How Will CT’s Coastal Roads and Marshes Respond to Sea Level Rise (SLR)?

Using CT’s Sea Level Affecting Marshes Model (SLAMM) to Identify Flood Mgt. Priorities

David Kozak, CT DEEP <david.Kozak@ct.gov>
Saltmarsh Unable to Keep Pace with SLR

Changing wetland type & open water
More Frequent ‘Sunny Day’ High Tide Flooding

Photo: Joel Stocker

Wetland fill
LIS Projected vs. Historic Sea Level Rise

Approximates CIRCA’s 20 inch/50 cm by 2050s
Key Questions

• How will CT’s coastal marshes change with SLR-- implications?

• How will coastal road flood change in respond to SLR

• Which coastal area roads are most flood-prone and how should intervention ($) assistance be prioritized?

• What frequency of coastal road flooding triggers intervention?

• How will we manage road reconstruction/elevation affecting marshes?

• Where are the best marsh migration area conservation opportunities and marsh creation/restoration through road reconstruction?
I. The Context-CT’s Embayment-dominated Shoreline

low-energy, bedrock-dominated sediment starved, ‘drowned’ shoreline
~ 23,000 Calendar Years Before Present
A ‘Typical’ CT Coastal Embayment

Hatchett Point

Point O’Woods
CT’s Coast: A. or B.?
II. CT Marshes: A Steeply Sloping Coast’s Response to SLR

Why Care About the Future of CT’s Saltmarshes?
Huge amount of biomass enters the estuary every year from dead marsh grasses.

Flow of nutrients from marsh grasses.

Source: A Field Guide to Long Island Sound, Patrick Lynch
Coastal Marsh Response to SLR

Migration to Higher Ground

Past sea level

Current sea level

Future sea level

Source: Make Way for Marshes (Northeast Regional Ocean Council)
BARRIERS TO MARSH MIGRATION

Current Sea Level  Future Sea Level

Steep terrain impairs or prevents marsh migration.

Land development blocks marsh migration.

Source: Make Way for Marshes (Northeast Regional Ocean Council)
A Saltmarsh with Nowhere to Go/Grow
Shoreline Protection Value of Coastal Marshes

- Significant wave energy attenuation and erosion control <2 foot waves
- ~ 50% of wave attenuation within first 30 feet of marsh (highly variable)
- Vegetation density, height, stiffness, width greatest determinants effectiveness
- Less effective when storm waves accompanied with large surge?
- Benefits vary with bathymetry, marsh health and hydrology
- Unaltered marshes best -
- Flood storage value?

Marshes Effectively Reduce Low Wave Height Wave Energy
Changes **BELOW** the MHW line:

- Sediment transport & particle-size change
- Vegetation loss
- Benthic Fauna, Birds, Fish abundance reduced
- Denitrification capacity reduced
Bulkheads vs. Saltmarsh for Erosion Control

Source: Gittman-Living-Shorelines-NH-Climate-Summit.pdf
Coastal Marsh Loss -----> Erosion + Flood Storage
III. CT Coastal Roads Flooding
(CIRCA Recommended SLR Rate)

![Graph showing the impact of SLR on km roads flooded. The graph indicates the increase in km roads flooded over time for different SLR rates, with labels for 2055, 2085, and 2100 years. The x-axis represents Relative SLR (m), and the y-axis represents km roads flooded. Three lines are used to represent roads flooded every 30 days, 60 days, and 90 days.](image-url)
Ground-truthing SLAMM’s Existing Tidal Flooding Frequencies
SLAMM Predicted Road Flooding Frequency Change

SLAMM Existing Road Flooding Conditions

2050’s Road Flooding Conditions ~20 inches SLR
Beach Communities Isolated by Road Flooding
Lessons Lost on Developing Coastal Area?

1934

1965

Storm Sandy flooding (shaded) 2012

Sources: Jennifer O’Donnell, Coastal/Ocean Analytics; UCONN MAGIC; NOAA/National Geodetic Survey ‘Topographic Sheets; CT Coastal Resilience Project, CT TNC
Road Flooding Mgt. → Marsh Mgt.
Modifying Roads to Restore/ Create Marsh
Coming ~March 2019 to CT ECO
SLAMM Road and Marsh Data
So What?

- CT’s embayment-dominant ‘drowned’ shoreline is different
- Marshes nature’s ‘infrastructure’
- CT’s marshes are changing in type (and extent?)
- Marshes are the flood pathways
- Coastal road flooding increases dramatically
- If you think you’ve got flooding problems now . . . .
- Elected officials facing increasingly difficult flood mgt. decisions
Difficult Questions

• How many times/year can road flood before residents revolt?

• Public support $ private beach community road reconstruction?

• When will towns abandon a chronically flooding road serving few?

• What’s an acceptable SLR planning horizon? (35 years?)

• What are the most effective flood haz. communication practices?
Long Island Sound at Night