The Governor's Council on Climate Change (GC3) Science and Technology Working Group

Final Phase 1 Report—November 2020

Science and Technology Working Group

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Executive summary

The "*World Scientists' Warning of a Climate Emergency,*"[1] now with over 13,000 signatories, followed devastating reports such as the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2019),[2] the interim 1.5°C report of the Intergovernmental Panel on Climate Change (IPCC, 2018),[3] and a National Climate Assessment (2018).[4] These reports unequivocally document that human activity is causing rapid change in the climate and the world's ecosystems. Despite decades of internationally coordinated science-based recognition of tipping points and imbalances,[5] continued ecological decline, and climate change's main cause – burning fossil fuels (coal, oil, and natural gas) - remain largely unaddressed.[6]

In the coming decades, significant changes in Connecticutare now inevitable and, to some extent, foreseeable. Science-based action to protect community lifelines and limit emissions and accelerate the uptake of greenhouse gases in Connecticut is urgent, and Connecticut has already charted a course towards reduced emissions. State policies should also be developed/modified to prioritize natural ecosystems' capacity to store and sequester greenhouse gases. Connecticut boasts the highest above-ground carbon per forested acre in New England.[7] Effective and equitable policies will require new science and a process to reconcile the benefits of stored carbon and reduced/negative emissions with other policy objectives.

Simultaneously, we must take measures to reduce the impacts of climate change and sea-level rise on the State's infrastructure, ecosystems, economy, local communities, and its residents' health.[8] Since there is much to be done, there will be potential opportunities for initiatives to advance multiple goals, and planning processes must be organized to recognize them. We recognize that Connecticut is already a leader in climate change mitigation and adaptation, and our recommendations are intended to guide the next steps.

We begin with a summary of the expected changes in Connecticut, provide a science research and monitoring plan, and offer an integrated overview of emerging topics relevant to the State.

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[1] World Scientists' Warning of a Climate Emergency, *BioScience*, 2020 https://doi.org/10.1093/biosci/biz088
[2] Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services https://ipbes.net/
[3] Intergovernmental Panel on Climate Change https://www.ipcc.ch/sr15/
[4] National Climate Assessment https://nca2018.globalchange.gov/
[5] https://securesustain.org/scientists-reporting/
[6] Capria, F. (2016) A Systems View on Life. Cambridge University Press
[7] http://apps.fs.usda.gov/Evalidator/evalidator.jsp
[8] https://science.sciencemag.org/content/356/6345/1362;
https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(18)32594-7/fulltext
https://publichealth.yale.edu/climate/YCCCH_CCHC2020Report_395366_5_v1.pdf

Impacts: Sea Level Rise, Temperature, and Precipitation

Technical reports that review the state of the science and projections for Connecticut have been prepared through the Connecticut Institute for Resilience and Climate Adaptation (CIRCA) for sea-level rise (O'Donnell, 2018)[9] and temperature and precipitation (Seth et al., 2019).[10] The following impacts and recommendations are based on these reviews and a consensus within the GC3 Science and Technology Working Group.

1. There is high confidence in projected changes through the mid-century. Projected changes after the mid-century will depend on mitigation actions taken in Connecticut and globally. Since our understanding of the processes that determine climate is advancing rapidly, and data is being continuously collected, we recommend a comprehensive review of projections be undertaken by the State at five-year intervals as outlined below.

2. Mean sea level in Long Island Sound could be up to 20 inches above the National Tidal Datum Epoch (1983-2001) by 2050 (O'Donnell, 2018). This projection is not sensitive to future trends in carbon dioxide emissions.

3. Changes in mean sea level will significantly impact the frequency of flooding along the Connecticut coast, but the flood zone will not expand much in most areas. With 20 inches of sea-level rise, coastal flood risk could increase by a factor of 5 to 10 with no change in storm conditions. High water levels, like occurred during Superstorm Sandy, would then be expected every 5 to 10 years.

4. Sea level rise will continue after 2050. Recent simulations indicate that the mean sea level could be up to 80 inches higher by 2100 if CO2 emissions are not reduced soon.

5. Average temperatures in Connecticut could increase by 5 ^{o}F (2.7 ^{o}C) by 2050 compared to the 1970-1999 baseline. Connecticut's temperature has already risen more than the global average in part because temperature changes tend to increase in middle and high latitudes (towards polar regions). Consequently, a 2 ^{o}C target for global average temperature would result in a higher temperature (than 2 ^{o}C) in Connecticut.

6. All indices of hot weather are expected to shift toward more frequent and higher temperature events. For example, by mid-century, the number of days per year with temperatures above 90 ^{o}F (32 ^{o}C) could increase. Statewide, from 1970 to 1999, the average number of days was 5, and this is projected to increase to an average of 25 days between 2040-

[9] O'Donnell, J. (2019). Sea Level Rise in Connecticut. CIRCA Report. https://circa.uconn.edu/wp-content/uploads/sites/1618/2019/10/Sea-Level-Rise-Connecticut-Final-Report-Feb-2019.pdf

[10] Seth, A., G. Wang, C. Kirchhoff, K. Lombardo, S. Stephenson, R. Anyahand J. Wu (2019). Connecticut Physical Climate Science Assessment Report (PCSAR): Observed trends and projections of temperature and precipitation. CIRCA Report. https://circa.uconn.edu/wp-content/uploads/sites/1618/2019/11/CTPCSAR-Aug2019.pdf

2069. (*Note that specific locations and specific years will show more days with extreme temperatures than statewide and long-term averages).* The number of days with frost could decrease from 124 to 85.

7. Temperature projections after mid-century are sensitive to policy choices on carbon dioxide emissions. Coordinated mitigation now means it is more likely that the temperature will stabilize after 2050. If not, warming is likely to accelerate.

8. Drought risk is also expected to increase. The probability of unusual events (extremely low annual and summer water availability, and extremely high 1-day and 5-day precipitation) are projected to increase by a factor of between 2 and 4 by mid-century.

9. Though it is unclear whether the frequency or intensity of *extratropical* storms in Connecticut will change, they will likely bring more precipitation. In general, warmer temperatures will result in less snow and more rain, but increased humidity will yield high snowfall events when temperatures permit.

10. Projection of changes in the frequency of tropical cyclones in a warmer climate are uncertain. However, they will likely have stronger winds and more precipitation. Since 1980 there has been an increase in the frequency of hurricanes in category three or greater.

The impacts outlined above reflect the reality that climate change is *here* - in Connecticut - and that natural systems are complex and dynamic. Connecticut is fortunate to have engaged citizens, businesses, and policymakers. An analysis of multiple moral foundations by the Cornell National Social Survey (USA) found that fairness and compassion are positively associated with a willingness to take action on climate change.[11]

[11] https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0163852

Research Recommendations and Top Priorities

A major goal of the Science and Technology Working Group is "locally-scaled scientific information and analysis to assess the consequences of climate change . . . in the context of the State's changing land use and demographics." **Addressing *this goal requires the assembly of a comprehensive data set that resolves the appropriate temporal and spatial scales and engages in an iterative analysis to best serve the public good and protect the public trust.*** Accordingly, the Science and Technology Working Group assembled members with cross-disciplinary expertise and hailing from rural, suburban, and urban communities in the State.

Climate Science for Connecticut

Review Climate Science at Five Year Intervals

Connecticut statutes (PA 13-17) already call for a review of sea-level rise projections at ten-year intervals in recognition that climate science evolves continuously and that data can guide the assessment of projections. We recommend that this strategy also be applied to the climate of Connecticut. We recommend a *five-year interval* for updates in recognition that climate science at regional and local scales is progressing rapidly. As noted above, some changes are inevitable and must be addressed now. The effects of the actions we take now to reduce greenhouse gas emissions will substantially impact the climate after 2050 and in the next century.

A 5-year update would allow an assessment of the effectiveness and relevancy of policies shaped by previous assessments and provide a venue for new issues to be considered. It would also be an opportunity to build new data and the results of improved models into the State's planning documents (e.g., Hazard Mitigation Plan and many others) and provide the citizens of CT with the best available information for their own decision making. The review should include an inventory of all substantial greenhouse gas sources and sinks and the effectiveness of actions and policies on reducing atmospheric concentrations. An expert review of the implications of new predictions of global climate models on Connecticut is also essential to sustaining the state's commitment to science-informed statewide and local climate action and adaptation and resilience.

To protect the environment in a changing climate and secure the health, prosperity, and equity of Connecticut's communities, careful planning and action must be complemented by innovative approaches and persistent monitoring of appropriate metrics that can inform the five-year review. These assessments should consider regional socioeconomic assessment models for Connecticut and, as discussed in more detail below, be sensitive to downscaled, local, and community-led opportunities.

Track Climate Change and its Impacts in Connecticut

It is essential to establish consistent and persistent data that characterize the impacts of climate change on the environment and society, and collaborative means for analysis of

projections of impacts at spatial and temporal scales relevant for ecosystems, public health, transportation, infrastructure, environmental justice, etc. The existing observation programs that have been used to infer the effects of climate change in Connecticut were developed for important but narrow goals in various agencies and towns. It is unlikely that this approach will provide us with the integrated data we will need to recognize changes and prioritize action in the coming decades.

It is important to note that the strain of climate change on communities and ecosystems interacts with other stressors to produce negative outcomes. Thus, monitoring for climate change impact should consider other major stressors. Examples of environmental data include: air quality, temperature, and humidity in places people live; toxin risks and water levels in flood zones; flow rates, water temperature, salinity, pH, and benthic invertebrate indicator communities in streams and estuaries; groundwater levels and quality; ecological niches and their connectivity, integrity, and recovery; soil health, above and below ground carbon storage and sequestration; biodiversity tracking and assessments including species interactions, land-use change, dispersal, demography, evolution and physiologic responses to climate change[12] (Urban et al. 2016 Science)This environmental data must be in a form that can be coordinated with social, economic, and health information to detect impacts on people. These data include: identification of community lifelines (sources of healthy food, clean water, transportation, energy, education, and internet service); the economic cost/benefit to enrollments in carbon markets versus other programs; equitable access to health care and open space for active and passive recreation (nature preserves, parks, beaches, etc.); distributed opportunities for energy efficiency, reduced waste streams, and healthy local economies and communities.

A Comprehensive Mitigation Approach

In 2013 the Intergovernmental Panel on Climate Change (IPCC) concluded that it was very likely that the central cause of the observed warming of the air and ocean was the increase in the concentration of greenhouse gases (GHG) in the atmosphere due to anthropogenic emissions. International treaties to address warming have focused on reducing the emissions of carbon dioxide (CO_2). In Executive Order 3, Governor Malloy committed Connecticut to a 45% reduction in GHG emissions by 2030.

To limit warming to safe levels, rates of removal of CO_2 from the atmosphere (negative emissions) must also increase, and limits must be placed on the release of other GHGs, i.e., Nitrous Oxide (N_2O) and Methane (CH_4). While effective technological approaches may emerge, Griscom et al. (2017) outlined the potential for conservation, restoration, and improved land management (Natural Climate Solutions) to provide substantial carbon storage and increased negative emissions.[13] New England has significant potential for additional negative emissions

[12] https://science.sciencemag.org/content/353/6304/aad8466.long
[13] https://www.pnas.org/content/114/44/11645; https://onlinelibrary.wiley.com/doi/full/10.1111/gcb.14612

while simultaneously reversing biodiversity loss.[14] To establish effective policy, Connecticut must accurately evaluate the inventory and rates of change in carbon stored in major ecosystems and understand how policy choices modify them. This information is critical to developing a comprehensive climate policy that recognizes the impact of all management decisions. Connecticut could then recognize progress toward net emissions reduction targets by leveraging investments in and policies that impact forests, wetlands, farms, fields, estuaries, urban ecology, etc.

The development of an optimal strategy (one that avoids negative ecological, economic, and social impacts) that includes "natural solutions" would necessitate considerable consultation and research. However, we recommend that the State includes protecting stored carbon and ongoing negative emissions as a goal of all land and ecosystem management policies. New advisory groups will be required to review the latest scientific literature, consult with stakeholder groups, and provide actionable advice to the state managers.

Leverage Natural Climate Solutions[15]

Actions that can be classed as "natural climate solutions" expand beyond processes that remove greenhouse gases from the atmosphere. Natural climate solutions also include using vegetation to increase shade, delay storm-water runoff, reduce coastal erosion, etc. They provide a range of co-benefits like nutrient removal, preservation of soil health, enhancing species diversity, and water filtration. Research is required to understand: the impact on albedo of changes in land use, including street tree and roadside tree canopy removal; the impact of wetland remediation/conservation activities on their net radiative forcing; kelp production in Long Island Sound to store carbon in agricultural fields and decrease methane fluxes from beef farms; nutrient (fertilizer) management practices that reduce nitrous oxide emissions and increase nitrogen use efficiency; management activities that offset ocean acidification; and remediation of "blue carbon" stocks such as salt marshes.

We recommend that the State form an interdisciplinary task force to develop a plan to provide data that the five-year review process would need to identify and track climate change impacts on Connecticut's people. The plan should build on existing data-gathering programs in the State and identify priority data-gaps. This data gathering should begin as soon as practical and be complemented by an effective data archiving and distribution system.

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[14] https://advances.sciencemag.org/content/6/36/eabb2824; https://harvardforest.fas.harvard.edu/sites/default/files/Finzi_Giasson_BarkerPlotkin_EcoMono_2020_Accepted%20Article_reduced%20file%20size.pdf; https://www.frontiersin.org/articles/10.3389/ffgc.2019.00027/full;

[15] https://www.pnas.org/content/114/44/11645; https://www.pnas.org/content/115/14/3663;

Multisolving Strategies

Our recommendations and our overview (below) highlight the intricately complicated interactions among climate, ecosystems, and society. It is clear that many of the environmental, social, and economic problems created or exacerbated by climate change are connected and that they connect us to each other. They are also connected to the planet's health: the climate crisis cannot be solved in a piecemeal fashion. We recommend that the development of recommendations on policies and priorities must be informed by interdisciplinary groups using the principles of *multisolving* (described in more detail below).[16] This approach can yield solutions that save money, protect the climate, and offer multiple co-benefits. Multisolving for climate resilience has been put into practice successfully in other areas.[17] Many new ideas may evolve and be Connecticut-specific - we are a small state with an ideal location, special qualities, strong communities, and a high population density.

Climate Science Education and Communication

The public must feel informed about climate change and its impacts – especially on their community - to support the positive changes required to avoid climate change's most devastating impacts. For example, recent scientific consensus outlines a powerful economic case for protecting nature with a range of strategies and at a range of scales.[18]

Education must occur at multiple levels and across demographics (i.e., age, race, socioeconomic status, etc.) and must be accessible and relevant to rural, urban, and suburban communities. Proactive messaging campaigns, hyperlocal examples, citizen science opportunities, and a range of new user-friendly apps can help mobilize cultural changes with multiple co-benefits.

We recommend the development of an inclusive Connecticut-based training strategy (with, perhaps, a *certification/professional development process*) for formal and informal educators. This will help them be effective communicators of climate science, climate change impacts, and resilience strategies. The program should reach audiences from K-12 school systems, current, and future teachers, municipal leaders, and diverse community groups. Engaging all parts of the system is needed to mobilize mutually beneficial ideas and positive collective action.

Nature and Associated Benefits for All Communities

We can address environmental justice and access to nature, open space, and economic and recreational opportunities in distressed communities while simultaneously prioritizing natural solutions for ecological integrity, health, climate mitigation, and climate adaptation.

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[16] https://www.climateinteractive.org/ci-topics/multisolving/what-is-multisolving/;
[17] https://www.climateinteractive.org/ci-topics/multisolving/multisolving-for-climate-resilience/;
[18] https://www.conservation.cam.ac.uk/files/waldron_report_30_by_30_publish.pdf;

Securing and improving open space for environmental justice communities (and ultimately for everyone) has multiple mitigation, biodiversity, health, and equity benefits - especially for those most nature-deprived. These public spaces connect people within communities, with the common good, and with our history: Bushnell Park was the first public park financed by public funds.[19] The pandemic has spotlighted the rapidly emerging research linking nature to health,[20] and many natural areas throughout Connecticut saw unprecedented visitation (and some frequently closed due to overcrowding). Equitable, local, and accessible opportunities such as community gardens, parks, forests, recreational trails, and nature preserves provide cool places for respite and benefit everyone.

Beyond individual benefits, we cannot lose sight of the fact that nature is our collective lifeline. It is imperative that we protect and increase ecological integrity strategically and connect ecosystems across the landscape – from urban spaces to forested regional corridors, and as recommended in the Green Plan.[21] Prioritizing nature for environmental justice includes identifying and prioritizing opportunities to protect ecosystems where possible and restore them as needed with evidence-based interventions in urban, suburban, and rural communities.

In some settings, more intensive programs are needed to restore or maintain habitats by addressing invasives and/or planting site-appropriate trees and native plants. In others, simply monitoring existing ecosystems, corridors, and/or tree cover enables ongoing ecosystem services, including cumulative carbon storage and biodiversity. In all cases, hyperlocal actions provide mitigation and adaptation while also providing job opportunities and ecosystem services of natural areas - including improved physical and mental health.

Comprehensive Place-Based Implementation of Mitigation, Adaptation, and Resilience

Select and establish pilot region(s) to quantify and demonstrate site-specific co-benefits of comprehensive climate resilience planning that is proactive and risk-based.

Making Connecticut's communities equitable and resilient to climate risk impacts and its challenges requires timely local actions and cultural shifts. Pilot regions anchored to nature and clean water, and examples in urban/suburban watersheds, will quantify diverse co-benefits of climate mitigation and adaptation, ecosystem services, and equity and community resilience.

We recommend establishing criteria for selecting a pilot *region*(s) for a comprehensive climate resilience plan (based on multisolving, as noted below) with *transferable benefits*. Targeted pilot projects must incorporate science, equity, and environmental justice, and showcase the interdisciplinary aspects of the GC3 and State planning at a pace, scale, and cost that transfers to other locations and inspires broader changes and informed decision-making.

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[19] http://www.bushnellpark.org/about-2/history-2

[20] https://pediatrics.aappublications.org/content/146/2/e20201271

[21] https://portal.ct.gov/-/media/DEEP/open_space/GreenPlan/2016GreenPlanSectionVIpdf.pdf

Pilot projects should be located in strategic ecoregions: ideally at least one coastal pilot, one rural pilot, and one or more centered in an urban-suburban watershed. Pilot projects will quantify and demonstrate a range of co-benefits to diverse stakeholders (clean air, water, energy; resilient infrastructure, community lifelines; climate, ecology, health). An essential goal of climate resilience is protecting clean water and considering the full range of the landscape - from managed urban ecology and working lands to regional headwaters, riparian corridors, and natural ecosystems that are healthy or recovering across the State. We recognize that there are many unknowns and a fiscal and ethical responsibility to maintain habitats the State invested in while also prioritizing the integrity of self-sustaining processes and natural selection.

The power of pilot regions is that they can mobilize cultural change and demonstrate our ability to be comprehensive, compassionate, and humble: we are a blip in evolutionary time. We are blessed with a beautiful state, strong communities, and a positive future. We need more long-term data on many fronts, but being visionary, specific, and proactive about land stewardship is essential. We need areas managed for resource production, areas for research and restoration (often requiring intervention, and this can also produce resources), and areas prioritized proactively as *natural ecosystems*, with evidence-based natural stewardship.

Together these decisions form a platform for community resilience that educates the public and serves the public good. Differentiated and proactive decision-making in all sectors is critical for mitigation and adaptation. It aligns dynamically with science, provides jobs that cannot be outsourced, and protects the full range of native biodiversity and pathways for climate migration.

Integrated Overview

"Science and everyday life cannot and should not be separated."
~ Rosalind Franklin, Ph.D. (1920-1958)

There is clear scientific consensus on the interconnected and accelerating crises in climate, biodiversity, and public health worldwide. In just two years, there have been approximately 30 peer-reviewed "Scientists' Warnings."[22] Most focus on ecological risk (including insects and soil) ***because nature is our lifeline***. It's urgent to collect long-term data and simultaneously identify clear and cost-effective solutions to mitigate and adapt to known impacts - and in some cases aligning with worst-case scenarios and reaching dangerous tipping points.[23]

Impacts are inevitable, and the cost of inaction will be high. We need to address the impacts of climate change in ways that provide long term benefits and prioritize essential building blocks and protect nature and serve people of all ages. It requires integrating new knowledge to ensure evidence-based decisions. Reducing greenhouse gas levels is ***necessary,*** but not ***sufficient.*** Keeping Connecticut's citizens healthy and the State's communities and economies functioning ***requires working across disciplines and without conflicts of interest.***

Scientific knowledge and technical measurement capabilities evolve rapidly, and downscaled information is critical for detecting local impacts on Connecticut communities.[24] To guide decisions and prioritize actions in an unbiased way, and as highlighted in our research recommendations, we must expand our capacity to cooperate and collect and integrate data across the State. As noted above, mitigating and adapting will demand a persistent focus on the best available emerging information. The risks are too serious for other paths forward.

Impacts and risks are inequitable and economically and environmentally devastating. We need to proactively protect citizens and entire communities that are most vulnerable and least able to withstand stress or recover from additional challenges. A chronic cycle of insufficient and incremental changes and special interest-based or siloed decision-making is reduced by multisolving[25] - because *multisolving saves time and money by addressing multiple problems and forging win-win solutions.* It always protects the climate as a primary goal - alongside equitable co-benefits such as creating local jobs, improving health, biodiversity, and disaster resilience, producing healthy food, and protecting clean air and water.

Impacts threaten natural systems and community lifelines. The protection of intact natural ecosystems, clean water, healthy soil, and beneficial insects where possible is essential and provides many co-benefits, including quantifiable economic benefits, social benefits, and

[22] https://scientistswarning.forestry.oregonstate.edu/journal-articles-related-scientists-warning
[23] https://www.nature.com/articles/d41586-019-03595-0
[24] https://www.ecolise.eu/
[25] https://www.climateinteractive.org/ci-topics/multisolving/what-is-multisolving/

improvements to public health and well-being.[26] This is the foundation of long-term local resilience, including local food systems. A recent study on well-being during the pandemic quantified "flourishing" (based on a standard scale) and found that feeling strongly nature-deprived had a bigger negative impact than losing wages - and was second only to unemployment (Tomasso et al., *under review*).[27]

A strategic balance between working and natural lands optimizes long-term climate protection, ecology, community, and health by protecting ecosystems and supporting programs for long-term research and responsible resource use and reuse. For example, a Connecticut-specific analysis outlined the powerful climate and economic benefits of preserving the carbon sink and preventing lost sequestration.[28] Coastal and inland wetlands store high carbon levels, and many of Connecticut's forests are unusually carbon-dense and still growing – currently unaccounted-for opportunities for mitigation and other co-benefits that have been identified for New England and other temperate ecoregions in the United States.[29]

A Spotlight on Multisolving

The multisolving **F**ramework for **Lo**ng-term, **W**hole-system, **E**quity-based **R**eflection ("FLOWER") diagram below is adapted from Climate Interactive (an independent, not-for-profit think-tank that grew out of MIT Sloan and developed the well-known En-ROADS simulator).[30] The schematic below reveals the diverse impacts and opportunities inherent in addressing climate change and is designed to identify the co-benefits of climate solutions. It is adapted to reflect the common mission of the GC3 and the consensus of the Science and Technology Working Group that ecological integrity and equity and diverse perspectives are central. These overarching issues, particularly the global crisis in species extinction and ecological integrity, have come more fully to the fore since FLOWER was developed. A short video explaining multisolving and the climate co-benefits using the FLOWER analysis is available.[31]

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[26] https://www.sciencedirect.com/science/article/pii/S0169204616000062; https://advances.sciencemag.org/content/5/7/eaax0903/tab-pdf;

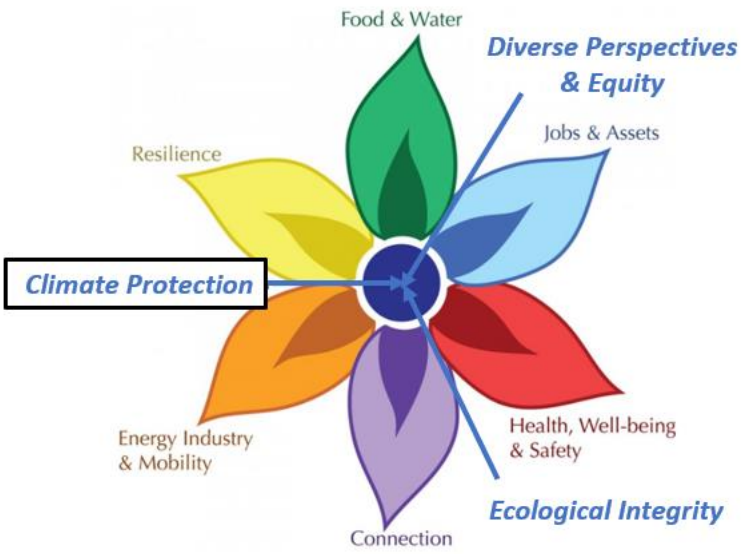
[27] Tomasso, L P, Yin, J, Cedeño Laurent, J G, Chen, J T, Catalano, P J, Spengler, J D. "The Relationship between Nature Exposure and Wellbeing under the Covid-19-19 Pandemic: a Survey Study."

[28] https://www.scirp.org/html/3-6702464_52176.htm

[29] https://newildernesstrust.org/about/wild-works/; https://cteco.uconn.edu/projects/carbon/index.htm; https://portal.ct.gov/-/media/DEEP/climatechange/GC3_Webinar_Series/Landuseandforestrypdf.pdf https://www.frontiersin.org/articles/10.3389/ffgc.2019.00027/full; https://www.pnas.org/content/115/14/3663 https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/eap.2039

[30] https://www.climateinteractive.org/

[31] https://www.climateinteractive.org/ci-topics/multisolving/flower/



Adapted **F**ramework for **Lo**ng-term, **W**hole-system, **E**quity-based **R**eflection (**FLOWER**)

Based on the high interest in and public feedback throughout this process, we celebrate a highly-engaged citizenry in Connecticut - an essential asset now and in the future. We continue to welcome suggestions for additional content and topics for Phase 2 of the GC3 process.

Themes and Goals

The Science and Technology Working Group was assembled to include cross-disciplinary expertise and represent a wide range of communities. Evaluating science and translating it into ***education*** and ***action*** in local communities is essential. Our subgroups were focused on 1) sea level, temperature, precipitation; 2) energy, infrastructure, and buildings; 3) ecosystems and health; 4) culture, recreation, and education. The ***overarching goals*** of this Phase One report are to outline known impacts, the range of future impacts, and existing opportunities and knowledge gaps.

What we do now makes the biggest difference, and we cannot afford wrong turns.

We need to act where impacts are known, continue to collect data and admit the unknown. Long-term solutions require mobilizing cultural changes across disciplines and sectors. Honest and updated assessments are fundamental to aligning science and public policy, engendering public trust, and ensuring that public resources serve the public good.

Connecticut is a proven leader. The robust and interdisciplinary process of the GC3 can put Connecticut on a path to the best future and catalyze actions in other states and communities. An equitable translation of science into policy and public knowledge and action can address -

simultaneously - climate change impacts, ecosystem impacts, community resilience, environmental justice, and public health. It will ensure that we protect natural, cultural, and historic resources throughout the state and enhance the quality of life in rural, suburban, and urban communities across Connecticut.

In Connecticut, we have an academic center to provide leadership and science support to towns, Connecticut Institute for Resilience & Climate Adaptation (CIRCA),[32] and a statewide community-based action network, Sustainable CT.[33] As of September 2020, Sustainable CT includes 112 registered and 48 certified towns, and its distributed success is leveraged by private money and non-profit, state, and local initiatives. These efforts are essential because evidence-based action requires local knowledge and can require analyses linking "big data" and "hyper-local" for cost-effective multisolving solutions.

Impacts: Infrastructure and Energy

Stewarding, managing, and upgrading our natural and built environment and energy systems to reduce risk and increase resilience is a priority for planning and action. Impacts to state-wide and community lifelines of infrastructure (*ranging among water, food, transportation, communication, shelter, resource distribution, disaster resilience*) and energy (*i.e., reducing demand; clean, affordable options; distributed local energy*) demand a multisolving approach to identify gaps, priorities, and opportunities. Jobs and economic opportunities should prioritize vulnerable communities facing an increased burden. Policies should not only seek the best science to address impacts on the environment; they should endeavor to use multisolving solutions to redress economic inequality in parallel with protecting and repairing the climate.

We need to incorporate the best available science *continuously* into planning and design. As one example (and noted in the Infrastructure and Land Use Working Group), this is essential to ensure transportation infrastructure durability and longevity. Planners and engineers have traditionally relied on historical estimates of precipitation, streamflow, and sea level – which may no longer reasonably predict future conditions (non-stationarity). There is a knowledge gap regarding how to best incorporate future climate model projections into the design practices for transportation infrastructure.

Research is currently underway to fill this gap. The American Association of State Highway and Transportation Officials (AASHTO), in cooperation with the Federal Highway Administration (FHWA), has sponsored the National Cooperative Highway Research Program (NCHRP)**,** which is administered by the Transportation Research Board (TRB) of the National Academies of Sciences, Engineering, and Medicine, to coordinate high-level research with which to develop a design guide of national scope that will provide engineers with the tools needed to amend practice to account for climate change. Connecticut Department of Transportation is involved

[32] https://circa.uconn.edu/
[33] https://sustainablect.org/

with this research (NCHRP Project Nos. 15-61, 20-44(23), 15-61A) and anticipates incorporating the resulting guidance into its design manuals.

Efficient transportation, including public transportation, are key parts of the solution. These are also well-established opportunities for multisolving.[34] Climate change impacts a range of factors that are causing major shifts in where people need or want to go and when. Transportation is a major source of greenhouse gas emissions, but it is also a community lifeline and a major source of economic development.[35] An increased focus on walking/biking, and efficient and effective public transportation offers mitigation, public health, equity, and more. Public outreach, education, and incentives can facilitate uptake and access. These actions, coupled with system-wide analyses, can ensure that routes and schedules maximize the ability of public transportation systems to serve the public good and support individual and community resilience. New data is needed to integrate emerging opportunities to maximize positive impacts, overcome barriers, and support community values.

Green infrastructure, broadly defined, is multisolving and is part of the solution. Climate impacts on the integrity and function of existing and future green infrastructure are complex and dynamic. The Environmental Protection Agency (EPA) defines green infrastructure as "*a cost-effective, resilient approach to managing wet weather impacts that provide many community benefits*."[36] Green infrastructure technologies include rainwater harvesting, rain gardens, bioswales, green roofs, street trees[37] , and much more. In some cases, we need patience: natural systems have many co-benefits. Some can strengthen over time and/or be virtually self-sustaining while offering mitigation, adaptation, biodiversity, and health.

Impacts and benefits of green infrastructure accrue at a range of temporal and spatial scales. A long-term, visionary and ongoing success is the Charles River Watershed in Massachusetts[38] - a decades-long effort, anchored by wetlands protection for flood prevention, transformed a trash-filled and polluted "*Dirty Charles*" into "*the cleanest urban river in America*."

Connecticut has many opportunities.[39] Some are simple, low-cost, and hyper-local: protecting and restoring wetlands and riparian corridors, reducing erosion, and reducing impervious surfaces by establishing biodiverse bioswales,[40] rain gardens, and green roofs, retaining and planting trees, and depaving. As noted, climate change will increase the heat island effect and flooding frequency, two impacts that converge on urban areas, and urban forests provide many

[34] https://www.climateinteractive.org/multisolving-in-action/examples-of-multisolving/efficient-transportation-cuts-carbon-and-reduces-poverty/
[35] https://journals.sagepub.com/doi/abs/10.1177/0042098013494426
[36] https://www.epa.gov/green-infrastructure/what-green-infrastructure
[37] https://www.sciencedirect.com/science/article/pii/S0169204617300464?via%3Dihub
[38] www.crwa.org
[39] https://portal.ct.gov/DEEP/Water/Watershed-Management/Low-Impact-Development-and-Green-Infrastructure-Municipal-Outreach
[40] https://www.mdpi.com/2412-3811/2/4/12

ecosystem services[41] – including free cooling.[42] *Unneeded impervious areas could or should be depaved and repurposed - for example, to roadside bioswales, natural areas, parks, community gardens, pollinator habitats, and/or community-scale energy projects.*

Impacts are reduced by leveraging *natural infrastructure*. Full protection of the ecosystem services from natural infrastructure (i.e., headwaters, wetlands, riparian zones, biodiversity) has mitigation and adaptation co-benefits along the shoreline and throughout watersheds. Clean water is a bedrock priority, essential to life and wellbeing, and Connecticut General Statute §22a-15 declares that "there is a public trust in the air, water, and other natural resources." Accordingly, water is held in the public trust, as is public land that protects it. Disturbing public natural areas protecting water should proceed with caution, grounded in the principles of harm reduction and evidence-based decision making.

Natural infrastructure represents low-cost multisolving: for example, the benefits of protecting and/or restoring natural ecosystems and their species diversity, including keystone species on land and in the water). In some cases, this can reduce disease vectors and the prevalence of public health threats such as Lyme disease,[43] expected to worsen with climate change.[44] Allowing naturally-occurring beavers to act as dam engineers (where possible*)* is a powerful approach to adaptation - reduces downstream flooding, creates successional habitat (at no ongoing cost), and benefits many species.[45]

Recurring and recent storm events underscore climate impacts on energy reliability. A pernicious cycle of power outages and recovery efforts (at all levels) risks serious economic and health impacts, lost mitigation, and cumulative impacts. Some factors for consideration are:

- *Economic and health impacts - loss of food security, income, transportation, education, cooling/heating, childcare, and more – are costly and an accelerating equity issue.*
- *Extensive vegetative management releases stored carbon and decrease ongoing mitigation. It increases local temperatures and can foster a network of invasive plants.*
- *A strategic plan to bury power lines and prioritize resilient, distributed, clean energy prevents impacts, protects the health, and solves multiple problems.*
- *Judicious evidence-based tree removal or pruning represents harm reduction: reducing negative impacts on mitigation, adaptation, equity, biodiversity, and public health.*
- *Local infrastructure to support the best energy options and local resources' best use creates jobs, lifelines, and equity.*

[41] https://pubmed.ncbi.nlm.nih.gov/26828167/
[42] https://www.sciencedirect.com/science/article/abs/pii/S0925857413000578
[43] https://www.pnas.org/content/100/2/567
[44] https://www.sciencedirect.com/science/article/pii/S1877959X15000874
[45] https://www.exeter.ac.uk/creww/research/beavertrial/

Climate change impacts and advances in science and technology require and enable us to reduce energy demand and reassess our energy portfolio. There are many benefits of energy efficiency and energy audits: they pay for themselves, make people more comfortable and healthy, and reduce energy demand and associated emissions.[46] These are major opportunities to increase equity[47] and can help upgrade and preserve small multifamily buildings.[48] Connecticut needs to stay on a strong path with lifecycle analyses, increase efforts to reduce energy demand, and increase efficient, clean, carbon-free, resilient, community-based energy - particularly in distressed and vulnerable communities. ***We need an unbiased and diverse set of voices on the Connecticut Siting Council.***

Clean, renewable energy does not increase greenhouse gas emissions. Transitioning from fossil fuels and carbon-based fuels is essential. Right now, most of the "renewables" powering our electrical grid (ISO New England[49]) are combustion-based (trash and wood). A cleaner power grid complements cleaner distributed energy, and we can practice *harm reduction* now by reassessing *existing subsidies*. We propose woody biomass subsidies should be downgraded from a Class I renewable (supported by ratepayer subsidies as equal to solar) due to impacts on mitigation and health:

1) It increases atmospheric carbon,[50] at a time when reducing emissions is essential and protecting and increasing forest carbon[51] is recognized as a powerful and cost-effective mitigation (and multisolving) opportunity in New England and beyond. Unfortunately, assumptions and errors in carbon accounting (for example, neglecting future sequestration) have propagated policies that subsidize making climate change worse.[52] A range of assumptions also undergirds estimates for product substitution, all of which need to be downscaled to Connecticut. These national and international "wrong turns," have resulted in major public subsidies and a major scientific outcry among leaders in the field.[53] We have to get this right.

2) The acute and chronic effects of air pollution on all systems, including the brain,[54] and myriad health impacts of chronic wood smoke particulates in all ages, are clear.[55] HEPA filters can help individuals.[56] Air pollution is an ongoing environmental injustice in Connecticut and less than 10

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[46] https://www.climateinteractive.org/multisolving/warm-up-new-zealand-is-multisolving-with-home-insulation/ https://www.weact.org/campaigns/home-energy-assistance-program/
[48] https://www.pschousing.org/news/preservation-multifamily-housing-key-housing-goal-ct
[49] https://www.iso-ne.com/isoexpress/web/charts
[50] https://iopscience.iop.org/article/10.1088/1748-9326/aaa512/meta; https://iopscience.iop.org/article/10.1088/1748-9326/aaac88
[51] https://www.frontiersin.org/articles/10.3389/ffgc.2019.00027/full https://www.nature.com/articles/s41586-020-2686-x
[52] https://sites.tufts.edu/gdae/files/2020/05/EU-Forest-Letter-3.pdf
[53] https://sites.tufts.edu/gdae/files/2020/05/Forest-Letter-to-Congress.pdf https://sites.tufts.edu/gdae/files/2020/05/EU-Forest-Letter-3.pdf
[54] https://www.pnas.org/content/117/25/13856
[55] https://woodsmokepollution.org/
[56] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3080954/

miles away is our neighbor of Springfield, MA - the asthma capital of the country.[57] We should not continue subsidizing pollution, especially in or near environmental justice communities.

Impacts of climate change will spur economic development: private investments in risk reduction, energy efficiency, and distributed systems have co-benefits. But we have to start with a combination of science, common sense, and integrated approaches. Statewide benefits include local jobs, equity, and community resilience. Prioritizing energy for on-site use, brownfields, dual-use, or within the built environment provides jobs and energy where needed (reducing transmission-based loss). It prevents loss of land needed for (or better suited for) other uses (food, housing, habitat, recreation, mitigation). Energy policy and siting decisions should be updated based on harm reduction, new technologies, lifecycle analyses, and environmental protection and justice.

Climate impacts underscore the need for local resource partnerships for use and reuse. Practical policies are needed, and adaptive reuse of existing resources and infrastructure can preserve natural resources, reduce waste, support local jobs and local decision-making, shorten supply chains, and increase community resilience. Regional co-ops or programs for municipal collaboration and equipment depots that partner farmers, arborists, and foresters, and various types of contractors can support access and distribution in local, circular systems (mitigation and adaptation) that reduce overhead and provide equity for small and beginning operators. A mechanism that could be leveraged for this purpose is the Intermunicipal Capital Equipment (ICE) program,[58] and there are examples of successful operations.[59] Public funding for technical assistance for establishing co-ops, preserving housing,[60] adaptive reuse,[61] local supply chains, and integrated resource reuse and recycling is needed. For example, a set of solutions was established to use lumber and protect its value within New England after the 1938 hurricane.

Climate impacts risk numerous community lifelines. Impacts at multiple levels are outlined in other working groups, and we emphasize that a genuine dual lens of science and equity is an essential and exciting crossroads. This perspective, along with a coordinated set of actions, offers critical transitional opportunities for co-benefits of mitigation, adaptation, nature-based solutions, and improved public health, based on connecting with nature, self-care, and mental health.[62] These building blocks of resilience, and knowing that the State and your local community is planning and preparing, can reduce anxiety and depression - an escalating widespread impact of climate change.[63] Local planning and action must proceed in an evidence-

[57] https://www.aafa.org/asthma-capitals/
[58] https://portal.ct.gov/OPM/IGPP-MAIN/Grants/Intertown-Capital-Equipment/Intertown-Capital-Equipment
[59] https://www.flamigearthproducts.com/; https://ilsr.org/baltimores-camp-small-zero-waste-initiative/; https://www.cooperativefund.org/
[60] https://www.pschousing.org/news/preservation-multifamily-housing-key-housing-goal-ct;
[61] https://www.thebalancesmb.com/introduction-to-reclaimed-lumber-2877753
[62] https://www.liebertpub.com/doi/full/10.1089/acm.2019.0421
[63] https://ecoamerica.org/wp-content/uploads/2014/06/eA_Beyond_Storms_and_Droughts_Psych_Impacts_of_Climate_Change.pdf

based way that educates and engages the public and engenders public trust. Adaptation should prioritize mitigation, conservation, efficiency, and self-sustaining systems wherever possible.

Despite the known and unknown impacts of climate change, Connecticut has a bright future. Many citizens are committed deeply to their local community, and everyone loves our State's natural beauty. Pride of place is an asset in comprehensive efforts and public-private partnerships. We have a chance to mobilize fairness and compassion[64] into action and showcase enduring "Yankee" values of thrift, ingenuity, niche markets, and small businesses. Ultimately new infrastructure and energy projects must meet known and projected impacts while protecting (or relocating) cultural and historical resources that make Connecticut special. Throughout the state, infrastructure and energy impacts range in size and scope - and create a wide range of jobs and opportunities for environmentally beneficial and equitable outcomes.

Impacts: Ecosystems, Public Health, Community Resilience

The world is too dangerous for anything but truth and too small for anything but love."

— William Sloane Coffin, Jr. (1924-2006)

The benefits and risks of a global economy came sharply into focus in 2020 when pandemic- and storm-induced disruptions combined and heightened public awareness of global crises in climate and biodiversity - as well as gaps in health care, local supply chains, and disaster preparedness. Connecticut continues to respond to this major "stress test" with an objective assessment of facts, clear resolve, and timely action. Facing the challenges of climate change also necessitates a sustained and systemic response. ***Connecticut can lead by example with its public agencies, policies, and resources, an unbiased interdisciplinary realignment, and a dual-lens of science and equity.***

Ecosystems, public health, and community resilience are connected. Natural systems benefited from the pandemic,[65] whereas a combination of international trade/travel and human interference in natural systems contributed to its occurrence (and to previous zoonotic events).[66] Protecting natural ecosystems, and restoring them where possible, is a first principle in protecting our future. The Department of Energy and the Environment is the steward of the State's environment and the public trust, with clear ethical responsibilities and standards.[67] It is imperative to be proactive in mitigation and adaptation with evidence-based actions - and, in some cases, humility and patience.

Impacts are local, and community engagement and local action are essential. The wide-ranging European Network for Community-Led Initiatives on Climate Change and Sustainability (ECOLISE)[68] published their first status report in 2019: "*Reshaping the Future: How local*

[64] https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0163852
[65] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7139249/
[66] http://www.emro.who.int/about-who/rc61/zoonotic-diseases.html
[67] https://portal.ct.gov/DEEP/Laws/Ethics/Ethics-Statement
[68] https://www.ecolise.eu/

communities are catalyzing social, economic and ecological transformation in Europe."[69] In a comprehensive review of dozens of grassroots and community-led initiatives across Europe, the report concluded that local, community-led action is essential and effective - and requires both technical and social innovation. Community-led initiatives can "*buffer risks rather than creating dependencies, systematically addressing gaps in the provision of necessary goods and services to build resilient local-regional economies rooted in ethics of care for people and nature*." (pp 118). The impacts of climate change can be addressed creatively by the multisolving potential of community-based programs.

Climate change impacts are expected on community lifelines of food and water. Impacts include the availability and safety of the food we consume and the water we need to drink and recreate (among many other uses). Adaptation is necessary, and a longer growing season and opportunities to support local gardeners and farms and increase carbon, biodiversity, and soil health on farmland may bring distributed emissions reductions and new incentives for farmers. To ensure vibrant local systems, farms need to be supported to fulfill their primary mission of growing food or providing resources. Protecting clean water and local food production and processing in Connecticut is an essential investment in reduced emissions, self-reliance, and the region's future: a recent global metanalysis showed that smaller farms grow proportionally more food, more diverse crops, and waste less.[70] Expanding EBT/SNAP benefits offered at farmer's markets to year-round programs can improve public health and equity and support farms and community resilience.[71]

Climate change is expected to globally increase multiple public health risks, including effects on bacteria, viruses, parasites, chemicals, and biotoxins linked to food and waterborne disease.[72] Connecticut is relatively fortunate, but changing rainfall patterns, extreme weather events, and increasing air and water temperatures will affect people directly and increase the persistence and occurrence of invasive species, bacteria, viruses, harmful algae, and corresponding risk of waterborne disease in food.[73] See the GC3 Public Health and Safety Statement of Health Impacts – Water-related Illness for a discussion of some of these risks. For this and other reasons, *increased long-term monitoring of and protection for healthy soil and diverse natural systems is imperative.*

Dr. Rebecca Shaw, Chief Scientist at World Wildlife Fund (WWF), put a spotlight on the core issue: "*One of the things that science has told us in the last decade so clearly is that we depend on intact natural systems and intact natural ecosystems, in all its component parts, to deliver*

[69] https://www.ecolise.eu/wp-content/uploads/2016/02/Status-Report-on-Community-led-Action-on-Sustainability-Climate-Change-in-Europe-2019.pdf

[70] https://www.sciencedirect.com/science/article/pii/S2211912417301293?fbclid=IwAR2pFFIi3aXzofpF9mDX2ps7TpAUibu7XDre6cTNCV13YdopBjaLvhr_VT4

[71] https://portal.ct.gov/DSS/SNAP/Farmers-Markets

[72] https://www.who.int/foodsafety/publications/all/Climate_Change_Document.pdf?ua=1

[73] https://www.who.int/publications/i/item/food-safety-climate-change-and-the-role-of-who

those things we count on every day: clean air, clean water, pollination, a stable climate, food, healthy soils to produce the foods we eat" and "*that health is declining and declining fast*." The recent WWF report - Living Planet 2020[74] builds on previous reports and does not equivocate: "*Our relationship with nature is broken."*

Protecting and restoring "Right Relationships"[75] in Connecticut starts with water and nature. Connecticut has outsized natural beauty and rich biodiversity for a small, densely populated state[76] - bordered by two other small and even-more densely populated states. We need to affirm this natural heritage – loved by all ages and all types of people across the State - as a major strength and steward it effectively. Forests are the most biodiverse terrestrial ecosystem; Connecticut's forests are the most carbon-dense in the region and host critical corridors on the *Eastern Wildway*[77] - a network for north-south species movement. Connecting[78] and stewarding nature is fundamental in protecting clean water and addressing the impacts of climate change.

Climate change impacts and future risks necessitate a proactive and strategic balance. The Working and Natural Lands Reports affirm that we need responsible management and stewardship of all types of land in Connecticut and for many reasons. Some research reports suggest making water the primary value of forests; forests and trees regulate the water, energy, and carbon cycle,[79] and New England's forests are now recognized globally for their role in climate stabilization.[80] Regarding working lands, technical assistance is needed in the emerging research area of climate-friendly forestry and farming. Simple solutions like retaining and buffering old forests, old-growth remnants and large trees preserves a disproportionate amount of biodiversity and forest carbon in the interim.[81] Composting adds carbon to farmland and can reduce our waste stream. Coordinated programs could facilitate this regionally, and, as noted above, keeping resources and jobs in local communities is essential to community resilience and self-reliance.

In parallel with land for resource production, prioritizing suitable land as natural areas as free as possible from unnecessary manipulation (similar to the stewardship of a National Park) is supported by diverse scientific evidence and a pressing need to protect the interior forest.[82] Public natural areas provide intergenerational experiences for people and are anchored on protecting what we know is important and the public trust held in *a)* unknown species, molecules and connections, and *b)* the ongoing process of evolution and natural selection.

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[74] https://www.worldwildlife.org/publications/living-planet-report-2020
[75] https://www.thechangingearth.net/
[76] https://www.statista.com/statistics/183588/population-density-in-the-federal-states-of-the-us/
[77] https://wildlandsnetwork.org/wildways/eastern/; http://apps.fs.usda.gov/Evalidator/evalidator.jsp
[78] https://www.nature.com/articles/s41467-020-18457-x
[79] https://www.sciencedirect.com/science/article/pii/S0959378017300134#bib0515;
[80] https://advances.sciencemag.org/content/6/36/eabb2824.full
[81] https://www.nature.com/articles/nature07276; https://news.harvard.edu/gazette/story/2020/08/new-englands-trees-capturing-more-carbon-says-25-year-study/;
https://www.frontiersin.org/articles/10.3389/ffgc.2020.594274/full;
[82] https://www.nature.com/articles/srep00653;

Protected and connected areas provide ecological integrity and the possibility that the full complement of species can migrate, adapt, and evolve.

Connecticut has a strong public and private commitment to land conservation of all stripes and hosts the country's largest state-level land conservation conference.[83] Connecticut's 2018 Green Plan recommended protecting 21% of Connecticut by 2023,[84] with 10% owned by DEEP and 11% by other public and private partners. We are short of goal (at 75%), and right now, only ~1% of Connecticut's land has strong protection as a nature preserve, i.e., like a National Park. Adequately protecting and monitoring public lands and waters intended as nature preserves is urgent for climate, biodiversity, and public health. They also provide an opportunity to integrate a range of Nature-Based Solutions into a comprehensive Climate Mitigation Approach.

New England's forests are relatively young (trees can live for hundreds of years) and on average can hold more than twice the carbon they do now.[85] Some forests are less likely to have invasive plants and older forests may be better able to withstand climate change stresses and continue to provide resources.[86] The Forests and Natural Lands Working Group have identified the following options enhance the role of forests in climate (change) mitigation solutions:

- A*void conversion of forest* to non-forest,
- *Mitigation-focused forest management – (*e.g., extending rotation periods and retaining more and larger trees), and
- *Reforestation* (conversion from non-forest to forest).

The development of effective and equitable mitigation-focused forest management policies will require research and broad consultation. Two well-established approaches are used currently in forests managed by the Connecticut Department of Energy and Environmental Protection (passive and active management). Natural regrowth and proforestation (growing suitable existing forests)[87] have recently been identified from a climate perspective as low-cost and immediate mitigation opportunities: 1) Natural regrowth was quantified recently as more powerful than realized previously;[88] 2) Proforestation can maximize carbon storage and ecological and structural complexity over time, similar to the management in the Adirondacks, Federal Wilderness Areas and National Parks in the United States, and in areas that may be termed "reserves," "forever wild," and similar.

The details of these management decisions and practices are complex, with a range of costs, risks and benefits; however, a strategy that maximizes climate mitigation and ecological value in Connecticut while minimizing impacts on society must be developed. This will require a significant effort by technical experts in ecology, forestry, climatology, and economics, and

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[83] http://www.ctconservation.org/annualconference
[84] https://portal.ct.gov/DEEP/Open-Space/The-Green-Plan
[85] https://academic.oup.com/forestscience/article/57/6/489/4604514;
[86] https://academic.oup.com/aobpla/article/10/1/ply003/4812670;
https://onlinelibrary.wiley.com/doi/10.1111/gcb.14656;
[87] https://www.frontiersin.org/articles/10.3389/ffgc.2019.00027/full;
[88] https://www.nature.com/articles/s41586-020-2686-x;

extensive consultation with affected stakeholders. Regulations and incentives to engage private landowners to implement mitigation-focused forest management will also be needed to maximize the impact.

Climate change impacts dictate that we "protect the best, restore the rest.[89]" Multiple global efforts have identified this simple approach - strategic planning of natural infrastructure centered on the principles of harm reduction and evidence-based decision-making. Mapping and connecting headwaters and cold water fisheries, invasive-free, healthy and recovering areas, special habitats and interior forest, and old-growth forest remnants will protect and (re)establish ecological integrity and the full range of species and molecular diversity. Natural stewardship with long-term monitoring[90] of intact, healthy and/or recovering areas offers mitigation and adaptation and provides for spiritual renewal, recreation, equity, science, education, and evolution. It works alongside dedicated research and restoration programs and resource partnerships, supports working lands and a range of options and advice for private landowners, and offers a strategic plan to address degraded areas across the state – and particularly in urban areas that have the most to benefit.[91] Together these efforts can work in a positive manner to reduce ongoing chemical use, reduce invasive plants, support total biodiversity and habitat programs dedicated to specific species, and increase the cumulative carbon stored on our land.[92] As noted in our recommendations, comprehensive place-based efforts can offer many co-benefits.[93]

Some impacts of climate change on nature are inevitable. Evolution is part of the solution. Framing change in a dynamic system and within evolutionary history provides perspective while we try, as quickly as possible, to realign our relationship with nature and improve ecoliteracy. Natural systems are complex and resilient and evolve more rapidly under stress: new research shows that tree species can adapt their germ line,[94] some ash trees can survive the emerald ash borer,[95] and even small wild places on riparian corridors and in urban areas provide critical links. Much is unknown, and the public strongly supports natural spaces on public land. The importance of nature for self-care and personal resilience was in full view as people flocked to natural areas during the pandemic.

Long Island Sound is part of Connecticut's natural landscape and one of our states' largest and most critical natural resources. Although not specific to any working group, many of our large-scale climate impacts are related to Long Island sound (sea level, precipitation, etc., noted

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[89] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6474764/; https://www.nature.org/en-us/what-we-do/our-insights/perspectives/10-steps-new-deal-for-nature-biodiversity/#forests;

[90] https://www.wildlandsandwoodlands.org/sites/default/files/W%26W%20Science%20update%202018.pdf

[91] https://onlinelibrary.wiley.com/doi/abs/10.1111/rec.13175; https://www.nature.com/articles/s41467-020-14496-6;

[92] https://cteco.uconn.edu/projects/carbon/Tomasso_webinar_14_9_23.pdf

[93] https://www.parkwatershed.org/wp-content/uploads/2020/01/Park_EnvEd-report.pdf

[94] https://onlinelibrary.wiley.com/doi/full/10.1002/evl3.121

[95] https://cdnsciencepub.com/doi/abs/10.1139/cjfr-2018-0320?mobileUi=0&journalCode=cjfr; https://www.nrs.fs.fed.us/disturbance/invasive_species/eab/control_management/lingering_ash/

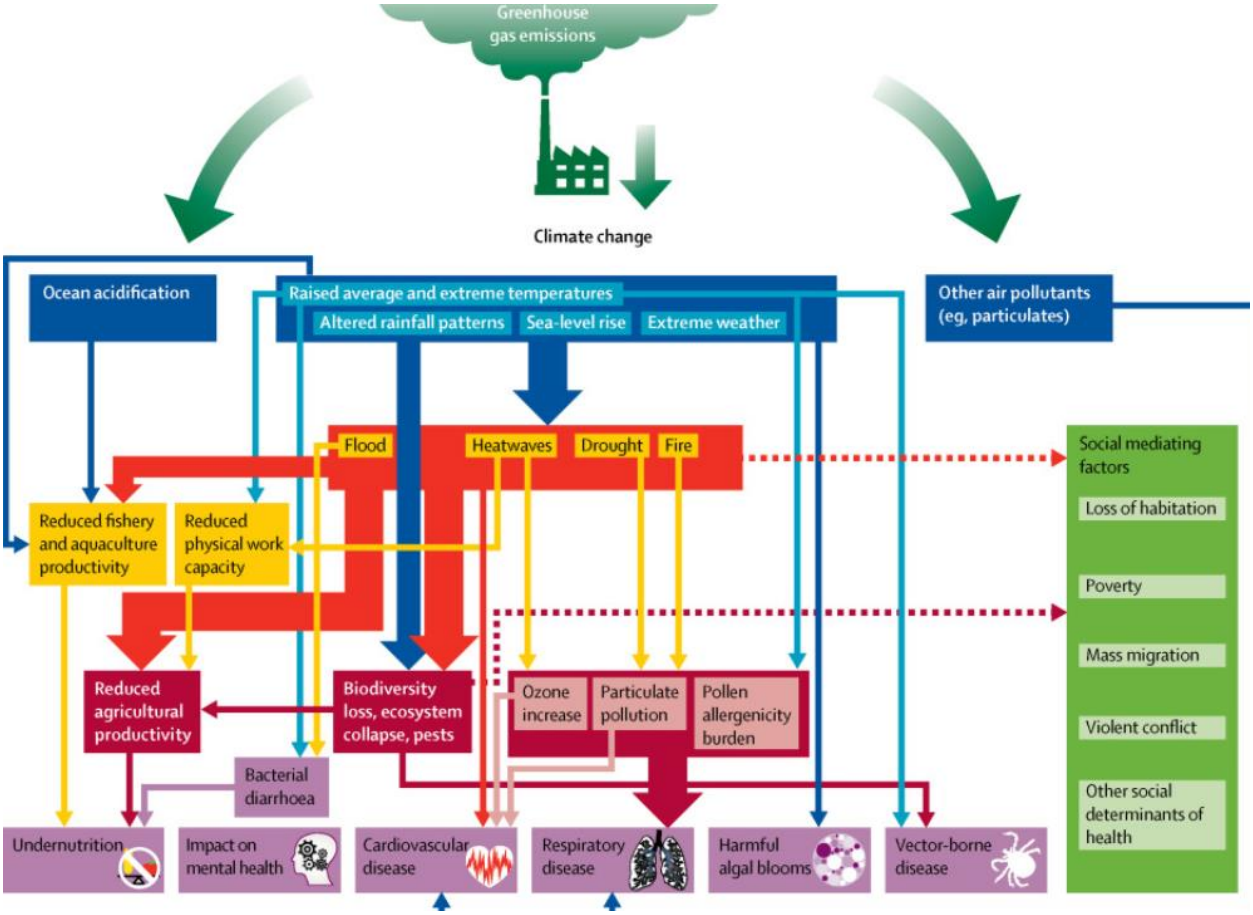
above, as well as ocean acidification, water quality, biodiversity). Vulnerable built and natural communities near the shore include wastewater infrastructure, ecosystems, fisheries and aquaculture, and more. All have community and economic impacts, and one of multisolving's benefits is the entire system is engaged: conflicts of interest cannot dominate, and everyone is focused on solving multiple problems for multiple benefits. This common-sense approach maximizes private and public good: generating new ideas that reexamine silos and habits to add new opportunities.

Climate impacts on our health are seen and unseen. Evidence-based approaches are needed to be good stewards of the natural world and our public health. These two actions are reinforcing, and each is complex, with acute and chronic components and opportunities for multisolving. A recent global consensus report described below outlines how climate actions focused on multisolving and protecting children have long-term co-benefits and help other vulnerable populations.[96]

A collaboration of 27 leading academic institutions, the United Nations, and intergovernmental agencies from every continent lighted the primary relationship between climate and health. Of particular note: the consensus report on climate and health broke down silos from its inception by including world experts in climate science, ecology, mathematics, geography, and engineering; energy, food, livestock, and transport experts; economists, and social and political scientists as well as the requisite public health professionals and doctors. This is the type of multisolving and interdisciplinary thinking that is needed to address climate change impacts and realign priorities.

The schematic below (from the report) links climate impacts to ecological, physical, and social wellbeing and is a snapshot of some of the interactions and complexities. Many of these impacts are featured by other working groups or discussed briefly above. We emphasize that the links between climate change and health deserve a high priority for *harm reduction* and *evidence-based decision-making* based on the principles of *preventative medicine* - and with a perspective that considers long-term and cumulative impacts for multiple benefits and optimal solutions.

[96] https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(18)32594-7/fulltext



We further emphasize that diverse impacts of climate change on health can have cumulative *transgenerational* effects, and climate-induced stress can limit or prevents recovery from any other acute and chronic stress(es). We acknowledge the critical role of nutrition in all aspects of health, and, as noted above, we see opportunities to reduce transportation-related emissions and prevent economic impacts on Connecticut's local farms while supporting community resilience and public health. Related to this, we further highlight the impacts of a climate *crisis* on mental health and well-being – the foundation of good decision-making and long-term strategic planning.

Climate impacts on mental health and personal resilience is a major, escalating concern. It will affect our ability to take care of ourselves, take care of each other, and take appropriate action. Mental health is precious asset that can be compromised at any time by tragedy, injury, stress and anxiety, lack of sleep, chronic poor nutrition, social isolation, and myriad environmental factors. Preexisting vulnerabilities and acute stress precipitate a range of devastating and costly problems like chronic mental illness, cognitive decline, drug addiction, relapse, domestic abuse, homelessness. While rates of mental illness (anxiety, depression, schizophrenia) are typically

higher in urban areas,[97] they increased more in rural areas during the pandemic.[98] Nevertheless, climate change-related anxiety is found across the landscape, across all demographics, and has been increasing: depression, drug overdoses, and suicidal thoughts (e.g., Hayes et al., 2018).[99]

In a study of nearly 2 million in the US, exposure to extreme weather, multiyear warming and tropical cyclones each were associated with increased mental health problems (stress, depression, and problems with emotions) (Obradovich et al., 2018).[100] Rates of negative psychological effects of climate change are particularly high among children and young people (Burke et al., 2018).[101] This should be a matter of grave concern, and a major impetus for positive messaging and community-based education and action, as there are direct measurable effects on short and long-term health, and secondary effects seen in poor school performance (e.g., Sheffield & Landrigan, 2011).[102]

Immediate changes are possible and known to improve immune function and mental health, such as increased opportunity for time spent in natural outdoor environments (e.g., Vanaken & Danckaerts, 2018)[103] aligning with a general research agenda to explore the relationship between nature contact and health,[104] even in urban forests.[105] A recent biodiversity intervention in a day care showed immune system benefits in children within one month. [106] SHIFT (**S**haping **H**ow we **I**nvest **F**or **T**omorrow) is an organization dedicated to the advancement of nature as a social determinant of health. The 2019 conference was devoted to the business case for protecting nature. The SHIFT conference in 2020 was titled "*Healthy by Nature*.[107]

Evidence-based *resilience* and *prevention* opportunities to support brain health in young people are a particular priority: the future is in their hands, and they are vulnerable to developing a lifelong mental illness.[108] Mental health and climate change was recognized in a major report

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[97] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5374256/

[98] https://content.apa.org/fulltext/2020-38395-001.html

[99] Hayes, K., Blashki, G., Wiseman, J., Burke, S., & Reifels, L. (2018). Climate change and mental health: risks, impacts and priority actions. *International journal of mental health systems*, *12*, 28. https://doi.org/10.1186/s13033-018-0210-6

[100] Obradovich, N., Migliorini, R., Paulus, M. P., & Rahwan, I. (2018). Empirical evidence of mental health risks posed by climate change. *Proceedings of the National Academy of Sciences of the United States of America*, *115*(43), 10953–10958. https://doi.org/10.1073/pnas.1801528115

[101] Burke, S., Sanson, A. V., & Van Hoorn, J. (2018). The Psychological Effects of Climate Change on Children. *Current psychiatry reports*, *20*(5), 35. https://doi.org/10.1007/s11920-018-0896-9

[102] Sheffield, P. E., & Landrigan, P. J. (2011). Global climate change and children's health: threats and strategies for prevention. *Environmental health perspectives*, *119*(3), 291–298. https://doi.org/10.1289/ehp.1002233

[103] Vanaken, G. J., & Danckaerts, M. (2018). Impact of Green Space Exposure on Children's and Adolescents' Mental Health: A Systematic Review. *International journal of environmental research and public health*, *15*(12), 2668. https://doi.org/10.3390/ijerph15122668

[104] https://ehp.niehs.nih.gov/doi/10.1289/EHP1663

[105] https://link.springer.com/article/10.1007/s11676-019-00916-x?utm_source=TrendMD

[106] https://advances.sciencemag.org/content/6/42/eaba2578;

[107] https://shiftjh.org/the-2020-shift-summit/

[108] https://www.biologicalpsychiatryjournal.com/article/S0006-3223(20)31738-8/abstract
https://www.who.int/news-room/fact-sheets/detail/adolescent-mental-health

coauthored more than three years ago by the American Psychologial Association.[109] Prevention is key, and regular sleep and quality food are essential for mental health and personal resilience. For teens, later school start times to allow for adequate sleep have multiple co-benefits (Wahlstrom & Owens, 2017).[110] Long term interventions like healthy nutrition have many benefits and can help support community resilience and our local farm-based economy (Adan et al., 2019).[111] To extend this idea, formal and informal farm-based work opportunities and treatment programs for mental illness can be successful and examples of local, community-based multisolving.[112]

The International Transformational Resilience Coalition is a professional consortium that has been raising awareness and gathering resources to be preventative and support personal resilience in the face of climate impacts.[113] In Connecticut a veteran-led organization has been focused on building resilience in veterans and first responders, but the training and skills apply to anyone.[114] A new partnership between CT DEEP and Department of Mental Health and Addiction Services recognizes the importance of mental health and the benefits of nature.[115] Overall, public health and mental health are topics well-suited for multisolving and new ideas.

The Role of Continuous Public Education and Positive Cultural Change

The impacts of climate change require rapid acceleration of positive education and cultural change. Impacts are and will continue to be dynamic, and the good news is that humans are highly adaptable - education is life-long and takes many forms. Leveraging the intersection between a growth-based mindset and intrinsic motivation is needed.[116]

Multiple impacts of climate change risk being worsened by poor scientific literacy or by defending positions motivated by non-scientific concerns.[117] Scientific literacy is variable across communities - even as it more important than ever to translate science to public policy in ways that benefit everyone. A well-informed citizenry that understands the power of compassion, collaboration and cooperation is best positioned to change habits and be

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[109] https://www.apa.org/news/press/releases/2017/03/mental-health-climate.pdf
[110] Wahlstrom, K. L., & Owens, J. A. (2017). School start time effects on adolescent learning and academic performance, emotional health and behaviour. *Current opinion in psychiatry*, *30*(6), 485–490. https://doi.org/10.1097/YCO.0000000000000368
[111] Adan, R., van der Beek, E. M., Buitelaar, J. K., Cryan, J. F., Hebebrand, J., Higgs, S., Schellekens, H., & Dickson, S. L. (2019). Nutritional psychiatry: Towards improving mental health by what you eat. *European neuropsychopharmacology: the journal of the European College of Neuropsychopharmacology*, *29*(12), 1321–1332. https://doi.org/10.1016/j.euroneuro.2019.10.011
[112] https://www.gouldfarm.org/
[113] http://www.theresourceinnovationgroup.org/intl-tr-coalition/
[114] https://www.mindfulresponder.org/
[115] https://portal.ct.gov/DEEP/News-Releases/News-Releases---2020/DMHAS-and-DEEP-Announce-Series-of-Wellness-Activities-in-State-Parks
[116] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5836039/
[117] https://www.pnas.org/content/114/36/9587

proactive, practice self-care, and make good (and sometimes difficult) decisions in the face of impacts. Polarized views can occur most often among knowledgeable individuals whose scientific understanding is colored by conflicts or religious or political viewpoints.

A first step is to emphasize that science is not just for "experts." Science is everywhere and part of everything we do. It is our cultural history and an ongoing process of facing the known vs. the unknown. Science and technology should not be intimidating: an informal but implicit scientific process is part of the trial (and error) of cooking, gardening, fishing, fixing things. It is implicit in improving your health, caring for a sick loved one, or raising a healthy child. It is part of the process of developing new tools, skills, habits or relationships, and in the ongoing innovation found in many professions that are not termed as "scientific" per se – artists, craftspeople, farmers, business owners, educators of all stripes.

A building block of scientific literacy is understanding the natural world that sustains us. Currently, Next Generation Science Standards are not a "core" content area: there is no daily requirement in early grades. Confidence in scientific thinking should be established early with respect to our primary reality, i.e., personal health, ecosystems, and climate – as well as an appreciation and an undertstanding that so much is still unknown. Updated these standards, mobilizing more scientists for regular public outreach, updating public websites, and supporting a range of professionally-facilitated and organized training and citizen science projects can offer so many co-benefits. We need to instill an ethos of caring for ourselves, each other and our natural heritage – not only because we need all of these things to survive, but also because these things are precious, priceless and beautiful.

Protecting natural ecosystems and "wild" areas that are healthy and/or recovering is essential - across the State and around the world. This is multisolving on many levels. Ultimately this is a small percentage of the overall landscape, but ***we need to prioritize clean water and the integrity of self-sustaining processes and natural selection where possible***. We need to protect the public trust and natural heritage held in our headwaters, cold water fisheries, riparian and wildlife corridors, special habitats, and interior, old and old growth forests. Nature creates young forests and structural diversity over time – there is no way to prevent it. But only patience creates complex intact habitats with full native biodiversity – including molecules, species and ecological interrelationships we have not even discovered.

The GC3 process positions Connecticut as a leader in a genuine dual commitment to science and equity. The Science and Technology Working Group is united in aligning with known science, admitting uncertainty, and forging interdisciplinary policies that apply the principles of ***1)*** *harm reduction*: reducing negative climate impacts of existing activities and services; and ***2)*** *evidence-based medicine*: ongoing decision-making based on the intersection among public good, public values and the best science. Emerging technologies and ongoing research will help us measure changes, integrate knowledge, and prioritize our ability to address expected (and unexpected) impacts and inequities.

Appendix I: Response to Public Comments

Here we summarize and address relevant and frequent themes that emerged from the comments on the Science and Technology Working Group's draft report. We then outline the main revisions. Multiple members reviewed the full public record.

Summary of comments: Several comments acknowledge our broad, inclusive report and supported "multisolving." Dozens of comments emphasize "protecting trees," "protecting nature," (some further specified protecting reserves, forests, wetlands, riparian corridors) and aligning with science. There is support for public education on climate science, distributed energy, carbon-free energy and transportation, energy efficiency and appropriate siting, community-led action, and removing subsidies for energy production from woody biomass. There is a focus on equity and for a "do no harm" approach.

There are questions about impacts and projections. There is strong opposition (from individuals and groups) to a new "fracked gas" power plant. There are detailed comments, including objections, on forests as a topic in the Science and Technology report. There is mixed support/opposition to proforestation (growing suitable existing forests). Proforestation is not a new idea, and the term arose recently from climate science and ecology as a natural climate solution with power and scale. It is relevant in New England and recommended in the "*World Scientists' Warning*" and in a consensus letter signed by members of the National Academy of Sciences, the IPCC, and dozens of established leaders in climate science and ecology. https://sites.tufts.edu/gdae/files/2020/05/EU-Forest-Letter-3.pdf

Summary of response and revisions: After the close of the comment period, we held two additional public meetings and reorganized and edited the report. In the revised version, we raise the prominence of the idea that removing greenhouse gases from the atmosphere (negative emissions) should be considered a component of the State's initiative to reduce **net emissions**, which was one motivation for the discussion of the State's ecosystems management strategies in the draft. We recognize more explicitly that a wide range of natural solutions for mitigation and adaptation should be promoted through coordinated research and evaluation. We also clarified the wording of the projection for temperature change and clarified a recommendation on proforestation.

Overall this report addresses climate change mitigation approaches, the likely impacts of climate change on Connecticut, and the need for adaptation strategies. Our goal is to be positive and proactive, and the term proforestation triggered considerable attention and some objections in the comments. We intended to recognize that special areas (old and/or carbon-dense forests, unfragmented and invasive-free ecosystems, headwaters, special habitats, and wildlife and riparian corridors) held in the public trust should be protected for multiple reasons. This has been highlighted in previous state plans and reports, but they have little or no special protection to date. The main point is that stewardship and management of the State's forests (and other ecosystems) should include climate change mitigation goals and that this approach can have other co-benefits. A panel of technical experts and stakeholders should consider a range of innovative approaches and recommend an effective science-based strategy.

Appendix II: Emerging Recommendations

Initial Recommendations for Actions to Implement Adaptation and Resilience Strategies

From the Science and Technology Working Group (draft, in no particular order)

Climate Change Communication for Public Engagement Develop professional certification program for unified messaging of Climate Change Impacts and Actions.	
Recommended Implementation Action Description	To implement any climate change strategy an understanding of what is at stake is required. The public must feel empowered to respond to needed behavioral changes that improve climate conditions effecting their health, their environment and earth systems. A training strategy for formal and informal educators to be effective communicators of climate change models, imagery, impacts and resilient actions will reach audiences from K-12 school systems, current and future teachers, municipal leaders and diverse community groups all needing to take collective action for improved outcomes. Development of a certification and professional development process for formal and informal education professionals supports the growth of science education, educational professional development and elevates the profession of environmental science throughout Connecticut.
Completion Timeframe	A timed, tier strategy for development of training is required to meet the levels of necessary outreach: Immediate financial support will continue the educational activities as specified in Public Act 18-181 Section D and currently conducted by DEEP and DOE with expansion to focus on diversification of professionals in the field of environmental and science education while providing knowledge and access to climate change educational materials. Create certification program for informal application and educational professional credit through college system within 2 years. Within 5 years, have an environmental education certification program for continuing education credit and high school career development through unified partnership of community and or private colleges. Leading to employment and higher education enrollment.
Implementation Entities	CT DEEP, Education Outreach, CT State Department of Education, CT State Department of Education, Higher Education Department, Coalition of Colleges and Universities, Connecticut Outdoor and Environmental Education Association, Connecticut Science Teachers Association, CT Green LEAF School Program
Climate challenges addressed	Education builds involvement in change. All actions suggested require public buy in and understanding. The ability to effect change and have an impact is learned. Public demand for improvements requires an understanding of what is at stake and what are our options. Education is not just for children. These same messages and concepts need to be taught to municipal and regional leaders, businesses, and advocates. Informal education centers serve the community and schools increasing environmental literacy that reflects the goals of our state and engages the public in taking action to alter behavior that reduces climate impacts. Successful messaging and education does not just happen. It requires a systematic plan to involve community, government, and educational systems working together as stated in the CT Environmental Literacy Plan. Unified messages of climate change education through public outreach education is the direct pipeline

	to public understanding of what is being asked of them and how they can engage in behavioral change that supports improvement in carbon levels, pollution reduction, land choices, community supported science, and personal action. Climate mitigation and adaptation actions are only considered when they are seen as possible and that comes with repeated and consistent messaging.
Protection of vulnerable communities	Public Act 18-181 section D identifies the support of climate change education in K-12 curriculum. Elementary educators, on average, provide only one hour of science education per week due to a variety of reasons. A common reason is lack of science training and security with the subject matter. Funding for educational support of teachers in underserved communities is a priority within the state education system. Access for science enrichment trainings has declined for all of Connecticut schools with the high-risk cities showing the greatest stress. Loss of grants and time constraints have squeezed school systems limiting access and opportunities. Increased educational training for formal and informal educators in urban and underserved communities, with a focus to increase diverse leaders in these fields, connects school to home and home to communities. Diversity is needed in science professions and in environmental sciences to effectively reach our diverse population. Developing a trained community of environmental professionals that reflect the demographics of our communities increases connections within communities. Underserved communities are at highest risk to climate impacts for health and safety. Targeting efforts in these already high priority areas will strengthen community growth and serve to increase environmental literacy of the communities through the community of schools.
References for action	*Classroom Teacher More Effective than Outside Presenter for Climate Change Education*. Journal of Environmental Education Research Vol. 18 2012 issue 5 *Teaching Climate Change: What educators should know and can do.* Danial Shephardson and Andrew Hirsh, American Educator VOL. 43 Number 4 Winter 2019-2020 Weather and Climate NGSS Concept Map;North American Association of Environmental Educators. https://naaee.org/sites/default/files/conference/session/naaee_research_symposium_2017.pptx

Advance Connecticut's Capacity for Water Quality Observations in Long Island Sound: Relevance to Food Safety and Security	
Recommended Implementation Action Description	Climate change has a profound impact on the availability and the safety of the food we consume and is expected to result in a significant increase in risk to public health through its effects on bacteria, viruses, parasites, and chemicals & toxins linked to foodborne diseases. Changing rainfall patterns, increases in extreme weather events, and increasing air and water temperature affect the persistence and occurrence of bacteria, viruses, harmful algae and corresponding foodborne disease. See the GC3 Public Health and Safety Statement of Health Impacts – Water-related Illness for a discussion of these risks. A number of predictive models incorporating oceanographic, meteorologic and remote sensing data are available to assist resource managers in forecasting Harmful Algal Blooms (HABs), naturally occurring bacteria such as Vibrio spp., and waterborne pathogens (such as Norovirus) related to sewage contamination, all of which have the potential to impact food safety and human and animal health. In order to be reflective of local conditions, these predictive models must be informed by high quality baseline monitoring of environmental parameters and in-situ sampling of water, phytoplankton, and indicator organisms. Existing oceanographic models can be applied to multiple areas for forecasting, however significant in-situ monitoring gaps exist, notably continuous and/or real-time water quality observations in near-shore coastal areas of Long Island Sound. Recommendations: Advance the State's capacity for real-time monitoring of water quality conditions through a robust in-situ observational network; Support the creation of an advisory committee tasked with identifying partner agencies, conducting an inventory of existing in-situ observational platforms and relevant water quality data sources, and prioritization of needs for forecasting efforts; Promote a comprehensive approach that builds upon existing monitoring efforts with guidance from the advisory committee; Integrate monitoring of water quality conditions in Long Island Sound for application to forecasting food safety related hazards (HABs, pathogens, etc.) via the NowCOAST system
Completion Timeframe	Support the creation of a Water Quality Observations Advisory Committee comprised of state entities listed below with technical advisors from academia and federal agencies: Inventory existing in-situ observational platforms and relevant water quality data sources, conduct risk analysis to identify gaps, and prioritize needs for coordination with existing operation platforms and forecasting efforts through NOAA NowCOAST: 3 to 5 years Implement recommendations of the advisory committee: Greater than 5 years
Implementation Entities	NOAA (NCCOS and NWS), NowCOAST, NERACOOS, LISICOS, EPA, USGS, Academic Institutions, DEEP, Department of Agriculture, Department of Public Health, municipalities, NGOs

Climate challenges addressed	Increasing climate-ocean impacts threaten marine species and ecosystems that are essential for sustaining jobs, supporting coastal economies, practicing cultural traditions and feeding billions of people around the world. These impacts will worsen in the future without urgent action. Climate change increases the frequency and severity of extreme weather events which impacts food security. Improved forecasting for unsafe conditions related to food will help managers prevent foodborne disease related to fisheries product safety and nutrition, as well as prevent economic losses related to disease outbreaks and recalls. Related GC3 Focus Areas: Equity and Environmental Justice Science and Technology Adaptation and Resilience Working and Natural Lands Public Health and Safety Drinking Water • Recreational Waters • Vector-borne Disease • Mental Health, Nutrition, and Food Safety • Floods and Storms • Vulnerable Populations • Health Co-benefits of Climate Hazard Mitigation
Protection of vulnerable communities	Vulnerable communities protected include food insecure, low-income populations who practice sustenance harvesting of fish, shellfish and seaweeds from impacted coastal waters. Low-income and immigrant workers are employed in the fisheries industry and improved forecasting protects these communities from unemployment.
References for action	Food Safety, Climate Change, and the Role of World Health Organization https://www.who.int/foodsafety/publications/all/Climate_Change_Document.pdf?ua=1 https://www.who.int/publications/i/item/food-safety-climate-change-and-the-role-of-who NOAA Ecological Forecasting https://oceanservice.noaa.gov/facts/ecoforecasting.html Lake Erie Harmful Algal Bloom Forecast https://tidesandcurrents.noaa.gov/hab/lakeerie.html USGS NowCast Great Lakes https://ny.water.usgs.gov/maps/nowcast/ NOAA NowCoast https://nowcoast.noaa.gov/ NOAA NCCOS Vibrio Predictive Models https://products.coastalscience.noaa.gov/vibrioforecast/northeast/default.aspx#LI Long Island Sound Coastal Observatory (LISICOS) http://lisicos.uconn.edu/ NERACOOS http://neracoos.org/

Recommended Implementation Action Title: Join the International Association to Combat Ocean Acidification (OA Alliance) and commit to furthering the five goals identified in the Alliance's Call to Action.	
Recommended Implementation Action Description	Carbon dioxide generated by human activity has increased the acidity of global oceans by approximately 30% since the Industrial Revolution. Essential marine species and ecosystems that sustain jobs, support economies in coastal communities, continue cultural traditions, and provide protein/food for millions are threatened by climate-ocean impacts including ocean acidification. The Ocean Acidification (OA) Alliance was formed following catastrophic losses of oysters at West Coast hatcheries in 2007 and 2008. The Alliance's Call to Action identifies five goals that members work together on to "highlight ocean acidification as an imminent threat to coastal economies and ocean ecosystems". Advance Scientific Understanding Reduce Causes of OA Build Adaptation and Resiliency Expand Public Awareness Build Sustained International Support The OA Alliance members include national governments, US states, municipal governments, and indigenous nations. The States of Maine, New York, Washington, Oregon, California, and Hawaii are members of the OA Alliance. There are no costs to join the OA Alliance. The only requirement is to develop an OA Action Plan and work to implement it and advance the five goals listed above. Benefits to joining the Alliance include support from the organization and guidance from other members. Joining the OA Alliance complements and further supports the GC3's mid-term reduction target recommendation was adopted by the Connecticut General Assembly when it passed An Act Concerning Climate Change Planning and Resiliency (Public Act 18- 82).
Completion Timeframe	Join the Alliance: Less than 1 year Development and adoption of the Action Plan: 3 to 5 years Implementation of Recommendations: Greater than 5 years
Implementation Entities	Join the Alliance: Governor, Commissioners of DEEP and Agriculture Development of Action Plan : Task Force with input from State and Federal Agencies, Municipalities, NGOs, Academic Institutions, Tribes

	Implementation: State and Federal Agencies, Municipalities, NGOs, Academic Institutions, Tribes
Climate challenges addressed	Increasing ocean acidification combined other climate-ocean impacts threaten marine species and ecosystems that are essential for sustaining jobs, supporting coastal economies, practicing cultural traditions and feeding billions of people around the world. These impacts will worsen in the future without urgent action.
Protection of vulnerable communities	Protecting shellfish, crustaceans, and fish communities from impacts of acidification protects minority communities that rely on these natural resources for sustenance as well indigenous people
References for action	International Alliance to Combat Ocean Acidification https://www.oaalliance.org/ Ocean Acidification Alliance Toolkit https://www.oaalliance.org/wp-content/uploads/2020/06/OAlliance_APToolkit_DOWNLOAD.pdf Northeast Coastal Acidification Network (NECAN) http://www.necan.org/references/ https://www.dec.ny.gov/lands/114877.html NY OA Task Force NY has agreed to assist CT with creation of the plan as it pertains to shared waters and resources. Many of the recommendations developed for the NY OA Action Plan are applicable and can be adapted to the CT waters of Long Island Sound. https://env.chem.uconn.edu/the-long-island-sound-lis-respire-program/# https://www.sciencedirect.com/science/article/pii/S0272771414001553

Recommended Implementation Action Title: Appoint a task force to develop an Action Plan to research, monitor, and address coastal acidification impacts to natural resources including shellfish, crustaceans, and fish	
Recommended Implementation Action Description	Carbon dioxide generated by human activity has increased the acidity of global oceans by approximately 30% since the Industrial Revolution. Essential marine species and ecosystems that sustain jobs, support economies in coastal communities, continue cultural traditions, and provide protein/food for millions are threatened by climate-ocean impacts including ocean acidification. Many coastal states are developing Ocean Acidification Action Plans to address the challenges posed by ocean acidification. We recommend that Connecticut also take this step. Development of a Task Force and Action Plan complements and is supported by the GC3's mid-term reduction target recommendation was adopted by the Connecticut General Assembly when it passed An Act Concerning Climate Change Planning and Resiliency (Public Act 18- 82).
Completion Timeframe	Creation of the Task Force: Less than 2 years Development and adoption of the Action Plan: 3 to 5 years Implementation of Recommendations: Greater than 5 years
Implementation Entities	Appointment of task force members: CGA Development of Action Plan: Task Force with input from State and Federal Agencies, Municipalities, NGOs, Academic Institutions, Tribes Implementation: State and Federal Agencies, Municipalities, NGOs, Academic Institutions, Tribes
Climate challenges addressed	Increasing ocean acidification combined other climate-ocean impacts threaten marine species and ecosystems that are essential for sustaining jobs, supporting coastal economies, practicing cultural traditions and feeding billions of people around the world. These impacts will worsen in the future without urgent action.
Protection of vulnerable communities	Complements Equity and Environmental Justice Concerns: Protecting shellfish, crustaceans, and fish communities from impacts of acidification protects minority communities and indigenous peoples that rely on these natural resources for sustenance.
References for action	International Alliance to Combat Ocean Acidification https://www.oaalliance.org/ Ocean Acidification Alliance Toolkit

	https://www.oaalliance.org/wp-content/uploads/2020/06/OAlliance_APToolkit_DOWNLOAD.pdf Northeast Coastal Acidification Network (NECAN) http://www.necan.org/references/ https://www.dec.ny.gov/lands/114877.html NY OA Task Force NY has agreed to assist CT with creation of the plan as it pertains to shared waters and resources. Many of the recommendations developed for the NY OA Action Plan are applicable and can be adapted to the CT waters of Long Island Sound. https://env.chem.uconn.edu/the-long-island-sound-lis-respire-program/# https://www.sciencedirect.com/science/article/pii/S0272771414001553

Example of Multi-solving Recommendations Incentivizing regenerative and sustainable practices that improve soil health and increase soil carbon and expanding year-round the benefits to local farms that are offered at farmers markets. Outcomes will be tracked based on farm survival, sustainability and revenues, as well as biodiversity and public health benefits and GHG mitigation.	
Recommended Implementation Action Description	Sustainable agriculture that increases land-based carbon, local food systems and local resource use can dramatically reduce GHG emission, increase community resilience, and improve health. We recommend that local whole foods from CT farms that are supported at $2 food/ $1 EBT transfer at farmers markets be expanded to CT supermarkets year-round. This improves health, supports community resilience and soil health, and increases land-based carbon.
Completion Timeframe	These time frame categories are a guide to implementation of this action: Less than 2 years 3 to 5 years Greater than 5 years This is a combination of new programs and incentives for farms and an expansion of an existing program.
Implementation Entities	Agencies, CGA, Municipalities, NGOs, Academic Institutions, etc. that may participate in the action.
Climate challenges addressed	This has the potential to reduce carbon emissions, N2O, and methane, and improve soil health long term. Needs expertise in this area to ensure these actions. Less transportation of food decreases GHGs as does improved public health.
Protection of vulnerable communities	Expanding farmers markets benefits is is a direct benefit for vulnerable communities. Improving soil health is a benefit for everyone.
References for action	Provide links to plans, reports, academic papers, etc. that support the action or where the action was first proposed, as applicable.* *pending*

Recommended Implementation Action Title As part of an adaptation strategy, evaluate how to address EJ lack of open space recreational opportunities in distressed communities while simultaneously prioritizing ecological integrity and ecosystem services.	
Recommended Implementation Action Description	Secure new open space as recreational opportunities for EJ communities; restore open space by planting trees if needed; and/or protect existing tree cover to increase carbon sequestration and protect carbon storage.
Completion Timeframe	These time frame categories are a guide to implementation of this action: Less than 2 years
Implementation Entities	CT DEEP, CGA, Municipalities, NGOs, Civic Groups may participate in the action.
Climate challenges addressed	Action provides means to sequester and store carbon, while also providing needed recreational opportunities, which offer other co-benefits, such as improved physical and mental health.
Protection of vulnerable communities	Provide new open space recreation opportunities located within a municipality considered as Targeted Investment Community or Distressed Municipality (CGS section 32-9p CGS)
References for action	Draft Conservation and Development Policies: The Plan for Connecticut, 2018-2023

Recommended Implementation Action Title Proactively address the climate change effects on health/mental health with preventative approaches	
Recommended Implementation Action Description	Prioritize ways to support health and prevent mental illness, particularly in young people and vulnerable communities
Completion Timeframe	These time frame categories are a guide to implementation of this action: Less than 2 years (immediately)
Implementation Entities	DEEP, DPH, DMHAS and others
Climate challenges addressed	Mental health problems are increasing, deplete collective resources and capacity to respond to climate change, and risk our ability to make decisions and participate in resilient communities. Some priorities that reduce anxiety include: Proactive planning as a public process to reduce anxiety Community lifelines of food, water, transportation, health care Access to natural areas, biodiversity interventions in schools/daycares Adequate sleep – statewide change to school start times for teens
Protection of vulnerable communities	Poor and urban areas suffer disproportionately from mental illness and are at increased risk due to climate change
References for action	See report. Climate Change and Health in CT 2020 Report, Yale Center on Climate Change and Health, Laura Bozzi and Robert Dubrow https://publichealth.yale.edu/climate/YCCCH_CCHC2020Report_395366_5_v1.pdf

Recommended Implementation Action Title Remove Woody Biomass from eligible Class 1 Renewable Energy Sources in the CT Renewable Portfolio Standard (RPS)	
Recommended Implementation Action Description	Remove Woody Biomass from eligible Class 1 Renewable Energy Sources
Completion Timeframe	These time frame categories are a guide to implementation of this action: Less than 2 years (immediately)
Implementation Entities	DEEP, PURA
Climate challenges addressed	Biomass energy, particularly wood biomass, emits more CO2/Btu than coal, and most biomass fuels are not renewable on the time scales that matter for meeting the Paris Agreement goals. It is critical to prevent sources of CO2 emissions to limit global warming. Burning biomass fuel also releases toxins and particulates damaging to public health.
Protection of vulnerable communities	Biomass facilities are often located in close proximity to vulnerable populations and create inequities in public health due to particulate and toxic emissions. Reducing CO2 emissions and global warming will ameliorate impacts on vulnerable communities which are often first and most affected.
References for action	Sterman et al, ERL, 2018; Dvivedi et al., ERL 2019 Brack, D. and King, R. (2020), Managing Land-based CDR: BECCS, Forests and Carbon Sequestration. Glob Policy. doi:10.1111/1758-5899.12827

Recommended Implementation Action Title Prioritize CO2 mitigation and research on public land to ensure protection of healthy ecosystems and evidence-based restoration and management of habitats that require intervention; ensure old-growth forest and remnants are protected.	
Recommended Implementation Action Description	Allow suitable existing natural public forests to grow to maximizes carbon accumulation and ecological complexity. Protect old-growth forests and remnants as they are essential to protecting the full range of native species, including species still-to-be-discovered.
Completion Timeframe	These time frame categories are a guide to implementation of this action: Less than 2 years (immediately)
Implementation Entities	DEEP
Climate challenges addressed	Immediate approach to maximize negative emissions. Provides opportunities for long term monitoring, climate migration, natural selection. Reduces loss of carbon from the land (mitigation) and enables prioritizing sufficient resources for monitoring and restoring habitats, maintaining existing young habitats where needed, restoring habitats - I.e. those with invasive plants and excessive deer browse that are not regenerating. Opportunity for outreach and public education, mental health
Protection of vulnerable communities	Places for respite, cooling, recreation and science and education across the state. Equitable access to nature.
References for action	See report and previous State plans

Water Inundation Encourage adaptation strategies that will ameliorate the effects of water inundation	
Recommended Implementation Action Description Focus on precipitation intensity Long island sound	Precipitation intensity is expected to increase as a result of climate change. Existing natural habitats have the potential to become overwhelmed by an increase in flooding events and water quality is expected to be impacted by elevated levels of stormwater runoff. The functionality of natural habitats, which naturally filter and retain precipitation, should be bolstered by reducing existing stressors such as invasives and habitat fragmentation, and by increasing natural habitat conservation within and around developed areas. Practices should be implemented to reduce water runoff, combined sewer overflow and non-point source pollution. Guidelines for drinking water facilities should be updated to compensate for an increase in water contamination. (2011 report)
Completion Timeframe	These time frame categories are a guide to implementation of this action: Less than 2 years 3 to 5 years Greater than 5 years
Implementation Entities	DEEP, DOT, UConn, Yale, CIRCA, etc. Municipalities
Climate challenges addressed	Flooding events Sea level rise Decrease in water quality Habitat degradation and erosion
Protection of vulnerable communities	Vulnerable communities in Connecticut likely to be negatively impacted by water inundation. Most of the population in CT lives along or next to a waterbody. Cities are most likely to be impacted by combined sewer overflow
References for action	*Pending*

New construction and infrastructure will need to take into account and review current environmental policies regarding the impacts of climate change on water inundation in Connecticut. They should prioritize green infrastructure.

Vector-borne and Zoonotic Diseases Intensify monitoring for vectors and develop strategies for controlling arthropods and zoonotic pathogens that threaten public and veterinary health	
Recommended Implementation Action Description	Vector-borne and zoonotic diseases (VBZDs) threaten the health of humans, pets, wildlife, and livestock. Consistent monitoring using standardized methods to track new and emerging zoonotic pathogens and their hosts, as well as arthropod vector species and their associated pathogens, should be intensified. Evidence-based vector control strategies that use integrated pest management (IPM) to minimize pesticide resistance and reduce risk to pollinators and other non-target organisms should be developed and deployed in areas at high risk. Partnerships with regional vector control specialists, academic scientists focused on risk and prevention, and with veterinary and wildlife specialists for predicting risk, are crucial to mitigating the geographic spread of vector species and zoonotic disease agents. Sustainable, public education efforts that include science-based information on risk assessment source reduction, personal protection, habitat modification, and should be intensified.
Completion Timeframe	These time frame categories are a guide to implementation of this action: 3 to 5 years Greater than 5 years
Implementation Entities	CT: CAES, CT DPH, WCSU, UCONN, YALE SPH, YALE EIP, CT DEEP With consultation/partnership with NEVBD, USDA, CDC
Climate challenges addressed	Rainfall effects, water inundation Temperature change Extreme weather events
Protection of vulnerable communities	Children and elderly adults are at particular risk for vector-borne diseases. Efforts to increase prevention education for these populations are needed, as well improved science communication regarding safe and judicious use of pesticides.
References for action	Hunter, P.R. 2003. Climate change and waterborne and vector-borne disease. Journal of Applied Microbiology. 94: 37-46S. Tabachnick, W.J., 2010. Challenges in predicting climate and environmental effects on vector-borne disease episystems in a changing world. Journal of Experimental Biology. 213: 946-954. Rocklov J., and Dubrow, R. 2020. Climate change: an enduring challenge for vector-borne disease prevention and control. Nature Immunology. 21: 479-483.

Establish a Program for Research, Planning, and Education of Climate Change Impacts on Health, Ecosystems, Biodiversity, Water, Food, and Soil.	
Recommended Implementation Action Description	Urgent recommendation, provides baseline for future measurement An inter-agency, inter-sector program should be developed to coordinate and synthesize important and complex adaptations to climate change. The focus would be on Health, Ecosystems, Biodiversity, Water, Food, and Soil. Research includes past and current monitor as well as projection to >2050 using modeling of climate change, topic-specific, and social-equity indexes. Topic-specific mapping tools should be designed for Connecticut to assist adaptation strategies. Education and engagement of citizens should harness the extensive environmental and health networks in Connecticut, but advances with digital technology tools, such a citizen-monitoring mobile apps and virtual-simulation of scenarios in the state. This program coordinates between counties, state, and Northeast Region. It can start with a coordinator in a state department, or hybrid institute like CIRCA, to build a program that serves as a hub for incremental expansion.
Completion Timeframe	Greater than 5 years
Implementation Entities	Connecticut Institute for Resilience and Climate Adaptation, Department of Energy and Environmental Protection, Department of Public Health, Department of Education, Green Bank, Sustainable CT, Connecticut Agricultural Experiment Station, Yale/University of Connecticut and higher education institutions, environmental-health NGOs and professional associations, Coalition of Northeastern Governors.
Climate challenges addressed	The primary changes projected for Connecticut will impact all six components of this program. The adaptation program centralizes and integrates with technological advancement to predict future risks and engages the citizens. Deeper awareness will move climate adaptation to public participation in mitigation.
Protection of vulnerable communities	Survey data indicates that the most vulnerable populations are most interested in climate change. This program uses social vulnerability index to predict the risks and provides accessible tools to empower their adaptation and mitigation of climate change exposures and risks. Critical to measure benefits within local communities.
References for action	IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp. Shi L, et al. 2016. Roadmap towards justice in urban climate adaptation research. Nature Climate Change 6: 131–137. French, R. 2018. Creating a Resilient Connecticut Coast: Constructing Infrastructure to Adapt to a Changing Climate. American Geophysical Union, Fall Meeting 2018, abstract #GC52A-04. O'Donnell, J., et al. 2018. Adapting to the Town-Scale Impacts of Climate Change in Connecticut. American Geophysical Union, Fall Meeting 2018, abstract #PA42B-10.

Climate Education Develop and educate about climate and health impacts and adaptation to other sectors of state government, municipals, NGOs, and public schools.	
Recommended Implementation Action Description	The public health risks and adaptation from climate change should be educated across state and local government departments. The developing public health impact and adaptation should be disseminated to the public by communicating with health-environment institutions, NGOs and professional societies. One goal is to develop an educational platform, including mapping tools, vulnerability indexes, mobile applications to engage citizens in monitoring the causes and symptoms of climate-related diseases. Modernized educational curriculum and tools should be developed for distribution to public schools and colleges. Coordination with regional and national coalitions would connect resources and patterns of health risks at a larger scale. Efforts need to include policy makers and teach about climate *science*
Completion Timeframe	3 to 5 years
Implementation Entities	Department of Public Health, state and local government departments, Sustainable CT, Yale University, University of Connecticut, Connecticut State Universities and other private/public universities, state health-environmental NGOs and professional societies, state media network, Coalition of Northeastern Governors, regional and national alliances on climate change and health.
Climate challenges addressed	Projected changes in temperature and precipitation will produce a wide range of public health risks from heatwaves to flooding to escalation of infectious diseases. Public interests in personal health would engage and mobilize citizen efforts in climate mitigation and adaptation.
Protection of vulnerable communities	Educational programs will be coordinated with the development of equity index tool to target vulnerable populations in our state for each public health risk.
References for action	Shaman J, Knowlton K. 2018. The Need for Climate and Health Education. Am J Public Health 108:S66-S67. doi: 10.2105/AJPH.2017.304045 Rohat, G., A. Monaghan, M. H. Hayden, S. J. Ryan, and O. Wilhelmi. 2020. Intersecting vulnerabilities: Climatic and demographic contributions to future population exposure to Aedes-borne viruses in the United States. Environ. Res. Lett. (in press). doi: https://doi.org/10.1101/732644. Semenza, J.C, David E. Hall, D.E, Daniel J. Wilson, D.J., Brian D. Bontempo, B.D. David J. Sailor, D.J., and George, L.A. Public Perception of Climate Change: Voluntary Mitigation and Barriers to Behavior Change. Behavioral and Public Communication 35: 479-87.

Identify and Conserve Ecosystem Services Identify and conserve ecosystem services vulnerable to climate change	
Recommended Implementation Action Description	Forests, marshes and other natural areas that are important for carbon sequestration, cumulative carbon, and emission reduction. Natural areas that protect riparian zones (wetlands, rivers, etc.). Wildlife corridors that protect wildlife and increase biodiversity. Forests and other natural areas that provide ecosystem services necessary for maintaining public health, such as drinking water, control of insects that carry vector-borne diseases, mental health, clean air, heat stress, etc.
Completion Timeframe	Greater than 5 years (identify soon, conserve over time)
Implementation Entities	DEEP, DOT, UConn, Yale, etc.
Climate challenges addressed	Sea level rise and extreme weather events
Protection of vulnerable communities	Vulnerable communities are more prone to changes in infrastructure development that disturbs natural areas. These communities will also be more impacted by the public health aspect and will experience increased benefits from protecting ecosystem services.
References for action	See report, pending.

Climate Change Research and Education Identify research needs and disseminate current climate change adaptation research and technical resources to the appropriate stakeholders, and encourage future efforts through state grants	
Recommended Implementation Action Description	Research and technical assistance in the areas of Agricultural practices that maximize soil health, reduce erosion, and employ pest management practices that minimize risk on human health and ecosystems for farmers, potential new design standards for drinking water treatment facilities, or habitat management practices. Identify current climate change adaptation research and technical resources, such as academic institutions, government agencies and non-profits and connect them with appropriate stakeholders. Future research and technical assistance grant programs should prioritize the most vulnerable areas and promote collaboration between research/technical assistance entities. (2011 Report)
Completion Timeframe	Greater than 5 years
Implementation Entities	Agencies, CGA, Municipalities, NGOs, Academic Institutions, industries, etc. that may participate in the action.
Climate challenges addressed	*Pending, various*
Protection of vulnerable communities	*Pending, various*
References for action	*Pending, various*

Cross-check with other education recommendations

Support Ecosystem Services Encourage land stewardship behaviors that support ecosystem services	
Recommended Implementation Action Description	Incentivize and encourage: the creation of storm buffers for communities near water bodies the maximization of carbon storage and sequestration (i.e. the protection of carbons sinks such as old growth forests and salt marshes, etc.) the reduction of habitat fragmentation and protection of vulnerable habitats, increase connectivity the restoration of abandoned lands to natural ecosystem habitats Tax credits to incentivize landowners for ecosystem services. Invest in data and monitoring of carbon programs and research Promote private and public partnerships for data gathering and monitoring Incentivize restoration on abandoned lands. Increase ecological integrity and consider conversion of repetitive loss properties
Completion Timeframe	Various timeframes: Less than 2 years 3 to 5 years Greater than 5 years
Implementation Entities	DEEP, DOT, UConn, Yale, etc.
Climate challenges addressed	See report
Protection of vulnerable communities	Among many other benefits, restoration of abandoned lands could benefit vulnerable communities
References for action	*Pending*

Comprehensive Place-Based Implementation of Mitigation, Adaptation and Resilience Select and establish pilot region(s) to quantify and demonstrate the benefits of implementing a comprehensive climate resilience plan that is risk-based. At least one region should be an urban/suburban watershed in order to take advantage of the co-benefits of climate mitigation and adaptation, ecosystem services, and equity and community resilience. Identify and mobilize actions with a range of costs and timelines and leverage diverse stakeholders and funding sources.	
Recommended Implementation Action Description	Making Connecticut's communities equitable and resilient to climate risk impacts and its challenges requires timely local actions and cultural shifts. We recommend establishing pilot region(s) to showcase and quantify benefits of a comprehensive climate resilience plan. Targeted pilot projects must incorporate science, interdisciplinary goals of the GC3 and the vision outlined in state planning documents at a pace, scale and cost that can inspire broader changes. Pilots should be in different ecoregions, with at least one in an urban-suburban watershed to express the full range of co-benefits with a range of stakeholders, costs and timelines. This recommendation interfaces with all working groups and addresses both mitigation and adaptation.
Completion Timeframe	This is a plan with multiple timelines with near-term and long-term benefits for health and climate. Less than 2 years <u>Actions with immediate and long-term benefits – No cost:</u> Protect public natural assets; avoid degradation; identify key connections and areas for additional protection or restoration; identify partners for projects and identify funding; engage community; develop outreach, education, assessment. 3 to 5 years <u>Actions w/ known benefits/ no downsides - A range of costs:</u> Targeted depaving, ecological restoration, and community-based food and energy; mobilize science and education; establish iterative process with outreach, education, assessment. Greater than 5 years <u>Actions w/ coordinated planning, permitting and funding</u> More complex restoration and permitting, such as: stormwater projects, land acquisition, long term assessment and monitoring.
Implementation Entities	A wide range of Agencies, CGA, Municipalities, NGOs, Academic Institutions, etc. may participate in the action, as well as Sustainable CT. A wide range of benefits for a range of communities.