Connecticut Department of Energy and Environmental Protection

Connecticut Department of
ENERGY &
ENVIRONMENTAL
PROTECTION

Connecticut Emission Targets & Inventory

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CT Emission Targets

- An annual, sector-wide GHG inventory is done each year using federal, regional, and state level data: 1990-2017, the most recent year for which full data are available.
- The statewide GHG emission inventory is an important tool for tracking Connecticut's progress toward achieving statutory reductions set by PA-08-98 & PA-18-82.

GHG emission reduction targets:

√ Not later than January 1, 2020 reduce emissions to a level at least 10% below 1990 levels.

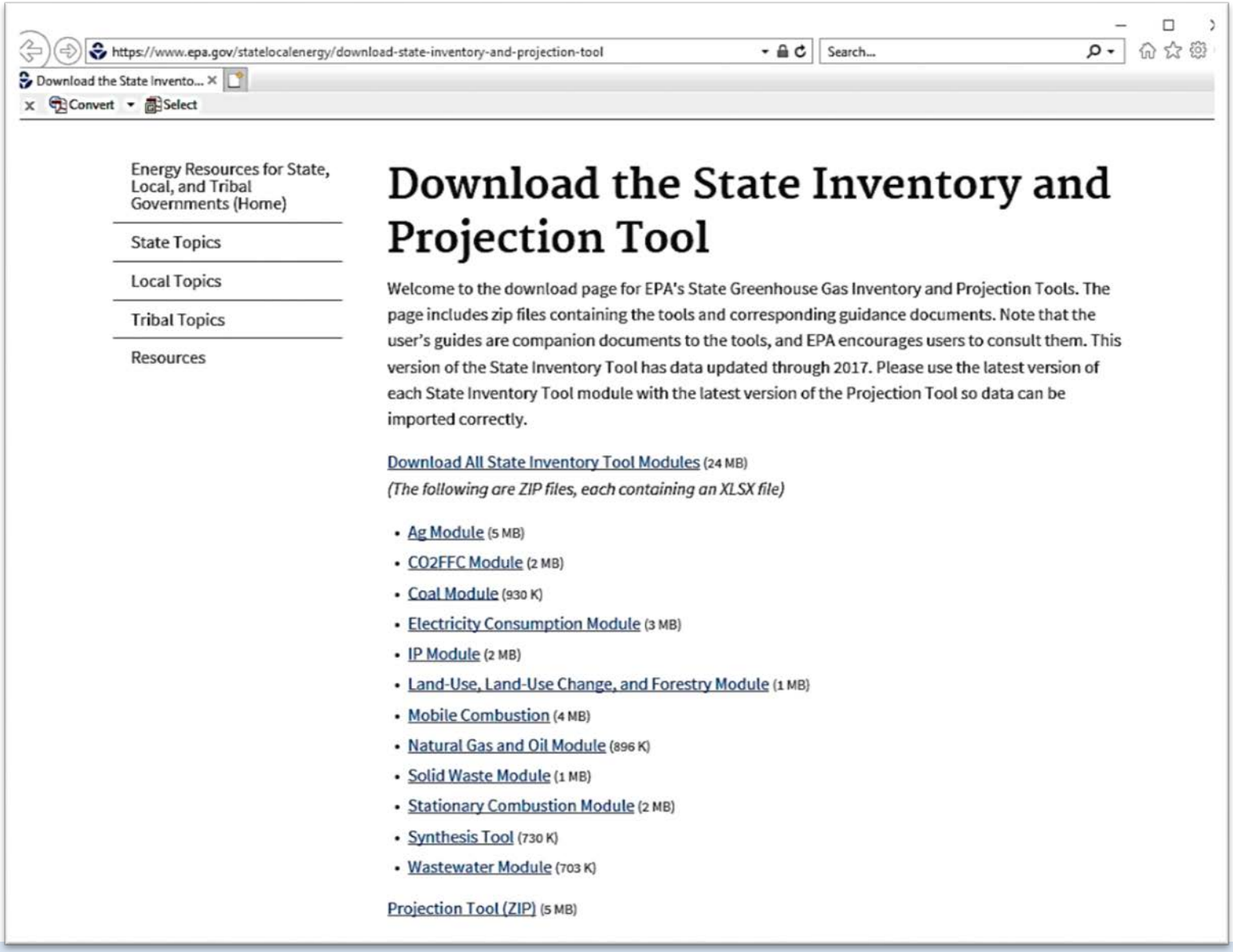
√ Not later than January 1, 2030 reduce emissions to a level at least 45% below 2001 levels.

√ Not later than January 1, 2050 reduce emissions to a level at least 80% below 2001 levels.

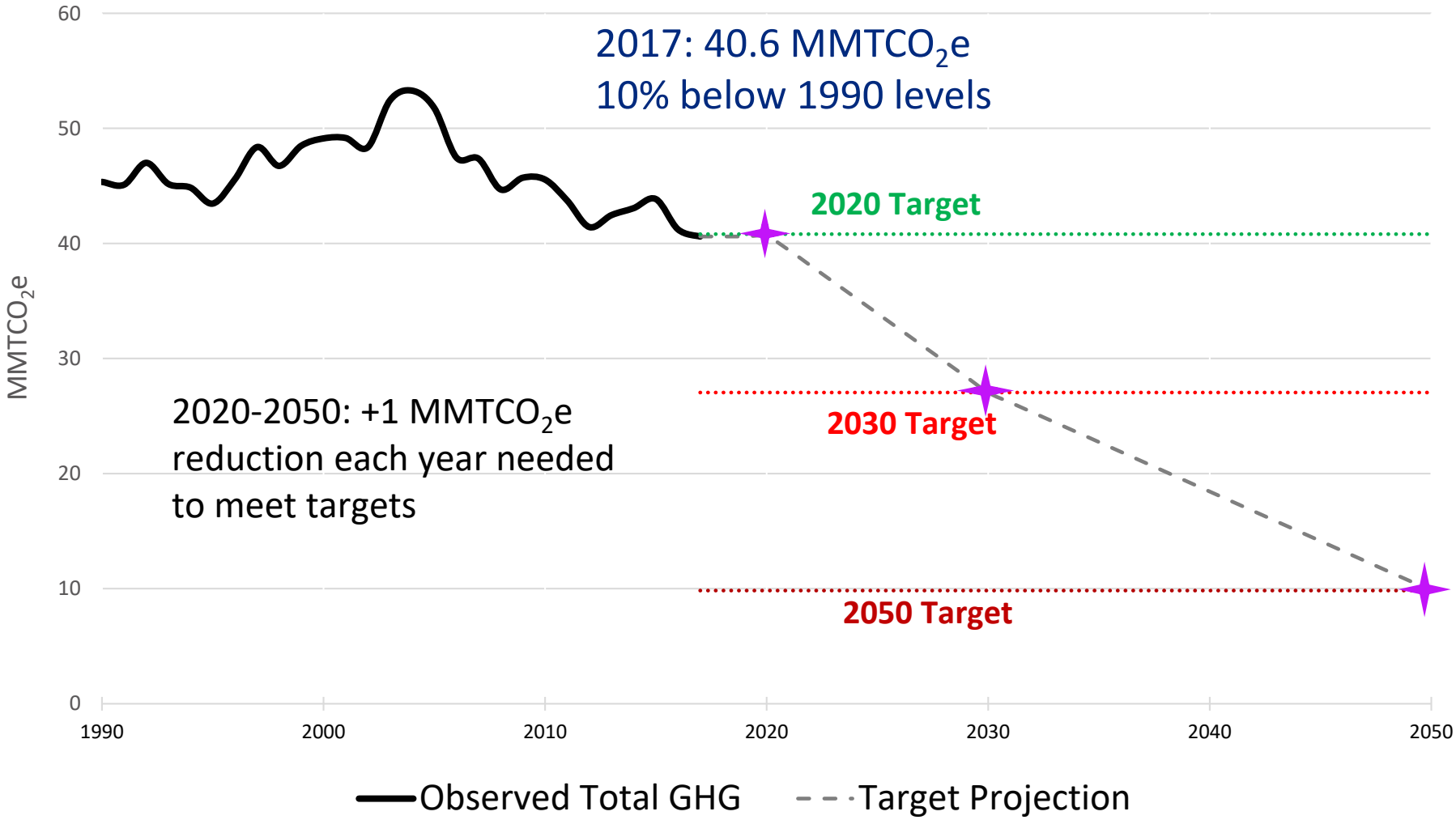
GHG Inventory Data/Methods

- Heavily based on the U.S. Environmental Protection Agency's State Inventory Tool (SIT).
  - Tool calculates sector-by-sector GHG emissions based on numerous state-level data sets.
- National statistics and state data (from EIA and federal sources) are used when appropriate.
- State demographic & transportation data are used for descriptive purposes.
- Default data is used most sectors (transportation, residential, commercial, industrial, waste and agriculture). Exceptions:
  - Solid-waste data from DEEP municipal waste program
  - **LULC and forestry default data not used => unreliable, questionable**
  - Consumption based accounting for electricity sector, based on MA DEP methodology
  - (NEW) Leakage from natural gas transmission and distribution systems data from PHMSA and PURA
- Sector estimates are subject to change based on adjustments to methods.

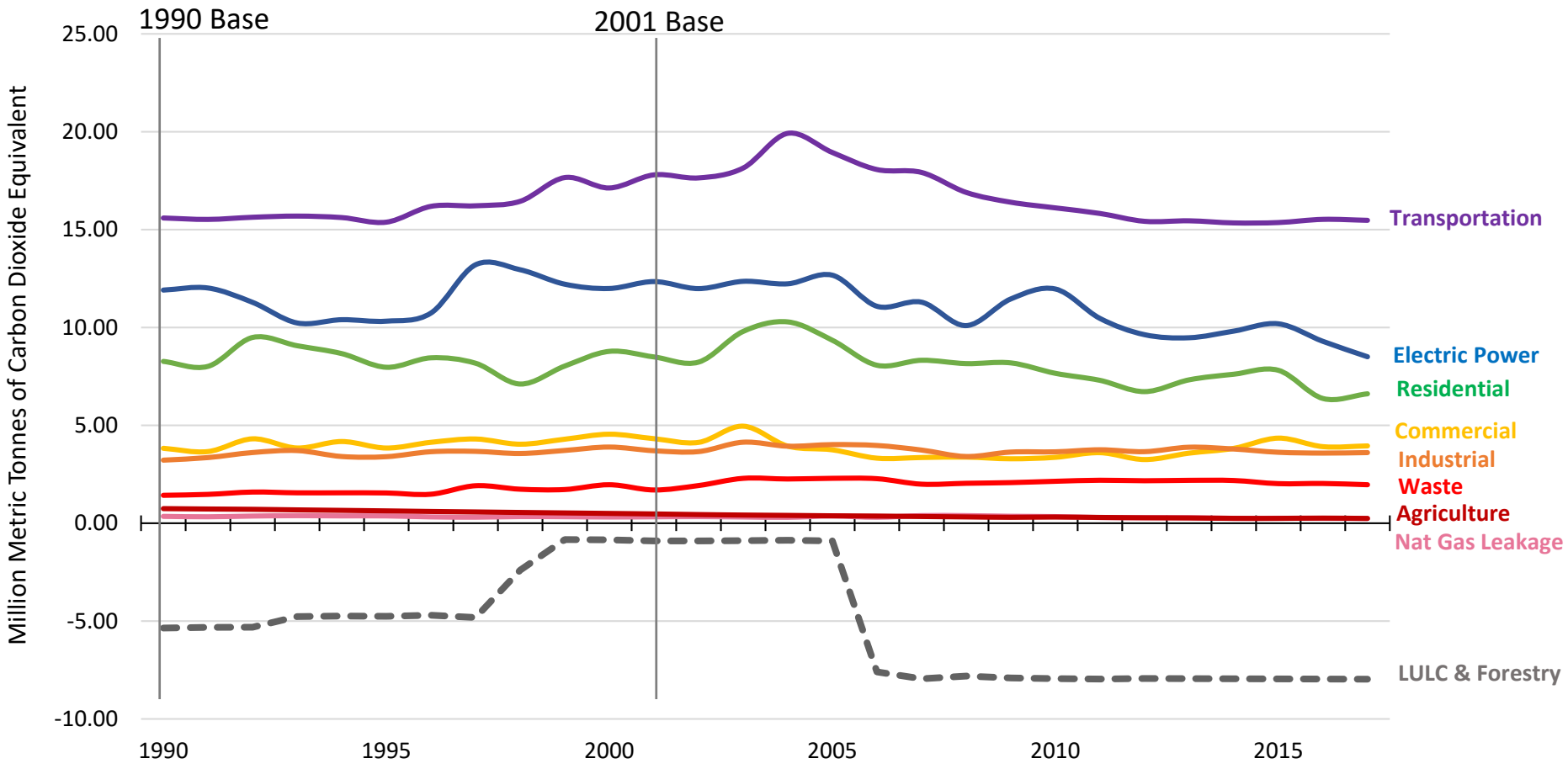
EPA SIT Modules



CT GHG Emissions 1990-2017, GHG Reduction Targets



Connecticut Annual GHG Emissions by Sector, 1990-2017



- Transportation Sector dominant source of GHG emissions: 38.1% of economy-wide emissions
- 2017 estimated LULC sequestered carbon: 20% of total 2017 emissions

EPA SIT LULC Module

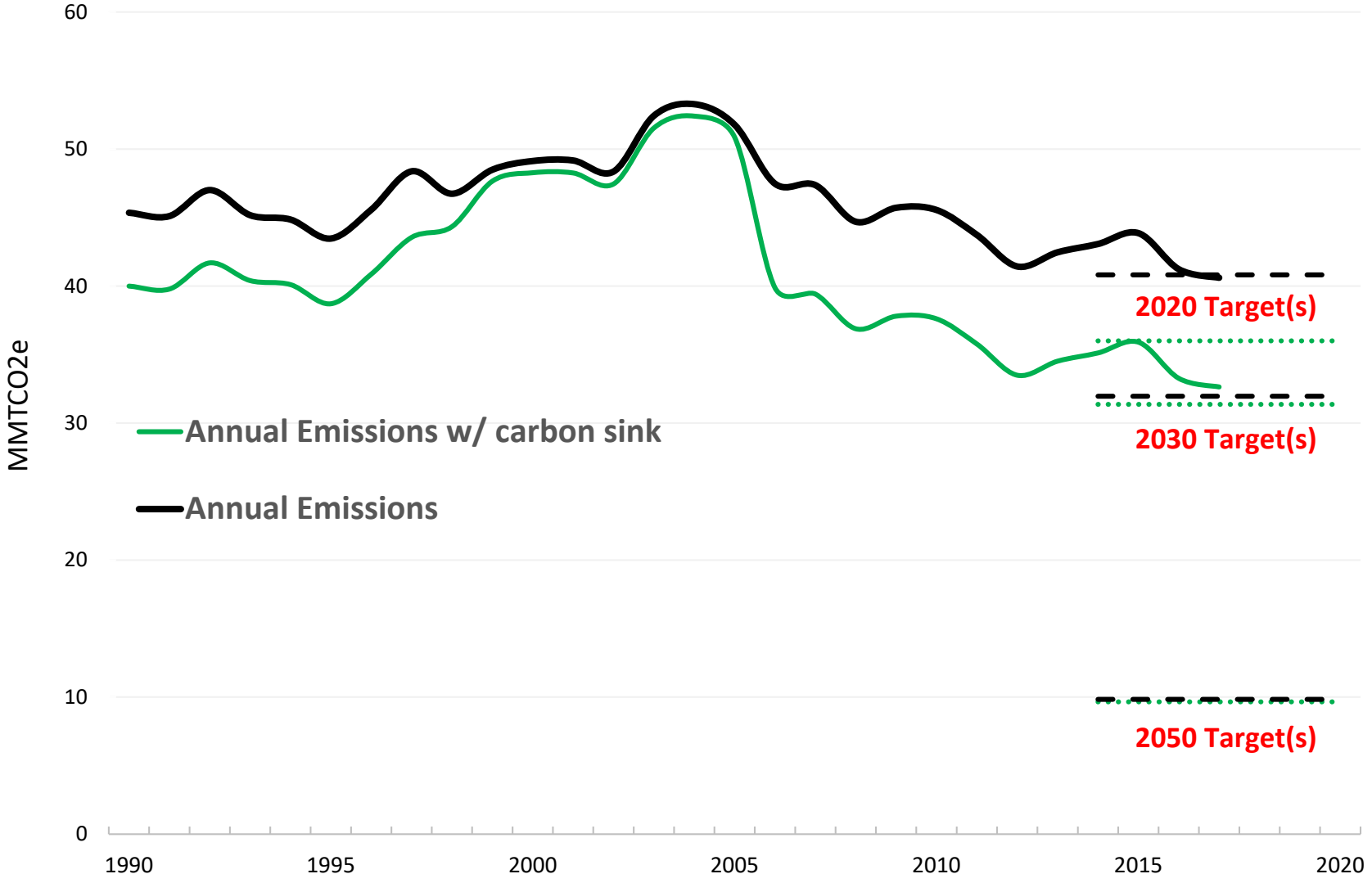
- Includes:
  - Forest Carbon Flux
    - Aboveground Biomass
    - Belowground Biomass
    - Dead Wood
    - Litter
    - **Soil Organic Carbon**

    } USDA Forest Service estimates from the Carbon Calculation Tool (CCT); static value from 2014-2017

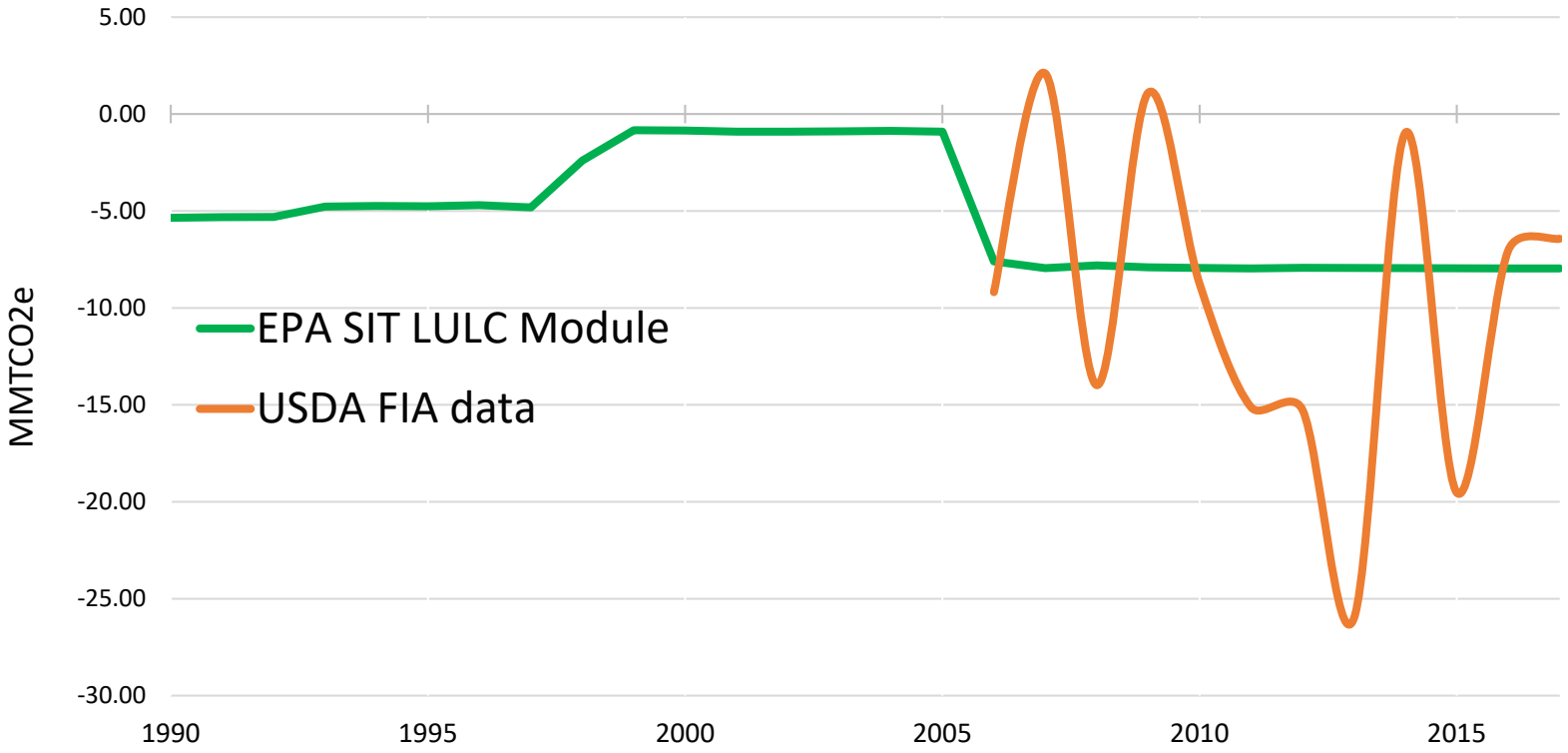
    - Total Wood Products and Landfills - USDA FS harvested wood product data; 1987, 1992, 1997 data used and extrapolated
  - Urban Trees – US Census urban area and static value for % of urban area with tree cover & sequestration rate
  - Landfilled Yard Trimmings and Food Scraps – based on population and static content ratio
    - Grass
    - Leaves
    - Branches
    - Landfilled Food Scraps
  - Forest Fires – NO DATA
  - N_2O From Settlement Soils – NO DATA
  - Agricultural Soil Carbon Flux - based on USDA NRCS estimates land use and land conversion

- Does not include – estimates from wetlands or coastal marshes

Emission Targets With & Without LULC Module Data



Forestry Carbon Sink from FIA Data



- FIA Data Problems: no/limited data availability before 2006; methodology changes & sampling

Future Inventory: Natural Lands & Land Use Sector

- Currently, CT does not account for GHG emissions from LULC Change and Forestry
  - Agricultural sector emissions are less than 0.6% of overall emissions, and no "sinks" are included
  - It can be estimated that 4-6 $MMTCO_2e/yr$ are sequestered in the forestry sector
    - BUT this is declining due to forest structure (age, type) & climate change (less soil sequestration & higher decomp rates)

- Prior research to assess carbon sequestration in the CT forestry sector (and natural working lands)
  - Tomasso and Leighton, 2014; Silver, 2015; Duveneck and Thompson, 2019
  - Connecticut's Forest Action Plan (2010, 2015, 2020 (not released))

- **Pending research with the US Climate Alliance, Natural & Working Lands Challenge & NASA Carbon Monitoring System (CMS)**

USCA NWL Challenge

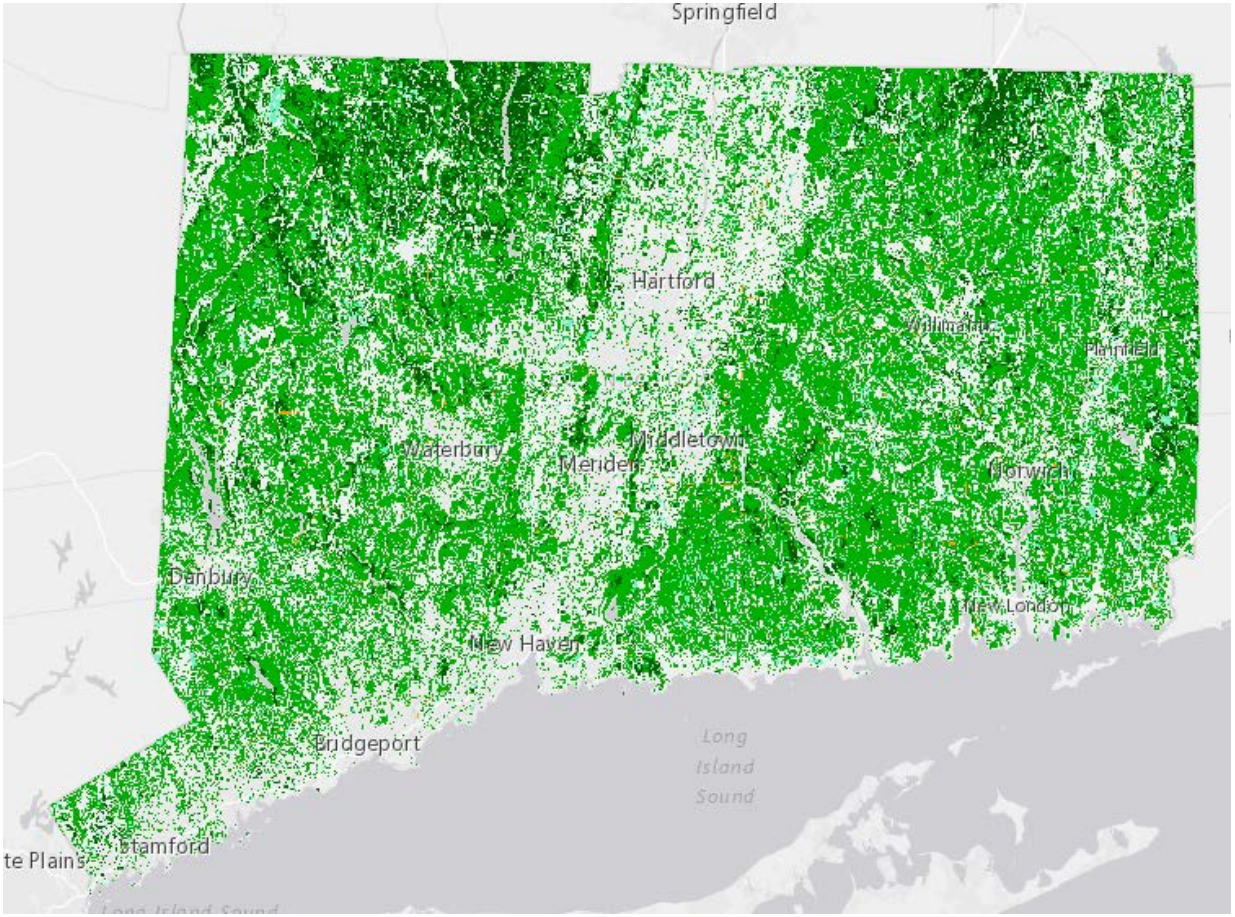
- "The USCA will work to identify best practices and policy pathways for protecting and enhancing resilient carbon sinks. USCA States will consider and, as appropriate, adopt practices that
  - increase long-term carbon sequestration in forests and forest products;
  - reduce losses from catastrophic wildfire and land-use change;
  - protect existing natural and working lands from conversion;
  - support healthy soils on farms and ranches;
  - restore coastal wetlands and sub-tidal habitats that protect shorelines against sea level rise;
  - restore ecosystems and open space for watershed protection and recreation;
  - and grow the urban forest and other greenspace to improve health and livability."
- Purpose is to "…reduce GHG emissions and increase carbon sequestration … in a manner that
  - supports watershed health from source to tap;
  - protects the viability of vital farmland, ranchland and productive forestland;
  - fosters resilient rural economies;
  - restores critical habitat and bolsters ecosystem adaptation to climate change;
  - and offers recreational opportunities across our states. "

- CT is part of a regional grant that includes MA, NY, RI, & VT
  - *Project Title:* Bringing forest carbon into focus: Improved estimates of carbon benefits from avoided forest conversion in New England
  - Lead: MA chapter of TNC
  - Awarded ~73K (MA TNC contributing ~30K?)

NASA CMS Program - Participant

- The NASA Carbon Monitoring System (CMS) program seeks to characterize, quantify, understand, and predict the evolution of global carbon sources, sinks, and fluxes through improved monitoring of terrestrial and aquatic carbon stocks and fluxes.
- Uses satellite remote sensing resources, computational capabilities, scientific knowledge, airborne science capabilities, and end-to-end system expertise.
- Utilizes state products like CT's 2016 Lidar data
- Sponsors workshops for carbon estimation at state and local scales (ex. March 12-13 in College Park, MD) ☹

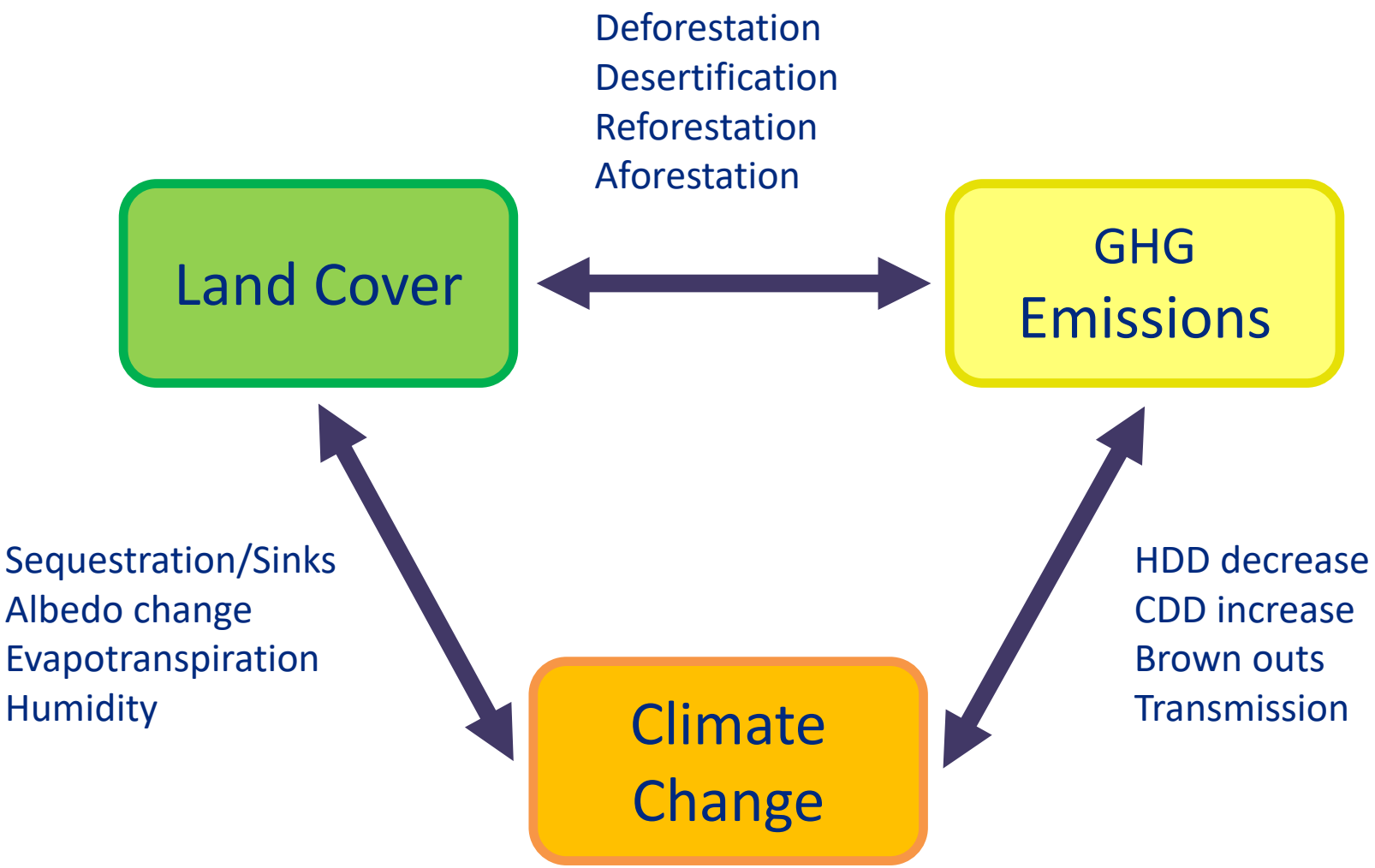
CT Forests



State Forest Coverage in 2010 (CLEAR, Connecticut's Changing Landscape)

- ~58% of land area is forest.
  - +1.8 million acres
    - 0.8 billion live trees
    - 70% of forest type is oak/history
  - 3.1% growth since 2012 (Butler, 2018)
    - Ratio of net growth to removals 5:1
  - 71% of forest area is owned by private landowners

IPCC Special Report on Climate Change and Land (2019): Impacts/Relationships

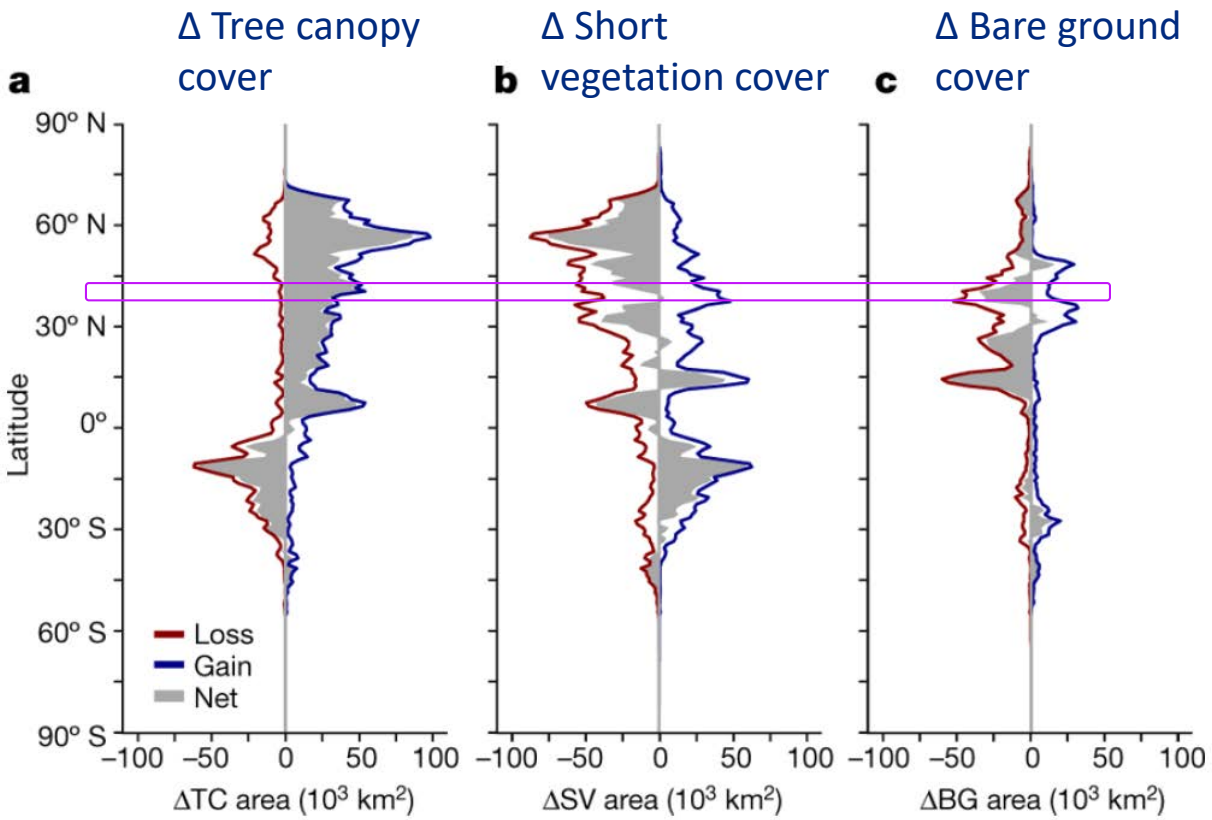


IPCC SR CCL, Chapter 2: Land-Climate Interactions

- Agriculture, Forestry and Other Land Use (AFOLU) => 22% of anthropogenic CO_2, CH_4, & N_2O emissions
  - Individual country GHG emission inventories vastly underestimate (at least 3x less) actual country contributions
- ~1/4 of the 2030 mitigation pledged by countries (not US) in their Nationally Determined Contributions (NDCs) under the Paris Agreement is to come from land-based mitigation options
  - Carbon Dioxide Removal (CDR) and soil restoration is key to meeting goals

IPCC SR CCL, Chapter 4: Land Degradation

- **Land degradation:** negative trend in land condition, caused by direct or indirect human-induced processes; expressed as long-term reduction or loss of: biological productivity, ecological integrity, and/or value to humans

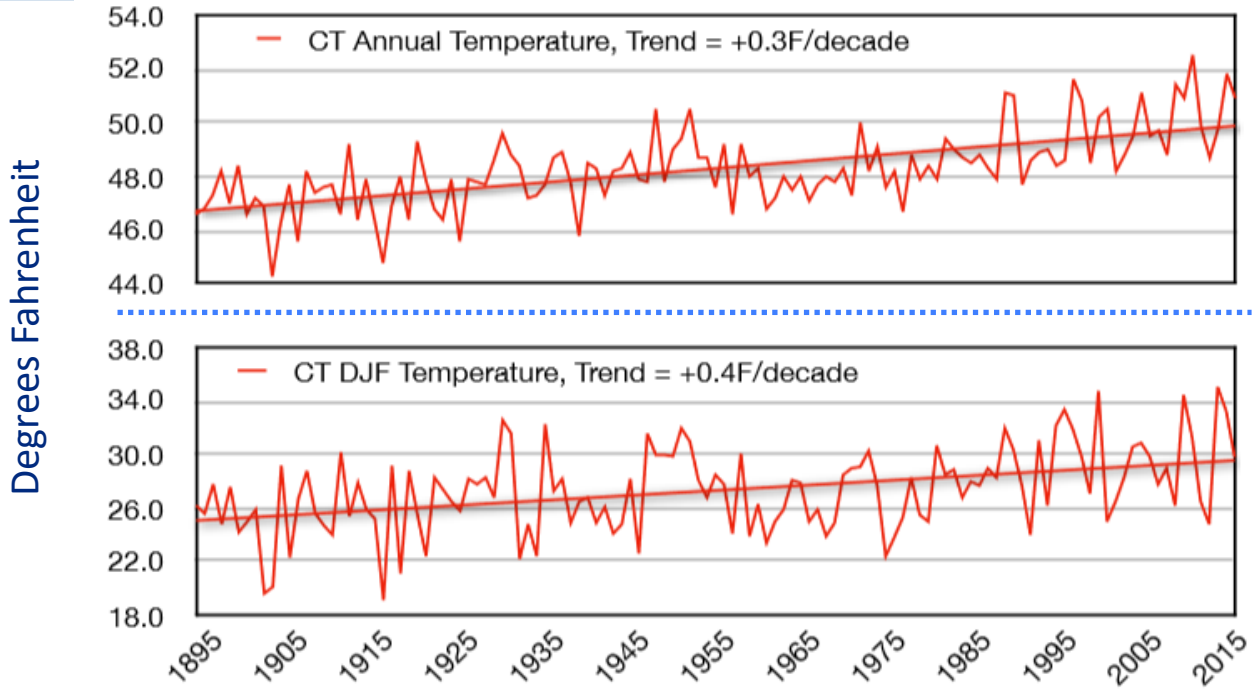


1982-2016 NOAA AVHRR data

Connecticut Climate Science

- CT Institute for Resilience & Climate Adaptation (CIRCA) 2019 Report: CT Physical Climate Science Assessment Report (PCSAR)
  - Provides an assessment of the state of the science regarding ***observed*** recent changes and ***projections*** for ***temperature*** and ***precipitation***
  - Methods:
    - Observed – station and gridded met datasets
    - Projections – statistically downscaled (MACA), multi-model ensemble (CMIP5) of BAU future scenario (rcp8.5) emissions

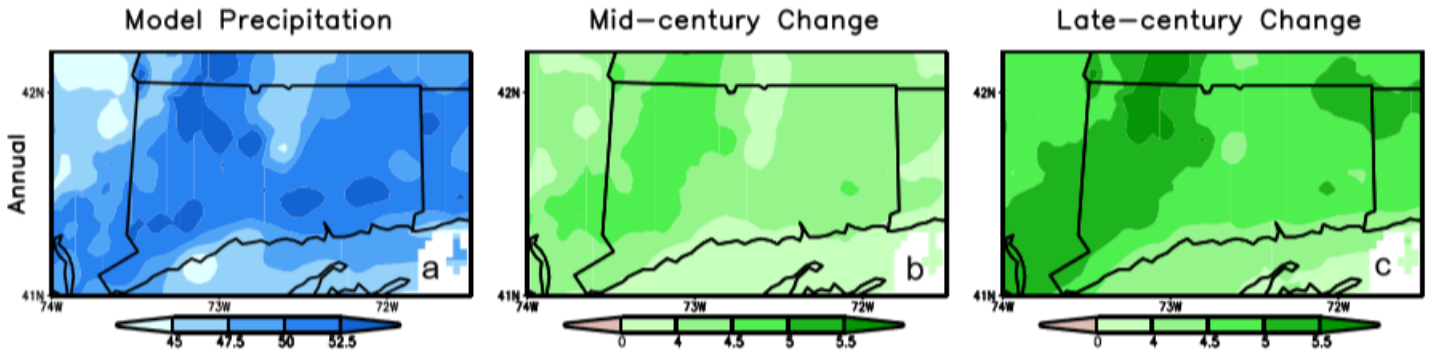
Temperature Trends



Change in °F	Mid-21 Century Change	Late-21 Century Change
Annual Mean	5.1 ± 1.3	8.3 ± 1.3
Winter (DJF)	5.2 ± 1.4	8.7 ± 2.3
Spring (MAM)	4.4 ± 0.9	7.1 ± 1.3
Summer (JJA)	5.5 ± 1.5	8.8 ± 2.4
Fall (SON)	5.2 ± 1.6	9.6 ± 2.4

Precipitation Change

- More atmospheric moisture, but as temperatures increase, the holding capacity of the atmosphere increases => more humid, but less rain
  - Increased cold season precipitation, little change in mean warm season precipitation (due to increased annual variability)



Change in total inches	Mid-21 Century Change	Late-21 Century Change
Annual Total	4.3 ± 2.3 (8.5%)	4.9 ± 3.3 (9.7%)
Winter (DJF)	1.5 ± 1.2 (13.4%)	1.8 ± 1.2 (16.3%)
Spring (MAM)	1.3 ± 0.9 (10%)	2.2 ± 0.5 (16.5%)
Summer (JJA)	1.0 ± 0.7 (7.6%)	N/A
Fall (SON)	N/A	N/A

Questions?

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