Long Island Sound Study (LISS)

Science & Technical Advisory Committee

Meeting Summary, 6/21/2019

Presentations

- Ammerman
- Kozak-Wilson
- Lund-Truscinski
- Mendelsohn
- Seth-Wang
- Tedesco

In Attendance:

STAC Members: James Ammerman, Paul Anderson, Chet Arnold, Sarah Crosby, Elizabeth Lamoureux, David Lipsky, Darcy Lonsdale (NY Co-chair), James O'Donnell (CT Co-chair), Julie Rose, Kelly Streich, Mark Tedesco, Johan Varekamp, Jamie Vaudrey, Penny Vlahos, Mickey Weiss

Others: Zachary Ballorsen (CIRCA), Zofia Baumann (U. Conn.), Cindy Corsair (USFWS), Mel Coté (EPA R1), Holly Drinkuth (TNC/CAC), Syma Ebbin (CT Sea Grant), Alan Fairbank (Yale, Forestry & Environmental Sciences [FES]), Alex Felson (CIRCA, U. Conn.), David Kozak (CT DEEP), Bill Lucey (Save the Sound), Katie Lund (CIRCA, U. Conn.), Robert Mendelsohn (Yale, FES), Nancy Seligson (CAC), Anji Seth (U. Conn.), Nicole Tachiki (EPA LISO), John Truscinski (CIRCA, U. Conn.), Guiling Wang (U. Conn.), Emily Wilson (U Conn.)

On the webinar: Robin Landeck Miller (STAC Member), Mateo Mezic (Stonybrook)

Jim O'Donnell (CT) Co-Chair, opened the meeting at 9:20 AM

Katie Lund and John Truscinski, CIRCA, U. Conn.: "*Update on The Connecticut Institute for Resilience & Climate Adaptation (CIRCA)".* Katie and John briefly discussed the origin and mission of CIRCA and where it is headed in the future. Its primary purpose is to leverage climate change-related research conducted at U. Conn. for the benefits of Connecticut municipalities, state and federal agencies, and others. CIRCA started in 2014 and since then has awarded over $1.6 M in grant funding (from Hurricane Sandy funds) for 1. Municipal Resilience, 2. Matching Funds, and 3. Research Grants. These grants have included subjects such as sea level rise, coastal and inland flooding, critical infrastructure, and green infrastructure and living shorelines; and went to groups throughout the state.

This funding is now largely gone and while seeking more, CIRCA is transitioning. In 2016, Connecticut (with a major leadership effort by CIRCA) was awarded $54.6 M in the National Disaster Resilience Competition sponsored by the US Department of Housing and Urban

Development. The project supports a pilot project in Bridgeport to connect coastal communities to resilient transit-oriented development along Metro North through resilience corridors. In addition, the funds also support development of a "*Connecticut Connections Coastal Resilience Plan"* for New Haven and Fairfield Counties. This effort brought together 8 different Connecticut state agencies in a Resilient Connecticut State Agency Workgroup, selected from the previously established Safe Agencies Fostering Resilience Council (SAFR Council).

The speakers described a three-phase resilience planning process with state agencies and municipalities and also CIRCA's technical supporting activities such as: 1. Flood Risk & Climate Impact Vulnerability Assessment for Connecticut, 2. Adaptation Option Scenarios and Economic Modeling, and 3. Capacity Building and Field Research Studies. In response to a question about what had been most effective, the speakers mentioned on-the-ground municipal implementation projects and shovel-ready planning. Also noted were pre- and post-project monitoring and evaluation. Finally, in the future there will be an increased emphasis on economic drivers.

Anji Seth and Guiling Wang, UConn.: *"Temperature and Precipitation Projections: An Update for Connecticut"*. Anji Seth started with a discussion of temperature impacts and was followed by Guiling Wang who discussed precipitation impacts. Anji started with a global climate change background, describing the range of emission scenarios, the paleoclimate evidence for sea level rise, and the impacts and risks of global warming for selected natural, managed and human systems. She concluded the introduction by noting that all warming and every action matter, especially if we want to limit warming to 1.5^{o}C rather than 2^{o}C.

Future Connecticut climate projections were developed by downscaling a number of global climate models with high resolution data using MACA methods, or Multivariate Adaptive Constructed Analogs. Such state-level assessments using these methods are relatively new and still exploratory. The high RCP8.5 emission scenario was used because it follows current trends, however, reduced emissions due to political changes would result in smaller effects. Eight downscaled models were used with a 4 km resolution.

Currently observed Connecticut temperatures are increasing at a rate of 0.3^{o}F/decade with the greatest increase of 0.4^{o}F/decade in the winter. Future projections of annual average temperature are +5^{o}F by 2040-69 and +8^{o}F by 2070-99 above the 50^{o}F average from 1970-99 reference period. The greatest increase would be in the summer in mid-century and in the fall in late-century. Other predicted significant changes include an increase in warm spells from 4 days to +40 (mid-century) and to +95 (late-century). Frost days would decrease from 124 (reference) to -39 (mid-century) and to -65 (late-century).

Guiling Wang followed with a discussion of predicted precipitation trends during the same time periods. With increases in temperature, global average evapotranspiration (ET) and precipitation both increase by about 2%/^{o}C. However, precipitation intensity increases by 7%/^{o}C, resulting in a decreased precipitation frequency, more consecutive dry days, and an increased drought risk. In the US, the Northeast has seen the greatest increase in heavy precipitation events.

Predicted annual Connecticut precipitation will increase by four inches (mid-century) and five inches (late-century) over the reference value of 51 inches. The increase will be significant in the winter and spring but is unclear for other seasons. There will be a decrease of potential water availability, especially in summer, as represented by the difference between precipitation and evapotranspiration. This will lead to an increasing risk of droughts. Flood risks will increase due to increases in both the amounts of heavy precipitation and the frequency of extreme precipitation events. Projections suggest that inland floods will be larger and last longer. Model uncertainties increase in the late-century compared to the mid-century, making prediction more difficult.

Finally, potential water quality impacts of climate change include accelerated microbial (bacterial and algal) growth because of elevated temperatures, and floods resulting in increased non-point source nutrient inputs and overflows of wastewater treatment plants and storm drainage. Droughts may lead to crop failure with leftover fertilizers to leach in future storms.

Robert Mendelsohn, Yale: *"An Economic Model of Optimal Coastal Defense".* Robert Mendelsohn discussed a model for Connecticut coastal protection and used examples of specific local towns. The focus was on flood protection and maximizing the net benefit (benefit minus cost). The benefit is the flood damage avoided and the cost is construction plus annual maintenance. Calculation of this benefit requires information on the probably of a given surge height (from both regular tides and storms), depth of flood at each property, and damage at each property from the property value and the depth of flood. Sea level rise (SLR) in the near term is assumed to be the regional historic rate of 3 mm/year, but would be at higher rates in long-term forecasts. Vulnerable properties are determined from GIS locations and LIDAR elevations.

He discussed examples from two coastal segments of East Haven, the eastern and western, where the storm surge during Hurricane Sandy was 9 feet. He posed the question about how high a wall should be built in each segment, as well as whether storm gates should be built in two nearby streams. The FEMA HAZUS model assumes 80% of a property's value is the building, but in East Haven the value is 65%, since land is more valuable near the coast. Damage estimates included only structural damage to buildings, no land damage, and were calculated based on the Federal Flood Insurance premium for a building worth $100,000 at different elevations and with or without a basement. Damage increases rapidly for buildings with basements of less than 2.5 m elevation, where no building should be built today.

Costs and benefits of building walls at MHHW for both the eastern and western segments of East Haven were analyzed, as well as the optimum height and the amount of protection provided. Optimum wall heights of less than 2 feet in East Haven would cost $25 M and provide a benefit of $33 M. In contrast a higher wall to stop a once in a century storm would cost $202 M but provide a benefit of only $57 M. Additional studies showed that storm gates on two nearby rivers would also provide significant storm protection benefits in excess of the costs.

Finally, SLR was shown to have only a minor impact in the near term but a greater impact as time goes on. A thirty-year lifetime for walls allows society to adjust wall heights as needed to address future SLR. He concluded that more should be done to protect the Connecticut coast from storm damage, though walls and storm gates must be carefully selected to provide benefits greater that the costs. Low probability storm events are too expensive to protect against, and increased SLR will be more important in the second half of the century. In general, new housing below 2.5 m elevation should be prevented.

David Kozak, CT DEEP and Emily Wilson, U Conn., CLEAR: *"CT's Coastal Marshes and Roads Response to Sea Level Rise (SLR): Using Sea Level Affecting Marshes Model (SLAMM) to Identify Marsh Conservation & Management Priorities".* David described the SLAMM model (Sea Level Affecting Marshes Model) and Emily demonstrated the Connecticut (CT) interactive website. Future sea level rise (SLR) will change the type and extent of Connecticut coastal marshes and increase the frequency of road flooding. How does this affect opportunities for marsh restoration and creation?

David briefly described the formation of Connecticut's drowned valley coastline and embayments and the SLAMM-predicted SLR under different CO_2 emission scenarios. He described marsh responses to SLR and how they are simulated by SLAMM, including the important marsh surface change parameters. He then explained the marsh migration process and how SLAMM can use either deterministic or probabilistic approaches to predict marsh changes. The high marsh-dominated coastal wetlands of CT were contrasted with the low marsh-dominated wetlands of the Long Island north shore. Depending on the amount of SLR, many of CT's high marshes are predicted to transition to low marsh by 2100. The marsh discussion was concluded with discussions of SLAMM limitations and potential improvements.

The future frequency of road flooding in CT can also be predicted by SLAMM under different degrees of SLR. This frequency is typically expressed in the interval in days between flooding, every 30 days, 60 days, etc. Future modification of roads in order to manage flooding can also be used to manage marshes at the same time, perhaps restoring or expanding current marshes or creating new ones. Emily showed a series of slides from CTECO, the CT Environmental Conditions Online site, specifically the Sea Level Rise Effects on Roads and Large Marshes viewer, https://cteco.uconn.edu/viewer/index.html?viewer=slamm
This view displays the expected response of all CT coastal roads and the 21 largest marshes to SLR as predicted by SLAMM. It is meant to serve as a screening tool to identify roads subject to tidal and storm flooding and upland areas for potential marsh migration. She focused in on both road flooding and marsh migration over time in the area surrounding Bridgeport Harbor, as well as several other areas throughout the state. The presentation concluded with a detailed list of management questions for road flooding and marsh restoration that will need to be addressed by state transportation and environmental managers.

Mark Tedesco, EPA: *"Building on 2018: Investment Decisions for 2019".* Mark focused on future planning but briefly reviewed the recent past. He showed the recent funding increases and noted that the current LISS budget was $14.6 M. He briefly reviewed the 2017 and 2018 investments and discussed 2019 key funding decisions and showed the budget distribution by program element. Mark concluded by noting that the House Appropriations Committee has approved $21 M for 2020 and also detailed the comprehensive planning process ahead, including the two-day Management Committee meeting in October.

Jim Ammerman, LISS/NEIWPCC: *"Long Island Sound Study Science Needs".* Jim provided a brief description of process for the development of future science needs. While the focus is on monitoring and research needs based on the Ecosystem Targets of the CCMP, it will also include cross-cutting issues like climate change impacts. A preliminary list will be widely distributed for discussion and input by the STAC, workgroups, the CAC and others. He showed several illustrative examples, including proposed science needs for hypoxia, eelgrass extent, marine debris, and climate change. A mention of a current micro-plastics project under the topic of marine debris sparked an extended discussion.

The meeting was adjourned about 2:15 PM.