



Long Island Sound Study

A Partnership to Restore and Protect the Sound

LONG ISLAND SOUND STUDY

SCIENCE NEEDS DOCUMENT

April, 2022

The Long Island Sound Study Science Needs Document

This science needs document is a summary of many of the priority Science Needs required to meet the management goals of the Long Island Sound Study (LISS), but should not be considered exhaustive. It was developed based on the input from a diverse array of LISS partners and is structured around the Themes and Ecosystem Targets of the 2015 Comprehensive Conservation and Management Plan (CCMP). Since the Sound Science and Inclusive Management Theme does not have Ecosystem Targets, a series of important cross-cutting issues were used instead, ranging from climate change to ecosystem-based management. This document also includes information on the current status of this need and the resources and partners addressing it. This Science Needs document is a broad reference which is meant to highlight important LISS science needs and is subject to continuous revision to incorporate new information.

Readers may also want to review the four themes of the 2015 Long Island Sound Comprehensive Conservation and Management Plan (CCMP) and the the 2020-2024 CCMP Update with revised Implementation Actions (IAs), both are available at <http://longislandsoundstudy.net/our-vision-and-plan/>.

Comments and questions should be sent to Jim Ammerman, LISS Science Coordinator, at james.ammerman@longislandsoundstudy.net.

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ID	Theme	Ecosystem Target, Indicators	Need	Categories	Status Of Need	Status Of Resources	Partners	Details, Implementation Actions
1	Waters and Watersheds (WW)	Extent of Hypoxia	Develop an online tool to calculate hypoxic area and volume from CT DEEP and IEC data. Port to a Shiny App or other Open Science tool.	Literature and Data Review/Synthesis	In progress	Full Resources	CTDEEP, UCONN, EPA/ORISE	To provide rapid and reliable calculation and presentation of hypoxic area and volume.
2	WW	Extent of Hypoxia	Develop a mechanistic understanding of the control of LIS bottom water oxygen under varying nitrogen and carbon loading.	Research	In progress	Partial Resources	UCONN/CLEAR, U New Hampshire, USGS, State Agencies, Others	Determine the importance of bottom vs. water column oxygen consumption and vertical mixing. WW-8
3	WW	Extent of Hypoxia	Develop a mechanistic model of the control of LIS bottom water oxygen under varying nitrogen and carbon loading.	Modeling	In progress	Full Resources	HDR/NYCDEP	Correctly model bottom dissolved oxygen response to nitrogen and carbon loading. WW-27, SM-11
4	WW	Extent of Hypoxia	Measure water flows and carbon and nitrogen fluxes in and out of the East River into LIS.	Research	In progress	Partial Resources	UCONN	To better understand East River impacts on LIS hypoxia.
5	WW	Extent of Hypoxia	Incorporate routine respiration measurement into some LISICOS buoys.	Monitoring	Not started	No Resources	UCONN	Project to make routine respiration measurements comparable with buoy measurements.
6	WW	Extent of Hypoxia	Provide real-time data from LISICOS buoys.	Monitoring	Not started	No Resources	UCONN	Project to improve buoy telemetry.
7	WW	Extent of Hypoxia	Predict annual hypoxic area and volume from spring/early summer nitrogen loading.	Modeling	Not started	No Resources	EPA/ORD	Potential ORD project to develop simple predictive model for management and communication purposes.

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8	WW	Nitrogen Loading	Point source loading--develop a Shiny App to report monthly nitrogen loading from wastewater treatment plants.	Literature and Data Review/Synthesis	In progress	Full Resources	EPA/ORISE	To provide rapid and reliable presentation of monthly nitrogen loading.
9	WW	Nitrogen Loading	Non-point source (NPS) loading--Enhance stormwater, embayment and tributary monitoring and modeling to determine loading and embayment status.	Monitoring	In progress	Partial Resources	STS/UWS, USGS, UCONN	To provide comprehensive NPS nitrogen loading information for LIS. WW-7
10	WW	Nitrogen Loading	Develop a tracking tool to improve load estimates.	Literature and Data Review/Synthesis	In progress	Partial Resources	NEIWPC	The ongoing tracking tool is for stormwater BMP implementation only. A comprehensive integrated watershed is needed for all land-based sources. WW-10
11	WW	Nitrogen Loading	Conduct studies and research to better understand the ecosystem's response to nitrogen reductions to support an evaluation of the 2000 DO TMDL.	Research	Ongoing	Partial Resources		WW-8
12	WW	Integrated chemical/physical/biological stress pressures and indicators/ Nitrogen Loading	Develop methodologies to link watershed condition to stream biointegrity to establish healthy watershed targets.	Research/Monitoring/Modeling /Assessment/Target-Setting	Ongoing	Partial Resources	EPA, State Agencies, USGS, UCONN/CLEAR	CLEAR is developing a protocol that links watershed condition to stream biointegrity based on EPA's Biocondition Gradient. It also estimates TN loading.
13	WW	Biointegrity/ Nitrogen Loading	Research to better understand the inputs and stream ecosystem response(s) of generalized stress from watershed disturbance, including nitrogen, from legacy and existing land use.	Research/Monitoring/Modeling /Assessment/Target-Setting	In progress	Partial Resources	UCONN/CLEAR, U New Hampshire, USGS, State Agencies, Others	Develop methods to monitor stream biointegrity and biological responses to watershed stressors, such as macroinvertebrate indices, and primary productivity and eutrophication responses to nutrients and other stressors. WW-8
14	WW	Nitrogen Loading	Maintain and enhance the management utility of water quality monitoring of watershed nutrient loads and ecosystem responses in LIS.	Monitoring	In progress	Partial Resources	CTDEEP, IEC, STS/UWS, USGS	WW-28, SM-8

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15	WW	Biointegrity/ Nitrogen Loading	Develop comprehensive, integrated ecosystem monitoring of watershed and stream biocondition, including nutrient loads, and the relationship between watershed health and ecosystem responses in LIS.	Monitoring/ Assessment/ Modeling	In progress	Partial Resources	EPA, State Agencies, UCONN/CLEAR, IEC, STS/UWS, USGS, Others	To date, the link between watershed and embayment health, and LIS has not been made as systems are treated independently rather than as an integrated ecosystem to ensure coordinated and effective assessment and management
16	WW	Nitrogen Loading	Develop and implement a monitoring strategy for upper basin states.	Monitoring	In progress	Partial Resources	NEIWPCC, USGS	WW-29
17	WW	Biointegrity/ Nitrogen Loading	Develop and implement a comprehensive, ecosystem-based monitoring strategy for the entire LIS Watershed that focuses on stream health and links to embayment and LIS outcomes	Monitoring/ Assessment/ Modeling	In progress	Partial Resources	EPA, State Agencies, UCONN/CLEAR, IEC, STS/UWS, USGS, Others	This is a critical need for CT and NY as well as for the upper basin states. Develop an integrated effort throughout the LIS basin .
18	WW	Nitrogen Loading	Evaluate challenges to implementation of bioextraction in LIS.	Literature Review/Data Gathering/Synthesis	In progress	Full Resources	NYSDEC	WW-25
19	WW	Nitrogen Loading	Improve understanding, management, and design of onsite wastewater treatment systems.	Research	Ongoing	Partial Resources	NYSDEC	WW-12
20	WW	Water Clarity	Track water clarity in the central Sound and especially in embayments where eelgrass could grow.	Monitoring	In progress	Partial Resources	CTDEEP, STS/UWS	Track water clarity to address ecosystem target and find suitable eelgrass habitat.
21	WW	Water Clarity	Investigate methods to improve water clarity in embayments suitable for eelgrass.	Research	Not started	No Resources		Increase potential eelgrass habitat.

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22	WW	Impervious Cover (IC)	Monitor impervious cover at increased resolution as mapping technology improves.	Literature and Data Review/Synthesis	Ongoing	Partial Resources	UCONN/CLEAR	Address ecosystem target. WW-17
23	WW	Land Cover Driver/ Disturbance	Monitor land cover at increased resolution and frequency throughout the region and continue to develop and improve land cover condition relationships to stream and estuarine health and decision support tools.	Literature Review/ Data Gathering/ Synthesis/ Assessment/ Research	Ongoing	Partial Resources	UCONN/CLEAR, NOAA, State Agencies	Although IC is a good indicator of stress from development, it is not the only stressor. Better to do comprehensive land cover analyses that can meet multiple needs more efficiently, including IC effect analyses on biointegrity.
24	WW	Riparian Buffer Extent and Condition	Monitor riparian buffer at increased resolution as mapping technology improves.	Literature Review/Data Gathering/Synthesis	Ongoing	Partial Resources	UCONN/CLEAR, NOAA, State Agencies	Nearing completion for riparian buffers/areas upland of buffers but improvements and research will likely be needed.WW-15, WW-16
25	WW	Approved Shellfish Area	Increase monitoring of pathogens using rapid molecular methods so that approved shellfish areas can expand.	Monitoring	Not started	No Resources		WW-23,WW-35
26	WW	Approved Shellfish Area	Increase monitoring of HABS and toxins using rapid molecular methods so that approved shellfish areas can expand.	Monitoring	Ongoing	Other Resources (non-LISS)	CTDA/BA	WW-36, WW-37
27	WW	Sediment Quality Improvement	Analyze and display the 2005, 2020, and 2015 EPA National Coastal Condition Assessment data for Sediment Quality.	Literature Review/Data Gathering/Synthesis	Ongoing	Full Resources	EPA/NCCA	Address ecosystem target. 2015 Sediment Quality data recently became available.
28	WW	Sediment Quality Improvement	Develop an indicator for toxic metals in sediments and their relation to sulfides.	Research	Not started	No Resources		WW-1

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29	Habitats (H)	Coastal Habitat Extent	Monitor all 12 coastal habitat extents including the priority habitats listed below.	Monitoring	Ongoing	Partial Resources	Various	HW-23
30	H	Eelgrass Extent	Monitor eelgrass extent and consider developing a Shiny App or other Open Science tool to track and display.	Monitoring	Ongoing	Partial Resources	USFWS	Periodic but insufficient monitoring. HW-25
31		Eelgrass Extent	Develop improved eelgrass monitoring methods.	Research	In progress	Partial Resources	EPA/ORD	Need more frequent and efficient monitoring. HW-25
32	H	Eelgrass Extent	Identify sites for eelgrass restoration based on water quality improvements to the site embayments.	Literature Review/Data Gathering/Synthesis	Not started	No Resources		This could be done through existing models and/or creating a new site assessment study that looked at location of WWTP outfall pipes and failing septic system locations.
33	H	Tidal Wetland Extent	Monitor tidal wetland extent and consider developing a Shiny App or other Open Science tool to track and present.	Monitoring	Not started			HW-27
34	H	Tidal Wetland Extent	Determine current limiting factors for tidal wetlands coverage in LIS, identify prime potential habitat regions for restoration and the potential for success.	Literature and Data Review/Synthesis	Not started			Create conceptual model that is consistent with the LIS Tidal Wetland Loss Workshop 2014 Proceedings.
35	H	Tidal Wetland Extent	Assess climate change and sea level rise impacts on marsh acreage and migration.	Research	In progress	Partial Resources	UCONN, BU	Consistent with the LIS Tidal Wetland Loss Workshop 2014 Proceedings.

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36	H	Tidal Wetland Extent	Assess historic impacts of ditching on marsh stability and migration and impacts of other historic alterations to elevation and hydrology.	Research				
37	H	Tidal Wetland Extent	Determine best methods for tidal marsh (especially high marsh) habitat restoration/enhancement and assess marsh integrity and habitat quality.	Literature Review/Data Gathering/Synthesis				Consistent with the LIS Tidal Wetland Loss Workshop 2014 Proceedings.
38	H	Tidal Wetland Extent	Develop recommended best practices for monitoring tidal marsh restoration projects, and fund monitoring and assessment in collaboration with groups like CTNERR and CIRCA.	Monitoring				All restored marshes should follow a standardized pre- and post-restoration monitoring framework that is consistent with the LIS Tidal Wetland Loss Workshop 2014 Proceedings.
39	H	Tidal Wetland Extent	Evaluate new remote-sensing technologies (satellites, drones, and others) to assess wetland acreage and condition.	Research				
40	H	Tidal Wetland Extent--Fauna	Monitor salt marsh obligate bird species, including the Saltmarsh Sparrow, and their habitats to determine productivity, survivorship, habitat use, and threats.	Monitoring				Supports conservation project outlined in the CT and NY State Wildlife Action Plans.
41	H	River Miles Restored for Fish Passage	Improve monitoring of fish passage, both upstream and downstream.	Monitoring	In progress	Partial Resources	UConn	Recently-funded research project seeks to measure downstream "return" access.
42	H	Shellfish Harvested	Identify habitat and policy limitations to increased shellfish harvest and explore solutions.	Research	Ongoing	Other Resources (non-LISS)	CTDA/BA	

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43	H	Habitat Connectivity	Improve measurement of habitat connectivity, develop methods as needed, including GIS data.	Literature and Data Review/Synthesis	In progress	Partial Resources		Develop methods to measure habitat connectivity.
44	H	Protected Open Space	Develop a more complete GIS data layer all LIS region protected open space as found on CT ECO.	Literature and Data Review/Synthesis				
45	Sustainable Communities (SC)	Waterfront Resiliency	Support and track planning and implementation of resilient development by both Connecticut and New York coastal communities.	Literature and Data Review/Synthesis	Ongoing	Full Resources	CT/NY SG	To address ecosystem target and support local community resiliency. SC-24
46	SC	Waterfront Resiliency	Support a compound flood risk modeling initiative.	Modeling	In progress	Partial Resources	CT/NY SG, USGS	To better represent the flow of water through the land/sea system and the dynamics connecting surface stormwater, coastal ocean, and groundwater. SC-26
47	SC	Harbor Navigability	Assess methods to increase beneficial uses of dredge material.	Research	Not started	No Resources		
48	SC	Public Engagement	Update public engagement survey	Surveys/Interviews	Ongoing	Full Resources	PIE WG	
49	SC	Public Engagement	Use the best available social science research methods to understand public's role in LIS ecosystem.	Research	Not started	No Resources		SC-22

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50	SC	Public Beach Closures	Optimize and implement more rapid bacterial detection techniques to prevent unnecessary beach closures.	Research	Not started			WW-23, WW-35
51	SC	Public Beach Closures	Implement a coordinated and standardized pathogen monitoring program in LIS watersheds.	Monitoring				WW-23, WW-35
52	SC	Public Beach Closures	Use microbial source tracking to identify bacteria sources.	Monitoring				WW-24, WW-35
53	SC	Marine Debris	Develop a marine debris action plan for LIS.	Literature and Data Review/Synthesis	In progress	Full Resources	CT/NY SG	CT and NY Sea Grant are developing this plan. WW-20, WW-21
54	SC	Marine Debris	Address highest research priorities of above action plan when final.	Research	Not started	No Resources		WW-20
55	Science and Management (SM)	Climate Change	Develop ocean acidification monitoring plan for LIS.	Monitoring	Not started	No Resources	UCONN, CTDEEP, USGS, CTDA/BA	Project to monitor acidification parameters in LIS under discussion. WW-32
56	SM	Climate Change	Determine how climate change will impact attainment of CCMP Ecosystem Targets, goals and objectives	Literature Review/Data Gathering/Synthesis	In progress	Partial Resources	UCONN, CTDEEP, CTSG	Using LISS vulnerability assessment and other resources. SM-27

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57	SM	Climate Change	Collect information on habitat and climate changes and the impacts on forage and other key species.	Research	Not started		CTDA/BA	HW-10, HW-16
58	SM	Climate Change	Compile and analyze information on potential long-term sentinel monitoring sites.	Literature and Data Review/Synthesis	Not started			Upcoming workshop will address sentinel sites. HW-5, HW-23
59	SM	Harmful Algal Blooms (HABs)	Develop research and monitoring plan for HABs and toxins.	Research	Ongoing	Other Resources (non-LISS)	SBU, CTDA/BA	WW-36, WW-37
60	SM	Invasive Species	Assess high priority needs for invasive species management across the LIS coastal watershed.	Research	Not started			HW-14
61	SM	Integrated Watershed Management - Ecosystem-Based Management	Refine the ecosystem metrics and targets based on the underlying science to clearly identify the characteristics of a "restored" LIS. Focus on the impact of the integrated Climate and Land Disturbance drivers.	Literature Review/ Data Gathering/ Synthesis/ Assessment/ Research	In progress	Partial Resources	UConn/CLEAR, EPA, NOAA, State Agencies, Climate Change Initiatives	Treat water quality/biointegrity in context of a changing climate where ecosystems are in transition. Coupling the climate and land disturbance drivers provides science relevant to management that may involve transition and regime changes that can be guided. SM-30
62	SM	Data Management	Assess options for establishing an LIS data management plan with a secure, long-term data portal that can access other systems.	Literature and Data Review/Synthesis	In progress	Partial Resources	EPA/ORISE, STS/UWS, UConn, IEC	Maximize the use of Open Science tools in the data management plan. SM-5, SM-9