Chase Garden Creek Presentation & Discussion – APCC Vulnerability Assessment

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Present: Jordan Mora (APCC), Eliza Fitzgerald (APCC), Nora Lavori (Resident), Andrew Gottlieb (APCC), Patrick Temple (CCCD), Martha Craig (CCCD), Liz Gorrill (DER), Steve Spear (NRCS), Rick Sawyer (ARC), Gabrielle Sakolsky (CCMC), Annalee Tweitmann (MassAudubon), Bill Bonnetti (Yarmouth Division of Natural resources), Barton Morris (CCMC), Cristina Kennedy (DER), Heather McElroy (Natural Resource Manager CCC), Nathan Whetten (Yarmouth DPW), Alexis Neffinger (Mass CZM) , Thomas Andrade (Town Engineer Dennis), Stephen Mckenna (CZM), David Fryxell (Dennis Conservation Land Trust), Ian Ives (Mass Audubon), Chloe Starr (ARC), Brittany DiRienzo (Conservation Town of Yarmouth), Erin Burnham (Town of Dennis), Tara Lewis (CCC Water Resources Analyst), Adrienne Pappal (MA CZM), Amanda Lima (Town Engineer Yarmouth)

Overview/Agenda:

- Project Scope and Timeline
- Existing Conditions
- Salt Marshes
- Vulnerability Assessment
    - UVVR
    - Rapid field assessment
- Conclusions
- Questions
- Restoration Options and Discussions
    - Discuss pros and cons and feasibility

APCC Project: Scope and Timeline

- 5 yr project funded by Lavori Sterling Foundation
- Year 1: assess marsh integrity and human impacts, coordinate with stakeholders
- Year 2: baseline monitoring (vegetation, GIS assessment, part of discussion today)
- Year 3: plan/ design restoration actions and seek funding
- Year 4: permitting, pre-restoration monitoring
- Year 5: implementation, post-restoration

Existing Conditions at CGC:

- APCC reviewed studies of sediment transport and previous salt marsh assessments. The location on the eastern end of Barnstable Harbor is a dynamic area for sediment transport as there is more than one direction of movement. The harbor, or mouth, of Chase Garden Creek has filled in with sediment over time.
- The salt marsh study from 2012 mostly focused on water levels and bathymetry. Our assessment takes a closer look at marsh plants on the platform.
- Low Lying Roads
    - Additional area of concern with the Low-Lying Roads project being led by the Cape Cod Commission. Already discussed the areas of concern (New Boston Road, Dr Bottero

Road, and Route 6A). Town of Dennis has already looked extensively at Dr Bottero Road and has started initial design and planning for New Boston Road. Route 6A will require leadership and oversight from MassDOT.
    - For this project and assessment, focusing on the interior of the marsh which has received less recent attention.

<u>Salt Marshes – Intro</u>

- Ecosystem services
    - Ecological value
        - Support threatened and endangered species
            - Juvenile winter skate
            - Salt marsh sparrow
            - Diamondback terrapin
            - Mitchell's sedge
        - Improve water quality by filtering and removing pollutants
    - Recreational value
    - Economical value
        - Flood and erosion protection
        - Essential habitat for commercial shellfishing and fish industry
        - Carbon sequestration
- Poll question #1: Rate the following salt marsh ecosystem services.
- Structure overview:
    - High marsh vs low marsh
        - Low marsh- dominated by *Spartina alterniflora*
        - High marsh- dominated by *Spartina patens* (and others, *Distichlis spicata and Juncus gerardii*)
        - Upland transitions zone- consists of brackish species which are less salt and flood tolerant
    - Accretion- salt marshes accrete over time in the case of sea level rise
        - Sedimentation coming in on incoming tide, increases elevation, trapped by plants
        - Buildup of organic material- organic matter becomes part of marsh platform- slow decomposition due to frequent flooding
    - SLR in New England—2-3 mm/ year- has doubled in past 20 years
- Threats to salt marshes:
    - Land reclamation (filling)
    - Ditching- historical agricultural and mosquito control
    - Restricted tidal flow- undersized culverts, dikes, embankments
    - Physical barriers to landward migration- roads, development
    - Invasive species
- Waterlogged Subsidence Trajectory
    - Results in the formation of mega-pools
    - Poor drainage from embankments can cause die-back and root collapse
        - Low lying areas near embankments become pools

- Oxidation Subsidence Trajectory:
    - Increased aeration in the soil from ditching causes increases decomposition, losing organic material

Vulnerability Assessment:

Methods:

1) UVVR:
    - Adrienne provided link to the UVVR information and 2021 layer in the chat: https://www.sciencebase.gov/catalog/item/60f9934dd34e3ccd82fe3fd2
    - Marshes are most stable at the 0.13 ratio of unvegetated to vegetated cover
    - Used spatial data processing methods provided by David Burdick and Grant McKown
    - Acquired NAIP imagery (from when the marsh is green
        - Also acquired tidesheds—areas that experience similar hydrologic dynamics
            - Used USGS 2021 tidesheds
        - Calculated NDVI
        - Classified vegetated and unvegetated
        - Accuracy assessment
2) MarshRAM
    - Salt marsh rapid assessment method (Kutcher et al.)
    - IMI- index of marsh integrity is based on the plant community
        - Each plant community has a different score
        - Example: high marsh= healthy marsh, dieoff/bare depression= low marsh health
    - Site selection- stratified in different tidesheds across a variety of UVVR scores

Results:

1) UVVR results:
    - Two areas that saw a lot of change- one area UVVR scores went down and one area went up- indicating vegetation loss and gains respectively
    - Looked at percent change to quantify changes
2) MarshRAM results:
    - Species in northern part of the marsh- had more high marsh plants- higher scores
    - Species in the southern part had more low marsh species- lower scores
    - Generally- UVVR and MarshRam scores were correlated but a lot of variability

Overall Conclusions:

- Most vulnerable/ most vegetation loss is in the central of marsh (mid-to low elevation gradient of platgorm), especially along creek edge
- In general, UVVR and MarshRAM corroborated. Lack of clear connection due to transect size and tideshed size – if tidesheds were smaller there may have been a tighter relationship here
- Take home:
    - Vegetation is cover is low in the midway of the marsh - between mouth and head of tide - and near the creek edge.

- When vegetation cover is low- accretion mechanisms are impaired- sediment deposition and accumulation of organic matter is limited causing a feedback loop of further subsidence and erosion.

Questions:

Tom: vulnerable locations/ where we see most change- could this be related to storms?

- Jordan- thinks both storm events and increased SLR are contributing to this. Stable, high integrity marsh should be resistant to these impacts
- Tom- what are next steps? Do we find out why this is happening or do we build up the marsh?

Rick Sawyer- has noticed increased sandbar in the mouth of the creek- is this contributing to the negative changes we are seeing?

- Could be the sandbars/ deposition downstream is choking off sediment supply further downstream
- Looking at studies with Brian Yellen at UMass- to look at the success of marshes in relation to sedimentation

Tom Andrade- velocity changes due to sedimentation?

Martha: other stressors- including excess nutrients, crab activity related to marsh subsidence

- We can look at this- but no major crab herbivory noticed
- Embankments and ditches are very prevalent here
- Jordan- this marsh should have a large capacity for nutrient absorption

Cristina: discussing herring run- significant drop? Access?

- CCCD hopes to restore this herring run- looking at design currently. Access is through whites Brook into Tom Mathews. Currently a very steep wooden fish run
- Steve: it seems like the CCWRRP has a piece of this
- Bill Bonnetti: history on herring run- where the fishway structure is, on Bass River Rod and Gun Club- over the years the club has been in collaboration in maintaining and upgrading that passage as well as they could. The town was able to enter into an agreement—they have an easement on that property to access that fishway- that will cover the design phase of this project

Dave- DCLT started WQ monitoring and just got data back- White Brook has poor water quality- more degraded sections of marsh- they did some targeted sampling at outfall pipes from old cranberry bogs

- Will send data to APCC

Potential restoration Goals and Actions

- Halt subsidence trajectories by bolstering natural accretion mechanisms
- Promote native salt marsh plants to recover habitat for threatened/endangered species

Step by Step goals:

- Restore tidal regime
- Enhance sediment deposition
- Increase plant productivity by improving drainage
- Raise groundwater table to reduce decomp rates (restore low oxygen conditions)
- Create microtopography
- Additional goals?

<u>Possible methods for restoring degraded marsh platform</u>

1. Establishing single channel hydrology
    a. Runnels
    b. Ditch remediation
2. Thin layer placement

There are permitting obstacles here, but they are possible!

Single Channel Hydrology:

Looking at BA GM as an example

- Showed ditches
- Showing restoration plan- improving drainage in waterlogged areas, and restoring higher groundwater table to ditched areas
- Examples of ditch remediation- shows effectiveness over the course of 3 years
- Examples of ditch remediation- pools greatly reduced, vegetation recovers within 3-5 years. Channels generally 30 cm wide and no more than 30 cm deep
    - Construction- hand-digging or equipment designed for low pressure

Thin Layer Placement (TLP)-

- Goal, quickly build elevation capital and enhance declining high marsh plant species
- Methods
    - Apply a thick layer of sandy dredged material
    - Sediment was moved using two hydraulic dredges and discharged via 20-cm pipe onto the existing marsh surface
    - Placed sediment was then graded by low ground –pressure bulldozers to target elevations
- Ninigret- 10-50 cm of sediment deposited on marsh using dredge materials

<u>Where should we restore:</u>

- Steve- areas that are most impacted – action here could improve areas that are moderately impacted
    - Just learned about Sesarma (Purple marsh crab) study (Steve Smith NPS) - sand deposition repelled purple marsh crab—could be an additional benefit of TLP
- Patrick Temple: early in the discussion to start prioritizing and making decisions- if we are thinking of altering marsh topography- runneling/ TLP- we want to look at groundwater across the entire system

- Cristina- getting as much data on the system is really important. Thinking of the marsh not just as a marsh but as a dynamic coastal system. That sediment that may be blocking tidal movement- this is also source material and future salt marsh source material – we should be careful with where we take sediment from.
- Bill- this system has not been dredged. Not included on 10 yr town wide dredge permit- has never been dredged- need to collect more data – planning and permitting process- can we use dredge spoils here? Permitting dictates so much of what we can do
- Alexis adds that considering marsh migration may be helpful.
- DEP meeting on guidance on restoration activities- particularly ditch remediation and runneling—may help determine if which projects are feasibility and timeline
- Steve- if the sediment is slowing the flow down- if that is removed, the velocity will change and affect the banks. Another technique that might help- using shellfish structure along the edge of the banks to stabilize them—living shoreline
    - Patrick- living shoreline oyster reef projects are promising in particular applications
- Tom- because there is no existing permit- permitting for dredging will be difficult