Environmental Quality in Connecticut

Through the Year 2015

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April 2016

Welcome to *Environmental Quality in Connecticut*. This edition explores the condition of Connecticut's environment through 2015.

The four summary pages present an overview of recent trends and important conclusions. The 20 pages of environmental indicators display a comprehensive set of environmental data for the 10 years ending in 2015.

Update: Data for a handful of indicators were not available when the report was published in April. The Council posted updates in June to The Water of Long Island Sound, Driving and Riding, Compliance and Climate Changers. Sign up for e-alerts to receive a notice when updates are published.

If you have any questions, the Council will do its best to answer them.

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STATE OF CONNECTICUT

COUNCIL ON ENVIRONMENTAL QUALITY

April 15, 2016

The Honorable Dannel P. Malloy
Governor of Connecticut
State Capitol
Hartford, CT 06106

Dear Governor Malloy:

I am pleased to submit Connecticut's annual report on environmental conditions through 2015. The report is on the Council's website, with no paper edition. It can be read online at www.ct.gov/ceq/AnnualReport.

This report uses reliable indicators to display the state's progress and problems. Viewed together, the indicators might seem at first to present a random hodgepodge of conflicting trends, but they actually display a consistent pattern of data that explain the current condition of Connecticut's air, water, land and wildlife.

Three factors can explain the many positive trends and the notable deficiencies: successful regulation (all positive), levels of private and public investment (mixed), and global trends (mostly negative). The varied responses of the indicators to these factors can provide guidance as Connecticut tackles its remaining environmental challenges.

Several indicators show strong trends and merit close attention:

For the first time, the forest indicators include not only acreage but also indicators of forests' ecological health as displayed by woodland bird populations. Unfortunately, birds and other species of wildlife that depend on unbroken "core" forest habitat are on the wane. For many years, core forest acreage declined faster than the total area of forest, a consequence of underinvestment in forest land conservation as sprawling land development carved up the forests. On a positive note, core forests did not shrink in the past five years.

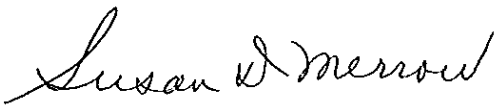
- Even with the outstanding success in protecting "The Preserve" in Old Saybrook and neighboring towns, land conservation proceeds at a pace too slow to meet the goals Connecticut set for itself. Again, the deficiency is caused by too little capital investment. The Council also notes that new approaches, beyond capital spending, will be needed to get close to the state's own goal.

- Capital investment exerts a powerful influence on the condition of Connecticut's environment, and a positive example is the very good water quality of Long Island Sound in 2015, almost certainly a product of substantial municipal, state and private investment in water pollution control.

Throughout the report you will find new information about the burden placed on air quality, coastal resources, wildlife and rivers by changes in our climate, often flagged with an "overheating earth" symbol.

As always, the Council looks forward to providing you with any additional information you might request.

Respectfully submitted,



Susan D. Merrow
Chair

Progress and Problems

2015 was a year of moderate drought and extreme cold and heat. The summer saw a modest retreat in Connecticut's march toward healthful air but better water at coastal beaches and in the depths of Long Island Sound. Some streams dried up in the autumn. A few wildlife species displayed inspiring recoveries but others continued discouraging declines. Viewed together, the indicators might seem at first to present a random hodgepodge of conflicting trends, but they actually display a consistent pattern of data that explain the current condition of Connecticut's air, water, land and wildlife.

3 factors can explain the many positive trends in Connecticut as well as the notable deficiencies:

1. Decades of successful regulation have reduced levels of many toxic substances in the environment, stimulated public and private investment in pollution control (see #2), prevented catastrophes and protected some types of habitat. The results include:

- Booming populations of Bald Eagles, Ospreys and other birds of prey.
- Generally improving levels of air pollution, though not in 2015 (see #3).
- The superior quality of Connecticut's public drinking water.

2. Levels of public and private investment in conservation and pollution control, which have yielded

- Improving levels of oxygen in Long Island Sound, a product of steady and substantial investment in sewage treatment and pollution control.
- Failure to get on track toward the state's own land conservation goals, the result of underinvestment.
- Declines in numerous species of wildlife that depend on specific habitats, especially unbroken forests, as investment in habitat conservation did not respond adequately to sprawling patterns of development.
- The long-term improvement in air quality, the result of many technological innovations and investments that were driven by regulation (#1, above).

3. Global trends, especially climate change and greater intercontinental trade and travel, which make Connecticut's job of protecting the environment more challenging:

- The decline in air quality in 2015 can be attributed to a very hot summer.
- A global fungal disease, apparently imported from Europe, has destroyed Connecticut's cave-dwelling bats.
- Rising seas are squeezing wildlife that inhabit Connecticut's coastal marshes.
- Lobsters seem to be gone; whatever the cause, warmer waters are not helping.
- Invasive species are on the verge of altering Connecticut's forests and waterways forever. Comprehensive data are not available and are not found in this report; nonetheless, the changes underway are titanic. Connecticut does little to address these changes.

These three factors govern the condition of Connecticut's air, water, land and wildlife, and knowledge of their effects should guide the state's environmental policies of the future.

A Deeper Look at Public and Private Investment: The Effect of Mandates

The first factor listed above – decades of successful regulation – usually does not work by itself. Most new regulations require businesses, local governments and consumers to install new equipment, switch fuels or buy better products (such as cleaner cars and trucks). These investments are essentially mandatory (often enforced by federal agencies) and have yielded measurable improvements in Connecticut's air and water. They also have averted uncounted catastrophes.

Connecticut also has established many goals that are not mandatory (in the sense that there are no consequences for failing to achieve them), and these have proven to be less effective. The Council concluded in 2015, for example, that Connecticut's prospects for meeting its land conservation goals are bleak. The goal established in statute and a series of state plans will not be met. The same probably is true for the goals Connecticut has set for itself regarding waste recycling and wildlife conservation.

2015 at a Glance

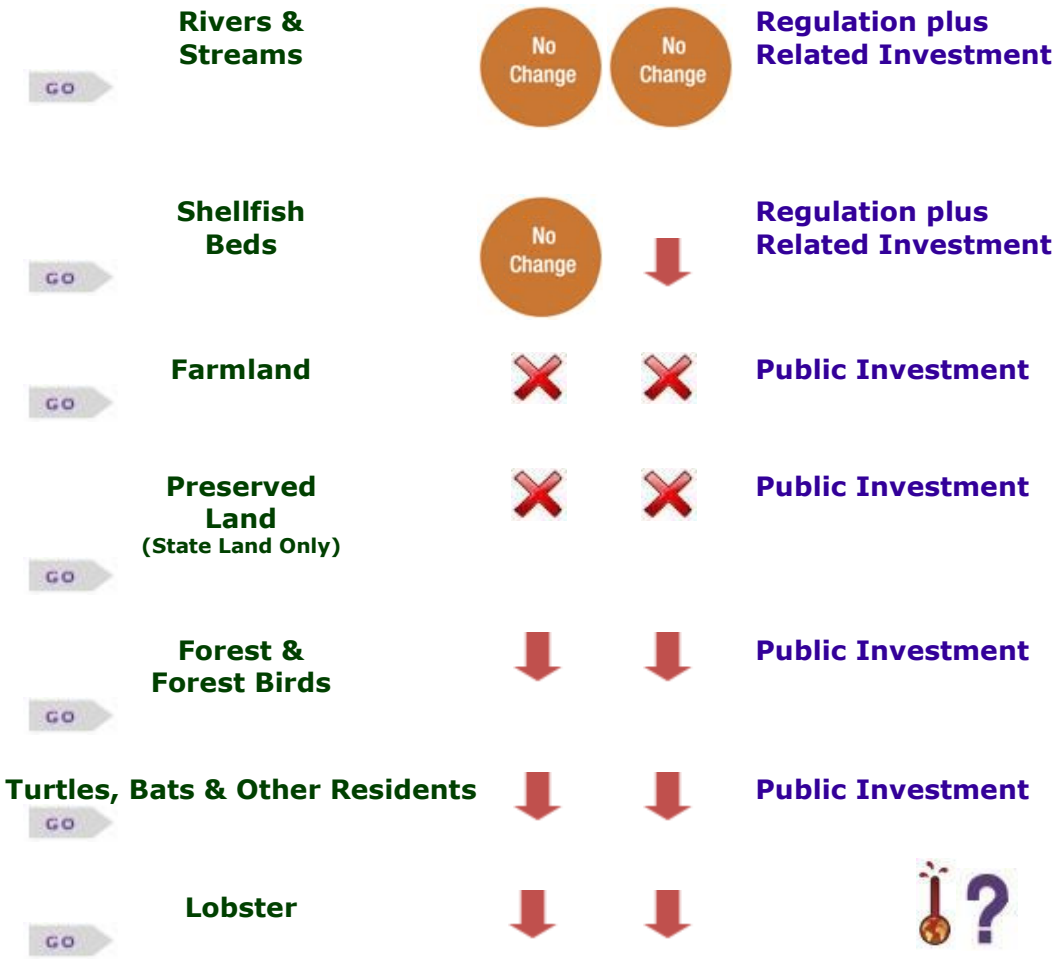
A Pattern is Revealed

The indicators of environmental quality that are the nucleus of this report are listed below in order of their rates of improvement since 2005.

As described in Progress and Problems, the trend of some environmental indicators reflects decades of (usually successful) regulation, which often drives private and private investment to achieve compliance. The direction of other indicators is mostly the product of direct public and/or private investment, sometimes driven by regulation and sometimes not. The chart below reveals a clear pattern: investment that is *not* driven by regulatory requirements is generally insufficient, resulting in Connecticut not being on track to meet its own goals.

To go directly to any indicator page, just click the corresponding "GO" arrow.

	Indicator *Listed in order of rate of improvement since 2006*	2015*	Ten-Year Trend	What Moves this Indicator in a Positive Direction? *Regulation, Capital Investment, or Both?*
GO	Bald Eagles	↑	↑	Regulation
GO	Piping Plovers	↑	↑	Regulation plus Volunteer Labor!
GO	CEQ Air Pollution Index	↓	↑	Regulation plus Related Investment
GO	Water Quality in Long Island Sound	↑	↑	Regulation plus Related Investment
GO	Public Drinking Water	✔ (99.9%)	↑	Regulation plus Related Investment
GO	Coastal Beach Closings	↑	No Change	Regulation plus Related Investment
GO	Good Air Days	↓	No Change	Regulation plus Related Investment



This report also includes several *Personal Impact* indicators (not shown above) that track trends in human activity that are expected to influence future environmental conditions. In 2015, the one such indicator that moved significantly is the number of solar electricity systems installed on Connecticut homes.

*For a few indicators, the most recent data are from a year other than 2015, and the ten-year trend covers a slightly adjusted time period because of limits on data availability.

A red "X" indicates that the state is not on track to meet its goals even if some progress has been made.

A green check mark is used instead of a "No Change" symbol where current conditions are excellent and the opportunity for positive change is limited.

As explained in New in This Edition, the overheating globe symbol is used throughout this report to emphasize the influence of climate change. Most of the indicators listed above are influenced by changing patterns of temperature, precipitation and sea level, but the symbol is applied on this page only to lobster, which has been affected severely.

New in This Edition

- The Council continues to add biological indicators of Connecticut's environmental health. This year, four experts in Connecticut birds assisted in selecting appropriate bird species to reveal trends in the ecological health of the state's forests. The results are presented in Forest and Forest Birds and are discouraging.

- Information (in text only, without charts) has been added about Ospreys (positive) and birds that nest in coastal marshes (negative). Instead of their own pages, these species are noted in the sections most relevant to their habitat. The marsh-nesting birds, for example, are declining because of rising sea level, and the information has been added to Trends Under the (Rising) Surface of Long Island Sound. These and similar climate-induced trends are flagged with this symbol:

- **New in June Update!** Climate Changers now includes an indicator that tracks the volume of gasoline and diesel used by Connecticut residents.

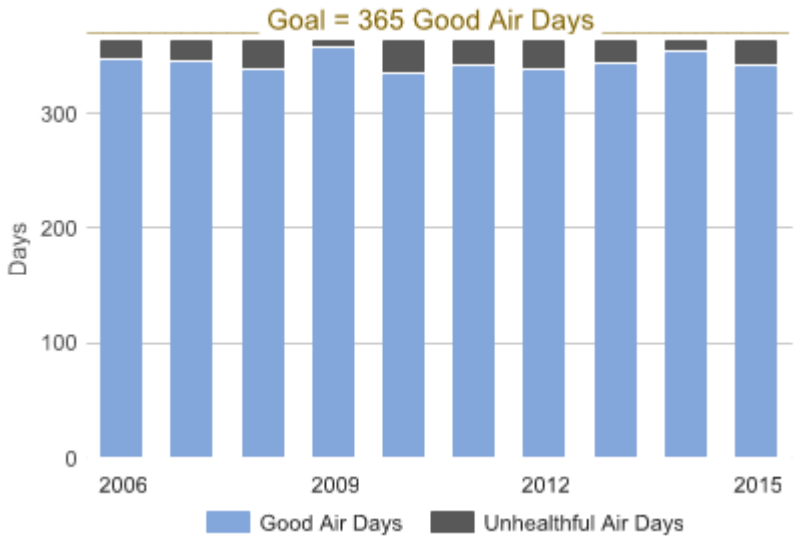
- **New Goals!** Late in 2015, the Long Island Sound Study published a much-revised Comprehensive Conservation and Management Plan. It presents several new or refined numerical goals for Long Island Sound's beaches, shellfish beds and open water. Some of these new goals have been added to the relevant charts, which occasionally required some adjustments. Readers who have questions about the Council's methods for translating the Study's goals into the indicator charts of this report are encouraged to ask.

American Oystercatcher with Parent

Good Air Days

2015 Conditions Declined

On 343 days, every Connecticut city and town had good air, making 2015 an average year.

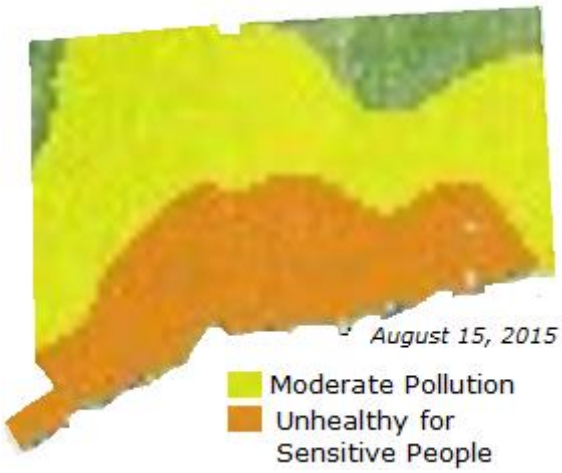


A Good Air Day is when every monitoring station in the state records satisfactory air quality. "Satisfactory air quality" is defined here as air that meets the health-based ambient air quality standards for all of the following six pollutants: sulfur dioxide, lead, carbon monoxide, particles, nitrogen dioxide and ground-level ozone. While no violations are detected at the monitoring stations on such days, it is likely that some residents are in fact breathing unhealthful air because of pollution from a local source such as a poorly-burning fireplace or outdoor wood furnace.

Connecticut's goal is to have air that meets health-based standards for all six pollutants. Violations of health-based air quality standards have been eliminated for four of the six pollutants, leaving ground-level ozone and fine particles as the problems.

Ground-level ozone is created when nitrogen oxides and organic compounds in the air react in the presence of sunlight. Weather is a major factor in year-to-year fluctuations. Motor vehicles remain a large source of ozone-forming emissions despite improvements in tailpipe standards.

In most years, cities and towns in coastal regions of the state see more bad ozone days than inland locations. The map below shows the pollution pattern for a typical bad-air day of 2015.



The green and yellow areas met the air quality standard for ground-level ozone, while the orange area did not. Residents in the yellow area who are unusually sensitive to pollution might have been affected. This day was not counted as a "Good Air Day" because of the poor air (orange color) in part of the state.

The coastal towns of Madison, Stratford and Westport had the most days with unhealthful air (10), while East Hartford (three) and Stafford (two) had the least.

No other New England state had more than four days with unhealthful levels of ozone.

The average number of good air days in the ten previous years was 343.6, nearly identical to 2015's number (343).

Much of Connecticut's ground-level ozone originates in states to the west. Unless emissions in those states are reduced substantially, Connecticut residents could breathe unhealthful air indefinitely.

Connecticut's "ozone season" is April through September. Temperatures during the ozone season of 2015 were very high: since 1895, only one year (2010) had a higher average temperature during the ozone season. Because levels of ground-level ozone generally rise with the temperature, Connecticut will have to reduce pollution even more just to maintain current air quality as the climate warms.

Fine particles, such as those found in smoke and haze, are 2.5 micrometers in diameter and smaller. These particles can form when gases emitted from power plants, factories and automobiles react in the air. Violations of the health standard occur mostly in summer and winter, rarely in spring and fall. Most of Connecticut meets the health standard for fine particles, as the technical details of that standard allow the air in the state to exceed the numerical limit for a few days each year and yet remain in compliance with the standard. Connecticut did not see *any* violations of the fine-particle standard in 2015, an improvement over 2013 (four days) and 2014 (three days).

Something Else in the Air

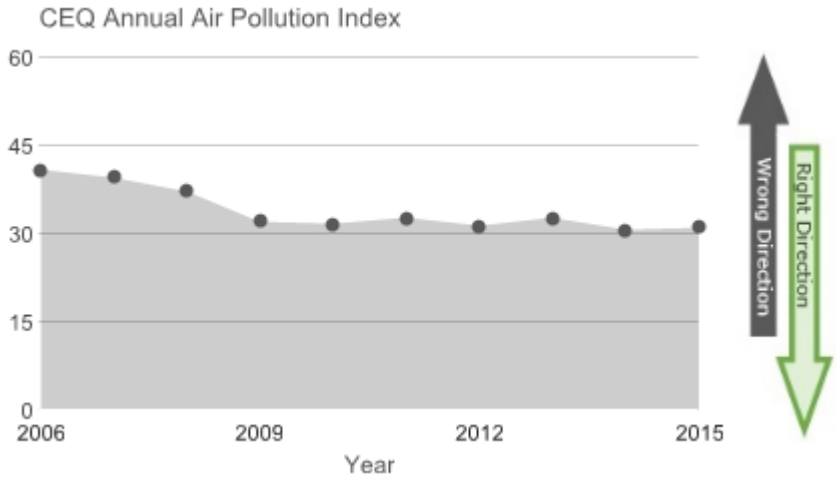
The sight of hundreds of chimney swifts swirling into the chimney of the Willimantic Town Hall on a summer evening is a cause for celebration. The chimney swift is one of several bird species that feed entirely on the wing, devouring insects and spiders high in the air. Unfortunately, swifts and other "aerial insectivores" are in a long-term decline. One hypothesis for the decline: the insects that sustain the birds are not as numerous as they once were, or perhaps not as nutritious. Could pesticides or other contaminants be the problem? Read more about the ecology of the air in the Connecticut Audubon Society's 2013 State of the Birds report.

CEQ Annual Air Pollution Index

Average Levels of Air Pollution

2015 Conditions Declined

After record-breaking low levels of pollution in 2014, Connecticut saw slightly **more pollution** in 2015.



The chart shows the average level of pollution in Connecticut's air.

Five air pollutants -- sulfur dioxide, carbon monoxide, particles, nitrogen dioxide and ground-level ozone -- are measured continuously across the state by DEEP. At the end of every year, the Council calculates the average level of each pollutant on a numerical scale where zero equals no pollution and 100 would represent the "unhealthful" level of the specified pollutant. The Council takes this annual number for each of the five pollutants and averages them to yield the single index value on the chart.

Connecticut's air quality in 2015 was slightly worse than in 2014 but better, on average, than in eight of the past ten years. As described in Good Air Days, summer heat led to more ground-level ozone. If not for that summer ozone surge, 2015 would have shown improvement in air quality over 2014.

The trend in sulfur dioxide (which is a component of the index value above but not shown separately) is worth noting. This pollutant has improved continually since 2005. Since late 2014, heating oil sold in Connecticut and several other northeastern states has, by law, contained very low concentrations of sulfur. By 2018, the sulfur content will be even lower.

Lead is Out: Until 2012, this indicator charted the combined average level of six pollutants, not five as it now does. The sixth pollutant was lead. In the early 1980s, lead was a serious problem, but unleaded gasoline and other advances have reduced lead levels dramatically. Levels of lead have dropped so low that in recent years they barely registered in this indicator. By removing lead from this indicator, the Council declared victory on behalf of Connecticut residents. (Lead still is monitored by DEEP, so it can be brought back into this indicator if levels rise unexpectedly in future years.)

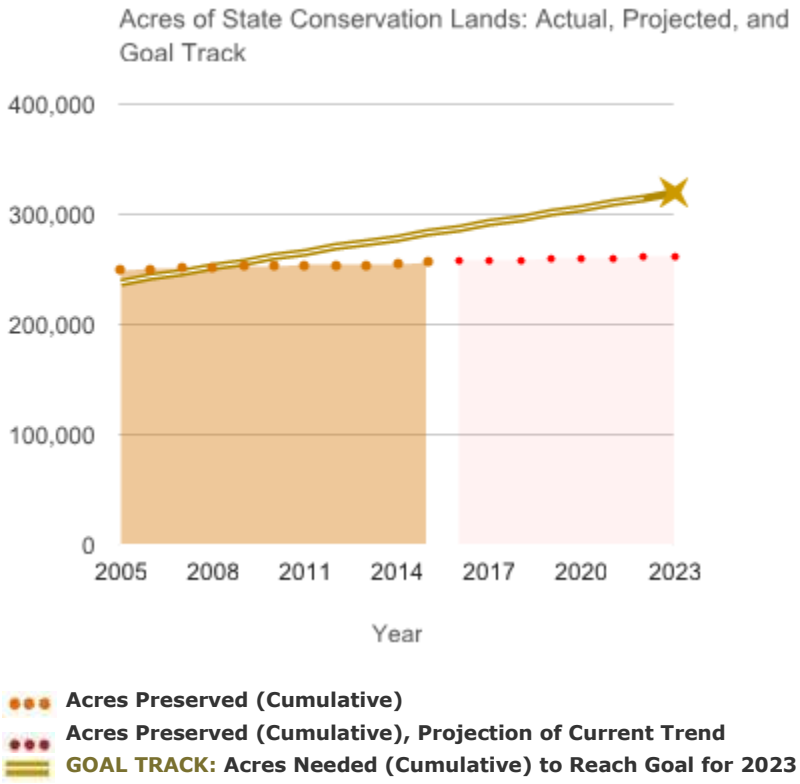
Preserved Land

Connecticut set two land conservation goals for 2023:

Goal #1: State Lands

State parks, forests, wildlife management areas and other state-owned conservation lands shall constitute 10 percent of Connecticut's land area.

In 2015, the state acquired 1,807 acres, far more than the ten-year average. More than half of this is "the Preserve," located mostly in the Town of Old Saybrook which owns the land jointly with the state. Even with this outstanding acquisition, progress is not nearly on track to reach the state preservation goal by 2023.



More information about the pace of state land preservation can be found on the *To Get Back on Track* page.

Goal #2: All Conservation Lands

Land conserved by towns and cities, the state, land trusts and other nonprofit organizations and water utilities shall constitute 21 percent of Connecticut's land area.

Nobody knows what that total is today.

State law sets a goal of conserving 21 percent of Connecticut's land area. The Green Plan, Connecticut's official land conservation plan, establishes 2023 as the target date. That goal includes conservation land owned by towns and cities, land trusts and other nonprofit organizations, water utilities and the state.

State grants helped municipalities and land trusts acquire 1,424 acres in 2015.

Many acres also are preserved each year by municipalities and land trusts without state grants, but that information is not reported to the state. The oft-cited estimate that Connecticut has achieved about 74 percent of its goal is inaccurate. A review by the Council in 2015 of published landholdings of land trusts showed nearly 60,000 acres held in fee and close to 30,000 in easements -- far more land than what is included in most published estimates. There is, however, no accurate, current census of all the preserved properties in the state.

The absence of an accurate inventory of protected land in Connecticut is a serious deficiency. DEEP had been collecting data from municipal records in a sequential fashion for 14 years; that effort almost certainly will not be completed, and in any event the earliest-collected data is well out of date. To make land preservation more strategic and cost-effective, Connecticut needs a reliable and up-to-date registry of the protected lands. An Act Concerning the State's Open Space Plan, adopted in 2012, should eventually lead to an accurate tally of preserved lands, but progress has been slow.

How the Goal Track is Calculated

The State of Connecticut has been acquiring land for parks, forests and wildlife conservation for more than a century. In 1997 and again in 1999, it committed itself to the goals stated above. For the state itself, this meant acquiring another 104,000 acres to reach the goal of 321,000 acres (or 10 percent of the land within Connecticut's borders) by 2023. Achieving this goal would have required Connecticut, beginning in 1999, to acquire about 4,500 acres per year (on average), a rate that is depicted as the "Goal Track" on the chart. Because the state has fallen below the Goal Track, it now will need to acquire about 7,900 acres per year. For more information about the pace of preservation, please see the *To Get Back on Track* page.

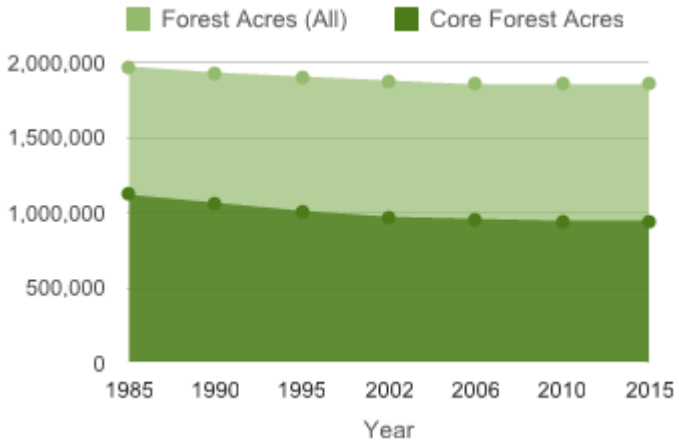
Preserved Forests = Clean Water

Rain that falls on land flows toward the nearest stream. If that land is mostly woods, there is a high probability that the stream will support a full range of aquatic life. If even 12 percent of the land is paved or built upon, then the life in the stream is almost certain to be affected. These revealing statistics are discussed further on the *Rivers, Streams and Rain* page.

Forest and Forest Birds

Forest Acres **Forest Birds**

The five years since 2010 were unusual: gains in forest acreage equaled the losses. After expanding for a century, Connecticut's forests -- especially the ecologically valuable core forests -- had been shrinking for three decades.



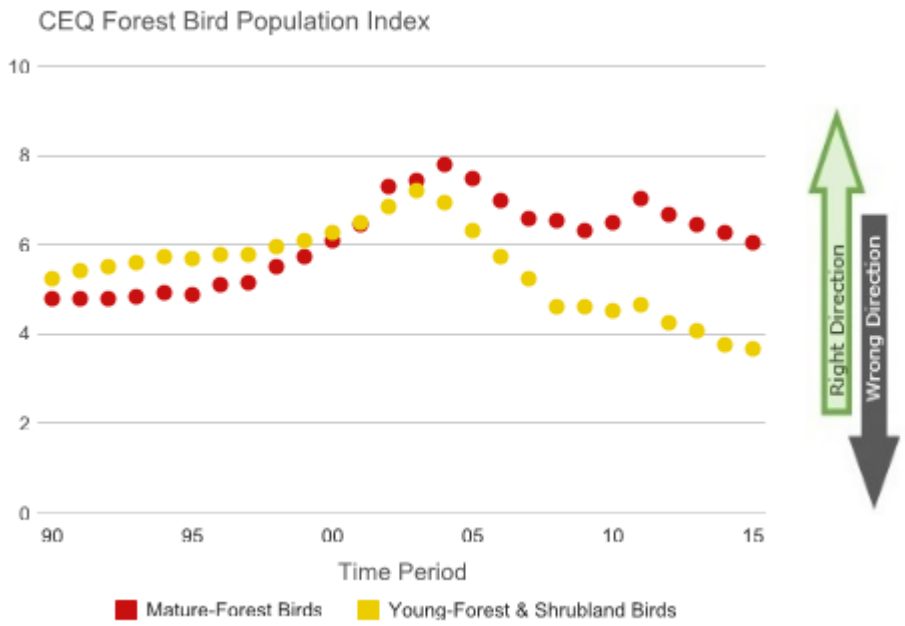
This indicator shows the total acreage of forests in Connecticut. The forests are divided into core forests and other forests. Forests that are at least 300 feet from non-forest development -- roads, buildings and farms -- are classified as core forests. Core forests provide habitat for many species of wildlife that cannot tolerate significant disturbance. Forests that are *fragmented*, or divided by roads and clearings, provide some forest functions but are not fully-functioning forest ecosystems. Fragmented forests are known to provide substandard or poor habitat for some species of wildlife and, in many cases, less opportunity for hunting and other types of recreation. Invasive species of plants and animals appear in the wake of activities that fragment the forests.

The acreage of forests can fluctuate over years or decades, increasing as fields grow into forests and declining as timber is harvested by clear-cutting or as agricultural fields are expanded. These temporary fluctuations are distinct from permanent declines caused by road and building construction.

The economic recession that began in 2008 slowed (but did not halt) new construction in most parts of the state. During the lull in land development, some areas that were observed to be cleared land in 2010 became forests by 2015. Gains appear to have balanced the losses. This five-year period of unchanging forest acreage is highly unusual in Connecticut's modern history.

The chart above shows the *acreage* of forest. The *health* of those forests is reflected in the populations of forest birds.

The number of birds nesting in Connecticut's forests has been shrinking. This is true for birds that nest in mature forests as well as for birds that nest in young forests and "shrublands."



NEW! Birds as Indicators of Forest Health

Birds that nest in Connecticut's forests have been declining in number for a decade, which could reflect changes in the health of the forest ecosystems.

The Connecticut Forestlands Council Forest Ecosystem Health Committee** developed a list of Avian Forest Health Indicator Species that "can be used as indicators in identifying both positive and negative areas of forest ecosystem health." From that list, the Council on Environmental Quality selected two groups of species that best typify forest birdlife throughout the state.*** In selecting the species, the Council was aided invaluably by four experts in ornithology.****

The chart tracks the combined nesting populations of eight species of birds that typically inhabit mature forests in Connecticut:

Hairy Woodpecker	Wood Thrush
Eastern Wood-Pewee	Red-eyed Vireo
Scarlet Tanager	Black-and-white Warbler
Veery	Ovenbird

The **bottom chart (yellow columns)** tracks the nesting populations of five bird species that typically inhabit forests that are young or dominated by shrubby vegetation, sometimes known as "shrublands":

American Redstart
Blue-winged Warbler
Chestnut-sided Warbler
Eastern Towhee
Yellow Warbler

Both categories of forest birds have been declining faster than the forests themselves. This rapid decline could be caused by several factors. Most of the mature-forest bird species are affected greatly by fragmentation. The predators, invasive species, overpopulating deer and human activities that follow roads and other intrusions in the forests cause nesting success to falter. The true forest birds, those that are not adapted to disturbed roadside or suburban habitat, will succeed in the long term only in forests that are not fragmented. After years of decline in the acreage of core forest, one would expect to see declines in many bird species, and Connecticut is seeing such a decline. Many studies have identified a time lag period between the fragmentation of a forest and the decline in birds, explained probably by the fact that the birds' breeding success diminishes gradually, not instantaneously, when a forest is divided into smaller parcels. The link between the conservation of unbroken forests and bird populations is the subject of the Connecticut Audubon Society's 2015 State of the Birds report.

Birds that depend on *young* forests have seen their habitat lost to development and to aging of the trees. Other young-forest wildlife, such as the New England Cottontail and Ruffed Grouse, also have declined as such habitat has dwindled. CTBirdTrends, a website developed by the University of Connecticut Ornithology Research Group, shows that nearly all shrubland bird species have undergone a long-term decline. Many landowners, including the state, have taken action to expand this type of forest habitat. Where land is managed to encourage young forests and shrublands, the wildlife responds favorably, but such managed areas are small in total.

The decline of Connecticut's forest birds has landed the majority of the above species on the state's 2015 list of wildlife species of greatest conservation need. The decline can be attributed to a combination of shrinking core forests, a lack of young forests and a surge in other threats. Connecticut's current efforts to maintain and improve forest ecosystems evidently are inadequate.

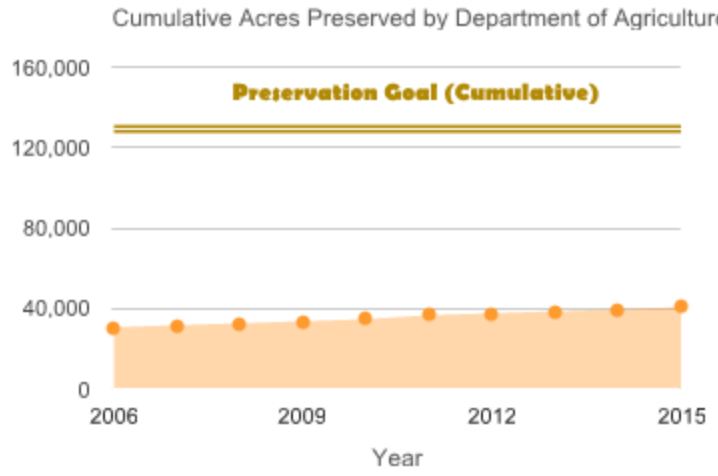
**The Connecticut Forestlands Council Forest Ecosystem Health Committee prepared a list of forest ecosystem health indicator species for *Connecticut's Forest Resource Assessment and Strategy* (see Appendix 4 of that document for the list of species).

***The Council used five criteria to select species that represent the birdlife of Connecticut forests. The species that meet the criteria are songbirds (excepting the Hairy Woodpecker) that have been nesting for decades throughout Connecticut where suitable habitat exists. Species thought to be moving into or out of the state because of a changing climate were excluded. (Information about climate-sensitive species can be found in a 2014 report by the National Audubon Society.) Annual nesting data are obtained from the North American Breeding Bird Survey (BBS), a cooperative effort between the U.S. Geological Survey and the Canadian Wildlife Service to monitor the status and trends of North American bird populations. Using a rigorous protocol, BBS data are collected by thousands of dedicated participants along thousands of randomly established roadside routes throughout the continent. Population data for the eight species are combined into an annual index value. The annual values are grouped into multi-year time periods to smooth the year-to-year fluctuations that might be caused by weather or other short-term factors. A full description of the Council's criteria and methods can be found here [coming soon].

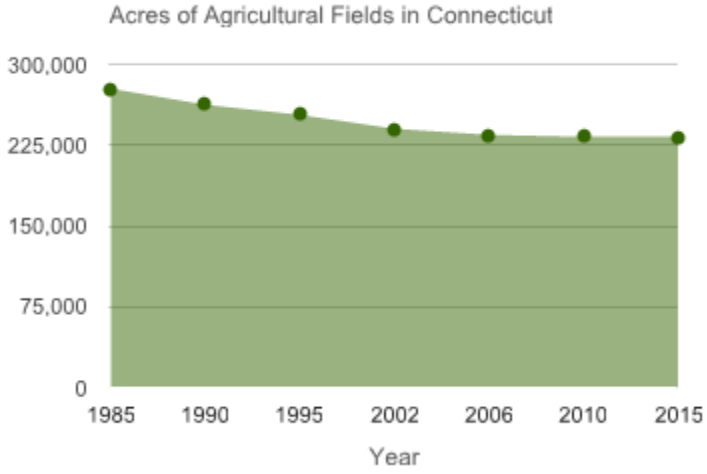
****Four biologists (please see acknowledgments) with expertise in ornithology were asked to review the criteria and a draft list of species. Their comments led to several improvements, including changes to the lists of species selected for the indices. The Council greatly appreciates their learned input but assumes full responsibility for any weaknesses in the charts.

Farmland

Preservation: Connecticut preserved 1,289 acres of agricultural land in 2015, the most since 2009.



Loss: Farmland loss slowed considerably after 2006.



The **top chart** shows the cumulative acreage preserved by the Connecticut Department of Agriculture, which began preserving land by purchasing development rights in 1978. In 2011, the Department launched the Community Farms Preservation Program for farms that do not meet all eligibility requirements of the longstanding farmland preservation program but are nonetheless worthy of preservation. The acreage figures for 2014 and 2015 include both programs. State bonding, the Community Investment Act and federal funds are the main sources of funding.

The **bottom chart** presents an estimate of the total area of land used for crops and pasture in Connecticut, developed by the Center for Land Use Education and Research (CLEAR) at the University of Connecticut using satellite-derived data. It shows that less farmland was lost to development between 2006 and 2015 than in prior periods, presumably because of the downturn in real estate development associated with the recessionary economy.

The top chart does not show agricultural land acquired for preservation by municipalities and nonprofit organizations. Several towns purchased farms in recent years with no state assistance, and those acres are not reported or recorded at the state level. Along with a central registry of preserved open space, Connecticut needs a registry of preserved farmland to help state agencies and other organizations preserve land strategically.

What is the Source of the Goal?

The Connecticut Department of Agriculture adopted a farmland preservation goal -- 130,000 acres in total, with at least 85,000 acres in cropland -- that originally was based on the amount of land needed for food production to sustain Connecticut's population.

Council projections show the goal being reached in the 22nd century, but in reality there will not be that acreage of agricultural land remaining in the state by the end of the current century if the rate of loss continues as it has for most of the past five decades. Preservation of at least 2,000 acres annually should result in success. During the last ten years, preservation has progressed at slightly more than half the needed rate. Please see the *To Get Back on Track* page for more information.

Technical note: The analysts at CLEAR made slight revisions to all years' data in 2015, and the chart above was modified accordingly.

To Get Back on Track

Milestones

The previous three pages of this section document Connecticut's insufficient progress in land conservation. This page tracks the mandatory milestones which, if met, are expected to get the state's land conservation effort moving forward at a greater pace.

In 2012 and 2014, legislation was adopted and signed (Public Acts 12-152 and 14-169, respectively) that set specific targets and timeframes for land-conservation planning.

Mandate for DEEP	Deadline	Deadline Met?	Notes on Progress
Prepare comprehensive land conservation strategy (including an estimate of total conservation acreage in the state) *CGS Section 23-8(b)*	December 2012	✗	Draft submitted to CEQ in February 2016. Previous plan expired in 2012.
Establish a process for state agencies to identify landholdings that might be valuable for conservation *CGS Section 23-8(d)*	No specific date	✗	Incomplete
Establish a publicly-accessible registry of conservation lands *CGS Section 23-8(e)*	January 1, 2015 Quarterly updates thereafter	✗	Project underway, site launched, behind schedule

The Pace of Preservation

The gauges below show the differences between the current rates of land preservation and the rates needed to meet the goals Connecticut has set for itself.

Preservation of Land by the State for State Parks, Forests, and Wildlife Management Areas

(Goal = 10% of Connecticut's Land Area)

Average Annual Rate of State Land Acquisition Needed to Reach Goal

Average Annual Rate of State Land Acquisition Since 2005

Please see the Preserved Land page for more information about this goal.

In the last ten years, the State of Connecticut has added about 7000 acres to its network of state parks, forests and wildlife management areas. Achieving the State's goal would require exceeding that ten-year total every year.

Preservation of Farmland by the State

Average Annual Rate of Farmland Preservation Needed to Reach Goal

Average Annual Rate of Farmland Preservation Since 2005

Please see the Farmland page for more information about this goal.

Preservation of Land by Cities, Towns, State, Nonprofit Organizations and Water Utilities

(Aggregate Goal = 21% of Connecticut's Land Area)

The gap between the goal and the rate of acquisition by these land-conserving organizations is not possible to assess. Acquisition data are not collected by DEEP or any other organization.

Small Parcel Size: A Big Impediment

One of the reasons that Connecticut probably will not meet its goals for land conservation is the fact that most forest land is owned in small parcels. Read more about this in a December 2015 CEQ staff memo.

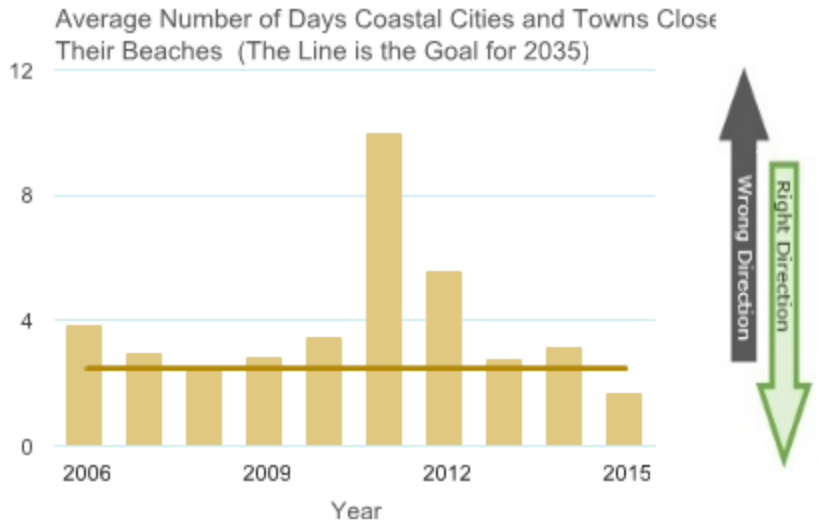
Heavy Rain ➡ Polluted Runoff ➡
Beaches and Shellfish Beds Closed

Many beaches and shellfish beds are closed when heavy rains carry overflowing sewage and polluted runoff into Long Island Sound. The National Weather Service confirmed in 2015 that heavy rains have become heavier and more frequent in Connecticut, and the trend is expected to continue.

Swimming

2015 Conditions Improved

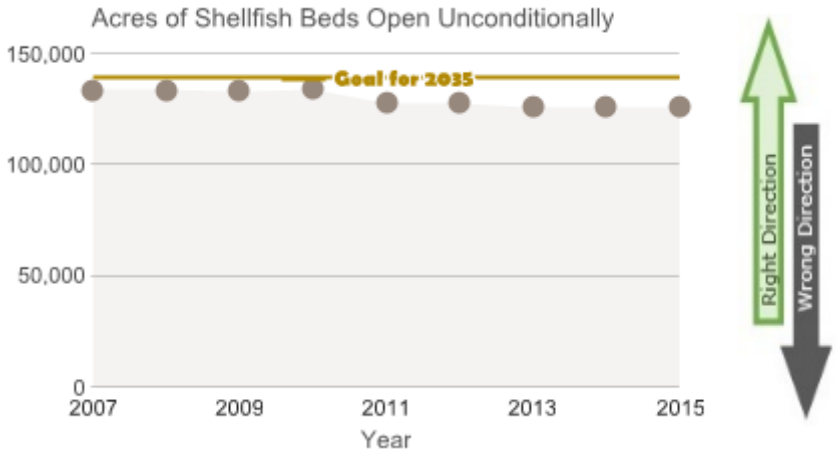
Coastal swimmers were in luck in 2015, as cities and towns had to close their beaches on fewer days.



The Council adds up the number of days that each coastal city and town closed one or more of its public beaches, and calculates an average for all the cities and towns with beaches. Continue reading [below] about beach closings caused by pollution...

Clamming and Oystering

The area of the Sound unconditionally approved for harvesting shellfish has remained essentially unchanged from 2013 through 2015.



The Connecticut Department of Agriculture's Bureau of Aquaculture and Laboratory Services monitors shellfish beds and classifies them according to their potential for yielding healthful, uncontaminated shellfish. The chart immediately above shows the acreage of shellfish beds that are included in the "approved" category for direct harvesting because they are generally unaffected by pollution. There is also a "conditionally approved" category, which requires a management plan and might be subject to closings seasonally or after rainfalls. (Even areas that are "approved" may be closed as a precaution following exceptional rainfalls of three or more inches.) Aquaculture experts have suggested that the gradual, historic shrinkage of "approved" shellfish beds is associated with an increasing volume of runoff from lawns and pavement flowing further into the Sound.

The **new goal** for shellfish beds, adopted in the 2015 edition of the Long Island Sound Study's Comprehensive Conservation and Management Plan, is to upgrade five percent of the acres that currently are restricted so that shellfish may be harvested in those areas freely. Adding those upgraded acres to the current unrestricted areas results in a target of approximately 139,550 "approved" acres by 2035.

Forecast: More Heavy Rains

Connecticut residents have witnessed a steep increase in the amount of rain arriving in downpours. In October 2015, the National Weather Service updated the precipitation frequency data for Connecticut that had last been published in 1961. The new data confirm what had been predicted by many: rainfalls are getting heavier, and heavy rains are becoming more frequent. In 1961, most of the state would have expected a four-inch one-day rainfall every five years or so; in some northwestern towns, that five-year storm would have brought less than four inches. Now, all portions of the state can expect the five-year storm to bring well over four inches and, in some northwestern Connecticut towns, close to five inches.

While this trend, generally attributed to a changing climate, can be found throughout the country, it is particularly strong in the northeastern states. The 2014 National Climate Assessment predicts this trend to strengthen.

More about beaches...

Because the bathing season is approximately 100 days long, the number of days shown on the top chart also equals the percentage of the bathing season when beaches were closed.

The cities and towns on the western half of the state's shoreline usually have a higher frequency of closings, and 2014 was no exception. Fourteen of the 24 coastal towns had beach closings. Of those 14, 10 were located in the western half of the coastline where there are more sewer systems with overflows and more paved surfaces that send contaminated runoff into the waters.

Yearly variations are products of rainfall patterns and unusual incidents such as sewer-line ruptures. The storms of 2011 (including Tropical Storm Irene) resulted in many closings.

Polluted surface runoff and sewage overflows after rainstorms are the most common sources of bacteria. After heavy rains, health officials must assume that polluted runoff and/or overflows from combined sanitary/storm sewers have raised bacteria levels. Though beaches are regularly monitored for bacteria, test results are not immediate. More closings are initiated preemptively, as a precaution after heavy rain, than are initiated due to actual monitoring results.

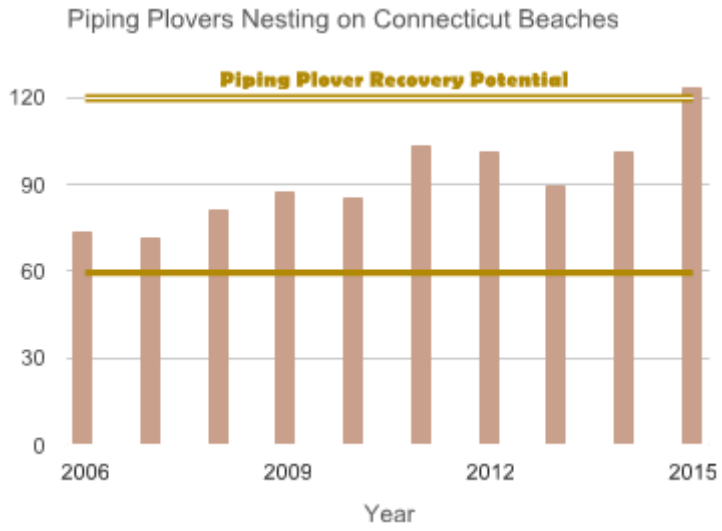
The water is tested at beaches from Memorial Day through Labor Day. At other times, the water could be clean or contaminated. Most sewage treatment plants along the coast disinfect their routine effluent discharges all year, but most treatment plants north of I-95 do not disinfect their effluent before May and after September.

The **new goal** line on the top chart is an approximation of the target adopted in the 2015 edition of the Long Island Sound Study's Comprehensive Conservation and Management Plan. That plan's goal calls for cutting the number of beach closings in half by 2035 (from 2014, with the number for 2014 calculated using a five-year rolling average). The plan's goal is tied to individual beaches, while the indicator above counts beach closings by grouping together the beaches within each municipality. A fifty percent reduction in individual beach closings will likely result in a comparable reduction in the indicator above.

Piping Plovers and Others

2015 Population Increased

From Bridgeport to Groton, the plovers nesting on Connecticut's shores continued their good run.



Piping Plovers are small shorebirds that nest only on sandy beaches with sparse vegetation. People, storm tides and predators frequently destroy nests.

The number of plovers on Connecticut's beaches now exceeds the initial recovery goal of 60 set in 1986 (the solid gold line on the chart), and in 2015 reached the "recovery potential" level (see below). However, the modest size of the population requires that the species continue in threatened status at the state and national level.

Nesting adults are counted (and in most cases protected) every spring by hundreds of volunteers working with the Audubon Alliance for Coastal Waterbirds.

Their habitat is a narrow strip squeezed between a rising Sound and higher ground. The Piping Plover population is, according to the United States Fish and Wildlife Service, "an indicator of the health of the fragile beach ecosystem." (*Atlantic Coast Piping Plover Revised Recovery Plan*)

Since protection and monitoring efforts began in 1984, nesting success has improved, resulting in more returning adults in subsequent years. In 2014, 116 chicks were raised by the Piping Plovers nesting on Connecticut's beaches, a modern record. That number declined slightly in 2015 to 112.

The damage from Hurricane Sandy in October 2012, which rearranged many of the beaches where plovers usually nested, is suspected as one cause of the decline of 2013.

Other Beach Residents

The protections afforded Piping Plovers benefit other threatened species, including American Oystercatchers and Least Terns.

While Connecticut's Least Terns had another down year, the oystercatchers had a big year in 2015, with a population of 161 adults (in 52 breeding pairs plus 57 non-breeders) producing 64 young, an unusually high number.

American Oystercatchers
parent and young

Ten-year Trend

Least Terns
still in their eggs

Ten-year Trend

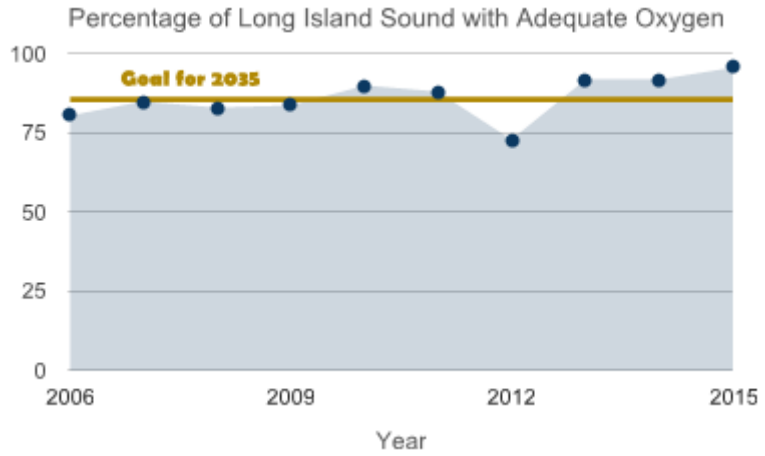
The Goal for Piping Plovers

When the federal government listed the Piping Plover as a threatened species in 1986, Connecticut was home to an estimated 40 nesting adults (in 20 pairs). The entire population inhabiting the Atlantic coast from Canada to North Carolina was estimated to number about 1,600. An initial recovery goal was set for Connecticut at 60 birds (and 2,400 birds over the plover's entire Atlantic coast range), a level that Connecticut has maintained every year since 2001. The federal government reviewed the goal in 1996 and revised the overall Atlantic coast goal upward to 4,000 birds; New England's share of the newer target is about 1,200 birds. At that time, scientists estimated Connecticut to have habitat for at least 120 nesting birds (depicted above as the "recovery potential"). The breeding population of Massachusetts has been so successful since then that New England's overall goal has been met. Connecticut now appears to have reached its potential (as estimated in 1986); perhaps a future reassessment will show the habitat to be greater than it was known to be.

The Water of Long Island Sound

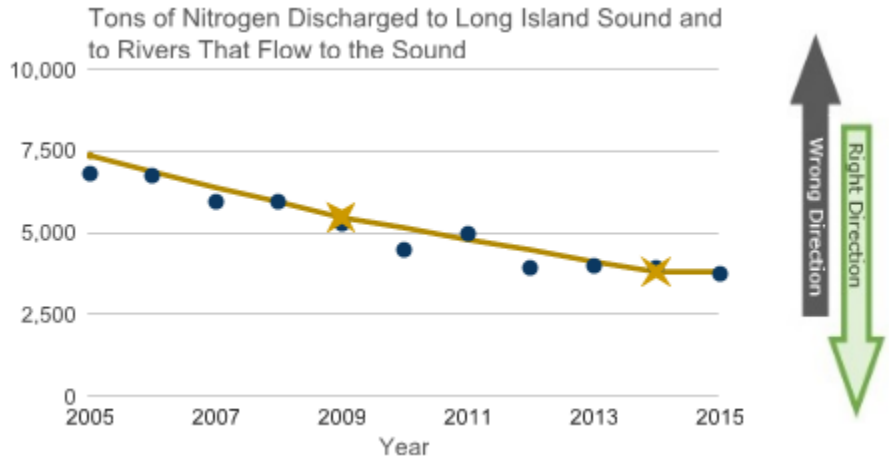
2015 Conditions Improved

During 2013 through 2015, **oxygen** conditions in Long Island Sound were the best in nearly twenty years and better than the 20-year goal.



Marine life requires oxygen. The percentage of Long Island Sound that has adequate oxygen throughout the year is shown in the chart above. Continue reading [below] about oxygen in Long Island Sound...

Nitrogen discharges improved slightly in 2015.

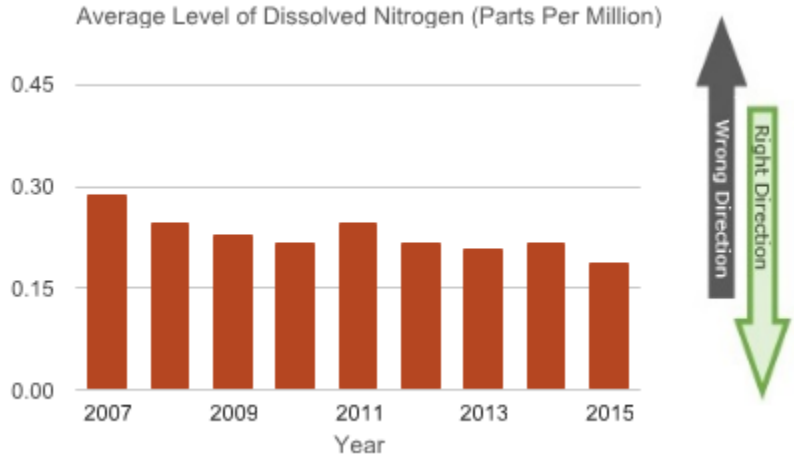


Connecticut's investments in nitrogen-removal technology at sewage treatment plants have been successful. Continue reading [below] about the critical role of nitrogen pollution in Long Island Sound...

2015 Conditions Improved

Dissolved Nitrogen

As Connecticut reduces the amount of nitrogen discharged into the Sound, the level of **dissolved nitrogen in the water** follows suit.



Top chart (Oxygen): During the summer, some areas of the Sound experience hypoxia, which is a condition in the water where oxygen levels are not adequate to fully support desirable forms of life, including fish and lobsters. Hypoxia occurs when the nitrogen in pollution stimulates excessive growth of aquatic plants, which die and get consumed by oxygen-using bacteria. Hypoxia occurs predominantly in the western portions of the Sound. Weather greatly influences hypoxia, making year-to-year changes less important than long-term trends. Detailed reports that include maps of the extent and duration of hypoxia in Long Island Sound are produced annually by the Department of Energy and Environmental Protection.

New goal for hypoxia: The new goal line on the top chart is an approximation of the target adopted in the 2015 edition of the Long Island Sound Study's Comprehensive Conservation and Management Plan. That plan's goal calls for "measurably reducing the area of hypoxia in Long Island Sound from pre-2000 averages." A "measurable reduction" is at least a 28 percent reduction, according to the plan's statistical analysis of the year-to-year weather-induced fluctuations that bedevil this indicator. It appears that the goal for 2035 already has been attained.

The **middle chart** tracks the amount of **nitrogen** discharged by 80 sewage treatment facilities across Connecticut, two large coastal industrial facilities and a small group of industrial sources in the Naugatuck River watershed. The sewage treatment plants include those along the coast and many more that discharge to rivers that flow to the Sound. Connecticut's investments in nitrogen-removal technology at many of those plants have been successful. The nitrogen discharges of New York, which lags Connecticut in nitrogen control, are not shown.

To reduce the nitrogen inputs that cause hypoxia, Connecticut and New York adopted a comprehensive management plan in 1994, and built upon that plan with an expanded agreement in 2002.

Connecticut's share of the total nitrogen pollution in Long Island Sound is about one-third, and New York's is two-thirds. In 2001, the federal Environmental Protection Agency approved the New York and

Connecticut joint plan for implementing a Total Maximum Daily Load (TMDL). The TMDL is the maximum amount of pollutants that can be discharged while still allowing water quality standards to be attained.

Despite the greater nitrogen discharges of 2013 and 2014, DEEP reports that Connecticut met the goal for "trade-equalized load," which takes into account the distance of inland treatment plants from Long Island Sound.

The effectiveness of Connecticut's approach to reducing nitrogen in the Sound is confirmed in two ways. First, the **bottom chart** shows the average level of nitrogen in the water of Long Island Sound. Levels have improved as Connecticut has reduced its nitrogen discharges.

Second, the United States Geological Survey published a report in 2016 that analyzed the nutrients being carried to the Sound by Connecticut's rivers and streams; since 2001, the total amount of nitrogen was reduced by more than ten percent.

Large uncontrolled quantities of nitrogen enter Long Island Sound when rainfall carries fertilizer from residents' lawns along with the pollutants that have accumulated on pavement.

Technical Notes

1. The top chart shows the area of Long Island Sound (both states combined) that had adequate oxygen levels throughout each year. The sampling area (2700 square kilometers) does not include the whole Sound (3400 square kilometers). The areas not sampled are shallow waters (less than two meters deep) near shore, which generally do not experience hypoxia; bays; the eastern end of the Sound, which is not expected to experience hypoxia; and an area in the far western end, which probably becomes hypoxic in most years.

2. More about the new hypoxia goal: Progress toward the goal should be assessed using a five-year rolling average. One or two years of promising data could be natural variability at work. The five-year rolling average is not shown here, but can be calculated or inferred fairly easily.

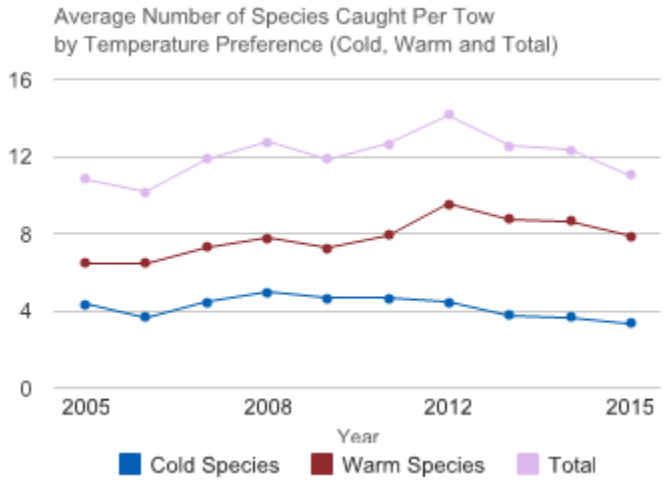
3. Hypoxia was redefined by DEEP in 2011. Areas of the Sound are now considered hypoxic where a liter of water contains less than 3.0 mg of dissolved oxygen. This is the criterion that was used prior to 2004. From 2004 through 2010, DEEP used 3.5 mg/l as the determining level. The threshold was returned to the 3.0 level in 2011 to be consistent with the definitions used by New York and the Long Island Sound Study. Data for all previous years have been recalculated to show the area of the Sound having adequate oxygen under the current definition (that is, at least 3.0 mg/l).

4. The nitrogen in the bottom chart is Total Dissolved Nitrogen.

Trends Under the (Rising) Surface of Long Island Sound

The water is warming and rising.

Fish species that thrive in cold water have become less common. Fishes from warmer regions are more common than they used to be, though they also declined in 2015.

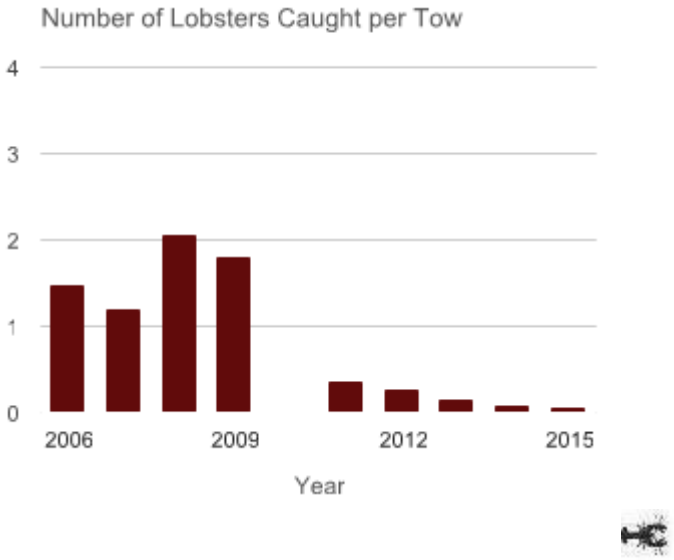


DEEP surveys marine fish, squid and lobster populations every spring and fall by towing nets from a research vessel. The chart above shows the average number of fish species caught in each tow during the spring and fall surveys combined. The well-documented trend toward species that favor warm water is apparent. The chart does not include the small but growing number of sub-tropical species captured in the fall tows. In 2014, the researchers netted their first Bluespotted cornetfish.

The chart below shows the number of lobsters caught in the average tow during DEEP's fall survey of marine life. The number caught in 2015 was the lowest ever. The steep decline of recent years is the nadir of a well-documented, decade-long decline in the lobster population that also is evident in a dramatic drop in commercial lobster landings during the same period (not shown). Throughout the 1990s (not shown on the chart), researchers generally caught between seven and eleven lobsters per tow, with a spike to nearly 20 in 1997. Researchers are focusing on a combination of four possible causes for the dramatic downturn in lobster populations since 1999: disease, changes in water quality, changes in climatic conditions and human impacts to the Sound. Research to date suggests that a trend toward warmer water temperatures is an important factor in the decline.

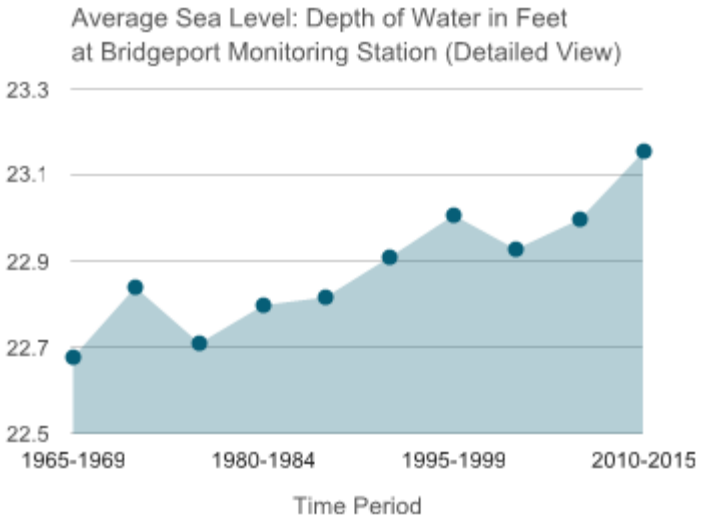
2015
Population
Declined

The lobster population of Long Island Sound has failed to recover.



The average temperature of the water in Long Island Sound has been rising, with the surface temperature rising slightly faster than the bottom water. The cold weather of early 2015 led to the coldest average water temperature in at least 25 years; the weather and water heated up in the summer, though the latter did not equal the record set in 2014. Hypoxia is most likely to be a problem when the surface water is much warmer than the deep water during the summer._____

The chart below displays average sea level from 1965 to the present at a monitoring station in Bridgeport. Since 1980, sea level has risen faster along the northeast coast of North America than in most other regions of the globe.



University of Connecticut scientists participated in a multi-year, multi-state assessment of bird species that nest in coastal marshes. The results, published in 2015, reveal several species in sharp decline. For Saltmarsh Sparrows and Clapper Rails, drops of 10 to 13 percent *annually* since 1998 augur a short road to local extinction. From the report: "The declines can be explained by increases in rates of nest flooding since 2002."

As the Sound rises, more tidal wetlands will be flooded. The natural "migration" of wetlands landward in response to sea level rise is prevented in many places by fill and development.

The changes in marine life, temperature and sea level are signs of a warming Sound. The Long Island Sound Study is working on a "sentinel" monitoring strategy that will track changes in the Sound related to climate change. If successful, that strategy will help Connecticut residents understand the changes in the Sound more fully. In the meantime, change is ongoing and Connecticut will need to pay close attention, as gradual change can become sudden change.

Technical Notes

1. The cold-adapted species shown on the top chart are those that prefer water temperatures below 60 degrees Fahrenheit. The warmer-adapted species prefer water ranging from 55 to 72 degrees Fahrenheit. Because no survey was conducted during the fall of 2010, that year was excluded from the chart.

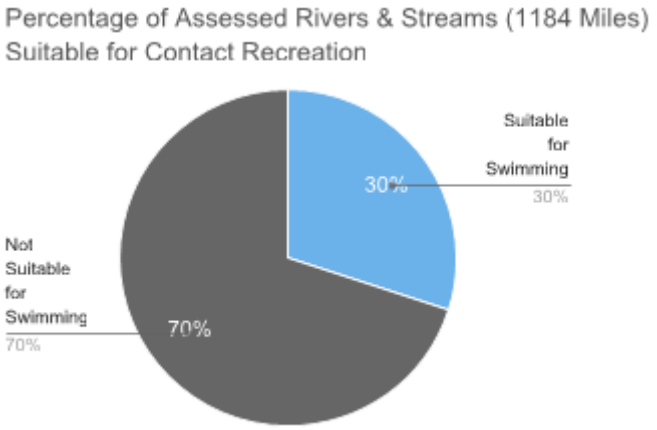
2. Lobster data for 2010 are absent because repairs to the research vessel *John Dempsey* precluded the fall Long Island Sound trawl survey.

3. The bottom chart shows the average level of the Sound at a point in Bridgeport, expressed as the number of feet above a submerged reference point.

Rivers and Streams

and Rainfall Trouble

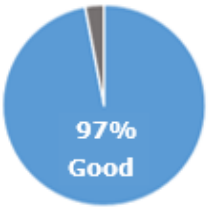
Throughout the state, about **30 percent** of assessed river miles are classified as being clean enough for swimming and other water contact sports.



Nearly 1200 miles were assessed by DEEP as to their safety for swimming and other recreation. About 356 miles (30 percent) are clean enough to fully support contact recreation. Read more [below] about recreation in Connecticut's streams...

The ecological health of a stream depends very much on a single factor: the percentage of the land in its watershed that is paved.

In nearly all cases, a stream that has *less* than 12 percent of its watershed covered by impervious surfaces will fully support aquatic life (shown as **blue**). Impervious surfaces are largely pavement and rooftops.



If watershed is **less** than 12% paved

In all cases, streams where *more* than 12 percent of the watershed is impervious will **not** fully support aquatic life (shown as **gray**).

If watershed is **more** than 12% paved

The watershed of a stream is all of the land from which water flows to the stream. For illustration, think of a stream as the drain of a bathtub; the watershed is the entire bathtub.

A random sample of 99 streams conducted by DEEP found that aquatic life is measurably affected when impervious surfaces -- largely pavement and rooftops -- cover 12 percent or more of the stream's watershed. *No* stream fully supported aquatic life if this 12-percent threshold was exceeded. Read more about aquatic life...

Rain: Too Little and Too Much

or, It Never Rains But it Pours

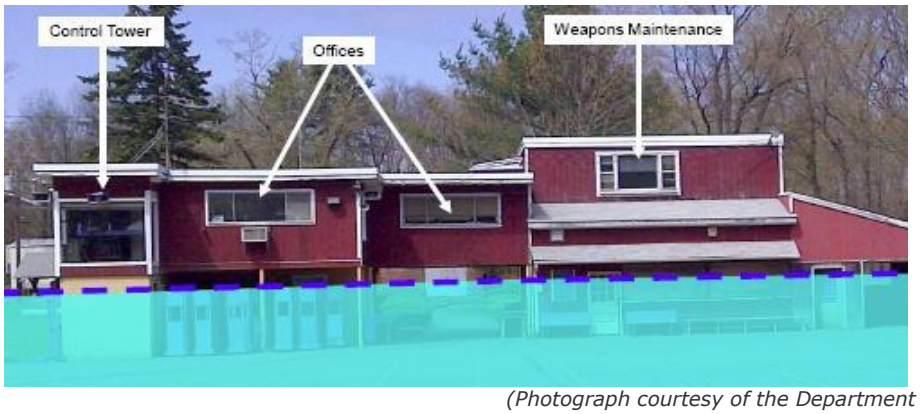
Late in 2015, several sizable streams in Woodbury, Bristol, and other Connecticut towns dried up. Connecticut had been experiencing a moderate drought, far from severe but bad enough: there simply was not enough water to keep drinking water wells and surface waters flowing*. The streams and their inhabitants were out of luck (and water).

Weekeepeemee River (in Woodbury), 2015
(Photo courtesy of the Pomperaug River Watershed Coalition)

Some large streams go dry during less-than-severe droughts because too much water is taken from the underground aquifers that would, under natural conditions, supply the waterways during dry weather. Only new commercial wells must obtain a permit to withdraw water; wells that existed before the state water diversion law was enacted in 1982 need only be registered with the state. Many streams are affected greatly by these older wells in their watersheds.

At the same time, Connecticut faces increasing probabilities of intense rains that cause flooding and pollution. At the Connecticut Department of Emergency Services and Public Protection's Division of State

Police firearms training facility in Simsbury, for example, floodwaters have reached or exceeded the level shown below at least five times in the last ten years.



(Photograph courtesy of the Department of Construction Services)

Most of the pollution problems observed in small streams, discussed above, can be traced to excessive runoff from land, especially land covered by impervious surfaces such as pavement. Additional information on the growing frequency of heavy rains can be found on the Swimming, Clamming and Heavy Rains page of this report.

One solution to both rainfall problems -- dry streams and floods -- is to reduce the area of impervious surfaces. Such reductions allow more rain to reach the groundwater table to keep wells and stream flowing during dry weather.

More about recreation in Connecticut's streams

In most sections of rivers and streams, bacteria levels are higher, at least some of the time, than what is considered safe for a person swimming or playing in the water. Detailed information is contained in the 2014 Integrated Water Quality Report submitted by DEEP to the federal government. The 2011 edition of that report estimated the percentage of fully safe rivers to be about 11, while the 2008 edition of that report estimated the percentage to be 15.

A separate statistical analysis performed by DEEP estimates that 47 percent of *wadeable* streams (which are streams shallow enough to be sampled using methods that involve wading) are suitable for recreation that involves contact with the water.

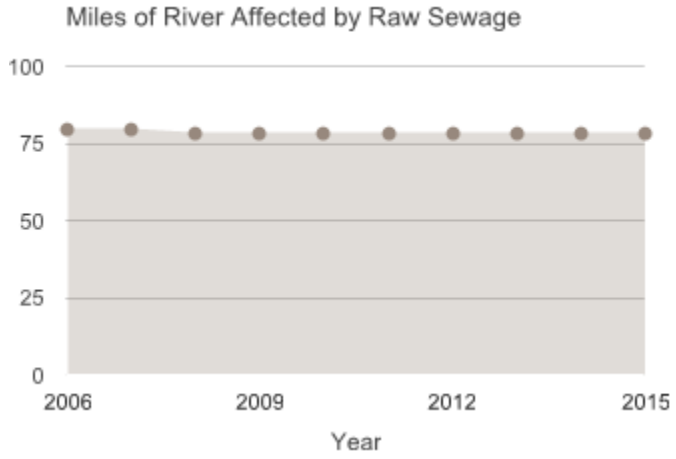
Apparent fluctuations in year-to-year results are probably due to limitations in data collection and not to widespread changes in water quality. The conclusion of all the analyses is that the water in most Connecticut streams and rivers might not always be safe for swimming and similar activities.

More about aquatic life

Numerous analyses point to the importance of keeping impervious surfaces to a minimum and reducing the runoff that flows directly from pavement into waterways.

There are hundreds of small streams where the water is very clean, and many of these have been documented by volunteers working with DEEP's Riffle Bioassessment by Volunteers (RBV) program. RBV enlists more than 400 students and adults to sample the aquatic life in more than 90 streams. In 2014, 37 out of 92 specific sampling locations -- the best ratio to date -- were found to harbor the types of insects and other life forms that signal a healthy ecosystem.

About 80 miles of rivers are polluted by overflows of **raw sewage**.



In 15 Connecticut cities and towns, sanitary sewers were built in combination with storm sewers. When it rains, these combined systems carry more water than their treatment facilities can handle, and a combination of stormwater and untreated sewage overflows directly into the rivers and Long Island Sound.

Several of the combined sewer systems have been completely or partly separated since 1990, reducing the volume of untreated sewage in rivers. Four cities that still contain multiple combined-sewer overflows -- Bridgeport, Hartford, New Haven and Norwich -- have reduced the number of overflow points, but about a hundred remain. Two other cities, Norwalk and Waterbury, have reduced their overflows to periods of exceptionally wet weather. During very heavy rains, the sewage treatment systems of many other municipalities, even those without combined sanitary and storm sewers, are overwhelmed and spill untreated or poorly-treated sewage to rivers and harbors. Regrettably, scientists predict climate change to yield more frequent high-intensity rainfall events in Connecticut.

DEEP maintains an interactive map showing the exact locations where sewage is known to overflow into waterways. The law that led to the map also required DEEP to publish notices of actual overflow events starting in 2014, but that deadline was not met.

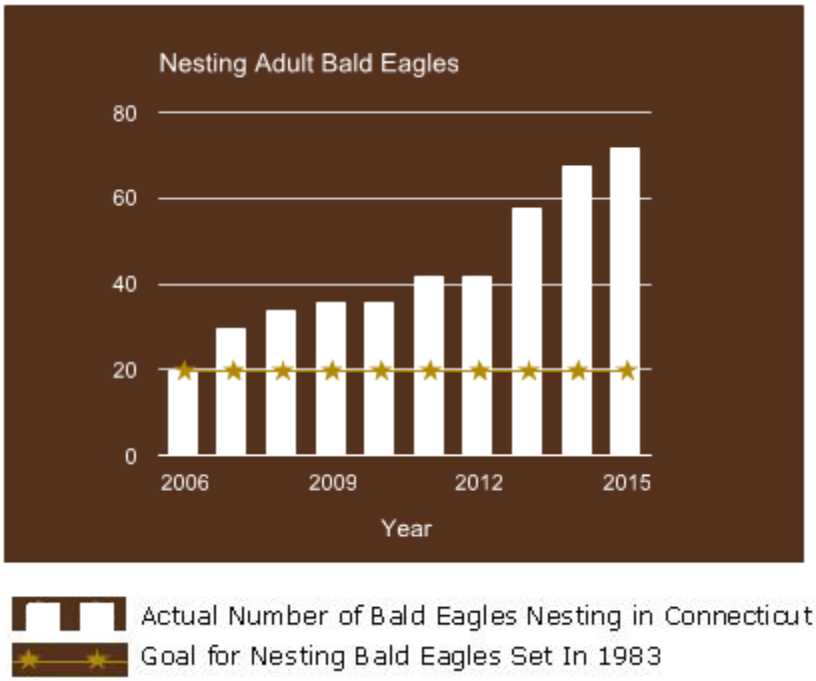
Connecticut's goal is to eliminate the effects of raw sewage discharges from combined sewer systems. Progress is slow because of the extraordinary expense of separating the sewers.

*Links to flow data for many Connecticut streams, as monitored and reported by the U.S Geological Survey, and other useful information about streamflow in 2015 can be found on the website of the nonprofit organization, Rivers Alliance of Connecticut.

Bald Eagles

2015 Population Increased

Another banner year for nesting Bald Eagles (and Ospreys, too).



Bald Eagles stopped breeding in Connecticut in the 1950s. The species declined throughout the lower 48 states and was declared endangered in 1967. A variety of environmental conditions harmed the eagle, including the widespread use of certain chemicals (chlorinated hydrocarbons) that accumulated in its prey (mostly fish). When those chemicals were banned and polluted waterways were improved, the Bald Eagle was able to reproduce again. Young eagles were reintroduced into nearby states in the 1980s, and a pair found their way to Connecticut in 1991 and successfully raised a family in 1992. In 2000 there were known to be eight nesting adults. Many more have since found acceptable nesting habitat on land protected by government and private landowners including utility companies and land trusts. DEEP monitors the eagles with the assistance of the Bald Eagle Study Group and other volunteers.

The population of Bald Eagles is included as an indicator because the eagle is representative of species, especially predators, that share similar habitat requirements: large areas of relatively undisturbed land near rivers or lakes where the birds can find adequate supplies of fish and other prey that are – very importantly – only minimally contaminated.

Bald Eagles can be seen fairly frequently where for decades they were scarce. On one morning in March of 2013, for example, 15 Bald Eagles were reported by experienced birdwatchers at Wethersfield Cove, only three miles from the State Capitol. More than 140 eagles spent the winter of 2014-2015 in Connecticut, mostly along rivers.

The federal government removed the Bald Eagle from its list of threatened and endangered species in 2007. In 2010, Connecticut changed the eagle's in-state status from endangered to threatened.

Another large fish-eating bird of prey, the **Osprey**, has rebounded in similar fashion. From a low of nine nesting pairs in 1974, Ospreys -- counted by the Connecticut Audubon Society's "Osprey Nation" volunteers -- were seen at more than 250 nests in 2015, including many along inland rivers and lakes.

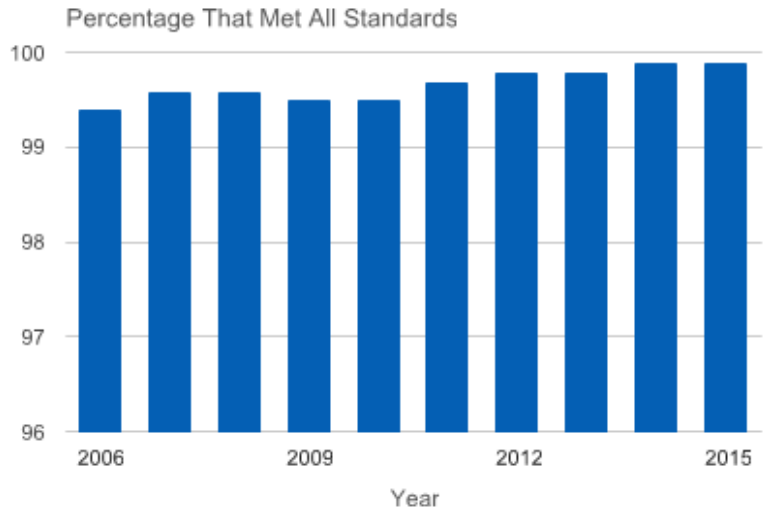
Osprey over Fairfield

What is the Source of the Goal?

The 1983 Northern States Bald Eagle Recovery Plan, prepared by the United States Fish and Wildlife Service, established a goal for Connecticut of 20 breeding birds (10 nests), which was reached for the first time in 2005. According to experts in the Bald Eagle Study Group, Connecticut could eventually host up to 200 nesting eagles (100 nests). (See page nine of the linked document.)

Public Drinking Water

Again in 2015, 99.9 percent of the water delivered by public water systems met all health standards.



Every public water system submits monthly quality reports to the Department of Public Health (DPH). This indicator shows the percentage of monthly reports that demonstrate full compliance, after weighting the reports to account for the number of people served by each system. Though long-term problems occur, they are rare in large systems, with the exception of the downturn in 2005 and 2006 caused by short-term problems in larger systems. This indicator would show greater fluctuations if the larger utilities failed to deliver good water. The most commonly encountered contaminants in systems with violations were coliform bacteria and high levels of chloride. Fewer violations were due to byproducts of disinfection, radioactive substances, and an assortment of other chemicals.

A Note About Lead

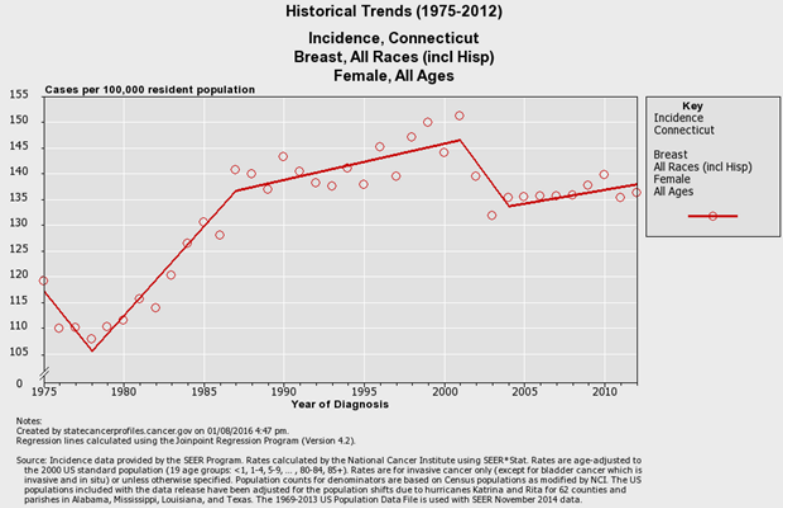
Lead contamination in Flint, Michigan gained national attention in 2015. Usually, as in Michigan, large-scale lead contamination is a result of mismanagement. The lead normally is not found in the water supply itself. The problem occurs when corrosive water enters homes and schools through pipes that contain lead. The Connecticut DPH oversees the monitoring for lead by public water supplies, and also requires public water to be tested for corrosive properties (including pH). Lead contamination is an uncommon problem here, generally affecting only very small systems. Lead is not included in the chart above.

Data are not completely comparable across all states, but federal reports suggest that Connecticut is among the very best in delivery of safe water from public supplies. This excellent record can be attributed to many factors, including Connecticut's policy of not permitting direct discharges of pollution into streams that flow to drinking water reservoirs.

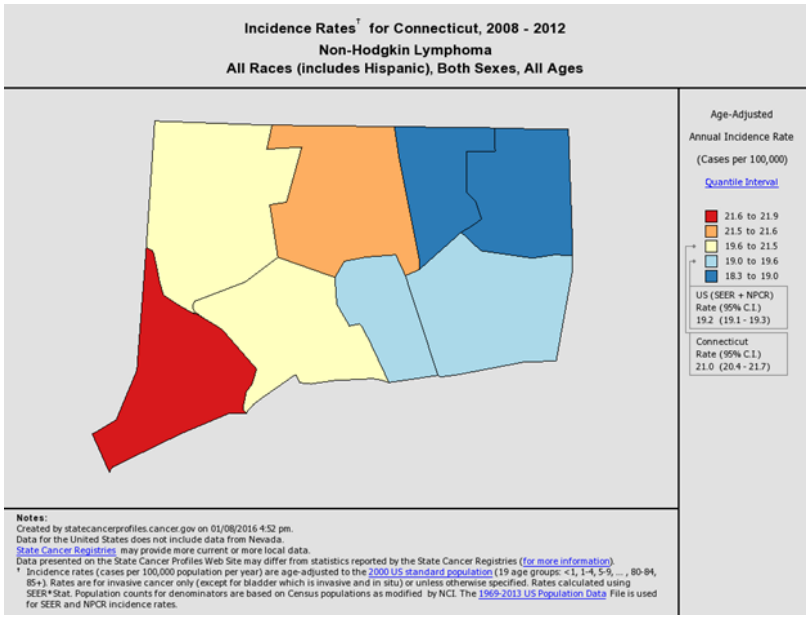
About 85 percent of people in Connecticut are supplied by the public water systems included in the chart above. The other 15 percent rely on private wells, which are not monitored by any government agency and are not counted in this indicator. An unknown but significant number of private wells are contaminated by pollution or naturally-occurring toxins such as arsenic. Residents who drink from private wells are not required to test their water, so the number of those people who drink contaminated water cannot be measured.

These human health indicators have been discontinued.

Two types of cancer (female breast cancer and non-Hodgkin's lymphoma) were tracked on this page for many years because of their possible association with environmental factors. Readers now have ready access to the same data from other sources. The website of the National Cancer Institute allows the reader to display the data in any number of ways. Here, for example, is the chart for breast cancer incidence in Connecticut (which is interactive on the NCI website):



Among the options on the NCI site are maps showing variability in specific cancer incidence rates within Connecticut. As an example, this map displays the varying rates of Non-Hodgkin's Lymphoma in the eight counties:



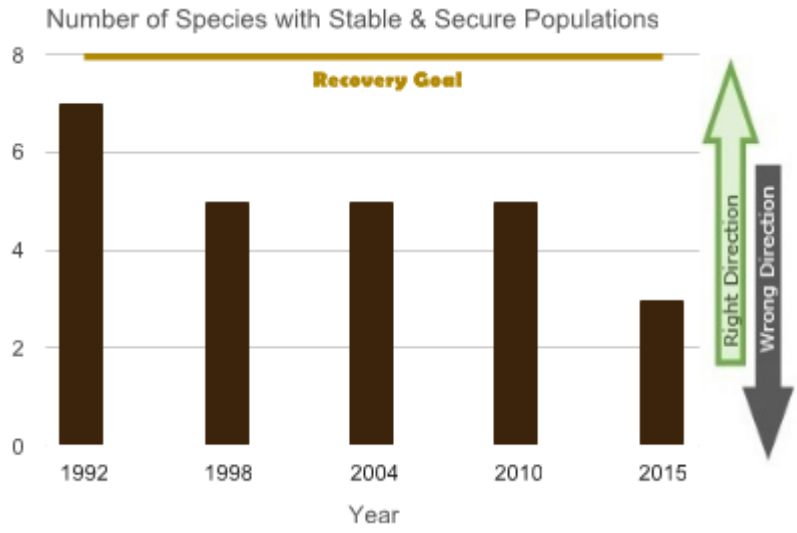
Additional data about cancer incidence and patterns can be found on the website of the Connecticut Department of Public Health.

Readers with a strong interest in the associations between human health and environmental quality are encouraged to bookmark those sites.

Resident Turtles

Latest Data:
Population
Declined

Five of the eight turtle species that live year-round in Connecticut are on the latest list of species that are endangered, threatened or of special concern.



Turtles are excellent indicators of ecological health. They live long lives, reproduce slowly and decline in number when their habitat declines. This indicator includes the eight species of turtle that live in Connecticut (but not the four marine species that visit Long Island Sound in summer, all of which also are threatened or endangered).

Through 2014, five of the eight resident turtle species were *not* classified as endangered, threatened or of special concern: common musk turtle, common snapping turtle, northern diamondback terrapin, eastern painted turtle and spotted turtle. The rare and/or declining species were the bog turtle (endangered), eastern box turtle and wood turtle (both state species of special concern).

The 2015 list classifies two more species of turtle as being of special concern: northern diamondback terrapin and spotted turtle.

Classification and protection of endangered species in Connecticut dates back to 1989 and the adoption of "An Act Establishing a Program for the Protection of Endangered and Threatened Species." The Department of Environmental Protection published the first list of Connecticut's Endangered, Threatened and Special Concern Species in 1992. At that time, only the bog turtle was on the list. The wood turtle and the eastern box turtle joined the list in 1998 as species of special concern.

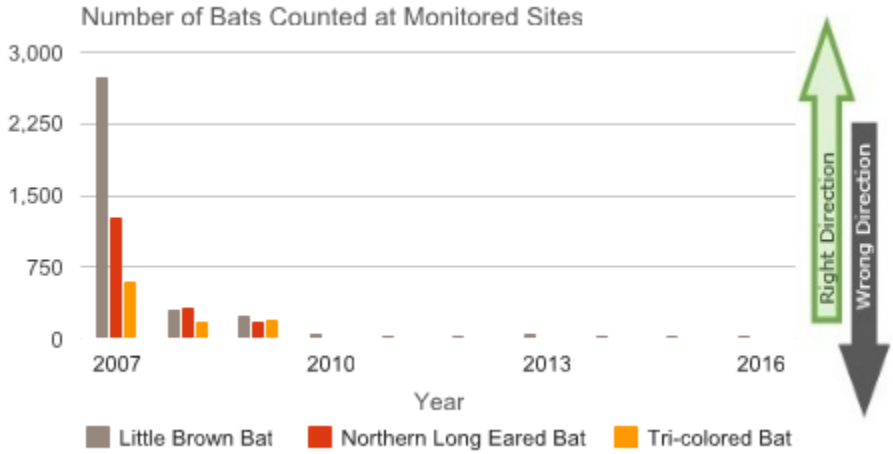
The Goal for Turtles

The goal for all endangered and threatened species is for recovery of their populations to a stable, sustainable level.

Bats

2015
Population
Declined

Cave-dwelling bat species have declined catastrophically.



The chart above depicts the winter populations of three cave-dwelling bat species at caves monitored by the Department of Energy and Environmental protection. (At one of the caves, the decline was so complete that monitoring ceased in 2011. In 2015, monitoring was discontinued at a second monitoring site.)

An epidemic fungal disease called White Nose Syndrome (WNS) is the cause of the bats' demise. WNS has been documented throughout the northeast states.

The catastrophic decline led to the classification in 2015 of all three species as endangered in Connecticut and to the federal government's listing of the northern long-eared bat as endangered. Prior to WNS, these were the three most common cave-dwelling bat species in Connecticut. The small brown bat population has not dropped to the single digits at the monitoring sites, as has the other species. The population decline might have stopped. Recovery, if one occurs, will be slow. They only produce one pup per year. A fourth species, the big brown bat, has declined but not by as much and is now the most common species.

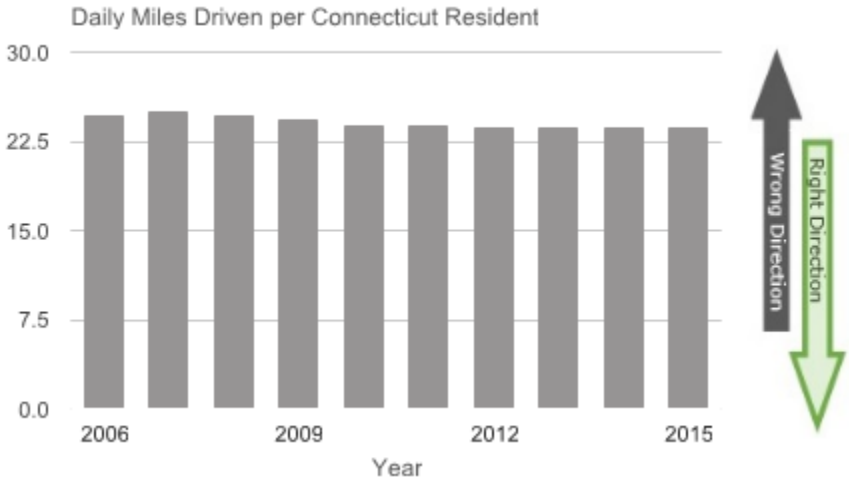
Bats are mammals, but the Connecticut Audubon Society included a review of these ecologically-important aerialists in their 2013 report on the State of the Birds.

Not all bats live or hibernate in caves. Many live in trees, and future editions of this report will include population trends for those species (three of which also are on the list of species that are endangered, threatened of special concern).

Coming next year: more species!

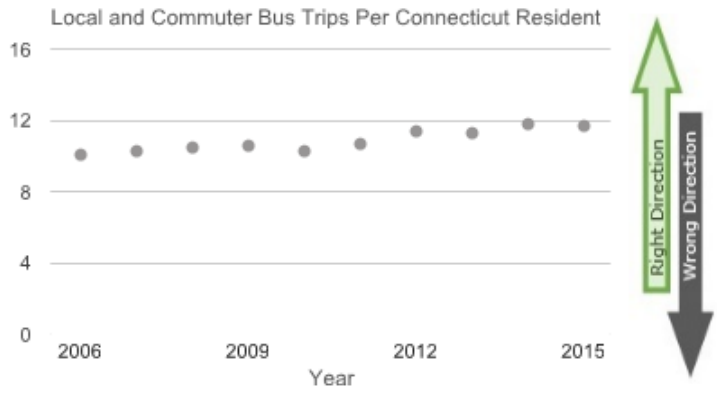
Driving

After a six-year trend of driving fewer miles each year, the average resident drove a few more miles in 2014 and 2015.



Riding

The average Connecticut resident took the bus slightly less often in 2015, but still more in any other recent year.



Top chart: Driving a car, truck or sport utility vehicle is one of the most environmentally harmful activities a Connecticut resident will engage in personally. Impacts are direct (air pollution, oil leakage, etc.) and indirect (creating demand for new roads). The Department of Transportation estimates the total miles driven each year in Connecticut. Nearly every year for several decades -- until 2008 -- the average Connecticut resident drove more miles than in the previous years. The reasons for the decades of increasing vehicle use are complex and include the fact that most new development was accessible only by private vehicle. The drop in driving by Connecticut residents that began in 2008 mirrored the national trend. As residents drove less, gasoline consumption decreased** and pollution was reduced. In 2014, residents started to drive slightly more (again following a national trend), but gasoline consumption did not climb along. – until 2015. NEW: Gasoline and diesel consumption is displayed on the Climate Changers page.

Bottom Chart: The number of in-state local and commuter bus trips taken by the average resident has been on an upward trend since 2005, when the average was 9.5 trips. In 2015, new routes were added and CTfastrak service was launched on the Hartford to New Britain corridor, but total ridership remained about the same. Riding a bus is just one way to avoid the negative environmental consequences of driving a car. Ridership data, collected by the Department of Transportation, are estimated for 2015 and will be refined in future reports.

* Personal impact indicators illustrate trends in behavior or practices that can be expected to influence the condition of tomorrow's air, water, land and wildlife.

** FY 2017 Midterm Economic Report of the Governor, Office of Policy and Management, February 5, 2014, page 48.

Compliance

With this update, the Council has discontinued its long-running Compliance Rate indicator.

The Compliance Rate indicator was developed when physical inspections were more important to the state's enforcement of environmental laws. Now that many violations are detected by other means (such as reviews of monitoring reports submitted electronically, cross-checking other data sources for unpermitted facilities, and following up on companies' failures to respond to initial notices), the Council has concluded that it is impossible to estimate the percentage of companies that are operating in compliance with all environmental laws. A reliable estimate would depend on random sampling of regulated facilities, but such sampling is not likely to occur. Instead, faced with dwindling resources, DEEP focuses enforcement on sectors where violations are commonplace (as discussed below). With no Compliance Rate to report, this page now focuses on aspects of compliance that can be documented.

About 900 violations of environmental laws were detected in 2015. As usual, most of the violations were at facilities that store or distribute gasoline and oil.

Who is breaking Connecticut's environmental laws?

To answer this question, the Council reviewed the 4,000-plus Notices of Violation (NOVs)** issued by DEEP in (fiscal year) 2011 and again in 2013 through 2015.*** The conclusions of the first year's analysis are summarized in an April 2012 staff memo and the violators are characterized in a series of charts . The overwhelming majority of businesses found to be in violation were small companies, and most violations were related to the storage, transport or distribution of petroleum. The largest group, by far, were gas stations and convenience stores. Only seven percent of NOVs were issued to manufacturers with more than 20 employees, fewer than the number issued to individual citizens.

The Council's review of the 1,098 NOVs issued in 2013 found similar data. Again, the largest portion were related to violations of laws pertaining to the storage or distribution of petroleum, and most of the laws broken were aimed at reducing the risk that pollution (from spills, discharges, leaks, etc.) would occur in the future. This was true again in 2014, when more than 1,200 NOVs were issued, and in 2015 when more than 900 violations were found.

The persistent high rate of violations at petroleum-handling facilities puts a large burden on DEEP. The Department could focus more resources on other problems if compliance were better.

The number of inspections conducted by DEEP is at an all-time low.

The Changing Tools of Enforcement

Faced with diminishing staff resources, DEEP has streamlined enforcement procedures in some programs, resulting in issuance of notices to more violators. Electronic submission of reports by permit-holders in some programs also has allowed for more targeted enforcement. To use the well-worn police-and-speeders analogy, this would be concentrating a smaller police force on the roads where speeding is believed to be most prevalent, with the result of more tickets being issued. But targeted enforcement alone might not explain the larger number of violations. Numerous studies have shown that the average speed on highways increases when drivers believe there are no police looking for speeders. Is there an analogous increase in environmental violations when people know that fewer inspections are being conducted?****

Compliance and Environmental Quality

The role of compliance has changed. For decades, the extent to which people, companies and government complied with environmental laws had an immediate effect on the condition of the state's environment. As compliance improved, so did the air, water, wildlife and other natural resources. With a few notable exceptions, such as some municipal sewage treatment facilities that still pollute large bodies of water from time to time, the current environment owes more to past compliance efforts than to current ones. According to the Council's analysis of enforcement data (see above), most violations and enforcement actions now relate to the prevention of petroleum leaks and spills. In contrast to those, many sites that are not violating any laws contribute enormous amounts of pollution to rivers and streams every time it rains. Compliance and enforcement remain important for maintaining a habitable state, but Connecticut residents should no longer expect higher compliance rates to lead to dramatic improvements in statewide environmental indicators.

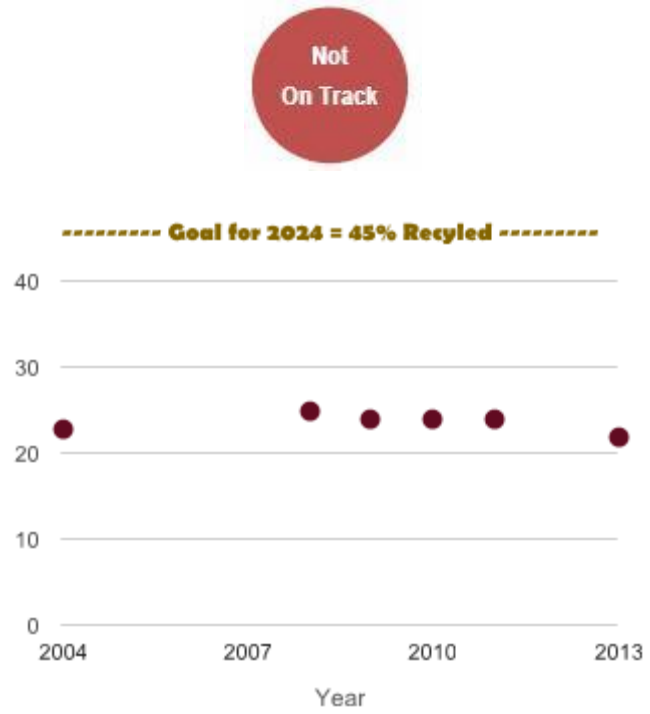
*Personal Impact indicators illustrate trends in behavior or practices that can be expected to influence the condition of tomorrow's air, water, land and wildlife.

**Notices of Violation (NOVs) are informal enforcement tools, generally issued whenever DEEP detects one or more violations at a facility. They carry no financial penalty. The recipient has 30 days to respond. They can be issued for relatively minor or major violations; in cases of the latter type, the recipient might also receive an order, which might carry a financial penalty. NOVs typically outnumber orders by a factor of five or more in any year. NOVs are good indicators of trends in violations because almost all violations found through inspections result in NOVs. DEEP also issues a much smaller number of warning letters, and those are included in the NOV totals above.

***For this indicator only, years pertain to federal fiscal years (i.e., October 1 through September 30), not calendar years.

****The analogy between speeders and environmental violators is imperfect at best. Speeders hope to avoid a ticket that comes with a significant financial penalty. A Notice of Violation (NOV) issued by DEEP, on the other hand, carries no financial penalty.

Recycling Rate



Connecticut struggles to recycle. It also struggles, like many states and municipalities, to gain an accurate accounting of the waste recycled. The 2013 (latest data available) recycling rate of 22 percent probably is a low estimate. DEEP and its partners hope to improve accounting in the future.

Recycling is not the only method for reducing the volume of waste that is burned and buried. Yard and food waste can be composted or even converted to fuel, as can agricultural waste. Other types of waste can be handled through programs established by the industries that produce the products; Connecticut requires producers to establish opportunities for consumers to return mattresses and unwanted paint for recycling, and sees potential for more product take-backs. Waste can be avoided altogether through more efficient packaging.

With adoption of An Act Concerning Connecticut's Recycling and Materials Management Strategy (P.A. 14-94), Connecticut set a challenging goal for itself to achieve by 2024: divert 60 percent of solid waste from disposal. This includes a recycling goal of 45 percent, shown on the chart above.

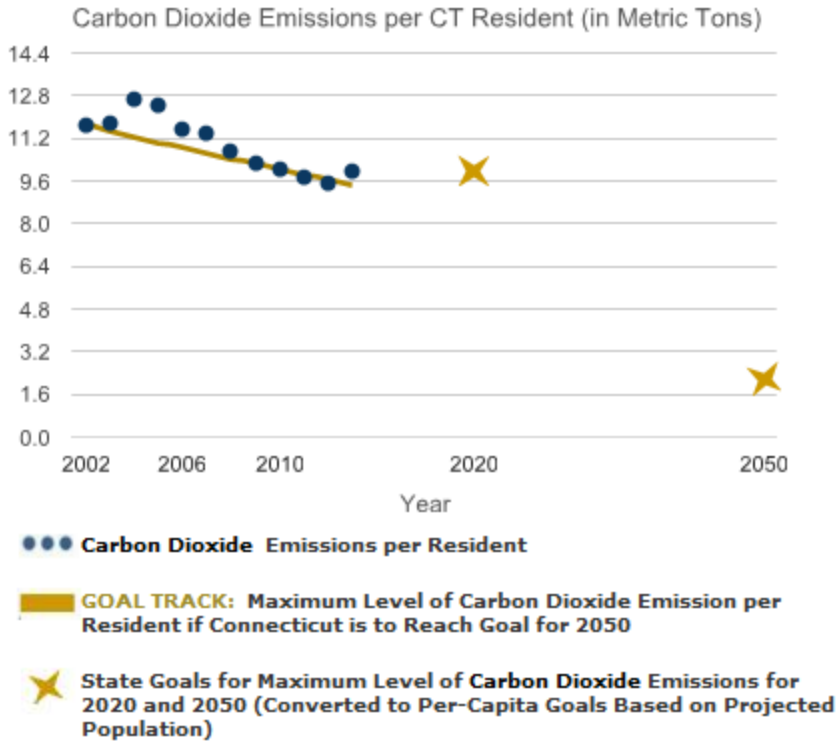
DEEP's *Draft Comprehensive Materials Management Strategy* includes a number of initiatives to divert additional waste.

*Personal Impact indicators illustrate trends in behavior or practices that can be expected to influence the condition of tomorrow's air, water, land and wildlife.

Climate Changers

Latest Data: More Emissions

Connecticut residents are meeting the 2020 goal for carbon dioxide emissions, but barely.

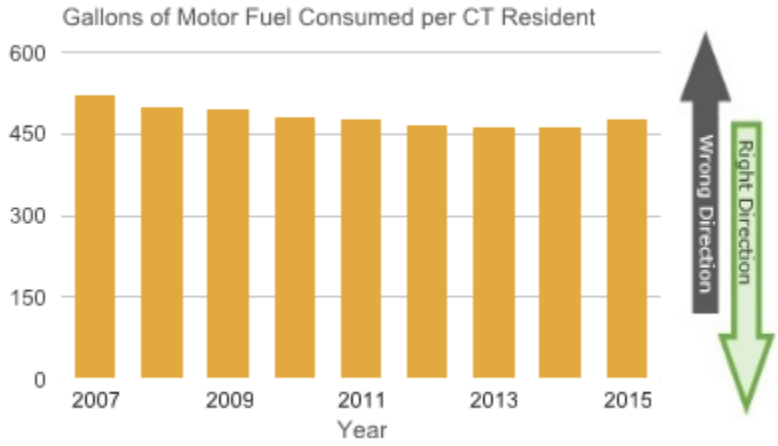


Certain gases in the air function like the glass of a greenhouse: they allow the sun's energy to pass through the atmosphere to the ground, then trap the heat that radiates from the ground. These gases often are called "greenhouse gases." Worldwide, a build-up of greenhouse gases is contributing to the ongoing rise in temperature. Carbon dioxide is not the only greenhouse gas nor even the most powerful, but carbon dioxide emissions are far greater in quantity than the others. Carbon dioxide is not the only greenhouse gas nor even the most powerful, but carbon dioxide emissions are far greater in quantity than the others.

The chart shows the total amount of carbon dioxide emitted in Connecticut from the burning of petroleum products, natural gas and coal divided by the population. The most recent data available are from 2013. Data are estimates prepared by federal and state agencies. Year-to-year fluctuations, such as the apparent jump in 2013, could be adjusted in future years. After vehicles, the largest sources are power plants, homes and industrial facilities.

Connecticut is more energy-efficient than the nation as a whole, and thus the average Connecticut resident's contribution to global climate change is smaller than the average American's.

NEW! Connecticut residents bought more gasoline in 2015, reversing a long trend toward greater efficiency.



New Indicator: Consumption of Motor Fuels (Gasoline and Diesel). Early in 2016, transportation (primarily the combustion of gasoline and diesel fuel in vehicles) overtook power plants as the largest source of carbon dioxide emissions in the United States.** Recent data for individual states are not yet available, but transportation had already been the largest source of carbon dioxide emissions in Connecticut (about 40 percent). As residents buy more petroleum, their carbon dioxide emissions rise.

How the Goal Track is Calculated

State law sets two goals for greenhouse gas emissions: reduce statewide emissions to 10 percent below 1990 levels by 2020 and 80 percent below 2001 levels by 2050. The top chart shows emissions *per Connecticut resident*, not total emissions. The goals on the chart have been adjusted to account for the growth in population that is projected for 2020 and 2050. Many more people are projected to be living in Connecticut in 2020 and 2050, so the average resident will have to work that much harder to reduce carbon dioxide emissions if the statewide goal is to be met.

Connecticut's goals are in line with national and international estimates of the extent carbon dioxide emissions from industrialized nations will need to be reduced in order to limit the rise in global mean temperature to no more than 3.6 degrees Fahrenheit (2.0 degrees Celsius) above preindustrial temperatures. In December 2015, most countries of the world agreed to this limit and also a further goal to pursue steps to limit warming to no more than 2.7 degrees Fahrenheit (1.5 degrees Celsius).

Goal Track vs. the Current Trend

Average Annual Per-Capita Reduction (in tons) in Carbon Dioxide Emissions Needed to Reach Goal for 2050

Goal Track

Average Annual Per-Capita Reduction (in tons) in Carbon Dioxide Emissions Since 2001 (Actual)

Current Trend

*Personal Impact indicators illustrate trends in behavior or practices that can be expected to influence the condition of tomorrow's air, water, land and wildlife.

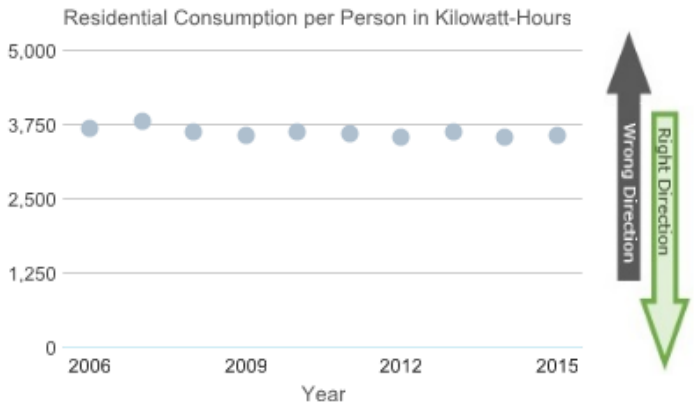
**Nationwide data are from the May 2016 Monthly Energy Review published by the U.S. Environmental Information Administration (specifically pages 180 and 181).

Electricity at Home and Work

At Home:

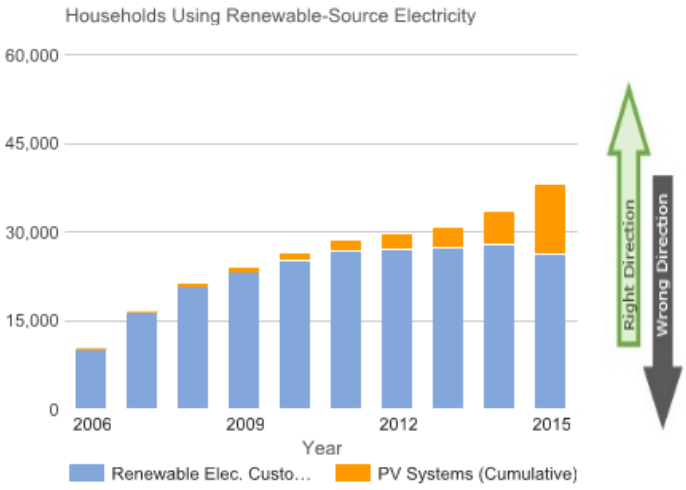
2015 Conditions Declined

The average Connecticut resident used slightly more electricity in 2015.



2015 Conditions Improved

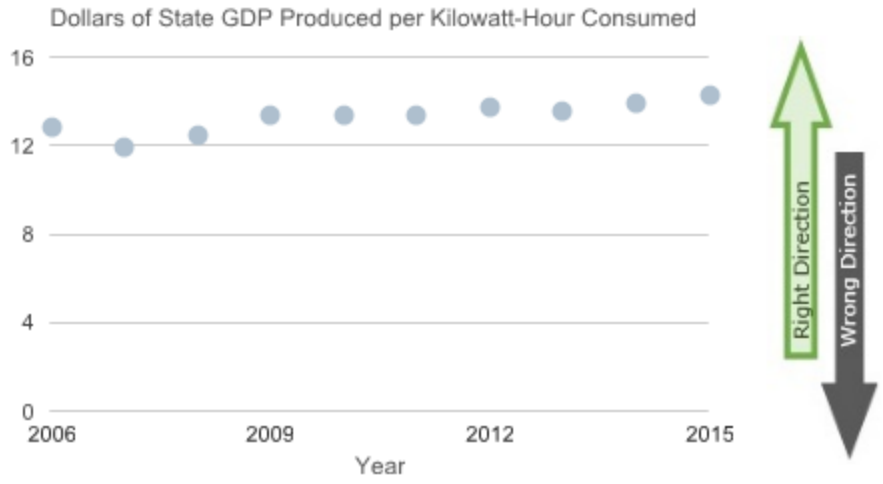
The installation of photovoltaic (PV) solar panels accelerated but, for the first time, fewer residents purchased all of their electricity from other renewable sources.



At Work:

2015 Conditions Improved

Connecticut's economy continued to expand while consuming less electricity.



Efficiency at Home (Top Chart): The trend in average Connecticut household consumption of electricity has been relatively flat since the peak usage year of 2007. The uptick of 2015 came in a year of extreme weather. Nonetheless, peak demand remains excessive. According to the Connecticut Siting Council, peak demand occurs during hot, humid summer days when residents use air conditioning. Most Connecticut consumers do not purchase the most efficient air conditioners. (Appliance purchasing data previously was tracked in this report but became unavailable in 2010.) Excessive electricity consumption in the summertime has had significant environmental consequences. On the hottest days, Connecticut's base-load power plants are unable to meet the additional demand, and older petroleum-fueled plants are brought online. Because they are used sporadically, many of these older plants are permitted to operate with no pollution control equipment. As a result, state residents generate the most air pollution on the hottest summer days when air quality is already bad.

The vast majority of Connecticut's electricity is generated from nuclear energy and the combustion of natural gas, oil and other fuels. Hydropower, wind, solar and other renewable resources are small but growing sources of electricity. Each source, renewable or not, has its own negative environmental consequences. Reducing those consequences will require Connecticut households to use electricity more efficiently. Such efficiency can be attained in part with ENERGY STAR appliances.

Residential Renewable Energy Purchasers (Middle Chart): The CTCleanEnergyOptions program enables customers to purchase electricity from renewable sources, especially wind. The consumer who elects this option is paying for the generation of renewable electricity on the regional electric grid, which in turn reduces the amount of electricity that otherwise would be generated by power plants. Participation grew steadily until 2011. The reasons for 2015 decline have not been identified. For customers who do not sign up to purchase electricity from renewable sources, a percentage of their "regular" electricity service is required by statute to be from renewable sources; that minimum percentage was 19.5 percent in 2015 and will escalate to 21 percent in 2016 and 27 percent in 2020.

Thousands of Connecticut homes (shown in gold on the chart) now use the sun to generate much of their own electricity. Legislation adopted in 2011 (CGS 16-245ff) set a goal of 30 megawatts of new photovoltaic capacity installed on residential properties by the end of 2022. The Residential Solar Investment Program of the Connecticut Green Bank (formerly the Clean Energy Finance and Investment Authority) reports that this goal was exceeded in 2014. In 2015, the law was amended to continue subsidies for residential photovoltaic installations until 300 megawatts is achieved, or until 2022. It is estimated by the Connecticut Green Bank that, by the end of 2015, it had assisted in the installation of 86.7 megawatts.

Efficiency at work: The **bottom chart** shows the trend in the efficiency with which Connecticut's economy uses electricity to produce goods and services.

Connecticut's businesses generally have been using less electricity to produce a unit of goods or services. Gross Domestic Product (GDP) is the total value of goods and services produced within the state in a single year. The federal Bureau of Economic Analysis put Connecticut's 2015 GDP at $258 billion (current dollars), an increase of 3.1 percent from 2014. At the same time, Connecticut's business and industrial sectors used slightly less electricity.

The Council investigated the question of whether the apparent long-term improvement in efficiency might have been caused by a shift in Connecticut's economy from energy-intensive manufacturing to financial services and other business sectors that consume less electricity. That shift probably has been a factor. Manufacturing GDP grew from 2004 through 2011 (the most complete data available at the time of this analysis) at a slower rate than the overall state GDP, while the financial and health care sectors expanded at a faster rate. The latter sectors probably use less electricity to create a dollar of GDP in comparison to manufacturing, so their increasing importance to the state's economy could make the overall business sector appear more energy-efficient.

Technical Note: Previous years' data for photovoltaic systems in the middle chart were adjusted this year to account for the Connecticut Green Bank's change to the date at which an installation is recorded as "completed."

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Activities of the CEQ in 2015

Research and Reports

The Council published the state's environmental quality report for calendar year 2014 in March, 2015. This continued the recent practice of publishing early in the year, which the Council has accomplished by switching its sources of data for many indicators.

During 2015, the Council continued to develop new indicators of ecological health. Specifically, the Council has identified species of wildlife that are true indicators of the quality of their habitats. The current report includes several of those species, with an emphasis on birds of the forest. The development of such indicators requires considerable care in the selection of species, and the Council is grateful for the advice it received from experts.

The Council is required to recommend legislation for "remedying the deficiencies of existing programs and activities," and usually submits those to the governor each January, as it did in 2015.Following up on the data that show discouraging progress toward meeting state land conservation goals, the Council began to lay the groundwork for new initiatives that will be required to reach the state's goal. A December staff memo describes some of the trends and the prospects for a possible new approach called "490 Forever."

Special Focus on Stormwater and Mining

At three successive Council meetings in 2015, residents alerted the Council to apparent deficiencies in the regulation of stormwater and surface mining.
Specifically, citizens described a sediment-laden stream polluted after the erosion controls at a solar energy facility were overwhelmed, the failure of the state's stormwater general permits to protect archaeological and historic sites as intended, and the absence of state oversight of sand and gravel mining. The Council investigated all three and published a draft report with recommendations. In December 2015 and January 2016, representatives of mining and construction industries, river protection organizations and state agencies were invited to review the draft. Many valuable comments were received, and the Council will publish a final report in 2016.

Review of State Projects and Programs

All agencies submit their environmental impact evaluations (EIEs) of proposed projects for the Council's advice.

For years, the Council has been working to help modernize the Connecticut Environmental Policy Act (CEPA) in the pursuit of more concise and less expensive EIEs. Council staff participated in meetings with other agencies to further those objectives. In 2014, the Council discussed with Commissioner of Energy and Environmental Protection Rob Klee and other DEEP staff the need to update the archaic CEPA regulations, which are under DEEP's jurisdiction and have not been amended since the 1970s. No amendments to the regulations have yet emerged.

The Council received complaints when DEEP proposed to move forward on the next phase of a park-development project while relying on an EIE that had been completed 23 years earlier. The CEPA statutes and regulations are silent on the question of how long an EIE should be considered valid, which points to one of the many needs to update the regulations. The Council reinforced this point in an October 2015 letter to Commissioner Klee.

The Council submitted comments on fewer individual projects than usual in 2015. It commented on a proposal to erect a signal tower on preserved land where it could not be permitted. And following up on a 2014 CEQ special report, the Council suggested to DEEP that permit renewals for alternative sewage treatment systems where compliance has been a problem should be limited to five years instead of the usual ten.

The Connecticut Siting Council also solicits the CEQ's comments on applications and petitions. The CEQ submitted comments on a proposed project in Farmington in 2015 as part of a long-term effort to improve analyses of visual impact.

Citizen Complaints

As noted in reports of the past five years, citizens of Haddam have spoken repeatedly to the Council about contamination of land and groundwater that has existed in their community for more than 30 years. The Council decided to follow this case closely to learn why the start of remediation in some communities is delayed for decades (if it ever occurs). In September 2012, the Council submitted a detailed letter to Governor Dannel P. Malloy to update him on the problems in Haddam "and the broader problems made evident by this case." In November 2013, the Superior Court ruled that the owner of a former industrial facility in the community was indeed required to abide by DEEP's requirements. Investigation of the site continues but, to date, there is no remedial activity. At the May 6, 2015 Council meeting, a resident and the First Selectman of Haddam resident reminded the Council of this fact and offered recommendations.

The following are examples of the many other complaints investigated in 2015:

- The state's proposal for a new state firearms training facility appeared to be inconsistent with its Conservation and Development Policies Plan.
- Three facilities that treat hazardous wastes have violated their water discharge permit limits.
- DEEP settled a significant encroachment on state forest land with no public input, and settled for too little.
- A landscaper explained how residents and lawn care businesses rely too heavily on chemicals and practices that harm the soil and Long Island Sound.
- Snapping turtles are not protected adequately by existing statutes and regulations, making the population susceptible to excessive commercial harvesting.
- Tree clearing along state highways has been excessive.

The Council investigated all of the complaints it received and offered recommendations to the relevant state agencies, where warranted.

Advice from the Public

At its regular monthly meetings, the Council heard from many people and organizations, including DEEP, Office of Policy and Management, University of Connecticut, Connecticut Land Conservation Council, Rivers Alliance of Connecticut, Berkshire-Litchfield Environmental Council, and others.

Many people across the state expressed their concerns during 2015. The Council worked to address them all, and truly appreciates the efforts people made to bring environmental problems to light. The Council looks forward to helping citizens and agencies solve the challenges of 2016 and beyond.

44

The Council has been fulfilling its duties for 44 years.

Council Duties

The main responsibilities of the Council on Environmental Quality are described in Sections 22a-11 through 22a-13 of the Connecticut General Statutes.

The Council is a nine-member board that works independently of the Department of Energy and Environmental Protection (except for administrative functions). The Chairman and four other members are appointed by the Governor, two members by the President Pro Tempore of the Senate and two by the Speaker of the House. The Council's responsibilities include:

1. Submittal to the Governor of an annual report on the status of Connecticut's environment, including progress toward goals of the statewide environmental plan, with recommendations for remedying deficiencies of state programs.

2. Review of state agencies' construction projects.

3. Investigation of citizens' complaints and allegations of violations of environmental laws.

4. Review of environmental impact evaluations that state agencies prepare for major projects under the Connecticut Environmental Policy Act (CEPA).

5. Publication of the *Environmental Monitor*, the site where all state agencies must post their scoping notices and environmental impact evaluations under CEPA. The *Environmental Monitor* also is the official publication for notice of intent by state agencies to sell or transfer state lands.

CEQ Members

Susan D. Merrow, Chair
Resident and former First Selectman of East Haddam. Member, East Haddam Conservation Commission. Board Member, Eightmile River Wild and Scenic Coordinating Committee; Former President, Connecticut Conference of Municipalities. Former President, National Board of Directors, Sierra Club. Author, One for the Earth: Journal of a Sierra Club President. Board Member, Connecticut League of Conservation Voters. Former Trustee, Connecticut River Watershed Association.

Janet P. Brooks
Resident of Middletown. Attorney with law office in East Berlin with a practice in environmental, administrative and land use law. Member of the Connecticut Bar Association Planning & Zoning Section and Environment Section. Co-author of *Connecticut Environmental Protection Act*, Volume 15 of the Connecticut Practice Series published by Thomson West. Formerly Assistant Attorney General in the Environment Department of the Connecticut Attorney General's (AG's) Office for 18 years enforcing the state's environmental laws running the gamut from noise, odor, water pollution, air pollution, pesticides to habitat protection and preservation of land. While at the AG's Office, coordinated the wetlands appeal practice and developed the legal training for wetlands commissioners for DEEP's annual training. Recipient of 1984 German Marshall Fund grant to study the effect of citizen participation on hazardous waste clean-ups in four European countries. Based on those experiences, authored a chapter published in *America's Future in Toxic Waste Management: Lessons from Europe.* Staff Attorney for five years at the Connecticut Fund for the Environment, Inc., representing citizens groups in administrative and court proceedings. Began practice of law assisting the Middletown City Attorney in the city's opposition to the utility company's burning of PCB waste oil within the city boundaries.

Alicea Charamut
Resident of Newington. Lower River Steward at the Connecticut River Watershed Council. Long-time grassroots advocate for Connecticut's water resources. Board of Directors, Rivers Alliance of Connecticut. President, Farmington Valley Chapter of Trout Unlimited. Secretary, Connecticut Council of Trout Unlimited. Secretary, Fisheries Advisory Council.

Lee E. Dunbar
Resident of Mansfield. Retired. Previously, Assistant Director, Bureau of Water Management and Land Re-Use, Planning and Standards Division, Connecticut Department of Environmental Protection. Responsible for developing scientifically defensible water quality standards and criteria to protect human health and aquatic life. Developed and implemented environmental monitoring and assessment methods. Participated in the development of regulations to better manage stream flow in Connecticut streams affected by water withdrawals and diversions. Oversaw the development of regulatory programs including the Total Maximum Daily Load (TMDL) Program, Nitrogen Trading Program, and Water Quality-based Discharge Permitting Program. Awarded Lifetime Achievement Environmental Merit Award by the U.S. EPA in 2010 for significant contributions to environmental awareness and problem solving. Board Member, Eastern Connecticut Forest Landowners Association. Board Member, Wolf Den Land Trust.

Karyl Lee Hall
Resident of Branford. Attorney with the Connecticut Legal Rights Project. Formerly with Murtha, Cullina, the Connecticut Fund for the Environment and Connecticut Legal Services. Chair, Branford Conservation Commission. Board Member, Connecticut League of Conservation Voters, Co-chair, Scenic Roads Advisory Committee for Routes 146 and 77. Member, Advisory Board, Branford Land Trust. Vice President, Citizens for Branford's Environment, 2002-2009. Connecticut Bar Association Pro Bono Service Award, 2003. Former Co-chair, State Implementation Plan [for Air Management] Revision Advisory Committee.

Alison Hilding
Resident of Mansfield. Long-time advocate for the environment and children, viewing clean air and clean water as important dimensions of child advocacy. Member, Connecticut Commission on Children, 2003 to present; Executive Board since 2008, Secretary since 2012. Founding member, Mansfield's Citizens for Responsible Growth. Background in financial management; worked for NYNEX in areas of capital budgeting for growth and modernization. Manages artistic estate of an American Modern artist.

Kip Kolesinskas
Resident of Manchester. Consulting Conservation Scientist. Current projects include assisting agencies, NGO's, and private individuals with farmland protection, land access and affordability for new and beginning farmers, farmland restoration, and climate change adaptation strategies. Member of the Working Lands Alliance Steering Committee, and has contributed to numerous publications and initiatives including Conservation Options for Connecticut Farmland, Planning for Agriculture-A Guide for Connecticut Municipalities, and the award-winning training videos for CT DEEP's Municipal Inland Wetland's Agency Training Program. Formerly USDA Natural Resources Conservation Service State Soil Scientist for Connecticut and Rhode Island, where he worked extensively with farmers, educators, government and nonprofits to help them protect farmland and wetlands, and use soils information to make better informed land use decisions. He is a recognized regional and national speaker on soils and land use planning, farmland protection, climate change adaptation, farmland access, and wetlands.

Matthew Reiser
Appointed in March 2016
Resident of Avon. Environmental, health and safety consultant with over 20 years of experience performing regulatory compliance auditing, planning, training and reporting; air, water and waste discharge permitting; and air, water and waste sampling for industrial, commercial, municipal and institutional facilities. Member, Connecticut Chapter of the Academy of Certified Hazardous Materials Managers. Member, Connecticut Marine Trades Association Environment Committee.

Michael W. Klemens
Served through August 2015
Resident of Salisbury. Educated in the United States (University of Connecticut) and the United Kingdom, Dr. Michael W. Klemens is a trans-disciplinary practitioner. Formally trained as a herpetologist, his current practice spans conservation biology, land-use planning, and empowering communities through the understanding and use of scientific data. Working at the interface of human societies and the natural world, he engages a diversity of stakeholders to explore how to create patterns of development that are ecologically resilient, economically viable, and socially equitable. More than three decades of field work have been concentrated in the northeastern United States. Through the support of the MacArthur Foundation he spent several years in east Africa, working with indigenous institutions to build capacity in biodiversity assessment and application of those data to protected area management, as well as studying the ecological impacts and economic mechanisms of the wildlife trade. His publications include the definitive study of Connecticut's amphibians and reptiles and over 100 scientific papers. In 1979 he joined the scientific staff of the American Museum of Natural History, where he continues collections-based research on amphibian and reptile biodiversity. He serves as a consultant to various government agencies, as well as municipalities, not-for-profit organizations, and developers and is in his second elected term to the Salisbury Planning and Zoning Commission, most recently (and currently) as its Chairman.

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Data regarding compliance at hazardous waste treatment facilities were presented to the Council by the Rivers Alliance of Connecticut early in 2015.

The Council also appreciates the work of its Executive Director, Karl Wagener, and Environmental Analyst Peter Hearn in drafting this report for review by the Council and preparing the final version for publication.

The Council notes the valuable contributions of two interns in 2015, Johann Graefe (Colby-Sawyer College) and Daniel Pidgeon (Trinity College); their research contributed greatly to this report.

Forest Bird Indicators: The new indicators of forest bird population trends benefitted from the expert input of four biologists: Dr. Robert Askins (Katherine Blunt Professor of Biology, Connecticut College), Milan Bull (Senior Director of Science and Conservation), Patrick Comins (Director of Bird Conservation, Audubon Connecticut), and Jenny Dickson (Supervising Wildlife Biologist, DEEP). Additionally, Christopher Field (PhD Candidate, University of Connecticut) reviewed the indicator and helped to refine it. (In fact, Mr. Field inspired the Council to redesign the directional arrows next to all of the report's charts, which now can be termed "Field Guides.") The input of all was indispensable, but the Council assumes full responsibility for any errors or weaknesses.

Image Credits: The "overheating earth" symbol used to denote indicators affected by climate change was created by Tracey Saxby, Integration and Application Network, University of Maryland Center for Environmental Science.

The photograph of the Chimney Swift on the Good Air Days page was taken by Julian Hough. The photograph of the Scarlet Tanager on the Forest and Forest Birds page was taken by A. J. Hand. The Osprey on the Bald Eagle page is part of a photograph taken by Anastasia Zinkerman. The Council greatly appreciates their generosity in allowing the use of these excellent photographs in this report.