Chapter 2

Connecticut's Habitats

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Summary

Much of Connecticut's landscape is forested despite being the country's fourth most densely populated and third smallest state. Forests cover approximately 56–61% of the State (CT DEEP, 2020), making Connecticut the 14th most forested state in the United States by percentage (Smith et al., 2018). While forests cover over half of the state, our state has a wide diversity of habitats, ranging from calcareous fens deep in the limestone valleys of the Northwestern Highlands to ancient magma trap rock ridges jutting from the ground throughout the Connecticut Valley region and glacial lake beds scattered throughout the state. Connecticut has a varied waterscape, ranging from mountain streams and rivers to tidal creeks, lakes, ponds, estuaries, and the Long Island Sound. Connecticut contains almost 300,000 acres of wetlands (Anderson et al., 2023), as well as 2,300 lakes and 5,828 miles of rivers (CT DEEP, 2022; rivers.gov, 2025). These aquatic landscapes support a variety of wildlife resources, including freshwater, estuarine, and marine species.

Connecticut's climate varies across regions, with inland areas experiencing more pronounced temperature fluctuations, colder winters, and hotter summers, largely due to the moderating influence of the Long Island Sound. Shifting environmental conditions are likely to continue posing a challenge for SGCN, SAPS, and their habitats. For instance, Connecticut has warmed significantly more than the Northeast region, with the average temperature increasing by 3.9˚F between 1895 and 2022, accompanied by a slight increase in average annual precipitation over the same period. Water levels along Connecticut’s coast are rising at a rate of 10-12 inches per century, which is higher than the global average (Kalmalkar et al., 2024). For more information on how shifting environmental conditions may affect Connecticut’s species and habitats, see Chapter 3.

Overall, more SGCN are found in wetland habitats than in any other habitat in the state, with approximately 284 out of all 573 SGCN (about 50%). Open Upland and Forested Upland had the next highest number of SGCN, with 201 and 179, respectively. Connecticut's experts assessed the condition of each of our 18 habitat types and communities found within each category. The condition of Connecticut's habitats varies considerably. Many uncommon habitats, like Old Growth Forests, Red Cedar Glades, and Pitch Pine – Scrub Oak Woodlands, are presently in Poor condition, but others are in relatively good condition like Red Maple Swamps and some Coastal Beaches and Dunes rated "Good." However, even among most habitat types, conditions vary depending on the location within the state. Some habitats, like Caves and Coastal Bluffs, lack sufficient information to assess their condition fully. Despite the difficulties our habitats may face, there have been many success stories over the past decade since Connecticut's last Wildlife Action Plan. Both these Chapter and Chapter 4 detail actions to help preserve Connecticut's fish, wildlife, plants, and habitats now and in the future.

Landscape Overview

Ecoregions

Much of Connecticut's landscape is forested despite being the country's fourth most densely populated and third smallest state. Forests cover approximately 56 – 61% of the State (CT DEEP, 2020), which is between 1,789,611 and 1,873,471 of the 3,078,017 total land acres of the state, making us the 14th most forested in the United States by percentage (Oswalt, 2018), While forests cover over half of the state, our state has a wide diversity of habitats, ranging from calcareous fens deep in the limestone valleys of the Northwestern Highlands to ancient magma trap rock ridges jutting from the ground throughout the Connecticut Valley region and glacial lake beds scattered throughout the state.

Connecticut comprises four major biogeographic regions: the Northwestern Highlands, the Connecticut Valley, the Coastal Plains and Hills, and the Coastal Lowlands, which are further subdivided into "ecoregions" (EPA, 2024; Figure 2.1). Ecoregions, generally speaking, are comprised of similar habitats because of shared conditions, including underlying geology (Figure 2.2), soil (Figure 2.3), and climate (Figure 2.5). Most soil in the state is geologically young, having formed either during the Wisconsin glaciation or, more recently, under hardwood forests. Organic soils are common throughout Connecticut, formed in depressions and basins where surface peats and mucks accumulate in a microtopography of hummocks and swales (Metzler and Barrett, 2006). The presence of species and their abundance on the landscape result from a synergy

between various factors, including habitat, climate, food availability, and competition among individuals and species, all of which are overlain upon a landscape with significant variations in geology and elevation (Klemens et al., 2021).

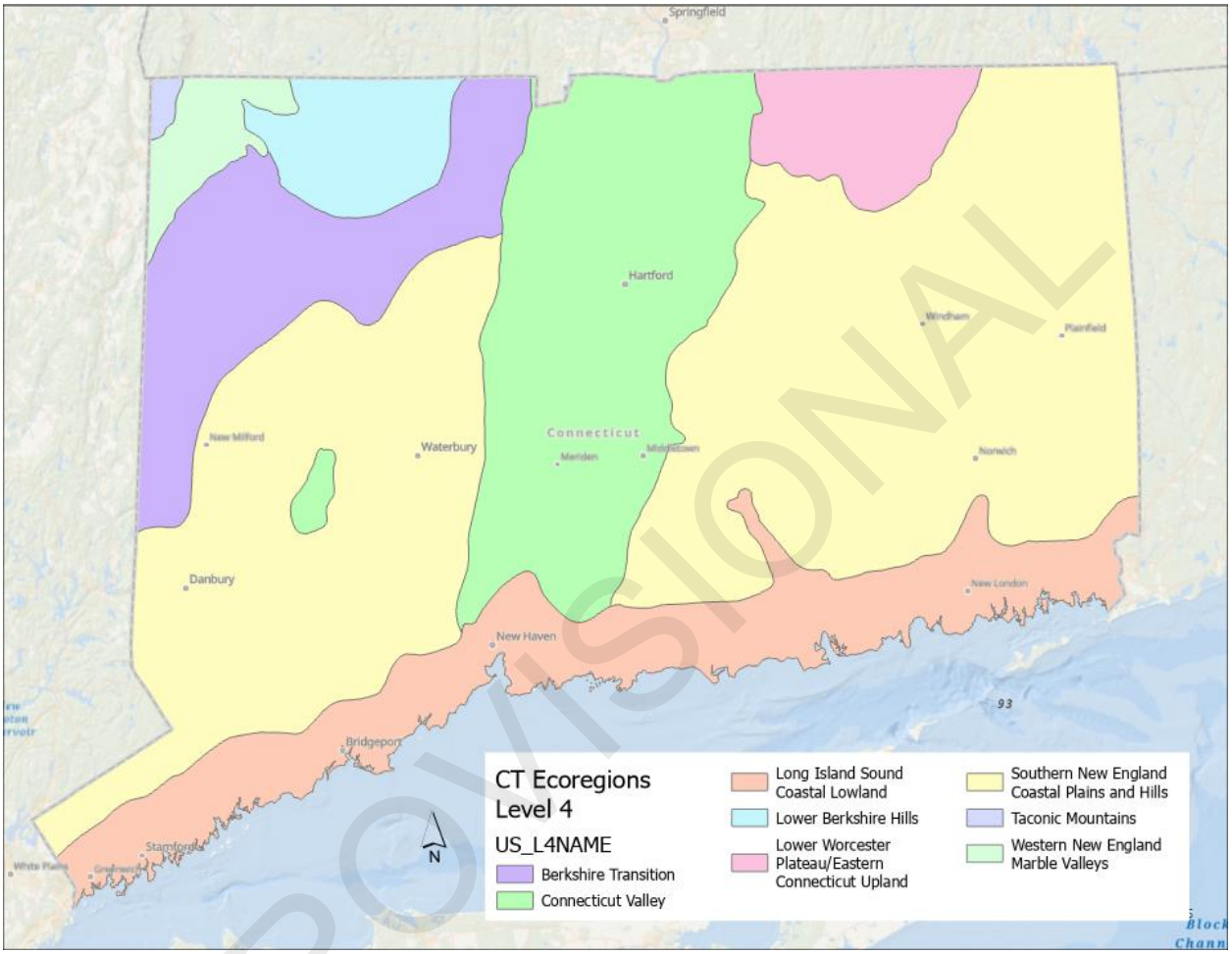

Figure 2.1 - Level 4 Ecoregions of Connecticut (US EPA 2024)

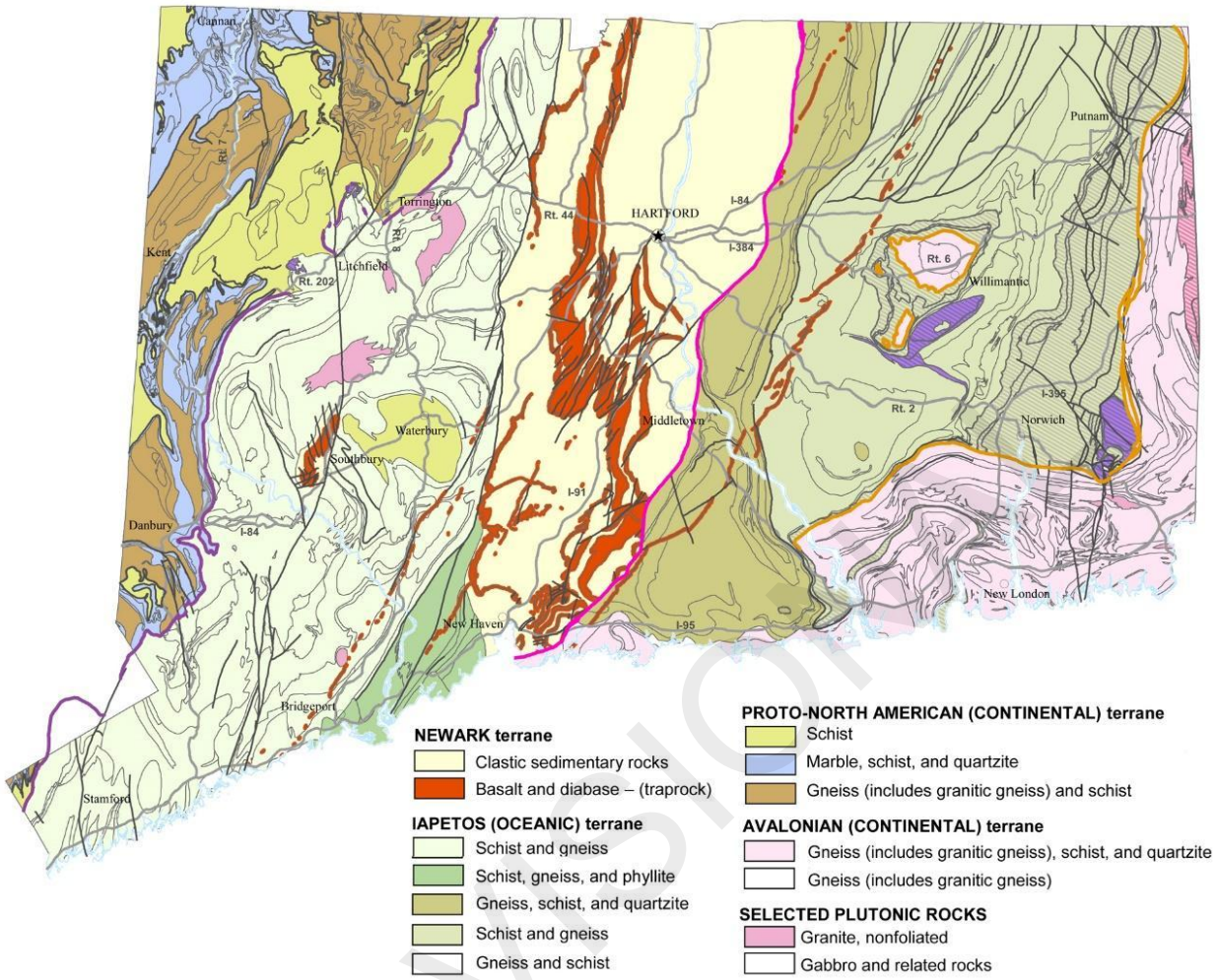

Figure 2.2 - Generalized bedrock geologic map of Connecticut (Connecticut Geological Survey, 2013). The purple line in the western part of the state is "Cameron's Line." The pink line in the center of the state is the Eastern Border Fault. The orange line on the eastern part of the state shows Honey Hill and Lake Char Faults.

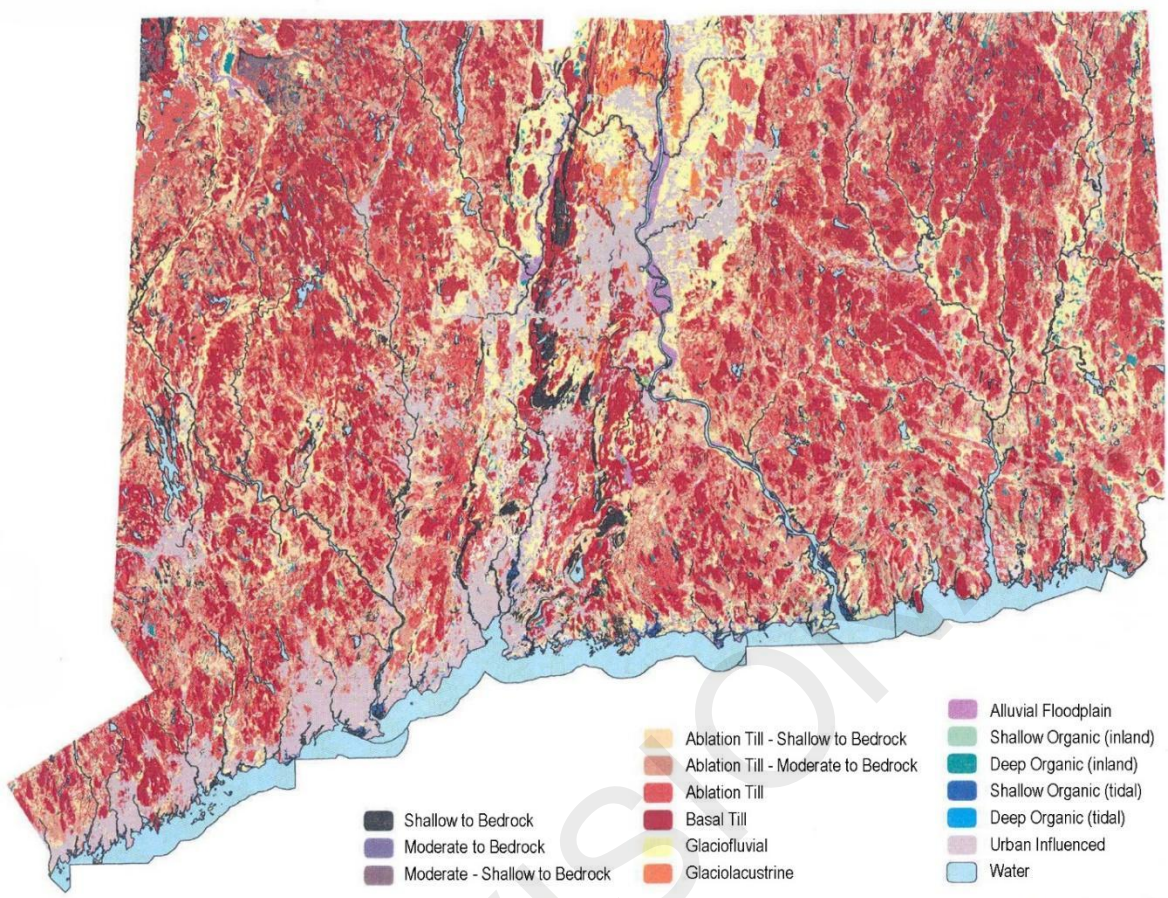

Figure 2.3 - Soils of Connecticut (USDA NRCS)

Northwestern Highlands

The Appalachian Mountains extend through the Northwest Highlands of Connecticut, connecting to the Berkshire Mountains in Massachusetts and the Taconic Mountains in New York. This area includes Connecticut's highest point, located on the southern slope of Mount Frissell (2,380 ft.), and nearby Bear Mountain (2,316 ft.), which is the highest mountain completely within state borders (Bell 1985; Patton and Kent 1992). The Northwest Highlands include the Berkshire Hills, Taconic Mountains, and Marble Valleys ecoregions, which share an underlying Proto-North American Continental Terrane geology, which includes Paleozoic Era igneous granites, gneisses, and metamorphic schists formed into north-south belts. Glacial till soils in the Northwestern Highlands are derived from the underlying crystalline rocks and tend to be rocky, with little organic accumulation. The low-lying Marble Valleys, a series of limestone-underlain valleys that extend from New York west-northwest into Connecticut and Massachusetts, are surrounded by higher bedrock outcrops and are characterized by large glacial gravel deposits (till) that occur at the interface between these valleys and the surrounding bedrock uplifts. These valleys support a unique floral and faunal assemblage associated with the circumneutral wetlands that

occur here, serving as important dispersal corridors for some species (Klemens et al., 2022).

Connecticut Valley

The Connecticut Valley is divided by the north-south Metacomet volcanic traprock ridge and talus slopes, rising over 1,000 feet above the valley floor, creating a unique habitat for plant and animal communities. The Connecticut Valley has considerably younger bedrock than the rest of the state, characterized by Triassic/Jurassic age sedimentary brownstone and shale, with intrusive, erosion-resistant igneous basalts forming the distinctive Metacomet Ridge (Metzler and Barrett, 2006). The fertile soils of the Central Valley were formed through a combination of fine-grained glacial lake sediments and loamy or sandy alluvial deposits. The Connecticut Valley is also home to the trap rock ridge system; the hard, igneous basalt trap rock has resisted erosion and now towers above the valley floor of the lowlands in the Valley and supports unique habitats for a wide variety of species, especially amphibians, and reptiles (Klemens et al., 2021). The veins of magma that form the trap rock ridge system are characterized by steep cliffs with extensive accumulations of exfoliated rock (or talus slopes) to the west, while the east sides are forested and more gently sloped. The summits of these ridges are characterized by sparsely vegetated, dry, savannah-like habitats with shallow soils and bedrock outcrops. These trap rock ridges trend north to south in two lines within the Central Connecticut Lowland. East-west tubes of magma that connect these ridges are called dikes and possess a much rounder morphology (Klemens et al., 2021). The most familiar magma dike is Sleeping Giant in Hamden (Sharp et al., 2013).

Coastal Plains and Hills

The Coastal Plains and Hills have a rolling topography shaped by Connecticut's glacial history, forming a band from the northeast corner to the state's southwestern portion. The state's northeast region includes the ridge and valley topography, the north-south Bolton and Tolland Mountain Ranges, and the Mohegan Range, the only east-west range in southern New England. These higher elevations slope into rolling areas, such as Windham Hills, generally grading from 1,100 to 500 feet toward the southeast region of the State (Bell, 1985). Similarly to the Western Highlands, the highlands found east of the Connecticut River Valley include Paleozoic Era igneous granites, gneisses, and metamorphic schists, which are formed into north-south belts.

Coastal Lowland

The Coastal Lowlands include the state's irregular shoreline, including rocky headlands, pocket beaches, barrier spits, coves, bays, and islands (Bell, 1985; Patton and Kent, 1992).

The subsurface geology of the Coastal Slope was created by glacial erosion and outwash from underlying bedrock.

Waterscape Overview

Waterscapes

Connecticut has a varied waterscape, ranging from mountain streams, rivers, tidal creeks, lakes, ponds, estuaries, and the Long Island Sound. Connecticut contains 14,836 acres of tidal wetlands and flats, which comprise a portion of the state's total 294,016 acres of wetlands (Anderson et al., 2023), as well as 2,300 lakes and 5,828 miles of rivers (CT DEEP, 2022; rivers.gov, 2025). These aquatic landscapes support a variety of wildlife resources, including freshwater, estuarine, and marine species. Of note, Connecticut is home to the largest area of estuarine habitat in the Northeast (TCI & NEFWDTC, 2023), making our state critical for the persistence of species that rely on estuaries. Diverse hydrology influences the distribution and abundance of Connecticut's fish and wildlife species (Metzler and Tiner, 1992).

Lakes and Ponds

Connecticut has approximately 2,300 lakes, ponds, and reservoirs. Most lakes and ponds were created during the last glacial retreat, but many artificial reservoirs also provide potable public water, energy production, and flood control (Jacobs and O'Donnell, 2002). Of the 2,100 lakes and ponds available for public recreational activities, 116 have been classified as "significant" for their recreational opportunities and/or outstanding aquatic habitat and fisheries. Some smaller lakes and ponds, such as Honey Hill in New Hartford and Trail Wood in Hampton, have been preserved by non-governmental organizations and local governments for their value to fish, wildlife, and residents (CT DEEP, 2004). Managed wetland impoundments, including Heron, Great Meadow, Wickaboxet, Sue Hopkins, and Ericson Marshes, sustain waterfowl, amphibians, and emergent marsh vegetation, while lakes and ponds, such as Hodge Pond, Green Falls Reservoir, and Peg Mill Brook, provide critical habitats for fish that rely on cool, clear waters with abundant aquatic vegetation (CT DEEP, 2022).

Rivers, Streams, and Drainage Basins

Connecticut is home to 5828 miles of rivers and streams (rivers.gov, 2025). The state has three major drainage basins (Figure 2.4), all of which drain into Long Island Sound: the Housatonic Basin, the Connecticut Basin, and the Thames Basin. In addition, four minor coastal drainage basins drain into Long Island Sound: the Southwest Coast Basin, the

South Central Coast Basin, the Southeast Coast Basin, and the Pawcatuck Basin. The Hudson River drainage basin is restricted to a small area in the southwest corner of the state and is an important drainage basin in adjacent New York.

High-gradient, non-tidal streams are prevalent in upland areas, providing critical habitat for fish and macroinvertebrates. Lower-gradient rivers in the state's central and southern regions offer important aquatic habitats and recreational opportunities (CT DEEP, 2022). Connecticut also has five federally designated Wild and Scenic River Systems - the Eightmile River, the lower Farmington River and Salmon Brook, the West Branch Farmington River, the Housatonic River, and the Wood and Pawcatuck River systems (Anderson et al., 2023).

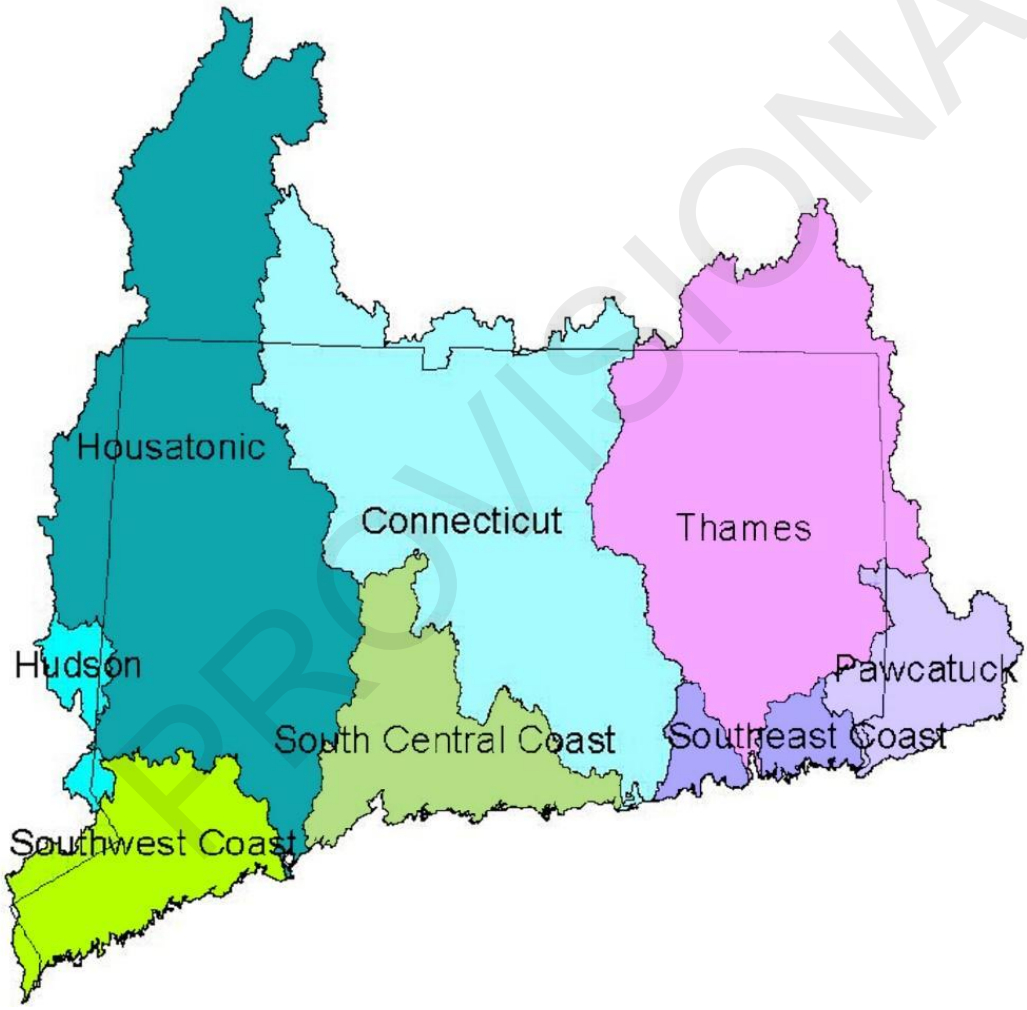

Figure 2.4 - Major and minor drainage basins of Connecticut (Source: CT DEEP Water Bureau, Watershed Coordination Program, 2004).

Estuaries & Long Island Sound

Estuaries are biodiversity hotspots due to the mixing of freshwater and saltwater. Connecticut's estuarine habitats within the Long Island Sound estuary system include vegetation beds, hard bottoms, sponge beds, shellfish reefs, and algal beds, each characterized by distinct environmental conditions and ecological functions (CT DEEP, 2022). The Long Island Sound, the state's largest and most significant estuary, was formed by retreating glaciers and marks the southern boundary of Connecticut (Latimer et al., 2014; Koppelman et al., 1976). The Long Island Sound encompasses 612 miles of coastline (LISS, 2025a). Its watershed covers 16,820 square miles in Connecticut and New York, receiving 90 percent of its freshwater from the three major Connecticut rivers (Connecticut, Thames, and Housatonic) (Koppelman et al. 1976). The Long Island Sound is unique among estuaries in that it has two connections to the Atlantic Ocean: to the east through the Race and Rhode Island's Block Island Sound, and to the west through the East River and New York Harbor. The Long Island Sound is approximately 110 miles long, east-to-west, and 21 miles wide at its broadest part, covering 1,320 square miles (LISS, 2014), and it supports an array of ecologically important areas.

Estuarine tidal marshes and creeks occur in a narrow band along the coastline, intruding northward upstream into various tidally influenced rivers that empty into Long Island Sound. Of the states in the Northeast, Connecticut has the largest area of estuarine habitat (TCI & NEFWDTC, 2023). Generally, the mouths of Connecticut's three large rivers each contain estuarine habitats that extend upstream, while many of the smaller coastal rivers have some limited upstream estuarine components. The mix of salt and fresh water provides an important and biologically productive habitat. The Connecticut River Estuary is one of only four estuaries in the Northeastern United States designated as a Ramsar Site, recognized for its global importance (Ramsar, 2023). Estuarine habitats lie in many of the most highly developed areas of the state, which have constricted and impinged upon many of the marshes associated with tidal mudflats. Heavy recreational use and development adjacent to these estuaries contribute to their degradation, but rising sea levels will be one of the most serious challenges. This rise will cause the estuaries to move further inland, where there is now little vacant land to expand into because of the intensity of current coastal development patterns (Klemens et al., 2021).

Climate

The Northeast is situated in the mid-latitude westerlies zone, so despite its proximity to the Atlantic Ocean, it experiences a continental climate characterized by warm summers and cold winters, with most weather systems moving in from the west (Zielinksi and Keim,

2003). In coastal regions of the Northeast, however, temperature and precipitation extremes are also impacted by conditions over the Atlantic Ocean (e.g., coastal storms). The Northeast climate, in general, exhibits high seasonal and year-to-year (interannual) variations due to complex interactions between regional characteristics (e.g., topography, coastal geography) and large-scale interactions between local and hemispheric-scale atmospheric circulation (Karmalkar et al., 2024), resulting in several bioclimatic and ecological zones across the Northeast.

Connecticut's climate varies across regions, with inland areas experiencing more pronounced temperature fluctuations, colder winters, and hotter summers, largely due to the moderating influence of the Long Island Sound (NOAA, 2022). The northwestern hills receive the most snowfall, averaging 50 inches a year, while the coast gets between 30 and 35 inches a year (NOAA, 2022). The center of the state averages more days per year with temperatures above 90°F (13 days) than the northwest (8 days) and the coast (4 days) (NOAA, 2022). The northwest experiences the most average days per year of extreme cold (temperatures below 0°F), with seven days, while the central part of the state experiences only two days, and the coast experiences one (NOAA, 2022). Average water levels along the coast is rising at a rate of 10-12 inches per century, which is higher than the global average. This increase in seawater levels increases the risk of flooding in low-lying communities.

Temperature

Throughout the Northeast, observations show a warming trend over the last ~130 years, with an overall warming of 1.4˚C (2.5˚F) since 1895. However, Connecticut has warmed significantly more than the region, increasing by 2.2˚C (3.9˚F) between 1895 and 2022 (Figure 2.5; Karmalkar et al., 2024). Over the same period, the average global temperature has increased by about 1.1˚C (2˚F), only half of what Connecticut has experienced. This warming pattern is present in all seasons but is more pronounced in summer. The coast and the adjacent Northwest Atlantic continental shelf regions have been identified as areas highly affected by shifting environmental conditions (Pershing et al., 2021; Karmalkar & Horton, 2021).

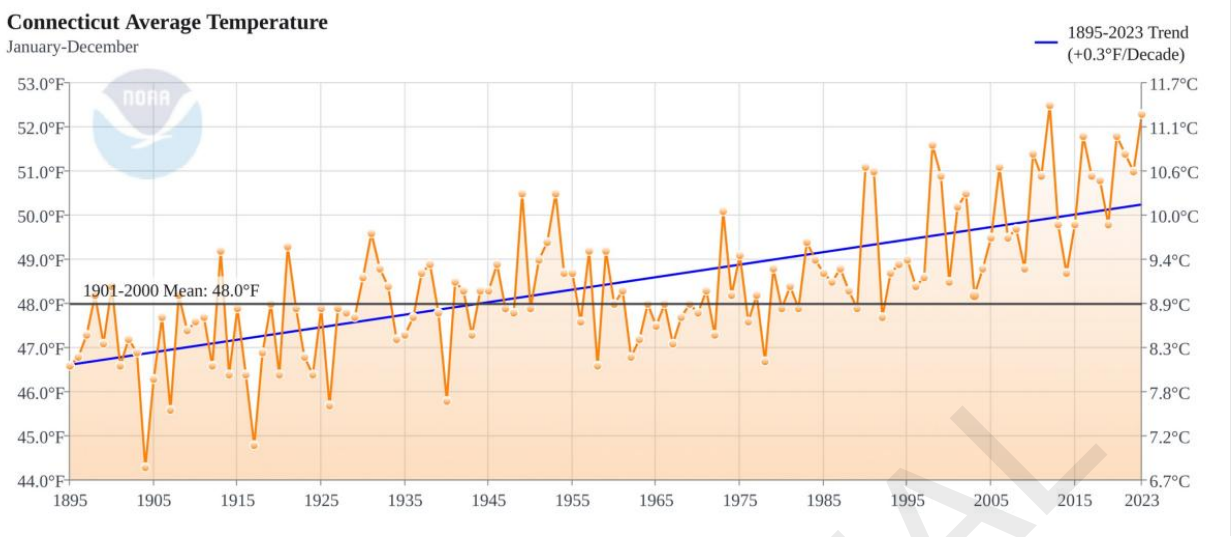

Figure 2.5 - Connecticut's annual mean surface air temperature between 1895 and 2022. The black line represents the twentieth-century average, while the blue line illustrates the trend over the entire period (NOAA, 2024).

Precipitation

The Northeast receives abundant and relatively uniform precipitation throughout the year, but there can be large variations from one year to the next. The region has experienced a modest increase in total annual precipitation (Marvel et al., 2023; Easterling et al., 2017) with a relatively strong increasing trend in the warm season and a dramatic increase in very heavy rainfall (top 1% of events) over the last 60 years (Whitehead et al., 2023; Hoerling et al., 2016; Wuebbles et al., 2017). Like the region, Connecticut has experienced a slight increase in average annual precipitation since 1895 despite a dry period around 2015 (Figure 2.6). A significant portion of the wetting trend in summer and fall is related to an increase in the intensity of heavy precipitation events associated with tropical (Barlow, 2011) and extratropical storms (e.g., Nor'easters; Kunkel et al., 2013).

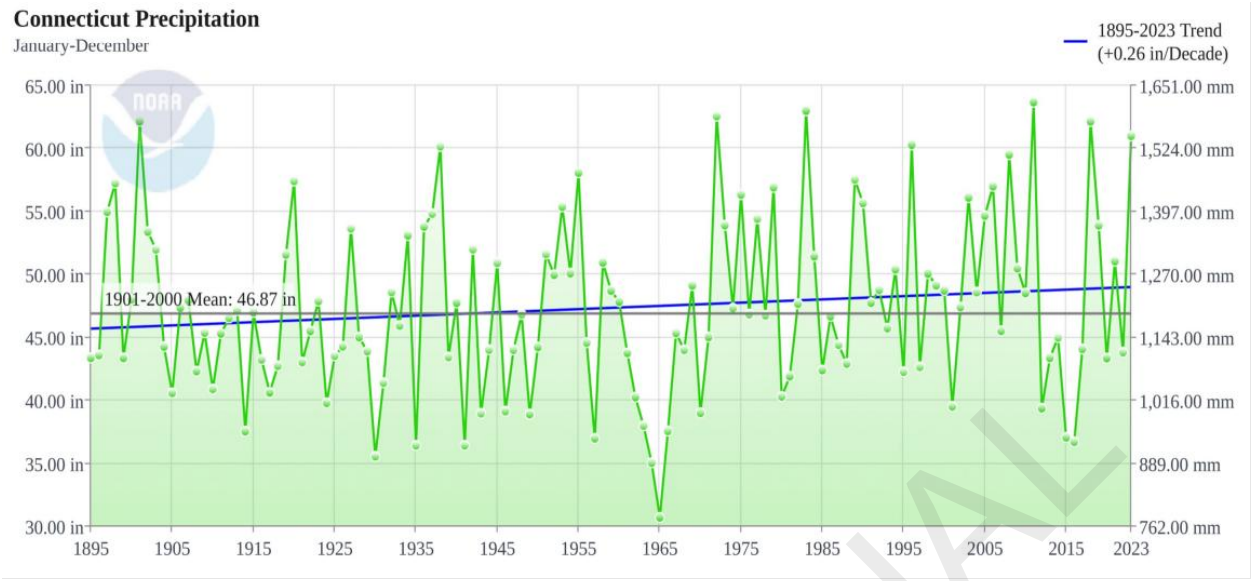

Figure 2.6 - The annual mean precipitation in Connecticut between 1895 and 2023. The black line shows the twentieth-century average, and the blue line shows the trend over the entire period (NOAA, 2022b).

Heavy precipitation events pose a major threat to the water quality and ecological balance of the Long Island Sound. As stormwater runoff increases, it carries pollutants such as nitrogen, E. coli, pharmaceuticals, heavy metals, and debris into the Sound, deteriorating water quality and impacting marine life. Implementing robust stormwater management and pollution control measures is essential to safeguarding the Long Island Sound's environmental integrity (LISS, 2025).

Rising water levels along Long Island Sound

The Northeast has experienced a steady rise in coastal water levels over the last century, approximately 12 inches since 1900, which is higher than the global rate (Sweet et al., 2022). As of 2018, the global coastal water level had risen by approximately 0.5-0.8 feet relative to 1900 and 0.2-0.5 feet relative to 1971. In Connecticut, the rise in has been consistent with the rest of the region, rising about 11 inches over the last century (Figure 2.7). Sea level along the Northeast coast also varies substantially from year to year due to variations in atmospheric conditions and ocean circulation. For instance, high coastal water levels in 2009 and 2010 have been linked to changes in the ocean circulation in the Gulf Stream region and changes in wind circulation associated with basin-wide variations in the atmospheric variability pattern in the North Atlantic basin (Goddard et al., 2015; Domingues et al., 2018; Piecuch et al., 2019).

The level of Long Island Sound is a growing concern for Connecticut's coastal cities, with long-term data indicating steady increases in water levels. In Bridgeport, the relative sea level trend is 3.33 mm per year (±0.38 mm), based on data from 1964 to 2023, equating to approximately 1.09 feet of rise over 100 years. Similarly, in New London, the

relative sea level trend is 2.87 mm per year (±0.21 mm), based on records from 1938 – 2023, translating to 0.94 feet of rise per century. These gradual but persistent changes heighten the risk of coastal flooding, shoreline erosion, and infrastructure vulnerability, underscoring the need for proactive adaptation and resilience strategies in these communities (LISS, 2024).

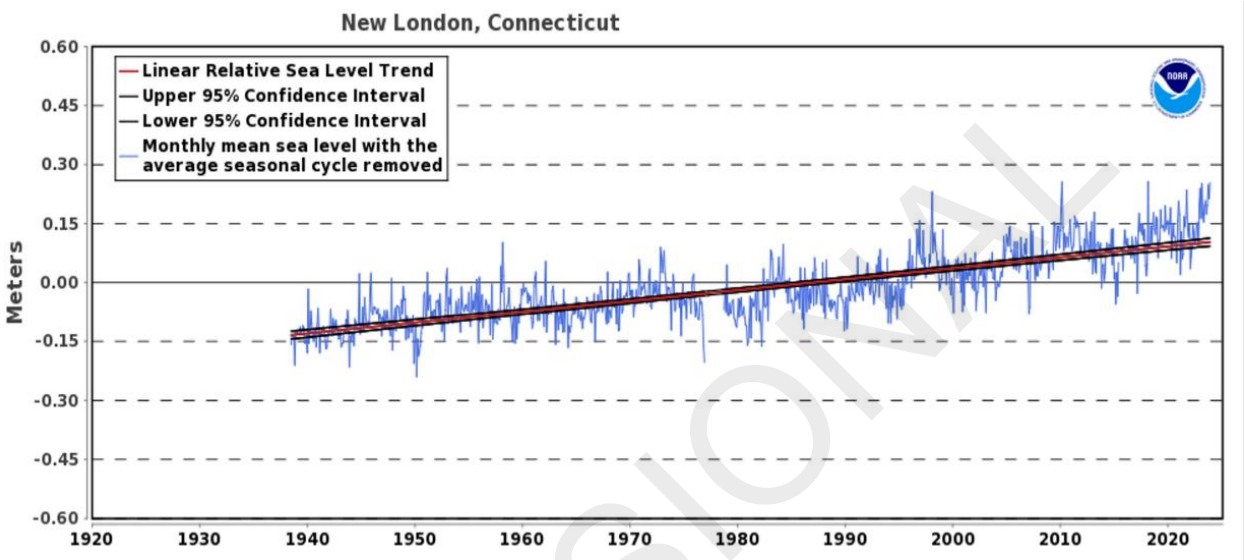

Figure 2.7 - Linear trend in relative rate of coastal water level rise in millimeters per year (mm/yr) in New London, Connecticut (NOAA Tides & Currents).

Higher water levels can enhance the impact of surges during winter storms (e.g., Nor'easters), hurricanes, and other severe weather events. Higher water levels mean storm surges can penetrate further inland, causing more extensive flooding and damage. It also can lead to an increase in the frequency and duration of minor coastal flooding events (called 'nuisance' or 'sunny day' flooding) along the Northeast coast (Sweet et al., 2018; Ezer, 2020) and loss of high marsh habitat. Storm surges and coastal flooding can have a significant impact on groundwater in coastal areas. There is mounting evidence that saltwater intrusion has been contaminating freshwater resources in the Northeast and throughout the United States (Panthi et al., 2022; USDA, 2020), rendering them unsuitable for drinking and agricultural use. Higher sea levels increase coastal erosion as waves reach further inland, wearing down shorelines and threatening coastal infrastructure. For more information on how the level of Long Island Sound may impact Connecticut's SGCN, please refer to Chapter 3.

Key Habitats

Overview of Habitat Types and Condition

Building from Connecticut's 2015 Wildlife Action Plan and the Northeast Regional Lexicon (Crisfield & NEFWDTC, 2022), our habitats have been categorized to ensure consistency with previous Wildlife Action Plans and regional efforts. This results in a subdivision of the 10 Habitat Groups into 18 Habitat Types, which are further subdivided into various Communities within each Type (Table 2.1). This is how the rest of this chapter is organized. Each habitat section below discusses differences between the 2015 Wildlife Plan and this 2025 Revision. As some habitat classifications have changed since the 2015 Wildlife Plan, a crosswalk of habitat categories for the 2005, 2015, and 2025 is provided in Appendix 2.1.

Table 2.1 - Key Habitats Groups, Types, and associated Communities.

Habitat Groups	Habitat Types	Community Name
Forested Upland	Forests & Woodlands	Calcareous Forests
		Coniferous Forests
		Maritime Forests
		Mixed Hardwood Forests
		Northern Hardwood Forests
		Oak Forests
		Old Growth Forests
		Young Forests
Open Upland	Cliff & Talus	Cliffs and Talus Slopes
		Traprock Ridges
	Glades, Barrens & Savannas	Grassy Glades and Balds
		Sand Barrens and Sparsely Vegetated Sand and Gravel
		Pitch Pine - Scrub Oak Woodlands
		Red Cedar Glades
	Grasslands	Cool Season Grasslands
		Warm Season Grasslands
	Shrublands	Reverting Fields and Early Successional Shrublands
		Maritime Shrublands
Palustrine	Non-Tidal Wetlands	Atlantic White Cedar Swamps
		Red Maple Swamps
		Floodplain Forests
		Northern White Cedar Swamps
		Red/Black Spruce Swamps
		Coastal Plain Ponds
		Calcareous Spring Fens

		Freshwater Marshes
		Wet Meadows
		Bogs and Fens
		Shrub Swamps
		Surface Springs and Seeps
		Vernal Pools
	Tidal Wetlands & Flats	Intertidal Beaches, Flats, and Rocky Shores
		Salt and Brackish Marshes
		Navigational Channels, Breakwaters, Jetties and Piers
Riverine	Big Rivers	Large Rivers and their Associated Riparian Zones
	Rivers and Streams	Cold Water Streams
		Head-of-tide and Coastal Streams
		Unrestricted, Free-flowing Streams
Lacustrine	Lakes & Ponds	Lakes and their Shorelines
Land-Water Interface	Beaches & Dunes	Coastal Beaches and Dunes
		Offshore Islands
	Shorelines	Coastal Bluffs and Headlands
Estuarine	Estuaries	Algal Beds
		Coastal Rivers, Coves and Embayments
		Hard Bottoms
		Sedimentary Bottoms
		Shellfish Reefs/Beds
		Sponge Beds
		Vegetation Beds
Marine	Marine Nearshore	Open Water
Subterranean	Other Subterranean	Caves and Other Subterranean Habitats
Developed	Developed Areas	Public Utility Transmission Corridors
		Urban and Man-made Features
*Open Upland	Agriculture: Cropland/Pastures	Agricultural Lands
Unspecified	Unspecified	----Unspecified----

A combination of these resources, along with the taxonomic teams (see Identifying Key Habitats below), provides the most comprehensive information on Connecticut's habitat types, relative conditions, and the location of fish and wildlife habitats. The updated regional habitat framework from the Northeast Lexicon and regional data from the Northeast Regional Conservation Synthesis are two primary sources for this chapter (Crisfield et al., 2022; TCI & NEFWDTC, 2023). The *Northeast Habitat Guide: A Companion to the Terrestrial and Aquatic Maps* (Anderson et al., 2013), published by The Nature Conservancy, presents profiles of each habitat type in the Northeast with distribution

maps, state acreage figures, identification of species of conservation concern, and assessment of overall condition in the region. The *Conservation Status of Natural Habitats in the Northeast (2023)* was updated and revised for the 2025 Wildlife Action Plan, incorporating an updated conservation land dataset and regional conditions (Anderson et al., 2023). Additional sources are cited within the relevant sections on key habitats. Due to the lack of information on the distribution and abundance of many wildlife species, especially invertebrates and plants, key habitats and associated communities are used for conservation planning and research activities.

Condition categories were qualitatively determined by CT DEEP foresters, wildlife biologists, and fisheries biologists specializing in habitat management. Given the wide variety of habitats statewide and their variation in factors and conditions, the same relative scale used in the 2005 and 2015 Wildlife Action Plans was employed to facilitate comparisons over the last 20 years.

Identifying Key Habitats for Connecticut's SGCN

After updating the SGCN list (see Chapter 1), the first step in identifying the key habitats for Connecticut's SGCN, the Taxa Teams were provided with a database (see Chapter 1) of existing information for each SGCN and a survey asking these state experts to confirm or update data of the habitat associations for each SGCN. The Taxa Teams included 50 wildlife experts from academia, conservation stakeholder groups, and state agencies (See Appendix 1.1 for a complete list of Taxa Team and Advisory Team members and their affiliations). CT DEEP and its consultants organized virtual workshops for the Taxa Teams in January 2024. These workshops were designed to help them navigate the existing data and the associated survey. From January to May 2024, Taxa Teams provided habitat data to CT DEEP consultants. In May 2024, CT DEEP consultants collated the data and sent the results back to each Taxa Team, which met in late May 2024 to discuss. The data was again collated and returned to the Taxa and CT DEEP Advisory teams in July 2024 for final approval.

Overall, more SGCN are found in Palustrine habitats than any other, with approximately 283 out of all 574 SGCN (about 50%!). Open Upland and Forested Upland had the next highest number of SGCN, with 200 and 181, respectively (Figure 2.8). Importantly, many species can be found in multiple habitats, with many requiring a mix of habitat types to fulfill various life history functions, so these numbers do not add up to 100%. For a list of all of Connecticut’s habitats, descriptions, and condition scores, see Appendix 2.1. For a list of habitat associations for each SGCN and SAPS, see Appendix 2.2.

CT DEEP and its consultants posted a public feedback form on their website in September 2024, asking the public to identify which Habitat Groups they believe should receive the greatest attention. Four hundred thirty-eight individuals submitted a form between September and November 2024. Similarly, CT DEEP consultants surveyed their conservation partners in December 2024 using a Qualtrics survey about which habitats they work in and which they believe require the most conservation action. Over 180 conservation partners filled out surveys. For more information on public and partner outreach, please refer to Chapter 6.

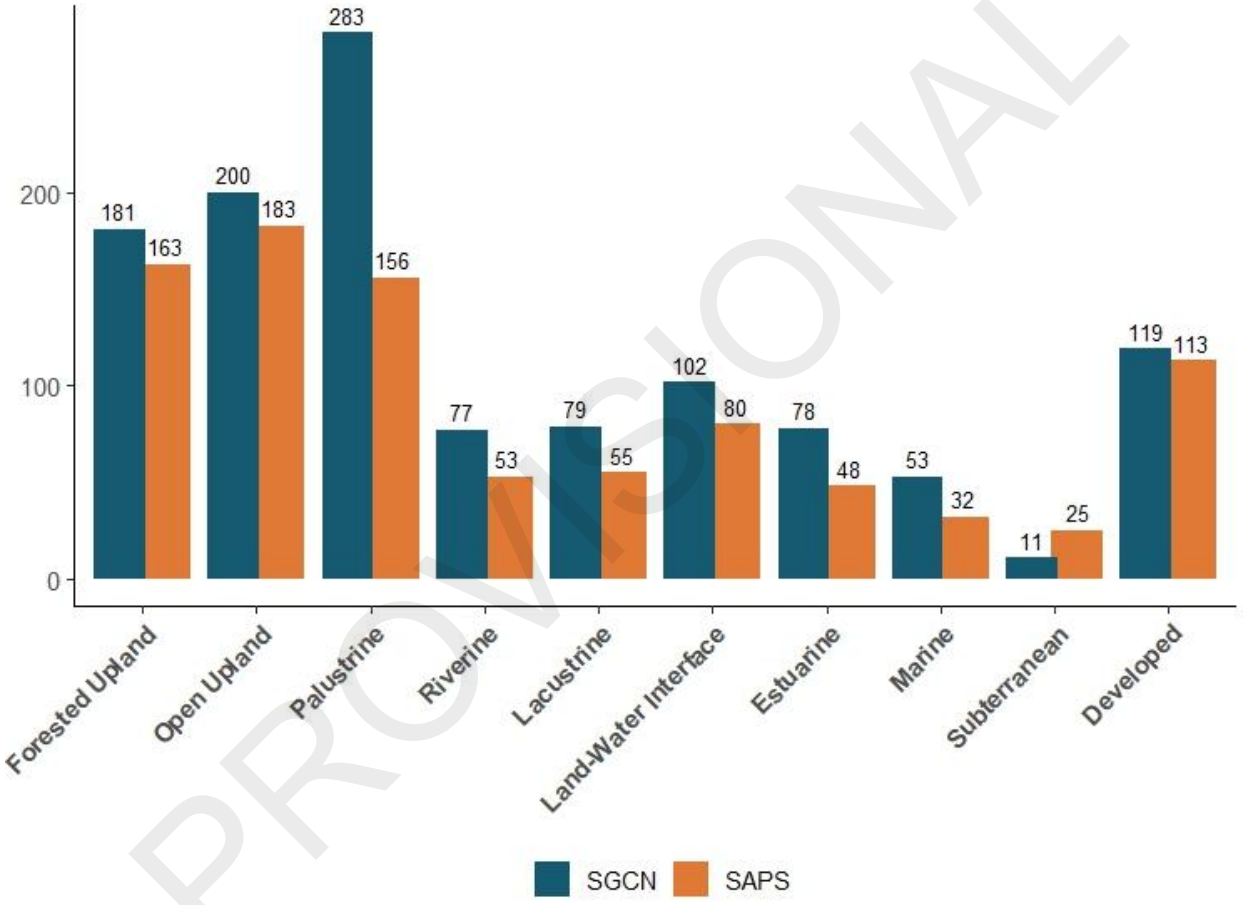

Figure 2.8- Number of SGCN and SAPS occurring within each Habitat Group. Many species can be found in multiple habitats, so these numbers do not add up to 100%.

Regional Overview

The Northeast is highly diverse, home to a wide range of plant and animal communities. Similar to Connecticut, the Northeast is over 60% forested. Throughout the region, the average forest age is approximately 60 years, and the region contains more than 200,000 miles of rivers and streams (Anderson and Olivero-Sheldon 2011), 36,675 water bodies

(Olivero-Sheldon and Anderson 2016), and more than 6 million acres of wetlands. Eleven globally unique habitats, ranging from sandy barrens to limestone glades, support 2,700 rare and restricted species (Anderson and Olivero-Sheldon, 2011). More than 150 Northeast sites have been designated National Natural Landmarks for their national significance as exemplars of their habitat types or geologic uniqueness. Further, six Northeast sites have been selected as Ramsar Wetlands of global importance, and 93 sites have been identified as Important Bird Areas by the Audubon Society.

Regional Species of Greatest Conservation within Connecticut

Connecticut actively participates in landscape-scale conservation across the Northeast through the Northeast Fish and Wildlife Diversity Technical Committee (NEFWDTC), which is part of the Northeast Association of Fish and Wildlife Agencies (NEAFWA). Every five years, NEFWDTC updates the regional list of Regional Species of Greatest Conservation Need (RSGCN; see TCI & NEFWDTC, 2023). Below are the number of RSGCN in Connecticut within the 24 regional habitat types (Figure 2.9). Regionally, wetlands, forests, rivers, and streams contain the highest number of species needing conservation.

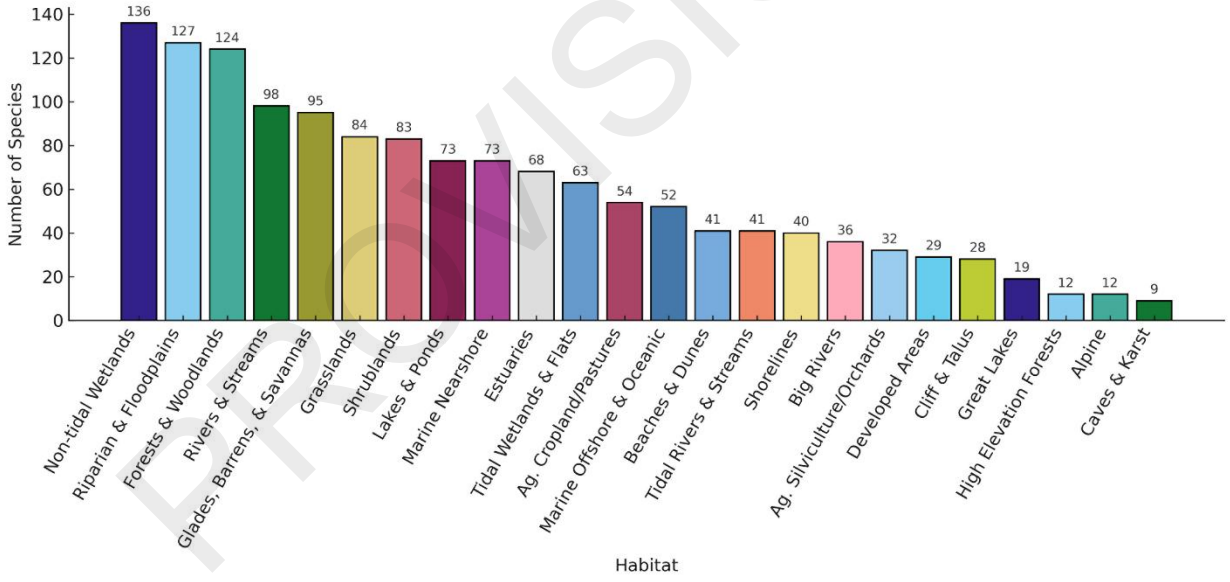

Figure 2.9 - The number of RSGCN and Watchlist species (all categories) associated with each habitat type in Connecticut.

Forest types, particularly Central Oak-pine and Northern Hardwood, are priority habitats because so many SGCN and RSGCN occur in these habitats, and many threats are associated with them. However, some smaller habitats are also high priorities because they support comparatively large numbers of species. Many of these habitats are

hydrologically defined, with wetlands, rivers, streams, and estuaries all being high-priority habitats.

Habitat fragmentation, degradation, and loss of natural system functions were key impacts to be addressed in forested habitats across the region. In 2015, State Wildlife Action Plans highlighted the need for landscape-level planning to maintain fish and wildlife diversity, focusing on large core areas with connectivity for RSGCN and SGCN in habitat management efforts in the Northeast (TCI and NEFWDTC, 2017).

According to *Conserving Plant Diversity in New England* (Anderson et al., 2021), the entire region has 24 mapped habitats covering approximately 2 million acres, with an average of 4% protected for nature and 23% secured against land-use conversion. However, these areas allow logging, mineral extraction, and recreation. Of the conserved lands, 47% are considered resilient (Figure 2.10). The region works towards achieving the Global Strategy for Plant Conservation (GSPC) target of protecting 15% of each habitat and the New England Target (NET) of securing 30% of habitats against conversion on climate-resilient land. Notable conservation efforts include 32 Important Plant Areas (IPAs), with three protected but none fully secured on resilient land. Several habitats partially meet these targets, such as the Laurentian-Acadian Northern Hardwood Forest and North Atlantic Coastal Plain Tidal Salt Marsh, with the latter offering opportunities for migration space. Only one habitat meets the GSPC target (Acidic Cliff & Talus), and one meets the NET target (North-Central Interior & Appalachian Acidic Peatland). To fully meet conservation goals, the region must protect an additional 245,979 acres for GSPC and 224,691 for NET (Anderson et al., 2021).

Unprotected Habitats Threatened by Conversion

Bold indicates a high responsibility to conserve, as > 33% of the regional habitat is in this state.

HABITAT	TOC	%PR	%S	GSPC	NET	R ac
North-Central Interior Wet Flatwoods	11%	1%	16%	1 K	1 K	1 K
Atlantic Coastal Plain Beach & Dune	6%	1%	27%	327	80	44
Northeastern Coastal and Interior Pine-Oak Forest	9%	1%	23%	5 K	3 K	6 K
North Atlantic Coastal Plain Heathland & Grassland	18%	1%	28%	186	29	158
Northeastern Interior Dry-Mesic Oak Forest	8%	2%	18%	126 K	121 K	197 K
North Atlantic Coastal Plain Hardwood Forest	18%	3%	14%	24 K	32 K	49 K
North-Central Appalachian Acidic Swamp	7%	3%	22%	14 K	9 K	29 K
Appalachian (Hemlock)-Northern Hardwood Forest	5%	3%	20%	68 K	56 K	160 K
North Atlantic Coastal Plain Maritime Forest	16%	7%	26%	461	220	628

P = Protected, **S** = Secured, **R** = Resilient
Unprotected = less than 10% protected & resilient
TOC = threat of conversion by 2050
%PR = % protected & resilient
%S = % secured
GSPC = Global Strategy for Plant Conservation target
NET = New England Target
R ac = resilient acres available

Figure 2.10 - From Anderson et al. (2021).

Habitat Profiles

Forested Upland

Forest Habitat Description, Distribution, and Conservation

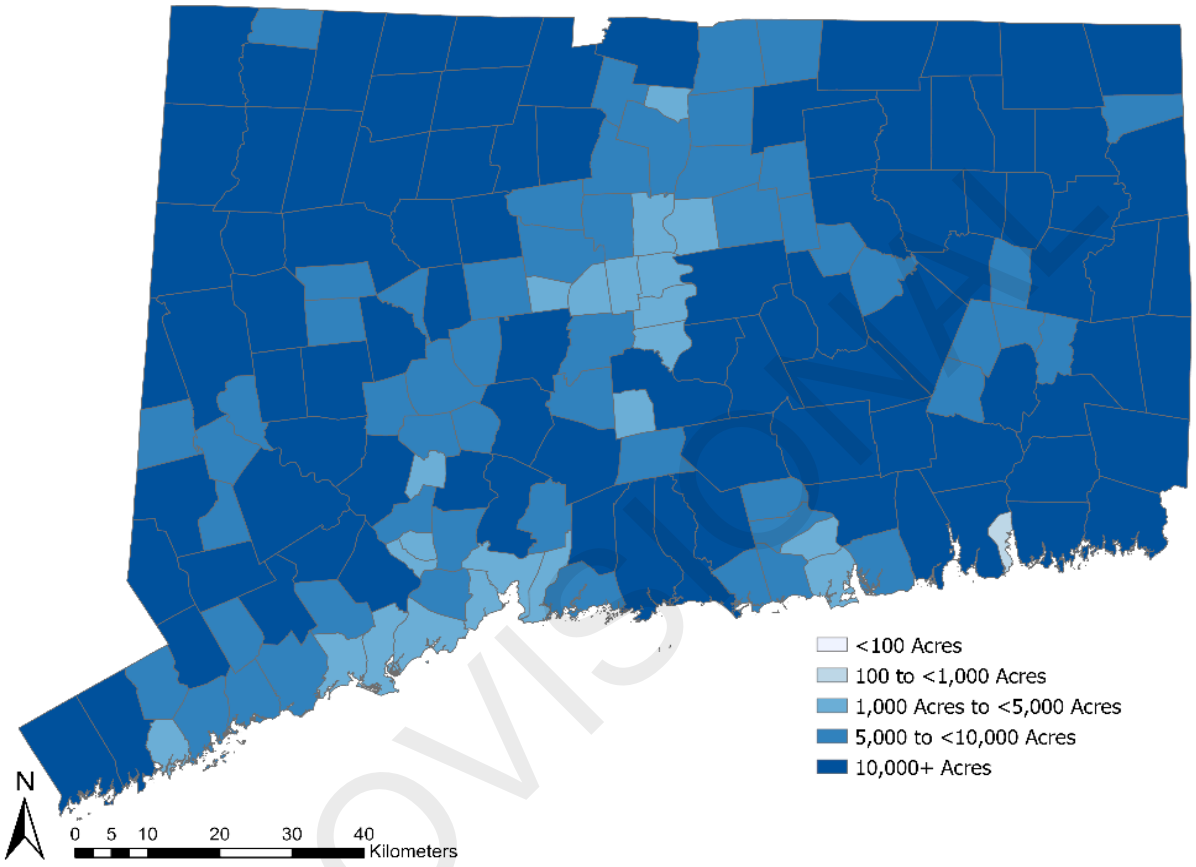

Figure 2.11 – Amount of forested habitat in each Connecticut township.

Forest habitat is the most extensive terrestrial habitat in the Northeast, covering 93 million acres in 2023 (Anderson et al., 2023). Forest types vary across the region, with the forests of New England and New York predominantly composed of northern hardwoods and boreal upland forests mostly restricted to the north portion of the region. Central oak-pine is the most common forest type in the southern Mid-Atlantic portion of the region (Anderson and Olivero Sheldon, 2011).

Connecticut contains approximately 3,203,694 acres of land, of which approximately 1,789,611 acres, or 56%, are forested, a 1% decrease from 2013 (USDA, 2019; CT DEEP, 2020). However, the forested area in Connecticut was relatively stable between 2010 and 2015 after a significant decline between 1985 and 2006 (UCONN

CLEAR, 2016; CT DEEP, 2020), but it has lost 45,000 acres of forest between 2015 and 2021 (CT CEQ, 2022). Despite the losses, Connecticut is the 14th most forested state in the US and has the highest number of urban trees, covering over 62% of the state's urban area (CT DEEP, 2020). Nearly 85% of Connecticut's forestland is in the large diameter size class (i.e., sawtimber-sized trees > 11" diameter for hardwood and > 9" diameter for softwood) due in large part to most trees in the state being over 61 years old (CT DEEP, 2020). The state's forests were cut over repeatedly in the nineteenth and early twentieth centuries, and the most recent regrowth period began in the early 1900s (CT DEEP, 2020). Additionally, about 950,655 acres (53%) of forest in the state are considered "core forest," which is any forested area at least 300 feet away from non-forested areas (UCONN CLEAR, 2016; CT DEEP, 2020).

Connecticut's forestland is nearly 72% privately owned, which makes working with coalitions across landscapes crucial to minimize fragmentation, preserve forests as forests, and maintain forested landscapes as healthy and productive as possible (CT DEEP, 2020). About 69% of Connecticut's forests are oak/hickory forests. An oak/hickory forest is made up of several forest types, including white oak/red oak/hickory, northern red oak, red maple/oak, chestnut oak/black oak/scarlet oak, cherry/white ash/yellow-poplar, mixed upland hardwoods, and yellow-poplar/white oak/northern red oak, among others (USDA Forest Service, 2019).

CT DEEP developed a Forest Action Plan in 2022 with the goal of "Keeping forest as forest." DEEP manages Connecticut's state forests, collectively the largest landholding in the state, to ensure that a viable and productive forest ecosystem provides clean air, water, and a sustainable supply of forest products while sequestering and storing carbon and protecting unique, fragile, and threatened habitats (CT DEEP, 2020). Connecticut maintains many working groups and committees to guide the state in this management, including the State Forest Stewardship Committee and Natural Resources Conservation Service State Technical Committee, both made up of members of government, non-profit, and private organizations. For more information, please review the state's 2020 Forest Action Plan.

Another initiative is the Old-Growth Forest Network, a national network of protected old-growth or mature native forests. It was established in 2011 and is headquartered in Maryland. As of 2022, the Old-Growth Forest Network included 185 Forests in 32 states. The goal of the Network is to locate and designate at least one protected forest in every county that can sustain a native forest, protect each forest in the network from logging, and keep them open to the public. Connecticut has forests in four counties in the Old Growth

Network: Hartford, Litchfield, New London, and Tolland. For more about the Old-Growth Network, please click on this link.

Species of Greatest Conservation Need in Forest Habitats

Forest and Woodland habitats in the Northeast support many RSGCN and Watchlist species, ranking third, alongside Non-Tidal Wetlands, among all habitat types. Two hundred sixty-two species are associated with these habitats, including 126 RSGCN, six Proposed RSGCN, 98 Watchlist (Assessment Priority), and nine Proposed Watchlist species spanning ten taxonomic groups. Additionally, 23 species linked to Forest and Woodland habitats are classified as Watchlist (Deferral) species (Table 2.2; TCI & NEFWDTC, 2023). Lepidoptera, which includes butterflies and moths, represents the largest group of RSGCN and Watchlist species within these habitats. Among the species of Very High Concern, those with at least 75% of their range in the Northeast, there are nineteen species, including nine amphibians, four Lepidoptera, four terrestrial snails, one firefly, and one mammal (TCI & NEFWDTC, 2023).

Table 2.2 - The number of species in each Regional Species of Greatest Conservation Need (RSGCN) and Watchlist category associated with Forest and Woodland habitat in the Northeast as of 2023.

Category	Number of Species
RSGCN	126
Proposed RSGCN	6
Watchlist [Assessment Priority]	98
Proposed Watchlist [Assessment Priority]	9
Watchlist [Deferral to Adjacent Region]	23
Total	262

Connecticut's SGCN and SAPS that occur in forests include major taxonomic groups except for fish, although fish benefit from healthy forests as they protect riparian areas and other aquatic habitats (Figure 2.12). Information from Connecticut's taxonomic experts highlights the need for targeted conservation efforts to protect critical habitats in Connecticut, particularly for species that depend on early successional habitats, wetlands, vernal pools, and connected upland forests. Key strategies include:

- Regulating farming and mining activities to reduce their impact
- Acquiring lands with populations of species such as the Eastern Spadefoot.
- Protecting wetland-habitat mosaics, particularly in areas with defined river systems and glacial outwash terraces.
- Efforts should also focus on protecting core forest-wetland habitat mosaics and addressing potential declines in species like Fowler's Toads by researching population movements and seasonal habitat use.

- Long-term efforts should aim to expand suitable habitats and protect critical migration corridors for SGCN.

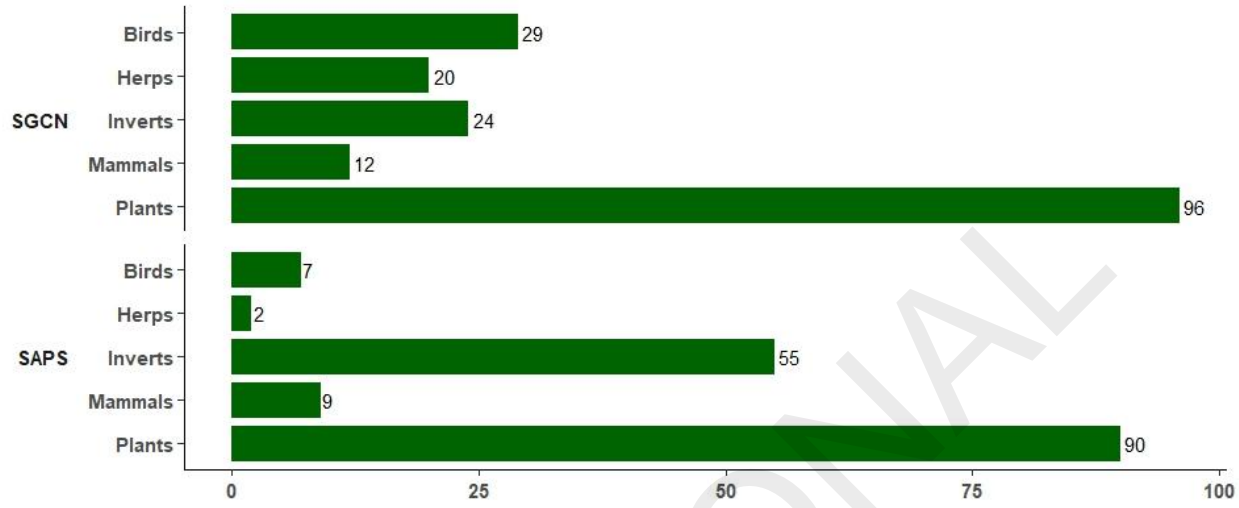

Figure 2.12 - The number of SGCN and SAPS species that can be found in forested habitats.

Forest Habitat Condition

Northeast Region

The Northeast region, historically (pre-colonial), was 91% covered by forests, but nearly one-third, or 38.6 million acres, had been converted to agriculture and development as of 2009. An estimated 25 million acres of historical Forest and Woodland habitat have been converted to agriculture, and 13 million acres have been lost to development. More forest and woodland habitats have been lost, proportionally, in the Mid-Atlantic region than in New England and New York (Anderson and Olivero Sheldon, 2011).

Threats to the multiple habitat types within the Northeast vary depending on location and habitat. However, key issues include development, agriculture, roads and transportation, logging, invasive species, and disease. Excessive deer herbivory represents a serious challenge to forest regeneration and biodiversity (TCI & NEFWDTC, 2023). These threats contribute to the conversion and fragmentation of Forest and Woodland habitats, with a substantial portion undergoing at least temporary transformation into other habitat types between 2001 and 2021 (Anderson et al., 2023).

Over 732,000 miles of permanent roads fragment the Northeast Forest and Woodland habitat. Large forest habitat blocks of at least 250,000 acres in patch size are uncommon, reducing Forest and Woodland connectivity by nearly 60% as of 2011 (Anderson and Olivero Sheldon, 2011). The most fragmented forest type is the oak-pine

forest, while the boreal upland forest is the most connected. Between 2010 and 2019, changes in forest and woodland habitat fragmentation appeared localized, with increasing fragmentation in suburban development areas (Anderson et al., 2023).

Connecticut's Forest Habitat

Table 2.3 - Conditions of sub-habitats of the Upland Forest Key Habitat Group.

Sub-habitat	Condition
Oak Forests	Fair
Calcareous Forests	Poor - Fair
Coniferous Forests	Variable
Old Growth Forests	Poor - Imperiled
Northern Hardwood Forests	Fair - Variable
Mixed Hardwood Forests	Fair
Young Forests	Poor - Variable
Maritime Forests	Fair - Poor

The relative condition of forest habitat in Connecticut is poor to fair, varying widely across the state depending on location, forest type, localized threats, and other factors. Upland forests are the primary habitat throughout Connecticut. This key habitat classification comprises eight sub-habitats that are determined to be most important to wildlife (Table 2.3). Connecticut's forests exhibit a wide range of conditions (Table 2.3), with many facing significant ecological challenges due to natural and human-driven stressors. Nearly 85% of Connecticut's forestland is in the large diameter size class (sawtimber-sized trees > 11" diameter for hardwood and > 9" diameter for softwood) (CT DEEP, 2020). The medium diameter size class (poletimber-sized trees > 5" diameter and < large diameter) comprises 9%, and the small diameter size class (i.e., saplings and seedlings < 5" diameter) is less than 5% (CT DEEP, 2020). Because much of the state's forests are relatively similar in age and lack structural diversity, they are particularly vulnerable to pests, changing weather patterns, and big storms (CT DEEP, 2020).

Calcareous forests in Connecticut are in poor to fair condition, but some notable ones remain; however, invasive species and recreational activities have a significant

impact on them. Maritime forests are similarly under pressure, with intensive recreation degrading their integrity. Old-growth forests are scarce, consisting of small and isolated patches. The state's hardwood forests have been heavily affected by invasive pests and diseases; since 2015, nearly all pole and sawtimber-sized white ash have been eliminated due to the Emerald Ash Borer. American Beech, already weakened by beech bark disease for decades, has suffered extensive impacts from beech leaf disease in the past five years, likely leading to widespread mortality across all age classes. Oak forests have been severely affected by spongy moth outbreaks between 2015 and 2019, leading to widespread mortality and limited oak regeneration in younger age classes. Consequently, foresters predict a continued decline of oak-dominated forests in the coming decades (CT DEEP, 2020).

Though present in some areas, young forests are limited in extent, with small and fragmented patch sizes. Often overlooked are the small tracts of forest that remain within the most heavily developed sections of the state in municipal parks, cemeteries, hospital grounds, schools, and other marginally protected sites. In these areas, the composition of plant species has been altered by replacing native species with invasive and exotic species. As a result, the sub-habitat is not recognizable as any naturally occurring forest type in Connecticut. For more information on threats and forest action, refer to Chapters 3 and 4, as well as the CT Forest Action Plan (2020).

Open Upland

Open Upland Habitat Description, Distribution, and Conservation

Native Habitats

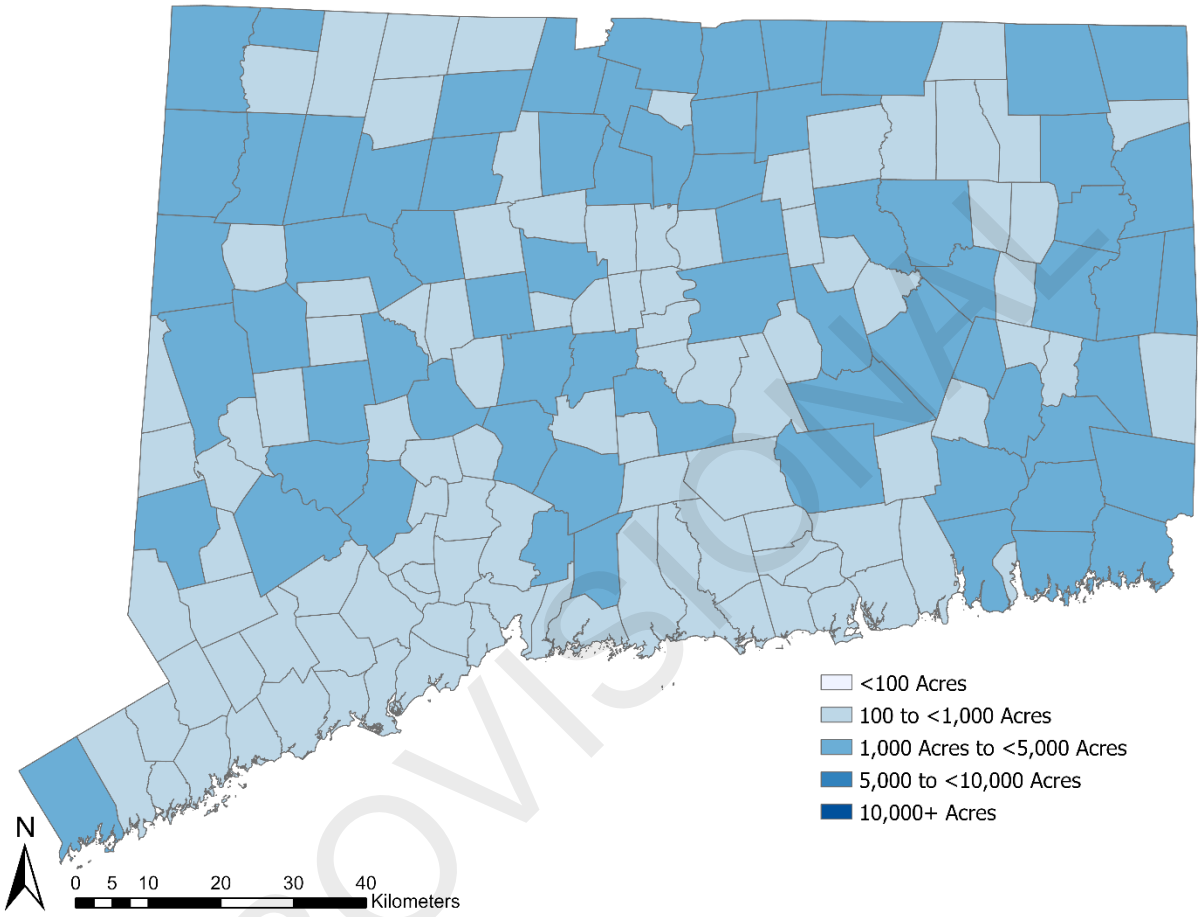

Figure 2.13 - Amount of Open Upland habitat in each Connecticut township. See Appendix 2 for details, as sub-habitats are included in this map.

Connecticut's Open Upland habitats encompass a range of ecosystems, including cliffs and talus slopes, glades, barrens, savannas, grasslands, shrublands, and agricultural lands. These landscapes contribute significantly to the state's biodiversity by supporting distinct ecological communities.

Cliff and Talus habitat is characterized by steep, rocky terrain with little soil development. These habitats provide critical bird nesting sites and support plant communities adapting to harsh conditions. In Connecticut, they are most commonly found in the western marble valleys, particularly in Salisbury, Canaan, Sharon, and Kent. Red Cedar Glades thrive on exposed summits, ledges, and rocky outcrops, where red cedar and little bluestem grass

dominate. Like Cliff and Talus habitat, Red Cedar Glades are most common in the western Marble Valleys, including Salisbury, Canaan, Sharon, and Kent. Quarrying has significantly degraded many of these areas, resulting in the reduction of native vegetation. *Pitch Pine–Scrub Oak Barrens*, another important upland ecosystem, develops on sandy soils or bedrock, where pitch pine and scrub oak form the dominant vegetation. The remaining stands are located in Pachaug State Forest, Lantern Hill, Pine Ledge, White Bluff, Bear Mountain, and on ridges near Candlewood Road (Gluck, 2015).

Grasslands and shrublands typically feature low vegetation cover, with less than 25% of the area covered by trees or shrubs. Sandplain Grasslands and Coastal Shrublands are key sub-habitats, though development and natural succession have significantly reduced their extent. Mowed grasses for urban or suburban parks, airports, golf courses, or athletic fields are considered within Developed Area habitat (see the section below). Shrubland habitats in Connecticut are concentrated in several key areas within the state. Pachaug State Forest contains one of the largest remaining blocks of shrubland/young forest (CT DEEP, 2018). The Scotland-Canterbury region has also been identified as a significant area for young forest habitat management, with conservation efforts targeting shrubland-dependent species like the New England Cottontail (*Sylvilagus transitionalis*) (Fuller & Tur, 2012). Additional focus areas for shrubland restoration include Goshen Uplands, Ledyard-Coast, Lebanon, and the Lower Connecticut River region (Fuller & Tur, 2012).

Agricultural Habitats

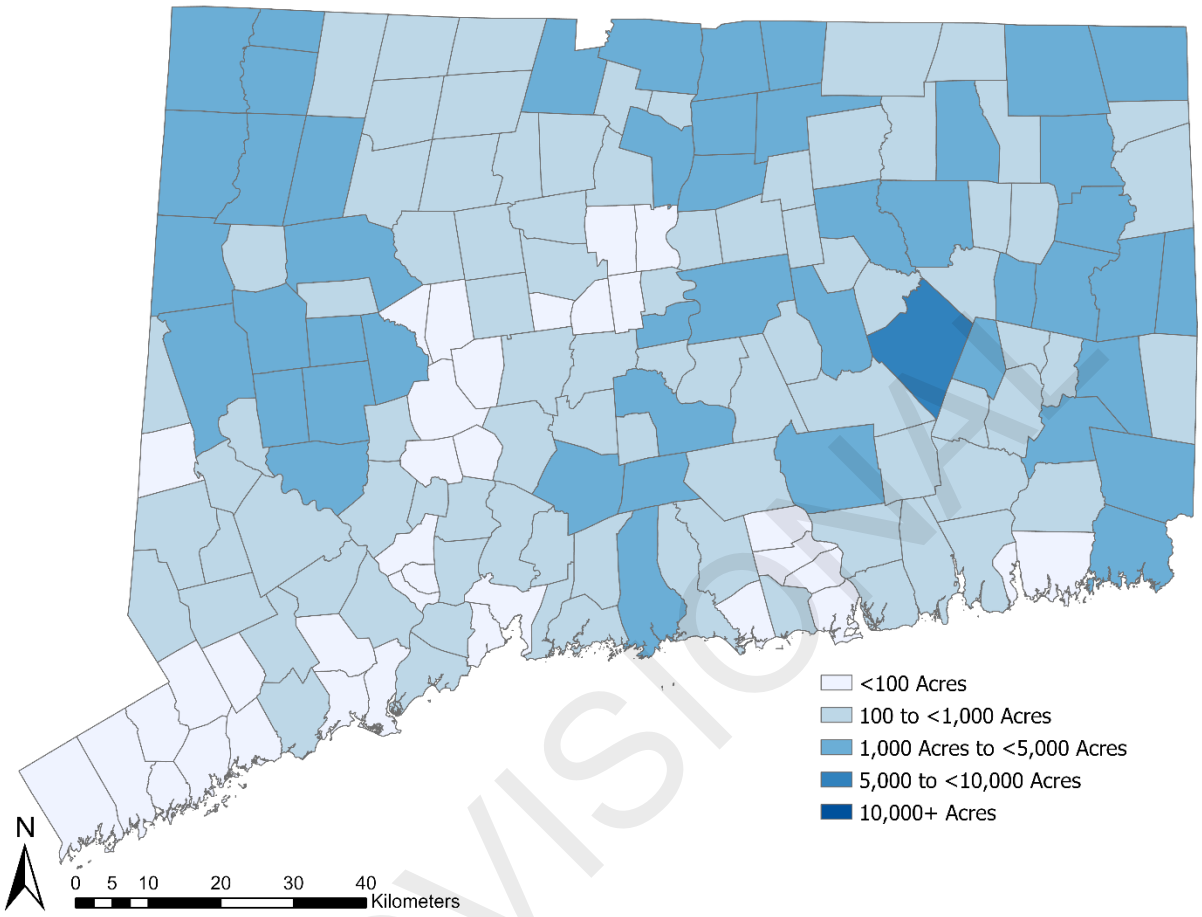

Figure 1.14 - Amount of Agricultural habitat in each Connecticut township. See Appendix 2 for details, as sub-habitats are included in this map.

Croplands and Pasture habitats include non-woody crops and pastures managed for agriculture. Some anthropogenic habitats can mimic natural Grasslands and early-successional habitats, but they provide suboptimal habitats for various wildlife. Other agricultural habitats include plantations, orchards, and vineyards. The Plantations and Orchards habitat type encompasses ruderal forests, plantations, orchards, and vineyards. Less than 5% of the region's forests are composed of ruderal and plantation forests (Anderson et al., 2023).

In 2022, Connecticut's total farmland area was estimated at 380,000 acres, unchanged from the previous year. However, this represents a significant decline from 1982, when Connecticut had 444,200 acres of farmland—a loss of 64,000 acres, or 14.5 percent (CT CEQ, 2024). In 2023, Connecticut preserved 1,559 acres of agricultural land,

representing a 33 percent increase compared to the previous ten-year average of 1,172 acres per year. The state protected 23 farmland properties, with an average of 68 acres per property. The cost per acre was $5,698, reflecting a 13 percent increase from the average cost per acre during the 2020–2022 period (CT CEQ, 2023). Since 1978, the Connecticut Department of Agriculture has preserved farmland by purchasing development rights, with the total protected acreage now reaching approximately 49,600 acres. However, at the current preservation rate of 1,211 acres per year, projections indicate it would take about 66 years to meet the state's farmland preservation goal of 130,000 acres (CT CEQ, 2023).

Species of Greatest Conservation Need in Open Upland Habitat

Native Habitats

Regional

Northeast Cliff and Talus habitats support 44 Regional Species of Greatest Conservation Need (RSGCN), one Proposed RSGCN, and 20 Watchlist [Assessment Priority] species across seven taxonomic groups (Table 2.4). Two additional species are classified as Watchlist [Deferral] species, deferred to adjacent Association of Fish and Wildlife Agencies (AFWA) regions. Of the RSGCN and Proposed RSGCN, 11 species—five salamanders and six terrestrial snails—are both of Very High Concern and have at least 75% regional responsibility in the Northeast (TCI & NEFWDTC, 2023).

Table 2.4 - The number of species in each RSGCN and Watchlist category associated with Cliff and Talus habitat in the Northeast as of 2023.

Category	Number of Species
RSGCN	44
Proposed RSGCN	1
Watchlist [Assessment Priority]	20
Watchlist [Deferral to Adjacent Region]	2
Total	67

Glades, Barrens, and Savanna habitats in the Northeast support the fifth highest number of Regional Species of Greatest Conservation Need (RSGCN) and Watchlist species of any habitat type, totaling 164 species. These include 77 RSGCN, 63 Watchlist [Assessment Priority] species, and six Proposed Watchlist species, spanning nine taxonomic groups (Table 2.5). An additional 18 species associated with this habitat are classified as Watchlist [Deferral] species, deferred to adjacent Association of Fish and Wildlife Agencies (AFWA) regions. Of the RSGCN and Proposed RSGCN, eight species—two salamanders, four moths, and two terrestrial snails—are both endemic to the Northeast and of Very High Concern (TCI & NEFWDTC, 2023).

Table 2.5 - The number of species in each RSGCN and Watchlist category associated with Glades, Barrens, and Savanna habitats in the Northeast as of 2023.

Category	Number of Species
RSGCN	77
Watchlist [Assessment Priority]	63
Proposed Watchlist [Assessment Priority]	6
Watchlist [Deferral to Adjacent Region]	18
Total	164

Northeast Grassland habitat supports 67 RSGCN, two proposed RSGCN, 46 Watchlist [Assessment Priority] species, and five Proposed Watchlist species across eight taxonomic groups (Table 2.6). An additional 15 species associated with this habitat are classified as Watchlist [Deferral] species, deferred to adjacent Association of Fish and Wildlife Agencies regions. Of the Grassland RSGCN and Proposed RSGCN, 36% (21 species) are of Very High Concern, highlighting their significant conservation need. Fifteen RSGCN and Watchlist species associated with Grasslands have at least 75% Regional Responsibility, with nearly half belonging to Lepidoptera. Five RSGCN species—three moths, one turtle, and one firefly—are both of Very High Concern and endemic to the Northeast (TCI & NEFWDTC, 2023).

Table 2.6 - The number of species in each RSGCN and Watchlist category associated with Grassland habitat in the Northeast as of 2023.

Category	Number of Species
RSGCN	67
Proposed RSGCN	2
Watchlist [Assessment Priority]	46
Proposed Watchlist [Assessment Priority]	5
Watchlist [Deferral to Adjacent Region]	15
Total	135

Northeast Shrubland habitat supports 58 Regional Species of Greatest Conservation Need (RSGCN), 47 Watchlist [Assessment Priority] species, and four Proposed Watchlist species across eight taxonomic groups (Table 2.7). An additional nine species associated with this habitat are classified as Watchlist [Deferral] species. Among the species of highest conservation concern in this habitat are the New England Cottontail (*Sylvilagus transitionalis*), Peaks of Otter Salamander (*Plethodon hubrichti*), and Daecke's Pyralid Moth (*Crambus daeckellus*), all of which are endemic RSGCN categorized as Very High Concern (TCI & NEFWDTC, 2023).

Table 2.7 - The number of species in each Regional Species of Greatest Conservation Need (RSGCN) and Watchlist category associated with Shrubland habitat in the Northeast as of 2023.

Category	Number of Species
RSGCN	58
Watchlist [Assessment Priority]	47
Proposed Watchlist [Assessment Priority]	4
Watchlist [Deferral to Adjacent Region]	9
Total	118

The Northeast's Agricultural Croplands and Pastures habitat supports 28 Regional Species of Greatest Conservation Need (RSGCN), one Proposed RSGCN, 35 Watchlist [Assessment Priority] species, and three Proposed Watchlist species across eight taxonomic groups (Table 2.8). Additionally, eight species associated with this habitat are listed as Watchlist [Deferral] species, deferred to adjacent Association of Fish and Wildlife Agencies (AFWA) regions. Among these species, five RSGCN species are classified as Very High Concern, including the Golden-winged Warbler, Blanding's Turtle, Little Brown Bat, Northern Long-eared Bat, and Tri-colored Bat (TCI & NEFWDTC, 2023).

Table 2.8 - The number of species in each RSGCN and Watchlist category associated with Agricultural Croplands and Pastures habitat in the Northeast as of 2023.

Category	Number of Species
RSGCN	28
Proposed RSGCN	1
Watchlist [Assessment Priority]	35
Proposed Watchlist [Assessment Priority]	3
Watchlist [Deferral to Adjacent Region]	8
Total	75

The Northeast's Agricultural Plantations/Orchards habitat supports 17 Regional Species of Greatest Conservation Need (RSGCN), one Proposed RSGCN, 15 Watchlist [Assessment Priority] species, and one Proposed Watchlist species, spanning six taxonomic groups. Additionally, six species associated with this habitat are listed as Watchlist [Deferral] species (Table 2.9; TCI & NEFWDTC, 2023). Among the species linked to Agricultural Croplands and Pastures, 10 RSGCN and Proposed RSGCN are classified as Very High Concern, including the New England Cottontail and the Bog Turtle, both of which are endemic to the region (TCI & NEFWDTC, 2023).

Table 2.9 - The number of species in each RSGCN and Watchlist category associated with Agricultural Plantation and Orchard habitat in the Northeast as of 2023.

Category	Number of Species

RSGCN	17
Proposed RSGCN	1
Watchlist [Assessment Priority]	15
Proposed Watchlist [Assessment Priority]	1
Watchlist [Deferral to Adjacent Region]	6
Total	40

Connecticut

Connecticut's Open Upland habitats encompass a diverse range of habitat types, including cliffs, grasslands, glades, barrens, and shrublands. Since most species found in Agricultural settings are also found in other Open Upland habitats, they are considered here instead of being separated, as in the overview of RSGCN above. However, like with forests, plant SGCN are by far the most represented group, but all groups (except fish, for obvious reasons) are represented (Figure 2.15). During the Wildlife Action Plan revision process, Taxa Teams identified a series of issues that affect Connecticut's SGCN and SAPS found in Open Upland, and identified actions that will benefit these habitats. Because of the variety of sub-habitats found in Open Uplands, Taxa Teams identified many issues and actions, which include:

- Protect early successional and breeding habitats, including shrublands, grasslands, glades, cliffs, talus slopes, and agricultural lands.
- Manage and restore large patches of contiguous habitat, particularly those near other open upland areas, to enhance connectivity for species dependent on these landscapes."
- Map core open ledge habitat areas statewide and monitor and manage these habitats to ensure that critical early successional vegetative stages remain.
- Protect ridgetop habitats and manage early successional habitats and grasslands to support species dependent on open landscapes.
- Protect and maintain high-quality shrubland patches and prevent habitat loss from reforestation and development.
- Ensure long-term conservation of warm-season and cool-season grasslands, including through 'pay-for-hay' programs that support bird breeding success.
- Conserve sand barrens, cedar glades, traprock ridges, and other specialized open habitats threatened by succession and invasive species.
- Limit development in sensitive open upland areas and work with landowners to encourage habitat-friendly management practices.

- Identify areas where grassland and shrubland habitats can be expanded or restored.
- Improve land management practices for agricultural lands to reduce pesticide use and promote native plant diversity to support pollinators and ground-nesting birds.
- Protect limestone and sandstone cliffs and quarries, which provide critical habitat for species dependent on these unique landscapes.
- Monitor species dependent on these habitats to assess population trends and habitat needs.
- Ensure connectivity among shrubland and grassland patches within larger landscapes to provide sufficient habitat for species requiring large, open areas.
- Management should include invasive plant inventory and adaptive management, especially since invasive plants can thrive in disturbed or disrupted areas.

For more information about the issues affecting Connecticut's SGCN and SAPS, see Chapter 3 and for more information about actions that may help, see Chapter 4.

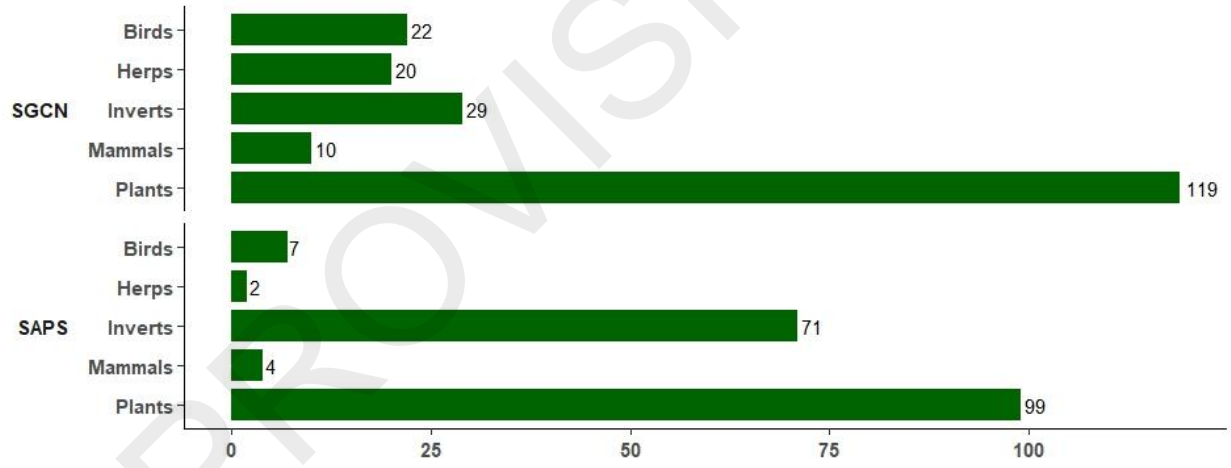

Figure 2.15 - Connecticut SGCN and SAP species requiring Open Upland habitat in Connecticut 2025

Open Upland Habitat Condition

Regional

Native Habitat

Northeast Cliff and Talus habitats, along with High-Elevation Forests and Alpine Habitat Groups, face minimal projected habitat loss, with most habitats expected to

decline by less than 1% due to development over the next 50 years (Anderson et al., 2013). However, these habitats remain vulnerable to localized threats, including recreational use, which contributes to soil erosion and vegetation loss, and shoreline stabilization efforts, which alter natural cliff dynamics along coastal areas (Anderson et al., 2023). In some cases, geological events such as landslides can damage existing cliff formations, though they also have the potential to create or expand Cliff and Talus habitat, reinforcing the natural dynamism of these landscapes (Anderson et al., 2023)

Glades, Barrens, and Savanna habitats face varying degrees of risk. Future projections suggest the Southern Ridge and Valley Calcareous Glade and Woodland (1.3%), Great Lakes Alvar (1.9%), and Southern and Central Appalachian Mafic Glade and Barrens (2.5%) will experience the lowest loss rates (Anderson et al., 2013). The Eastern Serpentine Woodland is predicted to face the highest loss at 17.0% (Anderson et al., 2013). In addition to development, habitat succession without natural disturbances, such as fire, further threatens these landscapes (Hielfierty et al., 2023). These habitats also rank among the poorest landscape context indices, particularly Eastern Serpentine Woodlands, where fragmentation from human land conversion isolates habitat patches and reduces connectivity (Anderson et al., 2013).

Grasslands across the United States face threats from invasive species, vegetation succession, wildfire suppression, agriculture, and development, all contributing to habitat loss and degradation (Glaser, 2012). In the Northeast, habitat assessments from the early 2000s projected ongoing grassland loss over the next 50 years, with development posing the most significant risk (Anderson et al., 2013). Grassland habitat patches are highly fragmented and poorly connected to surrounding natural landscapes, further limiting their ecological resilience (Anderson et al., 2013). The North Atlantic Coastal Plain Heathland and Grassland habitats face the greatest threat, with an estimated 22% loss expected over the next five decades due to development (Anderson et al., 2013). Additionally, assessments of landscape complexity—a key measure of climate resilience—found that Maritime Grassland communities exhibit low complexity and resilience, making them particularly vulnerable to environmental change (Anderson et al., 2013).

Connecticut

Table 2.10 - Conditions of sub-habitats of the Open Upland Habitat Group.

Sub-Habitat	Condition
Pitch Pine - Scrub Oak Woodlands	Poor
Red Cedar Glades	Poor

Maritime Shrublands	Poor
Grassy Glades and Balds	Good-poor
Sand Barrens and Sparsely Vegetated Sand and Gravel	Poor
Traprock Ridges	Good-poor
Reverting Fields and Early Successional Shrublands	Fair
Warm Season Grasslands	Good-poor
Cool Season Grasslands	Good-poor
Cliffs and Talus Slopes	Variable
Agricultural Lands	Unknown

The overall condition of the Cliff and Talus habitat varies (Table 2.10); while some areas remain intact, quarrying and other land-use changes have disturbed others, much like Red Cedar Glades, resulting in a poor score (Table 2.10). The lack of comprehensive mapping makes it difficult to determine their total extent in the state.

Connecticut's Pitch Pine–Scrub Oak Barrens have declined by approximately 95%, making them one of the most endangered upland ecosystems (Gluck, 2015), and they are rated as poor (Table 2.10). These fire-adapted habitats once thrived in sand plains, ridge tops, and glacial outwash deposits. However, fire suppression, invasive species, and habitat fragmentation have severely reduced their extent (Gluck, 2015; CT DEEP, 2018). Without frequent fire, hardwood species and white pine outcompete pitch pine, preventing regeneration and reducing habitat quality for rare species like the Buck Moth (*Hemileuca maia maia*) and Gerhard's Underwing (*Catocala herodias*) (Gluck, 2015). The CT DEEP Forestry Division is working to restore these barrens through controlled burns, mechanical thinning, and selective harvesting, particularly in Pachaug State Forest, where a long-term management plan prioritizes habitat restoration (CT DEEP, 2018). While these efforts help maintain scrub oak and early successional growth, modern fire suppression policies and ongoing development continue to threaten the remaining barrens in the State (CT DEEP, 2018).

Shrublands in Connecticut have declined due to reduced natural disturbances, land-use changes, and lower rates of forest regeneration, resulting in these habitats being underrepresented across the state (CT DEEP, 2018). Shrubland (sometimes referred to as

"Young Forest") now covers just 5% of Connecticut's forestland, threatening species such as the New England Cottontail, which relies on dense, early-successional habitats (CT DEEP, 2018). For both the region (TCI & NEFWDTC, 2023) and Connecticut, assessing the condition of Agricultural habitats is challenging due to the intensive management of these habitats for purposes other than habitat and species conservation.

Palustrine (Wetlands)

Wetland Habitat Description, Distribution, and Conservation

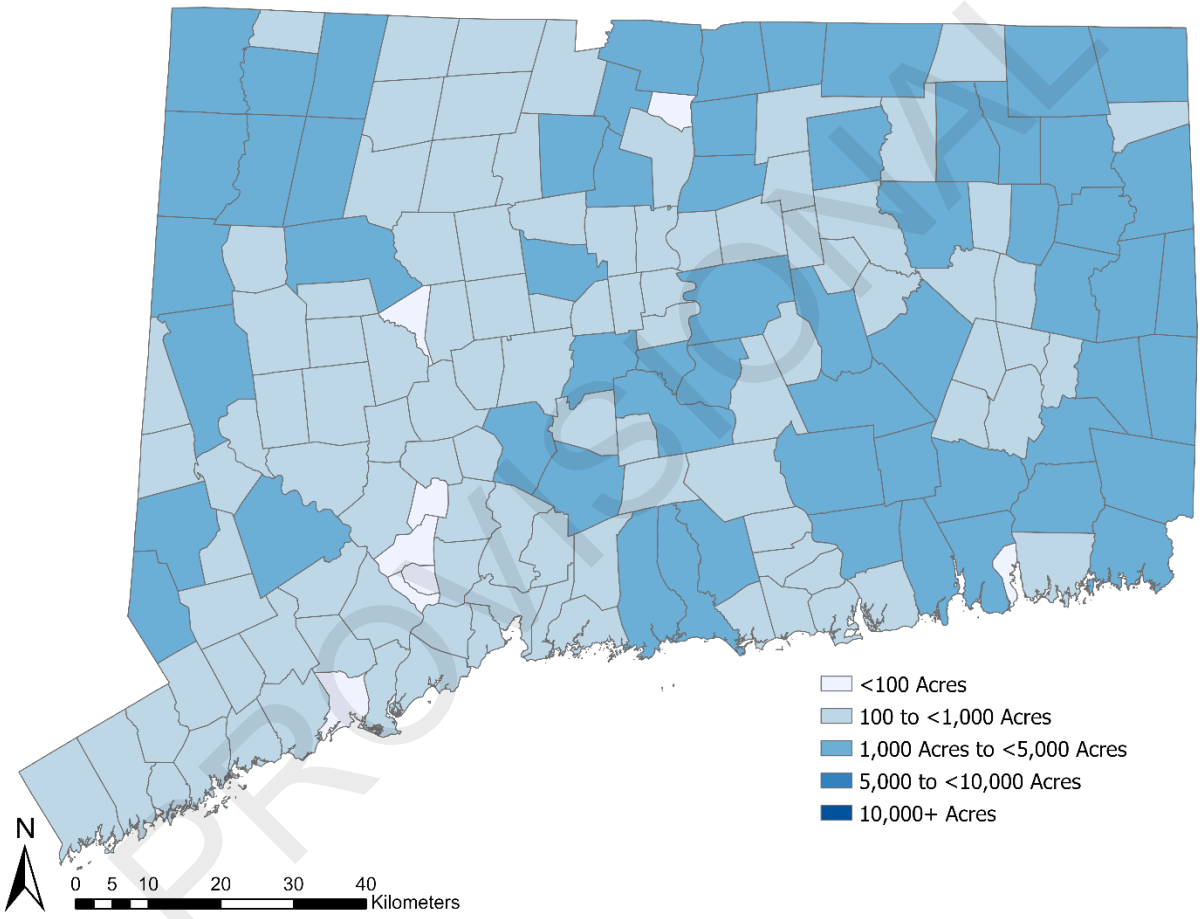

Figure 2.16 - Distribution of ALL wetland types in Connecticut, including all Non-tidal and Tidal Wetlands and Flats.

The Northeast contains nearly 700,000 wetland complexes, comprising Non-Tidal Wetlands, Tidal Wetlands, and Flats, which are distributed across the region (Ferree and Anderson, 2008). The average size of these wetland complexes varies by geographic area, ranging from 6.7 to 27.8 acres (Ferree and Anderson, 2008). As of 2019, the region had 11.6 million acres of wetlands, comprising Non-Tidal Wetlands, Tidal Wetlands and Flats, and

Riparian and Floodplain wetlands (Anderson et al., 2023). Non-tidal wetlands account for more than 8.3 million acres, making them the most extensive wetland type in the Northeast. Connecticut's non-tidal wetlands, which include swamps, marshes, peatlands, shrub swamps, wet meadows, and fens, are not influenced by tidal flooding or flowing rivers. Comprising 239,641 total acres, Connecticut's non-tidal wetlands are categorized into 10,278 acres of emergent basin wetlands and 229,363 acres of woody basin wetlands (Anderson et al., 2023). Permanently saturated soils support the thriving growth of emergent herbaceous wetlands, which feature perennials such as cattails, bulrushes, and sedges. Trees and shrubs that tolerate periodic inundation dominate wooded wetlands, providing habitat for many of Connecticut's SGCN.

Vernal pools are landscape depressions that periodically fill with water and lack a permanent above-ground outlet. These basins fill with the rising water table or with meltwater and runoff of snow and rain. Vernal pools hold water for a few months in the spring and early summer and are usually dry by late summer. Because of the ephemeral nature of vernal pools, they generally do not support fish. In the absence of fish, many wildlife species, especially amphibian SGCN, can thrive in these habitats, using them as breeding and feeding sites. Vernal pools can be found scattered across Connecticut in a variety of habitats in low areas of a forest, in the floodplain of a river or stream, within a vegetated wetland, in an open field, between coastal dunes, in abandoned quarries or natural rock formations, and other areas where water pools. A good example of a vernal pool can be found on the Beaver Marsh Trail at Sessions Woods Wildlife Area. Vernal pools have been the subject of a lot of attention lately, with efforts to map and monitor them throughout the state (CAWS, 2020).

Forested inland wetlands have hydric soils and a canopy cover of 60 to 100 percent, formed by a mix of evergreen and deciduous trees. Forested swamps in topographical basins contain decomposed peat and muck deposits, characterized by slow-moving or stagnant water. Floodplain forests, shaped by annual flooding along major rivers, create dynamic ecosystems. Connecticut has approximately 100,000 acres of forested wetlands, primarily consisting of red maple forests. Notable forested wetlands include Chester Cedar Swamp (Atlantic White Cedar Swamp), Holleran Swamp (Red Spruce Swamp), and Wangunk Meadows Wildlife Management Area (Floodplain Forest).

Shrubland wetlands throughout Connecticut have hydric soils and over 25 percent shrub cover, with shrubs typically taller than 1.5 feet. Trees may be present, but they contribute less than 25 percent to the canopy. The distribution and condition of these wetlands remain largely unknown, with no identified priority areas for conservation. Two sub-habitats, Bogs and Fens and Shrub Swamps, support key wildlife species. Shrub

Swamps vary in composition, including red maple sapling swamps, willow and alder thickets, and highbush blueberry and swamp azalea swamps. Bogs and Fens develop in topographic basins influenced by groundwater. Examples include Mohawk Mountain Black Spruce Bog in Cornwall and Pachaug State Forest in Voluntown.

Herbaceous inland wetlands are characterized by herbaceous plants, including grasses, sedges, forbs, and ferns, with less than 25 percent woody plant cover. Their distribution remains unclear, but all state-owned marshes are priority areas. This habitat type comprises three sub-habitats, notably freshwater marshes influenced by tidal activity. Examples include Beeslick Pond in Salisbury (Calcareous Spring Fen) and Charter Marsh in Tolland (Freshwater Marsh).

Tidal Wetlands can be freshwater, brackish, and salt subtypes. Tidal Flats are unvegetated substrates exposed at low tide and can consist of mud or sand (Greene et al., 2010). Tidal wetlands are located in the intertidal region and are regularly inundated by saltwater, with occasional exposure to freshwater. They are important foraging grounds for many shorebirds, crustaceans, fish, and invertebrate species (TCI & NEFWDTC, 2023).

Connecticut contains 14,836 acres of Tidal Wetlands and Flats, which comprise a portion of the state's total 294,016 acres of wetlands (Anderson et al., 2023). Connecticut's tidal wetlands and flats support a diverse array of plant and animal life and are crucial to the region's ecosystem. For instance, due to its international importance, the Connecticut River Estuary and Tidal Wetlands Complex is designated a Ramsar Wetland (Ramsar, 2023). Many bird species, including SGCN, rely on these wetlands for feeding and nesting. Marine fish species use these areas as nurseries, while mammals like the North American Least Shrew find shelter in the marshes. The largest salt marsh complexes develop within protected coves, bays, and salt ponds; however, about ten percent are fringe marshes, which are less than five yards wide. These are mostly found along the upper portions of tidal rivers. Salt marshes are among North America's most important wildlife habitats, and Connecticut's contribution to the regional distribution and conservation of this habitat type is significant. Examples include the Great Meadow Salt Marsh in Stratford, Charles E. Wheeler Wildlife Management Area in Milford, and the Barn Island Wildlife Management Area, which is the largest and most diverse coastal wildlife management area.

Brackish marshes, where fresh and saltwater mix, support a diverse array of plant communities. Some examples in Connecticut include the Oyster River and lower Connecticut River marshes (Old Saybrook), the lower Quinnipiac River & Mill River marshes (New Haven), and Great Meadow Marsh/Long Beach (Stratford). Brackish marshes are

highly vulnerable to climate change, particularly sea-level rise. Models predict a loss of 50 to 97 percent of high marsh by 2100 (Boyd and Rubinoff, 2014). Wetlands across the state also face threats from urban development and habitat alteration.

Over half of Connecticut's tidal wetlands remain unprotected, with 63% classified as unconserved and vulnerable to threats such as development and sea-level rise; only a very small percentage have the highest level of protection (GAP Level 1; Anderson et al., 2023). Wetland management is overseen primarily at the municipal level through local inland wetland and watercourse committees. CT DEEP oversees the preservation and management of inland wetlands, implementing regulations to prevent unregulated activities such as dredging, dumping, and filling, which have historically contributed to wetland loss and degradation. The Great Meadows Marsh in Stratford, Connecticut, spanning 700 acres, has undergone significant restoration due to historical degradation from development and invasive species. In 2021-2022, restoration efforts included controlled burning, topsoil removal, the creation of tidal creeks, and the planting of 165,000 native marsh plants. Positive early signs include the return of Saltmarsh Sparrows and a reduction in mosquito populations (Perez-Viscasillas, 2023).

Species of Greatest Conservation Need in Wetland Habitat

Non-tidal Wetlands

Non-tidal wetlands in the Northeast host the third-highest number of RSGCN and Watchlist species (262) of all habitat types and include 120 RSGCN, 10 Proposed RSGCN, 92 Watchlist [Assessment Priority] species, and 13 Proposed Watchlist species across 17 taxonomic groups (Table 2.11). Non-tidal wetlands support the most taxonomically diverse set of regional priority species among the 24 habitat types, representing 17 of 20 assessed taxonomic groups. Seven RSGCN and Proposed RSGCN endemic to the Northeast—three moths, a caddisfly, a dragonfly, a rabbit, and a turtle—are classified as Very High Concern (TCI & NEFWDTC, 2023).

Table 2.11 - The number of species in each RSGCN and Watchlist category associated with Non-Tidal Wetlands habitat in the Northeast as of 2023.

Category	Number of Species
RSGCN	120
Proposed RSGCN	10
Watchlist [Assessment Priority]	92
Proposed Watchlist [Assessment Priority]	12
Watchlist [Interdependent Species]	1
Watchlist [Deferral to Adjacent Region]	27
Total	262

Since more SGCN and SAPS can be found in Connecticut's wetlands than in any other habitat, it is unsurprising that so many of them can be found in our Non-tidal Wetlands (Figure 2.17), making conservation efforts especially important in this habitat. Many species from all groups of SGCN are represented in this habitat. During the Wildlife Action Plan revision process, Taxa Teams identified a series of issues that affect Connecticut's SGCN and SAPS found in Non-tidal Wetlands. They identified actions that will benefit these habitats, which include:

- Protect and manage early successional wetland habitat mosaics, especially those located along riverine systems that feature well-defined sand and gravel or glacial outwash terraces.
- Protect large, intact core forest-wetland habitat mosaics to maintain biodiversity and resilience against habitat fragmentation.
- Maintain and expand the state's habitat base by acquiring and conserving wetland areas.

For more information about the issues affecting Connecticut's SGCN and SAPS, see Chapter 3, and for more information about actions that may help, see Chapter 4.

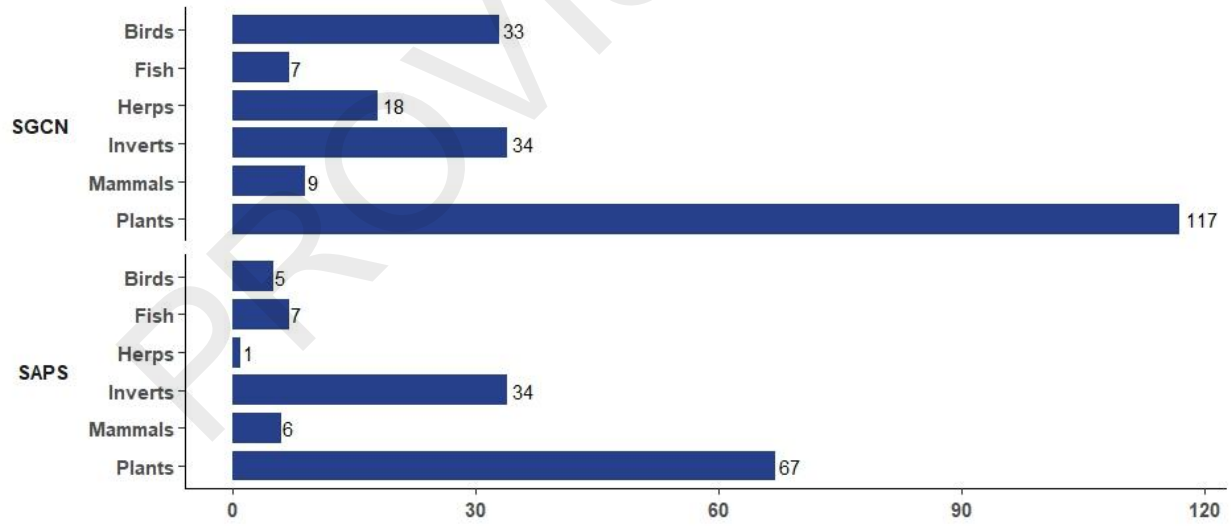

Figure 2.17 - The number of SGCN and SAPS species that can be found in Non-Tidal Wetland habitats.

Tidal Wetlands

There are 38 RSGCN, 35 Watchlist [Assessment Priority], and one Proposed Watchlist species across 13 taxonomic groups associated with Northeast Tidal Wetlands and Flats habitat (Table 2.12). Another 11 species associated with this habitat are Watchlist [Deferral] species that have been deferred to adjacent AFWA regions. Seven RSGCN associated with Tidal Wetlands and Flats are of Very High Concern – one diadromous fish, four birds, and two mammals. The Tuckahoe Masked Shrew (*Sorex cinereus nigriculus*) is endemic to the Northeast and of Very High Concern (TCI & NEFWDTC, 2023).

Table 2.12 - The number of species in each RSGCN and Watchlist category associated with Tidal Wetlands and Flats habitat in the Northeast as of 2023.

Category	Number of Species
RSGCN	38
Watchlist [Assessment Priority]	35
Proposed Watchlist [Assessment Priority]	1
Watchlist [Deferral to Adjacent Region]	11
Total	85

Connecticut's tidal wetland habitat is the area where the Riverine and Estuary habitats come together, allowing salt and freshwater to mix. It links the Riverine habitat that drains the innermost parts of the state to the depths of Long Island Sound, and the overall health of all these habitats relies heavily on each other. Since the Palustrine habitat has the most SGCN and SAPS in the state, species of all groups can be found in Tidal wetlands. However, it is especially species-rich in Plants, Birds, and Fish (Figure 2.18). Many issues that affect these species also impact others throughout this interconnected system. During the Wildlife Action Plan revision process, Taxa Teams identified a series of issues that affect Connecticut's SGCN and SAPS found in tidal habitats. They identified actions that will benefit these habitats, which include:

- A reevaluation of Shortnose Sturgeon conservation, protection, and enhancement policies in the Connecticut River basin, particularly about upstream and downstream passage at Holyoke Dam. This is in light of the recently documented, and repeated, successful spawning events of Shortnose Sturgeon in the lower Connecticut River below the Holyoke dam (CT DEEP, 2023).
- Maintain quality coastal wetlands and reduce disturbance by limiting development and recreational pressures.

- Maintain healthy coastal ecosystems and reduce disturbance to preserve ecosystem services.
- Protect habitat, limit human disturbance and predation, and pass laws about protecting the intertidal zone from human disturbance on beaches and islands where birds nest.
- Further develop nearshore monitoring efforts to track population changes and habitat conditions.

For more information about the issues affecting Connecticut's SGCN and SAPS, see Chapter 3 and for more information about actions that may help, see Chapter 4.

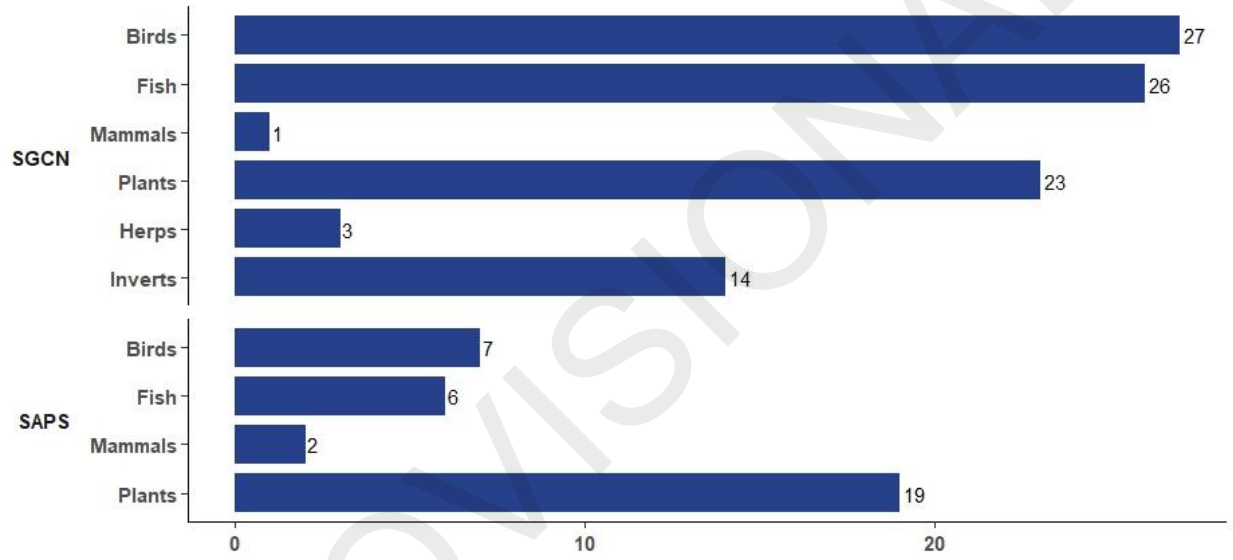

Figure 2.18 - The number of SGCN and SAPS species that can be found in Tidal Wetland habitats.

Wetland Habitat Condition

Non-tidal Wetlands

Regional

Multiple threats impact the habitat types within the Northeast's Non-tidal Wetlands, including development, agriculture, pollution, and climate change. The USFWS National Wetlands Inventory Program periodically evaluates the status and condition of these wetlands, documenting losses and trends over time (e.g., Dahl, 1990; Stedman and Dahl, 2008; Dahl and Stedman, 2013). By the early 2000s, at least 2.8 million acres—one-quarter of the historical extent—had been lost to development or agricultural land, and two-thirds of the region's wetlands had been converted to developed or agricultural land within 100 meters (Anderson and Olivero-Sheldon, 2011).

Over the past two decades, the non-tidal wetlands in the northeast region have remained stable, with 99.7% of these areas remaining unchanged (Anderson et al., 2023). However, emergent basin wetlands have experienced the greatest decline, with a 3% reduction, while woody basin wetlands have seen a modest decrease of 0.2% (Anderson et al., 2023). Human activities, particularly road development, have impacted the overall stability of wetland connectivity. Approximately 28% of the region's non-tidal wetlands fall into the "Severe Impact" category due to their proximity to roads, while another 42% are considered "Impacted" by moderate-density road networks. Only 18% of these wetlands remain unaffected by roads (Anderson et al., 2023).

Basin wetlands are among the Northeast's least disturbed wetland types, with 43% classified as undisturbed (Anderson et al., 2023). Conservation efforts have also played a significant role in maintaining wetland connectivity, with many non-tidal wetlands scoring above the regional average in local connectedness. Regionally, 42% of northern peatland wetlands and 32% of emergent marsh wetlands are protected (Anderson et al., 2023).

Connecticut

Connecticut's wetland habitats vary in conservation status, with significant portions remaining unprotected. Northern Swamps cover 132,618 acres, yet 76% lack protection, with only 1% designated as GAP 1 and 6% as GAP 2, indicating a limited area set aside for strict conservation (Anderson et al., 2023). Wet Meadows and Shrub Marshes span 17,241 acres, with a similar protection gap—74% remain unprotected, and just 1% fall under GAP 1 (Anderson et al., 2023). Basin wetlands, including swamps, marshes, peatlands, and fens, provide habitat for species, but are increasingly fragmented by roads and urban expansion. Atlantic White Cedar swamps conditions range from poor to good (Table 2.13), with a notable example of a well-preserved area being Upper Bolton Lake. However, reproduction in these swamps is limited. Invasive species, particularly Japanese Barberry, have significantly impacted floodplain forests. Red and black spruce swamps are generally in fair to good condition (Table 2.13), though they are limited in extent, with red spruce having a very restricted range in Connecticut. Floodplain forests face threats from land-use changes, underscoring the need for connectivity-focused conservation efforts (Anderson et al., 2023). Calcareous fens and seeps, which support rare plant species, are also present but lack detailed protection assessments (Anderson et al., 2023) and are threatened by invasive species such as phragmites, reed canary grass, and various invasive shrubs. Freshwater marshes, including well-preserved examples such as Dog Pond and Uncas Pond, are often dominated by Phragmites. Similarly, shrub swamps have been affected by invasions of buckthorn, both glossy and European varieties. For more information about threats related to non-tidal wetlands, see Chapter 3.

Table 2.13 - Conditions of sub-habitats of the Non-Tidal Wetlands Habitat Group.

Sub-habitat	Condition
Atlantic White Cedar Swamps	Good - Poor
Red Maple Swamps	Variable
Floodplain Forests	Good - Poor
Northern White Cedar Swamps	Poor - Unknown
Red/Black Spruce Swamps	Good - Fair
Coastal Plain Ponds	Fair - Poor
Calcareous Spring Fens	Good - Poor
Freshwater Marshes	Fair - Poor
Wet Meadows	Good - Poor
Bogs and Fens	Fair
Shrub Swamps	Fair
Surface Springs and Seeps	Variable
Vernal Pools	Variable - Unknown

Tidal Wetlands

Regional

Nationally, 48% of the marine and estuarine shoreline consists of brackish and tidal marsh (Gittman et al., 2015). Regionally, tidal wetlands and flats of the Northeast are orders of magnitude smaller than those along the Mid-Atlantic, South Atlantic, and Gulf of Mexico coastlines (Greene et al., 2010; Roman et al., 2000). Tidal Wetlands and flats are limited by the lack of a broad, relatively coastal plain in New England, which tends to create narrow, fringing marshes. Intertidal Flats are a common and extensive estuarine habitat type across the Northeast. The proportion of estuarine habitats that are intertidal tidal flats ranges from 75% in the vicinity of Mount Desert Island in Maine to 10% in Delaware Bay, with a general decrease in extent from north to south across the Northeast region (Roman et al., 2000). In southern New England, tidal wetlands have been reduced by approximately 50% since 1900 due to activities such as filling, dredging, and ditching (Rozsa, 1995). The updated habitat condition assessment from Anderson et al. (2023) identified over 11.6

million acres of all wetland types (non-tidal wetlands, tidal wetlands and flats, and riparian and floodplain wetlands) as of 2019. More than one million acres of these wetlands are tidal wetlands and flats. Tidal wetlands and flats are more protected in the Northeast region than non-tidal wetlands (Anderson et al., 2023).

Connecticut

Since European settlement, over 50 percent of Connecticut's estuarine marshes have been lost to coastal development, including docks, marinas, and industrial sites (Cowardin et al., 1979). Connecticut's tidal wetlands face significant ecological pressures, with 58% classified as severely disturbed, 24% as moderately disturbed, and only 18% as having low disturbance (Anderson et al., 2023), which is why they are in poor condition (Table 2.14). Roads significantly contribute to these threats, affecting 32% of tidal wetlands, while 35% experience moderate road impacts and 24% suffer severe road-related disturbances, often resulting in reduced native species richness (Anderson et al., 2023). The surrounding areas also show signs of degradation, with only 15% remaining undisturbed, while most Tidal Wetlands in Connecticut face moderate to severe disturbances (Anderson et al., 2023).

The quality of salt and brackish marshes is declining due to various factors, with shifting environmental conditions playing a significant role in this decline. These ecosystems are increasingly threatened by rising sea levels, which can lead to habitat loss and changes in salinity levels. Additionally, because Connecticut's coast is highly developed, there is limited opportunity for marsh migration. Another major threat is the invasion of non-native species, such as phragmites, which outcompete native vegetation and alter the marsh's balance. For more on threats to Connecticut's Tidal Wetlands and Flats, see Chapters 3 and 4.

Table 2.14 - Conditions of sub-habitats of the Tidal Wetlands Habitat Group.

Sub-habitat	Condition
Salt and Brackish Marsh	Poor
Intertidal Beaches, Flats, and Rocky Shores	Fair
Navigational Channels, Breakwaters, Jetties, and Piers	Poor / Unknown

Riverine (Rivers and Streams)

River and Stream Habitat Description, Distribution, and Conservation

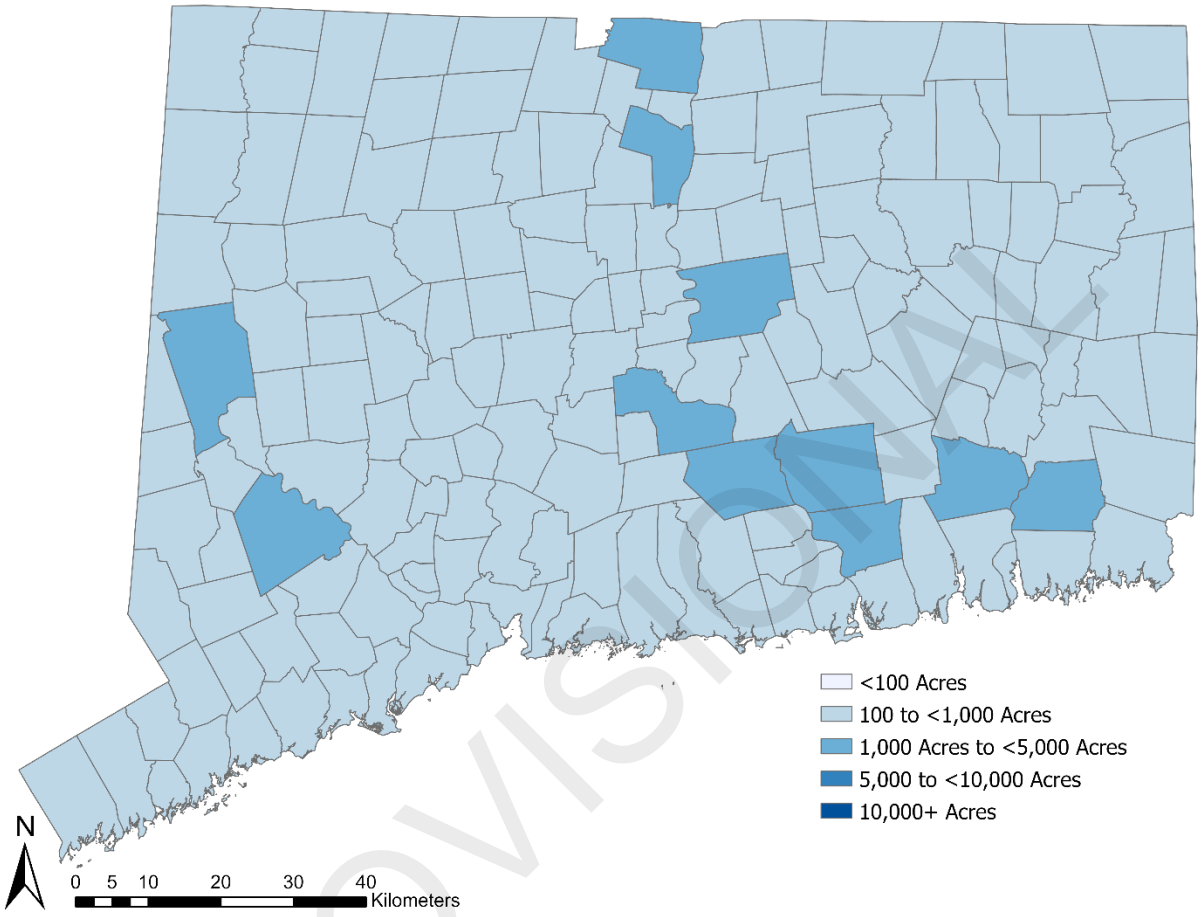

Figure 2.19 - Amount of Riverine habitat in each Connecticut township.

Connecticut is home to 5828 miles of rivers and streams (CT DEEP, 2022), which flow through diverse landscapes, including urban centers, agricultural areas, and forested regions. Major rivers like the Connecticut River, the longest in New England, traverse the state from north to south, while smaller rivers and tributaries spread throughout 81 regional basins. High-gradient, non-tidal streams are prevalent in upland areas, providing critical habitat for fish and macroinvertebrates. Lower-gradient rivers in the state's central and southern regions offer important aquatic habitats and recreational opportunities (CT DEEP, 2022). Connecticut also has five federally designated Wild and Scenic River Systems - the Eightmile River, the lower Farmington River and Salmon Brook, the West Branch Farmington River, The Housatonic River, and the Wood and Pawcatuck River systems (Anderson et al., 2023).

CT DEEP evaluated 3,446 miles of rivers and streams for aquatic life support, finding that 1,967 miles (57%) fully supported designated uses. In comparison, 579 miles (17%) failed to meet aquatic life standards due to nutrient enrichment and pathogen contamination (CT DEEP, 2022). Recreational use assessments revealed that 549 miles (16%) supported activities such as swimming and boating, whereas 844 miles (24%) did not, primarily due to elevated bacteria levels. The state also issued fish consumption advisories for 3,335 miles of rivers, citing mercury, polychlorinated biphenyl, and per- and polyfluoroalkyl substances (PFAS) contamination as the main concerns affecting public health and water quality (CT DEEP, 2022).

Connecticut's rivers are divided into regional basins for comprehensive assessment and management. Significant basins include the Connecticut River Main Stem (Region 40), the state's longest river, monitored for nutrient and pathogen loads; the Farmington River (Region 43), where flow alterations and aquatic habitat preservation are key concerns; and the Housatonic River (Region 60) and Quinnipiac River (Region 52). Connecticut's major river systems are outlined in the introductory section of this chapter above. Connecticut has also mapped significant cold-water stream habitats and made the map and associated data available online.

Restoration and management efforts focus on reducing pollution sources, improving water infrastructure, and identifying problematic road crossings and culverts, with plans to replace them to enhance connectivity, subject to available funding. The Connecticut Clean Water Fund provides vital financial support, with an estimated need of $5 billion over the next 20 years to address wastewater challenges (DEEP, 2022). Total Maximum Daily Loads are established for impaired waters to set pollutant limits, while the Second Generation Nitrogen Strategy targets nitrogen reduction in wastewater treatment, stormwater management, and embayments to alleviate hypoxia in Long Island Sound (DEEP, 2022). Citizen involvement plays a crucial role in water quality monitoring through programs like the River Bioassessment by Volunteers, which engages local communities in stream health evaluations using macroinvertebrate sampling. The Healthy Watershed Initiative preserves high-quality streams by promoting public education and encouraging Low-Impact Development practices to mitigate runoff and protect aquatic habitats (DEEP, 2022).

Species of Greatest Conservation Need in River and Stream Habitats

Regional

There are 25 RSGCN, one Proposed RSGCN, 13 Watchlist [Assessment Priority], and two Proposed Watchlist species across ten taxonomic groups associated with the Big Rivers habitat. Two additional species associated with this habitat are Watchlist [Deferral]

species that have been deferred to adjacent AFWA regions. Three freshwater mussels, one freshwater fish, and one diadromous fish, RSGCN or Proposed RSGCN, are of Very High Concern and at least 75% regional responsibility in the Northeast (Table 2.15; TCI & NEFWDTC, 2023).

Table 2.15 - The number of species in each RSGCN and Watchlist category associated with Big Rivers habitat in the Northeast as of 2023.

Category	Number of Species
RSGCN	25
Proposed RSGCN	1
Watchlist [Assessment Priority]	13
Proposed Watchlist [Assessment Priority]	2
Watchlist [Deferral to Adjacent Region]	2
Total	43

Riparian and Floodplain habitats in the Northeast have the second highest number of RSGCN and Watchlist species (301) of any habitat type. There are 132 RSGCN, 22 Proposed RSGCN, 99 Watchlist [Assessment Priority], and 16 Proposed Watchlist species across 15 taxonomic groups associated with Northeast Riparian and Floodplain habitat (Table 2.16). Another 32 species associated with this habitat are Watchlist [Deferral] species that have been deferred to adjacent AFWA regions. Sixteen of the RSGCN and Proposed RSGCN associated with Riparian and Floodplain habitat are of Very High Concern and at least 75% regional responsibility – six stoneflies, three terrestrial snails, two freshwater mussels, one moth, one dragonfly, one turtle, one firefly, and one caddisfly (TCI & NEFWDTC, 2023).

Table 2.16 - The number of species in each RSGCN and Watchlist category associated with Riparian and Floodplains habitat in the Northeast as of 2023.

Category	Number of Species
RSGCN	132
Proposed RSGCN	22
Watchlist [Assessment Priority]	99
Proposed Watchlist [Assessment Priority]	16
Watchlist [Deferral to Adjacent Region]	32
Total	301

Connecticut

Connecticut's Riverine habitat is especially important, since it links the innermost parts of the state to the Long Island Sound and flows through our Tidal Wetlands and Estuaries, and the overall health of all relies upon each other extensively. While many SGCN and

SAPS that can be found in our Rivers are fish, many other taxa can be found there (Figure 2.20), and many issues that affect these species also affect many others throughout this interconnected system. During the Wildlife Action Plan revision process, Taxa Teams identified a series of issues that affect Connecticut's SGCN and SAPS found in rivers, and identified actions that will benefit these habitats, which include:

- Protect headwater and cold-water streams and ensure a minimum 300-foot forest buffer to maintain water quality and habitat integrity.
- Maintain water levels and flow minimums
- Improving connectivity at road crossings
- Maintain long, wide stretches of high-quality riparian habitat to provide connectivity and ecosystem services
- Provide safe, timely, and effective upstream and downstream passage at dams to allow migratory species to access breeding grounds
- Monitor streams where historic runs of diadromous populations and freshwater fish occurred in Connecticut to assess their recovery potential and restore extirpated populations where habitat is suitable
- Protect and improve riparian habitat to ensure that clear, cool water with a gravel substrate is protected. This includes limiting development and controlling pollution sources.
- In light of the recently documented, and repeated, successful spawning of Shortnose Sturgeon in the lower Connecticut River at the Holyoke site, it is imperative that a reevaluation of Shortnose Sturgeon conservation, protection, and enhancement policies in the Connecticut River basin be initiated, particularly concerning upstream and downstream passage at the Holyoke Dam.
- Maintain vernal pools and migration corridors that are connected to forests to support amphibian breeding and migration.

For more information about the issues affecting Connecticut's SGCN and SAPS, see Chapter 3, and for more information about actions that may help, see Chapter 4.

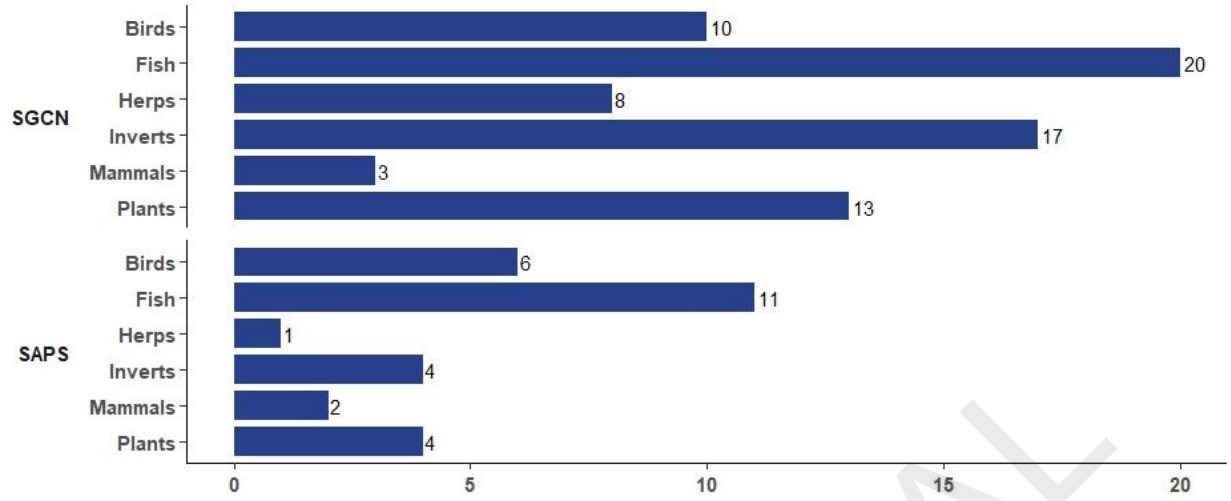

Figure 2.20 - The number of SGCN and SAPS species that can be found in Riverine habitats.

River and Stream Habitat Condition

Regional

Threats to the fine-scale habitats within the Northeast Big Rivers and associated Rivers and Streams vary by location and type but include pollution, dams, watershed development, and natural system modifications. A 2011 assessment highlighted decreasing natural cover along riparian buffers, with larger rivers (Big Rivers) exhibiting the highest levels of development (Anderson and Olivero-Sheldon. 2011). However, agricultural land use was lower along Big Rivers than in smaller streams.

Over the past two decades, impervious surface cover in upland habitats has increased, and nearly two-thirds of the Big Rivers in the Northeast have undergone significant hydrological alterations (Anderson et al., 2023). Further threats to these habitats include dams, culverts, watershed conversion to development and agriculture, and shifting environmental conditions. The region's Rivers and Streams remain highly fragmented, with an average of seven dams and 106 road-stream crossings per 100 miles of stream (Anderson and Olivero-Sheldon, 2011). Moreover, Tidal streams and rivers also show very high levels of alteration, with 99% and 92%, respectively, altered using the 10% or 20% threshold (Anderson et al, 2023).

Riparian and Floodplain areas were converted at a higher rate than conserved, though conserved lands have increased from 2012 to 2022 (Anderson et al., 2023). Hydrological alterations are more severe in Big and Tidal Rivers than freshwater Rivers and Streams, with the latter showing less hydrological impact but an increase in impervious surface cover over the last decade.

Connecticut

Connecticut has the highest number of dams per 100 miles of river in the U.S., with CT DEEP monitoring over 4400 dams in the state (CT DEEP Dams Public Viewer 2025). However, water quality in Connecticut has improved over the last few decades due to protective laws, remediation efforts, and investments in wastewater treatment (CT DEEP, 2022). The latest statewide assessment revealed that 76% of Connecticut's wadeable streams are healthy and meet aquatic life use support goals (CT DEEP, 2022), representing a significant improvement compared to the late 1970s and early 1980s.

Despite this progress, more work is required, particularly in nonpoint source (NPS) stormwater management, infrastructure maintenance, and improvements (CT DEEP, 2022). Many of the remaining impairments, such as Combined Sewer Overflows and urban stormwater runoff, are difficult to identify and correct. Combined Sewer Overflows discharge approximately 2 billion gallons of combined sewage into waterways annually (CT DEEP, 2022). Nutrient enrichment, particularly from high phosphorus levels, leads to eutrophication and algal blooms, while pathogen contamination from bacteria can limit recreational use and have adverse effects on aquatic ecosystems. For more information about Connecticut's water quality, please see the Habitat Conditions Section in Lakes and Ponds below. For more information about the threats affecting Connecticut's rivers and streams, please see Chapter 3.

Table 2.17 - Conditions of sub-habitats of the Non-Tidal Wetlands Habitat Group.

Sub-habitat	Condition
Large Rivers and their Associated Riparian Zones	Fair-Good
Unrestricted Free-flowing Streams	Fair-Good
Cold Water Streams	Fair-Good
Head-of-Tide and Coastal Streams	Fair

Lacustrine (Lakes and Ponds)

Lake and Pond Habitat Description, Distribution, and Conservation

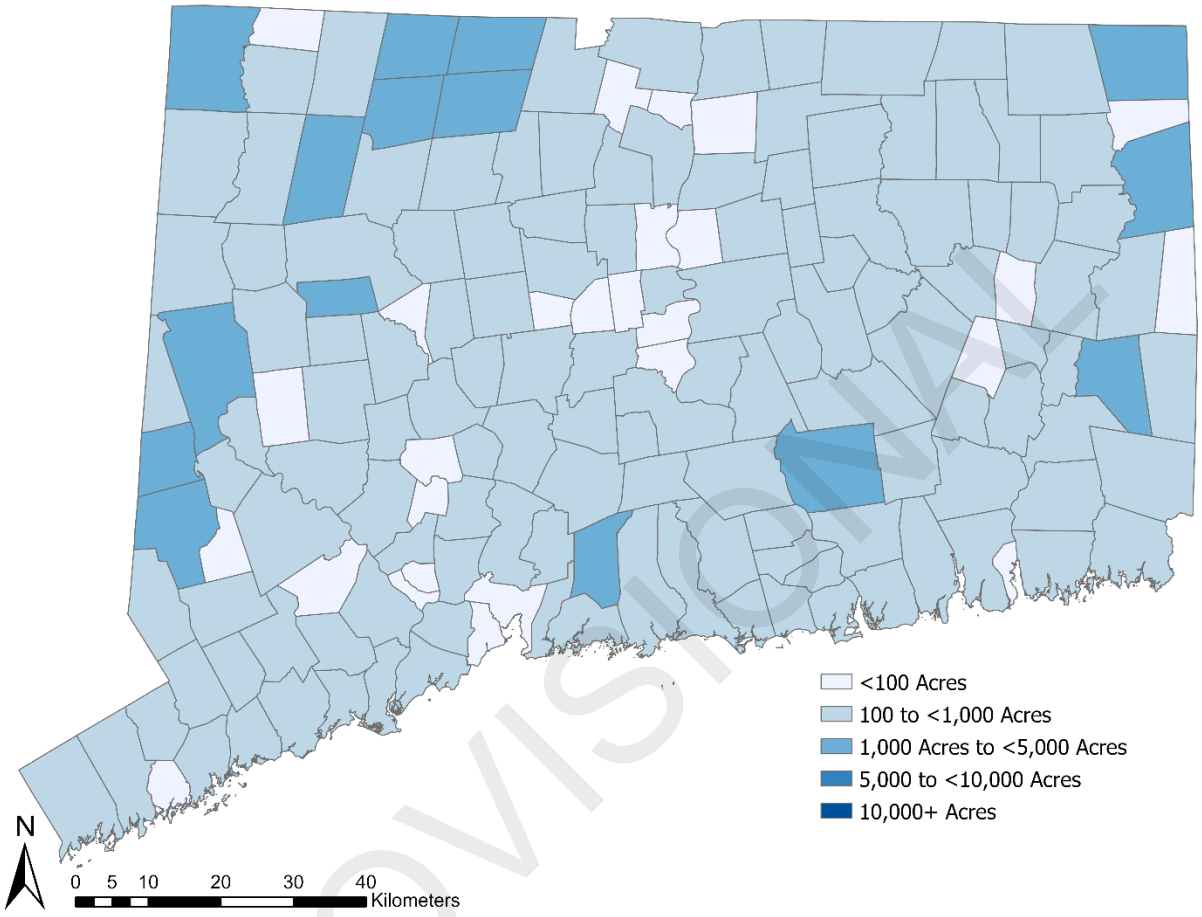

Figure 2.21 - Amount of Lake and Pond habitat in each Connecticut township.

Connecticut's lakes and ponds are part of a broader regional network that includes over 35,000 waterbodies covering approximately 2.7 million acres. These lacustrine habitats range from small, shallow ponds (2–10 acres) to larger lakes (over 1,000 acres) and even some deep lakes exceeding 10,000 acres (Anderson et al., 2023). The majority of the 36,000+ Lakes and Ponds of the region are Small Ponds (44%) and Large Ponds (34%), but because of their small size, they represent less than one-quarter of the total surface area of all Lakes and Ponds (Anderson et al., 2023).

Connecticut has approximately 2,300 lakes, ponds, and reservoirs. Most lakes and ponds were created during the last glacial retreat, but many artificial reservoirs also provide potable public water, energy production, and flood control (CT DEEP, 2015; Jacobs

and O'Donnell, 2002). Connecticut's lakes and ponds vary in size and characteristics. The state's lakes are classified into different categories based on their trophic state, which measures their productivity and water quality. Oligotrophic lakes, such as Bashan in East Haddam and Beach Pond in Voluntown, are characterized by their clear, low-nutrient waters. Mesotrophic lakes, such as Candlewood Lake and Coventry Lake, exhibit moderate nutrient levels and good water quality. Eutrophic lakes, such as Bantam Lake in Litchfield and Lake Lillinonah in Southbury, are characterized by high nutrient levels and tend to experience increased algae growth. In contrast, highly eutrophic lakes, such as West Thompson Lake, have the highest nutrient levels and are more susceptible to water quality issues (CT DEEP, 1996).

The lakes and ponds of Connecticut support a diverse array of wildlife. They provide an essential habitat for Amphibians and Reptile SGCN, including Red-spotted Newts, and numerous fish SGCN. Additionally, these waterbodies serve as critical breeding, feeding, and nesting grounds for waterfowl and numerous other species (Anderson et al., 2023). Managed wetland impoundments, including Heron, Great Meadow, Wickaboxet, Sue Hopkins, and Ericson Marshes, sustain waterfowl, amphibians, and emergent marsh vegetation, while lakes and ponds, such as Hodge Pond, Green Falls Reservoir, and Peg Mill Brook, provide critical habitats for fish that rely on cool, clear waters with abundant aquatic vegetation (CT DEEP, 2022).

Species of Greatest Conservation Need in Lake and Pond Habitats

Regional

There are 63 RSGCN, three Proposed RSGCN, 46 Watchlist [Assessment Priority], and two Proposed Watchlist species across 12 taxonomic groups associated with the Northeast Lakes and Ponds habitat. Another 12 species associated with this habitat are Watchlist [Deferral] species that have been deferred to adjacent AFWA regions (Table 2.18). Five RSGCN and Proposed RSGCN associated with Lakes and Ponds are of Very High Concern and at least 75% regional responsibility – three fish, one dragonfly, and one stonefly (TCI & NEFWDTC, 2023).

Table 2.18 - The number of species in each RSGCN and Watchlist category associated with Lakes and Ponds habitat in the Northeast as of 2023.

Category	Number of Species
RSGCN	63
Proposed RSGCN	3
Watchlist [Assessment Priority]	45
Proposed Watchlist [Assessment Priority]	2
Watchlist [Deferral to Adjacent Region]	12
Total	125

Connecticut

Perhaps unsurprisingly, plant and fish SGCN and SAPS are the two groups with the most species found in Connecticut's Lake and Pond habitat (Figure 2.22). However, many Invertebrates and Amphibians also use these habitats. Connecticut Taxa Teams identified a series of issues that affect our Lake and Pond SGCN and SAPS, as well as some actions that may help address these issues, including:

- Protect vegetated areas of small shallow ponds to large lakes, and in all but the smallest of streams, to maintain aquatic biodiversity, which is essential for reproduction and survival of many species.
- Develop a monitoring program to determine the current population status of lake-associated species.
- Ensure conservation actions address threats from habitat degradation, invasive species, and shifting environmental conditions.
- Reduce pollution and nutrient runoff from surrounding land use to prevent harmful algal blooms that degrade water quality.
- Maintain connectivity between lakes and adjacent wetland and riverine systems to support migratory fish and amphibians.
- Implement protections for critical breeding and nesting areas for waterfowl, shorebirds, and other lake-dependent species.
- Restore and conserve riparian buffers around lakes to reduce sedimentation and improve habitat quality.
- Evaluate and regulate water withdrawals to ensure stable water levels that support aquatic ecosystems.
- Manage invasive aquatic species that threaten native biodiversity through early detection and rapid response programs.
- Enhance public awareness and stewardship initiatives to promote sustainable recreational use of lake ecosystems.

For more information about the issues affecting Connecticut's SGCN and SAPS, see Chapter 3 and for more information about actions that may help, see Chapter 4.

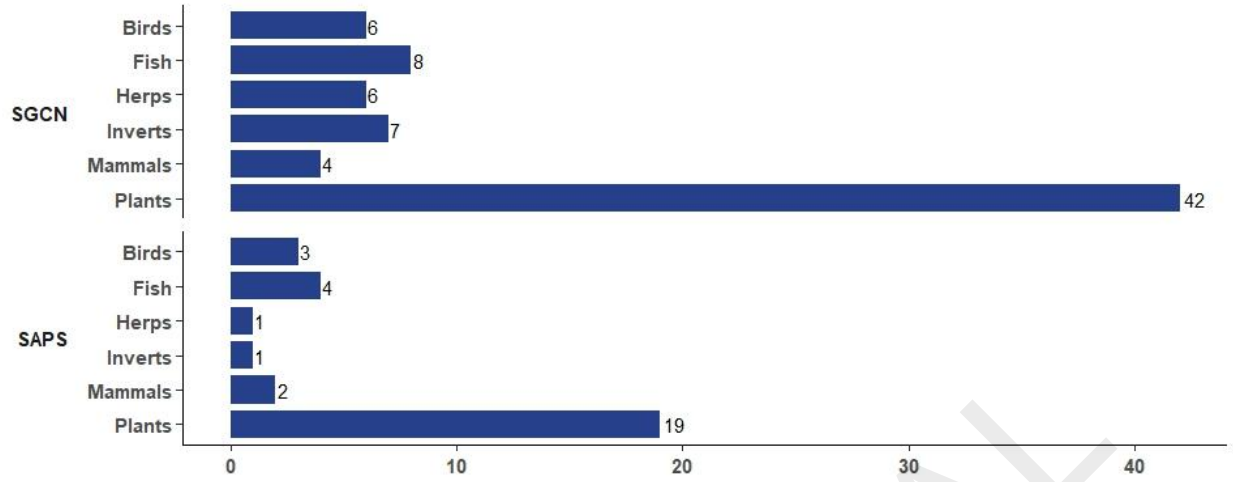

Figure 2.22 - The number of SGCN and SAPS species that can be found in Lacustrine habitats.

Lake and Pond Habitat Condition

Regional

Recent conservation efforts have yielded some progress; between 2012 and 2022, 300 new lakes and ponds in New England and New York have met the criteria for being "Highly Conserved," which requires that at least 70% of their shorelines are within conserved area boundaries (Anderson et al., 2023). However, the overall impact of impervious surfaces has worsened over the past two decades. While 38% of lakes and ponds are categorized as having a low impact from impervious surfaces, approximately 14% face severe degradation (Anderson et al., 2023). 83% of lakes and ponds are located within a quarter-mile of a road, and 69% are within one-tenth of a mile, intensifying runoff pollution and habitat fragmentation (Anderson et al., 2023). However, 21% of the region's lakes and ponds have most of their shorelines under conservation, and a significant proportion, about 44%, experience high levels of shoreline disturbance. These disturbances stem largely from development, proximity to roads, and agricultural practices, which result in increased impervious surfaces, docks, and septic systems (Anderson et al., 2023).

Nationally, conservation efforts have helped increase natural ponds, such as bog lakes, vernal pools, and kettle ponds, by 2.7% (49,000 acres) between 2009 and 2019, while agricultural ponds expanded by 8.3% (253,000 acres), largely for irrigation, water retention, and conservation (Lang et al., 2024). Urban ponds, including those in golf courses and residential areas, increased by 9.1%, while industrial ponds saw an 18.5% rise, often linked to stormwater management and industrial developments (Lang et al., 2024). However, these increases largely reflect a shift from vegetated wetlands, such as

marshes and forested wetlands, toward non-vegetated water bodies, raising concerns about overall habitat quality and wetland loss (Lang et al., 2024).

Connecticut

Connecticut's lakes and ponds vary widely in terms of water quality, habitat conditions, and wildlife suitability, with ongoing monitoring identifying both stable and impaired waterbodies (Table 2.19). While some lakes remain ecologically intact, others experience eutrophication, excessive algal blooms, and the proliferation of invasive macrophytes, which degrade water quality and habitat conditions (CT DEEP, 2022). Excess phosphorus and nitrogen drive eutrophication, leading to algal blooms and depleted dissolved oxygen levels, which harm aquatic life (CT DEEP, 2022). However, the Nitrogen discharged into Connecticut's waterbodies in 2022 was lower than the previous ten-year average (CT CEQ, 2023). Connecticut has reduced nitrogen discharges over the last decade by investing in nitrogen-removal technology at sewage treatment plants and implementing a Nitrogen Control Program; however, reducing nitrogen discharges from non-point sources remains a challenge (CT CEQ, 2023).

Two billion gallons of combined sewer overflows (CSOs) were released into Connecticut's waterbodies in 2023 (CT CEQ, 2023). CSOs occur when wastewater and stormwater are conveyed to larger bodies of water, with little or no treatment provided before discharge (CT CEQ, 2023). The discharge of untreated or partially treated sewage can have significant impacts on water quality. The volume from the CSOs comes from five treatment facilities: Bridgeport East, Bridgeport West, City of Norwich, Metropolitan District Commission (MDC), and Greater New Haven Water Pollution Control Authority (GNHWPCA). Extreme weather events/precipitation in 2023 are the primary reason for the significant increase in CSO volume in 2023 (CT CEQ, 2023). This does not include CSO from other states, which are large sources of additional volume.

Additionally, invasive aquatic plants, such as Eurasian Watermilfoil (*Myriophyllum spicatum*), Hydrilla (*Hydrilla verticillata*), Waterchestnut (*Trapa natans*), and Curly-leaf Pondweed (*Potamogeton crispus*), have spread throughout many lakes, displacing native vegetation and altering habitat structure (CT DEEP, 2022).

Table 2.19 - Conditions of sub-habitats of the Lake and Pond Habitat Group.

Sub-habitat	Condition
Lakes and Ponds	Poor - Good

Coastal Beaches, Dunes, and Offshore Islands (Land-Water Interface)

Land-Water Interface Habitat Description, Distribution, and Conservation

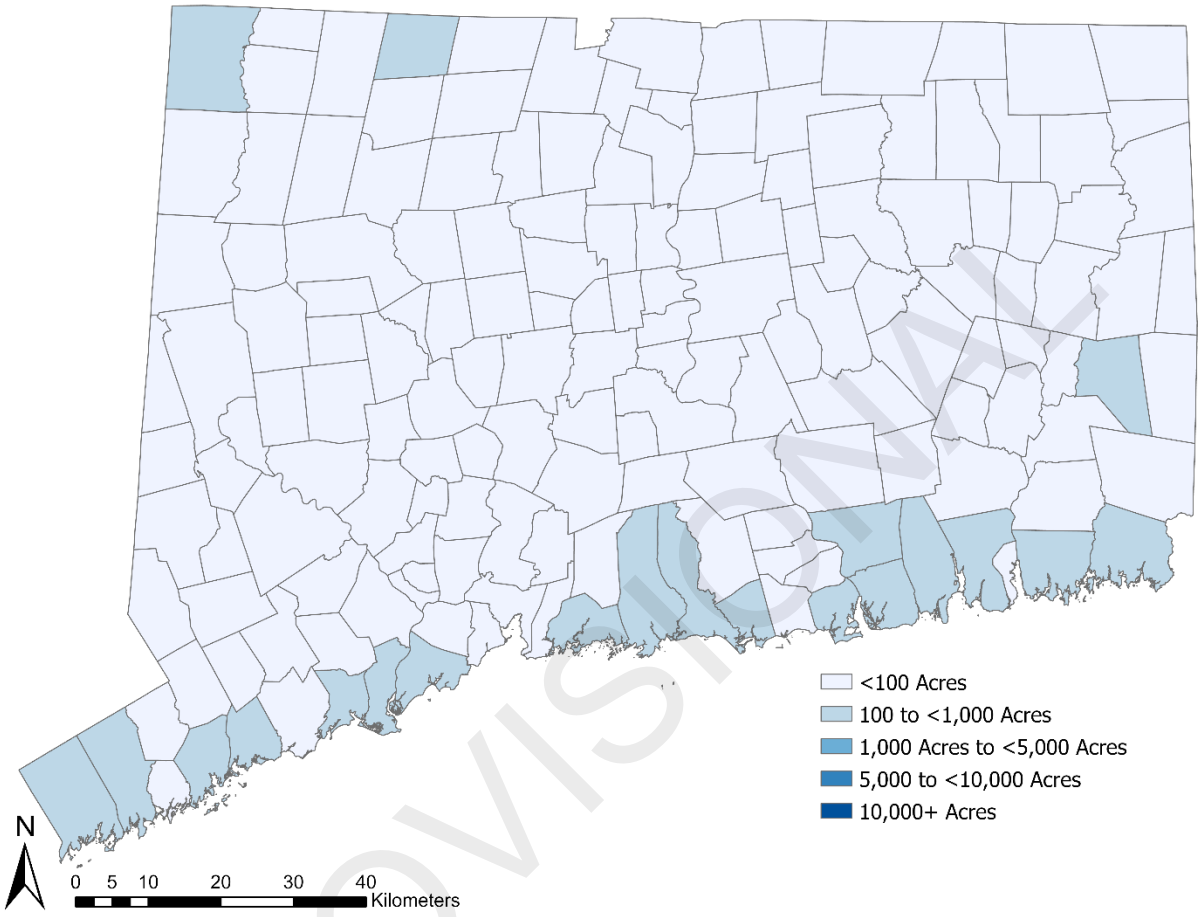

Figure 2.23 - Amount of Land-Water Interface habitat in each Connecticut township.

Connecticut's shoreline includes different types of beaches, such as sandy barrier spits, pocket beaches, and those composed of gravel or cobblestones. Barrier spits, such as those found at Bluff Point State Park and Griswold Point, Old Lyme, are formed by the movement of sand and water but differ from barrier islands, as Connecticut's coastline is influenced by factors like the proximity of Long Island and its irregular shape. However, sand is pushed landward by waves and wind, shifting and depositing sand on the landward side of beaches, which can bury marshes and lagoons. Storms exacerbate this effect, and with the addition of saltwater intrusion, the beach will continue to shift landward (Arnold et al, 2013).

Several offshore islands in the Long Island Sound play a crucial role in supporting wildlife, especially bird species. For example, Falkner Island in Connecticut is home to the largest least tern colony in the state and the only Roseate Tern colony in the state. These islands have been severely impacted by storms, such as Hurricane Irene and Sandy, which have damaged infrastructure and nesting habitats (Long Island Sound Study, 2015).

Connecticut's beaches are often smaller and fragmented than those found along other Atlantic Coastlines due to its unique geography and sediment dynamics (O'Donnell and Barrett, 2016). Connecticut's dunes are smaller and less developed than those along the Atlantic coastline. These dunes are important for coastal protection, helping to reduce the impact of storm surges and high waves (LISS, 2015). Beach and dune habitats typically have sparse or no vegetation, with a sand or gravel substrate that is continuously moved by winds, waves, tides, lake levels, storms, and ice. Without anthropogenic habitat modifications, beaches and dunes in the Northeast would persist in a natural equilibrium with rising sea levels and storm events, but would shift in space over time (TCI & NEFWDTC, 2023).

Shorebirds and colonial waterbirds rely on sandy beaches and dune habitats for nesting on the sparsely vegetated to bare ground and forage on or near the beaches and adjacent waters. Shorebird populations have declined 33% since 1970, second only to grassland birds in rate of decline (NABCI, 2022). Ten shorebird species and three waterbirds that occur in the Northeast are identified as Tipping Point (NABCI, 2022), with cumulative population losses of over 70% since 1980 and a future trajectory to lose another half of their remnant populations in the next five decades without intervention (NABCI, 2022).

Connecticut's coastal shoreline, primarily along the Long Island Sound, features a diverse landscape, including beaches, rocky bluffs, and tidal wetlands. Beaches, occupying only about 14% of Connecticut's 87 miles of tidal coastline, play a critical role in the state's ecosystem and economy (O'Donnell and Barrett, 2016). These include sandy barrier spits, pocket beaches, and those composed of gravel or cobblestones. Connecticut lacks barrier islands, instead having barrier spits due to the limited wind exposure from Long Island and the irregular shoreline shape (O'Donnell and Barrett, 2016). Fairfield (east of Southport Harbor), Milford Point, and Stratford are good examples of Connecticut's beaches and dunes. Since 2014, 2,239 acres of coastal habitat have been restored, exceeding the halfway mark of the 3,000-acre restoration goal (LISS, 2023).

Species of Greatest Conservation Need in Land-Water Interface Habitats

Regional

Beach and dune habitats support an array of wildlife, with 27 RSGCN, 19 Watchlist [Assessment Priority], and two Proposed Watchlist [Assessment Priority] species in eight taxonomic groups associated with this habitat type in the Northeast (Table 2.20). Another five species are on the Watchlist [Deferral] species list for another AFWA region. Three RSGCN associated with beach and dune habitats are of Very High Concern and endemic to the Northeast: the Bethany Beach Firefly (*Photuris bethaniensis*), Puritan Tiger Beetle, and Eastern Beach Tiger Beetle (*Habroscelimorpha dorsalis dorsalis*) (TCI & NEFWDTC, 2023).

Table 2.20 - The number of species in each RSGCN and Watchlist category associated with Beaches and Dunes habitat in the Northeast as of 2023.

Category	Number of Species
RSGCN	27
Watchlist [Assessment Priority]	19
Proposed Watchlist [Assessment Priority]	2
Watchlist [Deferral to adjacent region]	5
TOTAL	53

Among SGCN found in Connecticut's coastal beaches, dunes, and offshore islands, plants have the highest representation with 39 species, followed by birds with 26 species. Amphibians and reptiles, invertebrates, and mammals each have between 9 and 11 species, while Fish have only one species (Figure 2.24). For SAPS, plants account for 26 species, while invertebrates have 20. Mammals are the least represented, with only three species (Figure 2.24).

Connecticut

Based on feedback provided by Connecticut's expert Taxa Teams, many issues face our Connecticut's coastal habitats, and preventing habitat loss and degradation from development, human activity, and shifting environmental conditions are key to stabilizing SGCN populations. Some specific actions suggested include:

- Many coastal bird species rely on undisturbed nesting and roosting sites, yet habitat loss and human interference threaten their populations. Reducing disturbance at beach nesting sites (especially stricter dog and disturbance rules), enforcing intertidal zone protections, and strengthening beach patrolling and public education efforts will likely benefit our SGCN, especially species like Piping Plovers and Least Terns.

- Falkner Island, located off of Guilford's shore, was identified for needing special attention to mitigate the effects of sea-level rise, erosion, and human disturbance.
- Ensuring the availability of high-quality foraging habitat for fish populations in Long Island Sound will likely also benefit many of Connecticut's SGCN and SAPS found in coastal locations.
- Expanding conservation initiatives, such as the Audubon Alliance for Coastal Waterbirds, and using banding or radio tracking. will aid in our understanding of population movements and inform effective management strategies.
- A statewide survey of beach habitats would establish baseline population data, allowing researchers to assess trends and determine when and where further field studies are needed to address coastal bird declines.
- Green Crab, among several species, is an invasive species. Removal techniques include functional eradication, which is a cost-effective and plausible solution. If populations are kept below the threshold level, the impact on ecosystems can be minimized.

For more information about the issues affecting Connecticut's SGCN and SAPS, see Chapter 3 and for more information about actions that may help, see Chapter 4.

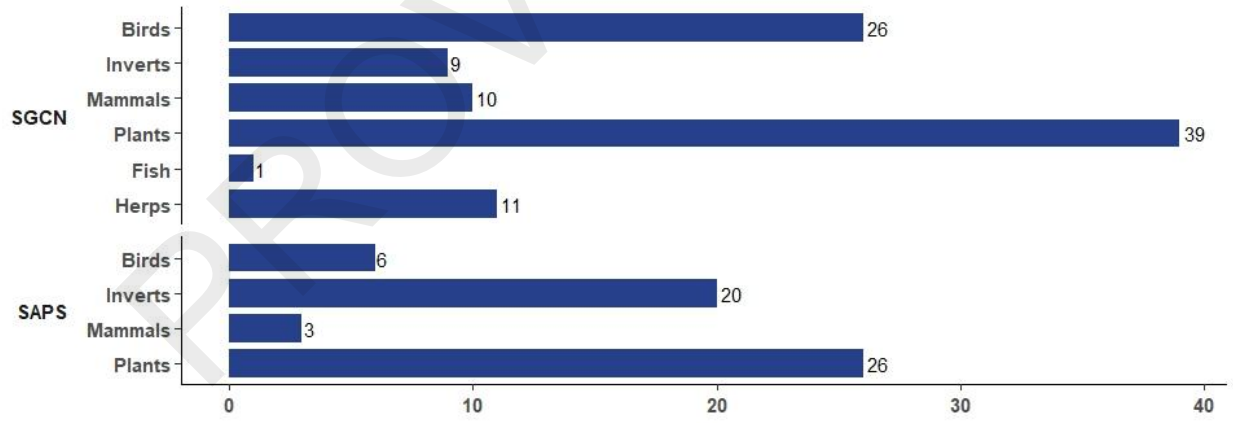

Figure 2.24 - The number of SGCN and SAPS species that can be found in Land-Water Interface habitats.

Habitat Condition

Regional

Although comprehensive regional assessments for estuarine Beach and Dune habitats are lacking, example data have been collected in New York State, particularly for Long Island's

Peconic Estuary and North Shore. CT DEEP provides technical support to towns for dune restoration. Several state-owned beaches have been restored, and the Long Island Sound License Plate Program has funded some of these municipal initiatives. Despite extensive protection efforts, these habitats face significant threats from development, natural system modifications, and shifting environmental conditions, with substantial losses documented, especially in Massachusetts and Connecticut. (TCI & NEFWDTC, 2023). Human activities, including development, beach armor, sediment placement, and beach scraping, have heavily impacted the region's beach and dune habitats. Of the nearly 97,000 acres of Atlantic coastal plain beach and dune habitat, on average, development has been displacing 165 acres of habitat per year (Anderson et al., 2013). By 2015, over 40% of the Northeast's marine sandy beaches had been developed, with significant erosion and habitat loss linked to coastal engineering structures (TCI & NEFWDTC, 2023). As the region faces increasing risks from shifting environmental conditions and coastal development, models project that 8,263 acres of beach and dune habitat will be lost by 2060 (Anderson et al., 2013).

Estuarine rocky Shorelines of the Northeast are threatened by non-native and invasive species (Threat 8.1.3), particularly Green Crab (*Carcinus maenus*) and Common Periwinkle (*Littorina littorea*) (Roman et al., 2000). The Common Periwinkle has become the dominant herbivore for intertidal algae on New England rocky shorelines since its introduction in the mid-1800s, controlling the structure of rocky intertidal communities. The Green Crab is a predator on both rocky shorelines and soft-substrate estuarine shorelines, significantly altering the structure and function of native communities in the Northeast (TCI & NEFWDTC, 2023).

Connecticut

Connecticut's beaches and dunes are facing erosion due to storms, rising sea levels, and changes in sand availability. The coastline is gradually moving landward, and many of the state's beaches are losing sand due to storms and infrastructure blocking natural sediment transport (O'Donnell and Barrett, 2016). Erosion has led some beaches to loss one to two feet of sand per year, which is exacerbated by stormwater runoff, coastal infrastructure like seawalls, and the lack of sand replenishment (Long Island Sound Study, 2015). The state's beaches and dunes are constantly reshaped by natural forces like storms and rising sea levels, threatening coastal properties and habitats. Coastal infrastructure, such as seawalls, can exacerbate erosion by disrupting the natural movement of sand along the coast (O'Donnell and Barrett, 2016). Given the shifting nature of these habitats, habitat conditions can be difficult to assess and varies across the coast (Table 2.21).

Additionally, many of the state's beaches are becoming narrower due to the loss of sand during storms, and some areas lack the natural replenishment of sand necessary for the beaches to maintain their protective role. The continued pressure of development along the coast, combined with the effects of shifting environmental conditions (Anderson et al., 2013), will necessitate a range of strategies, including the implementation of living shorelines and the careful management of dune restoration. Efforts to balance coastal development with environmental protection will continue to be a key challenge for Connecticut's coastal communities (O'Donnell and Barrett, 2016). Similar to regional concerns, invasive species are also a threat to Connecticut's rocky intertidal environments. Most recently, the rise of Asian Shore Crabs (*Hemigrapsus sanguineus*), first reported on the East Coast in 1988 in New Jersey, is a competitor to native and other invasive crabs (Epifanio, 2013). In some areas of the Long Island Sound, Asian Shore Crabs seem to even be replacing Green Crabs (Lohrer & Whitlatch, 2002). Chinese mitten crabs (*Eriocheir sinensis*) have also been introduced to the Long Island Sound, with the first reported sighting in Greenwich in 2012 (CT DEEP, 2012). Chinese mitten crabs pose multiple threats to native crab species, including competition and predation. They are also known to harbor pathogens that could infect native crab populations (Hudson et al., 2019).

Table 2.21 - *Conditions of sub-habitats of the Land-Water Interface Habitat Group.*

Sub-habitat	Condition
Offshore Islands	Variable
Coastal Bluffs and Headlands	Unknown
Coastal Beaches and Dunes	Good - Poor

Estuarine

Estuarine Habitat Description, Distribution, and Conversation

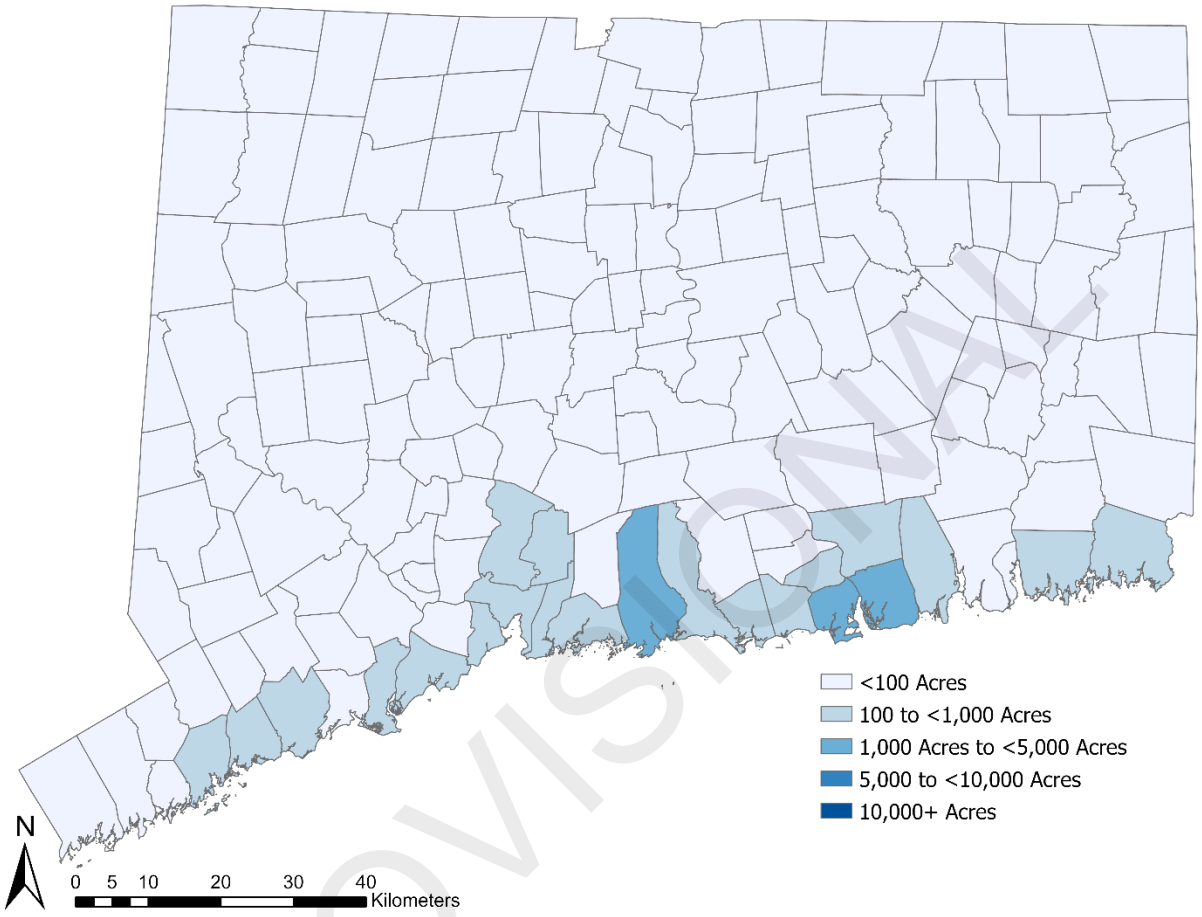

Figure 2.25 - Amount of Estuary habitat in each Connecticut township.

Estuarine aquatic habitats in Connecticut encompass a range of coastal and tidal waters characterized by varying salinity levels and diverse substrates associated with Long Island Sound. These habitats include the aquatic zones of Long Island Sound itself, as well as upstream areas subject to tidal influence where salinity levels reach at least 0.5 parts per thousand. The condition of these habitats is assessed using indicators based on the presence and abundance of resident estuarine and marine species. Notable SGCN and SAPS include Winter Flounder, Windowpane, and Hogchoker. Diadromous species, which migrate between freshwater and marine environments, further reflect the overall health of Connecticut's estuaries. These include SGCNs, such as American Shad, Blueback Herring, Alewife, and American Eel. Collectively, more than 120 species of finfish, both resident and migratory, have been documented in these estuarine habitats.

In 2022, over 50,000 acres within the Long Island Sound Estuary—including marshes, uplands, and open water areas in Long Island Sound as well as areas in the lower Connecticut and Thames Rivers—were designated as a CT National Estuarine Research Reserve. Moreover, the Connecticut River Estuary is one of only four estuaries in the Northeastern United States designated as a Ramsar Site, recognized for its global importance (RAMSAR, 2023). Furthermore, among the states in the Northeast, Connecticut has the largest area of estuarine habitat, with Virginia and Maryland ranking next highest, as they share Chesapeake Bay (TCI & NEFWDTC, 2023).

Coastal zones are composed of interconnected and shifting ecosystems, including estuaries, tidal rivers and streams, tidal wetlands and flats, beaches, dunes, shorelines, and the marine nearshore. These habitats are dynamic, with boundaries that change in response to winds, tides, freshwater inflows, coastal storms, and sea-level rise. Estuarine benthic habitats—such as oyster reefs, shellfish beds, and submerged aquatic vegetation—are particularly vulnerable to disturbance from dredging and constructions like jetties, groins, docks, and piers (TCI & NEFWDTC, 2023).

Connecticut's estuarine habitats within the Long Island Sound estuary system include vegetation beds, hard bottoms, sponge beds, shellfish reefs, and algal beds, each characterized by distinct environmental conditions and ecological functions (CT DEEP, 2022). Vegetation beds, primarily composed of eelgrass (*Zostera marina*), thrive in shallow, clear waters with moderate salinity (15 to 30 parts per thousand) and sandy or muddy substrates. These beds stabilize sediments, enhance water quality, and serve as nurseries for fish and invertebrates, though they are vulnerable to nutrient loading and sedimentation (CT DEEP, 2022). Hard-bottom habitats, characterized by rocky substrates and gravel beds, are found in areas with strong tidal currents that prevent sediment accumulation and support communities of algae, invertebrates, and fish (CT DEEP, 2022). Although less extensive and less documented, sponge beds inhabit stable hard substrates in subtidal zones with consistent salinity and moderate currents. Sedimentation and pollution can impair these filter-feeding organisms by clogging their filtration systems (CT DEEP, 2022). Shellfish reefs, primarily composed of Eastern Oysters (*Crassostrea virginica*), develop in intertidal and subtidal zones with salinity between 10 and 30 parts per thousand. Approximately 312 square miles of estuarine waters are designated for shellfish use, though only about 156 square miles are suitable for growth due to water quality impairments (CT DEEP, 2022). These reefs improve water quality through filtration and provide habitat for various species, supporting commercial and recreational harvesting (CT DEEP, 2022).

Principal rivers contributing to the Long Island Sound from west to east include the Housatonic, Quinnipiac, Connecticut, and Thames Rivers. Several areas within the estuary have been identified as conservation priorities, notably the lower Connecticut River, the Thames River near New London, Black Rock and Bridgeport Harbor (including Lewis Gut), and New Haven Harbor. Connecticut has mapped all impaired estuaries and provided the map and associated data online (CT DEEP, 2021).

Management actions target habitat protection, pollution reduction, and ecosystem restoration across all estuarine habitat types (CT DEEP, 2022). Efforts for vegetation beds focus on nutrient management to mitigate harmful algal blooms, reduce sedimentation, and monitor eelgrass coverage through bi-annual surveys (CT DEEP, 2022). Additionally, Eelgrass meadows, crucial for aquatic life and carbon sequestration, face population declines. Hard-bottom habitats are protected through restrictions on dredging and coastal development, with habitat mapping used to prioritize conservation areas (CT DEEP, 2022). Sponge beds indirectly benefit from broader water quality improvements, such as sediment control during construction activities and discharge regulation to prevent increases in turbidity (CT DEEP, 2022). Shellfish reefs are managed under the National Shellfish Sanitation Program, with the Connecticut Department of Agriculture's Bureau of Aquaculture (CT DA/BA) classifying growing areas like "Approved" and "Restricted," depending on fecal coliform bacteria levels (CT DEEP, 2022). Regular monitoring and closures during pollution events protect consumer health and maintain reef viability (CT DEEP, 2022). Management of algal beds involves nutrient reduction strategies aligned with the Long Island Sound Total Maximum Daily Load (TMDL) program to prevent excessive algal growth, which can lead to hypoxia and habitat degradation (CT DEEP, 2022). Despite these efforts, ongoing challenges such as habitat fragmentation, nutrient pollution, and coastal development necessitate continuous monitoring, adaptive management, and collaborative conservation strategies (CT DEEP, 2022).

Species of Greatest Conservation Need in Estuarine Habitats

Regional

A total of 43 RSGCN, along with 28 species on the Watchlist under the Assessment Priority category and two species designated as Watchlist Interdependent Species, can be found in Northeast estuarine habitats across seven taxonomic groups. An additional nine species linked to these habitats fall under the Watchlist Deferral category, meaning their primary conservation responsibility lies with adjacent regions within the Association of Fish and Wildlife Agencies (AFWA). Of the RSGCN and Proposed RSGCN species linked to estuarine ecosystems, eight are considered to be of Very High Concern in the Northeast, including three fish, four sea turtles, and one waterbird (TCI & NEFWDTC, 2023).

Table 2.22 - The number of species in each RSGCN and Watchlist category associated with Estuary habitat in the Northeast as of 2023.

Category	Number of Species
RSGCN	43
Watchlist [Assessment Priority]	28
Watchlist [Interdependent Species]	2
Watchlist [Deferral to Adjacent Region]	9
Total	82

Connecticut

Connecticut's estuarine habitat is especially important, since it sits at the interface between the deeper regions of the Long Island Sound, and our Tidal Wetlands and Rivers, and the overall health of all relies upon each other extensively. For example, pollutants that enter the waterways throughout the state flow through this interconnected system, affecting all these habitats and potentially leading to algal blooms and other issues in the deeper benthic areas of the Sound (see the Marine Habitat Condition, below). While it may seem that there are few SGCN and SAPS found in this habitat (Figure 2.26), many issues that affect these species also affect many others.

The Taxa Teams identified several issues affecting SGCN and SAPS found in the estuary habitat. Actions to mitigate these issues include:

- Managing ocean bottom resources and ensuring prey abundance will support seabirds during migration and wintering.
- Protecting shellfish beds and reducing pollution in Long Island Sound will improve water quality and sustain critical food sources for marine wildlife.
- Strengthening protections for eelgrass beds will ensure that they continue to provide essential habitat for marine life, particularly for species with conservation dependencies such as Winter Flounder.
- Conserving diadromous fish populations requires reducing bycatch in commercial fisheries, restoring access to historic spawning grounds, and managing water withdrawals to maintain migration pathways.
- Collaborations with the New England Fisheries Management Council, U.S. Fish and Wildlife Service, Atlantic States Marine Fisheries Commission, and the National Oceanic and Atmospheric Administration to decrease bycatch of Blueback Herring and Alewives in Atlantic Herring and mackerel fisheries.

- Preventing the use of copper sulfate for algae control in diadromous fish habitats will further protect these species.
- Ensuring safe upstream and downstream passage at hydroelectric facilities and other artificial barriers will improve population recovery and migratory success of diadromous SGCN.
- Removing migration barriers and monitoring River Herring bycatch in commercial fisheries will support broader conservation efforts for these species.
- Expanding nearshore monitoring and protecting riparian habitats with cool, clear water and gravel substrates will help sustain fish populations while limiting development impacts.
- Monitoring fish populations to provide insight into habitat conditions and potential conservation needs.

For more information about the issues affecting Connecticut's SGCN and SAPS, see Chapter 3, and for more information about actions that may help, see Chapter 4.

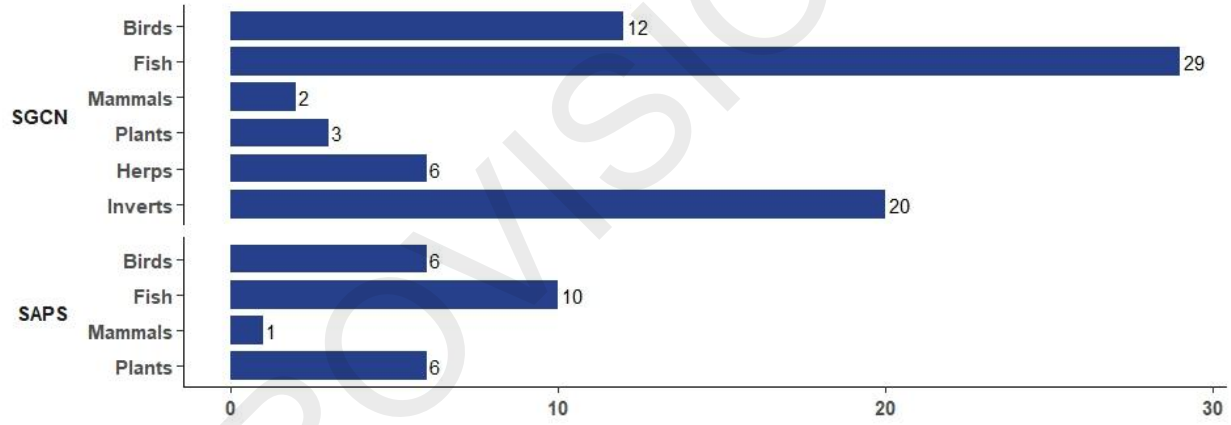

Figure 2.26 - The number of SGCN and SAPS species that can be found in Estuarine habitats.

Habitat Condition

Regional

Coastal habitats are dynamic and interconnected ecosystems undergoing significant shifts due to sea-level rise and saltwater intrusion. These processes transform freshwater rivers and streams into tidal systems, estuaries, and ultimately, marine nearshore environments (Dahl and Stedman, 2013; Ensign and Noe, 2018). Habitat changes result in gains and losses, with tidal wetlands converting into tidal flats, estuaries, or open water. Between 2004 and 2009, the United States experienced the loss of approximately 124,290 acres (2.4%) of vegetated estuarine wetlands, primarily due to conversion to unvegetated tidal flats, open-water estuaries, or marine nearshore habitats (Dahl and Stedman, 2013).

During this period, estuarine tidal flats increased by 20,854 acres nationally, including 2,211 acres along the Atlantic coast (Dahl and Stedman, 2013). Although estuarine surface area appears to be growing in the Northeast, largely due to habitat conversion resulting from rising sea levels, essential features within these ecosystems, such as mollusk reefs and seagrass beds, have declined significantly. Global losses of seagrass beds reached 29% by 2009, and oyster reefs declined by 85% as of 2011 (Kritzer et al., 2016). Historic losses of eelgrass in the Northeast, exacerbated by disease and anthropogenic impacts, have been partially offset by recovery efforts; however, nutrient enrichment and sedimentation continue to pose problems (Roman et al., 2000; Greene et al., 2010).

Roads and causeways, bridges, tide gates, and other artificial structures can fragment estuaries. Estuarine benthic habitats, such as oyster reefs, shellfish beds, and SAV, can be fragmented by dredging and artificial structures like jetties, groins, docks, and piers. The extent of habitat fragmentation of estuaries and their benthic habitat formations at the regional scale in the Northeast is not well known (TCI & NEFWDTC, 2023). Despite localized increases in estuarine areas, habitat quality remains a concern due to eutrophication, fragmentation, and declines in benthic communities (EPA, 2021; Greene et al., 2010). From 2004 to 2009, approximately 8,437 acres of coastal wetlands nationally—and 1,084 acres along the Atlantic coast—were converted to marine nearshore intertidal habitat (Dahl and Stedman, 2013). The Northeast has shown improvements in estuarine biological condition, with the proportion of estuarine waters in good condition increasing from 51% in 2005 to 71% in 2015 (EPA, 2021). However, fish tissue contamination remains a concern, with only 18% of Northeast estuarine waters in good condition for mercury levels in 2015 (EPA, 2021). Habitat fragmentation from infrastructure such as roads, tide gates, and causeways continues to disrupt ecological connectivity, while shifting environmental conditions and increased storm intensity further stress these systems (Greene et al., 2010; Zhang et al., 2022).

Connecticut

The condition of Connecticut's estuarine habitats, including vegetation beds, hard bottoms, sponge beds, shellfish reefs, and algal beds, varies throughout the coast (Table 2.23) due to water quality, habitat health, and environmental stressors (CT DEEP, 2022). Vegetation beds, particularly those composed of eelgrass, have experienced declines in coverage due to nutrient loading, reduced water clarity, and physical disturbances (CT DEEP, 2022). Dissolved oxygen and nutrient monitoring from 2019 to 2021 revealed hypoxia during summer months, especially in nearshore zones, which adversely affects submerged aquatic vegetation by limiting light penetration necessary for growth (CT DEEP, 2022). Hard bottom habitats generally maintain good water quality, with sufficient oxygen levels and low sedimentation rates; however, localized degradation occurs near urbanized

coastal areas due to dredging, anchoring, and coastal construction activities (CT DEEP, 2022).

Although less documented, sponge beds are vulnerable to sedimentation and changes in salinity. Elevated turbidity from coastal development can clog sponge filtration systems, impairing habitat function and reducing biodiversity (CT DEEP, 2022). Shellfish reefs are closely monitored through the National Shellfish Sanitation Program. Approximately 312 square miles of estuarine waters are evaluated for shellfish harvesting, with roughly 156 square miles deemed viable for shellfish growth. Water quality assessments based on fecal coliform bacteria levels categorize these areas as "Approved," "Conditionally Approved," "Restricted," or "Prohibited" (CT DEEP, 2022). Of the waters designated for direct human consumption, approximately 65.11 square miles fully support harvest activities, while other segments are classified as “Not Supporting” or “Insufficient Information” due to pollution concerns (CT DEEP, 2022). The availability of nutrients influences algal beds. Moderate nutrient levels promote productivity, but excessive nutrient inputs can trigger harmful algal blooms, causing localized hypoxia and habitat degradation (CT DEEP, 2022).

Shellfish growing areas, encompassing approximately 312 square miles of Connecticut’s estuarine waters, continue to undergo rigorous monitoring under the National Shellfish Sanitation Program. About 65.11 square miles of these areas fully support shellfish harvesting (Class SA), while others remain restricted due to fecal coliform bacteria contamination and nutrient-related impairments (CT DEEP, 2022). Although significant strides have been made through wastewater treatment upgrades and stormwater management, nonpoint source pollution remains a substantial challenge.

Table 2.23 - Sub-Habitats of the Estuarine Aquatic Key Habitat Group.

Sub-habitat	Condition
Coastal Rivers, Coves and Embayments	Variable
Vegetation Beds	Variable
Hard Bottoms	Variable
Sponge Beds	Variable
Shellfish Reefs and Beds	Variable
Sedimentary Bottoms	Variable
Algal Beds	Variable

Marine

Marine Habitat Description, Distribution, and Conservation

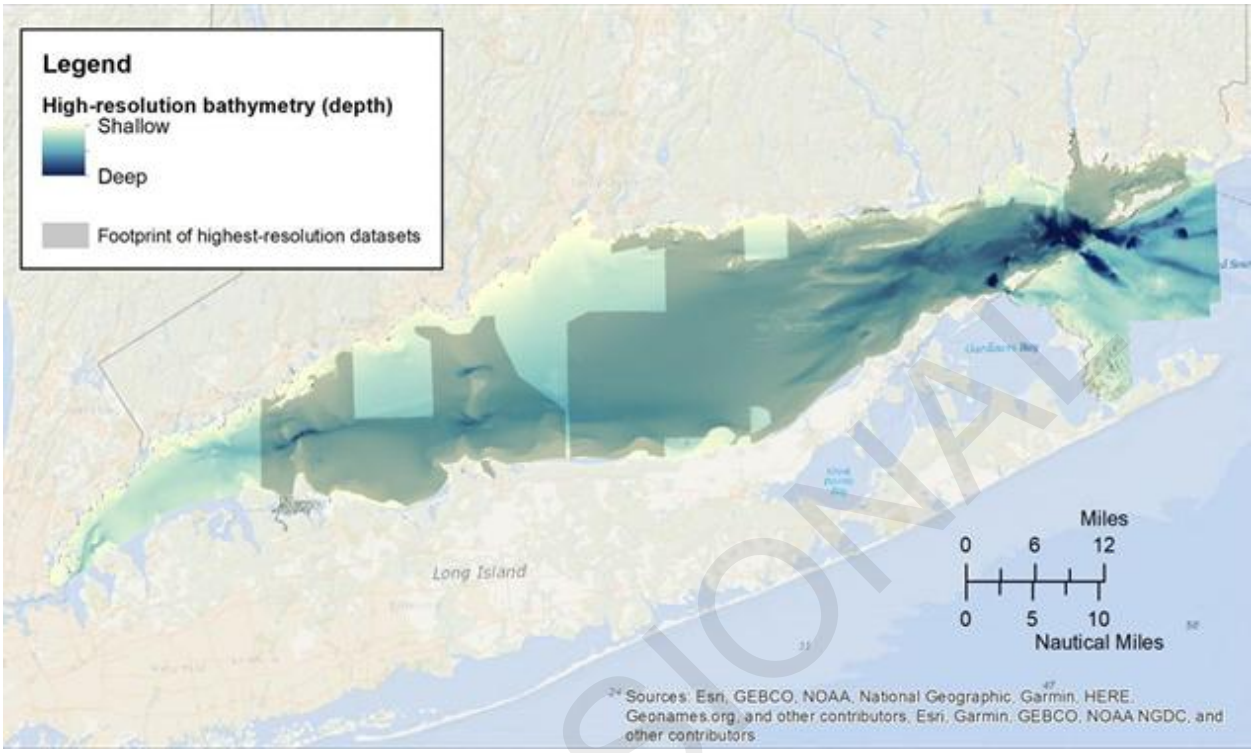

Figure 2.27 - Offshore Marine Habitat of the Long Island Sound (from CT DEEP, 2019).

Connecticut's marine habitats within the Long Island Sound encompass diverse environments that vary in depth, proximity to shore, and ecological composition. Note that the Long Island Sound is also an estuary, and it is also discussed in that section (see above). The estuarine waters of the Sound cover approximately 611.91 square miles and are segmented based on bathymetry, habitat use, and ecological features (CT DEEP, 2022). Deeper offshore habitats, typically found beyond the 50-foot depth contour, differ significantly from nearshore environments. These zones, primarily located along the central axis of Long Island Sound, feature soft sediment substrates, lower light availability, and cooler temperatures that support benthic invertebrate communities integral to nutrient cycling and ecosystem stability (CT DEEP, 2022). Demersal fish species, alongside various benthic organisms, utilize the deeper central basin, while nearshore environments provide critical areas for juvenile development and spawning (LISS, 2023). Since 1991, CT DEEP has led the Long Island Sound Water Quality Monitoring Program, which involves monitoring surface and bottom waters across the eastern, central, and western basins of Long Island Sound. Sampling occurs monthly at 17 core stations year-round, with expanded monitoring at 48 stations every other week from mid-June to mid-September.

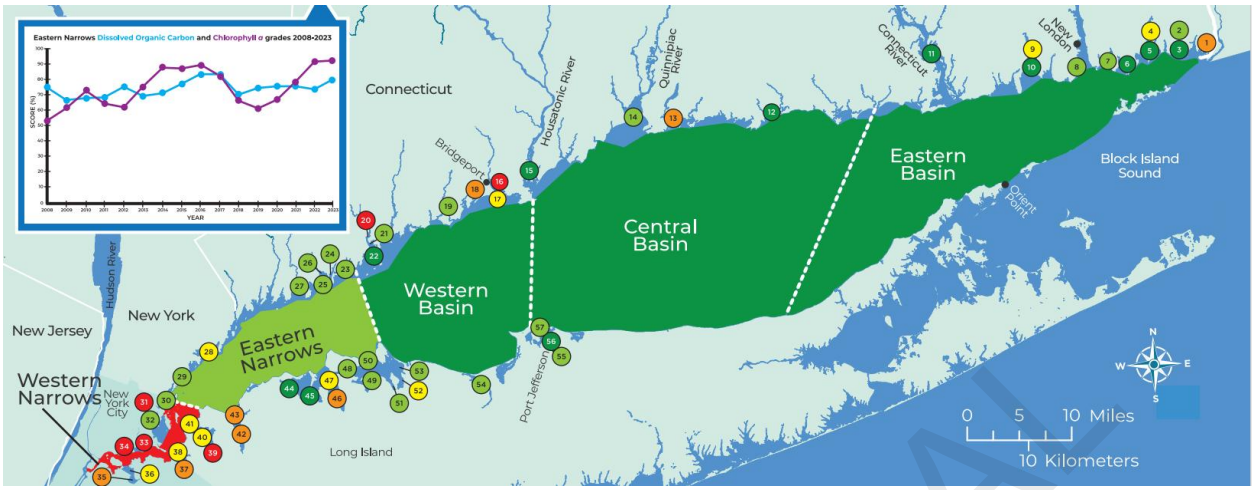

Figure 2.28 - Long Island Sound within Basins associated with graded water quality assessments. (Save the Sound, 2024)

The Long Island Sound Report Card is a comprehensive, biennial assessment that presents water quality data in the form of letter grades for the ecological health of the Sound. The Sound is divided into five open water regions. For these areas, more than 98% of the waters typically earn a grade of "B" or higher. The assessment in these zones is based on a suite of water quality parameters, including nutrient levels, particularly nitrogen, which is a major pollutant. Excess nitrogen contributes to issues such as algae blooms and dead zones by depleting the dissolved oxygen. The report card highlights key indicators such as chlorophyll a (a direct measure of algal presence) and dissolved organic carbon (DOC), which are critical for evaluating the overall ecological dynamics. The Eastern Narrows, which had received a "D+" in 2008, improved over the years, first to a "C," and more recently to a "B," as a result of reductions in these pollutants. The report card also breaks down water quality along the margins of the Sound into 57 distinct bay segments. Bay areas are typically more vulnerable to local pollution from sources such as stormwater runoff, fertilizers, and localized wastewater discharges. Approximately 42% of these bay segments have received a grade of C or below, reflecting more significant challenges in maintaining or improving water quality at the local scale (Save the Sound, 2024).

In 2019, CT DEEP published the Long Island Sound Blue Plan to facilitate a transparent, science-based decision-making process for the future use of Long Island Sound's resources. The spatial guide aims to help preserve ecosystems while protecting resources and traditional uses, maximizing their compatibility, and minimizing conflicts between them now and in the future (CT DEEP, 2019). Habitat restoration initiatives targeting these environments have enhanced habitat complexity and contributed to the

overall ecological diversity of the Sound (LISS, 2023). Habitat distribution within Long Island Sound reflects natural environmental gradients. Shallow nearshore zones support extensive seagrass beds that provide critical nursery habitats for fish and invertebrates. At the same time, deeper offshore areas with soft sediment substrates host benthic invertebrate communities that are important for ecosystem function (CT DEEP, 2022). Habitat mapping has documented the presence of these key habitats across both nearshore and offshore zones, with seagrass meadows concentrated in shallow coves and embayments and benthic communities extending across the deeper central basin of the Sound (CT DEEP, 2022). These habitats collectively contribute to the ecological diversity and productivity of Long Island Sound (CT DEEP, 2022).

Species of Greatest Conservation Need in Marine Habitats

Regional

The Northeast marine habitat supports a diverse range of species, including 54 Regional Species of Greatest Conservation Need (RSGCN), two proposed RSGCN, 29 Watchlist [Assessment Priority] species, two Watchlist [Interdependent Species], and one proposed Watchlist species across seven taxonomic groups (Table 2.24; TCI & NEFWDTC, 2023). Additionally, five species associated with this habitat are classified as Watchlist [Deferral] species, with their assessments deferred to adjacent regions of the Association of Fish and Wildlife Agencies (AFWA). Species of conservation concern in this habitat include 22 bird species, 16 marine fish species, 13 shark species, 11 diadromous fish species, nine skate and ray species, four federally listed sea turtle species, four bat species, and three whale species (two of which are federally listed). Among these, 12 RSGCNs and the proposed RSGCN are considered Very High Concern in the Northeast, with all but one being federally listed under national conservation laws (TCI & NEFWDTC, 2023).

Table 2.24 - The number of species in each RSGCN and Watchlist category associated with Marine Nearshore habitat in the Northeast as of 2023.

Category	Number of Species
RSGCN	54
Proposed RSGCN	2
Watchlist [Assessment Priority]	29
Proposed Watchlist [Assessment Priority]	1
Watchlist [Interdependent Species]	2
Watchlist [Deferral to adjacent region]	5
Total	93

Connecticut

Much like estuarine habitats, Connecticut's marine habitats are especially important, as they are the end of a series of interconnected habitats. This includes tidal wetlands and rivers, and the overall health of all relies extensively on each other. It may not be a surprise that the species that depend on this habitat are mostly aquatic, such as marine turtles, mammals, and fish; however, many birds also rely on this habitat, especially for feeding (Figure 2.29). Taxa Teams identified the following issues affecting Connecticut's Marine SGCN and SAPS, and some actions that may benefit these species:

- Manage ocean bottom resources that birds rely on during migration and wintering to ensure food availability.
- Maintain healthy seafloor and prey abundance to support marine food webs.
- Ensure quality shellfish beds throughout Long Island Sound and reduce pollution in Long Island Sound to maintain water quality and ecosystem health.
- Further develop nearshore monitoring efforts to assess marine species distribution and habitat changes.

See the Palustrine, Land-Water Interface, and Estuarine sections for more information, as well as Chapters 3 and 4.

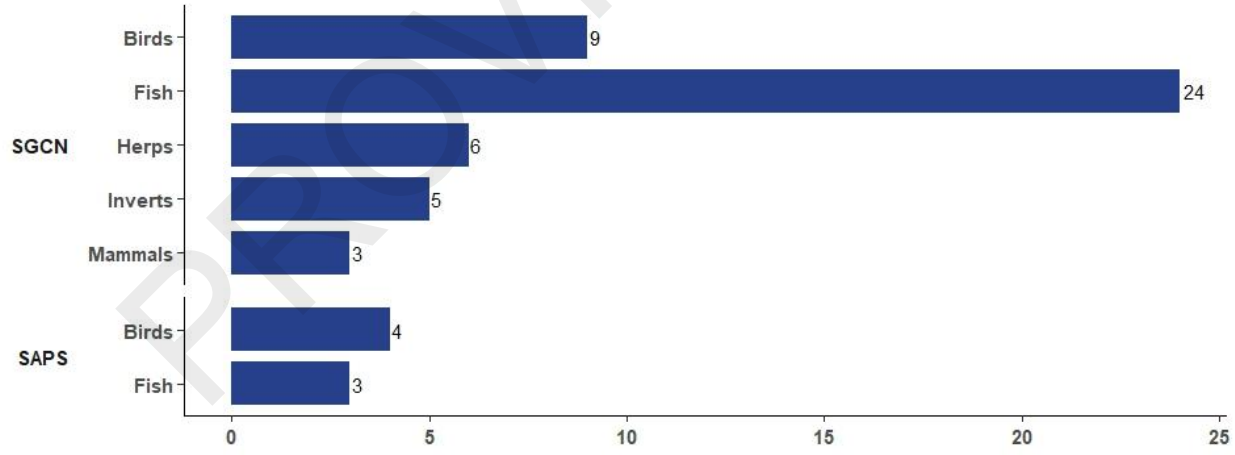

Figure 2.29 - The number of SGCN and SAPS species that can be found in Marine habitats.

Habitat Condition

Regional

Despite potential gains in habitat area, human activities have caused substantial losses of specific marine habitat features, including shellfish beds, submerged aquatic vegetation

(SAV), live hard bottoms, and coral (Greene et al., 2010). Data gaps persist regarding the full extent of these losses due to limited mapping of habitat distribution. Major threats to marine nearshore habitats include nutrient pollution, coastal development, sea-level rise, and fisheries impact (Halpern et al., 2019; Greene et al., 2010). Nutrient runoff from agriculture and urban areas, combined with wastewater discharges, exacerbates eutrophication and hypoxia, while coastal infrastructure projects contribute to habitat fragmentation (NCCOS, 2022). Global studies highlight that coral reefs, seagrass meadows, and mangrove ecosystems within the marine nearshore are among the most vulnerable habitats to cumulative human impacts, with climate stressors, shipping, and land-based pressures being primary drivers of degradation (Halpern et al., 2019). Marine habitats in the Northeast, particularly New England and maritime Canada, experience higher cumulative human impacts than other U.S. coastal regions (Halpern et al., 2019).

Connectivity among marine, estuarine, and freshwater systems is essential for sustaining species that rely on multiple habitats throughout their life cycles, such as diadromous fish and commercially important species like Tautog (*Tautoga onitis*) and Weakfish (*Cynoscion regalis*) (Kritzer et al., 2016; Greene et al., 2010). Habitat fragmentation from human activities disrupts this connectivity, affecting species migration, nutrient transport, and ecosystem resilience (Wenzel et al., 2020). Conservation efforts emphasize the importance of Marine Protected Area (MPA) networks and “other effective conservation measures” (OECMs), including fishery closures and military exclusion zones. However, comprehensive inventories of these measures in the Northeast remain sorely needed (Wenzel et al., 2020).

Connecticut

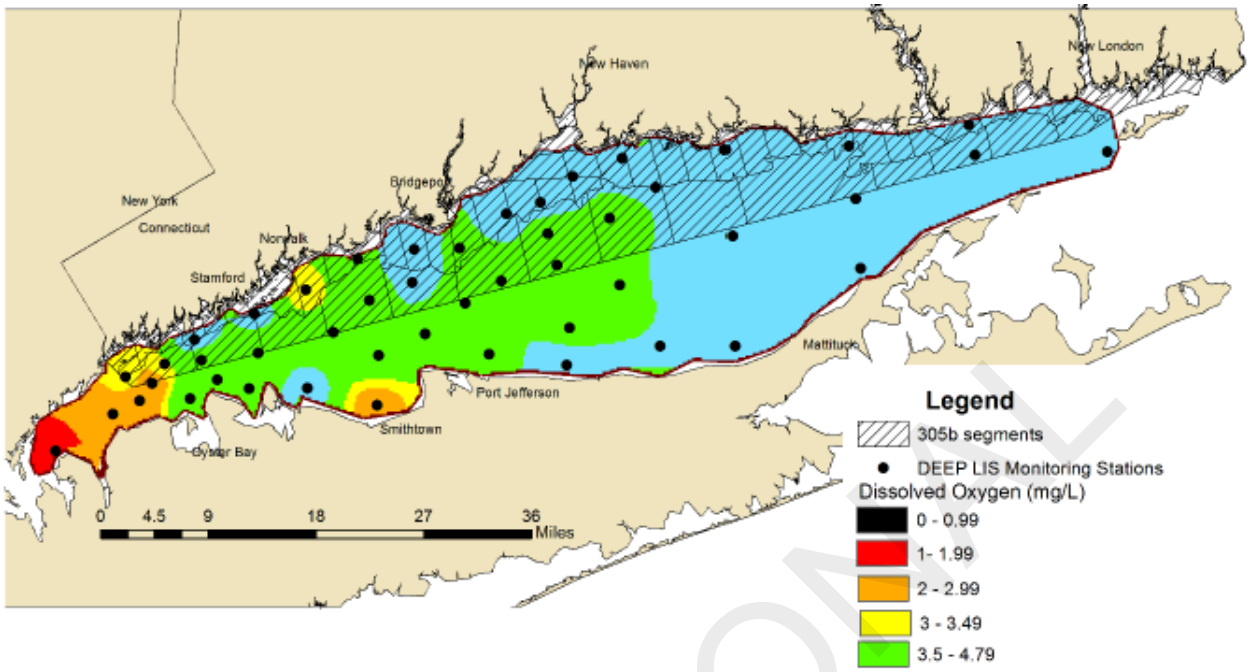

Figure 2.30 - Long Island Sound Hypoxia Concentration Map (CT DEEP, 2022).

Water quality assessments conducted by the CT DEEP focus on indicators such as dissolved oxygen, nutrient concentrations, chlorophyll a, water clarity, dissolved organic carbon, and sediment quality (Save the Sound, 2024). Dissolved oxygen levels are critical for aquatic life health, and between 2019 and 2021, hypoxic conditions (dissolved oxygen below 3.0 mg/L) were recorded in multiple areas, particularly during summer months. Over 10% of monitored sites exceeded the hypoxia threshold, with chronic low oxygen concentrations persisting in certain offshore and embayment areas, impairing the ability of these zones to support aquatic life (Figure 2.30; CT DEEP, 2022). Nutrient pollution, primarily nitrogen from agricultural runoff, urban stormwater, and wastewater discharges, drives eutrophication and harmful algal blooms in the Sound (CT DEEP, 2022).

In recent years, substantial improvements have been made in the Long Island Sound's water quality, primarily due to coordinated efforts targeting nitrogen pollution and enhanced stormwater management. Nitrogen pollution remains a significant concern, driven by discharges from wastewater treatment plants and agricultural runoff; however, wastewater treatment facilities have reduced nitrogen discharges by approximately 70.3% compared to the 1990s baseline (Kraseski, 2023). In 2022 alone, green infrastructure initiatives, such as the installation of permeable pavements, rain gardens, and bioswales in Connecticut municipalities like Bridgeport and Naugatuck, prevented an estimated 3,331 pounds of nitrogen from entering the Sound (Genovesi, 2023). Stormwater

management efforts also contributed significantly to water quality improvements, with approximately 5.3 million gallons of stormwater treated through various interventions to reduce nutrient and contaminant loads (LISS, 2023).

In 2000, the EPA and the states of Connecticut and New York established a Total Maximum Daily Load (TMDL) agreement aimed at reducing nitrogen discharges by 60% from a baseline of 59,000 trade-equalized pounds per day. This target was achieved by 2016, and nitrogen levels have continued to improve since then. In 2023, the average daily load from point sources was 18,252 lbs/day, surpassing the goal by 4,523 lbs/day. This achievement reflects a 69.1% reduction from the original baseline, demonstrating sustained progress in reducing nitrogen pollution and enhancing the health of Long Island Sound (LISS, 2025d), with contributions from the Connecticut shellfish aquaculture industry, which plays an important role in nitrogen removal from the Sound.

Habitat quality assessments, incorporating sediment analyses, benthic community monitoring, and biological surveys, highlight progress and ongoing challenges. Sediment contamination remains a concern, particularly in areas with a history of industrialization, where elevated concentrations of heavy metals and organic pollutants are found (CT DEEP, 2022). These contaminants have been linked to declines in benthic species diversity and abundance, especially in zones affected by hypoxia (CT DEEP, 2022). In response to concerns about nutrient cycling, researchers conducted bio-extraction trials using ribbed mussels (*Geukensia demissa*) in Northport and Huntington Harbors, New York, to assess the mussels' capacity to absorb nitrogen and improve local water conditions (Kraseski, 2023). Additionally, the Unified Water Study monitored 43 locations across Long Island Sound and collected comparable water temperature, clarity, and nutrient levels (LISS, 2023). Despite all this monitoring, offshore marine habitats remain difficult to categorize holistically (Table 2.25).

The water temperature in Long Island Sound has been steadily rising due to shifting environmental conditions, affecting marine ecosystems, water quality, and coastal communities. From 1960 to 2023, the LISS unearthed that the average water temperature for Long Island Sound increased by 3.7 percent (Save the Sound, 2024). Since 1984, there has been a noticeable shift in the types of finfish found in Long Island Sound. Surveys show a steady rise in the number of warm species caught in both spring and fall. While cold-water species have been less common, these trends hold across all seasons, with the most striking increase in warm-water species occurring during the fall, when the Sound experiences its highest temperatures (LISS, 2025c). Despite high overall finfish diversity, the species makeup is increasingly favoring those that thrive in warmer conditions. As water temperature continues to increase, as projected (see Climate section above), fish

populations may continue to shift their distribution or become extirpated from Connecticut's waters (Staudinger et al., 2019; Burgio et al., 2024).

Table 2.25 - Sub-Habitats of the Marine Habitat.

Sub-habitat	Condition
Marine Open Water	Good - Excellent

Subterranean

Habitat Description, Distribution, and Conservation

The distribution of Connecticut's caves is not well documented. In the Northeast region, caves primarily form in calcareous bedrock, including limestone, dolomite, and marble. These sedimentary rocks, originating from ancient marine environments, are highly soluble in mildly acidic water, facilitating the development of caves and underground streams (Anderson et al., 2023). Calcareous formations make up about 6% of the region's geology, supporting alkaline soils (pH 6–8) and a variety of species adapted to these unique conditions (Anderson et al., 2023). Moderately calcareous bedrock, composed of calcareous shales and sandstones, covers approximately 11% of the region and supports cave systems contributing to the state's geological and ecological diversity (Anderson et al., 2023). These geological environments shape the physical landscape and sustain specialized subterranean ecosystems that are increasingly rare across the state.

Species of Greatest Conservation Need in Subterranean Habitats

Regional

The Northeast's subterranean habitats support diverse species, including 15 designated as RSGCN, two proposed RSGCN, and two Watchlist species spanning nine taxonomic groups (Table 2.26). Of the RSGCN species, seven are bats, three are salamanders, and one is a crayfish. The West Virginia Spring Salamander (*Gyrinophilus subterraneus*) is endemic to General Davis Cave in West Virginia, while the Dixie Cavern Salamander (*Plethodon dixi*), proposed for RSGCN status, is endemic to Virginia and known from just three localities, two of which are cave systems. The Greenbrier Cave Crayfish (*Cambarus nerterius*), another RSGCN species, is restricted to cave habitats in West Virginia (TCI & NEFWDTC, 2023). Three additional species associated with subterranean habitats—each a bat—are listed as Watchlist species but have been deferred to adjacent Association of Fish and Wildlife Agencies (AFWA) regions (TCI & NEFWDTC, 2023).

Table 2.26 - The number of species in each RSGCN and Watchlist category associated with the Subterranean Areas habitat in the Northeast as of 2023.

Category	Number of Species
RSGCN	15
Proposed RSGCN	2
Watchlist [Assessment Priority]	2
Watchlist [Deferral to Adjacent Region]	3
Total	22

Connecticut

The only SGCN found in Subterranean habitats are bats (Figure 2.31). As temperatures drop in Connecticut, the Big Brown Bat and other cave-dependent SGCN, such as the Tri-colored Bat, Northern Long-eared Bat, and Eastern Small-footed Bat, migrate regionally to underground spaces to hibernate. These bats select hibernation sites based on environmental suitability, typically favoring abandoned mines, caves, and other subterranean structures where temperatures remain stable between 32°F and 49°F. During hibernation, a bat's body temperature can decrease dramatically from a summer range of 99–106°F to as low as 32°F, slowing its metabolism and conserving winter energy (Testerman, 2019).

Due to a lack of systematic surveys of the state's subterranean habitat (see below), Connecticut's Taxa Teams identified the following issues that affect Connecticut's subterranean SGCN:

- Locate, monitor, and protect maternity colonies, promote healthy insect populations, and improve habitat quality around these locations and hibernacula to support bat populations.
- Identify maternity colonies; invest in artificial hibernacula and explore hibernaculum modification to inhibit *Pseudogymnoascus destructans* (Pd) growth; identify critical foraging habitats to mitigate the impacts of White-nose Syndrome.
- Locate maternity roosts to protect and monitor, research habitat needs, and survey bridges and culverts for roosting sites.

For more information about the issues affecting Connecticut's SGCN and SAPS, see Chapter 3, and for more information about actions that may help, see Chapter 4.

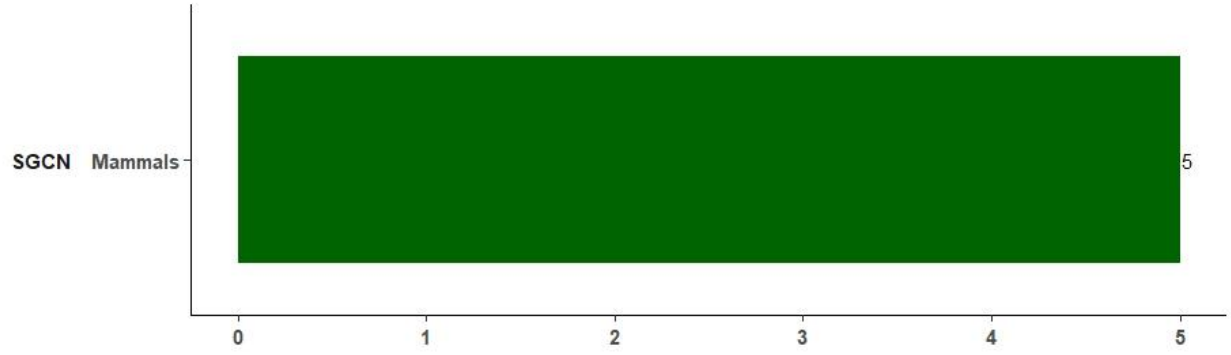

Figure 2.31 - The number of SGCN and SAPS species that can be found in Subterranean habitats.

Subterranean Habitat Condition

Regional

Subterranean habitats in the Northeast are experiencing increasing degradation due to anthropogenic activities and environmental pressures. Physical habitat loss occurs through cave collapses, sinkhole filling, and the intentional closure of cave entrances and abandoned mines (TCI & NEFWDTC, 2023). Hydrological changes, including alterations to groundwater flow and surface water connectivity, further destabilize these fragile systems and threaten the species that rely on them (TCI & NEFWDTC, 2023). Pollution poses a significant threat, with agricultural runoff, illegal waste disposal, and sedimentation frequently contaminating karst systems that are connected to surface and groundwater flows (Streater, 2009). Shifting environmental conditions compound these risks by altering cave microclimates and affecting humidity and airflow in caves, which can pose issues for hibernating bats (Burgio et al., 2024). Despite the ecological importance of subterranean systems, comprehensive assessments of their resilience are lacking. To address this knowledge gap, the Southeast Climate Adaptation Science Center initiated a project in 2022 to evaluate the effect of landscape modifications and climate variability on cave microclimates (TCI & NEFWDTC, 2023).

Anthropogenic subterranean environments, including abandoned mines and tunnels, now serve as vital, though suboptimal, refuges for wildlife in areas where natural caves are limited (TCI & NEFWDTC, 2023). Nearly 50% of the Indiana Bat population in the region depends on these artificial structures for hibernation, underscoring their significance for regional bat conservation (TCI & NEFWDTC, 2023). Although certain caves benefit from localized management and protection under state and federal conservation programs, the region lacks a comprehensive, landscape-scale conservation strategy (TCI & NEFWDTC, 2023). Over the past decade, calcareous areas throughout the region have

experienced an 84% decline in connectivity, heightening the vulnerability of species that rely on these isolated habitats (Anderson et al., 2023).

Connecticut

Since many of Connecticut's caves have yet to be censused systematically, the condition of our Subterranean habitat is unknown (Table 2.27). However, these habitats and the species that rely on them face growing threats from land-use changes, warming climates, groundwater contamination, and habitat fragmentation (TCI & NEFWDTC, 2023).

Table 2.27 - Condition of Subterranean Habitat.

Sub-habitat	Condition
Subterranean Areas	Unknown

Developed

Developed Habitat Description, Distribution, and Conservation

More than 14.6 million acres of the Northeast landscape have been developed, with further development increasing steadily over time (Anderson and Olivero-Sheldon, 2011; Anderson et al., 2023). Massachusetts, Rhode Island, and Connecticut are the most developed in the Northeast (Anderson et al., 2023). As of 2020, Connecticut had 2,783,060 acres of land classified as urban or developed. Among the New England states, Connecticut ranks among the most developed, with urbanization trends expected to continue (Anderson et al., 2023). Typically, Developed Areas are artificial features and structures used by wildlife, including urban parks and utility line corridors (TCI & NEFWDTC, 2023).

Municipal and privately owned open spaces, such as public parks, playgrounds, golf courses, campgrounds, and cemeteries, can contribute significantly to the region's green infrastructure and habitat availability (Anderson et al., 2023). These areas provide ecological connectivity within urban landscapes, supporting pollinators, birds, and other wildlife. A recent update to Connecticut's conservation lands database, conducted in 2022 by the Connecticut Land Conservation Council and The Last Green Valley Protected Open Space Mapping Project, has improved the accuracy of conservation data for urban parks and green spaces. This effort ensures that newly conserved urban lands are documented and integrated into statewide conservation planning (TCI & NEFWDTC, 2023). Urban forests are a prominent feature of Connecticut's landscape, particularly given the state's high population density. Connecticut has the highest urban tree cover in the nation, with nearly 62% of urban areas covered by trees (CT DEEP, 2020). Urban trees help

improve air and water quality, mitigate urban heat island effects, and provide habitat for wildlife (EPA, 2008), including some of Connecticut's SGCN (see below).

Utility line rights-of-way represent an often-overlooked but ecologically significant component of Connecticut's Developed Area habitat network. While these corridors are maintained for electrical and communication infrastructure, they provide habitat connectivity within fragmented landscapes. Utility corridors are typically cleared of trees and large vegetation, often supporting a mix of grasses, shrubs, and wildflowers that help create habitats for pollinators, small mammals, and birds (Anderson et al., 2023). Utility rights-of-way can serve as critical movement corridors for species in otherwise urbanized settings, helping to mitigate habitat fragmentation (Anderson et al., 2023).

Many programs and initiatives aim to enhance Developed Areas for wildlife, address urban wildlife management challenges, and promote habitat improvement (McCance et al. 2017). These efforts include guidance and certification for wildlife-friendly landscapes, urban forestry programs, and strategies to mitigate specific hazards such as light pollution, collisions with glass, and wildlife-vehicle interactions. National and regional organizations provide technical, financial, and educational resources to support these initiatives. Programs focus on creating pollinator-friendly gardens, bird-safe environments, urban forests, and wildlife-friendly infrastructure. Certification and outreach efforts often involve signage and public education to raise awareness. Additionally, federal programs support research and implementation of wildlife conservation strategies in urban and suburban settings (TCI & NEFWDTC, 2023). Below is a list of programs and links.

Programs for Improving Developed Areas for Wildlife

- National Wildlife Federation (NWF) Certify Wildlife Habitat Program: Certifies spaces like yards, gardens, and schoolyards that provide essential elements for wildlife, such as food, water, cover, and places to raise young. Learn more here.
- North American Butterfly Association Butterfly Garden Certification: Recognizes gardens that support butterflies by including specific host and nectar plants and avoiding pesticide use. Find more information here.
- Pollinator Pathways: This organization aims to de-fragment the CT landscape by encouraging landowners to turn private property into stepping-stones that create a connected corridor of native plants. Learn more here.
- Xerces Society Pollinator Protection Pledge: Encourages individuals and communities to commit to actions that support pollinators, such as planting pollinator-friendly flowers and avoiding the use of pesticides. Take the pledge here.

- Monarch Watch Monarch Waystations: Certifies habitats that support monarch butterflies by providing milkweed and nectar sources. Learn how to create and register a waystation here.
- National Audubon Society Bird-Friendly Initiatives:
    - *Plants for Birds*: Guides the creation of native plant gardens to support bird populations. Explore native plants for your area.
    - *Bird-Friendly Building Program*: Addresses threats like light pollution and glass collisions to make urban environments safer for birds. Learn about bird-friendly building practices.
- American Bird Conservancy Bird-Friendly Life: Identifies simple steps to contribute to bird conservation in your home and yard. Learn about these simple steps.
- U.S. Forest Service (USFS) Urban and Community Forestry Program: Assists communities aiming to improve urban tree canopies and green spaces. Discover more about the program.
- Arbor Day Foundation Tree City USA Program: Offers a framework for cities and towns to manage and expand their public trees, promoting urban forestry. See how your community can become a Tree City USA.
- USDA Animal and Plant Health Inspection Service (APHIS) Wildlife Conflict Management:
    - *Airport Wildlife Hazards Program*: Works to reduce wildlife hazards at airports, enhancing safety for both wildlife and air travelers. Learn about their initiatives.
    - *Wildlife Services Program*: Managing conflicts between wildlife and human activities in various settings. Find more information here.
- Wildlife-Vehicle Collision Mitigation Programs:
    - *USFS Highway Crossing Structures Guide*: Guides designing road crossings that facilitate safe wildlife movement. Access the guide here.
    - *Federal Wildlife Crossings Pilot Program*: Offers grants for projects to reduce wildlife-vehicle collisions and improve habitat connectivity. Learn about funding opportunities.

In addition to those above, national and regional programs to improve habitat conditions in Developed Areas for wildlife, Connecticut offers many programs through CT DEEP partner programs to enhance habitat for urban wildlife (see Chapter 6).

Species of Greatest Conservation Need in Developed Habitat

Regional

Developed Areas in the Northeast provide essential habitats for 37 RSGCN and related conservation categories. These species span eight taxonomic groups, utilizing urban parks, gardens, buildings, and other artificial structures for survival. Urban environments, while often considered inhospitable to wildlife, support diverse species that have adapted to human-modified landscapes (TCI & NEFWDTC, 2023). Within Developed Areas, regional experts classified 12 species as RSGCN, two species as Proposed RSGCN,15 species under Watchlist (Assessment Priority), and eight species under Watchlist (Deferred) (Table 2.28; TCI & NEFWDTC, 2023).

Several RSGCN species have demonstrated successful adaptation to urban environments. The Least Tern uses gravel rooftops as surrogate nesting sites, mimicking the open, sandy habitats it historically relied upon. Once critically endangered, the Peregrine Falcon (*Falco peregrinus*) has thrived in urban landscapes by nesting on high-rise buildings and bridges, which provide elevation and structural features similar to those found in natural cliffside nesting sites. Pollinator species, including the Monarch (*Danaus plexippus*) and various Bumble and Solitary Bees, can use urban gardens, parks, and green spaces for nectar resources and reproduction. Additionally, multiple bat SGCN use artificial structures such as bridges, culverts, and buildings for roosting, highlighting the need to integrate conservation strategies and infrastructure planning to support these and other species (TCI & NEFWDTC, 2023).

Table 2.28 - The number of species in each RSGCN and Watchlist category associated with Developed Areas habitat in the Northeast as of 2023.

Category	Number of Species
RSGCN	12
Proposed RSGCN	2
Watchlist [Assessment Priority]	15
Watchlist [Deferral to Adjacent Region]	8
Total	37

Connecticut

While many people may not think Developed Areas are habitats for many species aside from maybe Grey Squirrels, Pigeons, and House Sparrows, many would be surprised to see

that a good amount of Connecticut's SGCN and SAPS can be found in these habitats (Figure 2.32). While Developed Areas tend to be heavily impacted by human activity, the Taxa Teams identified a handful of issues that face these species and some actions that may benefit them:

- Enforce stricter protections for nesting colonies in developed regions to reduce human disturbance.
- Reduce disturbance in coastal areas through increased outreach and regulation to protect vulnerable species.
- Improve urban land management to enhance water quality and reduce pollution impacts on nearby wetlands and estuaries.
- Prevent development near key conservation areas, ensuring buffer zones to protect sensitive species and maintain ecological connectivity.

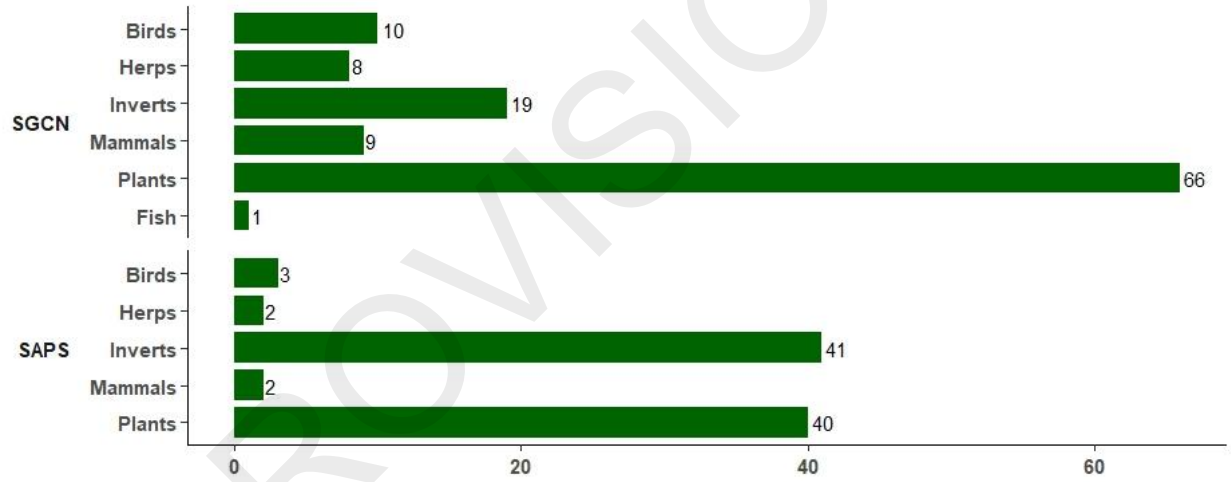

Figure 2.32 - The number of SGCN and SAPS species per Taxonomic Group found in developed areas.

Developed Habitat Condition

Regional

Developed Areas in the Northeast provide habitat for various species, but urbanization has significantly altered the landscape. More than 14.6 million acres of the Northeast have undergone development, with a trend of increasing development over time. Among the New England states, Massachusetts, Rhode Island, and Connecticut have experienced the highest levels of development (Anderson and Olivero-Sheldon, 2011; Anderson et al., 2023). Urban expansion has led to the conversion of multiple natural habitat types, thereby

reducing the available space for native species and creating fragmented and degraded ecosystems.

Conservation planners use spatial modeling tools such as the Designing Sustainable Landscapes (DSL) project to assess habitat conditions and predict future development. This initiative has classified 21,809,856 acres of Developed Areas in the Northeast, encompassing buildings, roadways, bridges, dams, and railways. Updated models forecast the extent of Developed Areas for 2040 and 2080, allowing researchers and conservationists to anticipate challenges and plan accordingly (McGarigal et al., 2018).

Multiple organizations offer certification programs for bird and pollinator-friendly habitats, urban forestry, and canopy tree restoration (TCI & NEFWDTC, 2023). Additionally, conservation programs target specific threats, such as light pollution, glass collisions, and the impacts of transportation infrastructure on bats and other wildlife (McCance et al. 2017). Programs such as the National Wildlife Federation's Certified Wildlife Habitat, the North American Butterfly Association's Butterfly Garden Certification, Pollinator Pathway, and Monarch Watch's Monarch Waystation program provide guidance and public engagement opportunities to enhance wildlife habitat in urban settings.

Connecticut

As of 2020, Connecticut had 2,783,060 acres classified as urban or developed land, making it one of the most heavily developed states in the Northeast (Anderson et al., 2023), while also being heavily forested. Urbanization pressures continue to increase, particularly in areas already experiencing high levels of development. The state's wildland-urban interface now encompasses more than 65% of its total land area, a percentage expected to increase as new development occurs (Anderson et al., 2023).

Projections for 2040 and 2080 indicate that urban expansion will continue, further reducing available natural habitat and increasing habitat fragmentation. The Designing Sustainable Landscapes (DSL) project models forecast growth in developed land, with Connecticut expected to experience significant land conversion in suburban and exurban areas. Expanding transportation corridors, commercial developments, and residential zones will contribute to ongoing habitat loss, particularly in regions adjacent to existing urban centers (McGarigal et al., 2018).

At the county level, the highest projected urban growth by 2040 and 2080 is expected in Fairfield, New Haven, and Hartford counties, where population density and economic activity are greatest (McGarigal et al., 2018). These areas are likely to experience increased impervious surface coverage, which will affect water quality and habitat

connectivity. In contrast, Litchfield and Windham counties are projected to retain more open space, though localized development pressures remain a concern (McGarigal et al., 2018; TCI & NEFWDTC, 2023).

Habitat loss in Connecticut's developed areas will primarily affect species that depend on fragmented green spaces, urban forests, and artificial structures. Expanding suburban landscapes will disproportionately impact pollinators, urban-adapted birds, and species reliant on tree canopy connectivity (Anderson et al., 2023). Additionally, recent pest outbreaks, including the emerald ash borer and spongy moth, have caused widespread tree mortality, increasing the need for proactive management and replanting efforts (CT DEEP, 2020). However, given the variety and dynamic nature of the Developed Area habitat, conditions vary depending on location and development activity (Table 2.37).

Table 2.37 - Sub-Habitats of the Developed Area Habitat.

Sub-habitat	Condition
Urban and Man-made Features	Variable
Public Utility Transmission Corridors	Variable

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