



WRACKLINES

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CHANGING CONNECTICUT

Big Changes are Happening
Close to Home

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From the EDITOR

CHANGING CONNECTICUT

Change is in the air! We shouldn't be surprised, after all, it's New England. Recently, I was asked to speak about what's changing in Connecticut, from the coastal perspective. I mentally put together a list, but like Pinocchio's nose, it kept growing longer and longer. The result was a theme for this issue of *Wrack Lines*, "Changing Connecticut".

It features some, certainly not all, major changes, explained by experts. From tiny beasties that fuel the food web of Long Island Sound to the landscape itself, to the flora and fauna, sea level, legal policies, people's attitudes, to the very landscape itself, change is happening rapidly. They may sound unrelated, but they're all interwoven. All these changes pose new questions that require new answers and solutions.

Another change will have happened by the time you read my letter. The next issue of *Wrack Lines* will have a new editor. After nearly 30 years with Connecticut Sea Grant and UConn, I have decided to begin the retirement journey. I am proud of the fact that *Wrack Lines* has continuously published for 17 years and will go on. It has been a pleasure serving you. I also want to profusely thank our wonderful graphic designer, Maxine Marcy at the UConn Design and Document Production Center. She has worked magic to make the magazine come alive.

Speaking of change, you may have heard about the proposed budget threat to cut Sea Grant from the federal budget, which would in effect eliminate the program. However, we know that many of you reached out to your legislators to sing our praises and that many will continue to support us. We thank you and hope we can continue to serve you and your community in the future.

Farewell,

Peg Van Patten

Wrack Lines editor

About our cover:

Aerial photos on the cover (Barn Island Dike), this page, page 3 and 4 are courtesy of Jeff Simon Photography.



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As Connecticut's Landscape Goes, So Goes the Sound

by Chester Arnold, Jr.

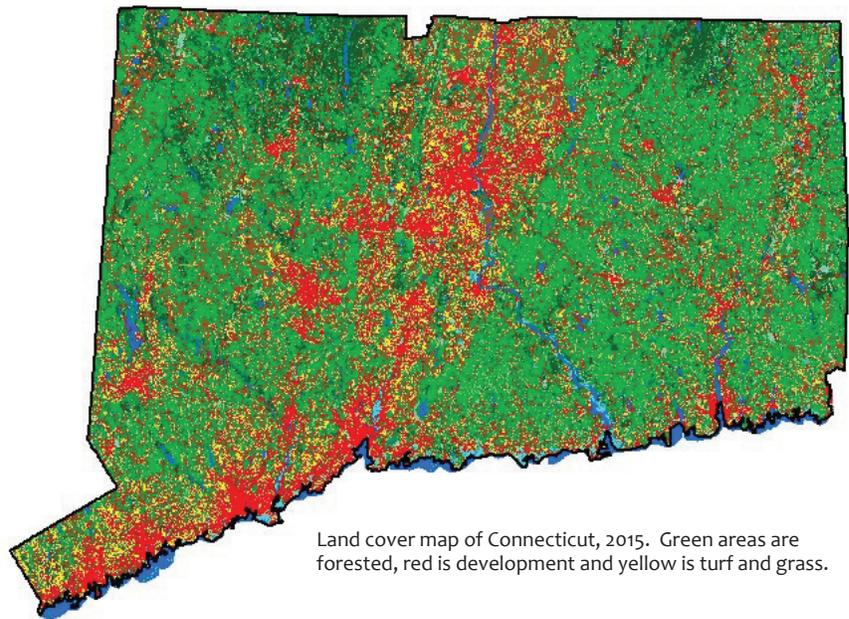
No elegant diagram of the water cycle is required to illustrate the basic truth that a water body is only as good as the water draining into it. Since this water is greatly affected by the land over which it runs, and since 99% of Connecticut drains to Long Island Sound, it becomes clear that Connecticut's landscape and the health of the Sound are intimately related.



This aerial photo of Barn Island in Stonington, Connecticut shows the intimate connection between our landscapes and the Long Island Sound.
Photo: © Jeff Simon.

For this and a lot of other reasons, it's important to have a handle on the changes occurring on the face of Connecticut. Charting these changes is the central purpose of *Connecticut's Changing Landscape*, a longstanding research project of the University of Connecticut Center for Land Use Education and Research (CLEAR). Connecticut's Changing Landscape (CCL) uses remote sensing technology to study the land cover of Connecticut and how it has changed over time. Land cover is what's physically on the surface of the land, such as forest or development. It is closely related to, but distinct from, land use, which is what is planned or permitted for a given area of land ("residential," "commercial," "protected open space"). A large and ever-increasing body of scientific research is uncovering the many relationships between land cover and the health of our natural resources, from wildlife to water.

The CCL study uses the tried-and-true Landsat series of satellites, which allows us to go back as far as 1985 for imagery that can be compared "apples-to-apples". The satellite measures the reflectivity of the land surface and this information is converted, after much computer processing and some best professional judgment, into land cover datasets made up of millions of 30-meter pixels (short for "picture elements," and I bet you didn't know that!). In these days of high resolution imagery on your phone, a study that produces data in 30 meter (100-foot) squares may seem a bit, well...20th Century. But, as CLEAR's geospatial expert Emily Wilson, who creates all the study's charts and maps, points out, "30-meter data is still the best way to look at large areas like Connecticut over long periods of time. High resolution imagery is too complex and expensive to convert to statewide land cover datasets at this point, although we are working on it in collaboration with the NOAA Office for Coastal Management. But with the Landsat imagery we can go into the past and look at change over time, which is the big reason why we did the Changing Landscape study."



Land cover map of Connecticut, 2015. Green areas are forested, red is development and yellow is turf and grass.

What's Trending?

CCL is nationally unique in terms of both the number of sampling datasets and the total time span covered -- seven datasets (1985, 1990, 1995, 2002, 2006, 2010, 2015) spanning 30 years. Multiply that by 12 land cover categories, and you have a lot of data to sift through. So, in this article we will hit only a few big-picture highlights, but you are encouraged to explore the information for yourself using our interactive online "story map" (*please see End Note to find out how*).

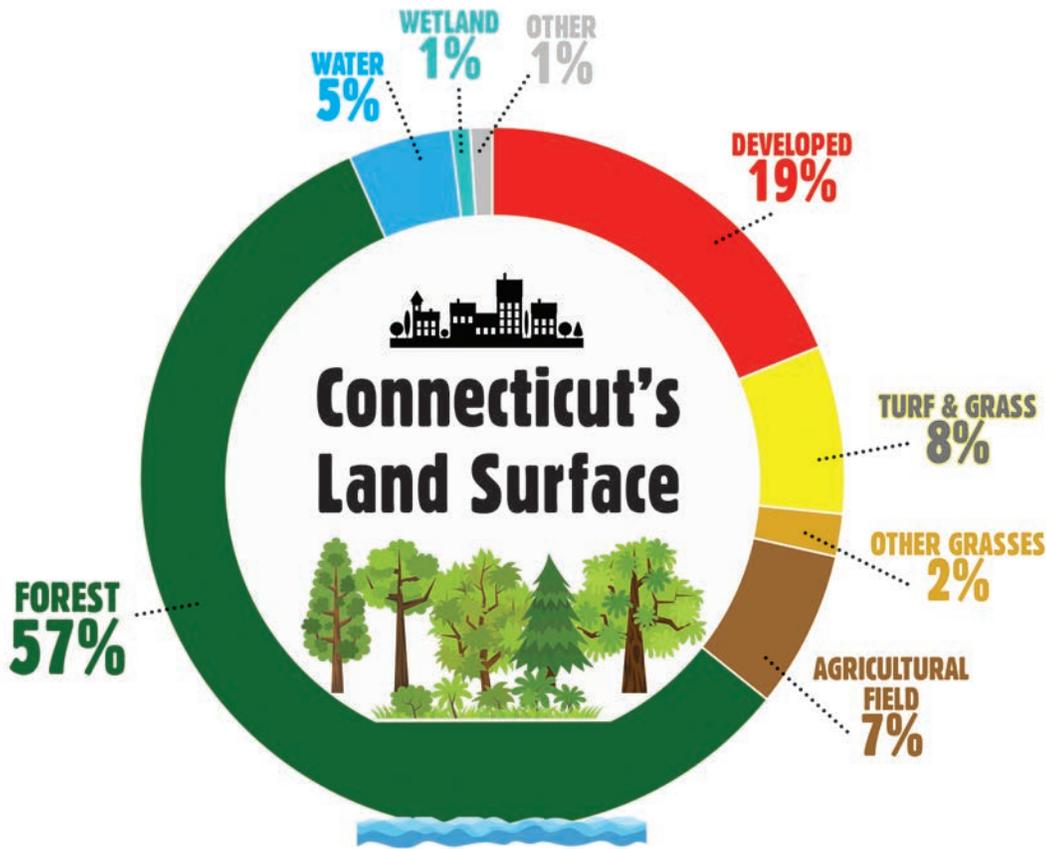
The CCL study gives us two basic types of information: land cover status for a given sampling date, and land cover *change* between any two sampling dates, including the entire 30 year period. The colorful image on this page shows the most recent (2015) land cover map for the entire state, with each color denoting one of the land cover categories. The map might look smashing on your living room wall, but we'll need to look at a couple of graphs to get a feel for our current status.

The image on page 6 is a pie chart that shows the 2015 breakdown between the major land cover categories of the study. The five most common land covers (excluding water) are forest (57%), followed by development (19%), turf/grass (8%), agricultural fields (7%), and

other grasses (2%). For an urbanizing state, the large percentage of forest might seem surprising, but in fact Connecticut has far more forest cover now than during the height of our agricultural past (although as we'll see, that number is declining). It's important to note, however, that "forested" land cover does not imply pristine unbroken forest, but simply means that trees are the predominant element of the landscape. Another striking fact is that the turf/grass category, which is made up of the manicured short grasses (lawns, ball fields, parks, golf courses) that are part and parcel of developed areas, now exceeds the agricultural field class; this has been the case since sometime between our 2002 and 2006 sampling dates.

Change over the entire study period of 1985 to 2015 is summarized in the image on the bottom of page 7. The center line marked with a "0" is the "no change" line; bars above the center line denote increases over time, and bars below denote decreases. This blocky tale of the "winners" and "losers" from the past 30 years perhaps tells the overall story best: there have been large increases in the development-related classes, which have come at the expense of decreases in the forested

continued on next page...



Percentage of Connecticut's land surface in 2015.

and agricultural field classes.

Of course, a bar chart is only so satisfying. The best way to look at change is with the study's "change maps," which can be zoomed into the town level (or even closer) to look at the location and form of what's been happening since 1985. The image on the top of page 7, taken from the CCL Story Map, shows the change map for an area in the southwestern part of the state that has experienced higher than average development. Although we can't be certain of the land use, the squiggly format of the new developed (red) areas strongly suggests a proliferation of residential subdivisions.

And you're telling me this because....?

Land cover change is not of itself good or bad. As noted, however, studies from around the country continue to link various land cover metrics with impacts to natural resources. The most well documented and perhaps also well known is the relationship between the amount of impervious cover in a watershed and the health of the water body to which the watershed drains. Man-made hard (impervious) surfaces such as roads and roofs short-circuit the water cycle, increasing stormwater runoff and creating associated flooding, erosion, water pollution, and aquifer recharge problems. Hundreds of studies from across the country, done in different ways and in different landscapes, show that waterway health

starts to decline at relatively low levels of watershed impervious cover, perhaps around 10% (although this number varies). Since the CCL developed class is based on a predominant signal of impervious cover, the growth of this category is not in most cases good news for the rivers, streams and ponds of Connecticut.

And, of course, neither is it good news for the ultimate receiving water, Long Island Sound, which is why the 2015 Long Island Sound Study Comprehensive Conservation and Management Plan (CCMP) has specific goals on reducing impervious cover, and its connection to waterways, in the greater watershed. An increasingly popular strategy to accomplish this "disconnection" of impervious surfaces is the suite of development practices known

as Low Impact Development (LID) or, in some cases, "green infrastructure." But that's for another article...

The CCL can tell us many things beyond the implications of basic land cover change. Follow-up studies done by CLEAR have looked at land cover change in specific areas, or in specific ways, that extend our understanding of the impact of our development patterns on natural resources. For instance, riparian (streamside) corridors are known to be important for a host of reasons, including habitat protection, water temperature regulation, and pollutant processing. As part of a CCL-based study of the Lower Long Island Sound Watershed done in 2011, CLEAR looked at land cover change in 100-foot and 300-foot corridors to either side of the region's streams, rivers, lakes and ponds. As a result, the CCMP has the goal of *increasing the percent area of natural vegetation within 300 feet of any stream or lake in the Connecticut and New York portions of the Long Island Sound watershed to 75% by 2035 from the 2010 baseline of 65%*. This is a complicated task involving both restoration and protection of these critical areas above and beyond what is provided by state Inland Wetlands and Watercourses regulations. But at least we have a baseline from which to measure progress, and maps to show where restoration and/or protection are needed most.

Using the data

The solutions to the problems documented by Connecticut's Changing Landscape are complex and multi-faceted. The changes we see in the CCL maps, and around us each day, are the result of a complicated mix of drivers that includes, among other things, historic development patterns, changes in modes of transportation, shifts in population and consumer preferences, and, most important of all, our home rule system of land use decision making that puts almost all the power in the hands of 169 different municipalities. But a solid understanding of where we are, and where we have been, is a good foundation for planning where we want to go. CCL information is being used to that effect in a wide variety of ways by a broad spectrum of organizations.

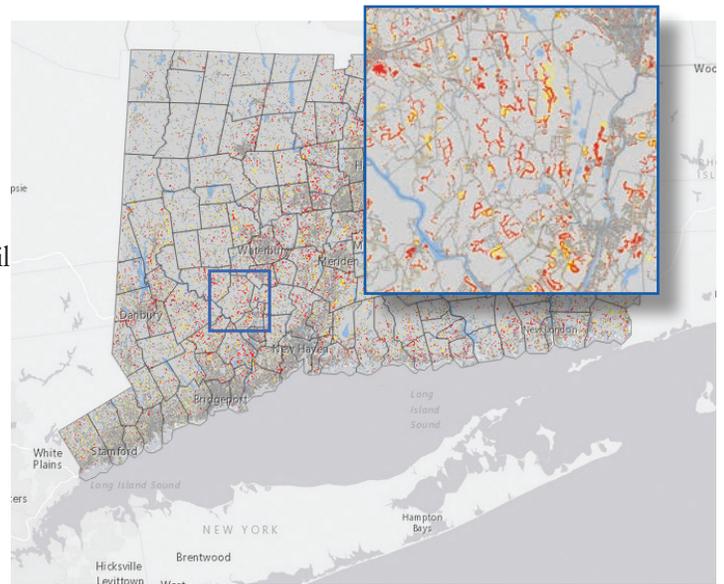
As noted, in 2011 the Long Island Sound Study funded CLEAR to do a CCL expansion to cover the lower Long Island Sound basin, including developing maps for watershed-level impervious cover and riparian corridor land cover that, as we've seen, have been used as the basis for several goals of the LISS CCMP.

"Combining CLEAR's land cover data with our ongoing coastal and marine research has proved very valuable over the years in furthering our understanding of the Sound," says Mark Tedesco, Director of the EPA's Long Island Sound Office. CCL maps and data are frequently incorporated

into municipal and regional Plans of Conservation and Development, and are used in the State Plan as well. The Connecticut Council on Environmental Quality uses other CCL metrics (forest fragmentation and changes to the agricultural field class) in its annual reports on the state of Connecticut's environment.

CCL data has been used by the Connecticut Department of Energy and Environmental Protection in the development of water resource regulations, including the first impervious cover-based Total Maximum Daily Load (TMDL) regulation in the country, and the statewide bacteria TMDL. And recent research supported by Connecticut Sea Grant uses CCL data as part of a model that looks more closely at sources of nitrogen to coastal embayments around the Sound. Finally but importantly, CCL data is used not only by academics throughout the state for classroom teaching but also for research into a host of environmental issues that connect to land cover.

The biggest of the big pictures is this: Connecticut is urbanizing. Well, duh. We knew that. But Connecticut's Changing Landscape helps us to understand the whens and wheres, and sometimes even the whys, of these changes, and their implications to the health and sustainability of our natural resources, including Long Island Sound. Now comes the hard part: using the information to help us change the pattern and design of



Change map, 1985-2015, from an area in Southwestern CT (inset). Red areas show new developed areas and yellow areas show new turf/grass areas.

our manmade world so that our development footprint drops a couple of shoe sizes.

END NOTE:

You can explore the data and maps yourself using CLEAR's new CCL "story map!" Story maps are a relatively new interactive mapping application that enables the combination of online maps with text, pictures, graphs and videos to tell a more compelling story than maps alone could do. In it, you'll be able to delve much more deeply and locally into the information provided in this article, so check it out! <http://clear3.uconn.edu/viewers/ctstory/>

CLEAR's CCL story map won first place in a national story map contest sponsored by the geospatial industry leader, Esri Corporation.

ABOUT THE AUTHOR:

Chet Arnold is a Water Quality Educator with the Department of Extension and the Director of the UConn Center for Land Use Education and Research (CLEAR).

Statewide Change, 1985-2015 (square miles)

