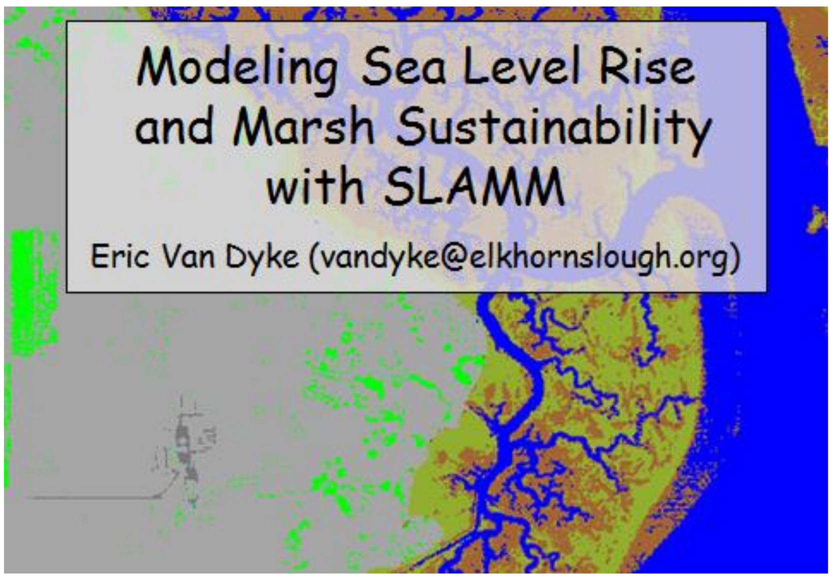


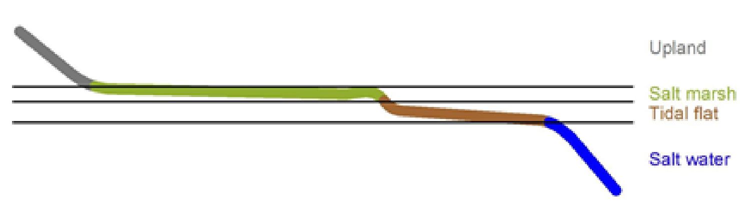
Modeling Sea Level Rise and Marsh Sustainability with SLAMM

Eric Van Dyke (vandyke@elkhornslough.org)

SLAMM (Sea Level Affecting Marshes Model) has been used to model the impacts of sea level rise on tidal wetlands throughout the U.S. and elsewhere. Six major versions have been released since 1985. The latest, v. 6.0.1 beta, is fully open source.

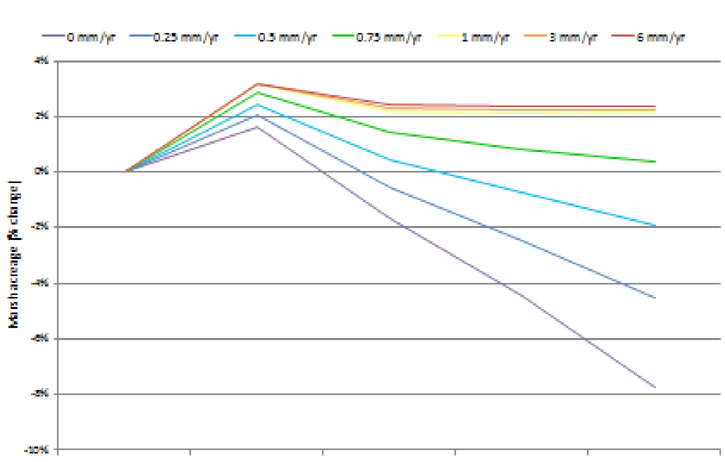
Habitat elevation ranges

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



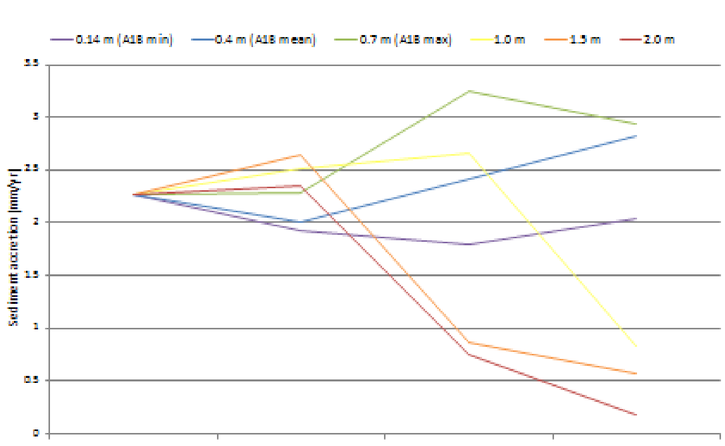
An elevation range is associated with each habitat class. SLAMM's decision tree depends on the lower boundary (mediated by slope) to initiate transition from one class to another (e. g salt marsh to tidal flat) as sea level rises.

Sensitivity to accretion rate



The model's mechanistic algorithms must be tested for sensitivity and stability and evaluated against site-specific empirical data.

Dynamic accretion rate



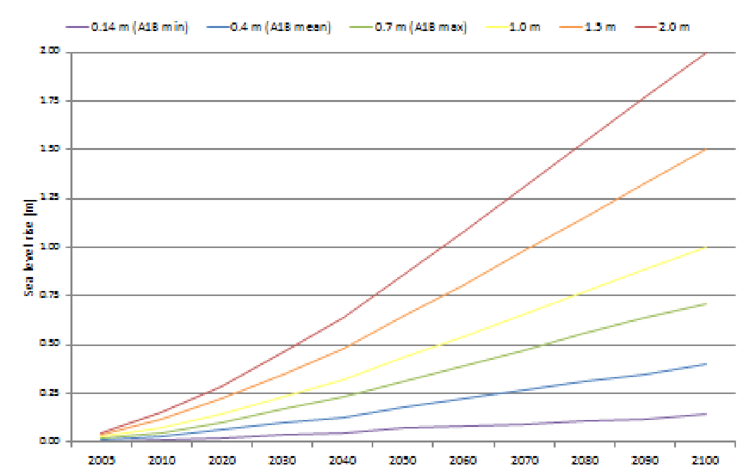
With dynamic accretion feedbacks, marsh sustainability predictions are more optimistic under moderate rates of sea level rise but more sensitive under higher rates. Habitat loss advances rapidly once the marsh platform reaches a lower elevation threshold.

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

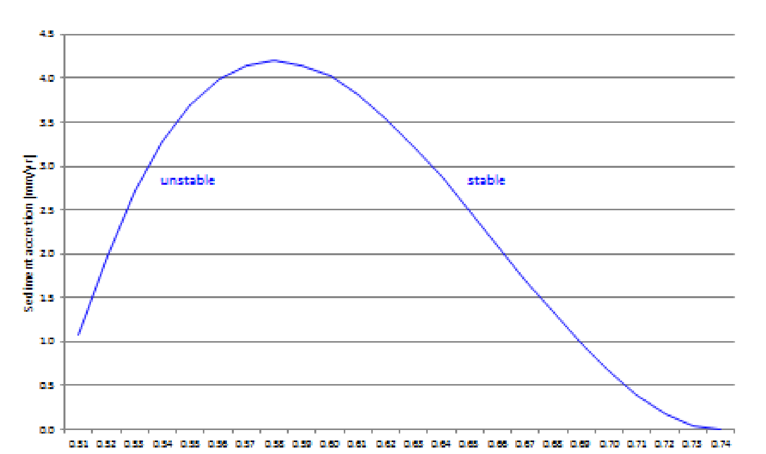
Accurate site-specific data is essential for accurate modeling. Elevation, water level, and habitat classification errors as small as a few centimeters can be critical at West Coast estuaries.

Sea level rise predictions (IPCC A1B and greater)



The future rate of eustatic sea level rise is the model's principal unknown. SLAMM incorporates a wide range of predicted accelerations derived from the IPCC "A1B" scenario (IPCC 2001).

Depth and vegetation feedback (dynamic accretion)



We have adapted published algorithms (Morris 2002) to account for dynamic feedbacks between water depth, sediment deposition, and the presence of emergent vegetation.

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

SLAMM is intermediate in complexity and predictive ability – it's not a hydrodynamic model. SLAMM is valuable for comparing scenarios and testing hypotheses, but its quantitative predictions should be treated with caution.