Sentinels of climate change: coastal indicators of wildlife and ecosystem change in Long Island Sound

Final report
September, 2014

Chris Field[1] and Chris Elphick[1,*],

With key contributions from co-investigators:
Maureen Correll[2], Min Huang[3], and Brian Olsen[2]

[1] Department of Ecology and Evolutionary Biology and Center for Conservation and Biodiversity, University of Connecticut, 75 North Eagleville Road, Storrs, CT 06268

[2] School of Biology & Ecology, Climate Change Institute, University of Maine, Orono, Maine 04469

[3] CT Department of Energy and Environmental Protection, Migratory Game Bird Program, 391 Route 32, North Franklin, CT 06254

*Please direct correspondence to: chris.elphick@uconn.edu

Project funded by Connecticut Department of Energy and Environmental Protection/Long Island Sound Study

Summary: We investigated potential indicators of climate change effects on key wildlife and ecosystem resources in coastal Long Island Sound (LIS). Our focus was on biological indicators with high potential to show climate responses, available historical data, ease of cost-effective future data collection, and the ability to inform real-world management decisions. For wildlife measures with long enough time series, we investigated whether variation was explained by a set of core parameters: measures of temperature, precipitation, and sea level. We found that beach-nesting and colonial waterbirds, which represent some of the longest time series for wildlife in LIS, are not strongly influenced by the core parameters. In contrast, several saltmarsh bird and plant measures are strong indicators of sea level and tidal flooding. Additionally, we conducted pilot investigations and collected baseline data for other potential indicators in an attempt to address topics that lacked a historical record, in particular rates of ecosystem change in areas thought to be experiencing marine transgression. Overall, our results suggest that (1) several components of saltmarsh ecosystems are already being affected by increased coastal flooding and (2) coastal forest ecosystems are potentially resilient to change in the face of increased coastal flooding. This temporal mismatch in responses to coastal flooding will likely create challenges for management aimed at saltmarsh conservation in LIS. Additional research and monitoring is needed to understand rates of marine transgression and the factors influencing them.

Key recommendations:

We recommend the following steps to advance monitoring biological responses to climate change along the Long Island Sound coast. Items on this list are divided into those that are of top priority (i.e., essential to tracking climate-related change) and those that are of high priority (i.e., would enhance our understanding and have good potential to improve sentinel monitoring). Lower priority recommendations can be found within the body of the report.

Top priority action items:

- Conduct regular monitoring of specialist saltmarsh bird (clapper rail, willet, saltmarsh sparrow, seaside sparrow) abundance and nest success at existing georeferenced points and using protocols now in use throughout the Northeast and Mid-Atlantic states. Optimal survey frequency is under investigation and annual surveys might not be necessary; until those results are available, planning for surveys at least every 2-3 years would be conservative.
- Conduct regular resurveys of the coastal margin transects created to quantify baseline conditions during this study. Expanding this baseline survey beyond forest habitats would broaden the inferences that can be made about marine transgression. With only one year of data it is impossible to estimate the optimal frequency for resurveys, but every 5-10 years is likely suitable. More frequent surveys in the near term (e.g., annual for 3-5 years) would allow formal investigation of optimal timing.
- Conduct regular resurveys of tidal marsh vegetation at existing georeferenced sites. Permanently marked points, newly surveyed in this study, should be visited every 2 years to ensure that rapid change is detected and the larger, pre-existing, set of randomly located plots should be visited every 5-10 years to ensure a representative sample and continuation of the longer time series.
- Deploy a network of "PlantCam" photo stations to quantify phenology of coastal vegetation change. Ideally, this network should be developed such that it simultaneously gathers data on other potential indicators of changing marsh conditions. Siting photo stations in a manner coincident with other tidal marsh monitoring work is also advised.

High priority action items:

- Expand tree core sampling of oaks to describe spatial variation in the resilience of coastal forests to marsh encroachment and climate-related growth patterns.
- Compile historic data sets describing tidal marsh vegetation and organize them in a consistent format. During our work we identified several such data sets, and others have been working to make this information more accessible. Analyzing that information was beyond the scope of our study and the wide range of different methods used made it unclear how fruitful further analysis would prove. Given the magnitude of vegetation change detected in our study, and uncertainty over the magnitude and nature of longer-term (multi-decadal) vegetation change, however, a focused project to systematically complete this task would be valuable.