Assessing the vulnerability of coastal habitats to changing climate conditions using CCVATCH

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Assessment Framework

Exposure:
- Heavy precipitation

Sensitivity:
- Un-buffered stream edge

Potential Impact:
- Erosion, water quality issues

Adaptive Capacity:
- Vegetated buffer

VULNERABILITY:
- Fully Functional
- Complete Loss
CCVATCH Scoring Components

Climate Stressors
- CO₂
- Temperature
- Precipitation
- Sea level
- Extreme climate events

Non-Climate Stressors
- Invasive/nuisance Species
- Nutrients
- Sedimentation
- Erosion
- Environmental Contaminants

Adaptive Capacity
- Degree of fragmentation
- Barriers to migration
- Recovery / regeneration ability
- Diversity of functional groups
- Management actions possible
- Human / institutional response

Direct Effects / Current Condition / Interactions
Certainty
General Process

1. Define Goals and Specific Questions
2. Assemble Team and Assign Research
   Review, ID Data Needs
3. Compile and Review Resources, Research, Information Sources
4. Hold Facilitated Meetings for Scoring
5. Review Score Results to Identify Management Actions
6. Share Resources, Outreach Product Development

All Scales using Web Tool Application

Regional

Adaptation Workbook
## Environmental Contaminants

### Current Condition:
- Presumed tolerance to historic and persistent levels of exposure however “cost” may be reduced ability to tolerate climatic stress

### CO₂:
- Increased plant productivity may positively influence accretion rates

### Temperature:
- Increased contaminant uptake
- Enhanced contaminant toxicity
- Increase in pesticide exposure

### Precipitation:
- Short term seasonal drought concentrates contaminant levels beyond tolerance
- Altered land use may enhance exposure

### Sea Level:
- Increased sensitivity to contaminants at elevated salinity levels

### Extreme Climate:
- Greater risk of high levels of contaminant exposure due to runoff, coastal flooding
RI Salt Marsh

- Stratified random site selection (N, C, S)
- Further restricted to sites that at least one assessment team member was familiar with (current condition and site characteristics)
- Initially a single assessment team, then break-out into multiple teams
- 14 sites assessed
Relative Scores

Current Condition

CO2

Temperature

Precipitation

Sea Level

Extreme Climate

DIRECT EFFECTS
Relative Scores

SEDIMENTATION

Current Condition

CO2

Temperature

Precipitation

Sea Level

Extreme Climate
Scoring Levels

*Sensitivity-Exposure*

*Adaptive Capacity*
Overall Vulnerability

Overall Vulnerability

Score Level
- very high
- high
- moderate
- low
- very low

Overall Vulnerability

Adaptive Capacity

Very Low | Low | Moderate | High
---|---|---|---
1 | Low | Moderate | 3
| Moderate | High | Very High
| Low | High | 9

Sensitivity-Exposure

High
Case Studies

*Nag Marsh [Prudence Island, RI]*

**Primary considerations**
- Rural and natural setting
- Limited invasives
- Moderate elevation
- Intact dune
- Limited capacity to migrate
- Fully protected
- Agency supports restoration
- Isolated location

**Final Score**
- Exposure-Sensitivity: 36.7
- Adaptive Capacity: 9.0
- Certainty: 2.2
- Overall Vulnerability: Moderate
Case Studies

Winnapaug Pond [Westerly, RI]

Primary considerations
- Built environment
- High nutrient levels
- Lagoonal system
- Low elevation
- Limited sediment supply
- Extreme ‘waffle’ marsh
- Limited capacity to migrate
- Not fully protected
- Limited restoration potential

Final Score
Exposure-Sensitivity  64.7
Adaptive Capacity      5.0
Certainty              2.2
Overall Vulnerability – Very High
Multiple Habitats/Geographies

Adaptive Capacity

Exposure-Sensitivity

Size of circle = 4 (maximum certainty) - certainty score
### Direct stressor or stressor interactions with identified research needs for RI salt marsh

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<th>Current Condition</th>
<th>CO₂</th>
<th>Temp.</th>
<th>Precip.</th>
<th>Sea Level</th>
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Applications

- Determine main sources of vulnerability
- Prioritize restoration & resiliency planning efforts and acquisition areas
- Education and outreach to decision makers
- Guide policy and funding decisions
- Compare relative vulnerability across geographic locations
- Identify research and monitoring needs
Acknowledgements

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Additional CCVATCH resources are available at www.ccvatch.com

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