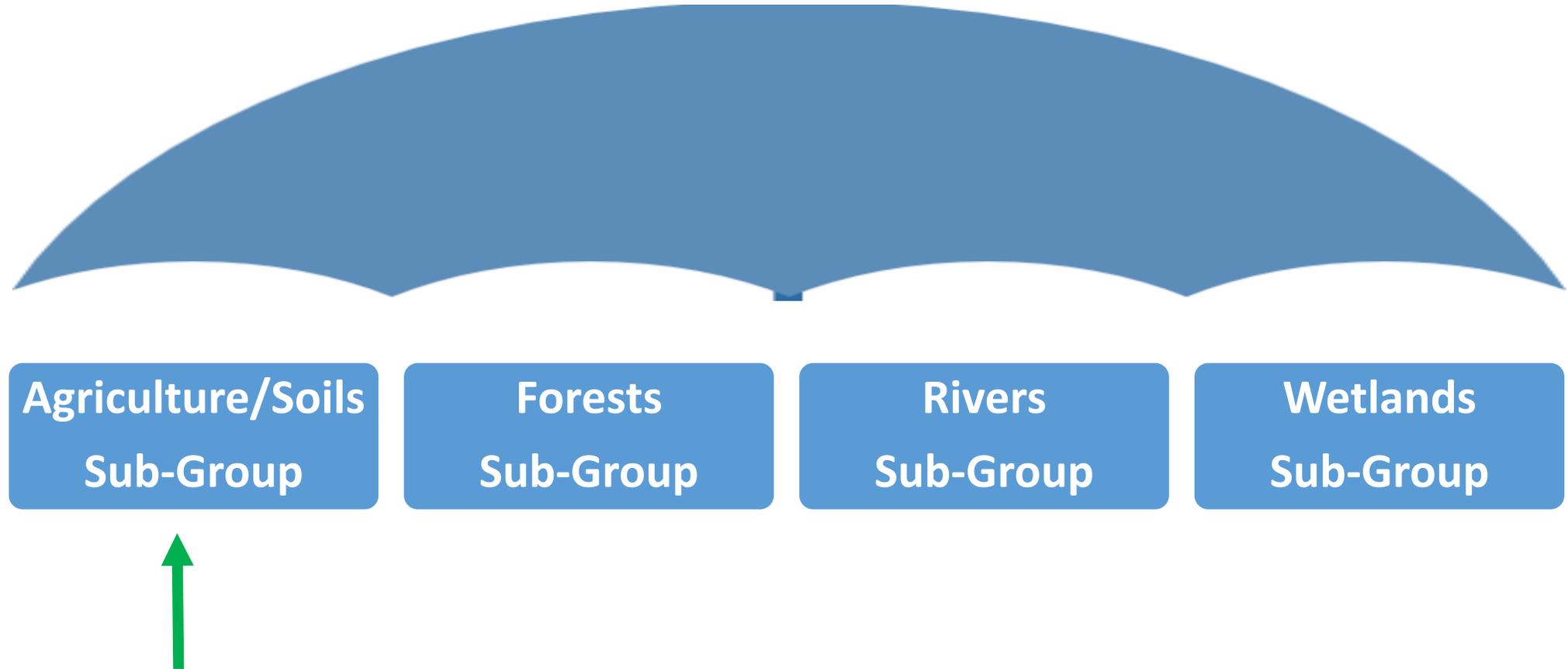


2020

Agriculture/Soils Sub-Group Draft Report



Working and Natural Lands Working Group



Agriculture/Soils Sub-Group Members

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- Indrajeet Chaubey, University of Connecticut
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**With support from Holly Lalime and Kayleigh Royston, Department of Agriculture

Climate Benefits of Agriculture/Soils

- Carbon Storage
- Carbon Sequestration
- Water Management/Hydraulic Functions
- Wildlife Habitat
- Green Space
- Historic Preservation
- Food Production
- Tourism
- Jobs
- Health and Wellbeing
- Community
- Energy Production

Connecticut farm operations account for over 380,000 acres of land across the state and 50,000 acres of managed aquaculture beds in the Long Island Sound.

Why is Agriculture Important in the Context of Climate Change?

- **The Power of Soil**

- Agriculture has the potential to become a significant carbon sink
- Soil holds three times more carbon globally than the atmosphere
- Land stewardship practices such as no-till and cover cropping can both reduce agricultural emissions and increase carbon sequestration and storage
- Healthy soils retain more water which prevents harmful runoff and reduces the demand for irrigation
- Healthy soil has a robust microbiome making nutrients more available and creating a soil environment that can more aggressively combat pests and disease pressure

Why is Agriculture Important in the Context of Climate Change?

- **Food Security**

- The availability of local food reduces demand for fossil fuels
- Local farmers markets (especially in urban areas) provide a source of fresh, nutritious food where it would otherwise be unavailable
- Value added products and year-round food production increases availability for consumers

- **Quality of Life**

- Green spaces (especially in urban communities) allow for recreation opportunities and a more enjoyable landscape
- More pervious surface area to absorb flooding and heavy rainfall
- Green jobs

Agriculture Reduces Threats to Vulnerable Communities

- **Reduce health inequities** – Soil health is intimately related to water quality and quantity; soil erosion causes sediment accumulation in lakes and rivers, and water runoff carries nutrients and chemicals that alter water quality.
- **Support community interests** – Urban agriculture is a growing industry, creating additional food security, economic development and job growth in urban communities.
- **Engage community** – Community gardens, farmer training programs, and land access resources are helping young and disadvantaged farmers build agricultural businesses.
- **Economic Opportunity** – Potential for new farmers and businesses in urban communities.

Recommendations of the Ag/Soils Sub Working Group

Increase Farmland Preservation

- Identify and eliminate any unnecessary regulatory roadblocks to the closing of agricultural conservation easements.
- Prioritize full funding for the farmland preservation program through both the Community Investment Act (CIA) and lump sum bonding.
- Prioritize utilizing “buy-protect-farm” mechanisms to expedite farmland preservation and create farmland access opportunities for the next generation of farmers.
- Prioritize and fund the Community Farms Program for the protection of smaller farms in more urban and suburban communities.
- Review and revise the Farmland Preservation Program and Community Farms Preservation Program regulations criteria to increase the pace of farmland preservation to more adequately reflect the current and future needs of Connecticut agriculture for farms of all sizes and types of farming.
- Provide a tax incentive for new and beginning farmers and underserved populations to be able to purchase permanently protected farms at farmland value.
- Consider allowing provisions in agriculture conservation easements that allow for appropriate new technologies, such as dual-solar, that can help mitigate climate change while protecting soil health.
- Consider the environmental role of forestland in agricultural easements and require forest management plans for any agricultural easement that includes forestland.

Improve Agricultural Easement Programs

- Accelerate and streamline CT Dept. of Ag Farmland and OSWA easement programs to close in 2 years or less with twice the amount of easements closed within four years (increase staffing, form partnerships, reduce barriers, pursue alternative appraisal processes, drop/reduce cost share requirements).
- Consider allowing provisions in agricultural conservation easements that allow for new technologies such as dual solar.
- Require forest management plans for any agricultural easement that includes forestland.
- Reduce conversion of Prime and Important Farmland Soils, active agricultural land, forest land, and other soil landscapes

Innovate Nutrient Management Technology

- Incentivize Dairy AD projects to help them become viable.
- Identify and incentivize innovative technologies that can spate out and reduce nutrients, especially Phosphorus in our organic materials that are applied to agricultural lands.
- Innovation should be applied in making compost to remove excess nutrients so it can be customized to meet the soil needs of homeowners and commercial growers.
- Alter DEEP composting regulations to ensure manure is considered manure and not categorized differently when farms co-mingle manures to create compost materials.
- Utilize new and emerging technologies to combine food waste with manures which can separate and remove nutrients which are trending towards saturation on some fields in this state.
- The incentive provided for taking food waste/scraps must cover the added cost of transporting increased volume of digestate.

Utilize Integrated Crop Management Systems

- Stay abreast of new threats and be aware of life cycles and how pests spread.
- Conduct regular scouting for weeds, insects, and pathogens, and control them with proven strategies.
- Use crop varieties and livestock lineage with resistance to pests and pathogens.
- Implement cultural and biological controls for pests whenever possible.
- Correctly use appropriate pesticides when pest or pathogens exceed economic thresholds.
- Practice sanitary farming practices (e.g. clean equipment in-between fields) to reduce the spread of pests and pathogens.
- Tests soils and compost regularly. Split applications to avoid loss

Increase Renewable Energy Adaptation on CT Farms

- Encourage adaptation strategies that build upon current programs that reduce on-farm energy usage and encourage the production of renewable energy.
- Propose policy in Connecticut that will enable funding and technical assistance to Connecticut farms that is comparable to what is offered in other Northeast states allowing for new and innovative farm energy technology. Incentives ensure on farm energy measures are implemented in a way CT farms can afford.
- Provide support to farms who may not be eligible for current federal or state programs. Particularly new and beginning farmers during start up.
- Reduce barriers, risk, and unexpected costs for farms seeking to implement on-farm energy projects.

Increase Renewable Energy Adaptation on CT Farms (continued)

- Increase funding for new energy efficient measures/new construction that will enable new and beginning farmers to see higher savings.
- Continue support for energize CT programs where farms can receive assistance in retrofitting their inefficient equipment with high energy measures.
- Encourage the use of new and innovative technology in conjunction with a farm operation (i.e. Battery packs for solar arrays and high efficiency equipment for greenhouse operations).
- Support policy that will enable anaerobic digesters on farms. Funding can be derived from a thermal credit program or incentives for phosphorus reduction equipment, and a small digester program.
- Ensure a balance between energy goals and the availability of affordable and productive farmland for CT farmers with regards to siting large solar fields.

Continue to Adopt Soil Conservation Practices

- Reduce tillage frequency and intensity, transition to low-till or no-till planting methods where feasible.
- Increase organic matter inputs through cover crops, crop residues, green manure crops, manures, and compost.
- Use winter and summer cover crops between main crops to maximize soil surface protection.
- Use mulches and raised beds to cool and warm soils.
- Use tillage methods which preserve plant residues. The goal is to minimize time with no plants covering the field.
- Alignment of State, Federal, local, and non-profit funding opportunities.

Soil is one of the **largest sinks for atmospheric carbon**, and one that can be managed to mitigate the effects of climate change and decrease the pace of global warming.

Create Soil Health Targets and Track Impact

- Map the current baseline: area and land use, % adoption and impact of 25% increase, 50% increase, and full adoption of soil conservation practices.
- Create specific goals for current ag land use types: hay, cropland, pasture. Goals associated with the use of practices are translated into tons of carbon.
- Concentrate on practices that are most impactful for soil health and have the greatest climate change mitigation potential: cover crops, reduced or no till, nutrient management.
- Increase education funding as it relates to soil tests, soil health, and conservation (expand Soil Science curriculum at UConn)
- Increase funding for conservation practices
- Establish a carbon credit program for soil health improvements

Improve Land Use and Planning Tools

- Require a statewide comprehensive plan for Connecticut Agriculture
 - The existing statutory framework in which to develop and guide this plan would be the Governor's Council for Agricultural Development
- Rethink the location of solar projects on farmland
 - Incentivize multiple-use projects that allow for solar and agricultural production to co-exist on the same footprint when there are no other prudent and feasible alternatives, and as needed, as part of the farm business and/or succession plan.
 - Maintaining soil health needs to be a critical component of the planning and installation of solar arrays.
 - Incentivize Community Energy Projects that provide energy to the farm and the surrounding community while mitigating any impact to productive farmland.
- Support additional research to understand how state and local land use planning laws relate to the trends in Urban and Highly Developed (UHD) and Low Density (LDR) conversion across New England and how that translates to wise land use planning for agriculture in CT.

Improve Land Use Planning at the State Level

- Encourage conservation sub-divisions where agricultural land can be set aside in perpetuity for agricultural production.
- Eliminate minimum acreages for farms in municipal zoning regulations.
- Encourage the use of unused publicly owned land in suburban and urban communities for local food production.
- Encourage repurposing of abandoned commercial and industrial sites for the processing of agricultural products including meat processing facilities.
- Recognize that farm and food production will look different in the future due to climate change. Large, indoor greenhouses for food production could become the new norm and should be embraced.
- Reduce regulatory and permitting obstacles to the construction and repurposing of infrastructure to allow local food processing centers and on-farm food processing.
- Consider adoption of Regional Agricultural Councils such as the Lower CT River Valley Regional Agriculture Council that can take a more regional approach to supporting and planning for Connecticut agriculture.
- Offer incentives and opportunities for year-round farmers' markets in either repurposed and/or multiple use existing facilities or new structures that are easily accessible and based on analysis.

Diversify Farm Enterprises

- Be open to change. Choose a variety of commodities, farm products and services that insulate against weather, environmental, market, and geopolitical threats.
- Diversify crop production by extending crop rotations and intercropping with multiple species or varieties.
- Select crop varieties based on maturity dates and genetics to match anticipated season length, rainfall and drought patterns, and pest/pathogen pressures.
- Consider controlled environment agriculture to extend the growing season, diversify operations, and decrease weather risks.
- Select livestock breeds and genetics that tolerate temperature extremes
- Diversify the soil resources used to reduce risk. Consider leasing, purchase of land, rotations to manage this.

Increase Farm Planning Tools and Adaptive Management Strategies

- Develop and implement a conservation plan
- Develop an adaptation plan to identify your risks and practices to remediate them.
- Conduct a whole-farm energy audit to increase efficiency and opportunities for renewable energy sources.
- Utilize precision farming apps, weather and climate tools (such as climatesmartfarming.org) to make more informed crop production decisions.
- New and renovated farm buildings should be energy efficient and designed to withstand predicted weather conditions, including severe heat, heavy rainfall, wind, and snow loads.
- When purchasing new equipment, select options to maximize fuel efficiency and decrease labor and time constraints.
- Consider purchasing crop insurance to reduce economic risks.

Build a Sustainable and Equitable Food System

- Review and the update structure, membership, and duties of CT Food Policy Council to promote food security, strengthen food systems, and mitigate/adapt to the impacts of climate change
- Support and fund a Food System Planner position at the municipal level. This would include replicating the city of New Haven's Food System Policy Director position in municipalities across the state.
- Support the CT Food System Alliance's plan to develop a Statewide Food Plan
- Develop a statewide agricultural plan that outlines a timeline and objectives for the State to have every resident in the State purchasing 5 percent of their groceries from local producers by 2030
- Support planning for urban agriculture initiatives including urban agriculture master plans at the local level
- Encourage municipalities to adopt urban agriculture ordinances/change zoning codes.
- Support feasibility studies to determine best practices/use for state funds to be expended on urban farming and community garden land acquisition needs - including revisiting the application requirements for the Community Farms Preservation Program.
- Pass a "Farmer Equity Act" to increase state support to the growing number of socially disadvantaged farmers throughout Connecticut.

Protect Urban Farms and Increase Urban Agriculture

- Strengthen outreach within the CT Department of Agriculture to urban agriculture organizations and urban communities on the Department's various grants and programs
- Strengthen DEEP's Urban Greens and Community Gardens program to expand and increase state funding for urban agriculture projects. Create a program that will promote improving soil quality in urban environments, accommodate proposals for land acquisition, support equipment needed to increase market opportunities and year-round production, encourage urban composting, provide support for farmers to transition to organic practices, and incentivizes innovative growing technologies and practices.
- Develop a Memorandum of Understanding between the CT DEEP (Forestry, Wildlife, Land Acquisition, Parks) and the CT Department of Agriculture to accelerate identification of parcels, assist with leases/permits or development of farm-friendly conservation easements, manage stewardship of farmed parcels, outreach to the agricultural community and complete utilization of the CT Urban Greens and Community Garden program. This would allow Urban Greens and Community Garden program participants to benefit from other DoAg. grant programs that may be of relevance to their operation/programs including the farm transition grant and the farm viability grant.
- Increase the extent and diversity of CT's Food System to improve food access and reduce racial inequities, improve public health, reduce food waste emissions, reduce threats from global forces and climate change, and improve farm viability

Increase Infrastructure and Marketing Techniques

- Support UConn Extension efforts to pull together a needs assessment for the meat producers/ industry to have success in Connecticut. This will include looking at the feasibility of a USDA certified mobile slaughter unit.
- Work with Connecticut Regional Development Authority to revitalize the Hartford Regional Market to include a multifaceted facility that would include a 365 farmers market, farm to table restaurants, a centralized processing and storage facility, and affordable housing opportunities and garden space for residents.
- Encourage more food cooperatives/ online ordering collectives/ home delivery ventures. An example of this is The Modern MilkMan and The Sunderland Food Collaborative in Massachusetts.
- Increase support for a potential incubator program with commercial kitchen storage space that supports dozens of food and agriculture companies across the state. Tenants would include but are not limited to specialty food product makers, artisanal bakers, caterers, food trucks, personal chefs, fishman, seaweed, and sea vegetable producers. An example of this is Hope and Main in Rhode Island.
- Increase food hubs across the state.
- Fortify the Department of Agriculture's existing Connecticut Grown marketing efforts to provide additional resources to both farmers and consumers.



Thank you
for your
time.....

2020

Forests Sub-Group Draft Report

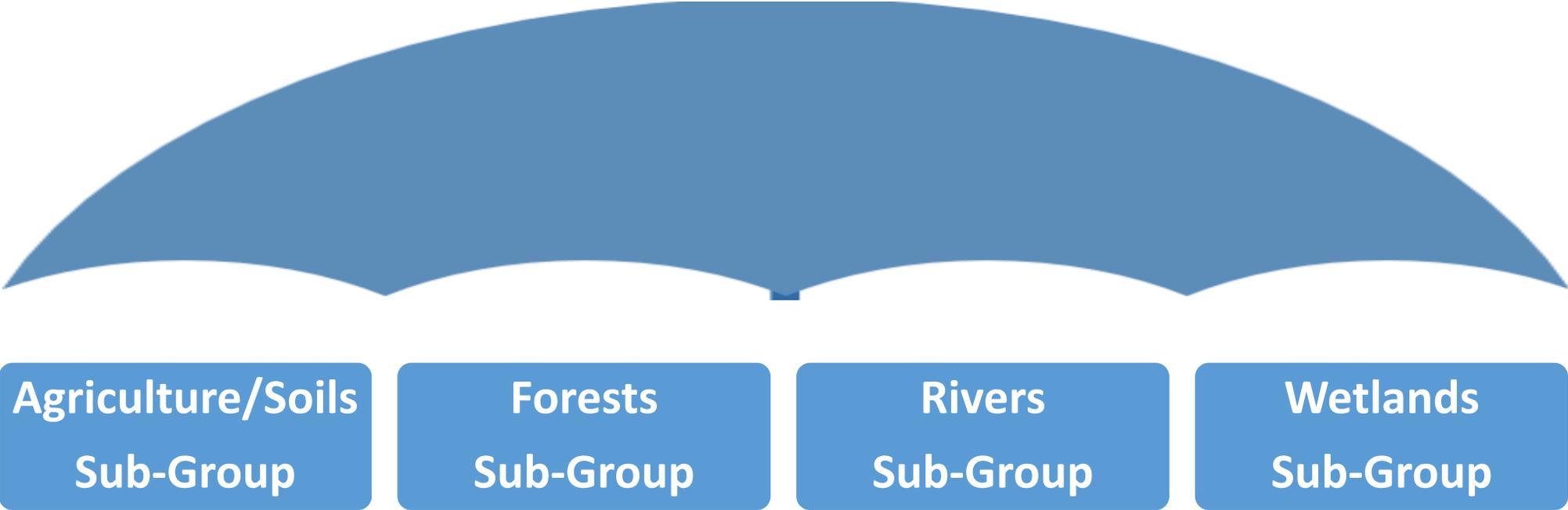


Forests Sub-Group Members

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- **Eric Hammerling**, Connecticut Forest & Park Association, Chair
- **Lisa Hayden**, New England Forestry Foundation
- **Charles Leigus**, Supreme Forest Products, Inc.
- **Amy Paterson**, Connecticut Land Conservation Council
- **Herb Virgo**, Keney Park Sustainability Project

With outstanding (!) support from **Rick Jacobson, Cary Lynch, Chris Martin, and Jaimeson Sinclair at DEEP.

Working and Natural Lands Working Group



Agriculture/Soils
Sub-Group

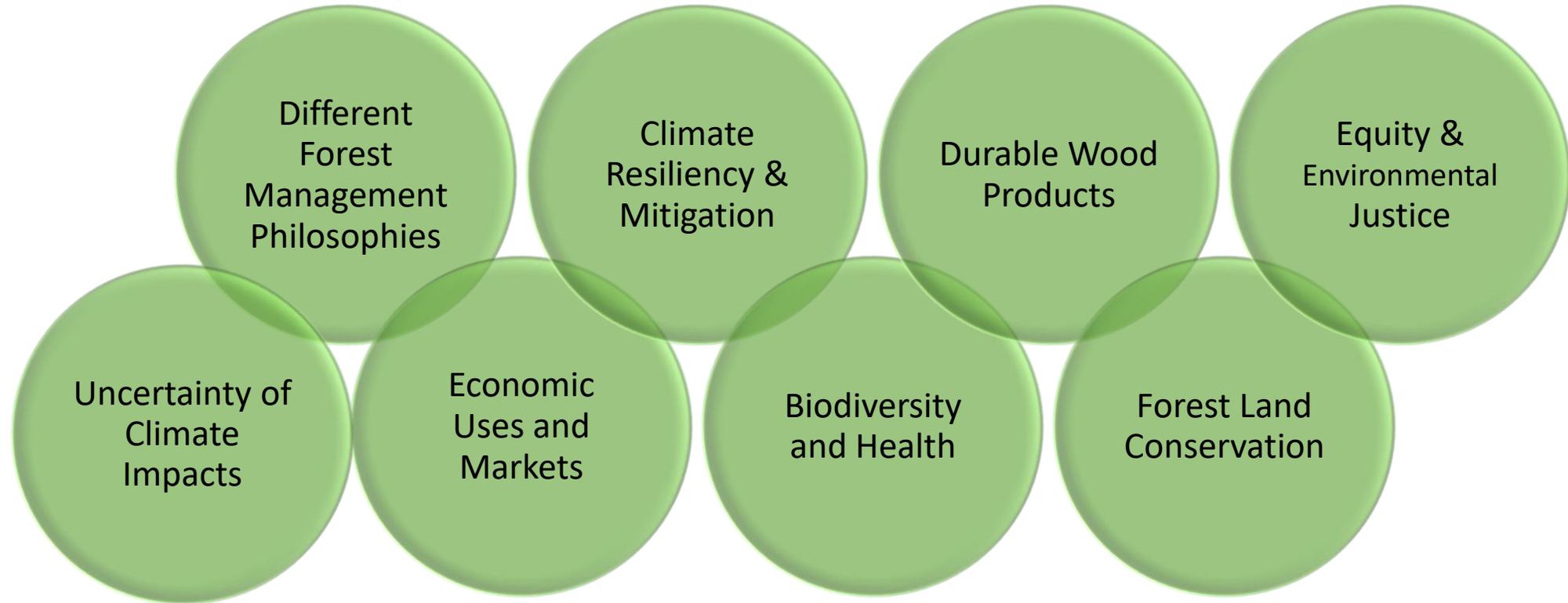
Forests
Sub-Group

Rivers
Sub-Group

Wetlands
Sub-Group



Finding best consensus amongst many views



Resilient Forests provide many benefits

Improve air quality

Reduce heat stress/shade

Climate adaptation & mitigation

Lower cooling & heating bills

Mental & physical health

Reduce stormwater/flooding

More livable communities

Wood products

Jobs/economic benefits

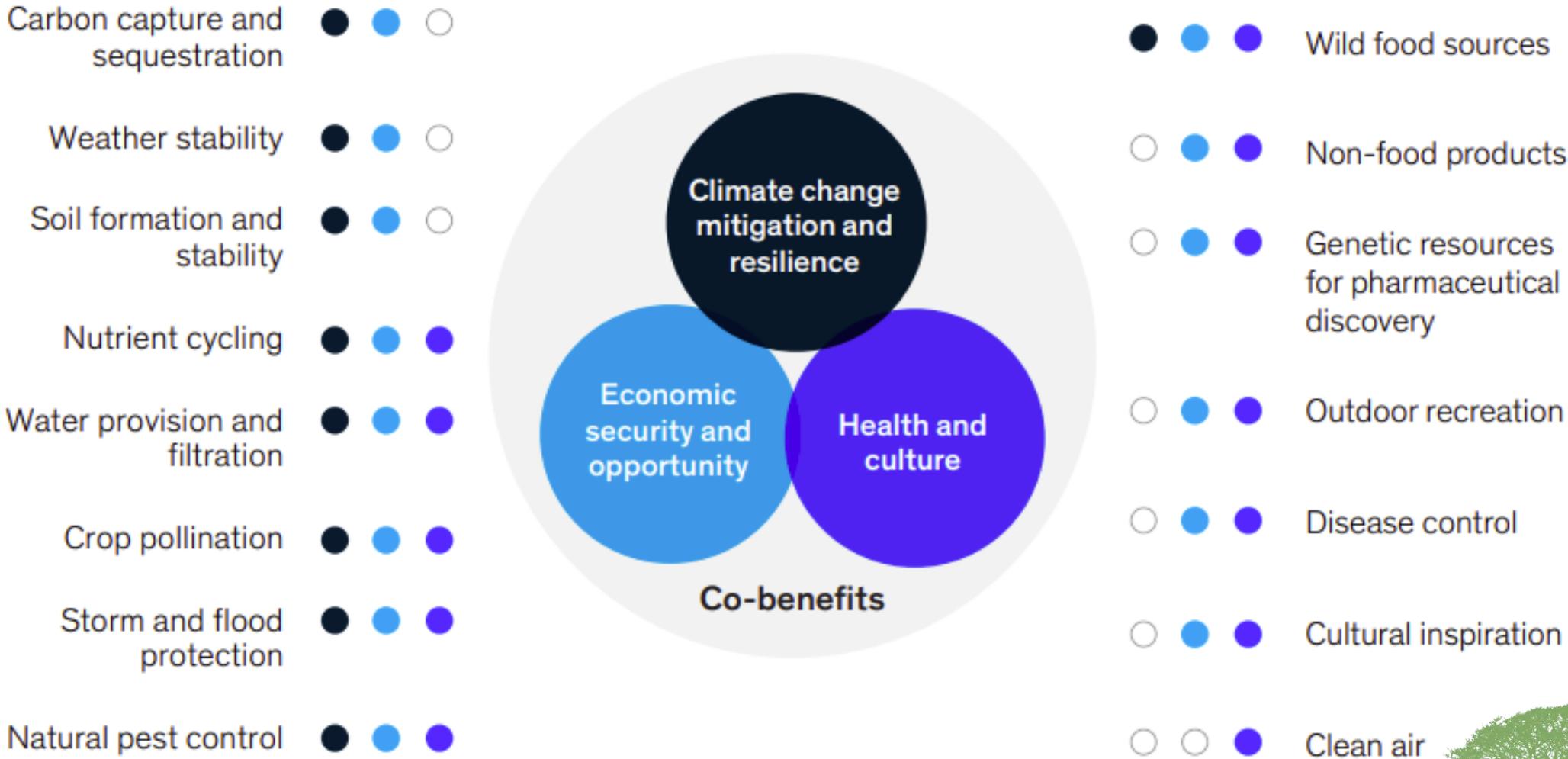
Wildlife habitat

Aesthetic beauty

More foot traffic for businesses



Ecosystem services¹

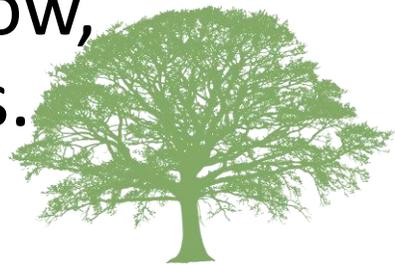


Source: McKinsey & Co 2020 report “Valuing Nature Conservation: A methodology for quantifying the benefits of protecting the planet’s natural capital.”



CT's Forests are Valuable for Carbon Storage

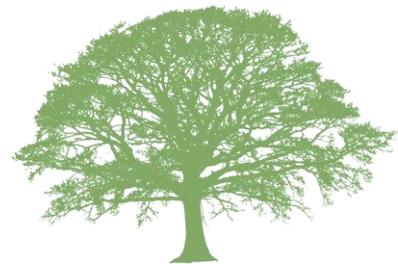
- Connecticut's forests are the most "carbon dense" in the Northeast in above-ground carbon stored/acre.
- ~16% of Connecticut's forests are 100+ years old, the highest percentage in the Northeast.
- Annual net growth of Connecticut's forests is estimated to be the highest in the region.
- Net growth currently exceeds net removals by more than 5X.
- Growth rates and carbon uptake rate will eventually slow, but most forests will accumulate carbon for 200+ years.



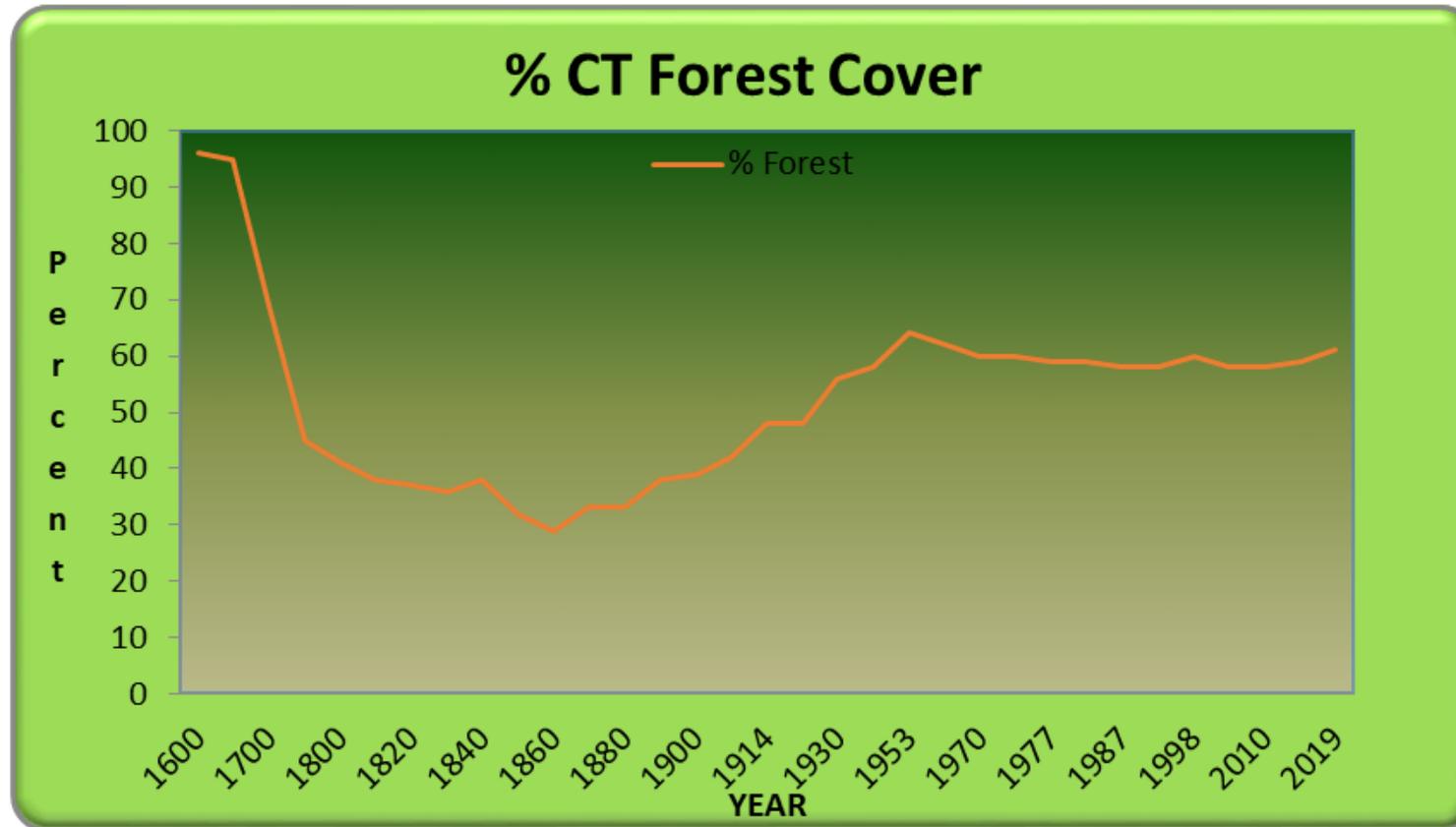
How much Carbon is stored in CT forests?

- 191 million metric tons (MMT) of Carbon is stored in CT's "forest" land (across 1.8 million acres). This Carbon has increased by ~9 MMT over the past decade.
- "Forest" is defined as at least one continuous acre of forest canopy cover, so the 191 MMT figure does not include individual trees or smaller groups of trees that don't fit the standard definition of "forest."

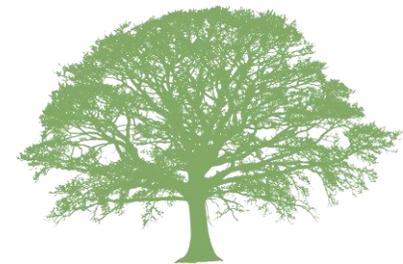
Source: 2019 USDA Forest Service's FIA/Forest Carbon Inventory



We are all forest dwellers in CT



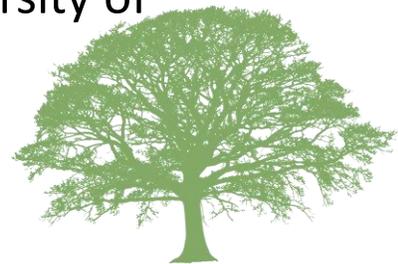
*Approximately **59%** of Connecticut is considered to be “forested”



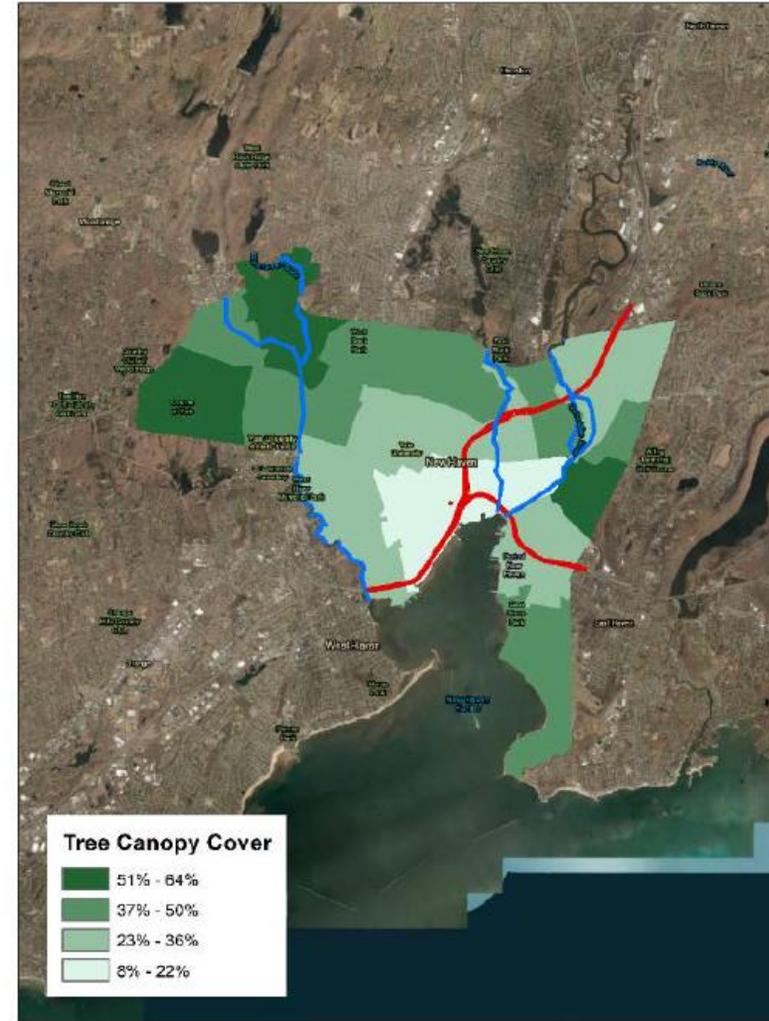
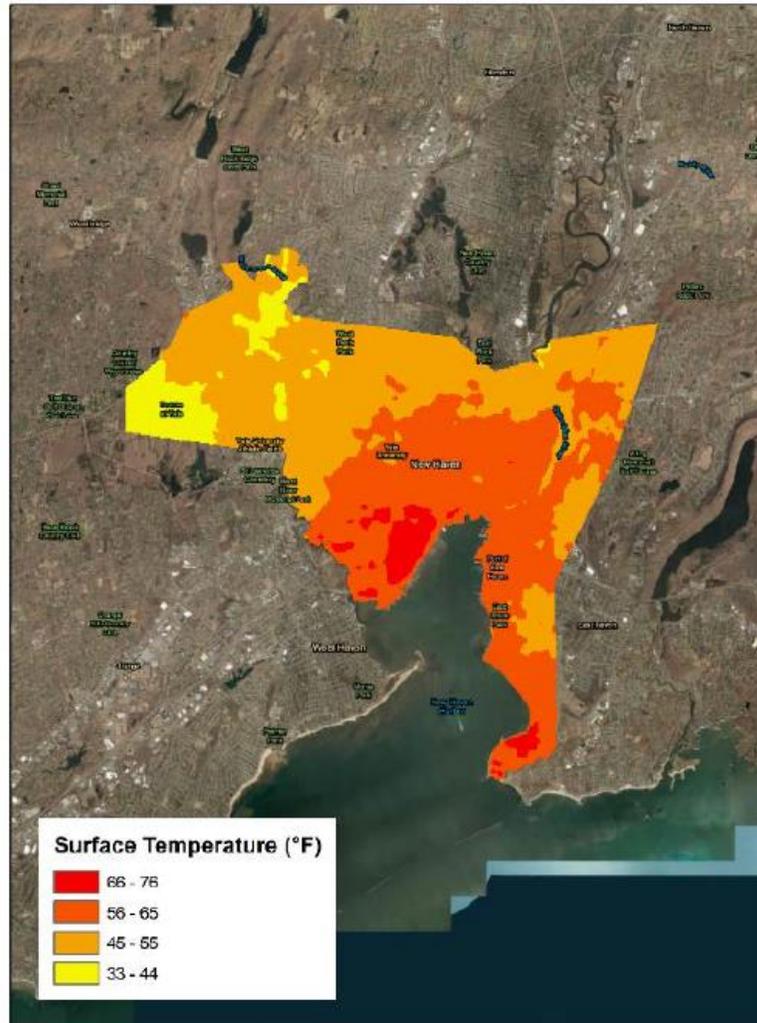
Tree Cover is much lower in our largest cities

- Bridgeport UTC = **27%** with additional 45% possible (2012 study)
- Hartford UTC = **26%** with additional 49% possible (2010 study)
- New Haven UTC = **38%** with additional 41% possible (2009 study)

Source: Urban Tree Canopy (UTC) Studies by Keith Pelletier & Jarlath O'Neil-Dunne, University of Vermont Spatial Analysis Laboratory with support from USDA Forest Service



Inequities are reflected in urban tree canopies



Source: Colleen Murphy-Dunning presentation to Forests Sub-Group on 3/24/20.



SUMMER HEAT IN

Hartford

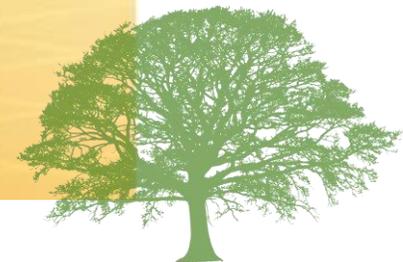
UP TO

19.0° HOTTER IN THE CITY
THAN IN NEARBY
RURAL AREAS

AVERAGE

2.5° CITY SUMMERS ARE
HOTTER THAN IN
RURAL AREAS

9 MORE DAYS ABOVE
90° F EACH YEAR,
THAN RURAL AREAS



Climate Change impacts vulnerable people hardest

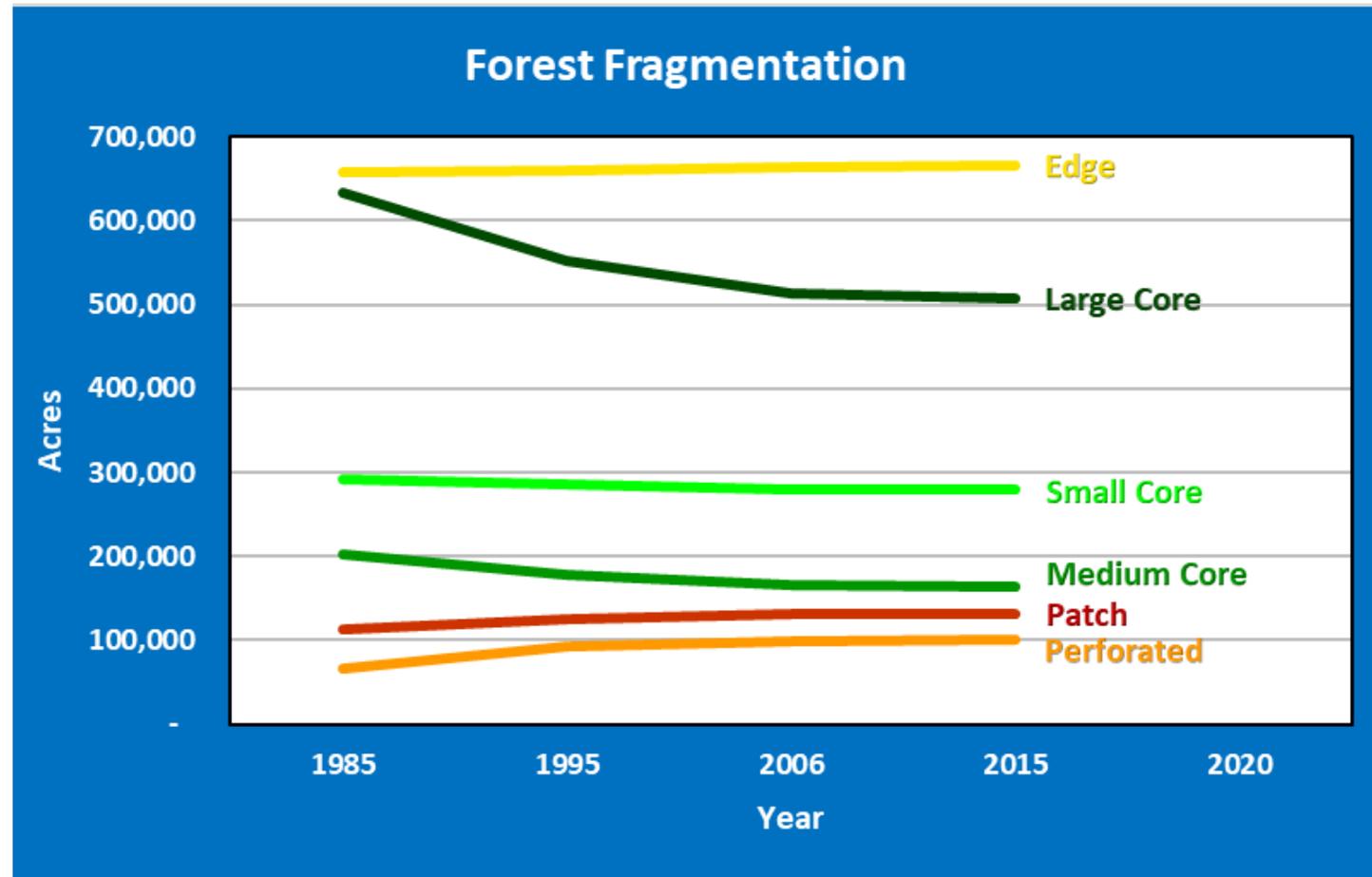
HEALTH DISPARITIES AND ENVIRONMENT

- West Indian/Afro-Caribbean immigrants are in better health than African Americans for one generation, then their health drops down to that of AA's
- Asthma is 50% higher in urban schools in CT when compared to rural schools
- Asthma deaths are 6 times higher in Black males between the ages of 15 and 24 than White males of that age group
- More than half of lead poisoned children in CT are Black or Latino
- Cancer, Diabetes, Lupus, Depression, ADHD, Low Birthweight, Sudden Death, etc.

Source: Dr. Mark Mitchell's presentation to the GC3 on 7/15/20.



Forests are getting fragmented and converted



~130,000 acres of Large Core Forest (500+ acres) was lost or fragmented between 1985 - 2015



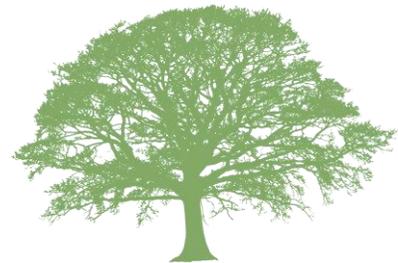
Climate Change Threatens Forest Resiliency

Climate change can exacerbate existing or emerging forest problems and make forests less of a carbon sink.

- More intense weather stressors (heat, drought, storms, frost damage) → more stressed trees;
- Warmer winters/Longer growing seasons → more invasive plants, forest pests, and deer;
- Increased decomposition → lower soil carbon; and
- Increased tree mortality → reduced carbon storage.



Resilient Forests provide the
largest climate benefits



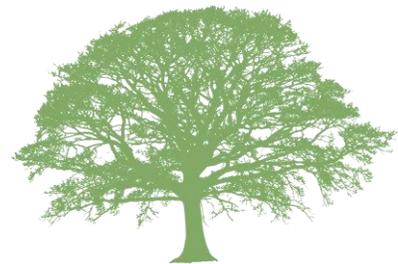
Overarching Recommendation:

Establish a “No Net Loss of
Forest (NNLF) Policy” for
Connecticut



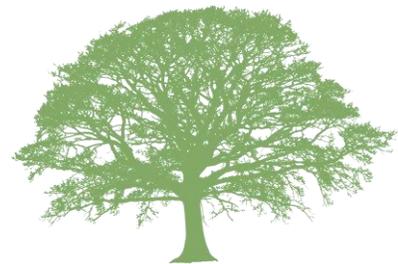
“No Net Loss of Forest” Policy

- 1. Increase forest cover/tree canopy where needed**
- 2. Avoid losses/conversion of forest**
- 3. Protect and Steward resilient forests**
- 4. Mitigate “permitted” losses of forest/trees**
- 5. Monitor for forest/tree resiliency and carbon**



1) Increase forest cover/tree canopy where needed

- Fund community-based plans and implementation to increase urban tree cover, green spaces, and gardens (e.g., 2020 Hartford Tree Canopy Action Plan).
- Support Youth Conservation Corps to expand capacity of community-based groups to increase urban tree cover.
- Develop action plan to increase forest cover statewide (59% to 60%).



2) Avoid losses/conversion of forest

- Incentivize landowners to protect forest lands, esp. core forests.
- Increase state/federal support to increase pace of forest protection, esp. vulnerable natural communities and buffers.
 - Protect existing programs that support land acquisition and easements for forest conservation (e.g. OSWA/CIA, LWCF, USDA programs).
 - Re-tool existing programs (e.g. RGGI, State Water Revolving Fund) to support forest retention, stewardship, and resiliency.
 - Create New funding and incentives for forest conservation (e.g. Municipal option, Carbon tax).
- Ensure State POCD, and other state, regional, and municipal plans avoid forest conversion to non-forest uses.



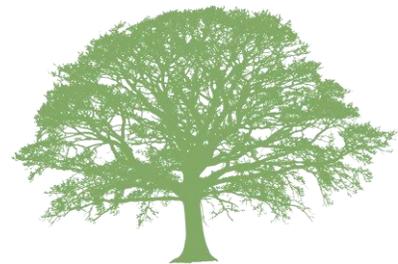
3) Protect and Steward resilient forests

- Acquire working forest and wildland conservation easements to support protection and good stewardship of forests.
- Establish criteria to designate core forest natural area preserves on state conservation lands.
- Manage for large, healthy trees and connectivity in urban/suburban/rural areas.
- Sponsor research on active and passive forest management to better understand tree resiliency across rural to urban landscapes.



4) Mitigate “permitted” losses of forest/trees

- Compensatory reforestation for planned/permitted forest losses of 1 acre or more.
- Acquire local or regional forest mitigation areas where forests can be grown and/or planted to offset forest losses.
- Authorize local tree ordinances based on models like Hartford that require replacement of trees that are removed.

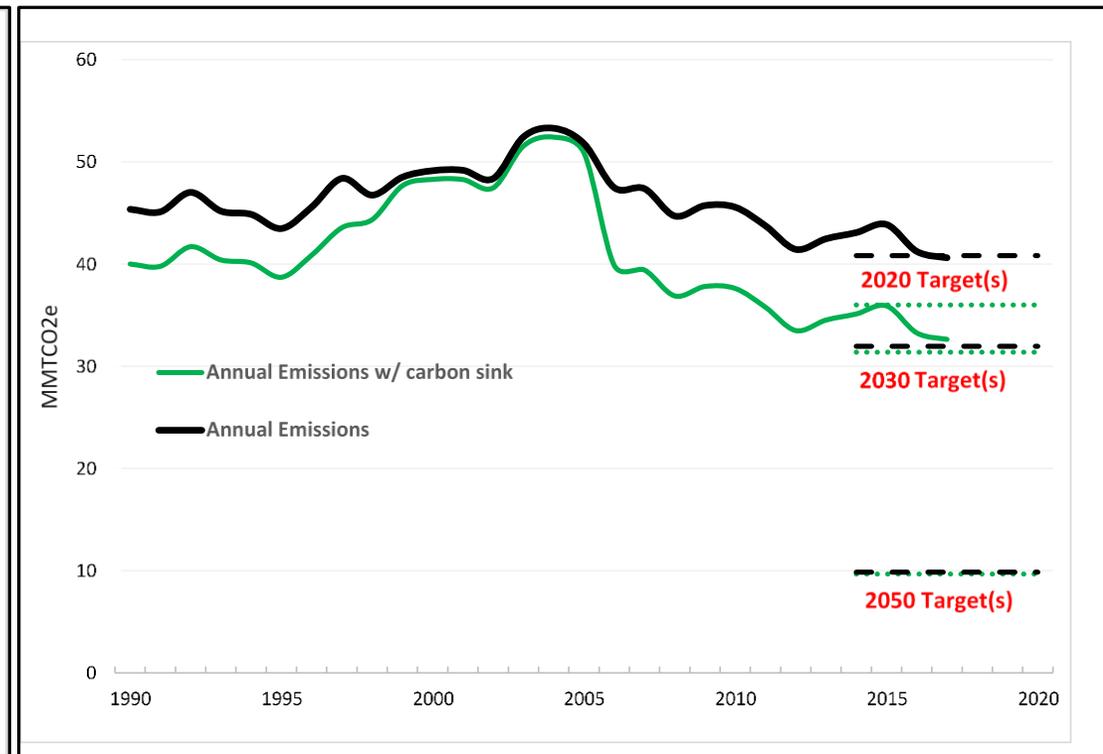
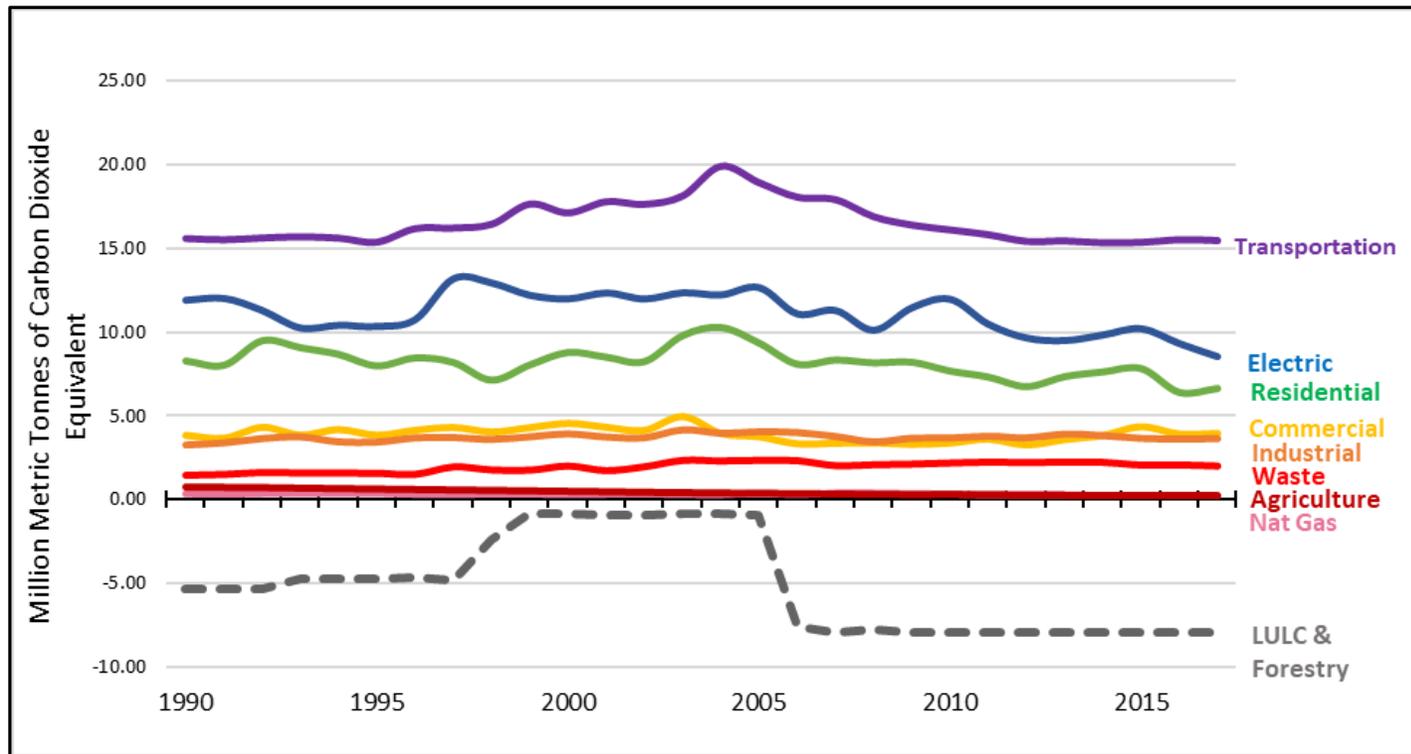


5) Monitor for resiliency and carbon

- Establish forest resiliency monitoring network to track resiliency in both developed and undeveloped areas.
- Develop a usable model to reliably monitor carbon sinks related to working and natural lands.
- Incorporate goals into the Global Warming Solutions Act for working & natural lands to increase Connecticut's carbon sink (a.k.a. "negative emissions").



Incorporate Working & Natural Lands in CT's goals



**Special thanks to Cary Lynch (formerly at DEEP) for these charts (included in the DRAFT Report).

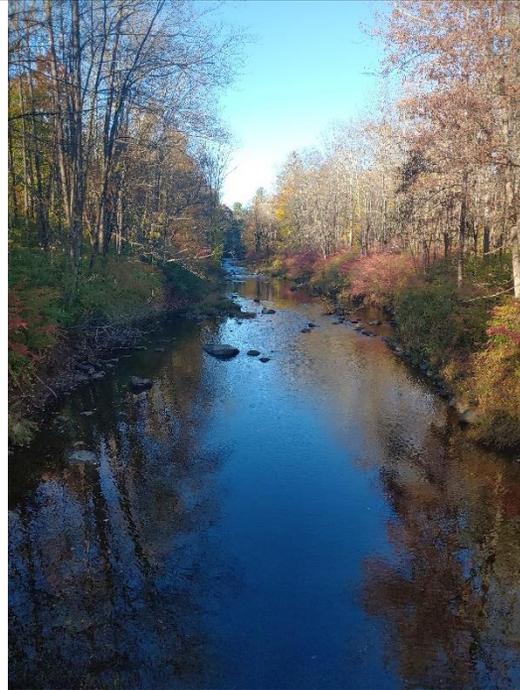


The future is in your hands

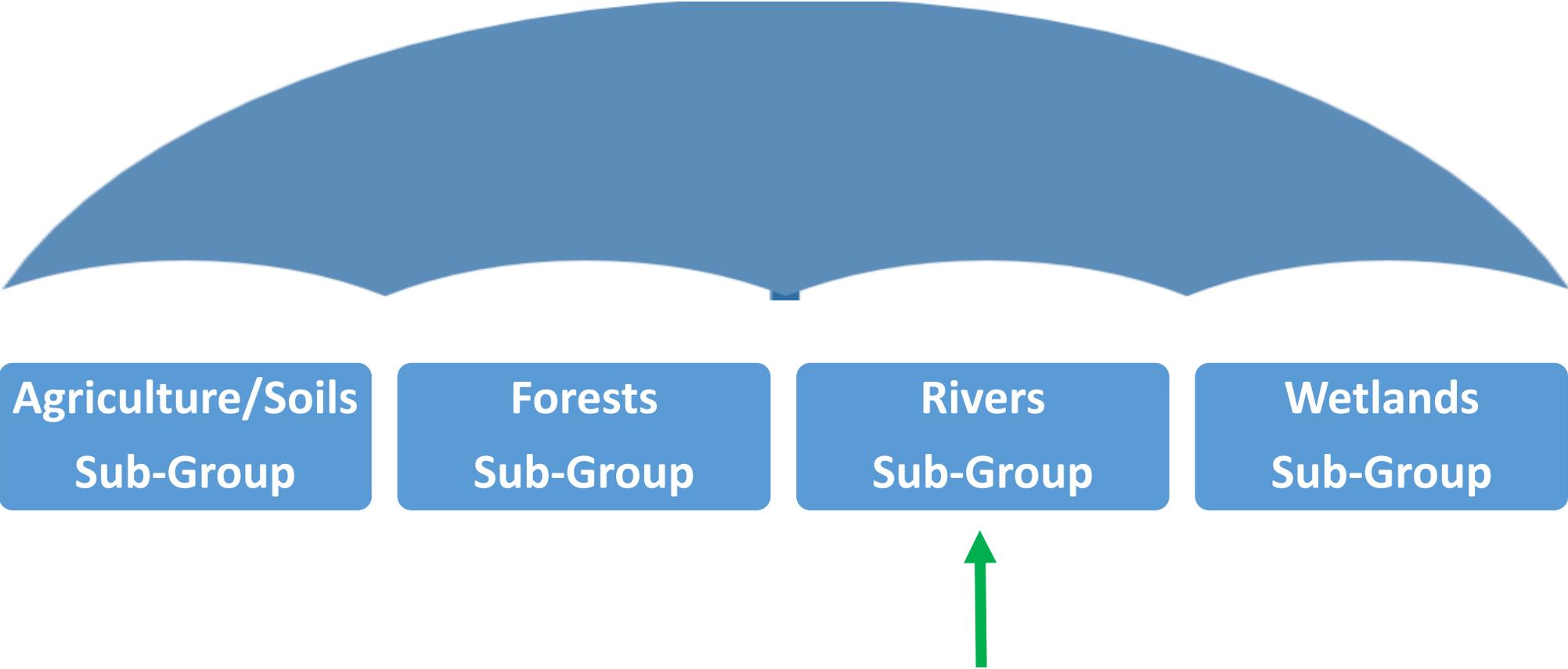


2020

Rivers Sub-Group Draft Report



Working and Natural Lands Working Group

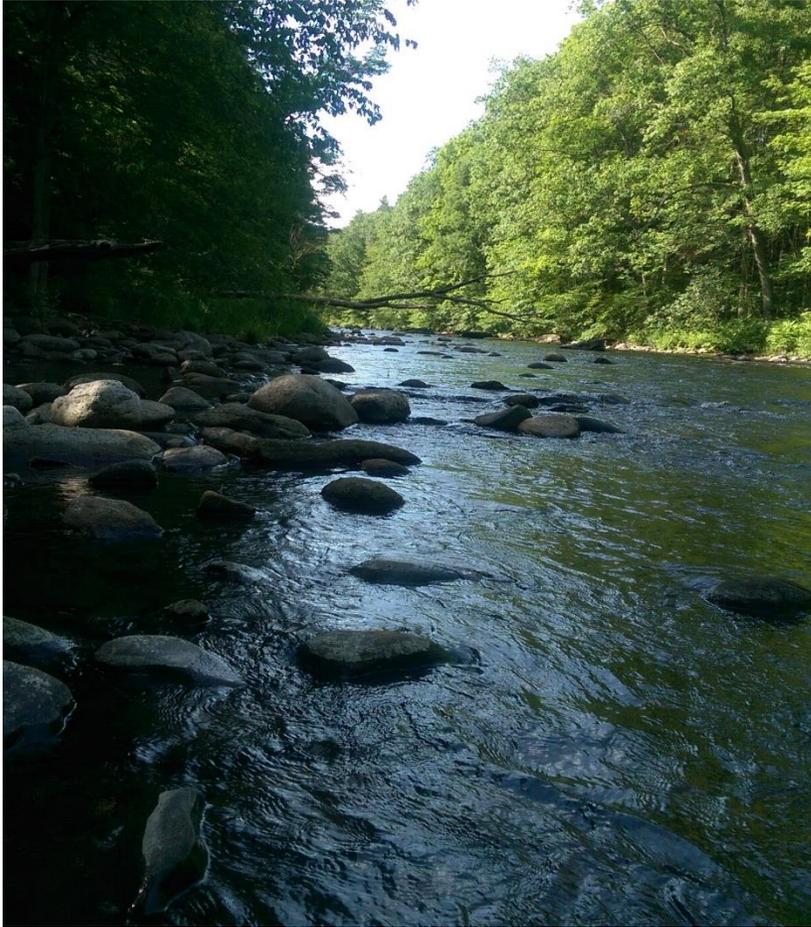


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- **Susan Peterson**, CT DEEP, BWPLR, Water Planning and Management
- **Lynn Werner**, Housatonic Valley Association
- **Eileen Fielding**, Audubon Connecticut
- **Kirt Mayland**, Reservoir Road Holdings & Mayland Energy
- **Erik Mas**, Fuss and O'Neill, Inc
- **Bill Dornbos**, Farmington River Watershed Association
- **Andy Fisk**, Connecticut River Conservancy
- **Jason Vokoun**, University of Connecticut
- **Mike Deitz**, University of Connecticut
- **Laura Wildman**, Princeton Hydro
- **Virginia DeLima**, USGS (retired)
- **Shelley Green**, The Nature Conservancy

**With outstanding (!) support from many members of the public who have participated.

Resilient inland waters provide many benefits



- Economic growth
- Quality of life/Spiritual/History
- Public health
- Wildlife habitat and corridors
- Carbon sink components
- Flood Protection
- Drinking water and power generation
- Biodiversity
- Navigation
- Recreation
- And many more



HEALTHY WATERS = HEALTHY COMMUNITIES = HEALTHY ECONOMIES





2011 → Present

Previous Projections are the Current Conditions

Increase in short-duration very wet precipitation events, more frequent droughts, and increase in temperatures

Taking bold action can be postponed no longer!

Impacts on our Inland Waters

- Increase in flooding
- Surface and ground water impairments (quality and quantity)
- Increase in harmful algal blooms
- Destabilization of aquatic communities
- Loss of viable native aquatic (and some terrestrial) species
- Decline in recreational use and negative impact on local economies
- Increase cost of drinking water and wastewater services to customers





Projection
Sea level rise

Impacts on our Inland Waters

- Inland flooding in tidal waters
- Saltwater Intrusion



Recommendation 2020 R.1

Protect the future of ecosystem services value of inland waters

Recommendation 2020.R.2

Safeguard water quantity for both “fish and faucet” through more balanced water use decisions

Recommendation 2020.R.3

Further develop policies, education/outreach, research, and funding opportunities that encourage protections for inland waters

Recommendation 2020 R.1 – Protect the future of ecosystem services value of inland waters

Employ Mainstream Nature-based Solutions at Scale

Low Impact Development

Green Stormwater Infrastructure

Habitat Improvement and Flood Mitigation

Recommendation 2020 R.1 – Protect the future of ecosystem services value of inland waters

Re-establish free-flowing character and connectivity of inland waters and hydrological connectivity

Ensure species population diversity; access to habitat for viable native species; geomorphic stability through the restoration of natural sediment transport processes; address aging infrastructure; and expand the range of movement for all aquatic species, such that they can more easily locate suitable habitat/refuge and adapt to climate change.

Recommendation 2020 R.1 – Protect the future of ecosystem services value of inland waters

Create safe, equitable opportunities for people of diverse backgrounds to access and enjoy freshwater resources

Adaptation and resilience to climate change will require ensuring safe and equitable access to, and benefits from, freshwater resources for Connecticut's underserved and vulnerable communities.

This harmful climate trend needs to be countered with freshwater-related adaptation and resilience actions that intentionally prioritize and enhance the safety, health, and prosperity of underserved and vulnerable communities.

Recommendation 2020.R.2: Safeguard water quantity for both “fish and faucet” through more balanced water use decisions

Promote Demand-side Water Conservation and Water Reuse

Adopt and implement a state water hierarchy that includes water conservation, capture, storage and re-use to reduce demand on rivers and inland waters such that enough water is available during droughts **without causing** low-or-no flows in inland water bodies.

Recommendation 2020.R.2: Safeguard water quantity for both fish and faucet through more balanced water use decisions

Explore water rights options that protect fish and wildlife

Elevate and mainstream the protection of healthy river systems that can support fish and wildlife as competition among water uses increase with climate change.

Recommendation 2020.R.3: Further develop policies, education/outreach, research, and funding opportunities that encourage protections for inland waters

Fund and enhance stormwater management programs

Based on Connecticut Physical Climate Science Assessment Report (2019) assessed the observed and projected the annual total precipitation in CT is projected to increase by 4-5 inches (approximately 8.5%) by the midcentury (2040-2069) and by 4.5-5.5 inches (approximately 10%) by the late century (2070-2099).

Recommendation 2020.R.3: Further develop policies, education/outreach, research, and funding opportunities that encourage protections for inland waters

Fund and enhance education, outreach and research

Articulate goals, incentivize participation, and provide training and data management, for monitoring and research projects that can detect climate change impacts on inland waters. Community engagement in monitoring and research will foster a greater level of stewardship.

Recommendation 2020.R.3: Further develop policies and funding opportunities that encourage protections for Inland Waters

Address funding deficiencies for wastewater infrastructure and barrier to wastewater solutions

Connecticut is already experiencing the impacts of climate change in more intense precipitation and frequent droughts that are already impacting water quality.

Addressing funding of important infrastructure projects (such as combined sewer overflow elimination and reduction), refining discharge limits, and addressing regulatory and oversight barriers to traditional and alternative septic are critical.



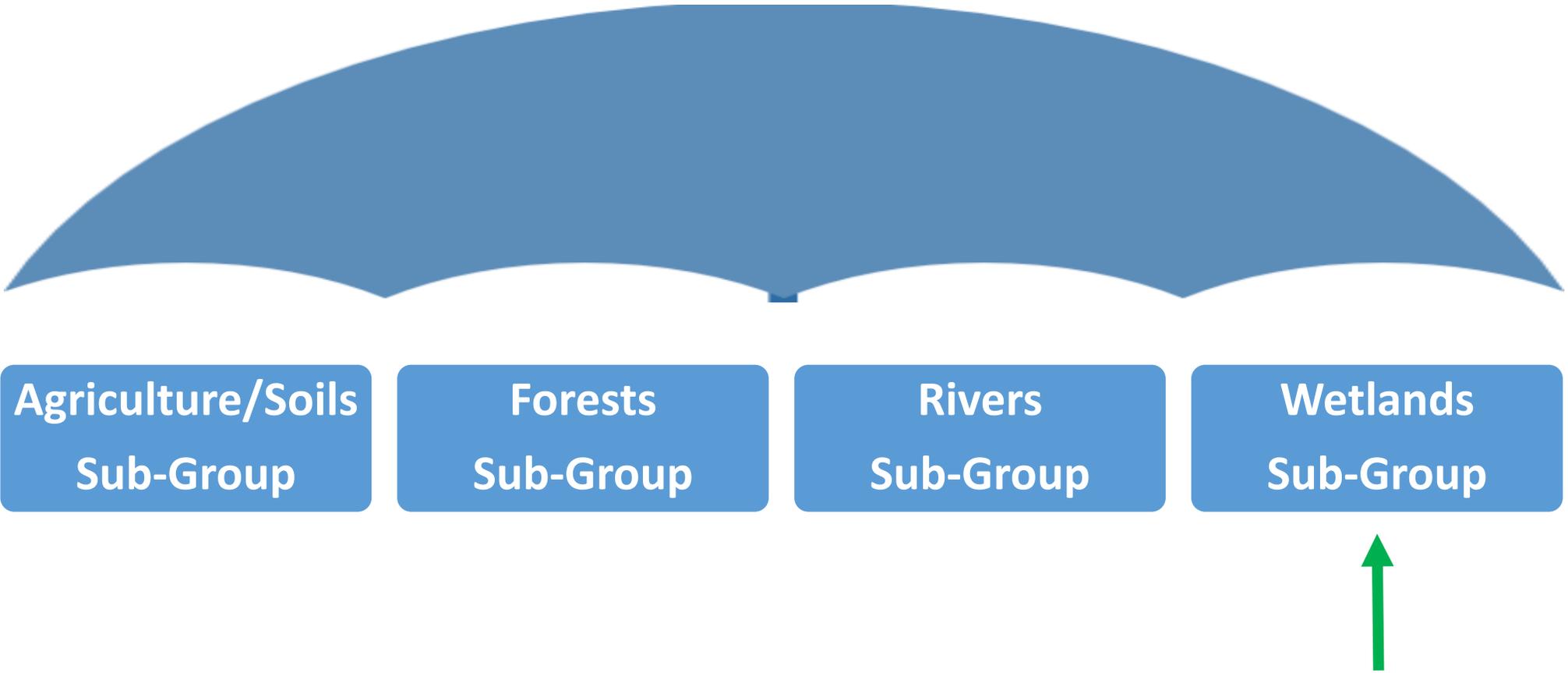
Thank you
for your
time.....

2020

Wetlands Sub-Group Draft Report



Working and Natural Lands Working Group



Agriculture/Soils
Sub-Group

Forests
Sub-Group

Rivers
Sub-Group

Wetlands
Sub-Group

Wetlands Sub-Group Members

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- **Julianna Barrett**, UCONN Sea Grant & NEMO
- **Chris Elphick**, UCONN Ecology and Evolutionary Biology
- **Michelle Staudinger**, USGS, NE Climate Adaptation Center
- **Kimberly Lesay**, CONN DOT
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- **Steve Lecco**, AICP, GZA
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With Support From:

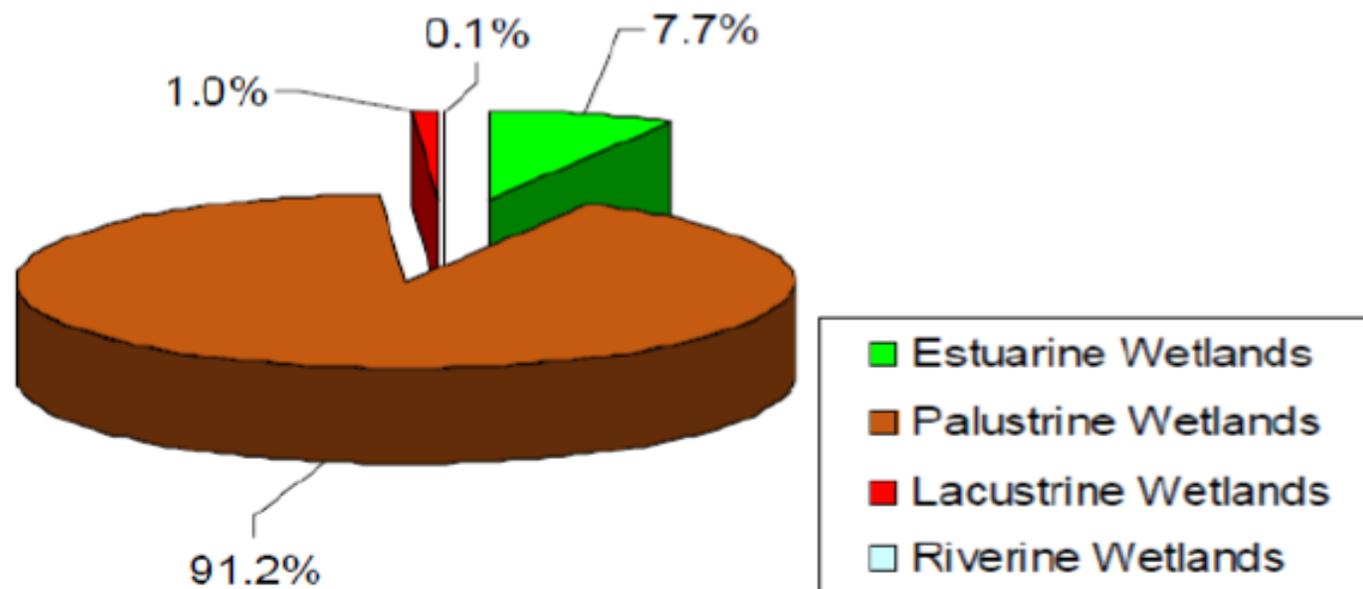
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- **Charles Vidich**, WestCOG
- **Amy Paterson**, CT Land Conservation Council
- **Brad Gentry**, Yale School of Forestry and Environmental Sciences
- **Robert La France**, Audubon CT

Connecticut's Wetlands

- Wetlands span 220,000 acres over Connecticut's 3,548,000 acre land surface.
- Wetlands are commonly identified using familiar terms such as marsh, swamp, bog, bank, or meadow, occurring within or near different types of watercourses.
- Are in two main categories — salt, brackish and tidal and freshwater wetlands.

WETLANDS IN CONNECTICUT 2010: ~220,000 ACRES, COVERING ~7% STATE

Connecticut's Wetlands
Classified by Ecological System



Tiner et al. 2013

Wetlands Working Group Focus

Inland Wetlands

- Defined by the Inland Wetlands Act
- inland wetlands are defined as “land, including submerged land..., which consists of any soil types designated as poorly drained, very poorly drained, alluvial, and flood plain”
- Identifying inland wetlands by soils allows us to recognize those areas during times of drought when there is no surface water present, or during winter when characteristic wetland indicator plants may not be obvious
- Watercourses were NOT included in our work

Tidal Wetlands

- Connecticut defines tidal wetlands as those areas which border on or lie beneath tidal waters, such as, but not limited to banks, bogs, salt marshes, swamps, meadows, flats, or other low lands subject to tidal action, including those areas now or formerly connected to tidal waters, *and whose surface is at or below an elevation of one foot above local extreme high water;*
- More broadly, tidal wetlands are systems containing plants adapted to wet conditions with tidal flow and poorly drained to very poorly drained mineral-rich organic soil.
- They occur in intertidal areas of marine, estuarine, and tidal riverine systems where the land meets the water and daily tidal action moves water in and out of the systems

Working Group Focus

Coastal Wetlands

- For our purposes these were considered to be areas immediately adjacent to the coast or subject to future sea level rise

Open Waters

- For our purposes these were considered to be areas of open water that were up to 10meters deep

Why?

For discussions around mitigation and resiliency for climate change there are differences in qualities between tidal, coastal and open waters.

For example: storm wave attenuation, soil carbon storage, marine habitats, etc.

Ecosystem Services		Wetland Types		
		Inland Wetlands	Tidal Wetlands	Near Coastal Waters
Provision services	Food	X	X	X
	Raw materials	X	X	X
	Fresh water	X		
	Medicines	X	X	X
Regulating services	Local climate modification	X	X	X
	Biomass - ecosystem productivity	X	X	X
	Carbon sequestration & storage	X	X	X
	Water purification and filtration	X	X	
	Erosion and sediment control	X	X	
	Water flow control	X	X	
	Moderation of extreme storms	X	X	
Support services	Species Habitat	X	X	X
	Biodiversity	X	X	X
Cultural services	Recreation	X	X	X
	Sense of Place	X	X	X
	Aesthetic	X	X	X
	Tourism	X	X	X
	Physical and mental health	X	X	X

Climate Change

- Storm severity increase – increased rainfall, runoff, and flooding
 - Storm timing variability – Winter rain instead of snow falling on frozen soils increasing flooding
 - Sea level rise
 - Standing waters increase mosquitoes and the diseases they carry
 - Increased storm water pollution
-

The Roles of Wetlands in Climate Change Mitigation

- Healthy wetlands reduce disease borne vectors - mosquitoes
- Carbon storage and sequestration
- Blue Carbon: Salt Marsh ecosystems can remove over 10X the amount of CO₂ from the atmosphere per hectare than forests
- Teal Carbon – fresh water wetlands
 - Maples in Red Maple Swamps store carbon - **more carbon is stored in the wetland soils than in the vegetation**

The Roles of Wetlands in Climate Change Resiliency

- Flood water storage to reduce impacts of heavy rain events and winter rainstorms when ground is frozen
- Storm water runoff water purification
- Storm water runoff reduction in sediment and nitrogen transport
- Reduction in coastal storm impacts



Tidal Wetlands

Including Tidal Wetlands, Coastal Tidal Wetlands and Near Shore Open Waters

TIDAL WETLANDS:

- **Are the single most vulnerable natural resource in the face of a changing climate and rising sea levels.**
- **They are ubiquitous with many of our urban communities along coastal Connecticut.**
- **Coastal wetlands are a dominant reservoir for carbon and provide protection of coastal resources in coastal storms.**

Keeping coastal wetlands healthy and resilient is vital to vulnerable communities and vital to achieving our climate mitigation objectives.

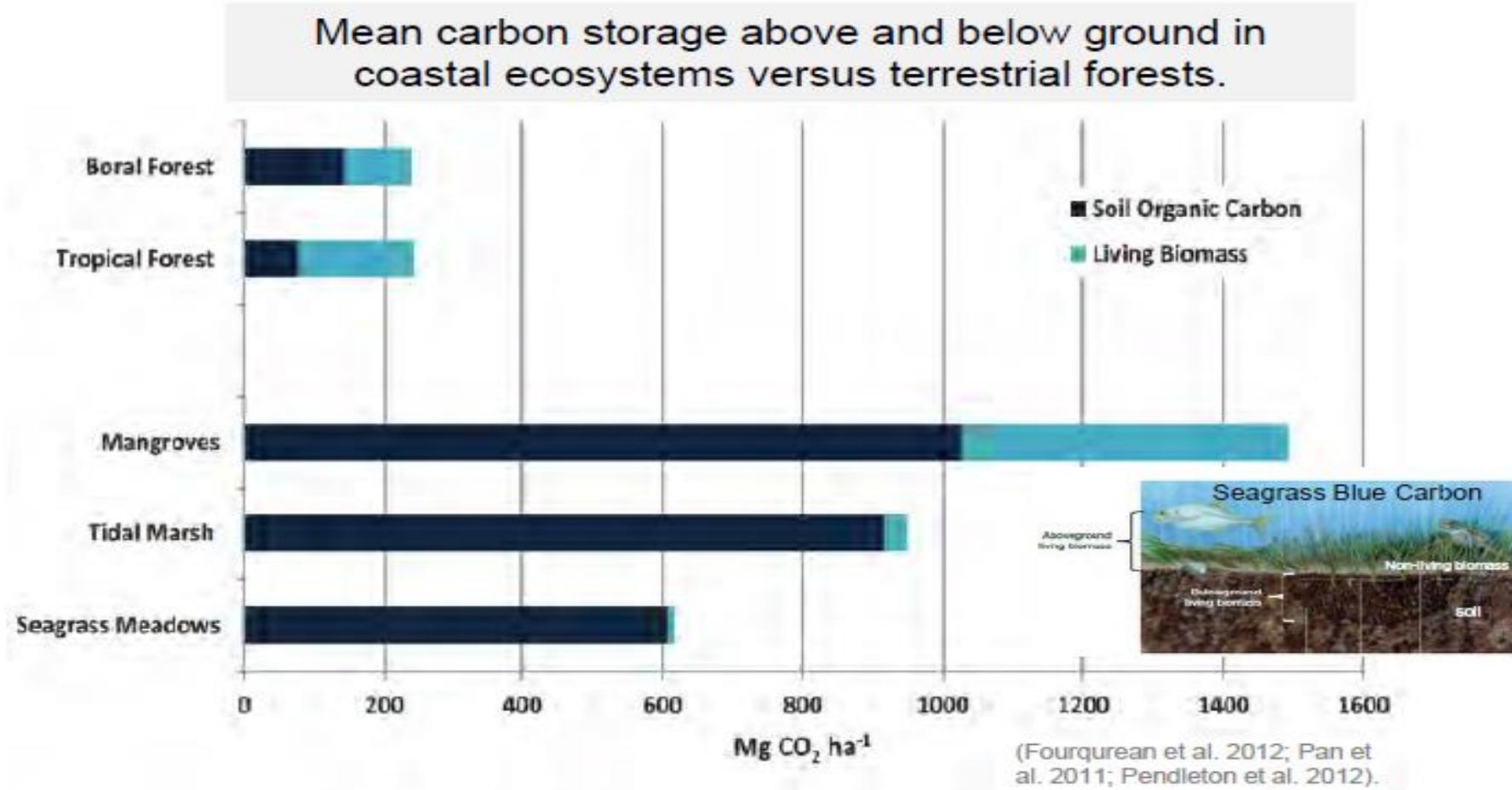
Why are Coastal Wetlands and the nearshore waters so Important?

- More than 23M people live within a 50-mile radius of Long Island Sound.
13M people live in coastal NY and CT
- **2.2 million people live in coastal portions of CT**
- Their role in storm protection is critical:
 - Provide \$23.2 billion in storm protection every year (NOAA).
 - Saved more than \$625 million in flood damages during Hurricane Sandy across the northeastern USA (Narayan et al. 2017).
 - An analysis of property damage from 88 tropical storms and hurricanes hitting the USA between 1996 and 2016, showed that counties with more wetland coverage experienced significantly less property damage.
 - On average, coastal wetlands provide about \$1.8 million/km² per year.
 - \$430 million more in property damage from Hurricane Irma because of recent wetland losses.

Benefits of Tidal Wetlands

- Are among the most biologically productive resources in the world
 - Spawning, nursery, and feeding grounds for shellfish, finfish, and waterfowl
 - Nutrient cycling within estuaries and nitrogen removal, which improves water quality
- Provide habitat, nesting, feeding, refuge areas for shorebirds
- Are nursery grounds for many organisms in LIS including fish and shellfish that are recreational and commercially harvested
 - \$214 billion/year commercial and recreational fishing industry that provides 1.8 million jobs (NOAA 2016).
- Attenuate wave action and provide natural protection of shorelines
- Play a critical role in carbon sequestration as coastal **Blue Carbon** sinks

Blue carbon is the carbon stored in mangroves, salt tidal marshes, and seagrass meadows within the soil, the living biomass aboveground (leaves, branches), the living biomass belowground (roots), and the non-living biomass (litter) (McLeod *et al.* 2011).





Inland Wetlands

Palustrine Wetlands; lands with poorly drained soils

Benefits of Resilient Inland Wetlands

- Are essential to an adequate supply of surface and underground fresh water
- Are integral to hydrological stability in the State
- Provide control of flooding and erosion by retaining water in storm events
- Improve water quality by trapping sediments
- Critical to habitat needs of many forms of plant and animal life
- Are **Teal Carbon** sinks

Wetland Services:

- Ecosystem services including: water quality, storm/flooding mitigation, and cooling from natural tree cover
- Wetland ecosystem services provide benefit to all communities, but failures of these intrinsic services rapidly overwhelm communities and individuals without the means to adapt to the loss of those services are affected to a much greater extent such as: repairs and replacements after flooding events, mold mitigation, costs of air conditioning where tree loss occurs, etc.

Wetland Services:

- Converting land back to wetlands and restoring ecosystem services can serve to protect vulnerable communities from unsustainable development practices which often result in direct harm to community health, economic prosperity, and stability
- Regional/local approaches to research and modeling will ensure that conservation efforts taken by the state are specifically tailored to the state's unique ecosystems, allowing conservation efforts to focus on preserving the ecosystems whose services are most relied on by vulnerable communities such as: supporting improved water quality, flood protection, biodiversity, and maintaining and improving access to and appreciation for Connecticut's open spaces



Wetlands Sub- Working Group

Recommendations for the Working and Natural Lands Report



**Recommendation 2020.W.1:
Protect and enhance the ecosystem services
value of wetlands using sound science and
adaptive management strategies**

1. Encourage land and ocean management behaviors that support ecosystem services
2. Identify and conserve ecosystem services vulnerable to climate change
3. Continue monitoring and assessment of impacts of climate change on wetlands and near coastal waters and update management tools and strategies.
4. Encourage research to understand the effects of potential adaptation approaches and develop new, innovative approaches to support adaptive management
5. Advance regional research and modeling to guide conservation efforts

Highlights:

- Encourage resource management policies that support wetlands ecosystem services
- Systematically identify the ecosystem services most vulnerable to climate change
- Monitor and assess impacts on wetlands and near coastal waters and update management tools and strategies





**Recommendation
2020.W.2:
Communicate the value of
wetlands to Connecticut
home and business owners
through engagement on
climate resilience efforts.**

1. Continue to develop and update all municipal emergency preparedness plans for extreme weather events
2. Educate and assist private landowners and developers in the management of their lands to minimize impacts to wetlands and reduce risk from climate change.
3. Encourage adaptation strategies, including natural habitat conservation, Low Impact Development (LID) Best Management Practices (BMPs), agriculture water BMPs and drinking water treatment standards that will ameliorate the effects of water inundation
4. Implement new or modified policies that would encourage appropriate land use and reduce repetitive losses

Highlights:

- Emergency preparedness planning
- Awareness of importance of wetlands to green infrastructure in communities
- Low Impact Development Best Management Practices





**Recommendation 2020.W.3:
Further develop policies that encourage protections
for wetlands.**

1. Update and develop wetland protection policies, including regulatory programs, to ensure that they include protection for climate change mitigation, adaptation, and resiliency benefits of wetlands and near coastal waters.

2. Reevaluate Connecticut's Green Plan, open space grant programs, and opportunities to enable local communities to enact local finance options in order to prioritize acquisition of land and conservation easements for ecosystem services most at risk from climate change

3. Acquire land and conservation easements to provide upslope — advancement zones adjacent to tidal marshes

Highlights:

- Update and develop wetland protection policies
- Reevaluate Connecticut's Green Plan
- Reevaluate CT's open space grant programs to prioritize acquisition of land and conservation easements for ecosystem services most at risk from climate change
- Acquire land and conservation easements to provide upslope advancement zones adjacent to tidal marshes



IN SUMMARY:

- Wetlands of all types provide important services that **mitigate climate change** – especially through carbon sequestration at higher rates than other soil systems.
- **Wetlands increase CT's resiliency** in the face of climate change especially severe storms:
 - Wave attenuation
 - Slowing rainfall runoff
 - Cleaning runoff water
- As we work to reach our statewide goals we **MUST continue to prioritize the natural systems** that are all around us

This is especially true of wetlands where science is just beginning to understand the complexities of systems that were once thought to have no value.



East River Marsh. Photo: Corrie Folsom-O'Keefe/Audubon

BREAKOUT SESSIONS



Thank You!

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