The University of Connecticut

Center for Land Use Education & Research

Progress Report 2007 – 2012

CLEAR

Contents

Acknowledgements

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- Page 6, computer training class, Susan Schadt
- Page 8, looking into manhole, Chester Arnold
- Page 9, pervious parking lot, Chester Arnold
- Page 11, training class, Cary Chadwick
- Page 12, students outdoors, Susan Schadt
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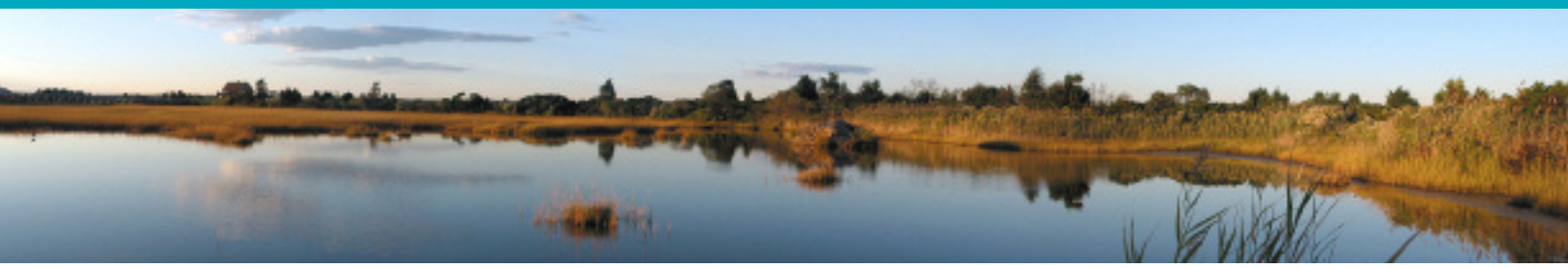


About CLEAR & This Report

The mission of the University of Connecticut Center for Land Use Education and Research (CLEAR) is to provide assistance, education and tools to Connecticut land use decision makers, in support of their critical role in determining the environmental, economic, and social health of their communities. This report contains recent highlights of major projects undertaken by CLEAR faculty, as well as summary information on Center grants, publications, awards and other accomplishments.

Although projects are categorized according to the Center's three main focus areas—research, tools and training, and outreach education—CLEAR takes pride in the integration of our programs and projects, and on our strong focus on providing "real world" assistance to decision makers across Connecticut. The report covers the period 2007 – 2012, in some cases with background information dating back to the formation of CLEAR in 2002. CLEAR's first five-year progress report, can be viewed online at *clear.uconn.edu* under "Publications."

CLEAR provides a unique resource to the communities and citizens of Connecticut and has provided leadership and services to Land Grant and Sea Grant colleagues across the country. The Center conducts remote sensing landscape research, develops geospatial tools and training programs, and delivers outreach educational programs directly to Connecticut communities and organizations. CLEAR is based in the College of Agriculture and Natural Resources (CANR) and is a partnership of the Department of Extension and the Department of Natural Resources and the Environment, both part of CANR, and the Connecticut Sea Grant College Program.

CLEAR is a small center with a present size of 7 faculty and 1 staff and an annual budget of $500,000 to $1 million. 60 – 70% of the Center budget comes through competitive external grants. Since its formation in 2002, CLEAR has obtained about 150 such grants, totaling $13.2 million; approximately 88% of these grants were from federal sources. Virtually the entire budget of the Center goes toward supporting "soft money" faculty and staff, many of whom have built statewide and even national reputations.

The Center conducts remote sensing landscape research, develops geospatial tools and training programs, and delivers outreach educational programs directly to Connecticut communities and organizations.

The Need For CLEAR

Connecticut is an urbanizing state, with a population density in the top five in the nation. With urbanization comes a host of complex land use issues related to balancing growth and natural resource protection. Adding to this complexity is the fact that land use in Connecticut is decided at the local level, with the state's 169 municipalities each writing their own Plan of Conservation and Development and developing their own zoning, subdivision, and other regulations. The boards that oversee the implementation of these regulations are made up of citizen volunteers, either elected or appointed, with very little required training. UConn CLEAR is the principal organization providing outreach education, technical training, web tools and landscape information to these critically important decision makers.

About CLEAR

Who Uses CLEAR, & For What

In the Fall of 2012 CLEAR sent out a survey to various Center contact lists, including planners and local land use commissioners in all 169 towns in Connecticut, for the purpose of assessing which CLEAR programs, information and tools were being used, and for what.

Who

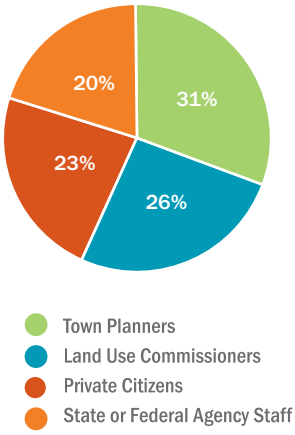
There were 238 respondents from 87 Connecticut towns, 10 other states, and 25 regional or state organizations. Respondents represented a balanced distribution of different sectors (Figure 1).

What

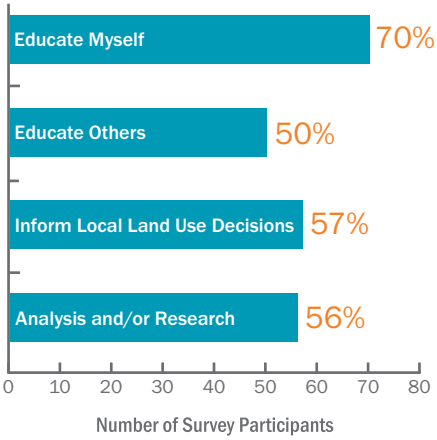
- The **Land Use Academy** (page 11) and **NEMO** (page 8) had the highest name recognition among CLEAR programs.
- **Changing Landscape** (page 4) online maps and the online **Low Impact Development Atlas** (page 10) had the highest name recognition among CLEAR projects.
- **CT ECO** (page 6) had the highest number of people reporting that they use it "all the time."

Why

Our clients use CLEAR to educate themselves, educate others, for research, and to inform land use plans and policies (Figure 2). Some of the specific uses reported appear in the box, below.



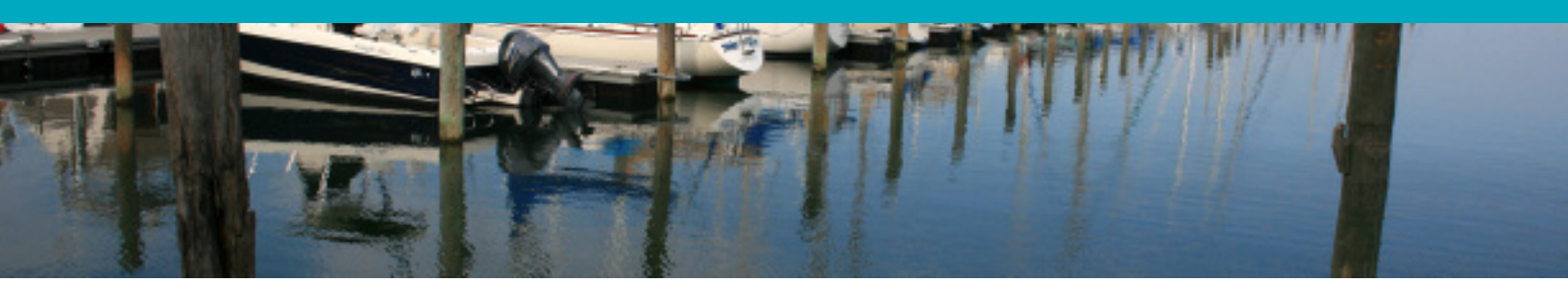
(Figure 1) Survey respondents



(Figure 2) What our clients use CLEAR for

Using CLEAR (as reported in our survey)

- Plan of Conservation & Development Updates (many responses)
- Assess impact to natural resources & conduct enforcement investigation
- Educate commissioners (many responses)
- Learn about low impact development (LID) (many responses)
- Analyze watershed characteristics
- Support approaches in other states
- Support state land use policies & programs
- Use geospatial information for site interpretations for conservation research, planning, & management
- Develop open space recommendations for future planning & acquisition
- Supplement geographic information systems (GIS) layers
- A model for university-based land use education programs
- Natural hazards mitigation plan
- Regional Plan of Conservation & Development
- Inform policy decisions
- Support grants & conservation planning
- Wetland application review (more reliable than town map)
- Research for amending regulations



What People Are Saying (from our survey)

"You are all Awesome. You are on the pulse of what is needed and find a way to consistently deliver. **Your staff and leadership are top notch and we are so lucky to have you in our state**."

"I am a huge fan of CLEAR because you **provide resources and approaches that would not be there otherwise**."

"**CLEAR is absolutely essential to understanding the health and well-being of Connecticut's communities and ecosystems**, particularly coastal, riverfront and watershed towns. It provides on-demand **valuable tools** that decision-makers can access and use locally."

"I have presented on non-point source pollution and watershed management issues around the country over the years and **have been proud to say that I am from Connecticut since it is so highly recognized due to its groundbreaking NEMO program** and research projects such as the Jordan Cove project."

"**There are so many intangibles I gain from CLEAR** beyond the **terrific resources** the staff have created. These include networking, ideas on approaches to sometimes difficult topics and audiences, inspiration, updates on **new technologies**, and how to build model outreach programs and information."

"**Two decades of success** in providing great resource information and planning tools to municipalities and local land managers ... **The wildlife and natural resources of Connecticut are better off** since you've been here."

"**I think CLEAR is an amazing organization with a wonderful, talented staff, that provides a critical service to residents, municipalities, land use planners, agencies, NGOs** in Connecticut (and outside of it too). Keep up the great work!"

"CLEAR is **one of the most important sources of information and training** not only to Connecticut residents, but to stormwater educators across New England and the rest of the country."

"The **combination of your expertise and continued creativity** is impressive and results in great and usable products."

"Very good organization. Every **training has been professional with great information**. A resource I wish I had known about long ago. Will be using more and more. Keep it up!"

"You are the best!! We appreciate your continuing efforts to **advance science and land use tools in planning and land use**."

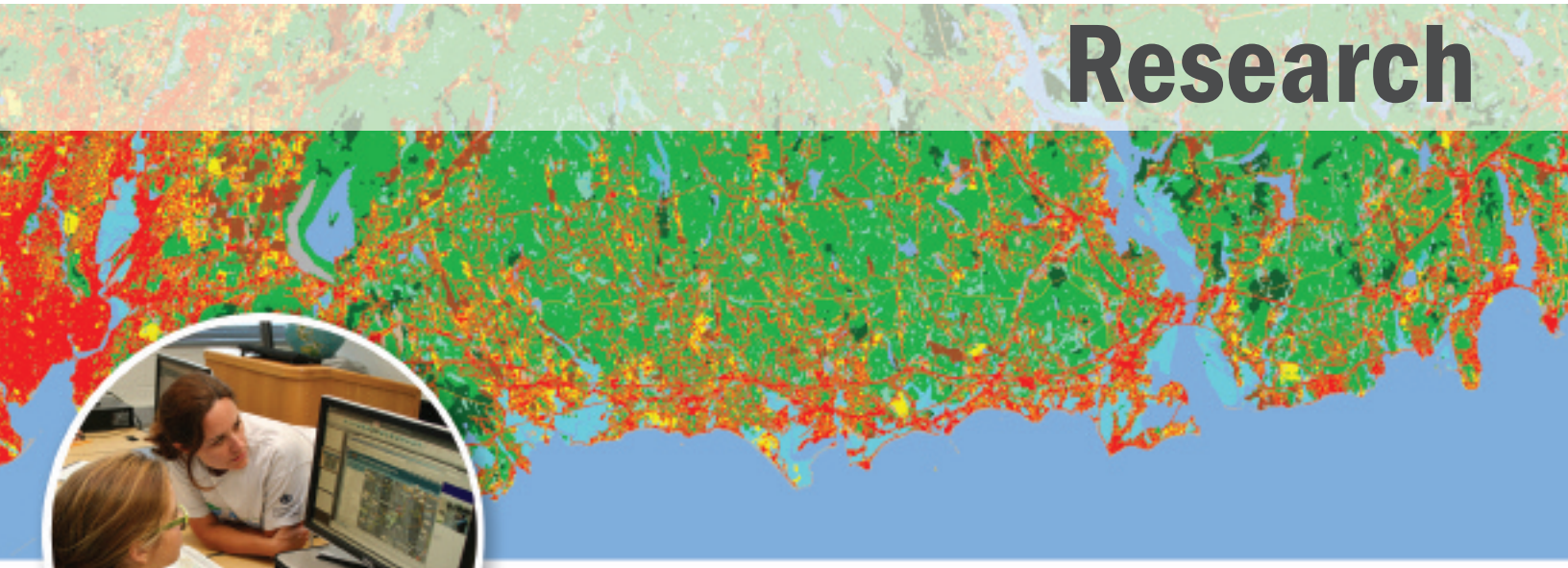
"CLEAR and NEMO have been **very effective and efficient ways to get natural resource information to local land managers**; keep up the good work!"

"I have extensively used the CLEAR information and hope it continues in its **friendly, simple to use** format. **VERY useful information, both from a commissioner's point of view and toward creating/updating a POCD**. Wish it was more well known ..."

"You are on the pulse of what is needed and find a way to consistently deliver. Your staff and leadership are top notch and we are so lucky to have you in our state."

CLEAR provides assistance, education and tools to Connecticut land use decision makers, in support of their critical role in determining the environmental, economic, and social health of their communities.

Research



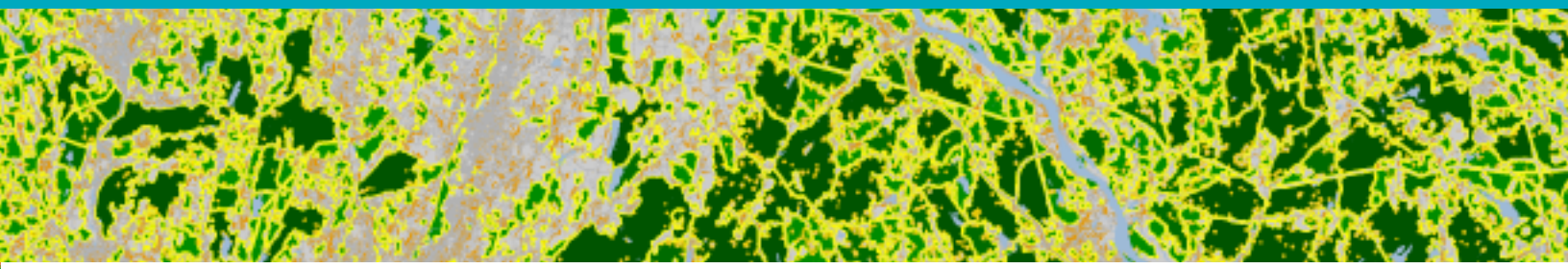
on the web at: clear.uconn.edu/projects/landscape

CLEAR research focuses primarily on using remote sensing science to map and quantify changes to Connecticut's landscape. The *Changing Landscape* (CL) project is a nationally unique project that charts these changes over a 25-year period, from 1985 to 2010. The CL project has given rise to several related projects that use the land cover data to look at specific geographic areas such as riparian (streamside) corridors (image, lower right), or natural resource issues such as forest fragmentation (image, top right). These data are then turned into accessible and useful information, which is provided in multiple forms on the CL website as maps, tables, charts and downloadable data.

Changing Landscape Supports Policies & Decisions at All Levels

The Changing Landscape information has informed decision making by a wide variety of organizations, in a number of different ways:

- **Local Planning**: Landscape and landscape change information provide a unique way for a town to look at its current status and growth patterns. CL maps and data are a common component of municipal Plans of Conservation and Development.
- **State Regulation**: CL data on impervious surfaces were used by the Connecticut Department of Energy and Environmental Protection (CT DEEP) to provide the foundation for their impervious cover TMDL water regulation for Eagleville Brook—the first of its kind in the nation (see page 8). Similarly, CL riparian land cover data was used by CT DEEP in the development of a statewide bacteria TMDL regulation.
- **Research and Education**: Faculty at UConn, Yale, Wesleyan, Trinity and other institutions of higher learning use CL information for research and/or as a



Example of a forest fragmentation map.

"Outstanding job of taking complex technical information and making it clear to municipal officials and those who educate decision-makers on land use and stormwater management."

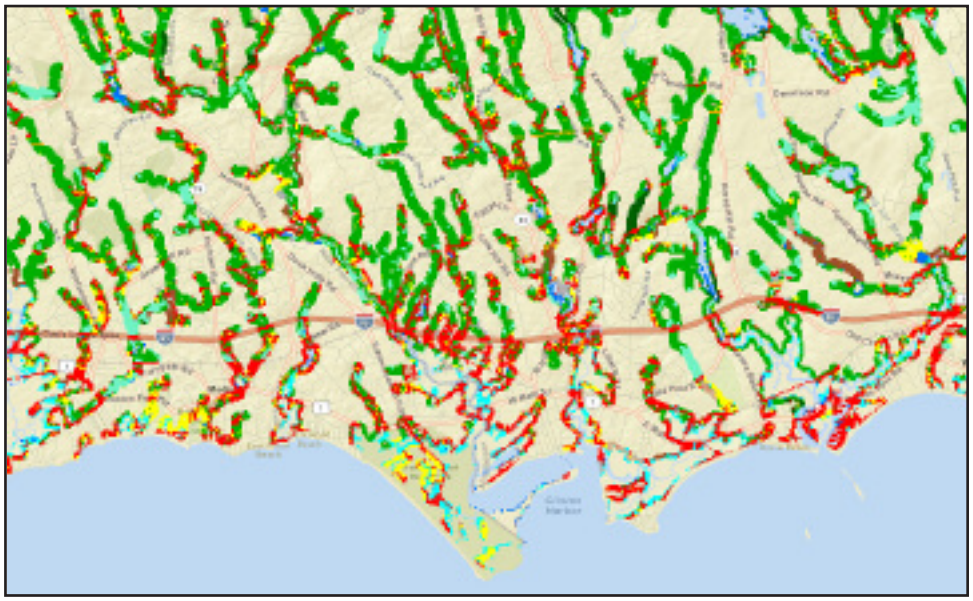
teaching tool in classes related to landscape architecture, environmental studies, and geospatial science.

- **State Planning and Monitoring**: CL land cover data provide a key information layer for the State Plan of Conservation and Development, currently under development by the Connecticut Office of Policy and Management. The Connecticut Council on Environmental Quality, a watchdog and monitoring organization created by the Legislature, uses CL land cover, forest fragmentation and agricultural lands analyses to help track Connecticut's environmental progress.

- **Regional Environmental Assessment**: The federal/state partnership Long Island Sound Study funded CLEAR to expand the CL project to include Westchester County and the Long Island portions of the Long Island Sound watershed. The project allows study researchers and managers to help track progress of several elements in its Comprehensive Conservation and Management Plan.

- **National Data Creation**: The NOAA Coastal Service Center used the CL website as the model for their Coastal Land Cover Atlas, a national web tool showing land cover change in all coastal states. As part of its creation, NOAA CSC also ran the CLEAR Forest Fragmentation model on its national land cover dataset, and have made the resultant maps and data available interactively through the Atlas.

- **Private Sector Partnerships**: Placeways, Inc. incorporated CLEAR's Forest Fragmentation tool into its popular CommunityViz© planning software, which is used by organizations all around the world.



Riparian land cover for a portion of the central Connecticut coast. The land cover is shown for 300 feet to either side of streams and water bodies. (Green is forest, red is developed, yellow is turf/grass, brown is agriculture.)

Geospatial Tools & Training

on the web at: cteco.uconn.edu

Geospatial Training Program

The Geospatial Training Program (GTP) was created to develop and conduct training in geospatial technologies to town officials, town staff, non-government officials and governmental agency staff and others. Since 2007, the program has trained well over 1,000 individuals in geographic information systems (GIS), global positioning systems (GPS), and new, rapidly evolving technologies designed to make maps and geospatial data available over the internet.

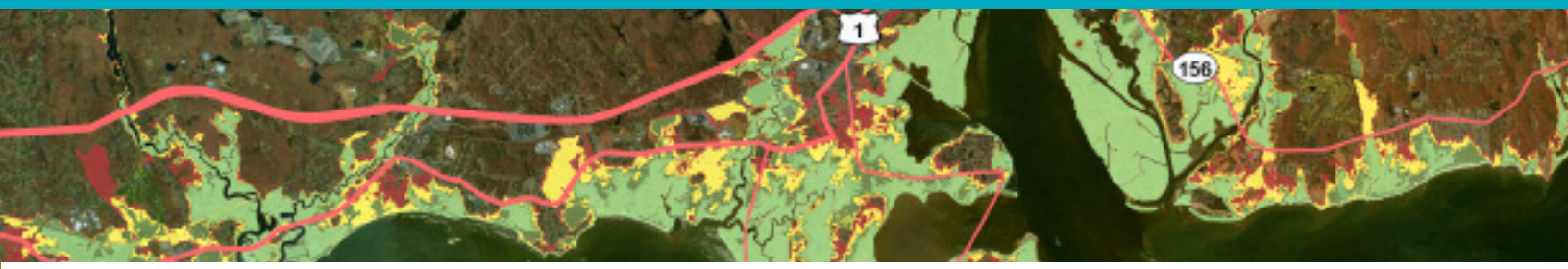
Since 2009, GTP has also conducted geospatial training for Land and Sea Grant colleagues nationwide, as part of a USDA Water Program grant.

In addition to teaching, GTP has evolved into a developer and builder of geospatial web tools, typically in partnership with another agency or another CLEAR program. See below for a prominent example.

CT ECO Provides Citizens & Businesses Easy Access to Statewide Data

Connecticut Environmental Conditions Online, or CT ECO, is a highly advanced internet mapping site that is a partnership between CLEAR and CT DEEP. Created in 2010, CT ECO has the state's most comprehensive and authoritative collection of natural resource (and related) data, and is designed to be accessible to all visitors of the website, regardless of technical ability. In the past year, over 23,000 individuals visited and used CT ECO over 40,000 times (Figure 3). In 2012, GTP took over primary responsibility for maintaining, enhancing and improving CT ECO.

The use of CT ECO just before Tropical Storm Irene demonstrates the power of this type of accessible information. On August 25, 2011, three days before Irene passed through Connecticut, CLEAR and



"CLEAR is absolutely essential to understanding the health and well-being of Connecticut's communities and ecosystems, particularly coastal, riverfront and watershed towns. It provides on-demand valuable tools that decision-makers can access and use locally."

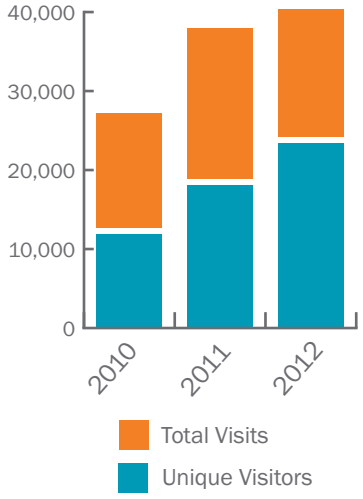
"This was the best hands-on class of this kind I've taken! Can't wait to see the technology evolve and come to another class."

CT DEEP sent out a message to municipal and agency mailing lists calling their attention to the Hurricane Surge Inundation maps available on CT ECO (lower right). In the days to come, CT ECO received about twice as many visits as normal (about 400 per day)—until the storm knocked out power to many areas. Below are some comments from CT ECO users:

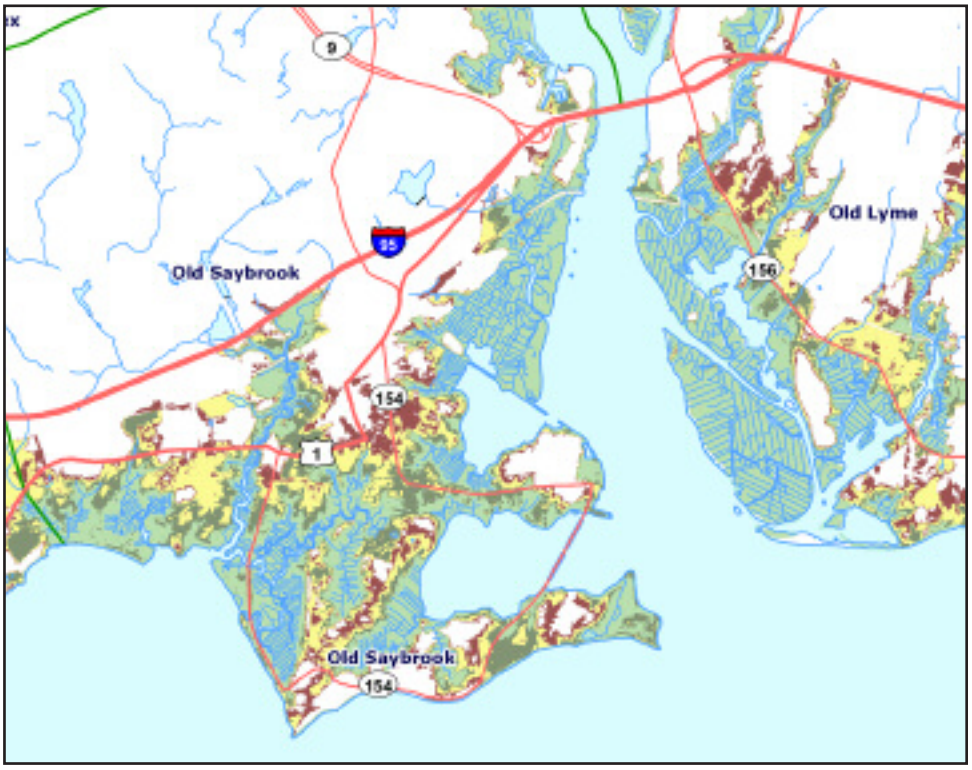
Boat Owner: "Once again, beautiful and timely! **The [CT ECO] site helped me decide it was safe to pull my boat out at our marina** at Pine Island marina, given NOAA predicted storm surge, and the inundation maps, rather than having to drive it to the Connecticut river for haul out. Thanks for your continued fantastic work!"

Municipal GIS Manager: "I just want to pass along to you ... that the town of Old Saybrook used the SLOSH data downloaded from the [CT ECO] website to prepare maps, in anticipation of Hurricane Irene, showing the Category 1 and 2 inundation areas. The **maps were distributed to emergency response organizations and were used to help identify neighborhoods to evacuate** and to highlight potential flooding of evacuation routes. The town's building official and a member of the Old Saybrook Fire Department told me that the maps were mostly accurate and extremely useful. I know you do a lot to help make GIS data available to communities and thought you'd like to hear back that it is very useful—**was invaluable in this particular case**."

State Emergency Operations Center Geolab: "The CT ECO services were very helpful for me during Irene. It was nice to have that info available without having to muck around with setting the data up ... We use the image services every day with our work ... **We know we can be confident that you folks, as stewards of the data, have the best and latest there**."



(Figure 3) CT ECO website use



A map from CT ECO showing the results of a NOAA Hurricane Surge Inundation model for the Old Saybrook area. Green (category 1), dark green (category 2), yellow (category 3) and maroon (category 4) overlays show that much of Old Saybrook south of I-95 would be flooded in a major hurricane.

Outreach Education

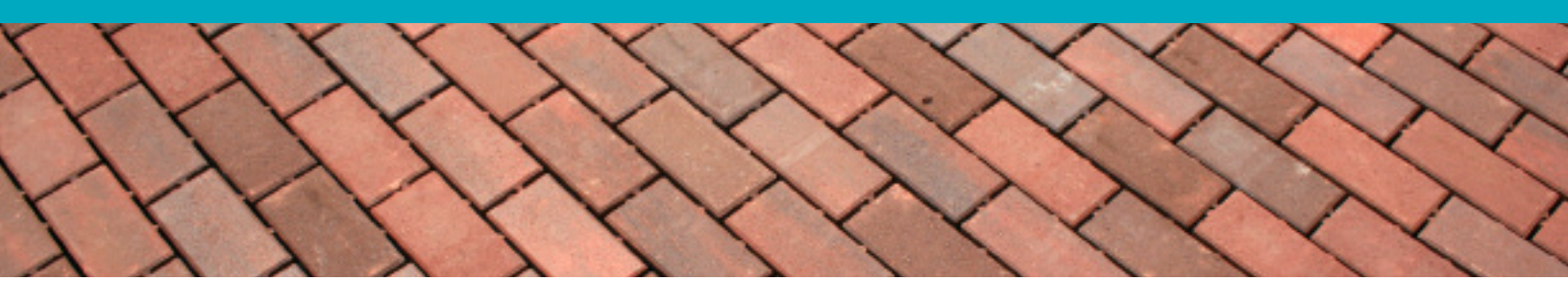
on the web at: nemo.uconn.edu

CLEAR outreach faculty provide direct support to Connecticut decision makers and communities through innovative Extension programs that combine sophisticated technology with traditional in-community workshops. By providing science-based information and creating tools that can be easily accessed, these programs have built a solid record of assisting municipalities to make changes to local policies, plans, regulations and practices. Four outreach program highlights appear below.

NEMO Enables Low Impact Development to Blossom on the UConn Campus

CLEAR's *Nonpoint Education for Municipal Officials* (NEMO) program educates communities on how to better protect valuable water resources through their land use plans, regulations and development techniques. Now in its 21st year, NEMO has worked with over three-fourths of the municipalities in the state, and won awards at the university, state, regional and national levels. Most recently, NEMO has assisted the University in transforming the way that the campus is developed. With the help of NEMO, UConn has become a state leader in the adoption of "low impact development" (LID) techniques. LID involves a suite of on-the-ground development practices that help to promote infiltration of stormwater into the ground, reducing the flooding, erosion and pollution problems associated with stormwater runoff from developed areas.

In 2007 the Eagleville Brook watershed, which drains much of the UConn campus, was placed by CT DEEP under a Clean Water Act regulation based on impervious cover—the first of its kind in the country. This innovative approach effectively creates a "budget" for impervious surfaces in the watershed, and is intended to make it easier



Concrete pavers along Hillside road allow runoff and snow melt to infiltrate.

"First, thank you for the program you presented in Milford Monday night! Everyone I have spoken with had nothing but great things to say about it. With your help, and the CLEAR website, we are much better prepared [for an update of our Comprehensive Plan]. Thanks again—you do VERY important work!"

"Your idea of going out there and educating municipal officials, often one town at a time, was brilliant and much needed ... I am 'pleased and proud' that EPA was able to help you launch National NEMO ... Clearly, NEMO has addressed an important need out there."

for a community to respond to the complex water quality and quantity issues resulting from runoff in urbanizing areas. However, as the first of its kind in the nation, there was no well-established method of responding to such a regulation.

NEMO led a collaborative project of CT DEEP, UConn and the Town of Mansfield to assess the campus and come up with a plan for addressing concerns with impervious cover by using LID "retrofits" to existing buildings and LID features for new buildings. With leadership by the UConn Office of Environmental Policy and Office of Planning, the result has been a steady stream of LID projects in both development and redevelopment projects at UConn. These include porous concrete and porous asphalt parking lots, vegetated (green) roofs, bioretention cells, and other practices (see images). There is national interest in this precedent-setting regulation and response.

LID practices on the University of Connecticut Storrs campus. (Above 1) the pervious asphalt lot at the Towers apartment complex absorbs water during a storm. (Above 2) the green roof at Laurel Hall. (Left) the large bioretention cell next to Laurel Hall receives runoff from the non-green portion of the roof.

Outreach Education cont...

on the web at: nemonet.uconn.edu

"I think the [National] NEMO conference is consistently the most beneficial conference I attend. The pragmatic approach taken by individual programs sparks many ideas on how I can approach issues in my own state. The trainings are top rate and the ability to network with the great group of people is awesome. THANKS!!!"

National NEMO Network

a 30-State Collaboration

National NEMO Network

CLEAR's *Nonpoint Education for Municipal Officials* (NEMO) program was founded in 1991, well before the formation of the Center itself. By 1994, the UConn team began to field requests from Land and Sea Grant colleagues from around the country who wanted to adapt NEMO to their own states. By 2000, the number of NEMO programs had grown large enough to enable the formation of a national network of affiliated programs—completely from the "ground up," and not funded by any agency or organization.

Today, the NEMO Network is comprised of 30 programs in as many states. While each program must obtain their own funding, coordination and training of the Network is done by CLEAR's National NEMO Network "Hub," which until 2012 had been funded primarily by USDA/NIFA and US EPA. The Network has an unequaled and well documented record of fostering changes to land use policies and practices, for which it has won a national award from the USDA/NIFA Water Program.

The LID Atlas highlights examples of low impact development around the country. The "balloon" shows details of a selected LID site. (Inset) A focus on Connecticut shows LID projects throughout the state.

The Hub has also created innovative web tools, such as the **National Low Impact Development Atlas** (left), that are being used not just by NEMO programs but by many other organizations. The LID Atlas is a GoogleMaps© powered interactive map that has examples of almost 1,000 entries of LID practices. In addition to many NEMO programs, two EPA Regional offices and several non-government organizations have contributed to the Atlas.

Academy training in 2011, held on the campus of Central Connecticut State University.

on the web at: clear.uconn.edu/lua

"I am a complete beginner. There is absolutely no training on the local level—no one even tells you what to expect or what's expected of you. These workshops are a godsend."

Land Use Academy
Fills a Critical State Need

Land Use Academy

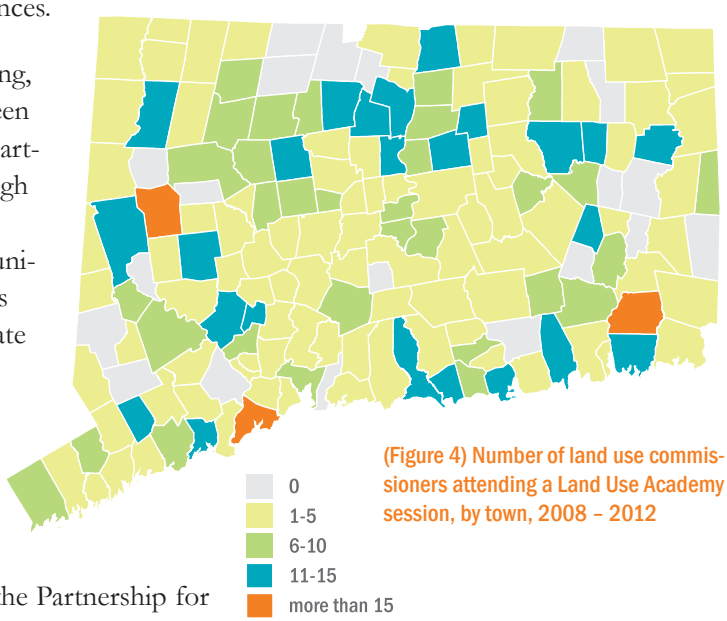
CLEAR's Land Use Academy provides "basic training" for commissioners on roles, responsibilities, legal requirements and map reading, and "advanced training" on various topics of interest raised by the clientele. The Academy is the only land use commissioner training program officially recognized by the state Office of Policy and Management (OPM). The Academy is founded on a strong partnership between CLEAR, the Connecticut Bar Association, the state's Regional Planning Organizations, and OPM.

Since 2007 (and despite loss of state funding in 2009), the **Academy has trained over 900 people from commissions in 149 of Connecticut's 169 municipalities** (Figure 4). Planning and/or Zoning officials make up about half of the audience, with the rest being comprised of Wetlands, Conservation, Zoning Enforcement and other board members (Figure 5). **Of the over 600 attendees providing evaluative feedback during this period, all of them—100%—said they would recommend the Academy to their fellow commissions**.

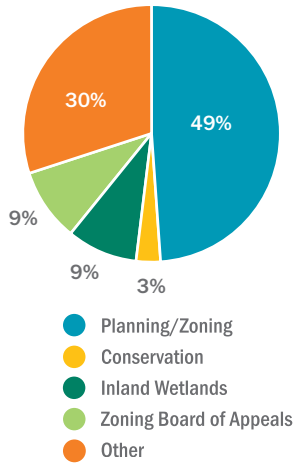
In 2011 the Land Use Academy developed an advanced training class for more experienced commissioners, based on two needs assessment surveys—one of commissioners, and one of planners. The help and expertise of the Connecticut Bar Association has been invaluable to this effort. To date, three advanced trainings have been held, all to capacity audiences.

In addition to training, the Academy has been working with new partners on emerging high priority issues for Connecticut communities. The Academy is working with the state Department of Economic and Community Development, the Capitol Region Council of Governments, and the Partnership for Strong Communities on educational programs focused on affordable housing and transit-oriented development along the proposed high-speed rail line from New Haven to Springfield, Massachusetts.

Finally, the Academy has been collaborating with CT Sea Grant and CT DEEP Office of Long Island Sound Programs on outreach programs focused on actions that coastal communities and property owners can take to help minimize the public safety, economic and environmental impacts of climate change.



(Figure 4) Number of land use commissioners attending a Land Use Academy session, by town, 2008 – 2012



(Figure 5) Academy attendees, by commission

Outreach Education cont...

on the web at: ctforestry.uconn.edu

"The program is excellent. It opened my eyes to all kinds of new resources and contacts, and reinforced my objectives and enthusiasm for my woodland and habitat projects."

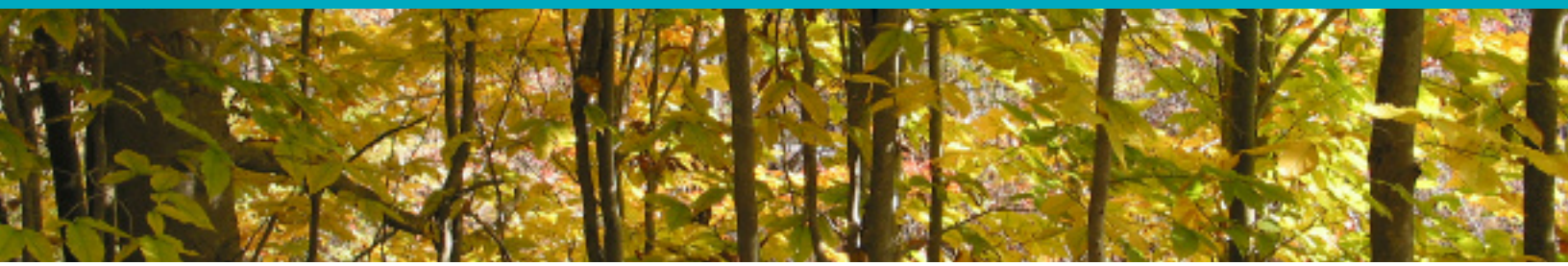
Forestry Program Assists Woodland Owners

The forestland within Connecticut provides numerous values and benefits to the quality of life and economy of the state. These include protecting public and private water supplies, supporting a $700 million annual forest products industry, providing the backdrop for a growing recreational and tourist industry, and providing wildlife habitat. 83% of Connecticut forestland is privately owned—there are over 100,000 woodland owners and over 40,000 that own ten or more acres. The health and productivity of the forest is threatened by parcellization, conversion to other uses, and fragmentation. Insects, diseases and invasive species are also significant threats to Connecticut's forestland. Research on forest health issues, assistance to forest landowners, and education of the general public can lead to a resource that is more optimally managed, healthier and more productive of the myriad benefits it provides.

The University of Connecticut Extension Forestry Program provides technical assistance and education to private forest landowners emphasizing the advantages of actively managing forest holdings and providing guidance in implementing management activities. The Extension Forestry Program provides:

- Assistance in forest management planning.
- Advice about selecting forestry services.
- Information necessary to guide ecologically sound decisions.
- Suggestions for management activities and actions.
- Information about available financial assistance.
- Educational programs for landowners and professional forest practitioners.
- Data to project future management needs and impacts.

The Forestry Program provides needed training programs, including Chain Saw Safety, held in fall 2012.



What We're Working On—Right Now!

- Making an Android version of our ***Rain Garden* App** (released for iPhones in January 2013 [image, right]). The App helps landscaping professionals and homeowners site, design, build and maintain these small stormwater treatment practices.
- Working with US EPA and the University of Rhode Island on a decision support **GIS tool to help identify sources and sinks of nitrogen** within a watershed.
- Working with the Connecticut Land Conservation Council to develop **geospatial training for land trusts**.
- Conducting **applied research on the nitrogen removing capacity of vegetated "bioretention" cells**.
- **Teaching geospatial basics to high school students** as part of the UConn *Natural Resources Conservation Academy*, a new program of the Department of Natural Resources and the Environment.
- **Preparing new high-resolution statewide imagery and elevation data** for posting on the CT ECO web mapping site (page 6).
- Making improvements to the **Connecticut Shellfisheries Mapping Atlas**, an online tool for shellfishery managers created by CLEAR in collaboration with the CT Sea Grant Program.
- Conducting **rain garden construction training** to small businesses, municipal employees and homeowners, with partners including Save the Sound/Connecticut Fund for the Environment, CT DEEP, EPA, University of Rhode Island, and Rutgers University.
- Constructing a **"Do It Yourself" multimedia online guide** to assist communities faced with impervious surface-based water regulations.

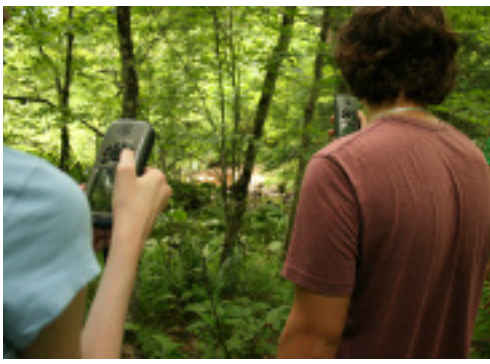
CT NEMO and the National NEMO Network collaborated on the creation of the new Rain Garden App. Details at nemo.uconn.edu/raingardens.

NEMO, with the Horsley Witten Group, conducts a rain garden construction training in Bridgeport, CT.

If You've Gotten This Far...

First of all, **congratulations**—you are a determined report reader. Second, hopefully you now have a good idea of CLEAR: small, productive, interdisciplinary, entrepreneurial, creative. And most important, dedicated to producing research, training, tools and outreach that are accessible and useful to land use decision makers, whether they're at the federal, state, regional, local, or private citizen level. Please visit the CLEAR website to see first-hand many of the things in this report, or to learn about all the things that we're doing that didn't make the report.

CLEAR Website: clear.uconn.edu



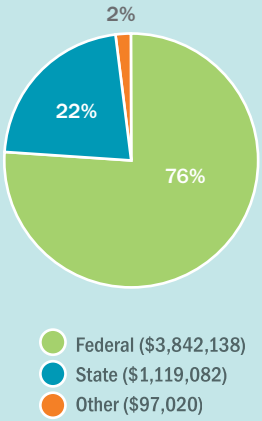
The Geospatial Training Program teaches geospatial basics to high school students as part of the UConn Natural Resources Conservation Academy.

CLEAR Productivity

This section of the report provides summary and representative information on CLEAR outputs.

CLEAR is smaller than it once was. The Center now has 8 full-time equivalents committed entirely or primarily to CLEAR-related projects—about one-third of the total reported in the 2007 Progress Report. The Center's small size, however, has not prevented its faculty and staff from procuring extramural grants, publishing, garnering awards, and establishing a number of important partnerships.

This section is intended not as a comprehensive listing of these accomplishments, but as an update complete with representative examples taken mostly from the last five years since the Center's last Progress Report.



(Figure 6) CLEAR external grant totals for 2007-2012. Over 76% of the $5 million was from federal sources of funding.

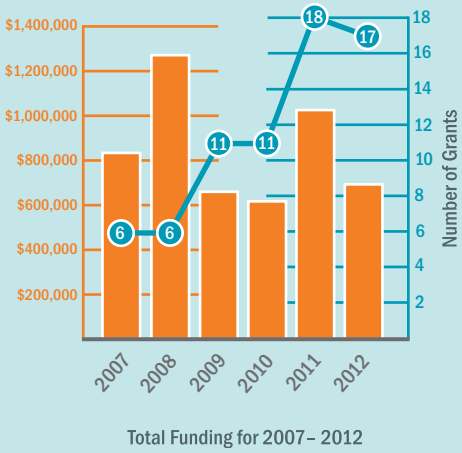
Grants & Funding

Only one of the Center's 8 faculty/staff is tenured faculty, with the rest being supported by a combination of sources. Extramural grants typically support 60-70% of the Center's personnel expenses (depending on the year), with the remaining support coming from the College of Agriculture and Natural Resources and the Connecticut Sea Grant Program.

Since the Center's inception in 2002, CLEAR has procured about 150 external grants totaling about $13.2 million. About 88% of this total amount has come from federal sources. During the 2007-2012 time period, CLEAR procured 70 grants totaling a little more than $5 million, with 76% of the funding coming from federal sources (Figure 6).

We believe that the number of grants says even more about the dedication and entrepreneurial mindset of CLEAR faculty than the amount of funding. CLEAR grants come from a variety of sources, which is indicative of the integrated and multi-faceted nature of its work. USDA, EPA, NOAA and NASA are among the federal agencies funding CLEAR. In Connecticut, CLEAR has obtained funding from CT DEEP, CT OPM, and CT DECD, as well as nonprofit organizations.

The table (page 15) is a listing of grants obtained in 2012, as an example of the varied nature of the topics and grantors. While the number of CLEAR grants has continued to rise over the last 6 years, the average amount of funding per year has dropped—indicative of the overall economic situation in the country since 2008 (Figure 7). The average amount of a grant during this period was $72,000, compared to an average of about $104,000 for the five years prior.



(Figure 7) While the number of grants has risen steadily, overall funding levels have not.

2012 Grants (an example of the range of CLEAR projects)

Grant Name	Funding Agency	Amount
Turning the N-SINK Nitrogen Modeling Tool into a Working GIS Application	EPA Office of Research & Development	$74,970
American Chestnut in Connecticut: Developing Geospatial Models for the Prediction of Probable Sites for Finding Flowering Sprouts & Habitat Suitability for Reintroduction	Connecticut Chapter American Chestnut Foundation	$6,000
Recommendations for Enhancements to NOAA's Coastal Land Cover Atlas	NOAA Coastal Services Center	$28,149
Multi-temporal Assessment of Connecticut Lake Water Clarity Using Landsat Satellite Imagery	Connecticut Institute of Water Resources	$72,751
Enhancement & Updating of the Connecticut Shellfish Mapper	NOAA National Marine Fisheries Service	$16,000
Creating a Rain Garden Website	Connecticut Department of Energy & Environmental Protection/Connecticut Fund for the Environment	$15,000
Rain Garden Training in the Quinnipiac River Watershed	Connecticut Department of Energy & Environmental Protection/Connecticut Fund for the Environment	$26,000
Monitoring Nitrogen Removal from a Bioretention Cell	EPA Long Island Sound Study	$66,000
Field Testing the Educational & Land Use Planning Value of a New Nitrogen Modeling Tool in the Niantic River Watershed	Connecticut Institute of Water Resources	$9,405
Verification of the Model SWMM for Low Impact Development (Year 2)	Connecticut Institute of Water Resources	$15,043
Creating a Rain Garden Smart Phone "App"	NOAA Sea Grant/Connecticut Sea Grant	$30,000
Poquetanuck Cove Action Plan for Preston & Ledyard	Eastern Connecticut Conservation District/Long Island Sound Futures Fund	$10,000
Community & Natural Resource Planning Program – Educational Workshops	ERT/RC&D	$40,000
Connecticut Emerald Ash Borer Monitoring	USDA/APHIS	$39,500
Enhancement & Maintenance of Connecticut Environmental Conditions (CT ECO) Mapping Website	Connecticut Department of Energy & Environmental Protection	$100,000
Multi-Faceted Support of Impervious Cover TMDL Implementation	Connecticut Department of Energy & Environmental Protection	$90,000
Riparian Corridors & the Pequonnock River Watershed	Long Island Sound Futures Fund	$34,999

CLEAR Productivity cont...

Publications

CLEAR faculty/staff produce a wide variety of publications, from peer-reviewed journal articles to newsletters and fact sheets. In addition, many of CLEAR's "publications" are now websites, and increasingly, web tools (page 18) and smart phone "apps" (page 13). The Center emphasizes the development of publications, websites and tools that will be of maximum utility to community decision makers. Center publications cover not only a wide range of formats, but a wide range of topics. The lists below, taken from the 2007- present period, are meant to give a feel for this variety.

Selected Major Extension Manuals & Publications (2007 – Present)

Chadwick, C. and E. Wilson. 2012 (latest revision). **Geospatial Technologies at Work: An Introduction to GIS**. Training manual. 450 pp.

Chadwick, C., D. Dickson and E. Wilson. 2012 (new). **Creating Feature Rich Web Maps with ArcGIS Online**. Training manual. 170 pp.

Arnold, C. 2011. **Responding to an Impervious Cover-Based TMDL: A Brief Step-by-Step Guide**. 110830.1 16 pp.

Drinkuth, H., Hayden E., Stahl, P. 2011. **Green Valley Connections, A Guide to Linking Greenways, Blueways and Wildlife Corridors**. 48 pp.

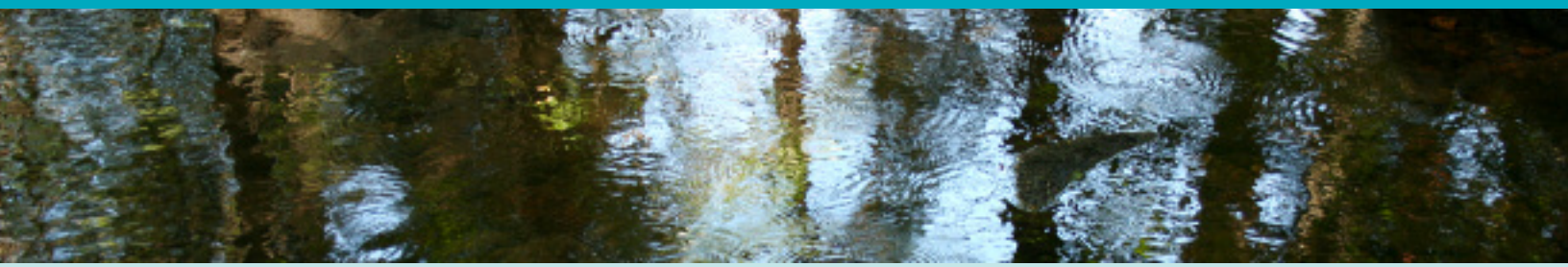
Hyde, Bruce. 2011. **Tax Increment Financing as a Tool for Affordable Housing in Connecticut**. Report to the Connecticut Department of Economic and Community Development. 24 pp.

Barrett, J. 2011. **A Guide to Planting Along the Connecticut Coast**. Publication of the Connecticut Sea Grant College Program. CTSG-11-03. 22 pp.

Barrett, J. and R. Cleveland. 2009. **A Planting Guide for Riparian Sites Along the Connecticut Coast**. Publication of the Connecticut Sea Grant College Program. CTSG-09-12. 8 pp.

Dickson, D. and Bonsack, K. 2009. **A Catalyst for Community Land Use Change: National NEMO Network 2008 Progress Report**. 030930.1 38 pp.

Dietz, M. and K. Filchak. 2007. **Rain Gardens: A Design Guide for Homeowners in Connecticut**. 12 pp.



Selected Journal Articles (2007 – Present)

Wilson, E.H., J. Barrett and C.L. Arnold. 2011. **Land cover change in the riparian corridors of Connecticut**. Watershed Science Bulletin Fall 2011: 27-33.

Dickson, D.W., C.B. Chadwick and C.L. Arnold. 2011. **National LID Atlas: A collaborative online database of innovative stormwater management practices**. Marine Technology Society Journal 45(2): 59-64.

Arnold, C.L., C.J. Bellucci, K. Collins and R. Claytor. 2010. **Responding to the first impervious cover TMDL in the nation**. Watershed Science Bulletin 1(1): 11-18

Rozum, J. and J. Barrett. 2010. **Habitat-based management planning for land stewards**. Journal of Extension, 48(6): published online.

Chabaeva, A., D.L. Civco, and J.D. Hurd. 2009. **An assessment of impervious surface estimation techniques**. ASCE Journal of Hydrologic Engineering 14(4): 377-387.

Potere, D., Schneider, A., Angel, S. and Civco, D.L. 2009. **Mapping urban areas on a global scale: which of the eight maps now available is more accurate**? International Journal of Remote Sensing, 30(24): 6531-6558.

Dietz, Michael. 2008. **Stormwater runoff and pollutant export changes with development in a traditional and low impact subdivision**. Journal of Environmental Management 87: 56-566.

Gilmore, M.S., E.H. Wilson, D.L. Civco, S. Prisloe, J.D. Hurd, and C. Chadwick. 2008. **Integrating multi-temporal spectral and structural information to map dominant tidal wetland vegetation in a lower Connecticut River marsh**. Remote Sensing of Environment 112(11): 4048-4060.

Westa, S.P., C.B. Tyson, S.H. Broderick, P. Stahl. 2007. **Continuing education needs in the Last Green Valley: a natural resource, land use and community design needs assessment**. Journal of Extension, Volume 45(5): published online.

Dietz, Michael. 2007. **Low Impact Development Practices: a review of current research and recommendations for future directions**. Water, Air and Soil Pollution 186: 351-363.

CLEAR Productivity cont...

Websites

The CLEAR website, which was created in late 2004, has evolved and grown to a multifaceted resource for users from research scientists to homeowners.

Online Tools

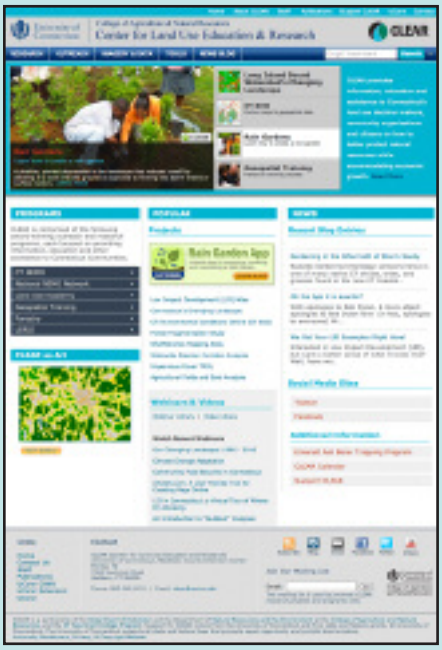
CLEAR-related websites are typically very deep—there are almost 600 pages on the main CLEAR site alone. Most can be considered as active tools or resources, rather than static postings. A full reporting on websites is beyond the scope of this report, but the box below highlights some web pages that have been newly-created or renovated since 2007, or are currently under construction.

Web Usage

In the calendar year 2012, the CLEAR website (including program and project-related websites) had an average of almost 7,000 unique visits per month. Statistics collected for the year include:

- **83,770 visits**
- **52,401 unique visitors (different individuals)**
- **3 minutes, 26 seconds average visit duration.**

clear.uconn.edu



Access to most online tools, as well as program information, webinars/videos, blog, social media sites, publications and other valuable information can be found on the CLEAR website home page (above) at clear.uconn.edu.

Online Tools

Most online tools can be directly accessed through the CLEAR Home page.

- Connecticut Changing Landscape (improved and updated with 2006 and recently 2010 data) clear.uconn.edu/projects/landscape
- CT ECO (created in 2009 with CT DEEP and just overhauled) cteco.uconn.edu
- Low Impact Development (LID) Atlas clear.uconn.edu/tools/lidmap
- Forest Fragmentation Analysis clear.uconn.edu/projects/landscape/forestfrag
- Riparian Land Cover Change Analysis clear.uconn.edu/projects/riparian
- Agricultural Fields & Soils Analysis clear.uconn.edu/projects/ag
- NEMO Rain Garden Website & Rain Garden App nemo.uconn.edu/raingardens
- Connecticut Shellfish Mapper (on CT Sea Grant Website) seagrant.uconn.edu/whatwedo/aquaculture/shellmap.php
- NEMO Impervious Cover TMDL Project Website clear.uconn.edu/projects/TMDL
- Online Webinar clear.uconn.edu/webinars & Video Library clear.uconn.edu/videos
- CLEAR Blog clear.uconn.edu/blog

Awards

CLEAR faculty and programs have won awards at the university, state, regional and national levels. Below is a listing of all awards since the Center's inception in 2002. The awards (including ten national awards, marked in blue) span a range of excellence incorporating teaching, leadership, public engagement, and the development and delivery of educational programs in land use, water resource protection, and geospatial technology.

2012

Connecticut Chapter of the American Planning Association 2012 Public Service Award, to CLEAR and CT DEEP for their work on CT ECO (page 6).

Environmental Merit Award, EPA Region 1 (to Mike Dietz and Chet Arnold)

Connecticut Woman of Innovation Finalist, Academic Women of Innovation and Leadership (to Emily Wilson), Connecticut Technology Council

Award for Excellence in Land Conservation (to Tom Worthley), Connecticut Land Conservation Council

2010

SAIC Estes Memorial Teaching Award (to Dan Civco), American Society of Photogrammetry and Remote Sensing

2009

Excellence in Outreach Education Award (to Geospatial Technology Program), University of Connecticut College of Agriculture and Natural Resources

Award of Excellence in Extension, Northeast Region (to Chet Arnold), USDA/NIFA and Association of Public and Land Grant Universities

2008

Environmental Leadership Award (to Chet Arnold), University of Connecticut Environmental Policy Advisory Council

Outstanding Integrated Program in Water Resources Award (to National NEMO Team), USDA/CSREES

Environmental Professional Award (to Emily Wilson), Connecticut River Coastal Conservation District

Communications Award (to CT NEMO), Connecticut Chapter of the American Planning Association

2007

Excellence in College and University Teaching in Food and Agricultural Sciences Award (to Dan Civco), USDA/CSREES

2006

Outstanding Achievement Award (to CT NEMO for *Putting Communities in Charge* publication), Renewable Natural Resources Foundation

Public Outreach and Engagement Award, University of Connecticut (to CT NEMO)

2005

Environmental Leadership Award (to CLEAR/LERIS), University of Connecticut Environmental Policy Advisory Council

Public Education Award (to GVI), American Planning Association

Bronze Award, Best Extension Web Site (to CLEAR for Connecticut's Changing Landscape), Association of Natural Resource Extension Professionals

Award of Excellence (to Bob Ricard), University of Connecticut College of Agriculture and Natural Resources

2004

Frederick Law Olmstead Award (to GVI), Connecticut Chapter of the American Society of Landscape Architects

Award of Excellence (to Bob Ricard), Northeast Extension Directors

2003

James W. Toumey Outstanding Service Award (to Bob Ricard), New England Society of American Foresters

Best Scientific Paper in Geographic Information Systems (to Civco, Hurd, Wilson, Arnold, Prisloe), American Society for Photogrammetry and Remote Sensing

Teaching Award of Merit (to Dan Civco), North American Colleges of Teachers of Agriculture

2002

Best Scientific Paper in Geographic Information Systems (to Arnold, Civco, Prisloe, Hurd, Stocker), American Society for Photogrammetry and Remote Sensing

Contact CLEAR

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Dan Civco, Director
Department of Natural Resources and the Environment
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Email: daniel.civco@uconn.edu

Mailing Address

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University of Connecticut
Middlesex County Extension Center
1066 Saybrook Road, P.O. Box 70
Haddam, CT 06438

Phone: 860-345-4511
Email: clear@uconn.edu

CLEAR Program Contact Information

NEMO (Nonpoint Education for Municipal Officials)

Michael Dietz, CT NEMO Director, Extension Educator
Phone: 860-345-5225
Email: michael.dietz@uconn.edu
Website: nemo.uconn.edu

National NEMO Network

David Dickson, National NEMO Network Coordinator, Extension Educator
Phone: 860-345-5228
Email: david.dickson@uconn.edu
Website: nemonet.uconn.edu

Land Use Academy

Bruce Hyde, Land Use Academy Coordinator, Extension Educator
Phone: 860-345-5205
Email: bruce.hyde@uconn.edu
Website: clear.uconn.edu/lua

Forestry

(Forest Stewardship and Coverts)
Tom Worthley, Assistant Extension Professor
Phone: 860-345-5232
Email: thomas.worthley@uconn.edu

(Urban and Community Forestry, Meskwaka Project)
Robert Ricard, Senior Extension Educator
Phone: 860-570-9257
Email: robert.ricard@uconn.edu

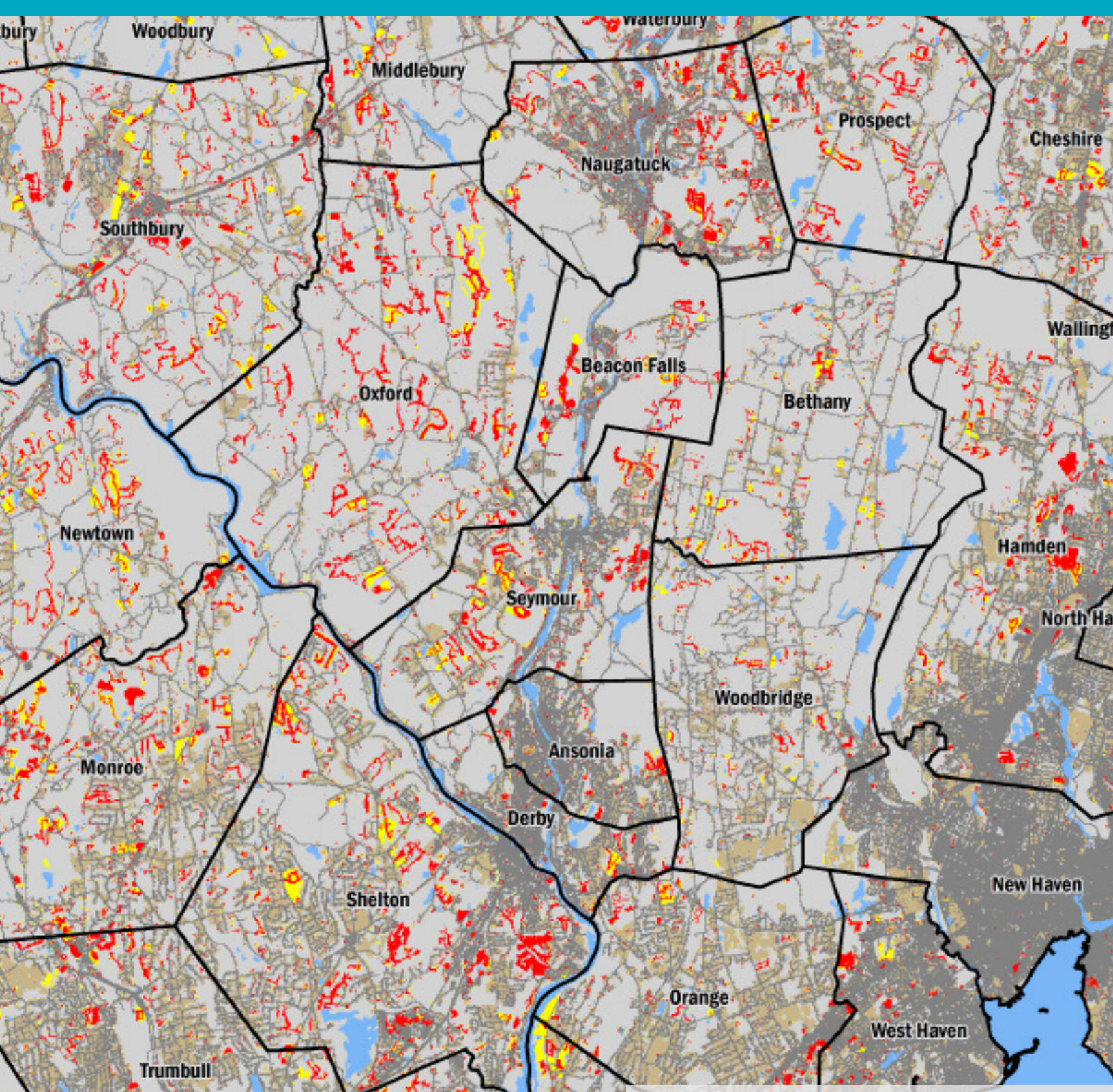
Website: www.ctforestry.uconn.edu

Geospatial Technology (GTP)

Cary Chadwick, Geospatial Training Program Coordinator, Extension Educator
Phone: 860-345-5216
Email: cary.chadwick@uconn.edu

Emily Wilson, Geospatial Specialist, Extension Educator
Phone: 860-345-5226
Email: emily.wilson@uconn.edu

Website: clear.uconn.edu/geospatial



Connecticut Change Map

The Connecticut change map is a part of the Changing Landscape Project (see Key Impacts, page 4) and shows land use change between 1985 – 2010. In this example, from central Connecticut, red depicts newly-developed land since 1985 and yellow depicts new turf and grass, maintained grasses associated mostly with developed areas. Details about this and other changing landscape projects are at **clear.uconn.edu/projects/landscape**.

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CLEAR is a partnership of the Department of Extension and the Department of Natural Resources and the Environment at the College of Agriculture and Natural Resources, and the CT Sea Grant College Program. Support for CLEAR comes from the University of Connecticut and from state and federal grants.