The Beaches Conference
June 14, 2019
Dynamic Coasts Using Science to Inform Forecasts, Management, and Policy
(34 attendees)

Moderator: Robert Furman
Facilitators: Joseph Kelley, Emily Mitchell, Tom Shyka, John Cannon

Joe Kelley, History of Coastal Changes on Camp Ellis

- 1785 map of Saco Bay – with no navigation structures at that time – but would have been extremely difficult to navigate. Originally had 4 tidal inlets and 1 barrier island.
- 1880 map – first jetty on constructed by the Army Corps of Engineers on North – accreted sand there becomes Camp Ellis.
- First jetty completely ineffective. South jetty and extension of north jetty proposed in 1887. Still little Camp Ellis dev at this point.
- Residential and recreational development expands greatly in last 19th – early 20th century on new land from ebb tidal delta collapse. But erosion of this temporary land soon began and by 1910 first homes have fallen to erosion. In response, 22 m long spur jetty built
- By 1940 the industrial period in Saco Bay is coming to an end and by 1958 all mills closed.
- After WWII, from 1940 - 1955 huge growth in residences in ME overall and at Camp Ellis. In 1953 Surf St seawall was constructed. In 1955 ACoE study concludes that the jetty was not the cause of beach erosion, suggested that "holes" in Saco estuary proved no sand was coming downstream. In this same period, the Saco Bay inlet narrowed, initiating the 1957 dredge with sand put on the spit. ACoE made no connection between Camp Ellis erosion and Pine Point accretion.
- 1969 – The original anchorage area was in ruins as sand accumulated in the harbor. In 1970 new, deep anchorage was dredged, new dock added, jetty raised and smoothed with intent of blocking sand entry. At the same time, the Camp Ellis beach is eroded.
- In 1978, the Storm of the Century and in 1979 Maine's Sand Dune Rules were adopted in response, which became law in 1983. No new seawalls, no rebuilding of houses damaged by greater than 50%, development must be in back dune and 100 year sea level rise needed to be considered in development plans.
- In 1990's loss of Camp Ellis property continues and real estate values plummet with blame focusing on ACoE. Save Our Shores Camp Ellis is formed.
- $6 mil on ACoE study of alternatives, also finds that "the navigation project may, to some extent, influence the area." Joe Kelley's research study indicates that the ACoE structure "absolutely controls coastal processes." Confirms that sand moves from south to north and that erosion began with the jetty.
- "I do not believe any more jetties or revetments should be constructed at Camp Ellis… the construction of new seawalls is prohibited in Maine…the impact of building large coastal structures can be unpredictable and far-reaching…currently the erosion problem is localized at Camp Ellis…I do not want to see the problem transferred to other areas. Large structures also are expensive to build and have high

long-term maintenance costs. All these concerns make non-structural solutions much more desirable." Dean Marriott, Commissioner, Maine Dep't. Environmental Protection, 1/28/92

- ACoE evaluated renourishment options, but within a few years the benefits would be eliminated.

Summary:

- Dr. Kelley recounted more than 150 years in an ongoing struggle between human interests and natural processes at Saco's Camp Ellis. The character of this struggle changed significantly a century ago with increased human occupation of the shoreline. Since then, "residential development and the erection of engineering structures, combined with a general ignorance of ongoing geological processes, have led to tragic property losses and extraordinary public expenditures," as Kelley and co-author Brothers wrote in a 2009 paper.
- Kelley pulled no punches in criticizing decision-making, particularly at the U.S. Army Corps of Engineers, which has apparently dismissed or resisted acknowledgment of sand transport in natural and engineered settings. Among his pronouncements at The Beaches Conference: "Replenishment is futile." Dr. Kelley announced plans to share his materials via the UMaine Digital Commons.
- Kelley, J.T., and Brothers, L.L. 2009. "Camp Ellis, Maine: A small beach community with a big problem...its jetty" in Kelley, J.T., Pilkey, O.H., and Cooper, J.A.G., eds., America's Most Vulnerable Coastal Communities: Geological Society of America Special Paper 460, p. 1-20, doi: 10.1130/2009.2460(01).
- https://www.sacomaine.org/Camp%20Elis/2009-06%20-%20Special%20Paper%20-%20GSA.pdf

Q&A

What's the origin of wood chips in river? From dredge material

Emily Mitchell, Littoral Dynamics and Public Policy, Are States paying attention to which way the sand moving?

- Works with Professor John Duff, at UMass Boston, School for the Environment on the integration of coastal sediment science into effective coastal management policies in the 7 northeastern states – ME down through NJ
- Definition of littoral cell –a self-contained compartment within which sediment processes occur with little to no interaction with adjacent cells. Each cell has a sediment budget that is made up of sediment sources and sediment sinks, and sediment pathways by which sediment moves within the cell.
- Examples of sediment processes that occur within a littoral cell. Sources vary geographically but can include cliff erosion, river transport, sand from the dunes, and human made beach nourishment. Sinks include sediment lost offshore, lost into dunes and sand deposited on spits or barrier islands. Sediment processes are incredibly complicated and difficult to map – directions of sediment movement can change seasonally making the net directions of sediment difficult to define

- Coastal processes research – a dramatic increase in the amount of research and depth of understanding in last 30 years
    - 1900s – isolated processes – sand in one direction
    - 1960s – sum of processes in littoral zone
    - 1980s - Relating littoral knowledge to human communities
    - 2000s to present – agreement on need for science informed management
    - This research is looking at whether these calls are being listened to – we've gotten smarter, but are we acting smarter? – looking back at 50 years, what have we accomplished.
- Why do we care
    - As coastal populations increase and sea levels rise, erosion is growing hazard to coastal communities. Without an understanding of the processes at play, managers cannot make fully informed decisions about best to responding to issues of both coastal erosion and accretion of sediment.
    - Impacts from erosion becoming more evident
- Research focuses in all Northeast states
    - Erosion hotspots in the region
    - We searched for laws, regulations, executive orders, state agency plans, state-convened task force reports, and agency outreach materials for explicit and implicit references to sediment transport concepts.
- Results
    - The mentions of sediment processes in coastal management policies are found in mapping programs, research efforts, laws and regulations, and non-legislative policies
    - In ME and NH focus of this presentation
        - Laws and Regulations - Although the mentions of sediment processes are limited, they do exist. Generally, they fall into two categories: Spatially based legislation, or project based legislation.
            - For example: Spatially based rules are those like the Coastal Sand Dune Rules in Maine. (MENTION STATUTE). These regulations require that if a project is to take place within a coastal sand dune area, as has been mapped by the state geological survey then the project must meet certain requirements to
            - Similarly, New York has coastal erosion hazard areas.
            - Other states have project based requirements. For example – In NH, if a developer or citizen wants to build a sea wall or a jetty, they have to meet specific permit requirements.
            - Some states have combinations of the two.
        - Geospatial data – informs law and policy
            - They range in how much sediment processes information they convey. On one end of the spectrum there are shoreline change maps, only looking at where the shoreline has moved over the years (RI). (1939, 2012, 2014). And although the state does warn that these maps should be used with caution since

shoreline change can be episodic, they are still used to determine setback requirements for new coastal construction
        - Maine = scores beaches based on their change over time. Instead of just looking at 3 years, by looking at each year, at multiple seasons.
        - Finally, some areas have been mapped to delineate littoral cells
    - Non legislative – most mentions in non binding policy docs recently published
        - Enhanced data with effective policies of how to utilize that data can be just as effective. And many of the states are moving forward with policies like this.
        - The Maine Coastal Program Strategic Outlook 2015-2020 recognizes the importance of mapping shoreline change and erosion trends as important for the state to identify erosion hazards and how to better manage sediment. Additionally, the Strategic Outlook includes a call for a "comprehensive inventory of shoreline stabilization structures…. And sediment budgets"
        - The NH coastal risk and hazard commission report: preparing NH for projected storm surge, sea-level rise, and extreme precipitation includes a recommended action that NH establish a beach monitoring program to collect data including data on "sediment characteristics and processes" = moving in the direction of processes informed governance.
    - Summary: Ms. Mitchell explored how states in the Northeast integrate the science of littoral dynamics into governance and coastal management. She defined littoral cells and recapped a century in the study of natural sand-movement processes and the incorporation of human activity into such studies in the 1980s. Ms. Mitchell covered her investigation of the degree to which coastal management laws and policies from Maine to New Jersey integrate sediment transport or littoral dynamics. Her conclusion: Management entities must look beyond jurisdictional lines. Both legislative and non-legislative should be evaluated, involving state, federal, and international bodies. She cautioned that "policy documents do not equal action."

- Summary
    - All states are engaging in some for of coastal processes *mapping*
    - Each state is pursuing a more *enhanced understanding* of how sand is moving
    - *No state is fully integrating* coastal processes into their coastal management
    - Each state has differing management priorities, they include:
    - **ME** – Enhancing data, continuing to integrate data into management

        - **NH** – Establish beach monitoring program, and better understanding sediment characteristics and processes
        - **MA** – Expanding mapping and modeling, predicting erosion hazards
        - **RI** – Use new technology to enhance data, limiting erosion hazards, set backs
        - **CT** – Preserve natural sediment dynamics, analyze shoreline change
        - **NY** – Develop coastal sediment budgets, quantify sources, sinks, and pathways of sediment transport
        - **NJ** – Dune protection and reconstruction, limiting erosion hazards, continued monitoring
    - Next steps
        - Continue to compare findings between states and compare internationally

Tom Shyka and John Cannon, Powerful Storms and Battering Waves

Tom Shyka

- What is wave run up = Max level wave run up in relation to max run up level used to predict erosion, overwash and inundation
- US Geological Survey developed beach run up forecast and invited NWS and NERACOOS develop an imaging system for it
- Coastal flooding toolkit –
    - Developed in partnership with NWS forecast offices. Delivers wave run up forecast for sites throughout New England. Integrates key forecasts and observations of water level, waves and winds
    - Menu with tools options
        - Sites where wave run up forecasting is available
        - Forecast wave height, surge used
        - Dashboard with forecasted impacts
            - ID of wave run up, erosion point, and overwash
            - Also shows forecasted water levels
            - Map view – of locations where stations for predictions are available
- USGS tool similar but with few sites in SME using LiDAR data
- Summary: Mr. Shyka went over the factors that must be understood when attempting to forecast storm-driven tidal effects. Tide run-up is affected by factors including weather, wave height, and water level. NERACOOS and NWS have developed a web-based tool, incorporating USGS wave run-up and coastal change forecasts, that will permit coastal managers to obtain specific beach wave forecasts and other measurements when storms threaten their communities.

John Cannon

- Recent Major Coastal Storms: Forecasting erosion, splash-over and inundation
    - Discussion of 3 unique storms and dune profiles
        - Oct 30, 2017, Jan, 4 and March 3, 2018

        - Oct 30 2017 “Outlier”
            - *<u>Low</u> astronomical tides/High Wind & Storm Surge Event*
            - Record warm water, large storms, = surge
            - Inland and coastal impacts
            - Huge storm surge but at low tide
            - Storm team BP ID erosion as impact
        - Jan 4 2018
            - Near all-time record high storm tide event
            - Waves but not extreme impacts on beaches
            - Results in major inundation
            - Little change to beach profiles
        - March 3, 2018
            - Slow moving extremely large long period wave event
            - “Boulders into the road” - 27 ft waves
            - Major dune erosion and structural damage over several tide cycles.
            - Storm Survey – destroyed Ferry Beach dune
            - Flooding tool kit correctly predicted
            - Wells and Goose Rocks added to dune during storm during huge waves pushing sand landward
- NERACOOS Wave Runup Output Performance
    - Products elicit storm responses!- Performed well
    - Future goal: NERACOOS wave run-up “alerts” are automatically *<u>pushed</u>* via e-mail to NWS Situational Awareness Operations PCs when criteria are met!
- Summary: Mr. Cannon engaged the audience in a short quiz using three case-study storms, each structurally distinct and with differing impacts (inundation, washover, erosion).

<u>Q&A</u>

- Storm teams not called out recently - but asking John to notify. But John would like to be able to give more notice
- Which buoys used? Those closest to the site.
- USGS wave run up – web search, give link
- Floating ice – does it dampen wave run up?? John doesn’t know, but ice on upland can hold water.
- Why doesn't Saco jetty just get removed? Enormity of physical task, political complexity, don’t know what would happen if the structure comes down in terms of impacts. Conflicts between coastal processes and social systems.