect Sea Level Rise and Coastal Wetlands

The SLAMM Model

Description. Because no previous researchers had developed a satisfactory model, it was necessary for us to develop a simulation model suitable for analyzing the impact of sea level rise on coastal wetlands. The model, called SLAMM (Sea Level Affecting Marshes Model), simulates the long-term change in coastal areas due to rising sea level. The model employs a reasonably straightforward but complex set of decision rules to predict the transfer of map cells from one category to another (Figure 4-8). These rules embody assumptions of linear, average responses. They may not apply in detail for any particular area; however, they are suitable for policy development on a regional basis, providing an estimate of the magnitude of the problems and suggesting the nature of the regional policies needed to mitigate those problems.

Figure 4-8 summarizes the model. The average elevation for a cell is determined by subtract-

Sea Level Affecting Marshes Model

http://warrenpinnacle.com

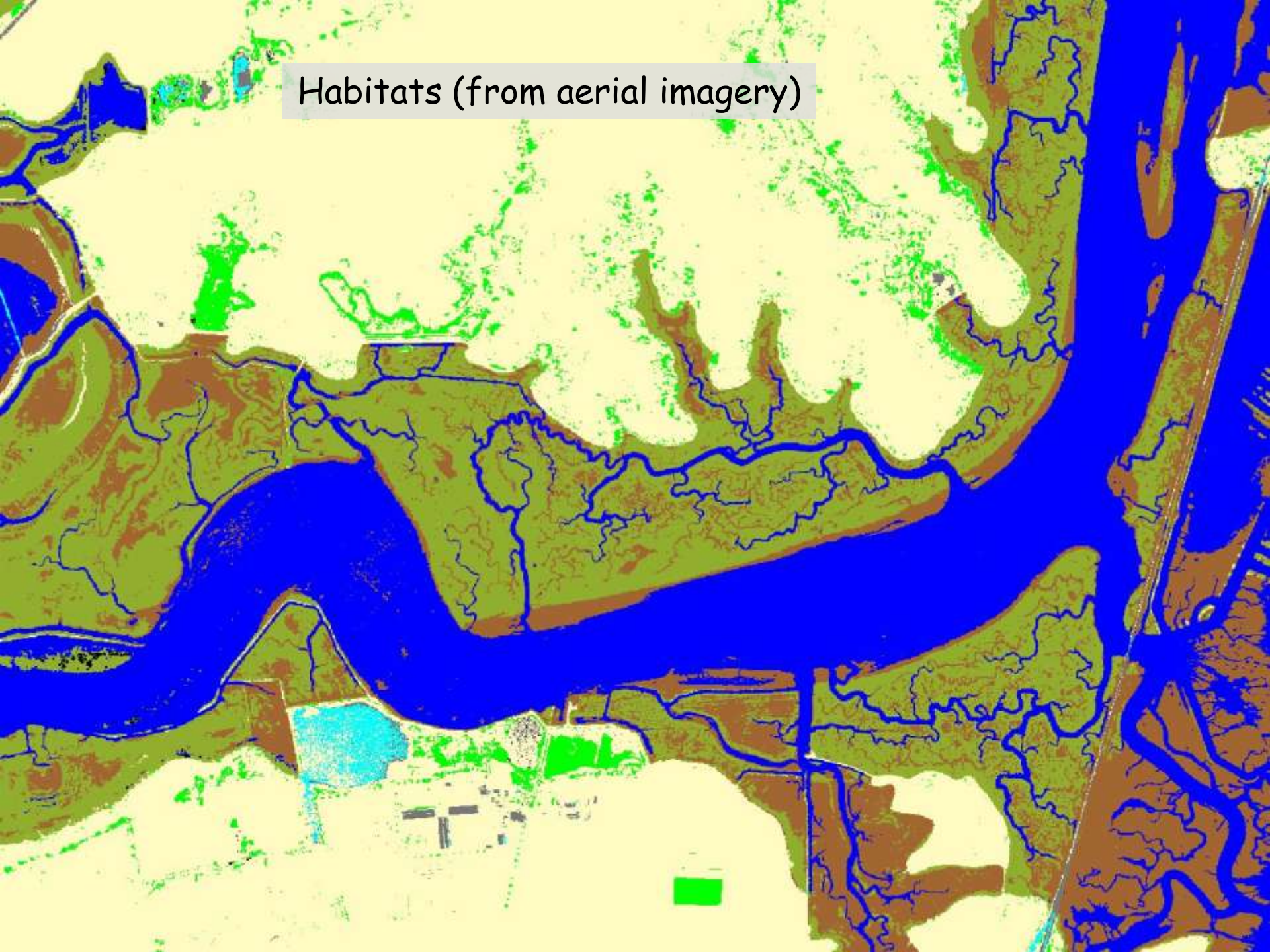
- SLAMM (1985, Dr. Richard A. Park)
- v. 2 (1991)
- v. 3 (1993)
- v. 4 (1998) GIS maps & GUI
- v. 5 (2007) salinity model
- v. 6 (2009) flexible elevation ranges
- v. 6.1 beta (2010) open source

Principal users

- EPA
- National Wildlife Federation
- U.S. Fish & Wildlife Service
- The Nature Conservancy
- Ducks Unlimited
- … more

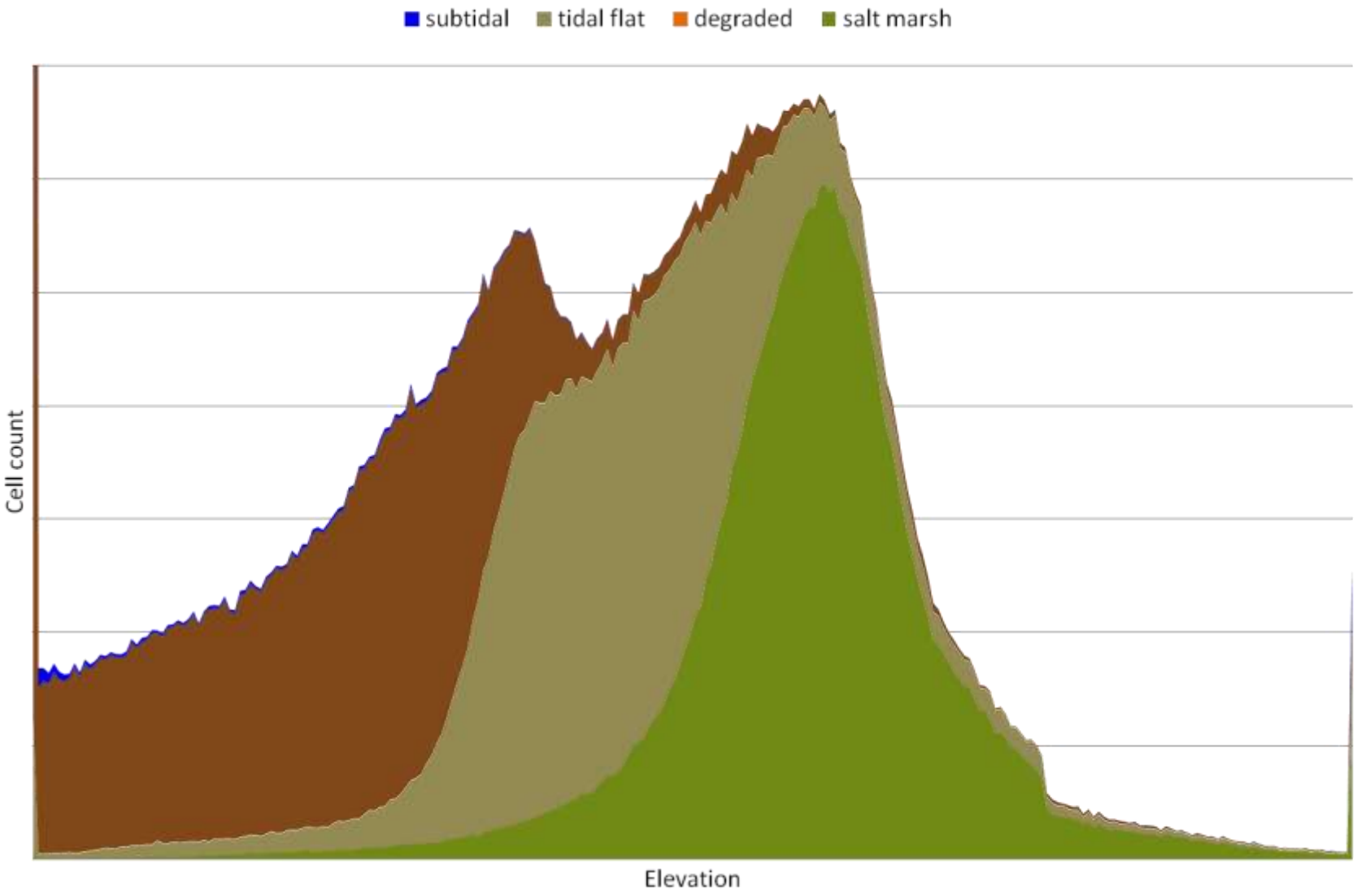
Data requirements

- Wetland habitats with elevation ranges
- Precise elevations ("bare earth" DTM)
- Tidal range
- Accretion rates (marsh, tidal flat)
- Erosion rates (marsh, tidal flat)
- Regional subsidence or uplift
- SLR predictions (IPCC)
- optional: levees, % impervious, subsites


Habitats (from aerial imagery)

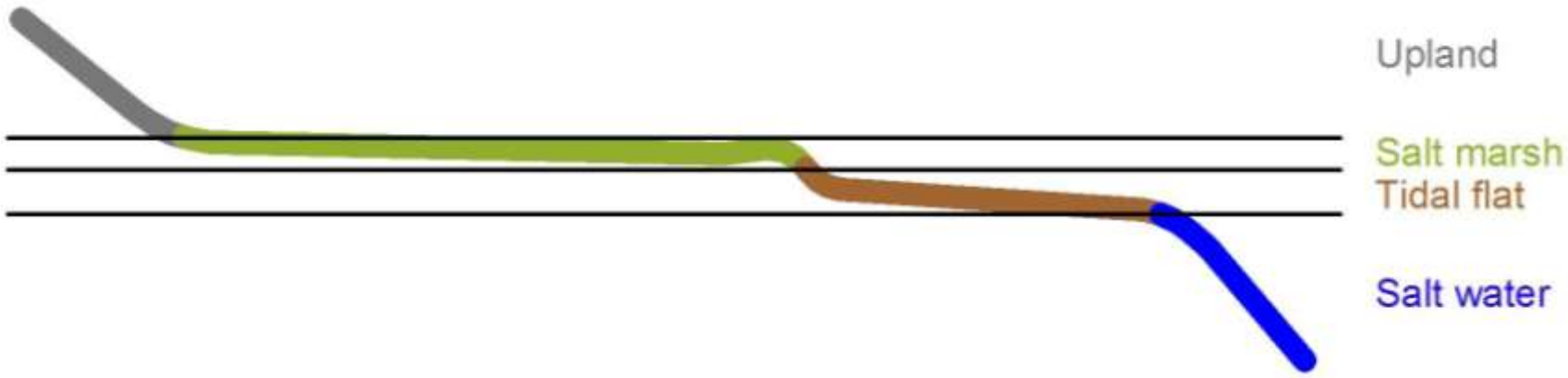

Elevations (from LiDAR)

Habitat / Elevation registration errors

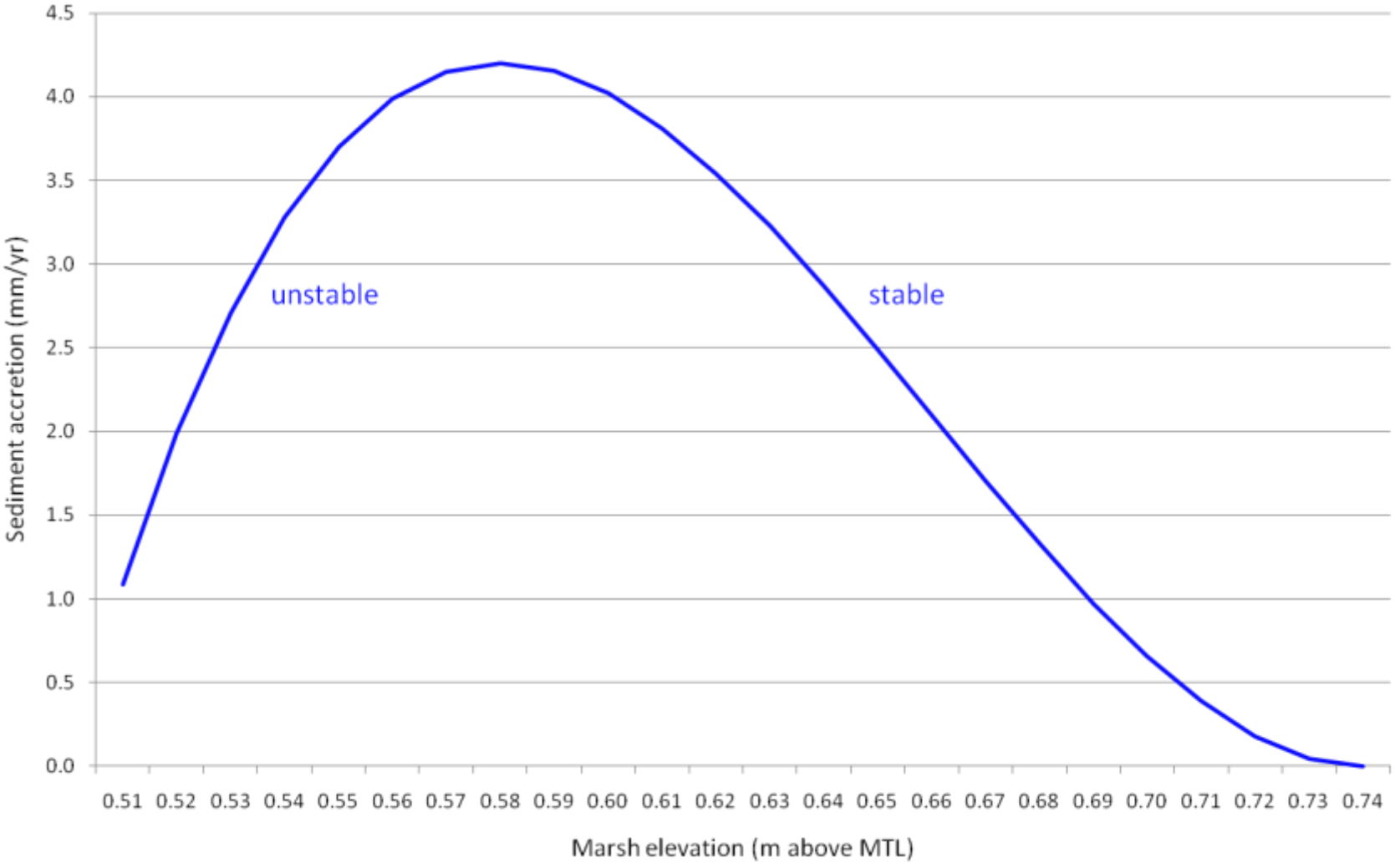


Habitat elevation ranges

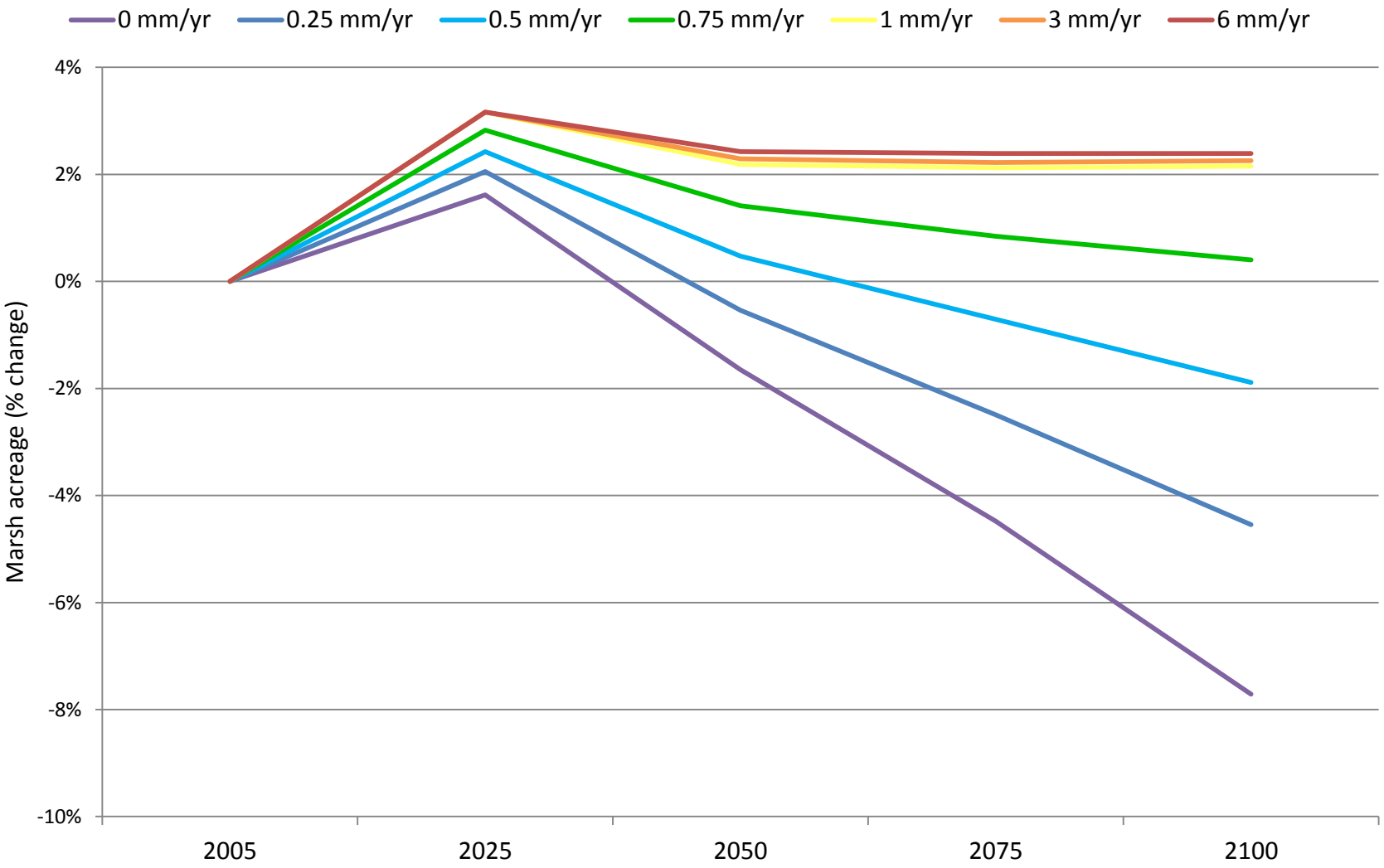
Category	Transition	Minimum	5%	Mean	95%	Max	Stdev
Upland	0.82	0.10	4.25	9.05	9.52	21.16	1.74
Salt Marsh	0.40	-1.15	0.01	0.54	0.94	1.20	0.29
Tidal Flat	-0.20	-1.13	-0.07	0.23	0.51	1.18	0.19



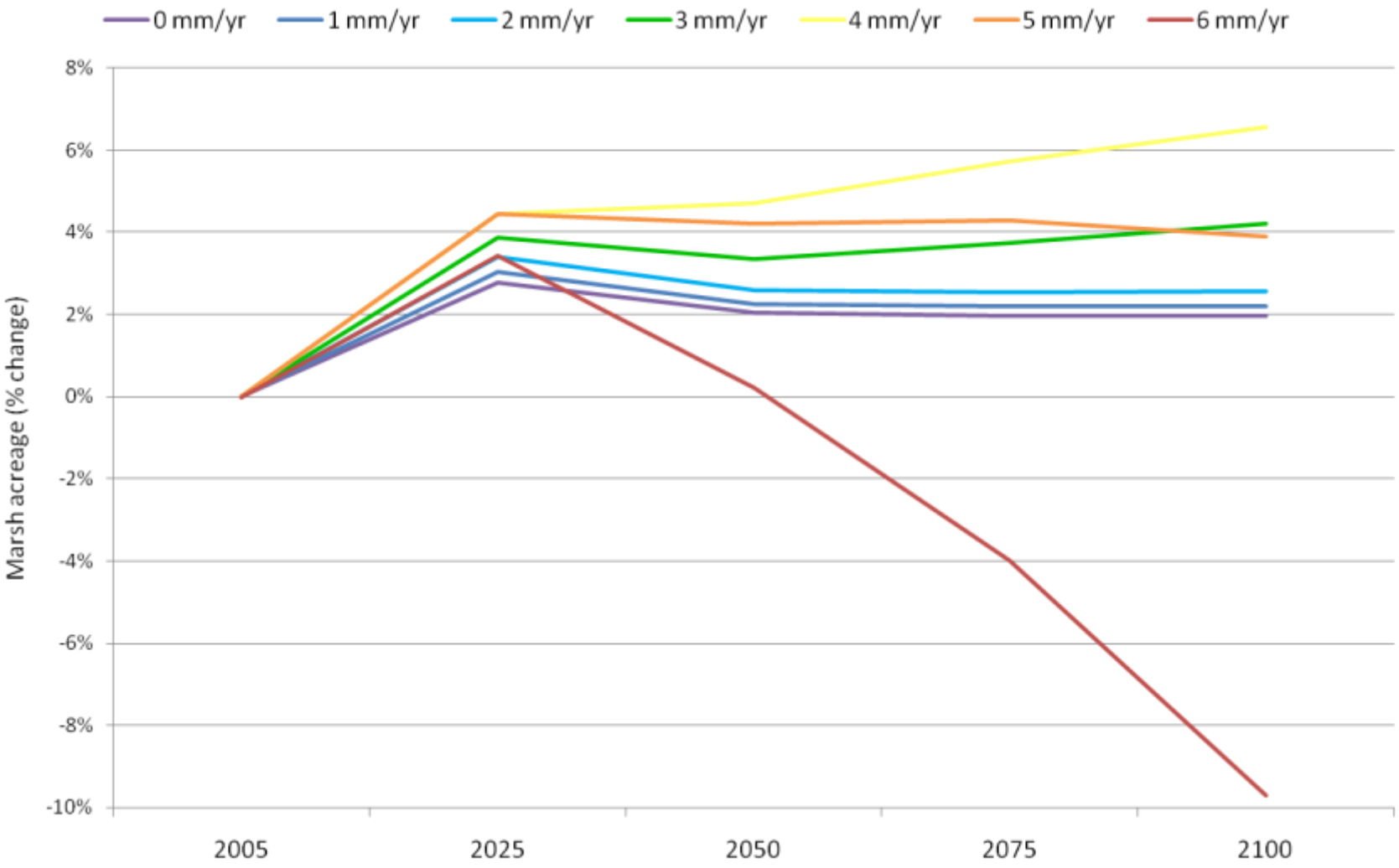
Depth and vegetation feedback (dynamic accretion)



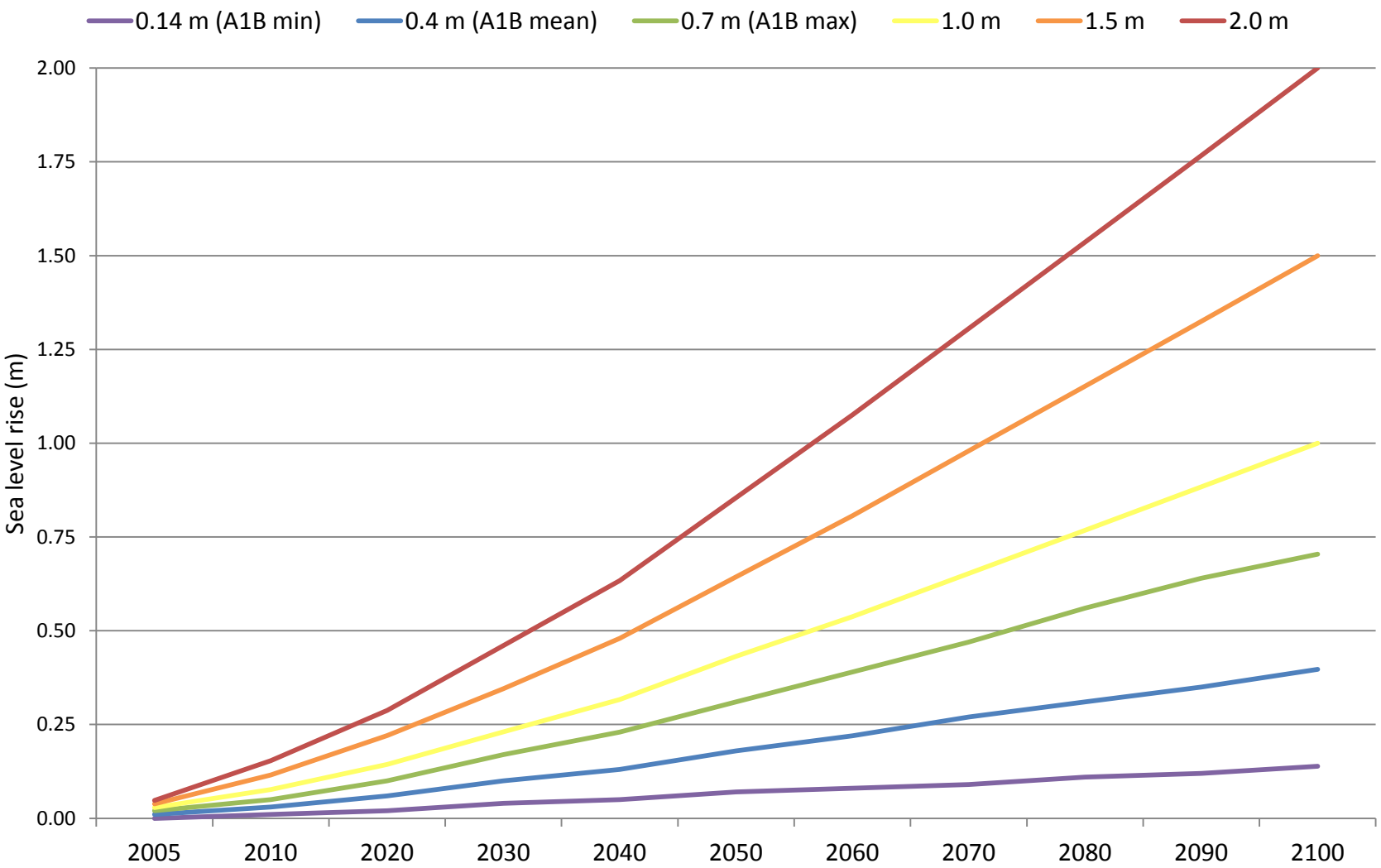
Sensitivity to accretion rate



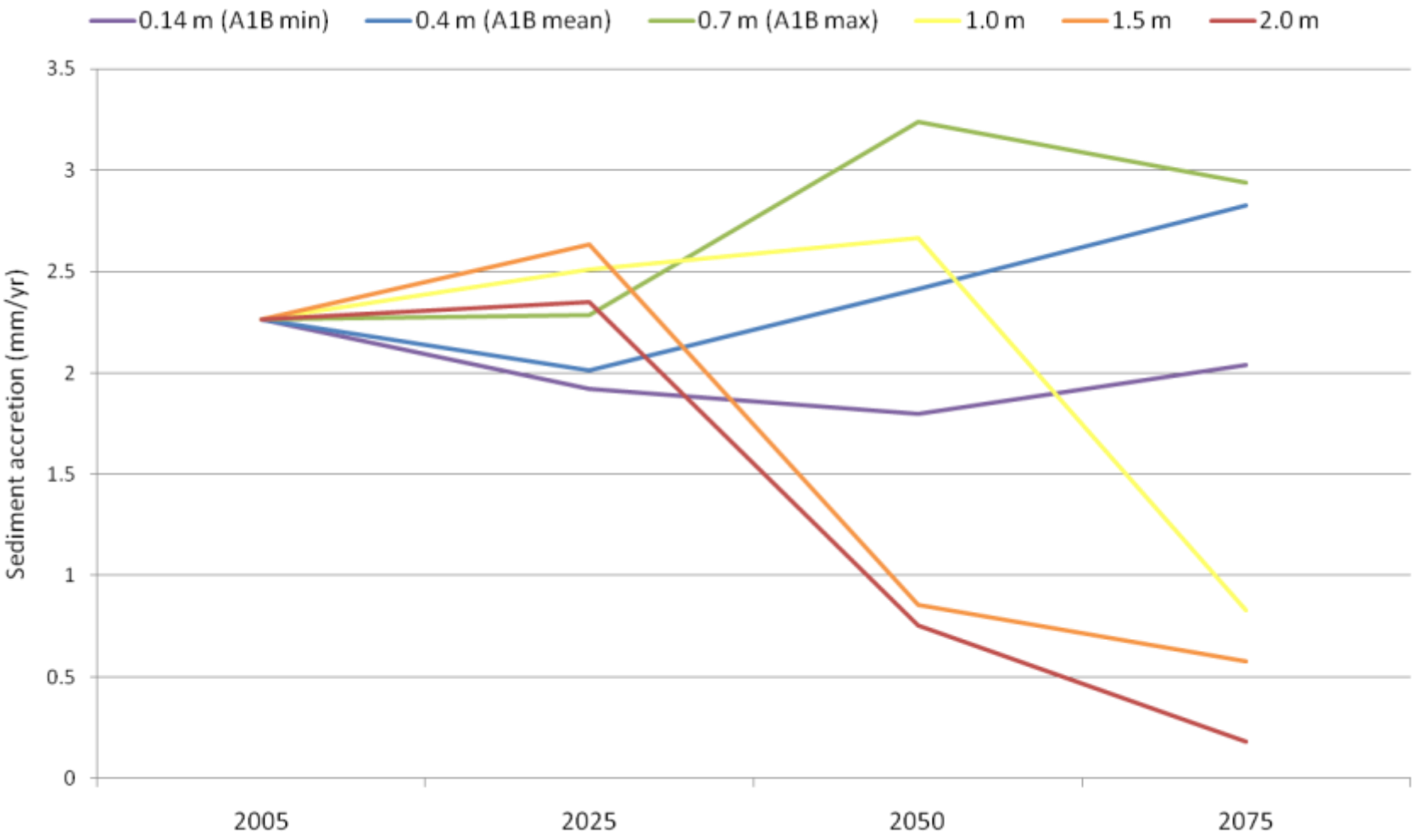
Sensitivity to subsidence rate



Sea level rise predictions (IPCC A1B and greater)

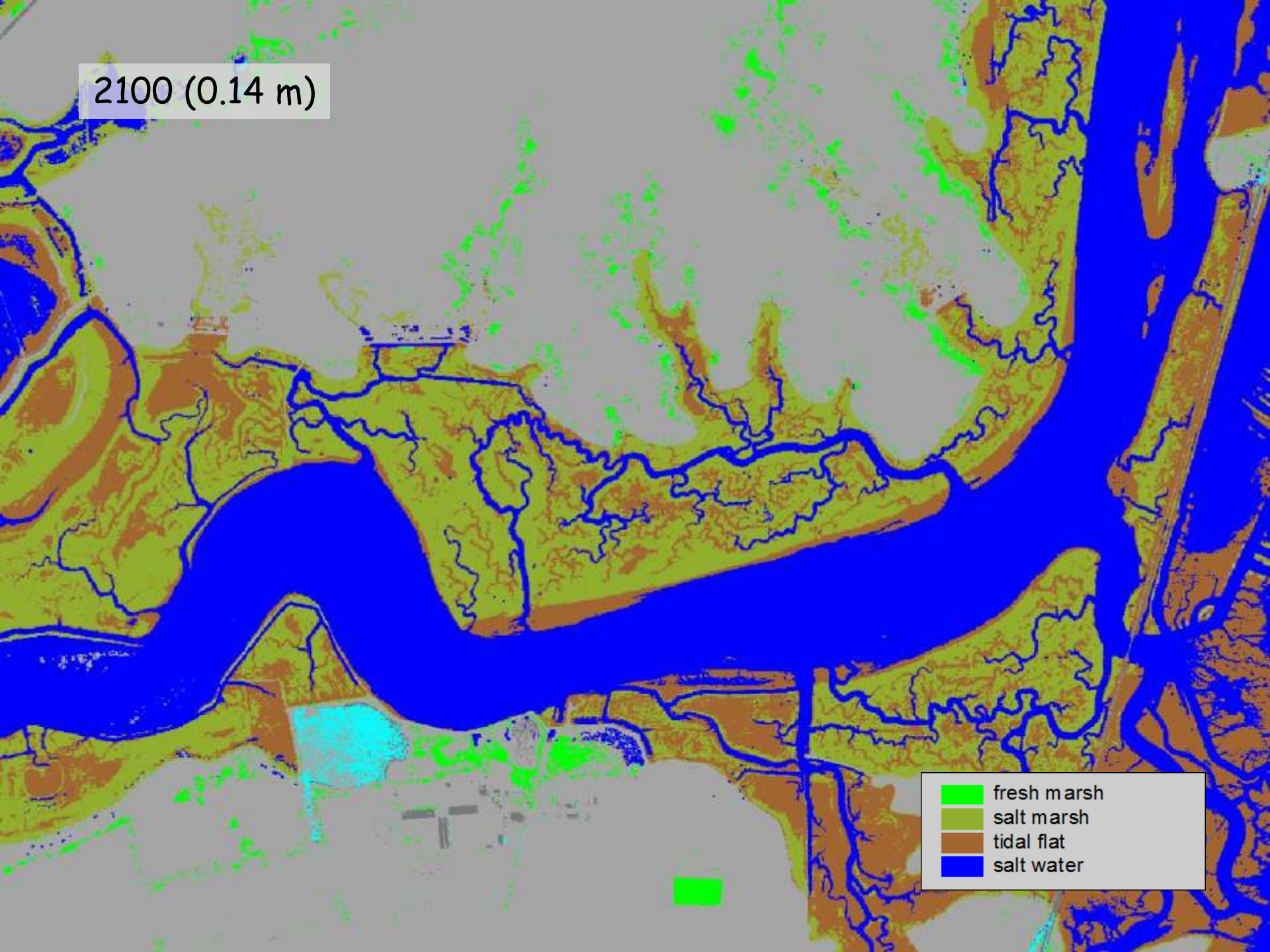


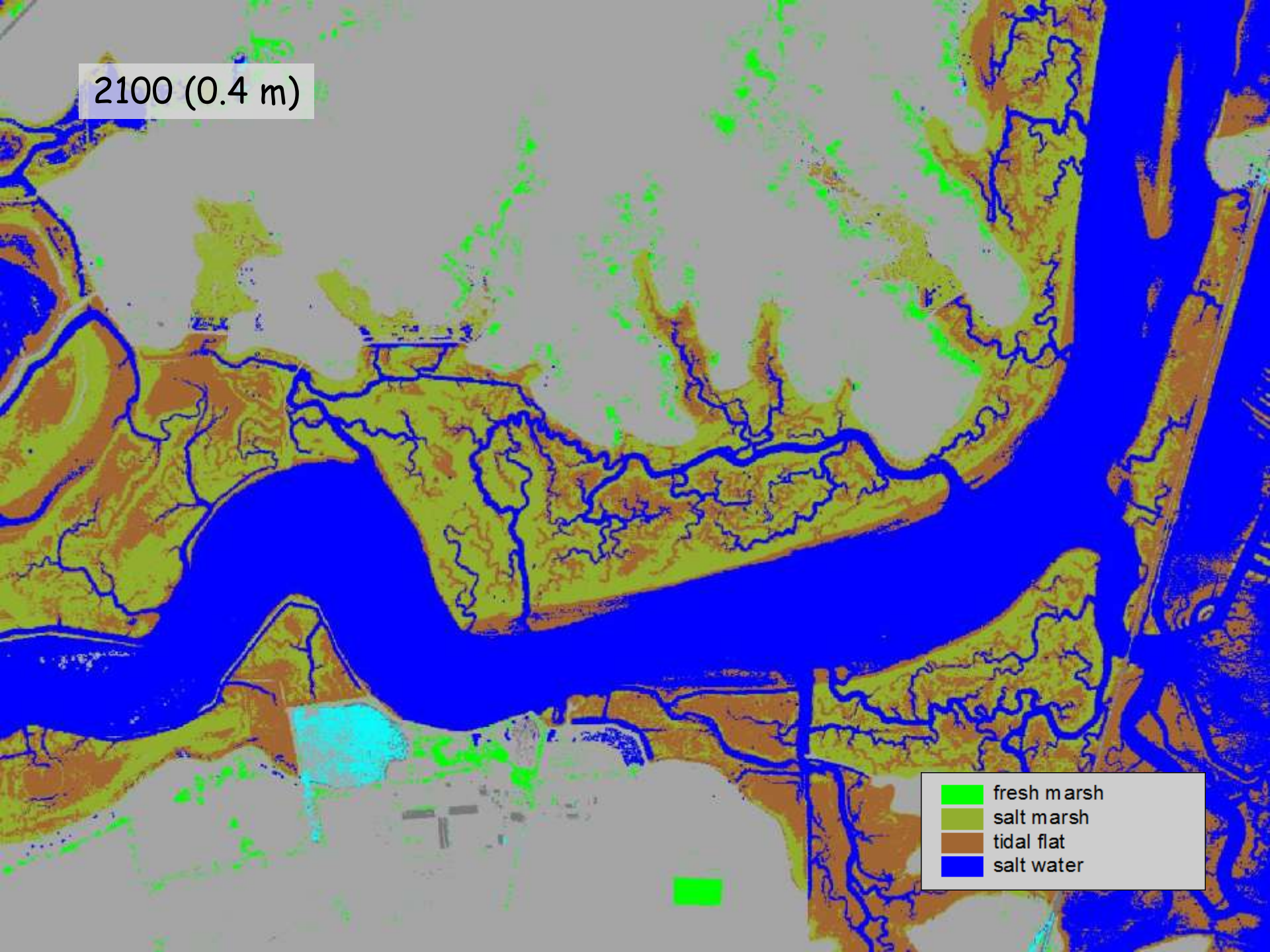
Dynamic accretion rate

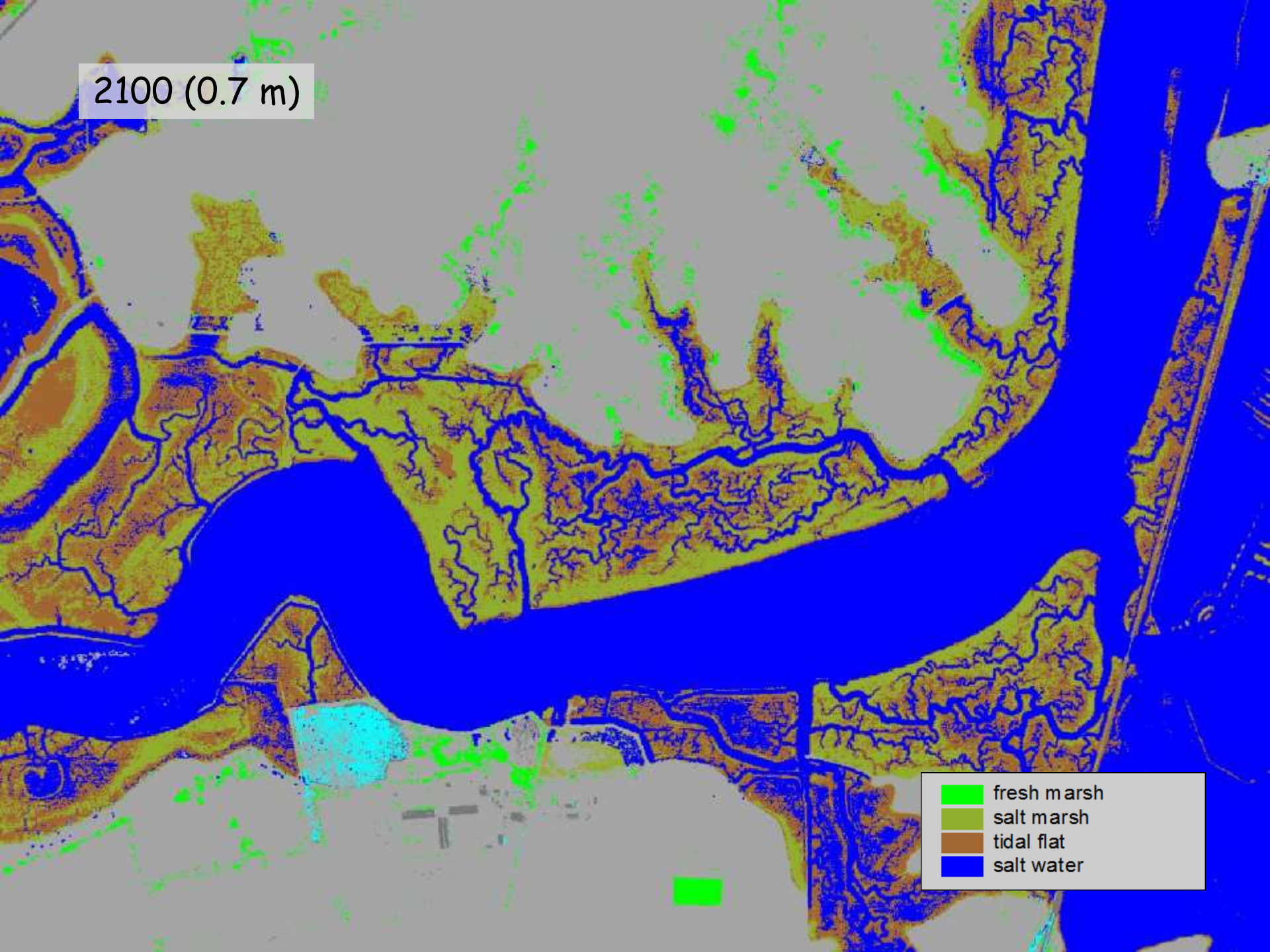


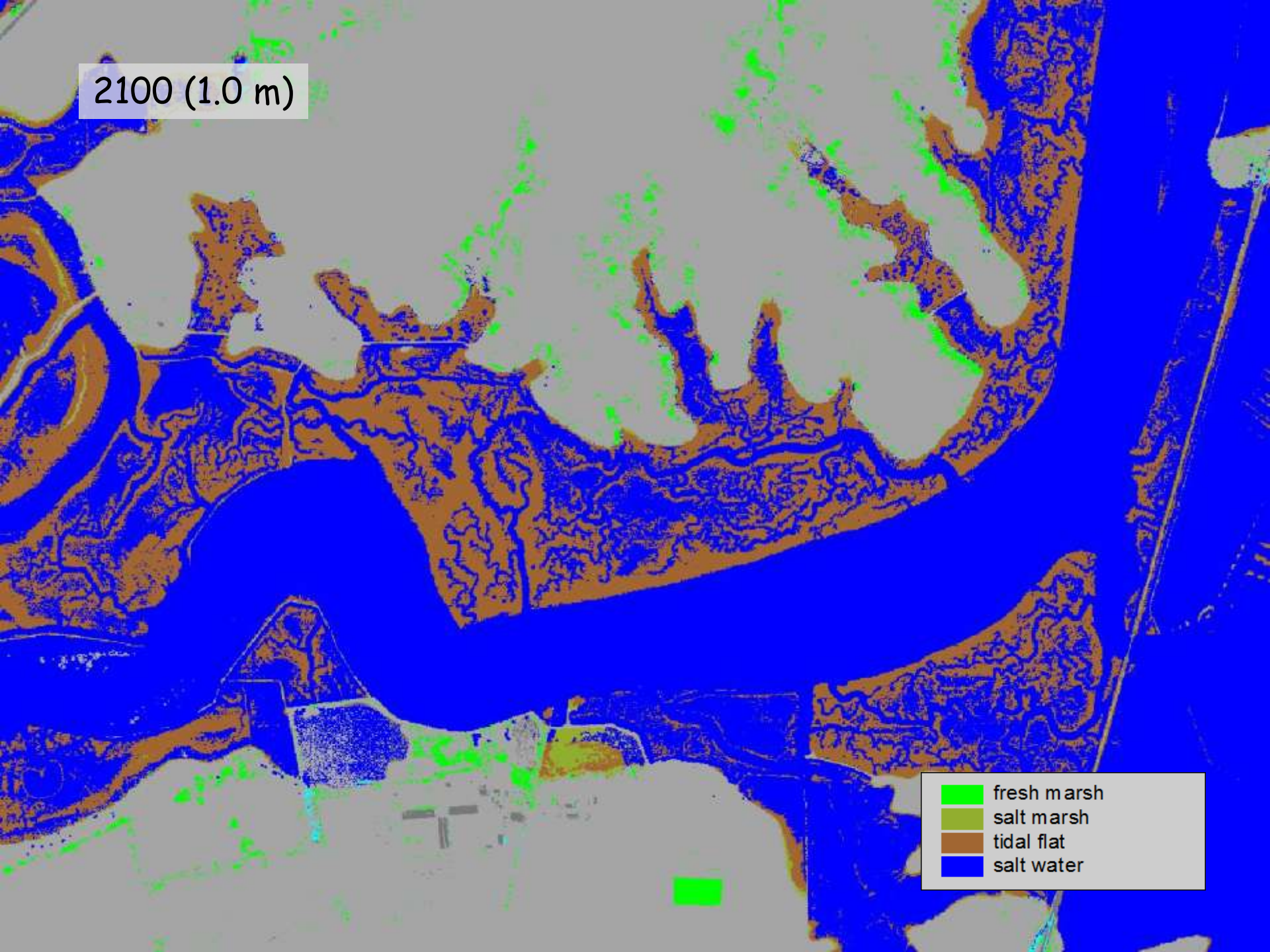
Model limitations

- Habitat elevation boundaries are rigid
- Accretion rates are constant (fixed!)
  Added dynamic accretion
- Subsidence rates are constant
  Below ground processes should be modeled
- Episodic events (storms, floods) are not accounted for
- Accuracy assessment of model predictions is difficult


2100 (0.14 m)
fresh marsh
salt marsh
tidal flat
salt water


2100 (0.4 m)
fresh marsh
salt marsh
tidal flat
salt water


2100 (0.7 m)
fresh marsh
salt marsh
tidal flat
salt water


2100 (1.0 m)
fresh marsh
salt marsh
tidal flat
salt water