Salt Marsh Migration in Long Island Sound
Understanding Marsh Migration into Upland Habitats

Jamie O’Connell, MESc 2015
Yale School of Forestry and Environmental Studies
Advisor: Dr. Shimon Anisfeld
Overview

• Salt marshes and sea level rise
• Migration as an adaptation to sea level rise?
• Research Questions
• Methods and Site Selection
• Results
• Conclusions
Introduction

Will sea level rise cause marsh drowning?
Survival Option: Migration

Aboveground Profile

Image modified from:
http://www.eserc.stonybrook.edu/cen514/fall2003/images/vegzonsm.gif
Research Qs

(1) Are marshes migrating into upland habitat?

(2) If so, how quickly?
2 urban transects
- 1 Forest
- 1 Scrub

3 rural transects
- 2 Forest
- 1 lawn

Carolina Creek - East Haven, CT
Hammonasset Beach State Park - Madison, CT
1. Collected 4-5 soil cores /transect
2. Surveyed transect elevation
3. Measured hydrology with water level logger
1. Collected 4-5 soil cores /transect
2. Surveyed transect elevation
3. Measured hydrology with water level logger

Methods

How to differentiate between marsh and upland soil?
Methods

• Differentiate by:
  – Color?
  – Carbon (LOI)?
  – Foraminifera
RESULTS

QUESTION 1: IS THERE EVIDENCE OF MIGRATION?
Depth of Forams Relative to HAT

Elevation Relative to HAT (m)

Depth of Forams (cm)

- Marsh
- Upland

Legend:
- East Haven Open
- East Haven Tree
- Hammo Lawn
- Hammo Forest 2
- Hammo Forest 1
- HAT
Depth of Forams Relative to HAT

Elevation Relative to HAT (m)

Depth of Forams (cm)

-0.7 -0.6 -0.5 -0.4 -0.3 -0.2 -0.1 0 0.1 0.2

East Haven Open
East Haven Tree
Hammo Lawn
Hammo Forest 2
Hammo Forest 1
HAT

Marsh
Upland
RESULTS

QUESTION 2: HOW QUICKLY IS THIS MIGRATION HAPPENING?
Aerial Photograph Analysis

- Change in management or vegetation?
- Tree canopies at forest transects “migrate” into marsh

Hammonasset Lawn, 1974
Source: UCONN MAGIC
CONCLUSIONS AND NEXT STEPS
Conclusions and Next Steps

• Marshes are migrating!

• Use radioisotopes to date cores (Pb-210 or Cs-137)

• Does upland type or urbanism affect migration rate?
Acknowledgements

• Hixon Center for Urban Ecology
• SeaGrant
• FES Dean’s Office
• Dr. Shimon Anisfeld
• Kate Cooper, Kevin Sherrill, Troy Hill, Annie O’Connell
Survival Option #2: Migration
Belowground Profile

Past Marsh/Upland Border

Marsh/Upland Border Today

Tidal Channel

New marsh, aka migration!
Hammonasest Lawn Transect, June 11, 2014
Looking Towards Hammonassett Forest Transects, June 25, 2014
Methods

4. Differentiate by:
   - Color?
   - Carbon (LOI)?
   - Foraminifera?
Methods

5. Determine rate of migration:
   – Date soil cores with radioisotopes
   – Aerial photographs – quantify shifts in vegetation
Survival Option #1: Salt Marsh Accretion

Image modified from: http://www.eserc.stonybrook.edu/cen514/fall2003/images/vegzonsm.gif
Surface Foram Density Relative to HAT

Foram Density (forams/wet g)

Elevation Relative to HAT (m)

- East Haven Open
- East Haven Tree
- Hammo Lawn
- Hammo Forest 2
- Hammo Forest 1
- HAT
Surface Foram Density Relative to HAT

![Graph showing foram density relative to elevation]

- **Foram Density (forams/wet g)** on the y-axis.
- **Elevation Relative to HAT (m)** on the x-axis.

Legend:
- **East Haven Open**
- **East Haven Tree**
- **Hammo Lawn**
- **Hammo Forest 2**
- **Hammo Forest 1**
- **HAT**