CT Envirothon Workshop- Current Issue 2: Energy Sprawl
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Energy Sprawl Is the Largest Driver of Land Use Change in United States

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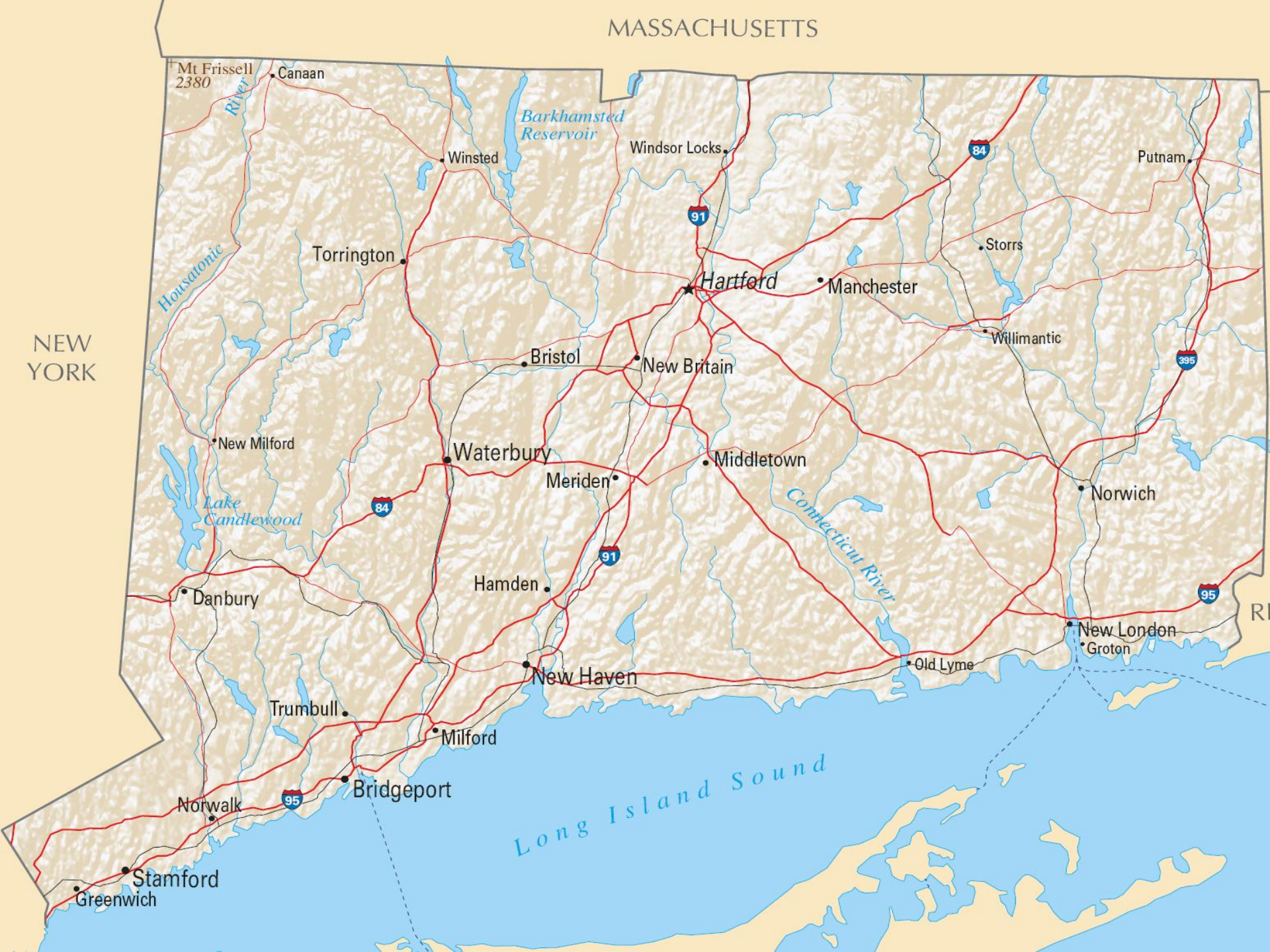
Abstract

Energy production in the United States for domestic use and export is predicted to rise 27% by 2040. We quantify projected energy sprawl (new land required for energy production) in the United States through 2040. Over 200,000 km^2 of additional land area will be directly impacted

What are the issues and impact of large scale Renewable Energy Projects?

What impact do they have on Sustainability?


MASSACHUSETTS
NEW YORK
Mt Frissell
2380
Canaan
Housatonic River
Barkhamsted Reservoir
Winsted
Windsor Locks
Putnam
Torrington
Hartford
Manchester
Storrs
Willimantic
Bristol
New Britain
New Milford
Waterbury
Middletown
Meriden
Norwich
Lake Candlewood
Connecticut River
Danbury
Hamden
New London
Groton
Old Lyme
New Haven
Trumbull
Milford
Bridgeport
Norwalk
Stamford
Greenwich
Long Island Sound
84
91
395
95

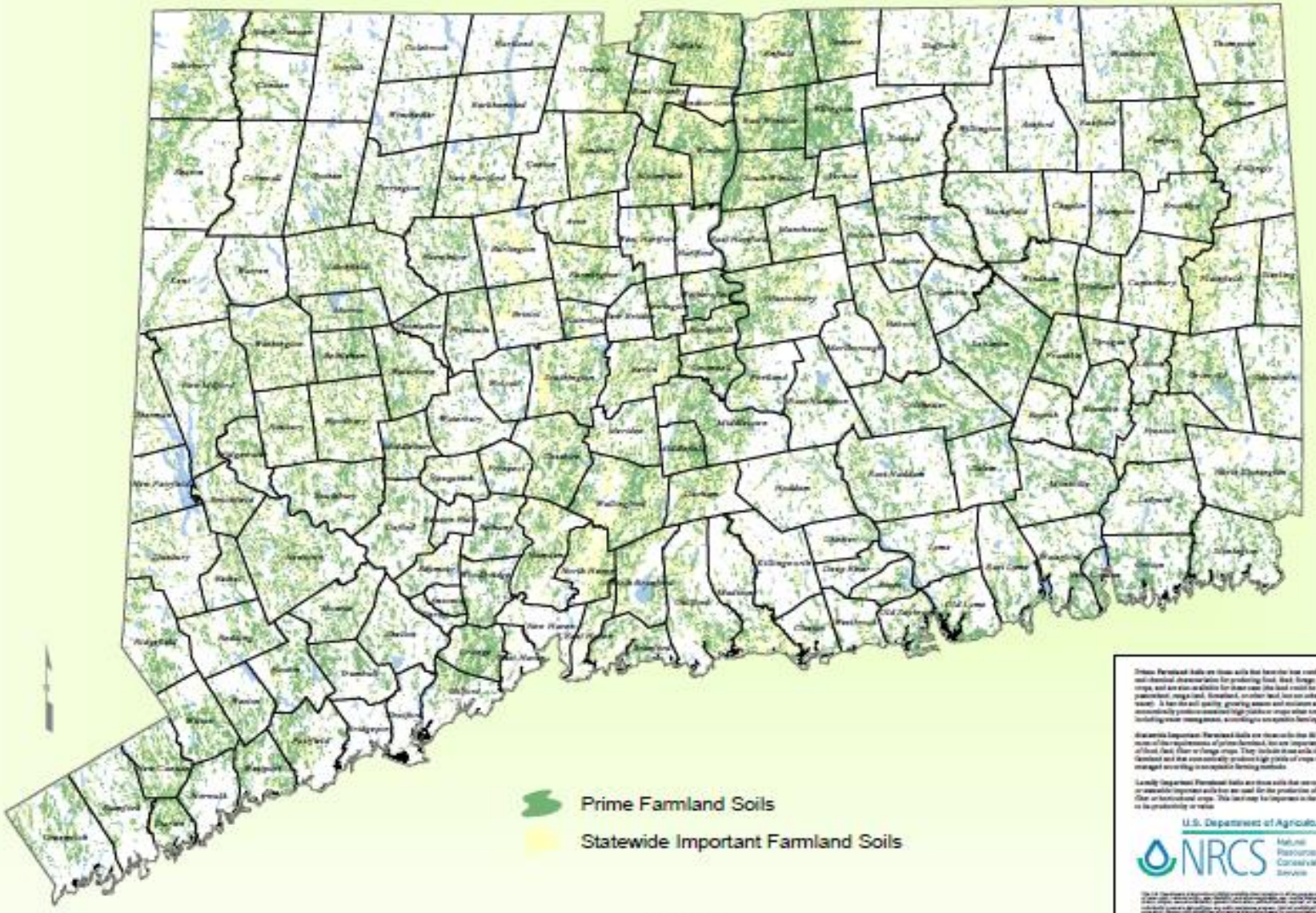
Important Connecticut Facts

- Home to 3.6 million people
- 3.18 million acres of land
- 4th most densely populated State
- 49% Forest, 39% Developed, 12% Ag- 5.6% fields
- 4th highest % loss of farmland in US since 2001
- Food Shed for NYC, Boston, Providence
- 99% of State flows to Long Island Sound
- Intersection of Northern Forest & Mid Atlantic Ecosystems
- Atlantic and CT River Flyways
- Some of Nation's Wealthiest Towns and 3 of the Poorest Cities

Preferred Suitability for Large Scale Solar Arrays

- Nearly level, gently sloping
- South Facing
- Well drained soils
- Avoids wetlands, water bodies
- Buffers from residential
- Near transmission lines, substations with capacity
- Open land, easily cleared
- Sufficient contiguous acreage
- Inexpensive to own/lease

Connecticut Prime and Important Farmland Soils



Prime Farmland Soils are those soils that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and are also available for these uses (the land could be cropland, pastureland, rangeland, forestland, or other land, but not urban built-up land or water). It has the soil quality, growing season and moisture supply needed to economically produce sustained high yields of crops when treated and managed, including water management, according to acceptable farming practices.

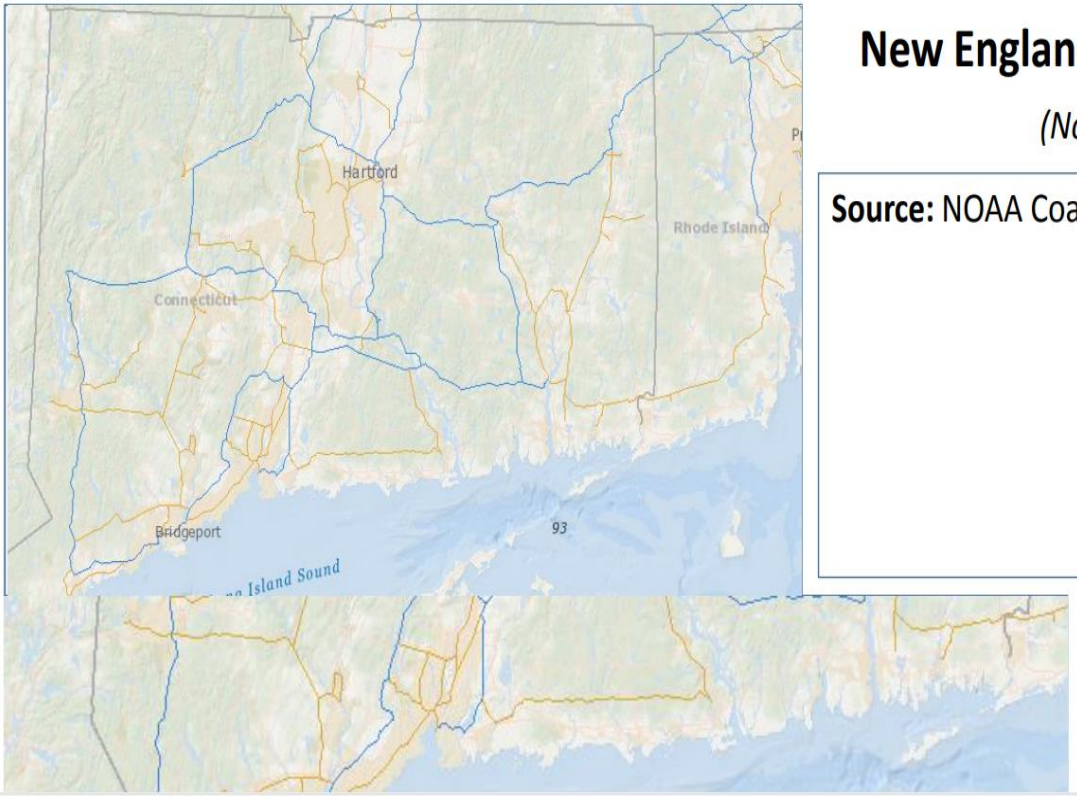
Statewide Important Farmland Soils are those soils that fall to meet one or more of the requirements of prime farmland, but are important for the production of food, feed, fiber or forage crops. They include those soils that are nearly prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods.

Locally Important Farmland Soils are those soils that are not categorized prime or statewide important soils but are used for the production of high value food, fiber or horticultural crops. This land may be important to the local economy due to its productivity or value.

U.S. Department of Agriculture

NRCS Natural Resources Conservation Service

Access instructions. Go to http://www.northeastoceandata.org/data-explorer/. Go to Energy and Infrastructure > Infrastructure > New England Electrical Transmission Substations



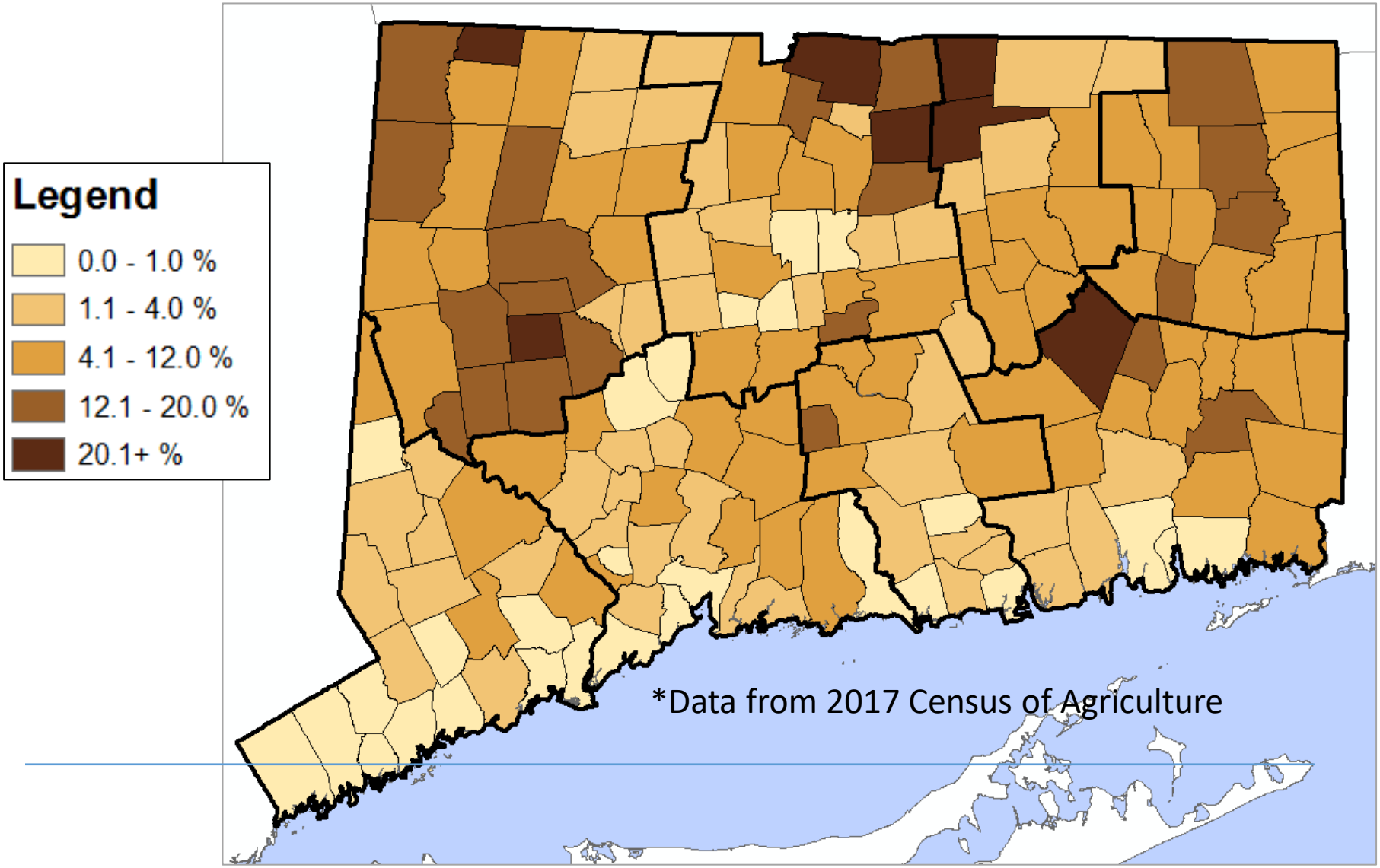
New England Electrical Transmission Lines

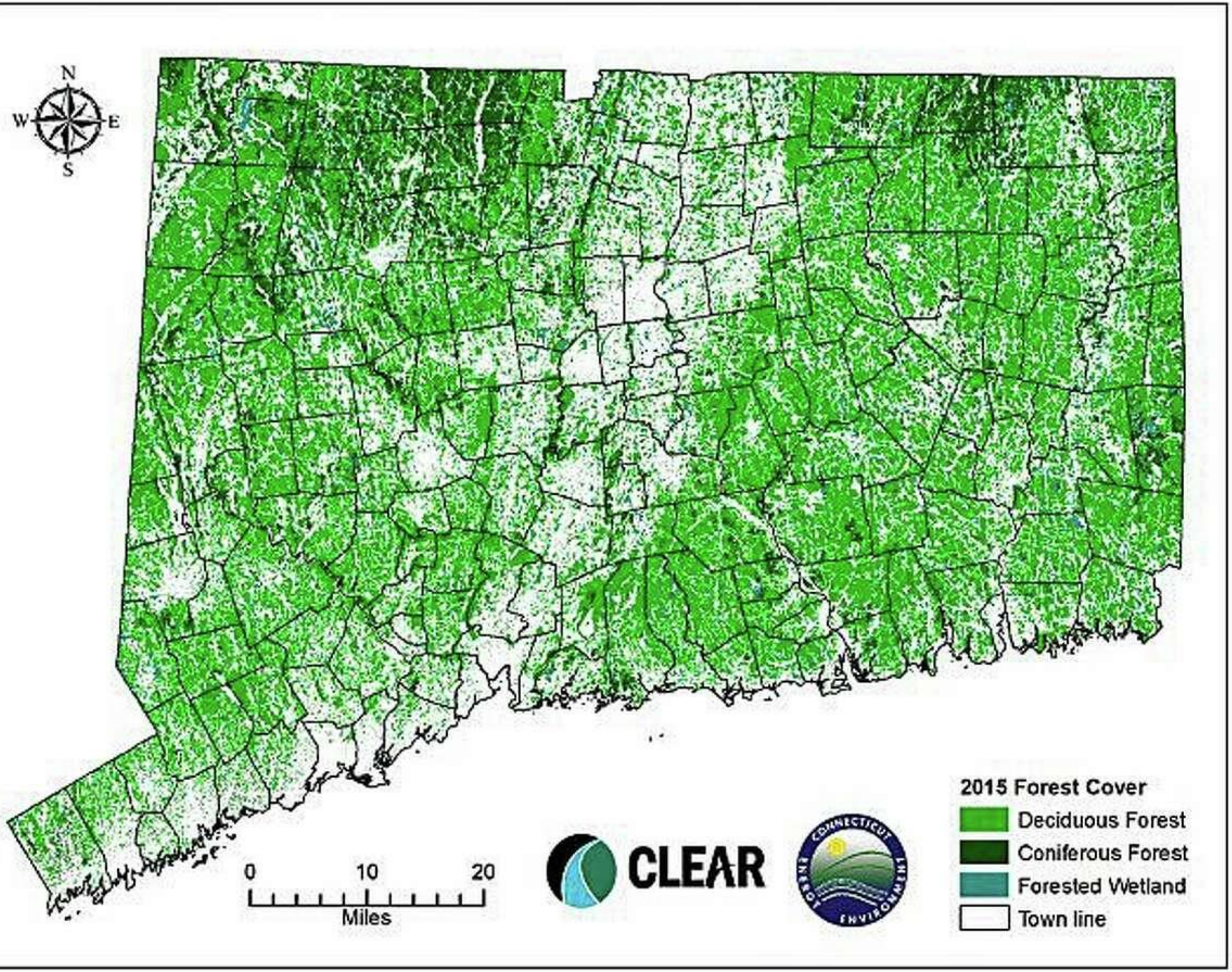
(Northeast Ocean Data Portal)

Source: NOAA Coastal Services Center

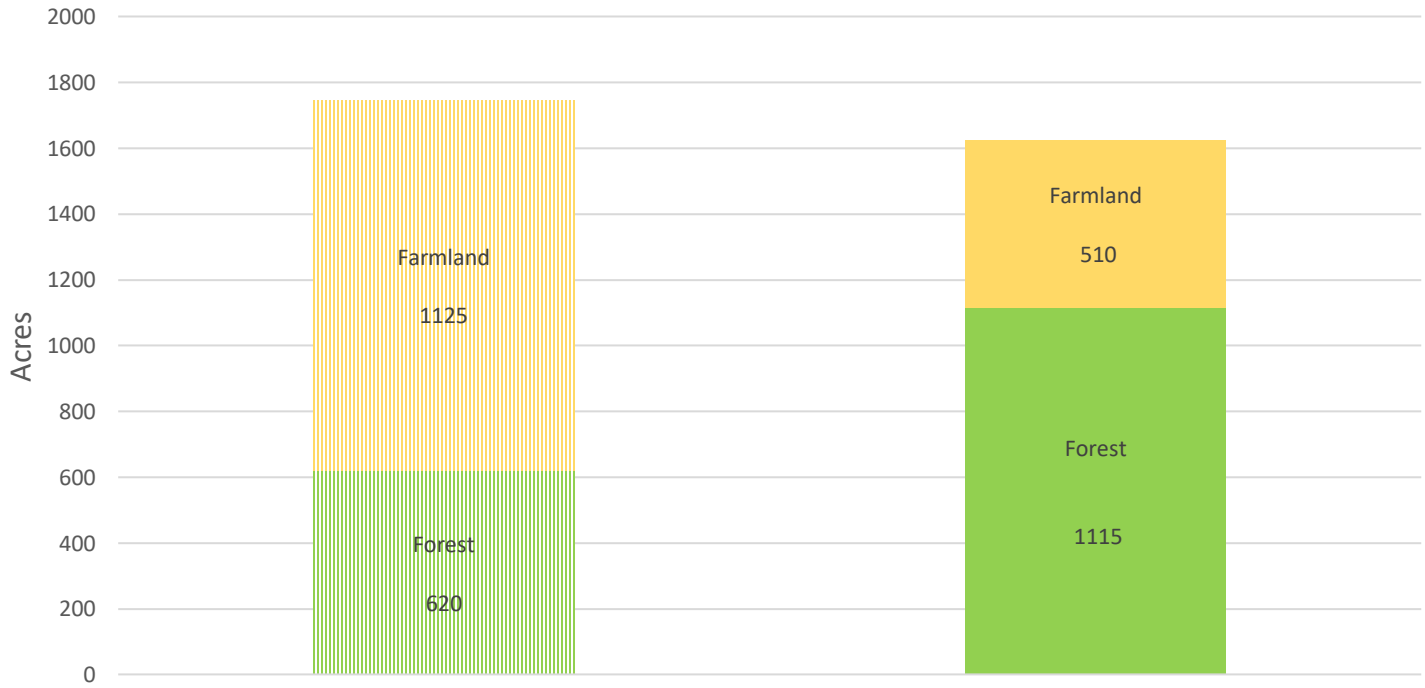
Where is our agricultural land?

Total Land in Farms: **381,000*** **11.9%, 5.6 % fields**




N
W
E
S
0
10
20
Miles
CLEAR
CONNECTICUT
FOREST & ENVIRONMENT
2015 Forest Cover
Deciduous Forest
Coniferous Forest
Forested Wetland
Town line

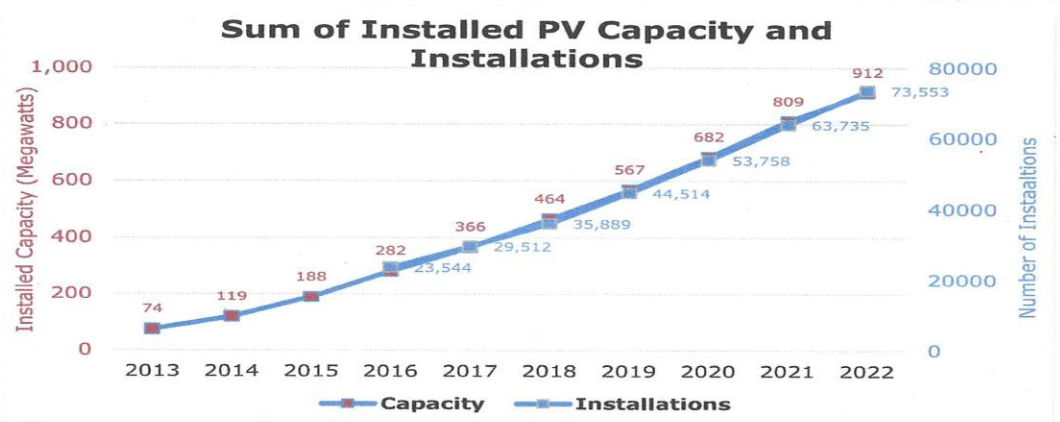
2016 Solar Development on Farm and Forest
vs.
Average Annual Land Conservation



Acres of Farm and Forest Preserved Annually by DEEP & DOA (10-Year Average)

Acres of Farm and Forest Selected and/or Approved for Solar Projects in 2016

The number of solar installations throughout Connecticut increased in 2022.



Thousands of Connecticut homes and businesses now use the sun to generate much of their own electricity. Through December 2022, total installed solar photovoltaic (PV) capacity from over 73,500 installations exceeded 912 megawatts (MW) in the state.[77] On January 1, 2022, the new Residential Renewable Energy Solutions (RRES) program replaced the previous net metering and Residential Solar Investment Program, administered by the Green Bank, for residential renewable energy projects. In 2022, 5,998 solar PV installations with a total capacity of 47,133 kilowatts (kW) were deployed throughout Connecticut as part of the RRES Program.[78] The RRES program offers residential solar installations the opportunity to sell the energy produced and the renewable energy certificates (RECs) at a fixed 20-year price by selecting one of two incentive rate structures (tariffs).

Public Act 22-14 expanded the Non-Residential Energy Solutions program (NRES) and Shared Clean Energy Facility (SCEF) program. The new law also increased the maximum size of individual projects under the programs; expanded the programs capacity; allows commercial and industrial customers in the NRES program to use their entire rooftops to site projects and increases the proportion of SCEF projects that must benefit low-income customers.

Utility Scale and Behind-The-Meter Solar PV

The Independent System Operator for New England (ISO-NE) projected that a total of approximately 1,880 MW of solar PV capacity could be installed in Connecticut by 2031.[79] The environmental and social impact of solar PV installations in Connecticut is mixed. The primary advantage of solar PV technology is that it produces electricity with zero emissions – no air pollution, wastewater, or noise. The 912+ MW of installed PV capacity in the state in 2022 is calculated to produce more than 1.16 million megawatt-hours (MWh) of electricity, which is calculated to potentially displace over 310,000 metric tons of carbon dioxide equivalent (CO_2e) emissions.[80]

Issues of Large Scale Solar on Agricultural Land & Forest

Land use concerns related to the siting of large scale solar projects:

- Competing goals of encouraging least “expensive” renewable sources of energy and protecting valuable farmland
- Existing Farmland is typically considered the easier and cheaper location for large scale solar
- The loss of farmland is the potential loss in agricultural activity/$
- Loss/fragmentation of forest land and many ecosystem services
- Loss/fragmentation of habitat for wildlife
- Impacts to the visual landscape
- Property rights of land owners and farmers

Potential Impacts to Agricultural Viability

- Loss of Prime and Important Farmland soils
- Loss of soils most resilient to impacts of climate change
- Potential erosion/sedimentation during/after installation
- Soil compaction
- Soil profile & hydrologic disturbance by trenching, grading, infrastructure
- Increased soil temperature
- Increased runoff
- May increase use of more marginal soils
- Potential impacts of herbicide use
- Decrease in productivity if ever returned to production

Potential Impacts to Agricultural Viability

- Loss of access to land base for the business
- Creates competition for remaining land
- Creates barriers to Succession Planning
- Reduces opportunities for new & beginning farmers
- Fragmentation of fields/farms/habitat
- Creates uncertainty about land access
- Creates speculation by landowners, may elevate land values

Potential Impacts to Agricultural Viability

- Reduces potential for agritourism
- Reduces land base for proper manure/organics mngmt
- Reduces opportunity to create a better food system
- Reduces potential to store additional carbon
- Positive source of farm income and diversification
- Potential for co-location uses of ag & solar array

ONE ACRE
OF PRIME FARMLAND
CAN PRODUCE:


27,000 LBS

or


8,400 LBS

or


6,000 LBS

or

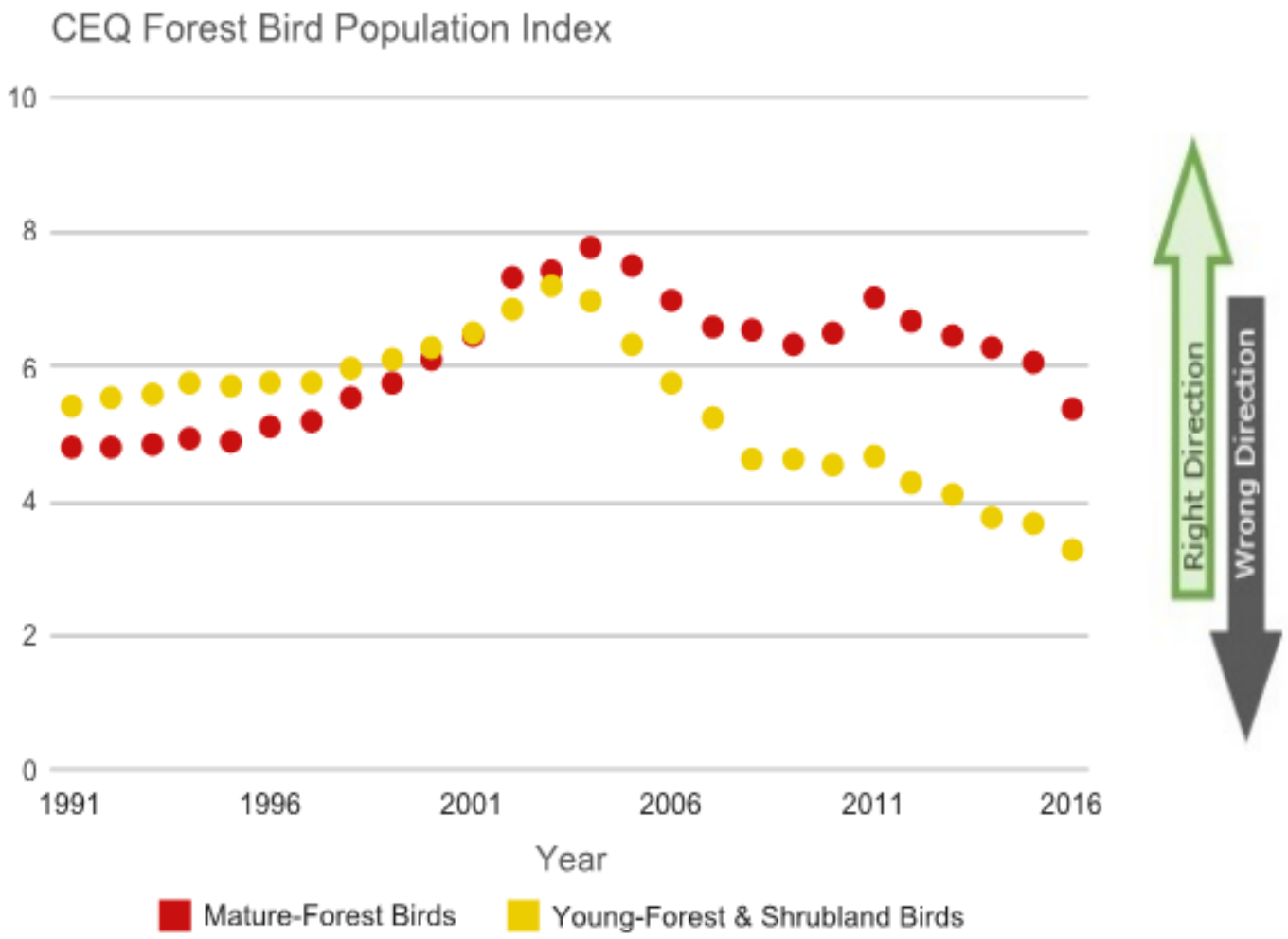

3,900 LBS

- One acre of solar array can provide power to 32 households
- Can supply 12 weeks of food in a CSA to 30+ families
- Helps support 80+ species of birds, hundreds of invertebrates, mammals, reptiles, and amphibians
- Provide feed and land for manure application for ½ cow
- Sequesters soil carbon, reduces food miles, organic waste, as part of local food system

Potential Impacts to Ecosystem health

- Fragmentation/loss of habitat, species
- Loss of core forests
- Fencing disrupts movement of biota
- Potential erosion/sedimentation during/after installation
- Changes landscape hydrology, increased runoff
- Possible hazards to waterfowl
- Increased water temperature
- Potential for spread of invasives
- Loss of productive forest land
- Loss of carbon sequestration of forests
- Loss of migration corridors for plants and animals, biodiversity

Chestnut sided Warbler


CEQ Forest Bird Population Index
10
8
6
4
2
0
1991
1996
2001
2006
2011
2016
Year
Mature-Forest Birds
Young-Forest & Shrubland Birds
Right Direction
Wrong Direction

The Process for Siting Solar Arrays varies in every State

- What are the rules and regulations
- Process for selection and approval
- Incentives offered
- BMPs required
- Opportunities/incentives for on farm and co-use
- Decommissioning process and requirements
- Restoration and bonding requirements
- Recommendations to offer landowners
- Consideration of the potential impacts on soils. other natural resources, and communities

What CT laws and policies created this conflict?

Commitment to renewable energy

Deficiency: DEEP's project-selection criteria value short-term price above all else

Solutions: 1. Require DEEP to give "meaningful weight" to non-price factors
2. Allow incentives for better sites

Deficiency: Siting Council must approve utility-scale solar facilities, with very little discretion

Solutions: 1. More thorough Siting Council review, &

Allow Siting Council to consider impacts to agricultural land (Now Public Act 17-218)

Summary of the solar siting processes and criteria:

In 2017, the Connecticut General Assembly passed Public Act 17-218, An Act Concerning the Installation of Certain Solar Facilities on Productive Farmlands, Incentives for the Use of Anaerobic Digesters by Agricultural Customer Hosts, Applications Concerning the Use of Kelp in Certain Biofuels and the Permitting of Waste Conversion Facilities. This Act primarily impacts the Siting Council process for solar photovoltaic facilities of greater than 2 megawatts that seek a "declaratory ruling" from the Connecticut Siting Council as opposed to a certificate. Pursuant to Public Act 17-218, such facilities must meet the following requirements:

The Siting Council must not find a "substantial adverse environmental effect" and For facilities that are to be located on prime farmland or forestland (excluding facilities selected by DEEP prior to July 1, 2017), the Department of Agriculture must write to the Council that such projects "will not materially affect the status of such land as prime farmland" and/or the DEEP must write to the Council that such project will not materially affect the status of such land as core forest. Both DOA and DEEP may consult with USDA and soil and water conservation districts to conduct this evaluation.

Proposed facilities may elect to proceed through the certificate proceeding at Siting Council and avoid the requirement of a letter from DOA or DEEP. However the certificate proceeding requires more time and is more costly. The certificate process also requires that Siting Council conduct a more detailed review of the environmental impact of the facility that, since the passage of Public Act 17-218, must include every significant adverse effect on agriculture.

Siting Solar in New York

- New York's solar market is growing fast–575% in the last four years alone–so demand for sites to install large-scale solar electric systems is high.
- Across New York State, solar developers are contacting farmers and landowners to secure long-term land leases for siting solar arrays.
- Before considering such a lease or contract, installing solar panels on farmland may trigger a "conversion penalty" and may increase the taxable value of the overall property.
- To fully understand the impact of these factors, landowners are urged to consult with an attorney and their municipal assessor before signing any documents.

FACT SHEET

LANDOWNER CONSIDERATIONS FOR SOLAR LAND LEASES

NEW YORK STATE OF OPPORTUNITY. | NY-Sun

New York's solar market is growing fast–575% in the last four years alone–so demand for sites to install large-scale solar electric systems is high. Across New York State, solar developers are contacting farmers and landowners to secure long-term land leases for siting solar arrays. The amount of land desirable for a lease generally ranges from 10 to 30 acres, depending upon the size of the solar array.

Before considering such a lease or contract, you should know installing solar panels on farmland may trigger a "conversion penalty" and may increase the taxable value of the overall property. To fully understand the impact of these factors, landowners are urged to consult with an attorney and their municipal assessor before signing any documents.

What is shared solar?

NY-Sun, Governor Andrew M. Cuomo's initiative to add more than 3GW of installed solar capacity in New York State by 2023, encourages and supports the installation of solar arrays to generate clean and renewable energy statewide. Tens of thousands of New Yorkers have already put solar panels on their homes. Many buildings, however, are not suited for solar panels due to shading, roof condition, or other factors. New Yorkers now have the opportunity to subscribe to larger "shared solar" systems. Shared Solar provides opportunities for renters, homeowners, businesses, and municipalities to subscribe to a portion of shared solar energy projects. The siting of these systems is creating an even greater interest in the leasing of farmland.

Is solar right for your land?

The size of a solar installation is measured by its capacity to produce energy. A 1-megawatt (MW) installation will generate approximately 1,174,000 kilowatt hours (kWh is how electricity usage is measured on your utility bill) each year. A 1-MW system will generally require about six acres of land for 3,000 to 4,000 individual solar panels, and will cost $2 million to $3 million to build. Systems built on open land will connect directly to the electric grid and will have their own utility meter. Solar panels are typically warrantied for 25 years, but a system can last longer than that if panels are replaced over time.

What are the per acre lease rates?

Rates can vary. If you are approached by a developer or have interest in leasing your land, research the going rate for land leases in your area. Contact multiple solar developers to gauge interest in your land. Certain site characteristics are especially attractive for solar development, such as cleared land that is south-facing with road access and in close proximity to the substation. Do research online about solar lease rates in other areas and consider working with a real estate professional.

Prior to signing a lease with a solar developer, landowners should examine possible tax consequences and issues associated with the construction of roads, fencing, and electrical poles. Landowners should consider asking an attorney to carefully examine the land lease terms.

Do you receive an agricultural assessment on your property?

Under the Agriculture and Markets Law, if a landowner receives an agricultural assessment and converts the land to a nonagricultural use, the landowner may be subject to a monetary payment for converting the land. A conversion of land is "an outward or affirmative act changing the use of agricultural lands" (AML §301(8)).

Municipal assessors are responsible for tracking conversions when they occur. Landowners are also required to notify the assessor within 90 days whenever a parcel receiving an agricultural assessment is converted to a nonagricultural use. A fine of up to $1,000 can be levied against a landowner who fails to report the conversion.

Who is responsible for paying a conversion penalty?

The landowner on record is responsible for paying the conversion penalty. Your assessor can work with you to determine what the conversion penalty may cost. Make sure you know where the solar array will be placed on your property so that a comparative analysis of benefited acres versus total converted acres, by mineral, organic, and farm woodland soil groups can be determined.

Are solar panels considered real property and taxable?

Yes. A solar energy system is "real property" once it has been permanently affixed to land or a structure [Real Property Tax Law (RPTL) § 102(12)(b); 8 Op. Counsel SBEA No. 3]. The definition of "real property" also includes a "power generating apparatus" [RPTL §102(12)(f)]. As such, it is taxable unless it qualifies for an exemption (RPTL § 300).

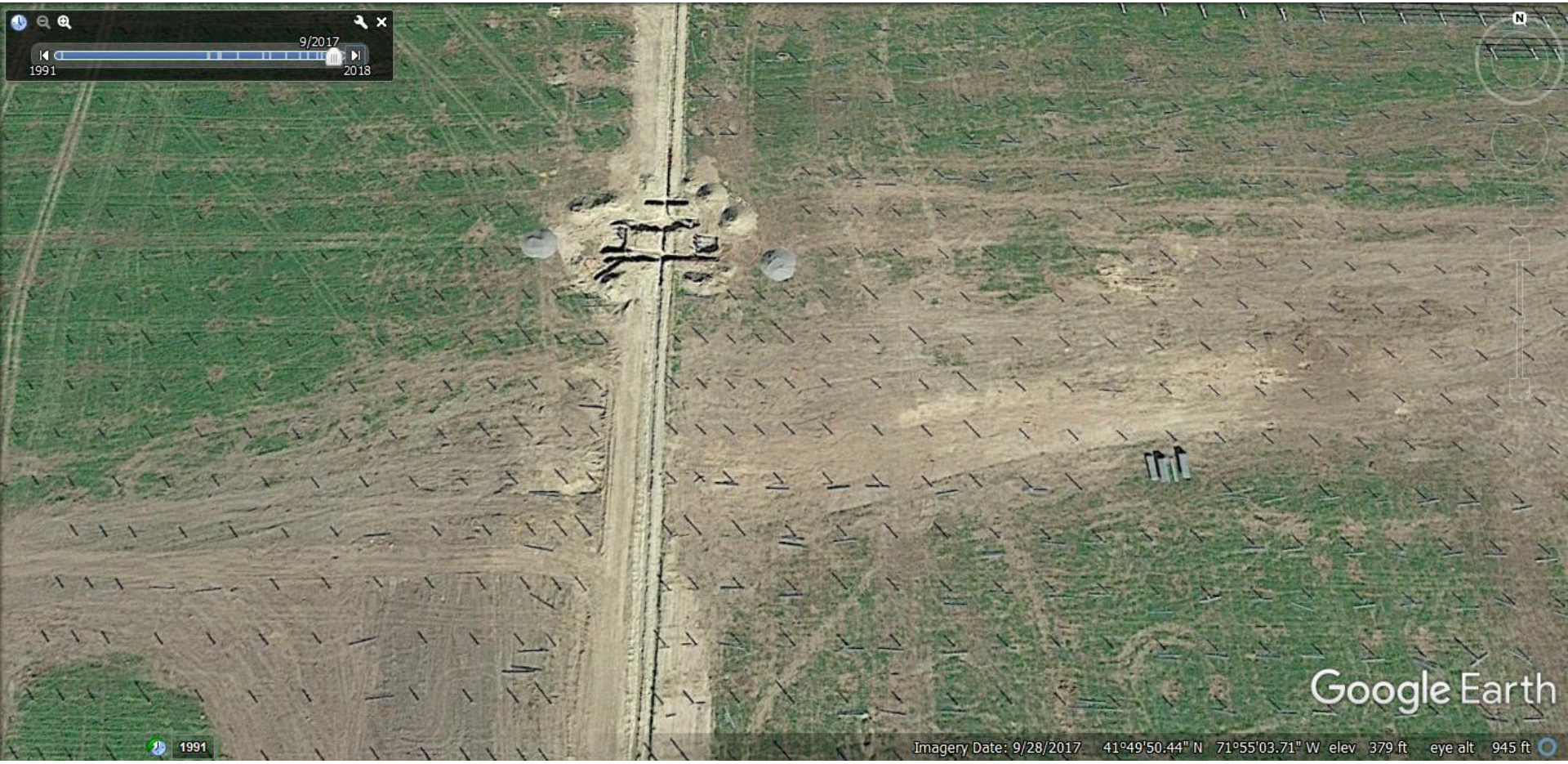
Will the siting and construction of a solar array on my property affect other taxes?

Possibly. The assessor must determine the contributory value of the solar array to the value of your property. If the value of the converted acreage devoted to the solar array increases, it may affect your taxes. An increase in taxable value may affect your county, town, village, and school taxes as well as other taxes that may be levied, such as highway, fire, ambulance, library, lighting district, drainage district, and other taxes and levies. It may also affect special district taxes for municipal water and sewer districts if the land is no longer predominantly used for agricultural purposes.


4/2016
Rogers
1st St
2nd St
Bigelow Ln
Gendreau Dr
N
Cooney Rd
Searles Rd
Spaulding Rd
White Brook Dr
Laurel Dr
Amanda Ln
Birchwood Dr
Highview Dr
Luzon Ave
Google Earth
1991
Imagery Date: 4/26/2016 41°49'52.48" N 71°55'16.90" W elev 356 ft eye alt 10681 ft


9/2017
Rogers
1st St
2nd St
Gendreau Dr
Gooney Rd
Searles Rd
Spaulding Rd
White Brook Dr
Laurel Dr
Luzon Ave
Birchwood Dr
Highview Dr
Google Earth
1991
Imagery Date: 9/28/2017 41°49'52.48" N 71°55'16.90" W elev 356 ft eye alt 10681 ft


Rogers
Main St
Technology Dr
Litchfield Ave
Boys Ave
2nd St
Blueberry Ln
Gendreau Dr
Cooney Rd
Searles Rd
Laurel Dr
Edgerton Ave
Birchwood Dr
Highview Dr
Amanda Ln
Cheryl Ave
© 2018 Google
GoogleEarth
1991
Imagery Date: 4/22/2018 41°50'00.40" N 71°55'08.57" W elev 386 ft eye alt 10146 ft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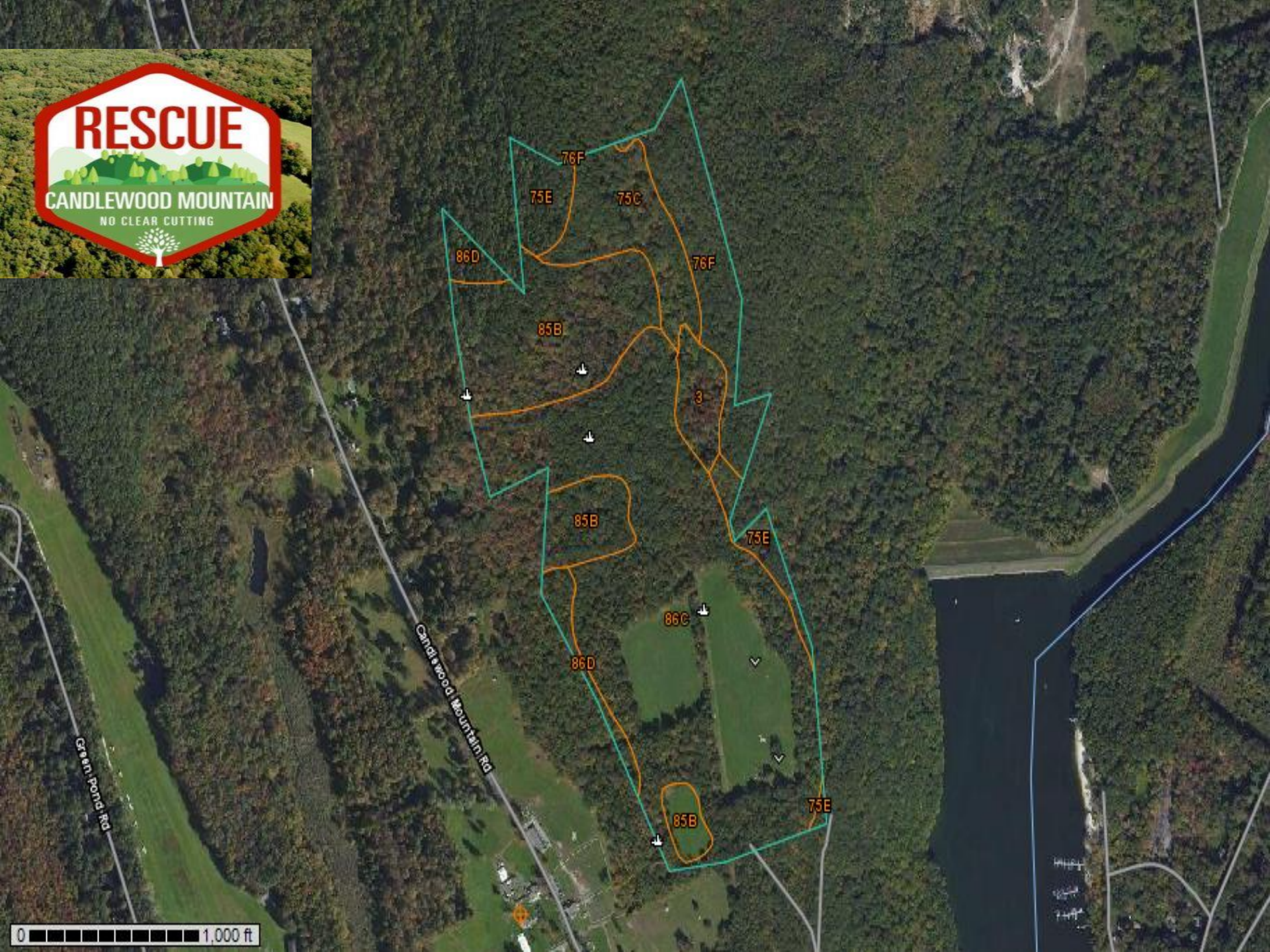

RESCUE
CANDLEWOOD MOUNTAIN
NO CLEAR CUTTING
76F
75E
75C
86D
76F
85B
3
85B
75E
86C
86D
85B
75E
Candlewood Mountain Rd
Green Pond Rd
0
1,000 ft

Successful On-Farm Usage in CT

- Farms use a considerable amount of energy. Top two industries in the state in terms of economic value and energy consumption are the greenhouse/nursery and dairy industry.
- By reducing on-farm energy usage through EE and RE measures there is more supply for the grid and more dollars in the pockets of farmers.

246 kW roof mounted solar array at Oakridge Dairy in Ellington, CT.

Ground Mounted 129 kW solar array at Freund's Farm, E. Canaan, CT. First Farm in CT to Virtual Net Meter. Additionally the farm has installed a 223 kW roof mounted array on their new robotic milking barn.

Prides Corner Farm in Lebanon, CT installing 240 kW solar system on a newly constructed greenhouse structure.

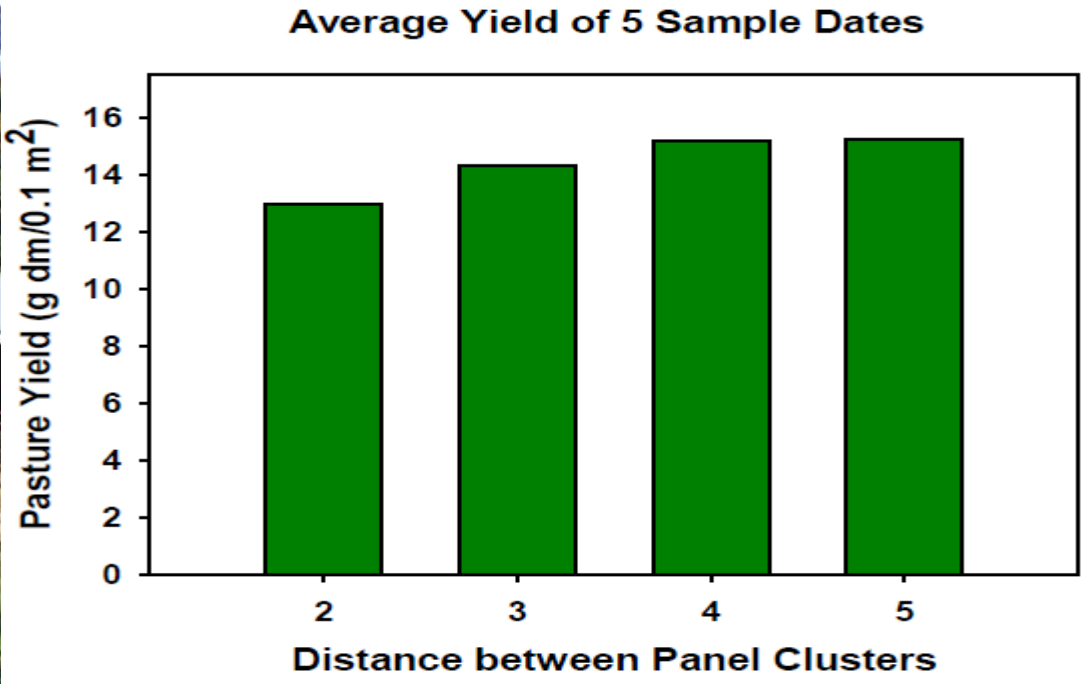
What about on farm use and co-use of solar arrays Agrivoltaics?

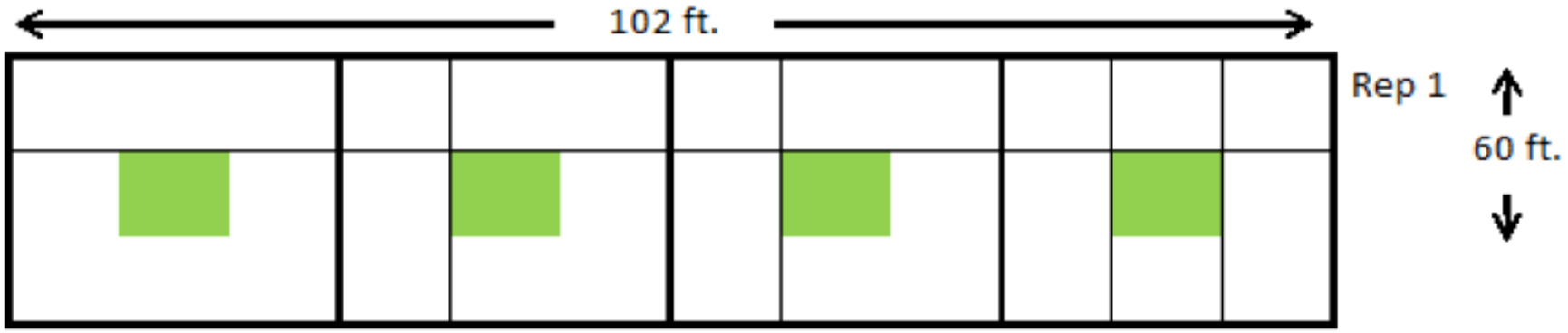
- More upfront planning needed
- Need to protect inherent soil properties
- Understand economics of yields, costs, short term & long term impacts
- Understand zoning, taxing implications
- Limits potential for kinds of agriculture/markets
- What is a legitimate Agricultural use?

Agriculture and Solar Energy Dual Land Use

Stephen J. Herbert, Phaedra Ghazi, Kate Gervias, Emily Cole and Sara Weis

Stockbridge School of Agriculture





		cost	risk	on-going labor
1	Sheep	low	low	low
2	Low Grow Grass	low	low	low
3	Decorative Plants	medium	low	medium
4	Low Light Crops	medium	low	high
5	Mowing	high	high	high
6	Chemicals	medium	medium	medium
7	Vegetation Barriers	high	medium	low

Basic BMPs to protect Soil Health and Landscape Integrity on ground mounted arrays

- Develop detailed baseline mapping and data
- Avoid cuts and fills, keep soil onsite for restoration
- Utilize existing farm roads, infrastructure
- Avoid traffic on wet fields, use of large equipment
- Avoid trenching, backfill any trenches as per original soil horizons
- Maintain vegetative cover during and after construction
- Manage soil nutrient status and vegetation to facilitate ag
- Use of soil scientists, conservationists during construction
- Develop decommissioning plan that offers bonding, returns site to baseline conditions, emphasis on decompaction, rebuild soil health for ag, forest, habitat
- Use of clustering of arrays, different mounts for different Ag

Guidance for the siting and approval of energy projects

- Develop ranking criteria and applicant guidelines that better reflect impacts on sustainability
- Focus on reuse of previously developed and disturbed land
- Use lands that have lower agricultural/forest quality
- Use mitigation where there are no alternatives
- Consider impacts to the broader agricultural, cultural, and ecological landscapes
- Collect more robust site data to assist with soil /landscape management and restoration
- Develop comprehensive restoration plans
- Utilize performance bonds to ensure success
- Consider opportunities to incorporate agricultural production in the project upfront!
- Meet with developers upfront before they apply

What Are the Other Options?

- Continued Energy Conservation
- State Lands
- Landfills
- Brownfields and Industrial Lands
- Grayfields
- Rooftops, parking lots and canopies
- Waterbodies
- Co-location with agricultural use
- Non P & I soils
- Right of Ways, Transportation Corridors
- Improve energy infrastructure to allow additional connections
- Increased efforts on energy conservation, mass transit, smart growth
- More smaller community and residential systems

Resources and Information

- New Solar Siting special collection of resources on the American Farmland Trust Farmland Information Center (FIC): http://www.farmlandinfo.org/special-collections/4718
- Energy Sprawl in Connecticut: Why Farmland and Forests are Being Developed for Electricity Production; Recommendations for Better Siting CT Council on Environmental Quality Special Report (2017)
- Core solar siting law: Connecticut Solar Siting Statute (2017) This law establishes siting standards and creates incentives for installing solar facilities in Connecticut.