Chapter 2: Key Habitats, Sub-habitats, and Vegetative Communities in Connecticut

Connecticut's landscape ranges from coastal plains in the southern portion of the state to mountain ridges and valleys in the northwest and northeast corners, separated by the broad Central Valley and Metacomet Ridge (Dowhan and Craig 1976). The distribution and abundance of Connecticut's wildlife are directly related to the condition and location of wildlife habitats. The state's varied climate, geology, soil types, topography, and watersheds support a wide range of vegetative communities that provide diverse habitats for its wildlife. The landscape and waterscape diversity provide a complex ecological framework, resulting in unequal distribution of wildlife species in the state, especially those at the northern and southern edges of their habitat range (Dowhan and Craig 1976, Metzler and Tiner 1992, Klemens 1993). Metzler and Wagner (1993) have described 13 imperiled communities, including flora and fauna, that are most in need of conservation in Connecticut.

Connecticut's Landscape

Physiography

Connecticut includes a diverse physiography. The state's irregular shoreline includes rocky headlands, pocket beaches, barrier spits, coves, embayments, and islands (Bell 1985, Patton and Kent 1992). The sandy ridge and swale coastal plain topographies extend as far as 10 to 15 miles inland to the fall line (Bell 1985). The Central Valley is divided by the north-south Metacomet volcanic traprock ridge and talus slopes, rising one thousand feet or more above the valley floor.

The physiography of Connecticut includes the Northwest Highlands, where the Appalachian Mountains extend through the state, the Central Valley with the Connecticut River Valley running through it, and the Eastern Uplands or Highlands region. The Southwest and Windham Hills are areas within the Piedmont and have rolling hills that have been shaped by Connecticut's glacial history. The Coastal Plain forms a relatively narrow band along Long Island Sound in the southern portion of the state. New York borders Connecticut to the west (and the south across Long Island Sound). Massachusetts forms the northern border and Rhode Island the eastern border (Figure 2.1, page 2-2).

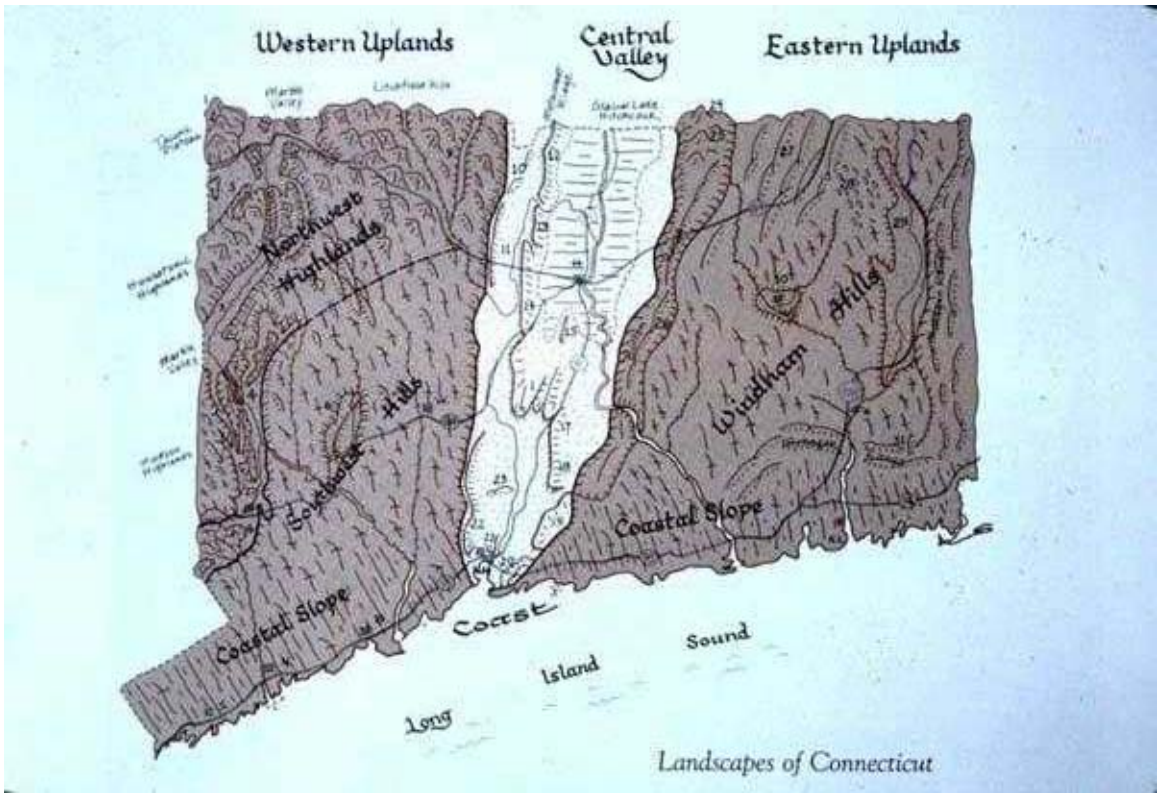

Figure 2.1 Physiography of Connecticut (Source: Bell 1985)

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, Mount Frissel (2,380 ft.), and nearby Bear Mountain (2,316 ft.), the highest mountain located completely within the state (Bell 1985, Patton and Kent 1992). The rolling hills of the Southwest Upland area were formed by glacial erosion and deposition approximately 18,000 years ago. The Northeast Highland's ridge and valley topography includes the north-south Bolton and Tolland Mountain Ranges, as well as the Mohegan Range, the only east-west range in southern New England. These higher elevations slope into rolling areas, such as the Windham Hills, grading generally from 1,100 to 500 feet toward the southeast region of the state (Bell 1985, Figure 2.1).

Geology

The sand and gravel deposits of the Coastal Plain were created by glacial erosion and outwash from underlying bedrock. The bedrock of the Western and Eastern Highlands is mainly Paleozoic Era igneous granites, gneisses, and metamorphic schists folded into north-south belts. Metamorphosed limestone of Paleozoic age underlies the appropriately named Marble Valley and others in the west. The Central Valley has considerably younger bedrock of Triassic and Jurassic age, sedimentary brownstone, and shale with intrusive, erosion-resistant igneous basalts forming the distinctive Metacomet Ridge (Metzler and Barrett in press) (Figure 2.2, page 2-3).

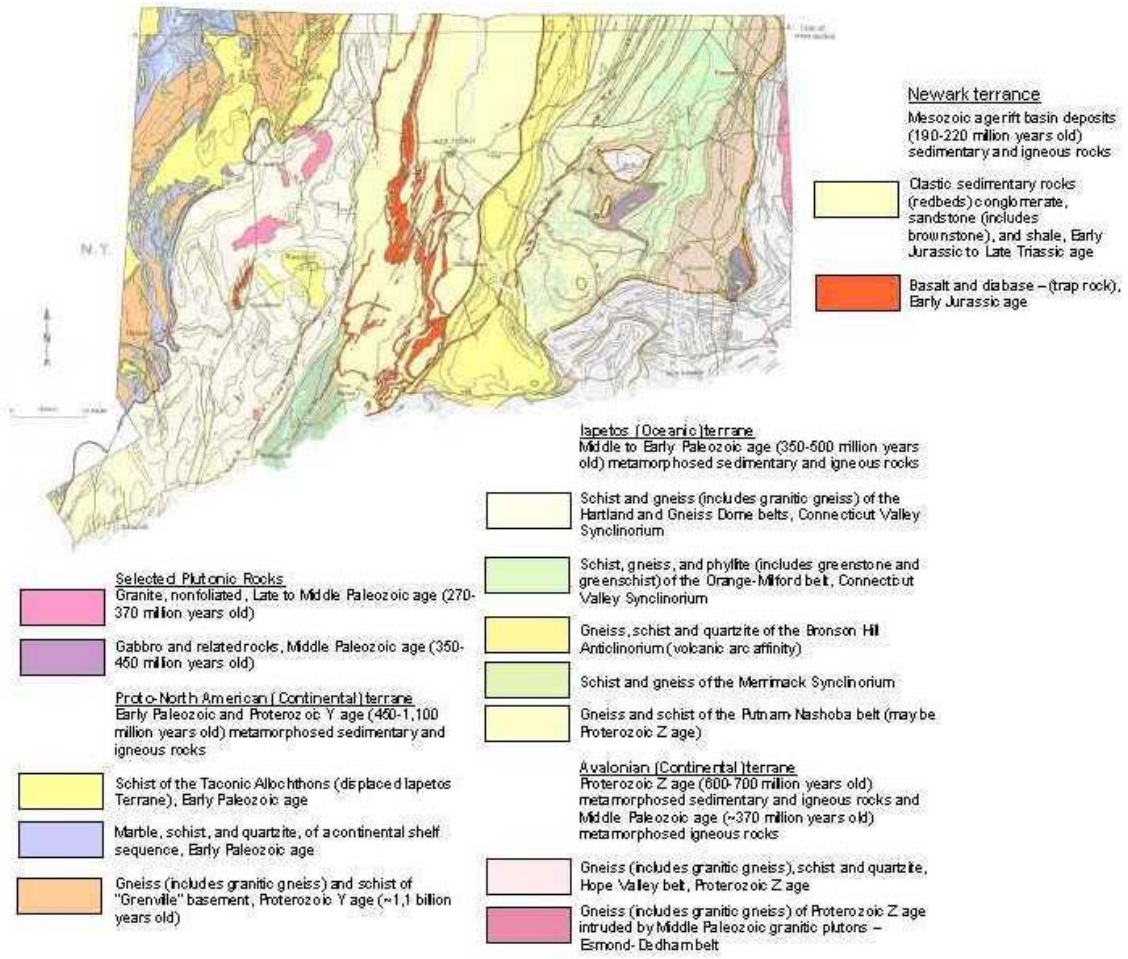

Figure 2.2 Geology of Connecticut (Source: DEP's Geological and Natural History Survey 1996)

Soils

Soil types vary with geology, being derived primarily from the underlying bedrock of the region. The fertile soils of the Central Valley were formed through a combination of fine-grained glacial lake sediments and loamy or sandy alluvial deposits. Glacial till soils in the Western and Eastern Highlands, derived from crystalline rocks, tend to be rocky with little organic accumulation. Most soils are geologically young, having formed during the Wisconsin age or more recently under hardwood forests. Organic soils also 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 in press). (Figure 2.3, page 2-4).

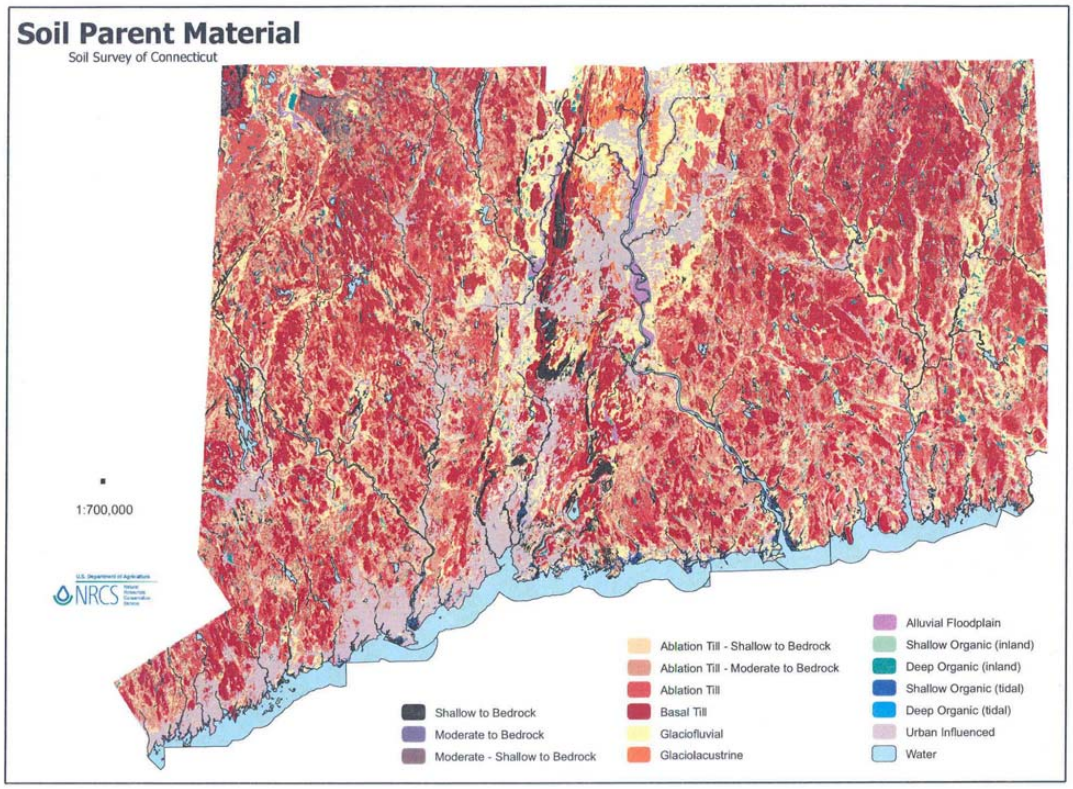

Figure 2.3 Soils of Connecticut

Climate

Connecticut's climate is influenced by the interaction between continental air from the prevailing westerly winds and warm moist maritime air carried north from the Caribbean Sea (Metzler and Barrett in press). The local climate varies with topography, from coastal to montane, tending in winter toward rain on the coast and snow in the mountains. Temperature, snowfall, and length of frost-free season vary with elevation and distance from the coast (Metzler and Tiner 1992). In general, Connecticut has a wide temperature range, both daily and seasonally. Precipitation is equally dispursed throughout the year while the growing season extends from mid-April to mid-October. Climatic extremes, such as hurricanes, tornadoes, droughts, and ice storms, occasionally occur (Metzler and Barrett in press).

Connecticut's Waterscape

Connecticut is home to a varied waterscape, from mountain streams to tidal creeks, lakes and ponds, and Long Island Sound. These waterscapes support a variety of wildlife resources, including freshwater, estuarine, and marine species. As with topography, the diverse hydrology influences the distribution and abundance of Connecticut's fish and wildlife species (Metzler and Tiner 1992).

Rivers and Streams

There are approximately 5,830 miles of rivers and streams in Connecticut (CT DEP 2004). The state has seven major drainage basins (Figure 2.4), all of which drain into Long Island Sound:

1. Housatonic River, with Naugatuck and Shepaug Rivers and other tributaries;
2. Connecticut River, with Farmington River and other tributaries;
3. Thames River, with Shetucket and Quinebaug Rivers and other tributaries;
4. Southwest Coastal, including the Saugatuck River;
5. Southcentral Coastal, including the Quinnipiac River;
6. Southeast Coastal; and
7. The Pawcatuck River.

The Hudson River drainage basin also is included in Figure 2.4 as one of the basins in Connecticut, but it is restricted to a small area of the southwest corner of the state and is an important drainage basin in adjacent New York.

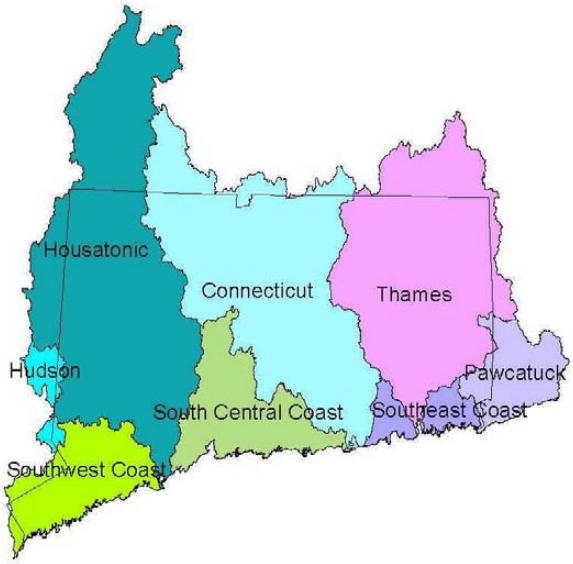

Figure 2.4 The Major Drainage Basins of Connecticut (Source: CT DEP, 1981. *Natural Drainage Basins in Connecticut (map).* Natural Resources Center, Hartford, CT)

All of Connecticut's major rivers have tributaries in other states and some in Canada. The Housatonic River drainage basin includes areas of Massachusetts and New York. The Connecticut River starts in New Hampshire and flows through Vermont and Massachusetts. The Thames River receives water from Massachusetts and Rhode Island. The Pawcatuck River also receives water from Rhode Island. In addition, two smaller drainage basins in western Connecticut drain into the Hudson River in New York.

The Connecticut DEP Bureau of Water Management implemented a Rotating Basin Monitoring Strategy from 1996 to 2001 (CT DEP 1999). Figure 2.5, (page 2-6) shows assessed river segments as reported in the 2004 Connecticut Water Quality report to Congress (CT DEP 2004) These segments were assessed according to their ability to

support aquatic life as described in Connecticut Water Quality Standards (CT DEP 2002). Use support status was determined by examination of all available physical, chemical, and biological data.

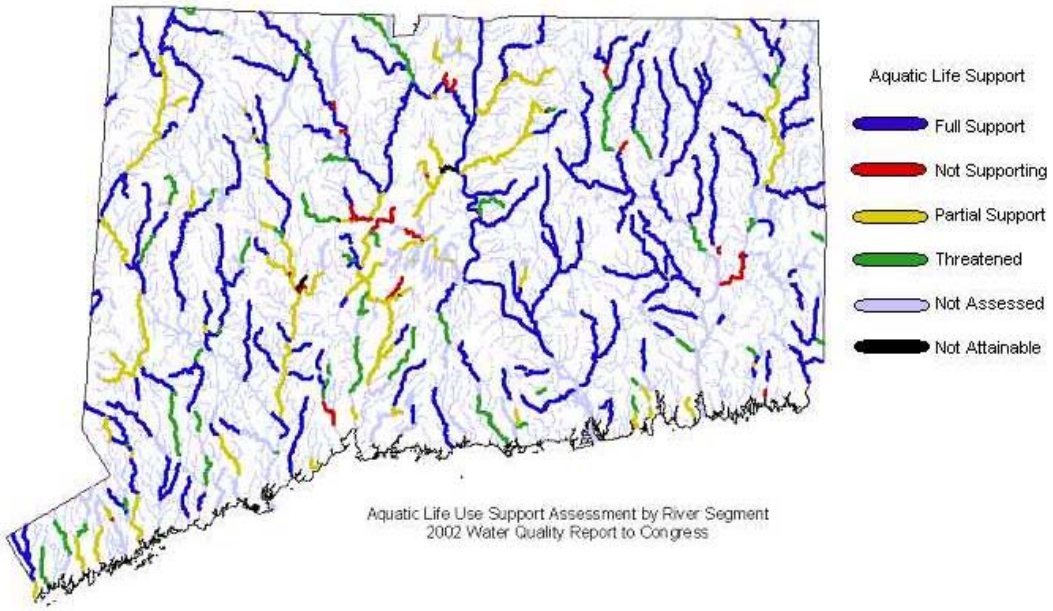

Figure 2.5 Aquatic Life Use Support Assessment (Source: CT DEP 2004)

Many of Connecticut's waters have received state, national, and international recognition for their importance to fish, wildlife, and the public. The lower tidelands of the Connecticut River have been designated one of the Western Hemisphere's 40 "Last Great Places" by The Nature Conservancy, an American Heritage River by the President of the United States in 1999, one of the most important ecological landscapes in the country by the U.S. Department of Interior, and one of 18 wetlands of international importance by the Ramsar Convention. The U.S. Congress and National Park Service (NPS) have also designated the Quinebaug and Shetucket River valleys in northeastern Connecticut as a National Heritage Corridor. NPS has officially added the West Branch of the Farmington River as a "Wild and Scenic River." Connecticut DEP's Water Management Bureau has ongoing assessment and monitoring programs (CT DEP 2004a). The USFWS National Wetlands Inventory monitors the status and trends of wetlands in Connecticut (Figure 2.6, page 2-7), as well as in other states, and can be viewed online at http://www.nwi.fws.gov .

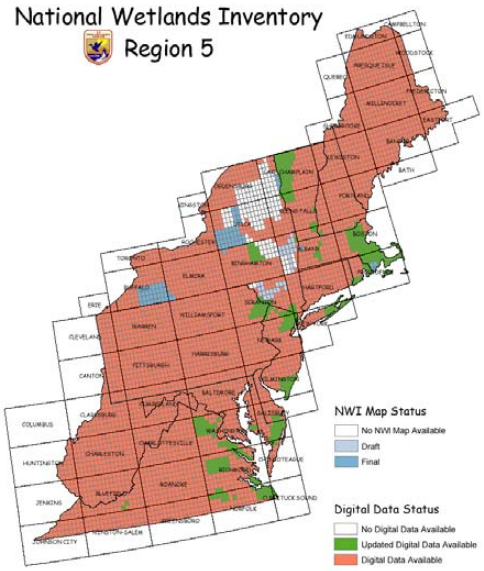

Figure 2.6 NWI Wetlands Map (Source: USFWS NWI)

Lakes and Ponds

Connecticut has approximately 2,300 lakes, ponds, and reservoirs. Most of the lakes and ponds were created during the last glacial retreat, but a fair number of man-made reservoirs 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 outstanding aquatic habitat and fisheries (Table 2.1, page 2-16). Many of the smaller lakes and ponds, such as Honey Hill in New Hartford and Trail Wood in Hampton, have been preserved by NGOs and local governments for their value to fish and wildlife resources and to local residents (CT DEP 2004a). Detailed information on the distribution and relative condition of lakes and ponds in Connecticut is found in the annual DEP Water Bureau 305d Report and other water quality assessment efforts (CT DEP 2004a).

Wetlands

Wetlands in Connecticut include salt marshes, brackish and freshwater tidal marshes, emergent wetlands, scrub-shrub marshes, and forested wetlands, among others. These wetlands provide an incredible variety of habitats and consequently are key to maintaining biodiversity in Connecticut. Many of Connecticut's Greatest Conservation Need (GCN) species are dependent upon wetlands for all or part of their life cycles.

Based on the National Wetlands Inventory maps and definition, palustrine wetlands comprise nearly 90% of Connecticut's wetlands (152,000 acres). They include tidal freshwater marshes, as well as inland wetlands dominated by shrubs, trees, and herbaceous vegetation. Connecticut also has about 17,500 acres of estuarine tidal

wetlands (Metzler and Tiner 1992). While it is difficult to quantify historical losses, Metzler and Tiner (1992) estimated that Connecticut has probably lost between one-third and one-half of its original wetlands, with urban and coastal areas losing more acreage than rural areas.

In recent history, wetland loss has been diminished greatly by protection afforded these habitats by the Tidal Wetland Act of 1969 and the Inland Wetlands and Watercourses Act of 1972. In addition, the DEP has a Wetland Restoration Program that has restored over 2,000 acres of degraded tidal marshes and 200 acres of inland wetlands since the 1970s. Continued protection and ongoing restoration and enhancement efforts for wetlands will be critical to the conservation of GCN species.

Estuaries

Long Island Sound (LIS), created by retreating glaciers, forms the southern boundary of Connecticut. The biodiversity of estuaries is due to the mixing of freshwater with saltwater from the ocean. Long Island Sound encompasses 612 square miles in Connecticut; its watershed covers 16,820 square miles in Connecticut and New York, receiving 90% of its freshwater from the three major rivers of Connecticut. It 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 estuary is approximately 110 miles long east-to-west, and 21 miles wide at its broadest point, covering 1,300 square miles. Mid-Sound depths range between 60 to 120 feet, with salinity ranges from 23 to 35 parts-per-thousand (EPA LISO 1994, 2004). Significant conservation efforts and programs have focused on LIS and provide detailed information on the relative condition of this important estuary (EPA LISO 2004). Of special interest is the recent, cooperative LIS Stewardship Plan involving multiple federal, state, and regional partners (U.S. EPA draft), as well as the Coastal and Estuarine Land Conservation Program (CELCP) plans to assess coastal resources (US EPA LISO 2004). Ecologically important areas of LIS are shown in Figure 2.7 (page 2-9).

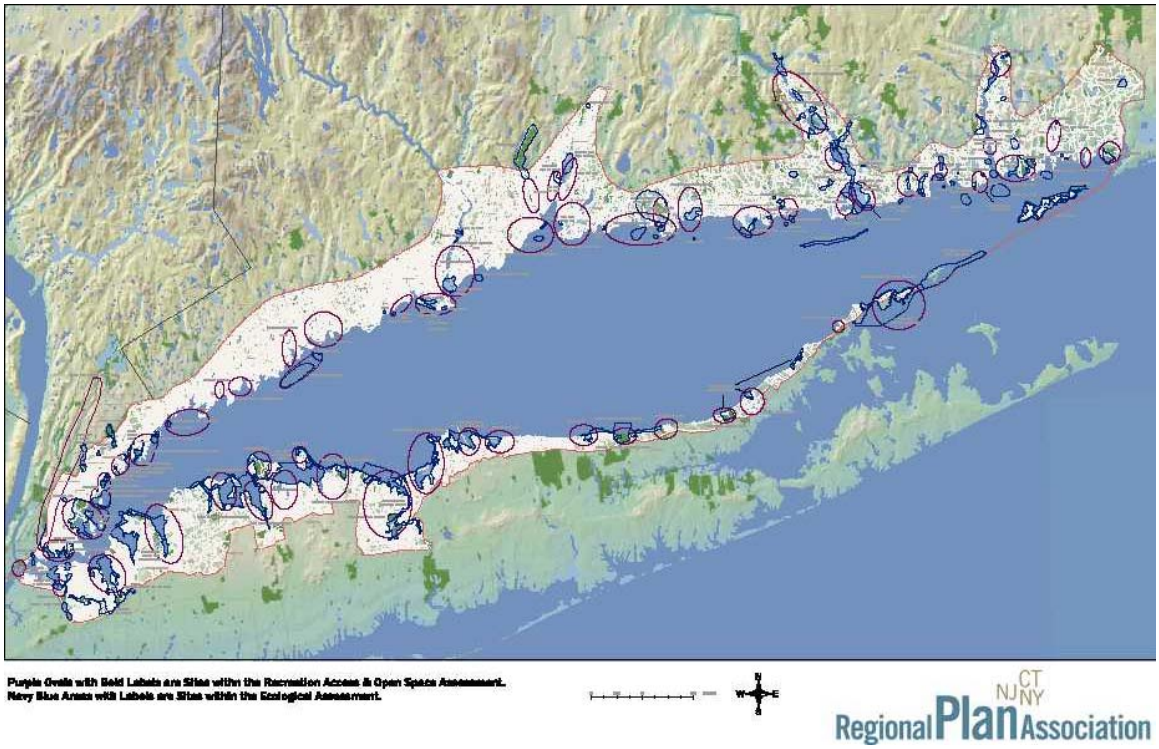

Figure 2.7 LIS Stewardship Initiative Ecological Areas (Source: EPA 2004)

Ecosystem Classifications

Several ecosystem classification systems have been applied to the Connecticut landscape. In 1976, Dowhan and Craig subdivided Connecticut into 11 climatic bio-geographical units based on the physical and ecological variation in the state. Each of their "ecoregions" is distinguished from the others based on physical and biological attributes. Their purpose was to describe the distribution of species, especially rare or range-limited species that could serve as "indicator" species, within their landscape (Dowhan and Craig 1976).

In 1995, Bailey provided descriptions of the ecoregions of the U.S. Forest Service classification system (McNab and Avers 1994, Bailey 1995). According to Bailey, Connecticut falls within two ecological provinces, of which most of the state falls within the Appalachian Oak Forest Section of the Eastern Broadleaf Forest (Oceanic) Province. The Nature Conservancy (TNC) adapted Bailey's system (1995) to classify ecoregions for its regional planning effort (Figure 2.8, page 2-10) (Groves et al. 2002). Like Bailey's classifications, the majority of Connecticut falls within TNC's Lower New England – Northern Piedmont Ecoregion. However, TNC includes Connecticut's coastal plain in the North Atlantic Coast Ecoregion (Sneddon and Lundgren 1998, Beers and Davison 1999, Barbour et al. 2003).

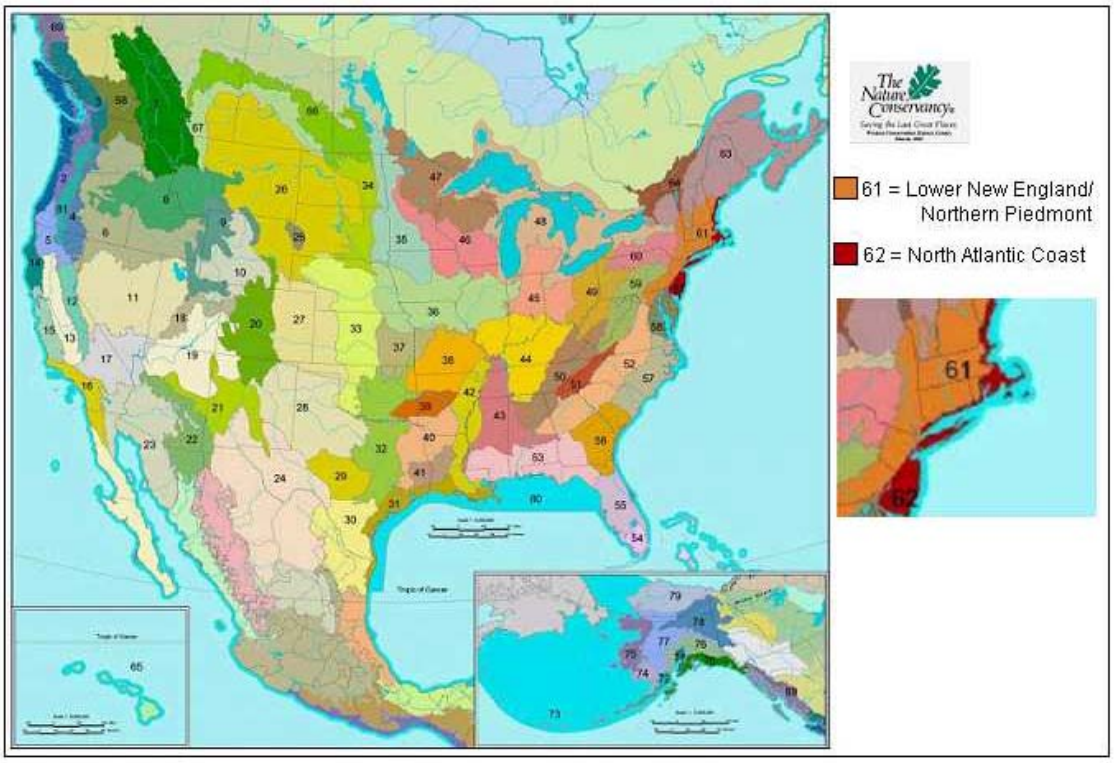

Figure 2.8 TNC Ecoregion System (Source: TNC website)

In 1998, the North American Bird Conservation Initiative, in conjunction with Partners In Flight (PIF), developed its Bird Conservation Regions (BCR) based on TNC's Ecoregions. Connecticut falls within three BCRs: the New England and Mid-Atlantic Coast BCR (#30), the Atlantic Northern Forest BCR (#14), and the Appalachian Mountain BCR (#28) (Hodgman and Rosenberg 2000, Detmers and Rosenberg 2000) (Figure 2.9, page 2-11).

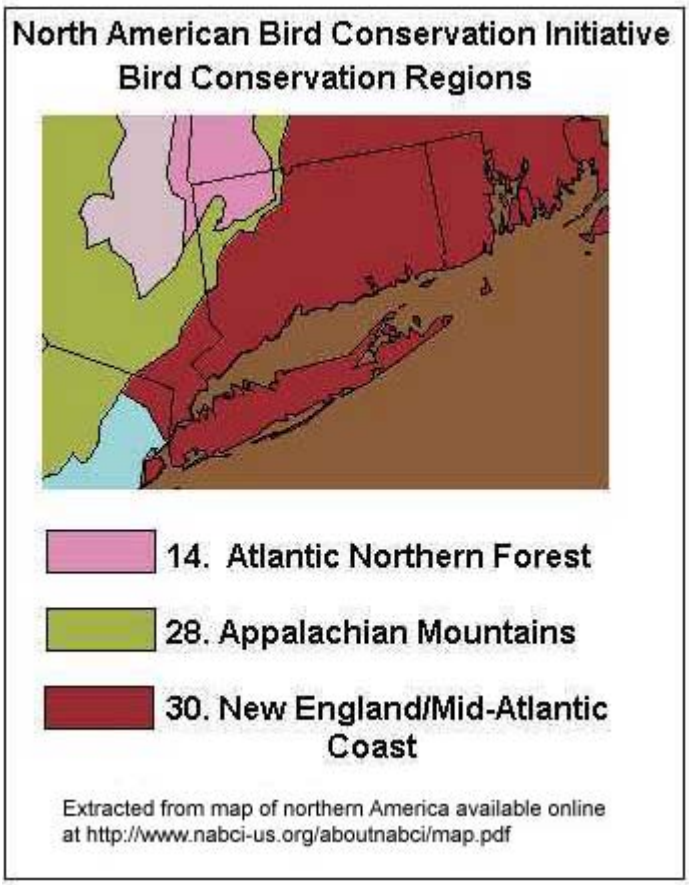

Figure 2.9 North American Bird Conservation Initiative Bird Conservation Regions (Source: NABCI website)

The most current ecoregion classification for Connecticut, which is shown in Figure 2.10 (page 2-12), corresponds with the habitat classification used in this CWCS. Metzler and Barrett (in press) modified Keys et al., "Ecological Units of the United States" (1995) to develop this ecoregion classification system. This system consists of eight classifications:

- Berkshire Vermont Uplands (BVU),
- Taconic Mountains (TM),
- Western Connecticut [Hudson Highlands] (WCT),
- Connecticut Valley [Lower Connecticut River Valley] (CT Valley),
- Eastern Connecticut [Southern New England Coastal Hills and Plains] (ECT),
- Connecticut Coast [Southern New England Coastal Lowlands] (COAST),
- Worcester/Monadnock Plateau (WM), and
- Long Island Sound (LIS).

Most of Connecticut is part of the Oak Dominated Forest of the Eastern Broadleaf Forest Province, and only the northwestern corner of the state includes areas within the Northern Hardwoods Forest of the Laurentian Mixed Forest Province (Metzler and Barrett, in press).

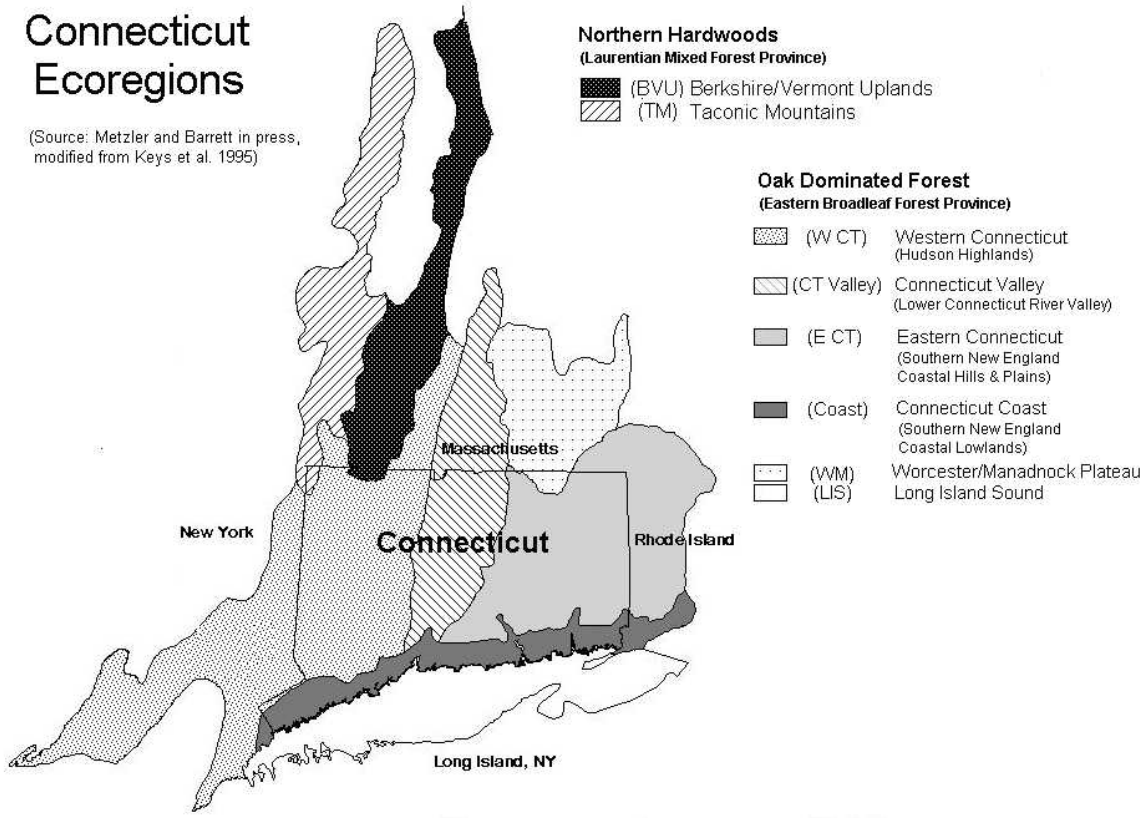

Figure 2.10 Connecticut Ecoregions (Metzler and Barrett, in press)

Vegetative Communities

Three recognized, standardized classification systems have been used to describe Connecticut's vegetated landscape. Each system is described briefly, as it was used in developing Connecticut's key wildlife habitats that are described below.

The National Vegetation Classification Standard (NVCS) was established in 1997 as the standard vegetation classification system for federal agencies (Federal Geographic Data Committee 1997). The NVCS uses a hierarchy of nine levels, using seven levels of physiognomic factors (such as climatic, environmental, and structural characteristics) at the coarse scale and two levels of floristic factors (such as dominant and indicator species) at the fine scale (FGDC 1997, Comer et al. 2003).

A second system of vegetation classification, developed by NatureServe, was derived from a consortium of state natural heritage programs and conservation agencies and organizations (primarily TNC) involved in fish and wildlife conservation. The classification was established as a database system for natural heritage data in the United States (Comer et al. 2003) and uses the fine-scale floristic levels of the NVCS system to categorize land cover.

Metzler and Barrett (in press) have developed an updated Vegetation Classification for Connecticut (Appendix 2a). This new classification system uses the regional landscape approaches of Bailey (1995) and Dowhan and Craig (1976), but it is tailored more to the localized influences of Connecticut's relief, surficial features, and major drainage patterns on vegetation community distribution than to climate. This classification represents the best available description of vegetative communities in Connecticut.

The Southern New England Gap Analysis Program (SNE-GAP) produced predictive maps of the vegetative communities of Massachusetts, Connecticut, and Rhode Island using the NVCS system to define terrestrial habitats (Zuckerberg et al. 2004). Such maps are useful at planning and regional scales and for further modeling of species distribution according to their habitat associations (Figure 2.11).

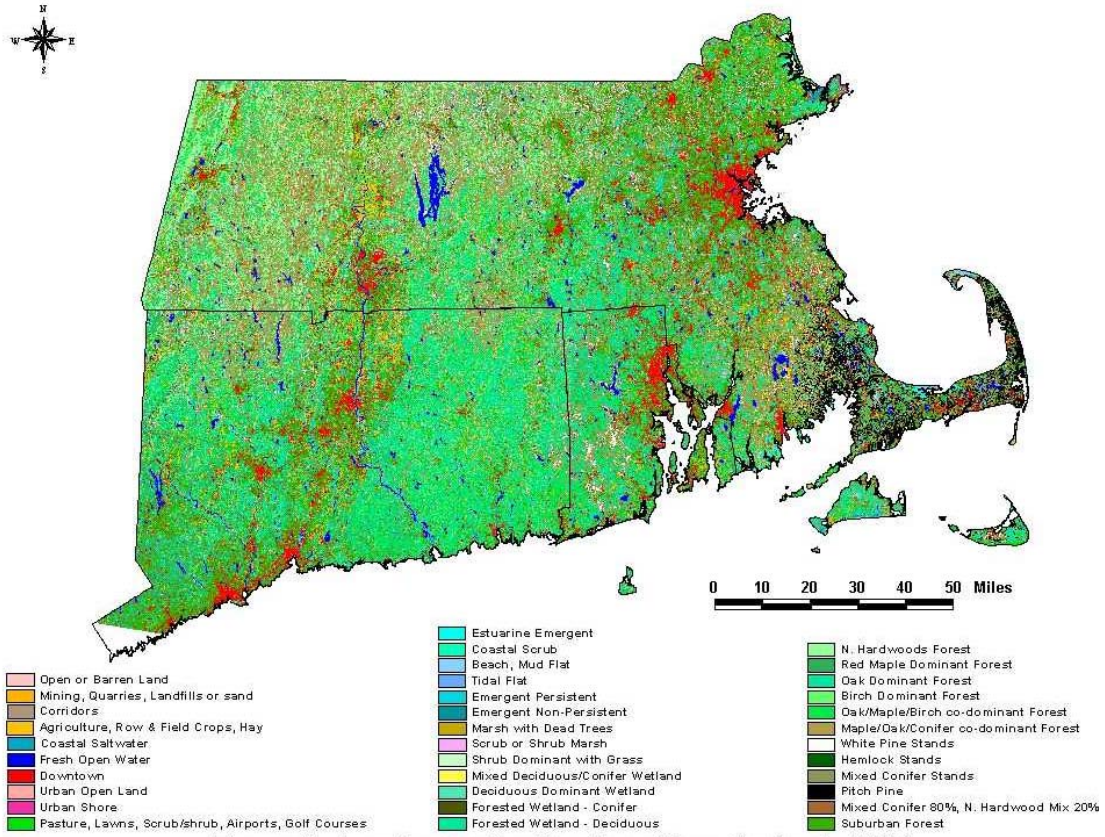

Figure 2.11 SNE-GAP Landuse/NLCD (Source: SNE-GAP, Zuckerberg et al., 2004)

The University of Connecticut's Center for Land Use Education and Research (CLEAR) uses satellite imagery to map the Connecticut landscape. The project uses a vegetation-based classification system for Connecticut's landscape, defining 12 land use and land cover categories. Periodic updates allow patterns and trends of the state's changing landscape to be identified (http://clear.uconn.edu).

The Resource Protection Project (RPP), a joint effort between EPA and CT DEP, identified important natural resource protection areas through a process involving many conservation partners. Now a decade old, it still indicates the general location and distribution of these important habitat areas recommended for protection throughout the New England states. These habitat types and resources identified for protection are illustrated in the following maps (Figure 2.12 – 2.14).

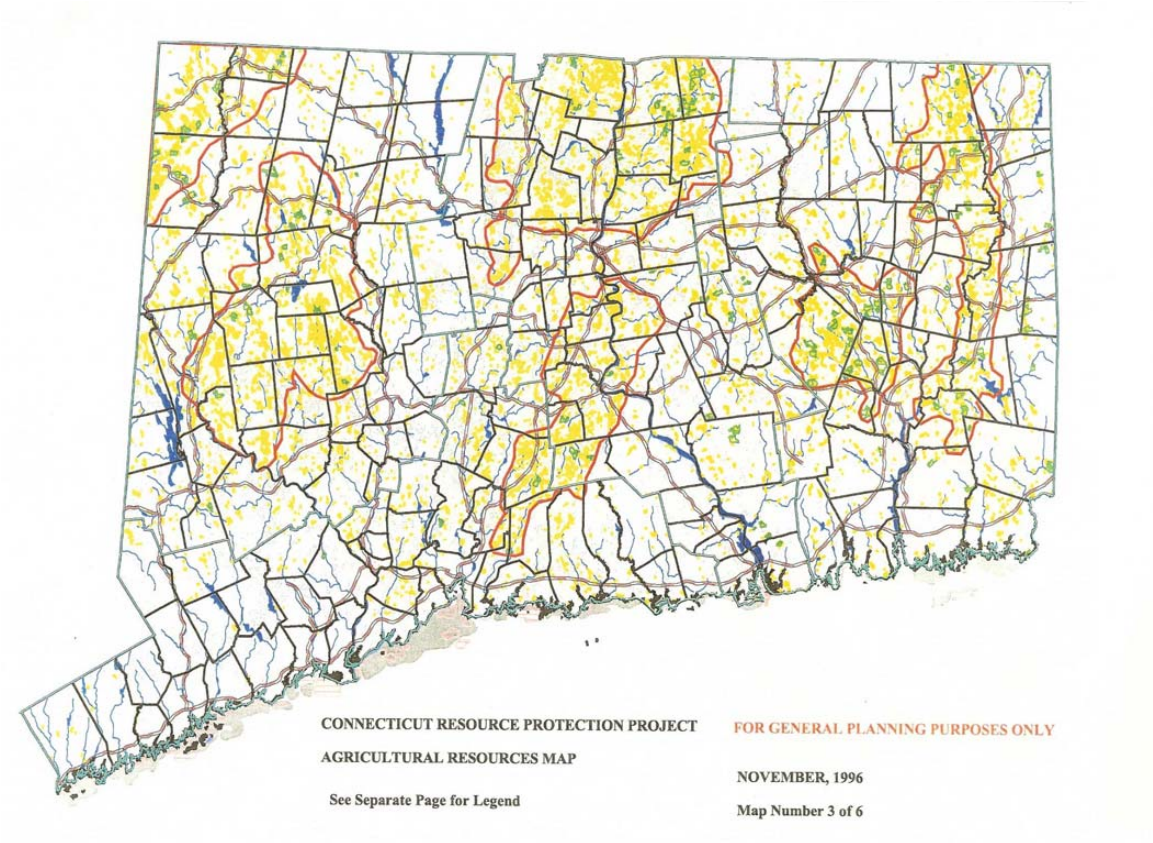

Figure 2.12 Agricultural Resources Map (Source: CT DEP and EPA 1996)

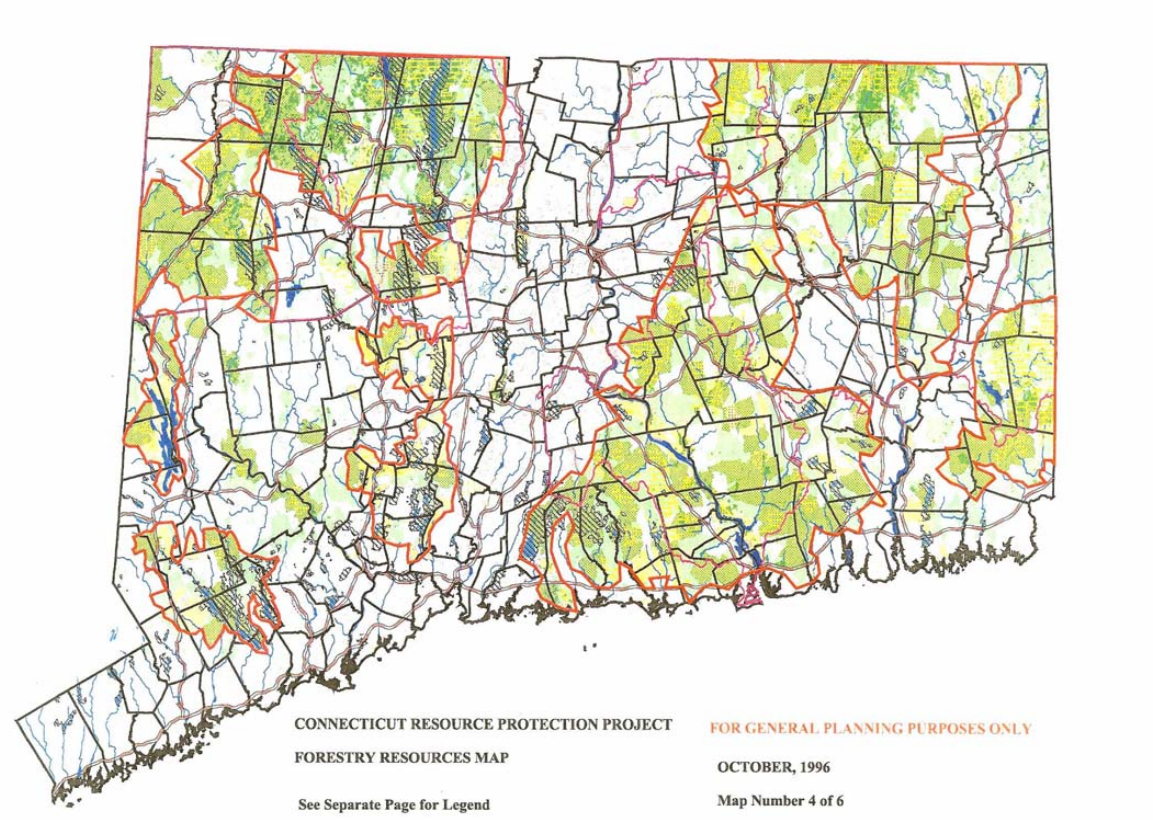

Figure 2.13 Forestry Resources Map (Source: CT DEP and EPA 1996)

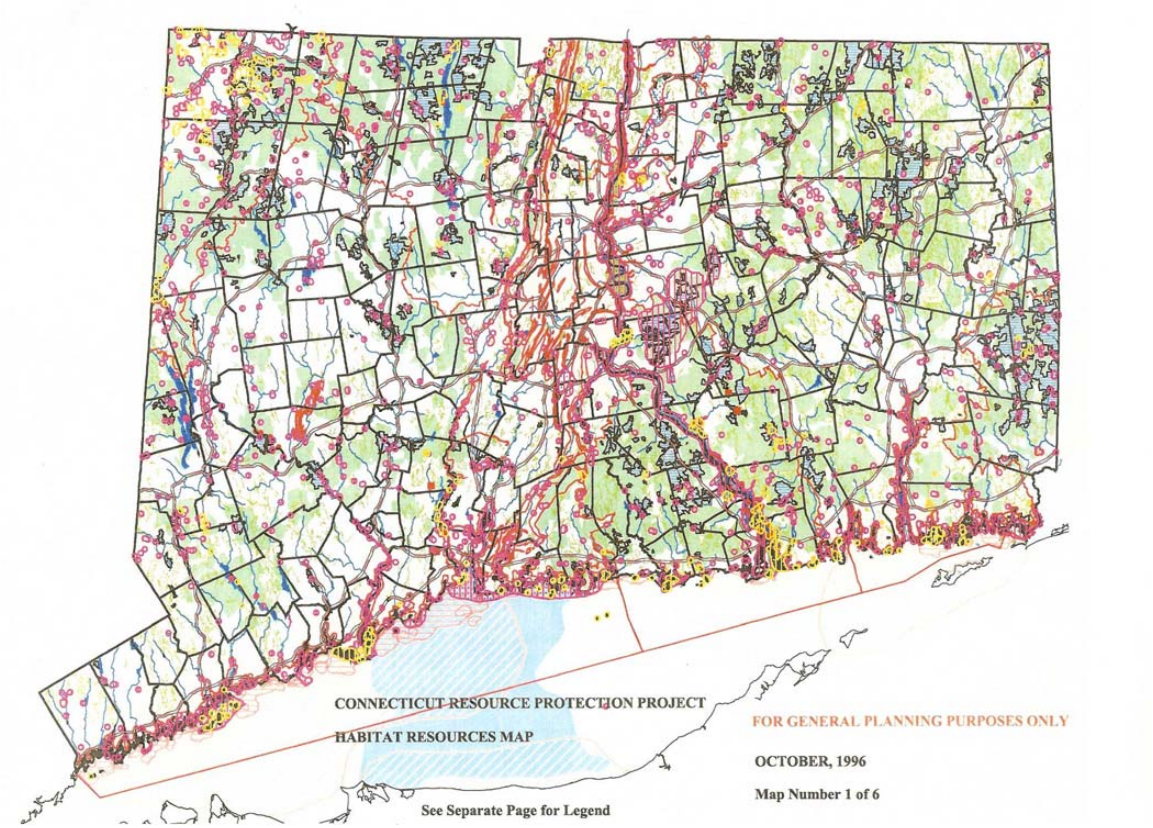

Figure 2.14 Habitat Resources Map (Source: CT DEP and EPA 1996)

The combination of the above sources provides the best available information on the types, relative condition, and location of wildlife habitats in Connecticut. Because these vegetative communities have not yet been mapped at a fine scale, the collection of additional habitat information is necessary. Due to the lack of distribution and abundance information for many wildlife species, especially invertebrates, information on key habitats, sub-habitats and associated vegetative communities is used for conservation planning and research activities.

Key Habitats of Greatest Conservation Need (GCN)

As with the identification of GCN species discussed in chapter 1, the identification of key habitats essential to GCN species involved input and analysis by DEP staff, the Endangered Species Scientific Advisory Committee (ESSAC), and stakeholders. Staff from the Wildlife and Fisheries Divisions and Environmental and Geographic Information Center (EGIC) developed an initial list that was subsequently refined by the Wildlife Division's Habitat Unit and the ESSAC for plants. Using information from the existing ecoregion and vegetative classification systems, an initial list of habitats important to wildlife in Connecticut was developed and repeatedly refined by input from these groups. This list was then compared and cross-referenced with NVCS and NatureServe (Appendix 2b) for regional and national consistency. DEP staff and the ESSAC used these data to identify 12 key habitats and 43 sub-habitats (Table 2.1). Each habitat may contain more than one sub-habitat that is similar in vegetative structure and characteristics in terms of wildlife habitat. Each of these sub-habitats has been referenced, in Table 2.1, to Metzler and Barrett's eight ecoregions from Figure 2.10 (page 2-12).

Table 2.1 Key Habitat Types, their Associated Sub-habitats or Vegetative Communities, in relation to Ecoregions defined in Figure 2.10

Habitat	Sub-habitats or Vegetative Community	Ecoregion (see Figure 2.10)
1) Upland Forest	a) Dry Oak Forests on Sand and Gravel	CT Valley (lower), ECT, Coast
	b) Calcareous Forests	WCT (specifically Marble Valleys)
	c) Coniferous Forests	Throughout
	d) Old Growth Forests	WCT, TM
2) Upland Woodland and Shrub	a) Red Cedar Glades	Traprock - CT Valley (lower), Limestone - WCT (Northern Marble Valley)
	b) Pitch Pine – Scrub Oak Woodlands	CT Valley (lower), Coast, ECT, TM
	c) Coastal Shrublands and Heaths	Coast
3) Upland Herbaceous	a) Coastal Dunes	Coast
	b) Grassy Glades and Balds	WCT, TM, BVU, CT Valley (lower)

	c) Sandplain and other Warm Season Grasslands	CT Valley (lower), Coast, ECT
	d) Sparsely Vegetated Sand and Gravel	CT Valley (lower), Coast, ECT
4) Forested Inland Wetland	a) Atlantic White Cedar Swamps	ECT, eastern Coast
	b) Red/Black Spruce Swamps	TM, BVU, WCT
	c) Northern White Cedar Swamps	WCT (Northern Marble Valley)
	d) Floodplain Forests	Throughout
5) Shrub Inland Wetland	a) Bogs, Seeps, and Fens	Bogs - throughout except coast; Acidic Seeps - mostly throughout but poorly known; Acidic Fens - poorly known; Calcareous Fens - WCT (Northern Marble Valley); Sea level Fens – eastern Coast
6) Herbaceous Inland Wetland	a) Calcareous Spring Fens b) Freshwater Marshes	Northern Marble Valley Throughout
7) Sparsely Vegetated Inland Wetland	a) Surface Springs	Unknown
	b) Vernal Pools	Throughout
8) Tidal Wetland	a) Tidal Wetlands	Coast, Major River Estuaries
	b) Intertidal Beaches and Shores	Coast
9) Freshwater Aquatic	a) Large Rivers and Streams and their Associated Riparian Zones	Throughout
	b) Unrestricted, Free-flowing Streams	Throughout
	c) Cold Water Streams	Unknown
	d) Head-of-Tide	Major Rivers
	e) Lakes and their Shorelines	Throughout
	f) Coastal Plain Ponds	CT Valley (lower), central Coast
10) Estuarine Aquatic	a) Coastal Rivers, Coves, and Embayments	Coast, LIS
	b) Vegetation Beds	Coast, LIS
	c) Hard Bottoms	Coast, LIS
	d) Sponge Beds	Coast, LIS
	e) Shellfish Reefs/Beds	Coast, LIS
	f) Sedimentary Bottoms	Coast, LIS
	g) Open Water	Coast, LIS
11) Unique or Man-Made Habitats	a) Traprock Ridges (various habitats)	CT Valley (lower) and Pomperaug outlier
	b) Offshore Islands (various habitats)	Coast, LIS
	c) Coastal Bluffs and Headlands	Coast

	d) Caves and other Subterranean Habitats	Caves - WCT (specifically Northern Marble Valley), Mines - WCT
	e) Urban Habitat	Throughout
12) Intensively Managed Habitats	a) Early Successional Shrublands and Forests	Throughout
	b) Cool Season Grasslands	Throughout
	c) Wet Meadows	Throughout

Each key habitat and its associated sub-habitats are described in greater detail in Metzler and Barrett (in press). Summary tables of associated wildlife species, by taxa, are presented for each of the 12 key habitats, and in some cases sub-habitats, in chapter 4. These tables were produced from the database developed by DEP staff, expert advisors, and stakeholders following the same process outlined in chapter 1 to identify GCN species.

The best available information and expert opinion on the location and relative ecological condition of each of the 12 key habitat types, is described in chapter 4. Representative sites and priority areas within the habitats also have been identified by DEP staff, ESSAC, and stakeholders. Primary sources of information used in developing this list of habitats were Metzler and Barrett (in press) and Metzler and Wagner (1998). In general, habitat location and relative condition of habitats are sufficient to determine what conservation action should take place for most GCN species. However, additional study and mapping of rare natural communities will provide improved baseline information for many rare species, especially invertebrates.