Vermont State Legislature
House Committee on the Environment & Energy
Testimony on climate change and forests

23 April 2026

Dr. Lesley-Ann L. Dupigny-Giroux

Distinguished Professor – Geography & Geosciences, UVM

2026 AAAS Mani L. Bhaumik Award for Public Engagement with Science
National Academies –Board on Atmospheric Sciences & Climate
Past President – American Association of State Climatologists
Lead author – Northeast chapter – Fourth National Climate Assessment

Vermont Climate Council – House Appointee with expertise in climate change science
Fellow – Vermont Academy of Science & Engineering; Vermont Academy of Arts & Sciences

Fellow – American Meteorological Society; American Association of Geographers

Fellow – Gund Institute of Environment

Vermont State Climatologist

Our conversation today

factors affecting plant growth

variability

- climate change AND climate variability
- hazards and stressors on forests
- seasons

weather & climate impacts

- air quality
- winds
- moisture extremes
- wildland fire

Implications of climate change & next steps

Hydroclimatic hazards in Vermont

severe storms

winter storms

drought

flooding

fires

air pollution

temperature extremes

wind
- microbursts
- shirkshires

biotic
- insects
- disease

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Forestry and tree crops

invasive species – emerald ash borer

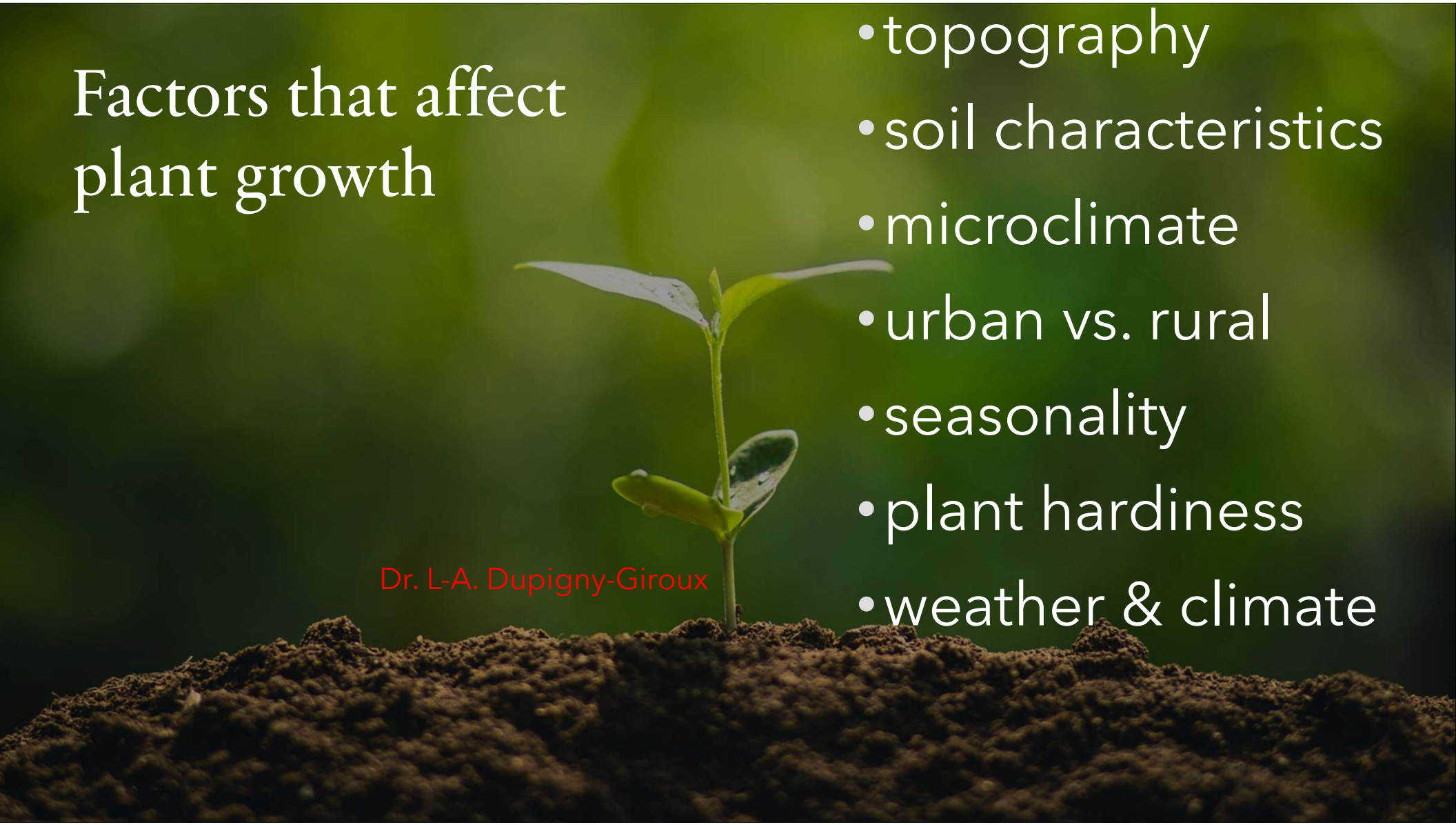
wildfire threat

spring
- frosts and Christmas trees
- over-winter injury to red pine
- length and quality of maple sap productions

summer
- droughts and fall foliage (early)
- outbreaks and defoliation (FTC)

fall
- early frosts
- late freezes – leaf drop; early snowfall
- droughts & fall foliage (late)

Factors that affect plant growth



- topography
- soil characteristics
- microclimate
- urban vs. rural
- seasonality
- plant hardiness
- weather & climate

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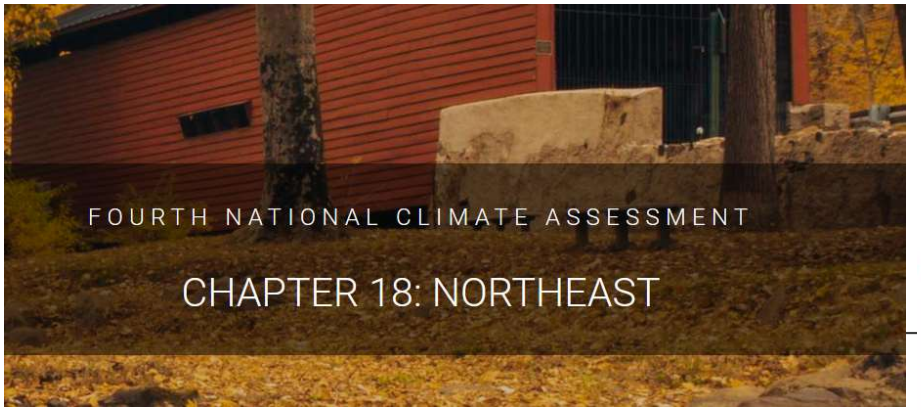
Our changing climate



FOURTH NATIONAL CLIMATE ASSESSMENT

CHAPTER 18: NORTHEAST

KEY MESSAGES

1 2 3 4 5

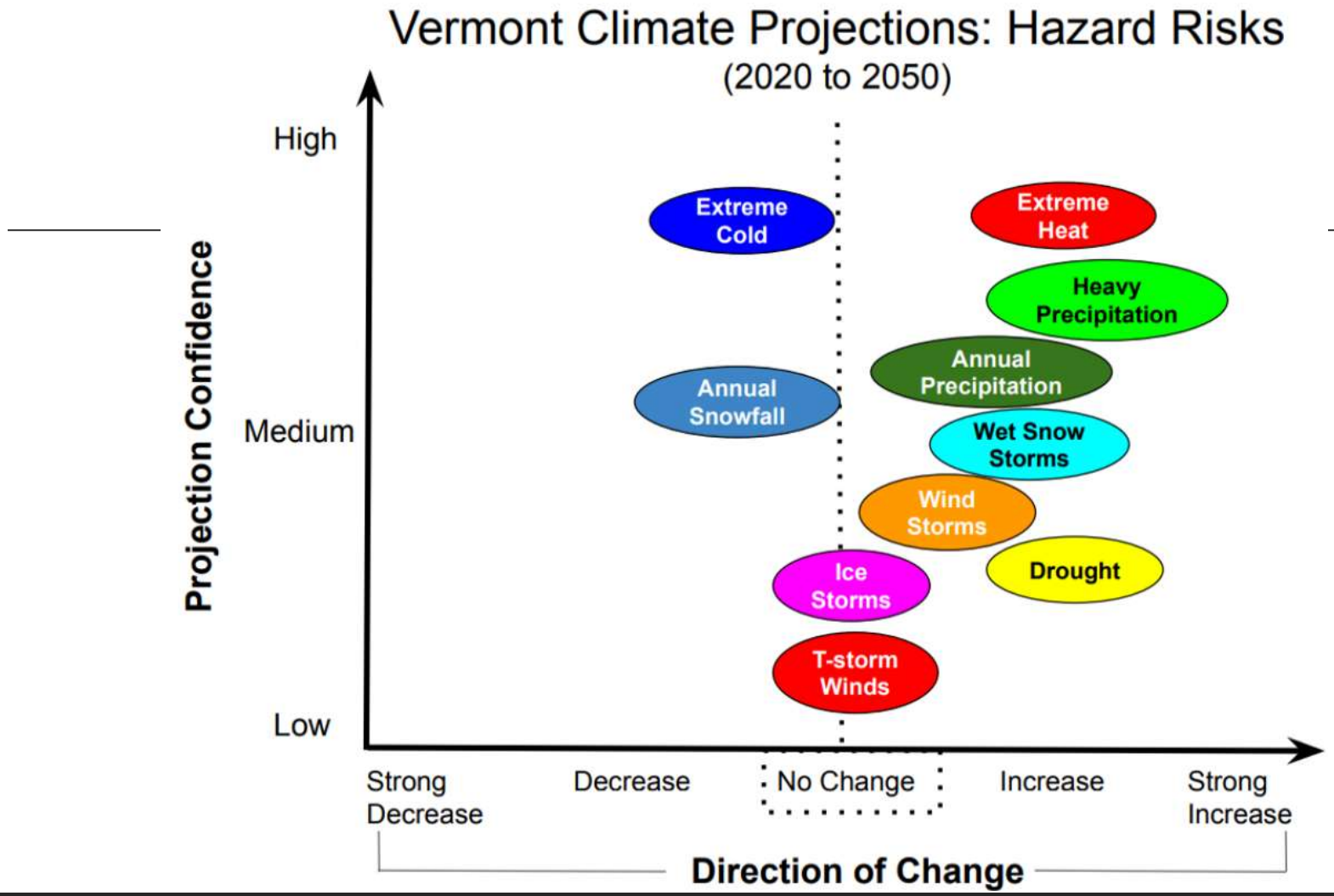
Key Message 1: Changing Seasons Affect Rural Ecosystems, Environments, and Economies

The seasonality of the Northeast is central to the region's sense of place and is an important driver of rural economies. Less distinct seasons with milder winter and earlier spring conditions (very high confidence) *are already altering ecosystems and environments* (high confidence) *in ways that adversely impact tourism* (very high confidence), *farming* (high confidence), *and forestry* (medium confidence). *The region's rural industries and livelihoods are at risk from further changes to forests, wildlife, snowpack, and streamflow* (likely).

Major uncertainties

Warmer fall temperatures affect senescence, fruit ripening, migration, and hibernation, but are less well studied in the region[98] and must be considered alongside other climatic factors such as drought. Projections for summer rainfall in the Northeast are uncertain,[4] but evaporative demand for surface moisture is expected to increase with projected increases in summer temperatures.[3,4] Water use is highest during the warm season;[141,400] how much this will affect water availability for agricultural use depends on the frequency and intensity of drought during the growing season.[302]

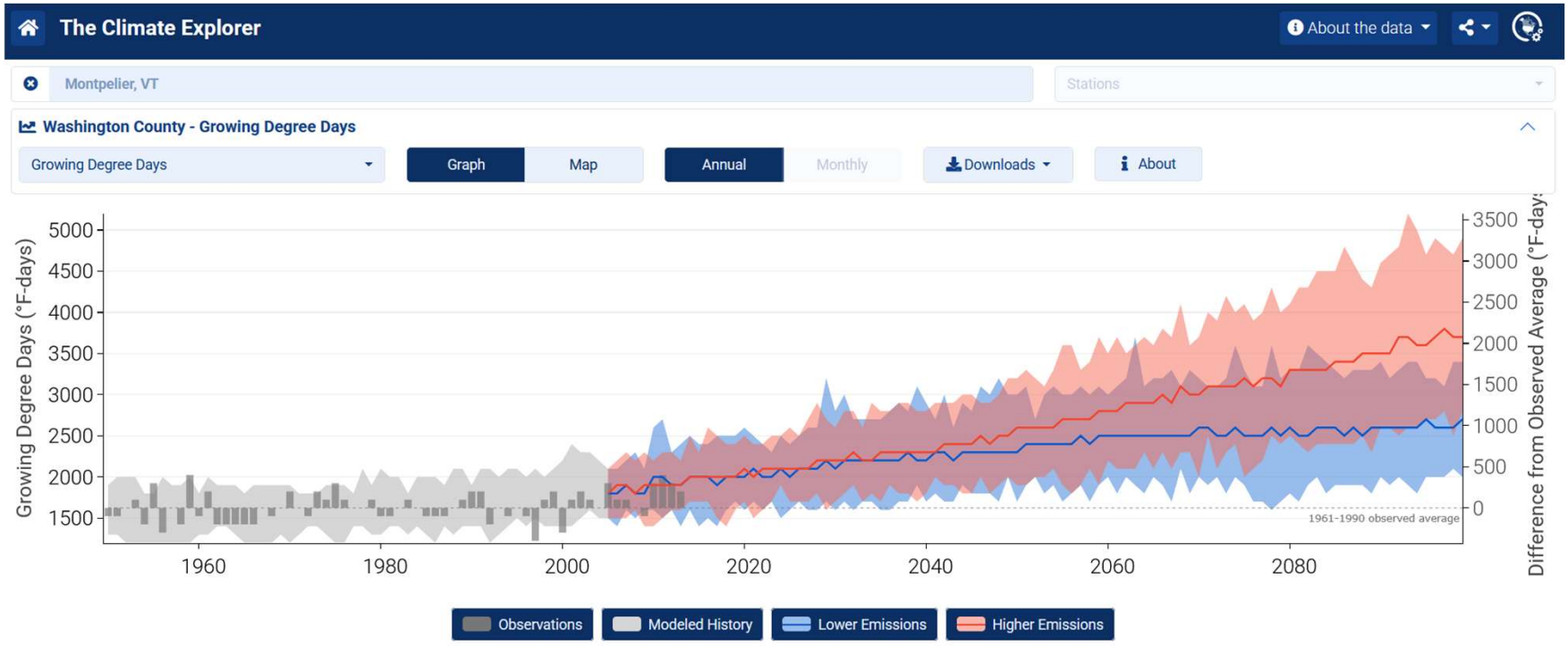
https://climatechange.vermont.gov/sites/climatecouncilsandbox/files/2021-12/Initial%20Climate%20Action%20Plan%20-%20Final%20-%2012-1-21.pdf



Dr. Jay Shafer, VT Climate Action Plan, 2021

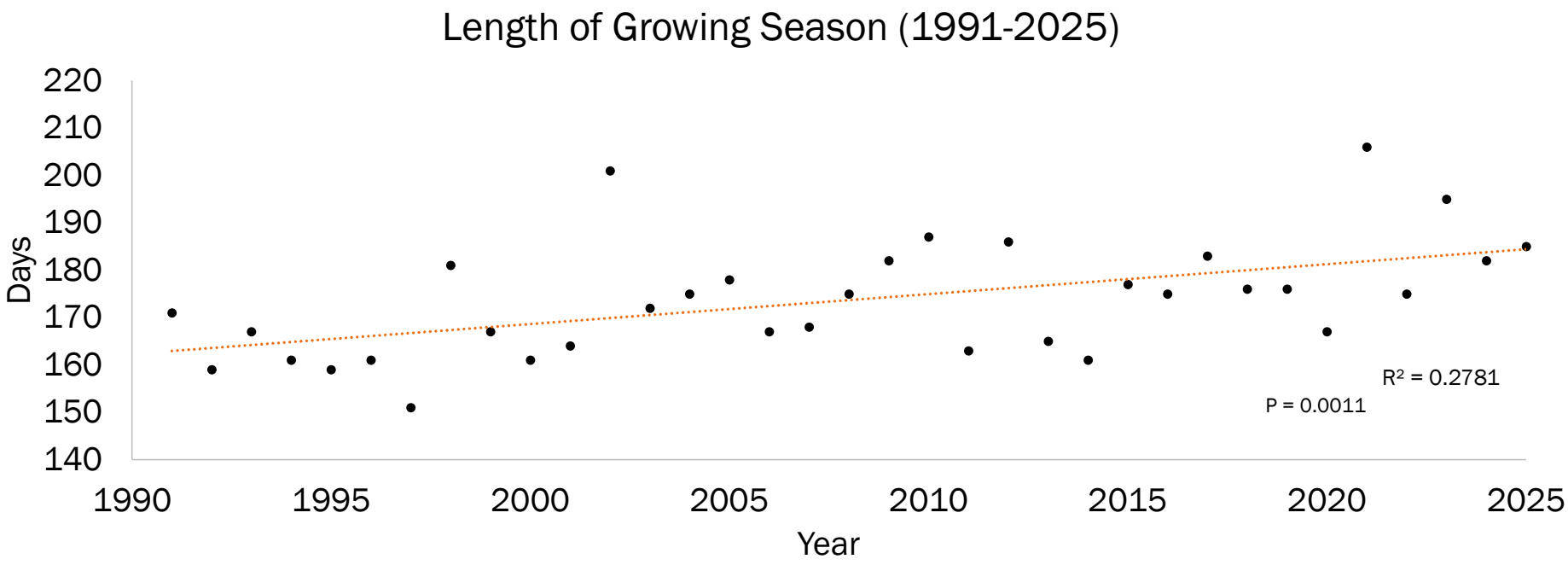
Climate change for Washington County

Growing Degree Days (GDD) are used to estimate the growth and development of plants and insects during the growing season. The basic concept is that development will only occur if the temperature exceeds some minimum development threshold, or base temperature (TBASE). The base temperatures are determined experimentally and are different for each organism. https://mrcc.purdue.edu/gismaps/gddinfo



https://crt-climate-explorer.nemac.org/

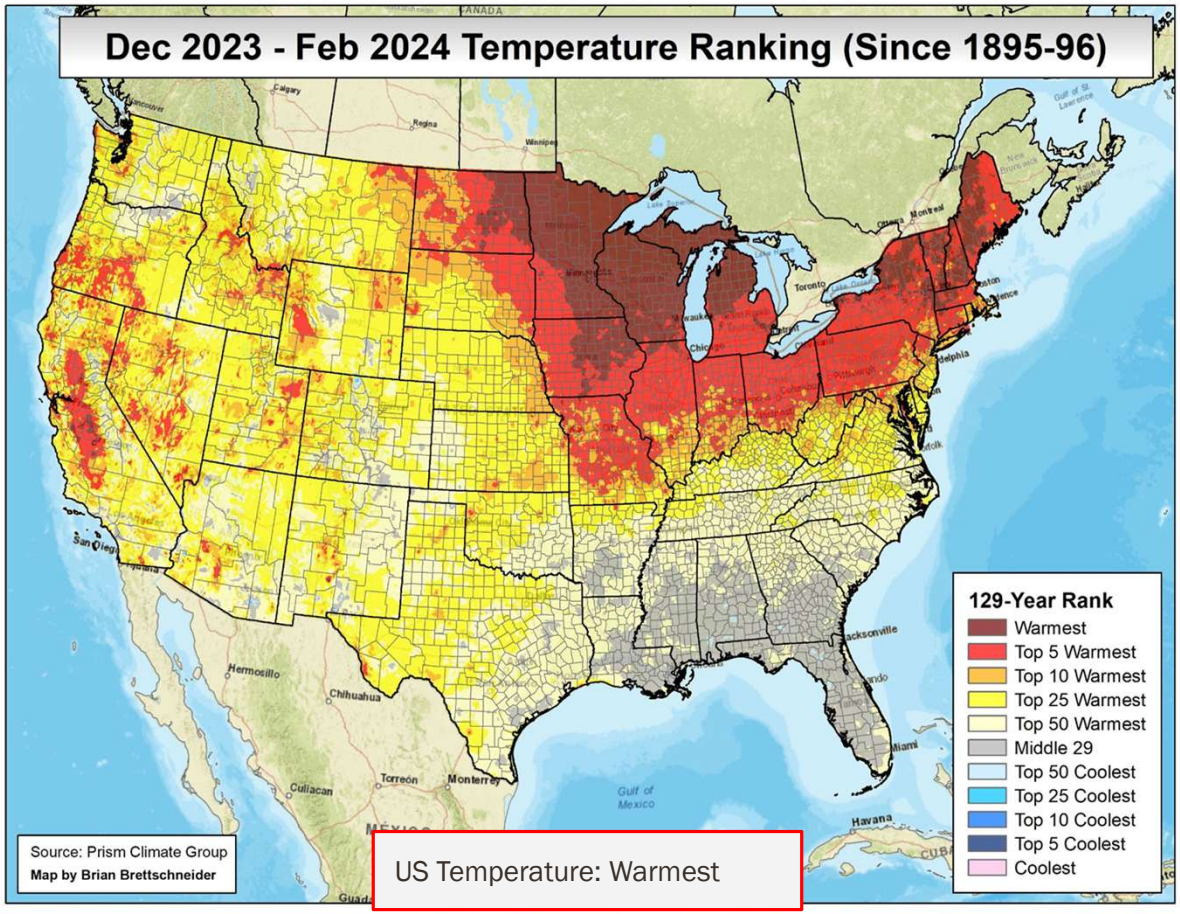
. Changes in length of sugar maple growing season from 1991-2025 at Proctor Maple Research Center, Underhill, VT. Growing season length is defined as the number of days between budbreak and leaf-drop. The growing season for sugar maple has extended an average of 22 days since monitoring began in 1991.



Courtesy: Josh Halman, VT ANR/Forests, Parks & Recreation

Winter & spring

Winter temperature check: Our strongest changing season



US Temperature: Warmest

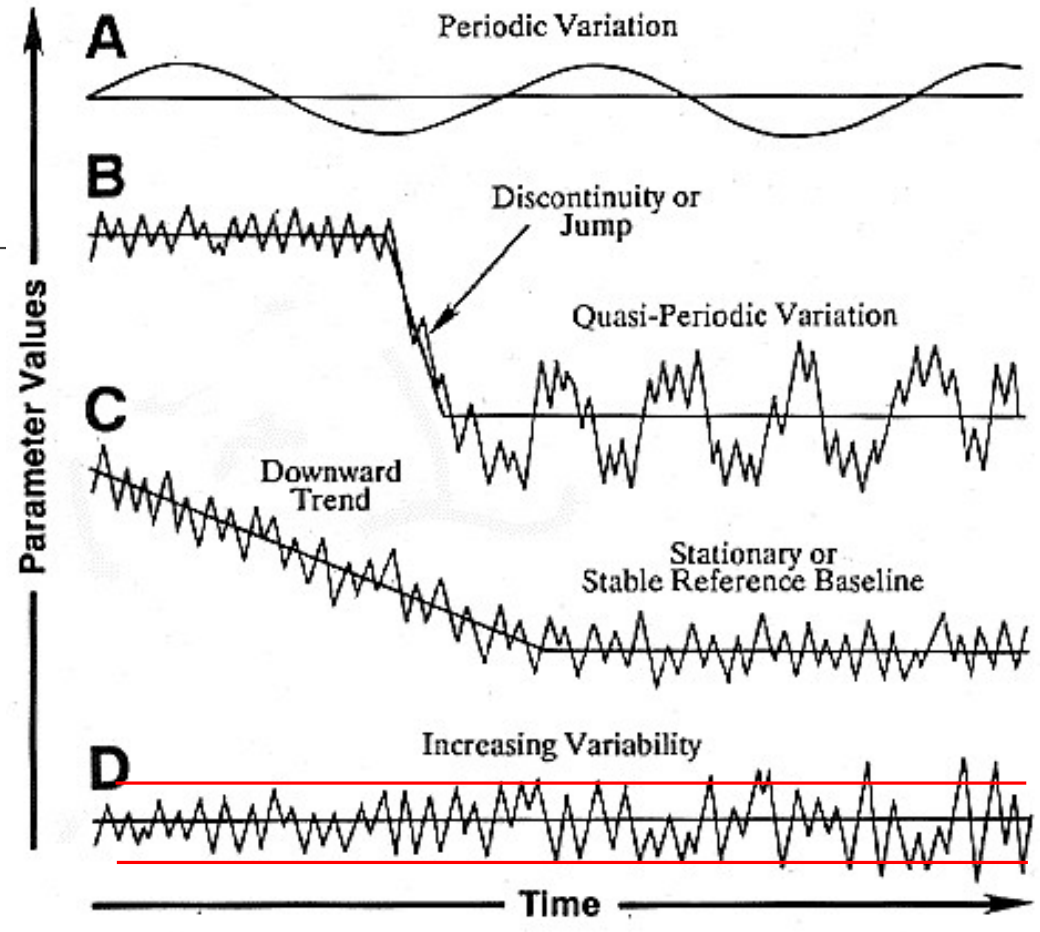
Top 10 Warmest Winters at Burlington (1941-2024)

1	2023-2024	30.7
2	2015-2016	30.1
3	2016-2017	29.5
4	2022-2023	29.0
5	2001-2002	28.7
6	2011-2012	27.8
7	2019-2020	26.1
8	1948-1949	25.8
9	1996-1997	25.6
-	1952-1953	25.6

2023-2024 was also the second wettest

Warmer and Wetter Winters: More thaws, less reliable snow cover, heavier precipitation events, more wet snow

Credit: David Robinson, NJSC



Types of climatic variation

Freeze/thaw cycles affect oaks, red spruce, red pine

Backward spring

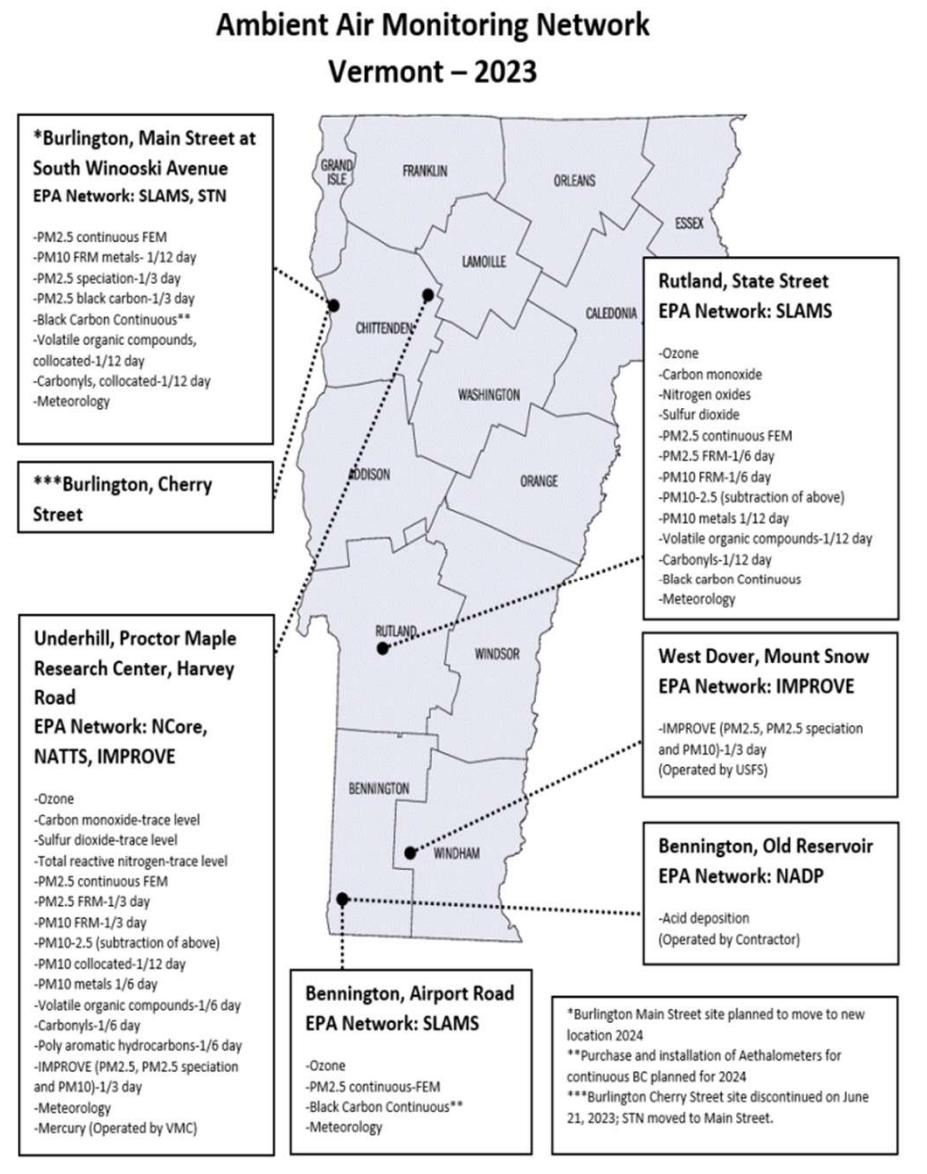
- low temperatures in January – June
- land-locked stations colder
- winter freeze/thaw cycles – predictor
- snow, freezing rain – April to June
- summer killing frosts
- summer drought
- NW flow

Photo credit: L-A. & M. Dupigny-Giroux

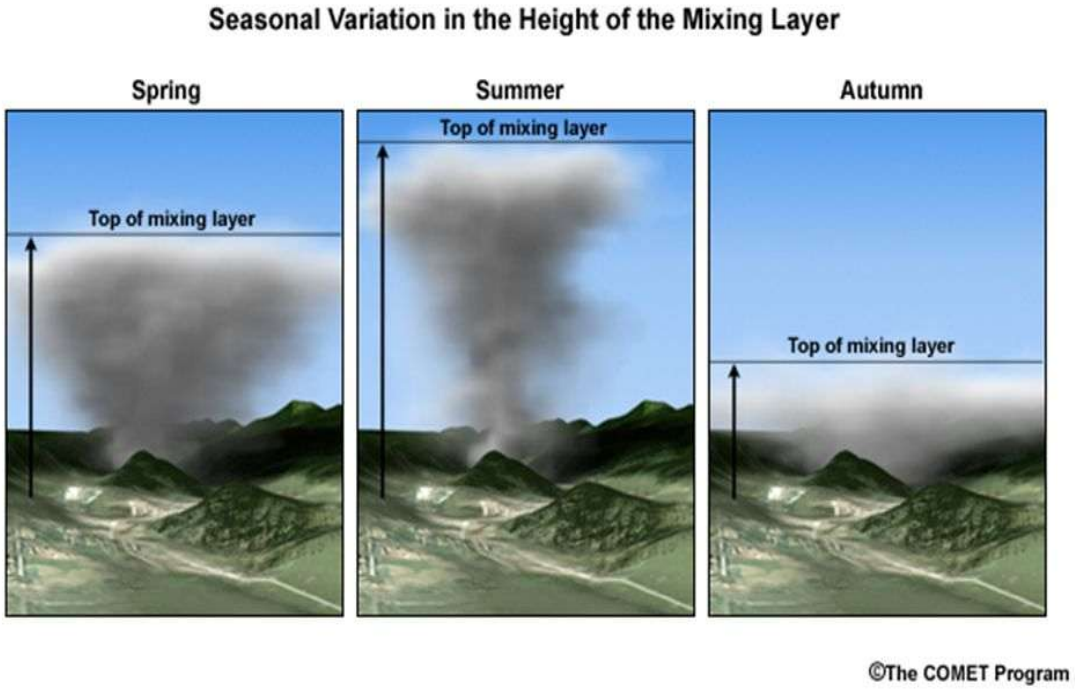
Dupigny-Giroux, L.-A. (2009) "Backward seasons, droughts and other bioclimatic indicators of variability," in Historical climate variability and impacts in North America, Lesley-Ann Dupigny-Giroux and Cary Mock (Editors), Springer Publishers, pp.231-250.

Air quality

https://dec.vermont.gov/air-quality/air-monitoring-section/monitoring-network-design

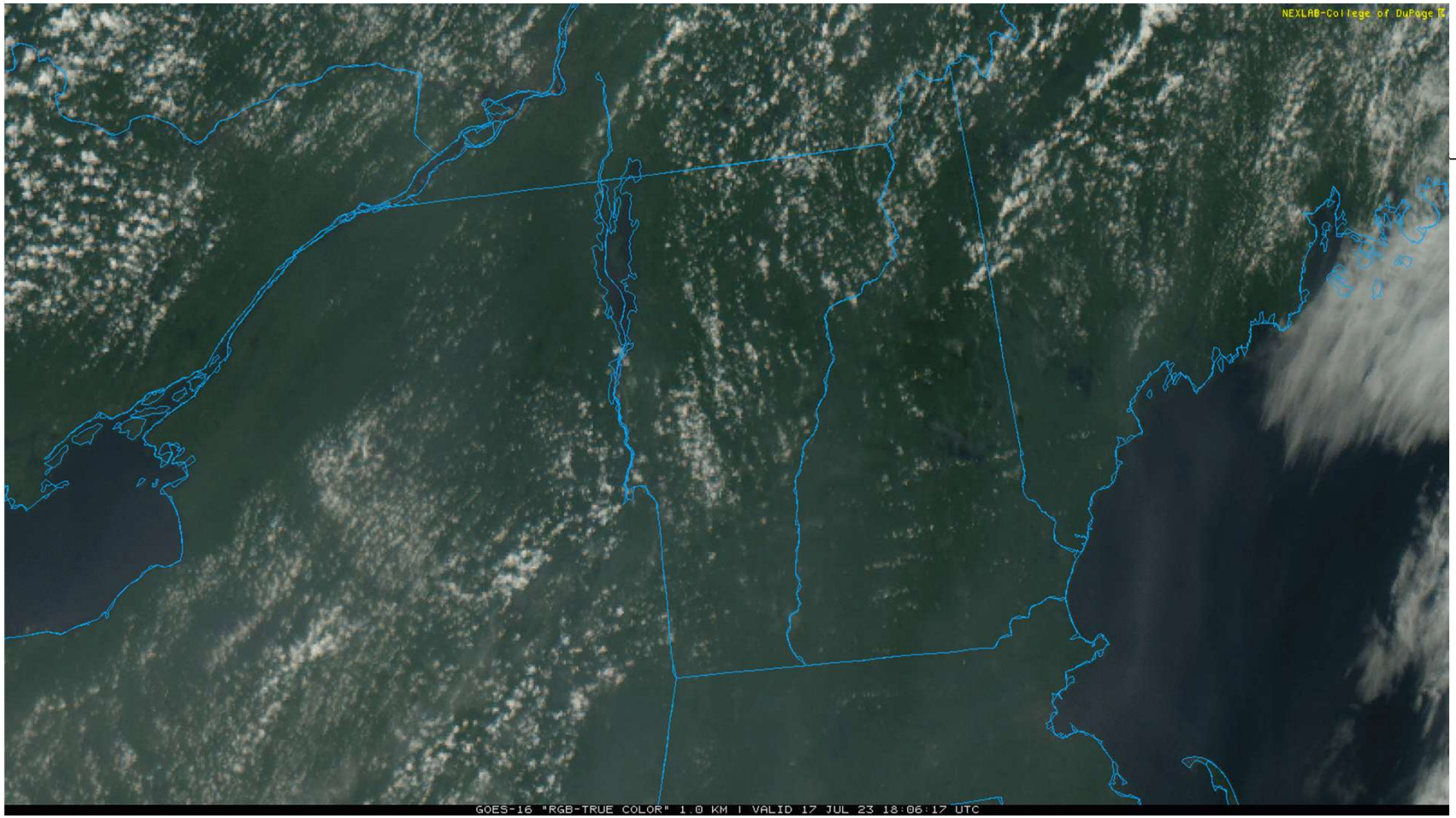


Our geography matters (Green Mountains)



Dr. L-A. Dupigny-Giroux

Wildland fire smoke – 17 July 2023



Ground-level ozone

Ozone Injury to White Ash
Photo by Gretchen Smith

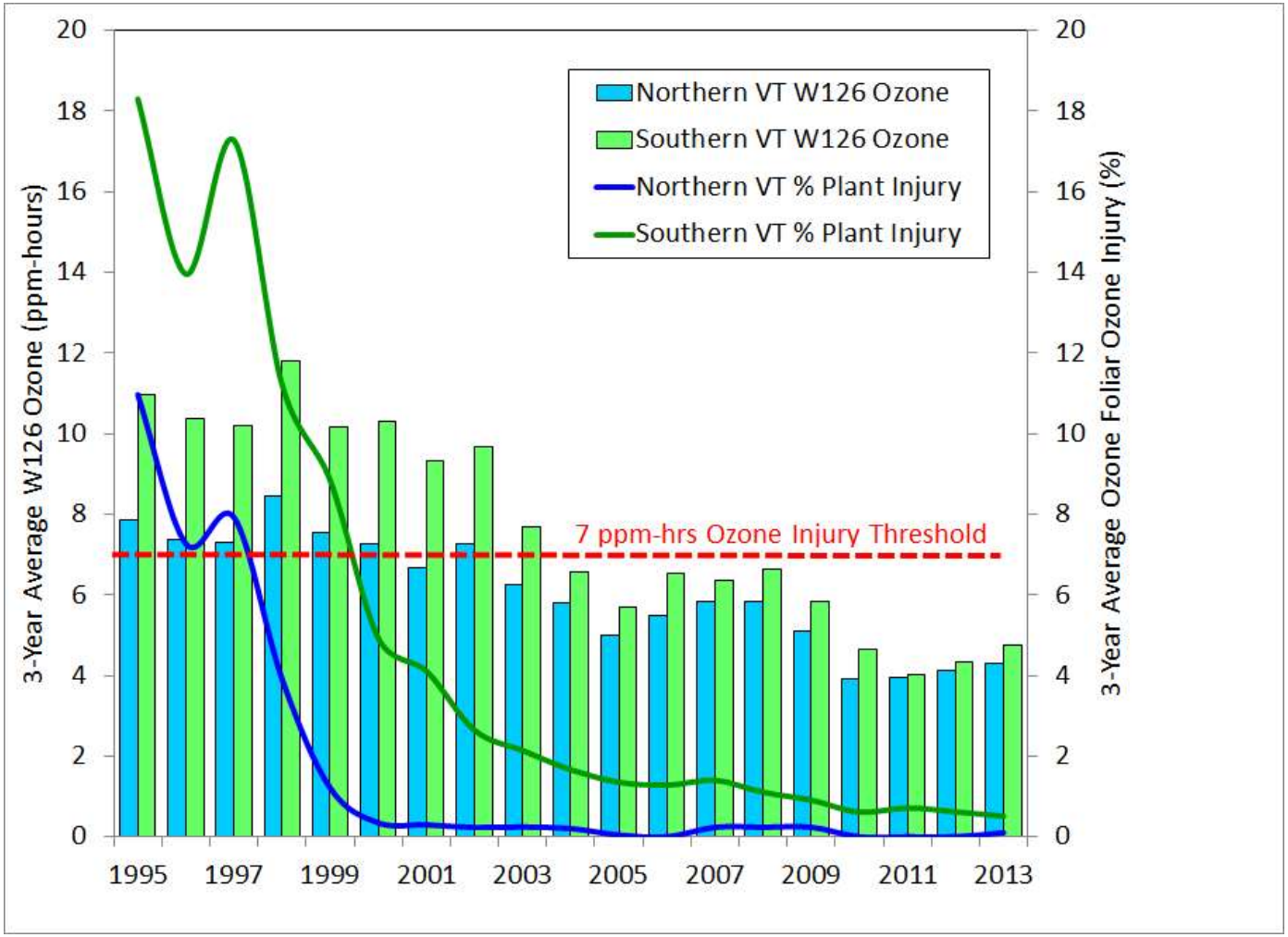
reduces plant growth & vigor

reduces seed production

increases susceptibility to insects & disease

cumulative effect over growing season

Black cherry, white ash, yellow poplar



Three-Year Average Trends in Ozone Pollution & Plant Injury in Northern & Southern VT

COURTESY R. POIROT – VT ANR/AIR QUALITY. POST 2006 DATA (FEMC)

https://www.uvm.edu/femc/CI4/attachments/project/999/annualreport/2014/figure18_ozone.png

Winds

Microburst

A microburst is a small downburst with an outflow less than 2½ miles (4 kilometers) in horizontal diameter and last for only 2-5 minutes. Despite their small size, microbursts can produce destructive winds in excess of 160 mph. They can also create hazardous conditions for pilots and have been responsible for several disasters

Microburst in the Adirondack Mountains - Photo credit Mark Isselhardt

Downburst damage

Straightline wind damage in Cavendish, Vermont.
Photo taken by Steve Hogan & Brooke Taber. (July 21, 2003)

Wind speeds 55-72 mph

Courtesy: NWS/BTV

Wildland fire

VERMONT'S WILDLAND FIRE SEASONS

Every year wildand fires burn grass, brush, and forest fuels in Vermont. The majority of these fires burn in the spring. Occasionally, summer or fall fires occur in a dry year.

Spring Fire Season

Generally spring fire season begins shortly after snowmelt when weather conditions are favorable for drying wildland fuels, dead grasses, leaves and twigs. Clean-up after a long winter season generates a great deal of debris burning activity. Most Vermont wildland fires occur between the end of March and the beginning of June.

Southern counties, low-elevation areas, and exposed south-facing slopes generally experience dry conditions earlier during spring, while northern counties and higher elevations have dry conditions later in the season. During the spring fire season, access to fire areas can be extremely hampered due to mud conditions.

Spring is the time of year that most involves changing weather patterns. Low relative humidity and gusty winds, combined with dry fuel conditions and tough terrain, can make controlling wildland fires difficult and hazardous. Fortunately, spring fires seldom burn deeply into the ground litter, which makes clean up easier and less expensive.

Fire Season Transition from Spring to Summer

Fine dead fuels after snow melt dry quickly when exposed to sun, wind and low relative humidity.

Live vegetation mixes in and shades dead fuels from weather elements after green up.

Summer Fire Season

After green-up has occurred and the spring rainy periods have subsided, the summer months can become hot and dry. Even though wildland areas may look green and damp, the forest ground fuels and litter may be dry enough to sustain fire. Campfires, logging operations, and lightning are common causes of summer fires. Most summer fires occur from mid- to late August into September. Depending primarily on the amount of rain received, a summer fire season may or may not occur.

https://fpr.vermont.gov/forest/wildland-fire/wildland-fire-seasons

Fire Weather Concerns For Today

Burlington, VT
WEATHER FORECAST OFFICE

OVERVIEW:

- The combination of low relative humidity, gusty northwest winds, and dry fuels will create fire weather concerns over northern New York and the northwest, central, and southern portions of Vermont this afternoon and early evening.

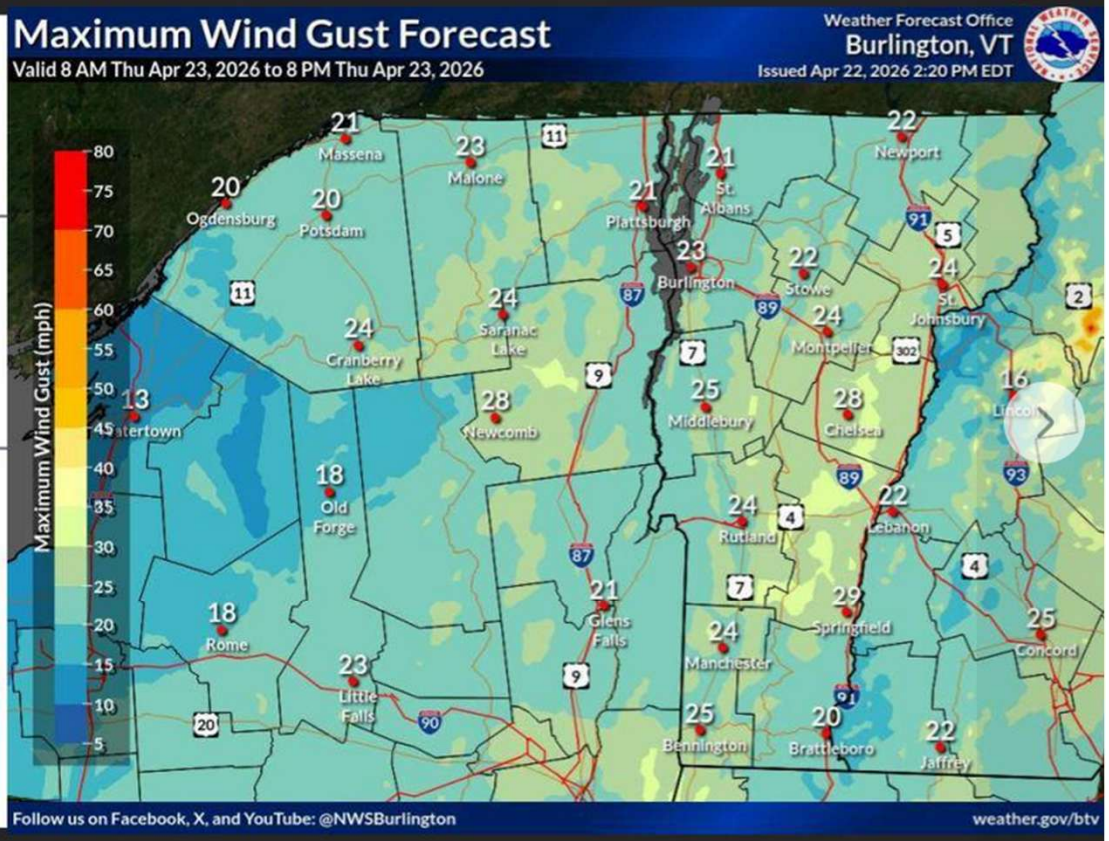
TIMING	▪ The lowest relative humidity values and strongest northwest winds will occur between Noon and 7 PM Today.
HAZARDS & IMPACTS	▪ Any fires that were to start in these critical fire weather conditions could quickly get out of control and be difficult to contain. ***This applies to most areas outside of the Red Flag Warning as well.*** ▪ Follow state guidelines in Vermont regarding open burning and remember a Burn Ban exists in New York through May 14th, which means no open burning is allowed.
NWS ALERTS	▪ A Red Flag Warning is in effect for the western portions of Franklin, Chittenden, Addison, and Rutland counties in Vermont as well as all of Orange, Windsor, Bennington, and Windham counties of Vermont. The warning is valid from Noon until 7PM. Expect relative humidity values as low as 25 percent and northwest wind gusts in the 25 to 30 mph range.
POST-EVENT OUTLOOK	▪ We are anticipating an extended period of dry weather through the remainder of the week, which will help to further dry out the fuels. A gradual warming trend is expected, but winds will not be as strong as today and relative humidities not as low as today either.
NEXT BRIEFING	▪ This will be the last briefing unless conditions change.

Fire Weather Watches and Warnings

ISSUED: 4/5/2021 6:14 AM nwsbtv.info@noaa.gov 802-658-0150 www.weather.gov/btv

Near Critical Fire Weather Conditions Tomorrow

- Lowest humidities and highest winds are expected tomorrow afternoon.
- Southerly winds 10 to 15 mph with gusts up to 30 mph expected.
- High temperatures in the 50s anticipated.
- Minimum humidities will range from 25% to 30%, with lowest values in northeastern New York as well as the Champlain and Connecticut River valleys.
- If any fires were to start, the weather and fuel conditions could cause fires to quickly get out of control and be difficult to contain.



NATIONAL WEATHER SERVICE - Burlington

Latest info at weather.gov/btv

Updated: April 22, 2026

Friday, April 18th, 2025

As part of the 2025 Open Burning Weather Awareness Campaign from the NWS in Burlington, VT we will examine Fire Weather Watches and Red Flag Warnings:

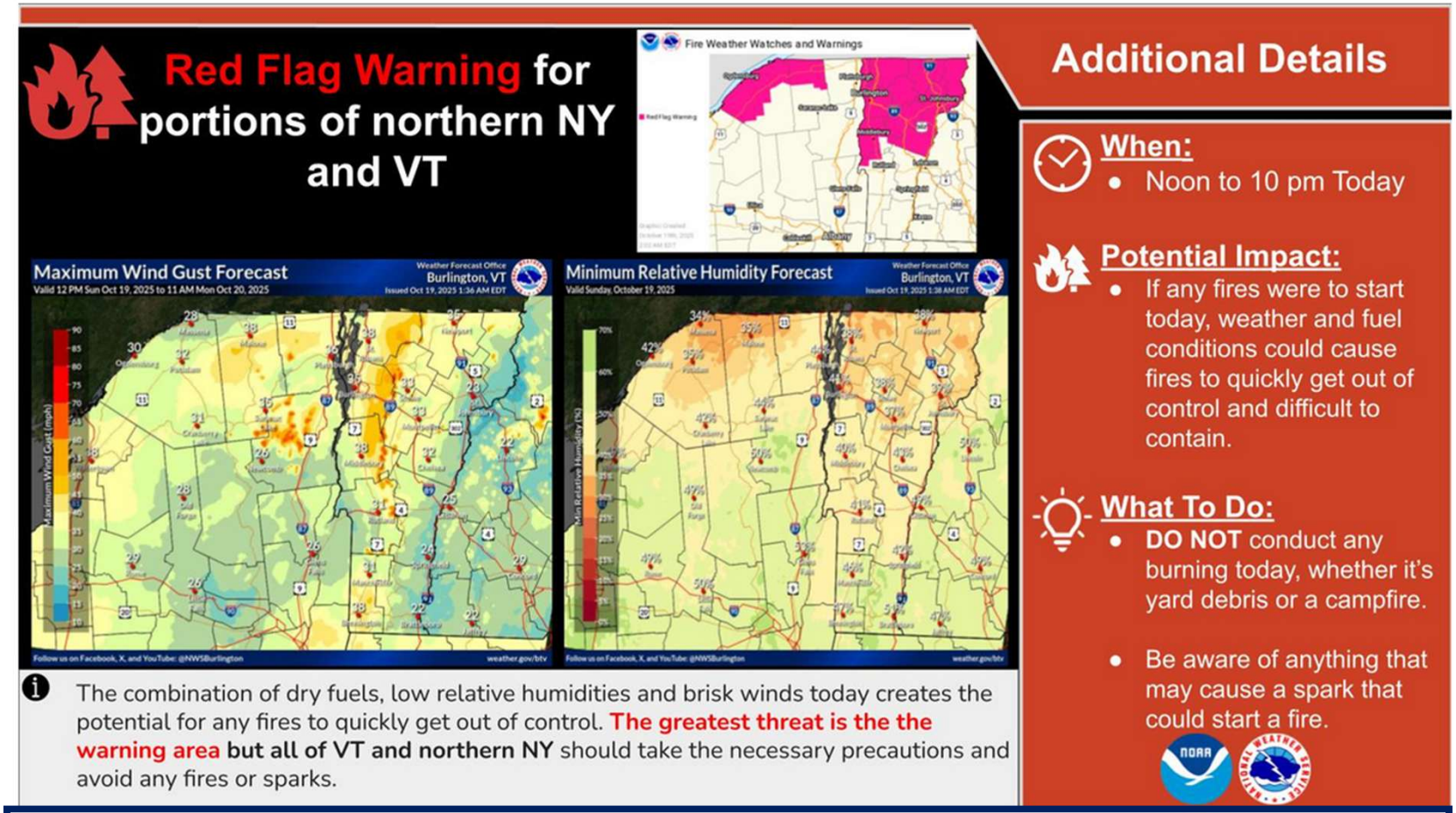
- Red Flag conditions develop when the combination of very dry fuels, low relative humidity values, strong winds, and an extended period with little to no precipitation all come together.
- If the potential were to exist for red flag conditions, the NWS issues a Fire Weather Watch 12 to 48 hours in advance of the potential event. A Fire Weather Watch alerts fire and forestry personnel, as well as the public that upcoming weather conditions combined with the very dry fuels could potentially create critical fire weather conditions.
- If Red Flag conditions are expected or occurring, the NWS issues a Red Flag Warning within 24 hours of the expected event to highlight concerns for firefighter and public safety as any fires that did start would likely spread quickly, burn intensely, behave erratically, and be difficult to contain.
- Open burning is strongly discouraged in these situations and you should follow guidance from your state or your local Fire Wardens.

Fire weather forecasts and additional information are always available at weather.gov/btv and weather.gov/btv/firewx

https://www.weather.gov/btv/safetycampaigns

Gusty Winds Today and Tonight

Red Flag Warning...Beware of any Burning



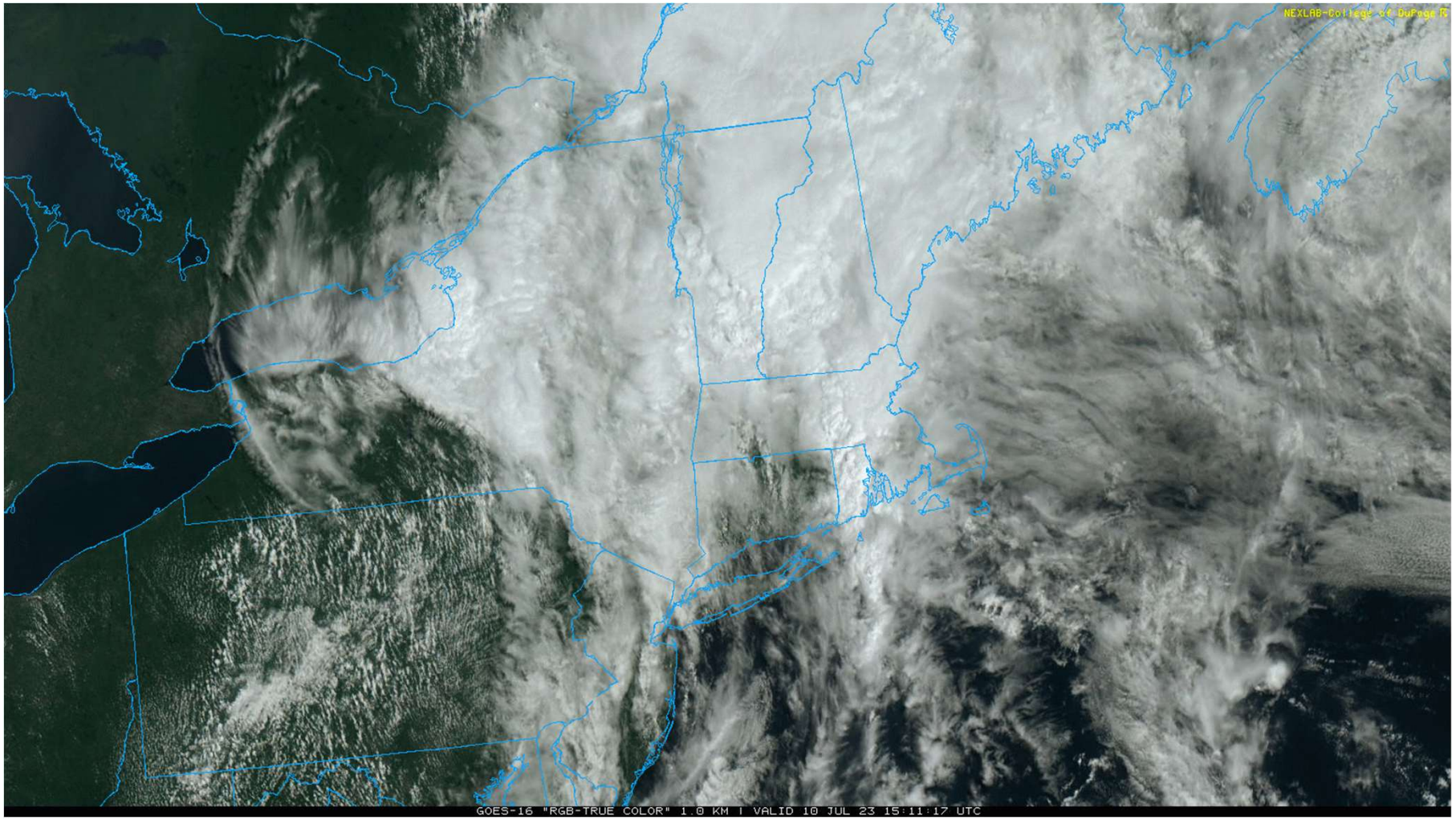
The combination of dry fuels, low relative humidity's and brisk winds today creates the potential for any fires to quickly get out of control. The greatest threat is the the warning area but all of VT and northern NY should take the necessary precautions and avoid any fires or sparks.

Red flag day – 12 October 2025

https://www.weather.gov/btv/weatherstory


Moisture

10 July 2023

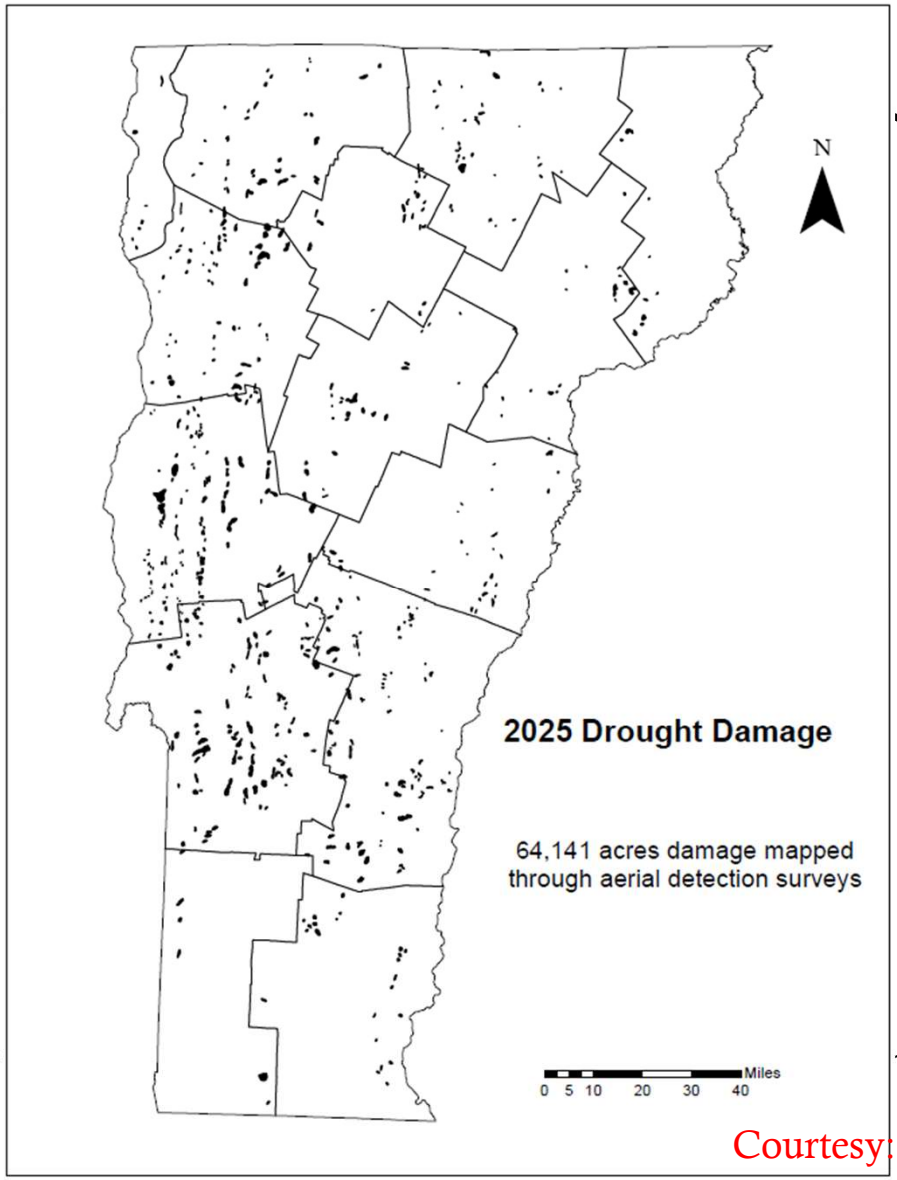

NEXLAB-College of DuPage
GOES-16 "RGB-TRUE COLOR" 1.0 KM | VALID 10 JUL 23 15:11:17 UTC

TS Irene – moisture disturbance

https://www.youtube.com/watch?v=H71fsL-0r_4

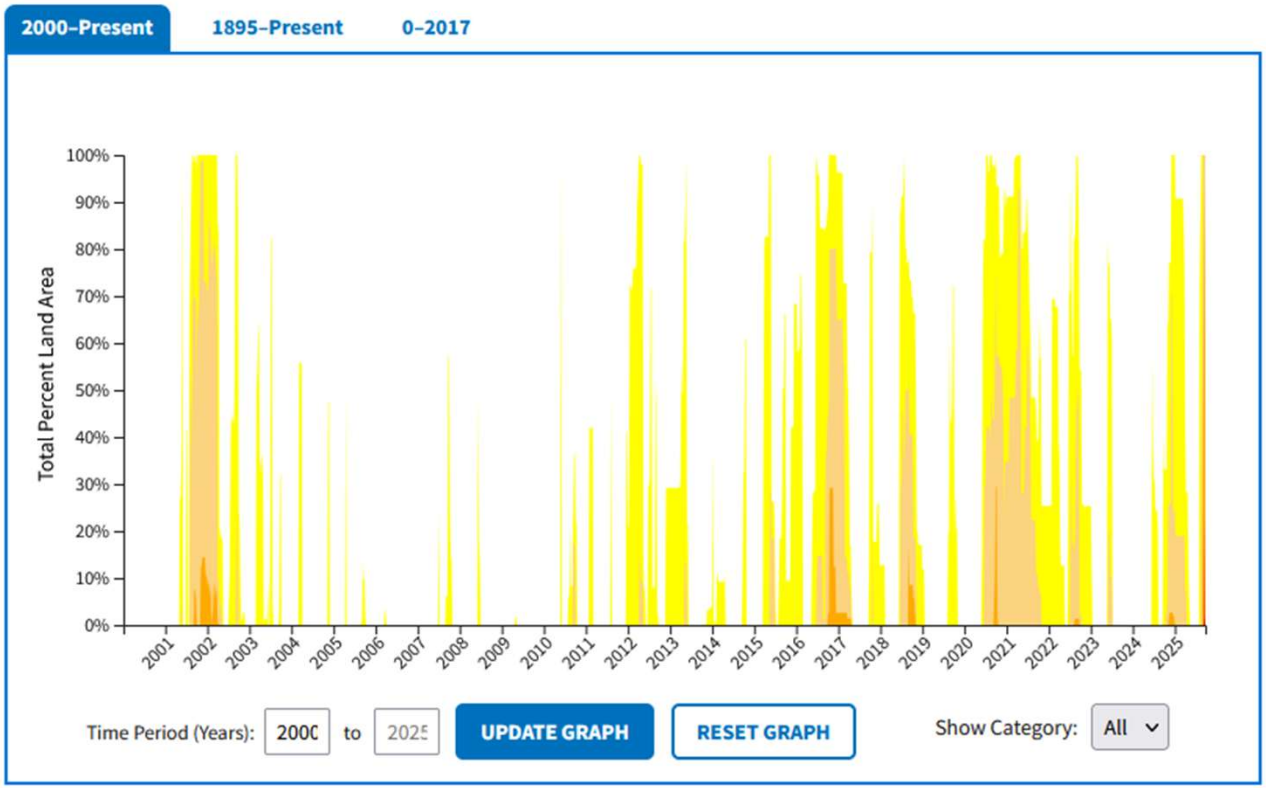
DROUGHTS

Photo: L-A. Dupigny-Giroux



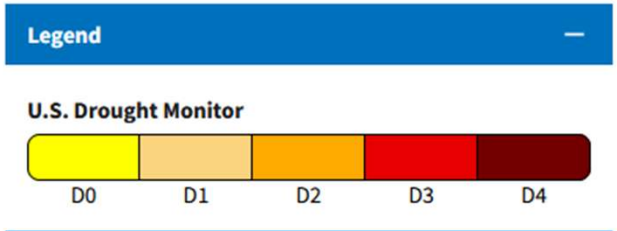
Drought damage observed through Aerial Detection Surveys. Drought was the agent that cause the greatest extent of forest damage in Vermont in 2025. Data were mapped from mid-August through early September, and are likely an underestimation of acres impacted since some areas were flown prior to visible symptoms.

Courtesy: Josh Halman, VT ANR/Forests, Parks & Recreation



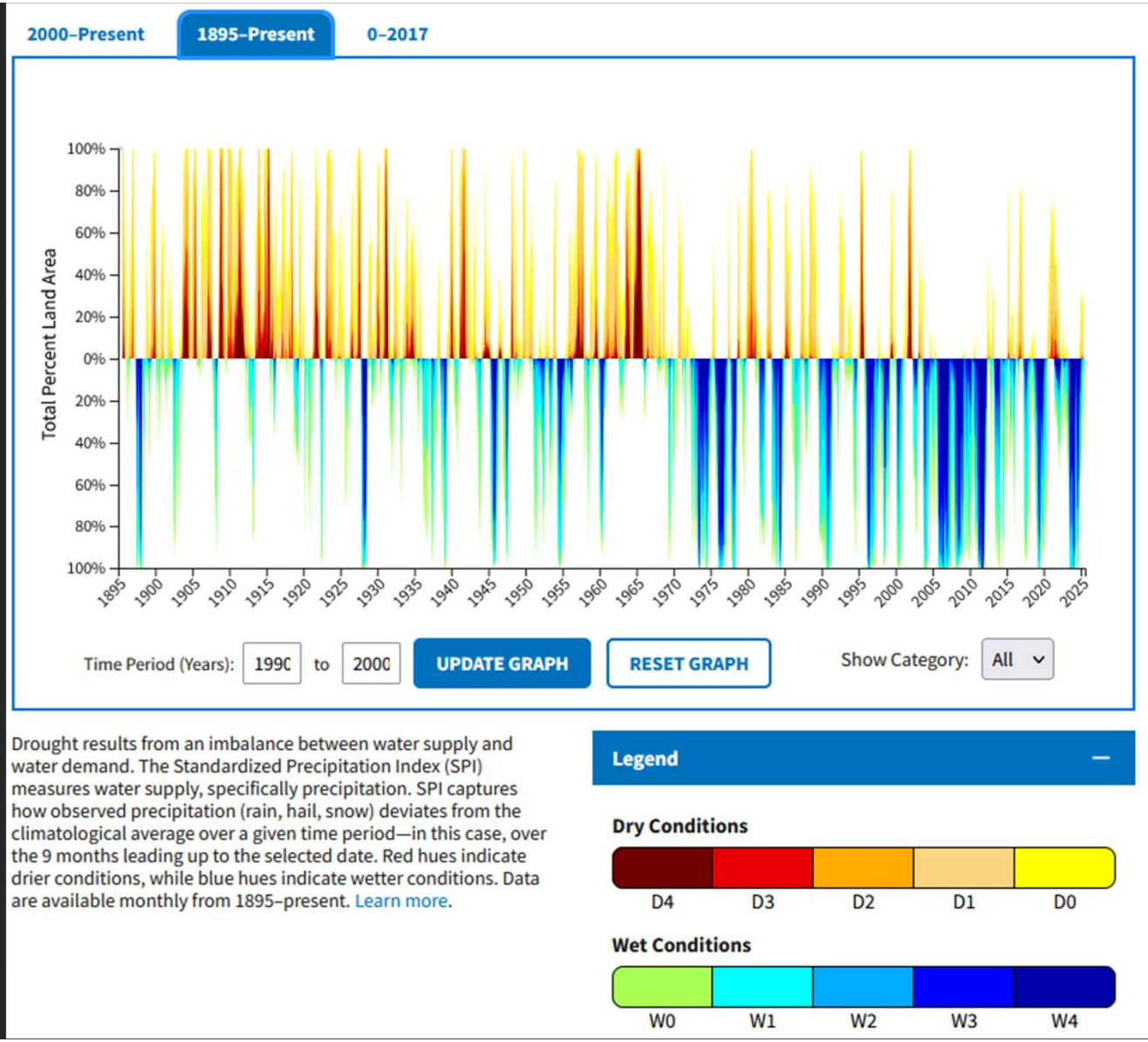
The U.S. Drought Monitor (2000–present) depicts the location and intensity of drought across the country. Every Thursday, authors from NOAA, USDA, and the National Drought Mitigation Center produce a new map based on their assessments of the best available data and input from local observers. The map uses five categories: Abnormally Dry (D0), showing areas that may be going into or are coming out of drought, and four levels of drought (D1–D4). Learn more.

LATEST AVAILABLE DATA: 2025-09-23



https://www.drought.gov/states/vermont

Droughts in Vermont - 1895 to present



https://www.drought.gov/states/vermont

Category	Examples of historically observed impacts
D0	Crop growth is stunted; planting is delayed
	Fire danger is elevated; spring fire season starts early
	Lawns brown early; gardens begin to wilt
	Surface water levels decline
D1	Honey production declines
	Irrigation use increases; hay and grain yields are lower than normal
	Trees and landscaping are stressed; fish are stressed
	Voluntary water conservation is requested; reservoir and lake levels are below normal capacity
	Wildfires and ground fires increase
D2	Fish kills occur; wildlife move to farms for food
	Golf courses conserve water
	Producers begin feeding cattle; hay prices are high
	Specialty crops are impacted in both yield and fruit size
	Trees are brittle and susceptible to insects
	Warnings are issued on outdoor burns; air quality is poor
	Water quality is poor; groundwater is declining; irrigation ponds are dry; outdoor water restrictions are implemented
D3	Crop loss is widespread; Christmas tree farms are stressed; dairy farmers are struggling financially
	Extremely reduced flow to ceased flow of water is observed; river temperatures are warm; wells are running dry; people are digging more and deeper wells
	Water recreation and hunting are modified; wildlife disease outbreak is observed
	Well drillers and bulk water haulers see increased business

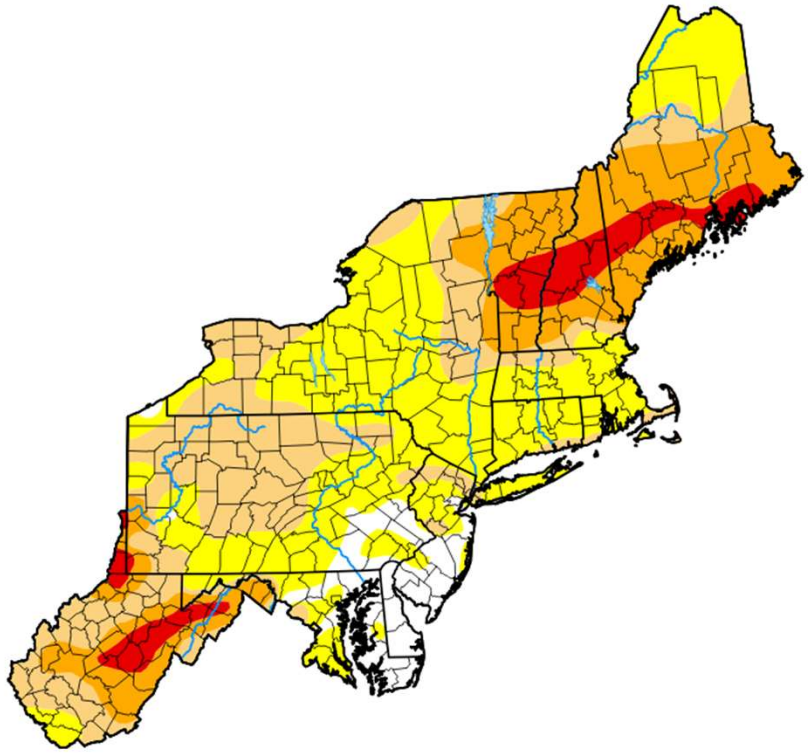
https://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?VT

U.S. Drought Monitor

Current | Maps | Data | Summary | About | Conditions & Outlooks | Ag in Drought | En Español | NADM

Northeast

Home / Northeast



Map released: Thurs. September 25, 2025

Data valid: September 23, 2025 at 8 a.m. EDT

Intensity

- None
- D0 (Abnormally Dry)
- D1 (Moderate Drought)
- D2 (Severe Drought)
- D3 (Extreme Drought)
- D4 (Exceptional Drought)
- No Data

Authors

United States and Puerto Rico Author(s):

Brad Rippey, U.S. Department of Agriculture

Pacific Islands and Virgin Islands Author(s):

Tsegaye Tadesse, National Drought Mitigation Center

https://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?Northeast

2025 drought impacts persist into 2026

Young spruce on ledge nearly dead due to drought. Plymouth, VT, January 2026

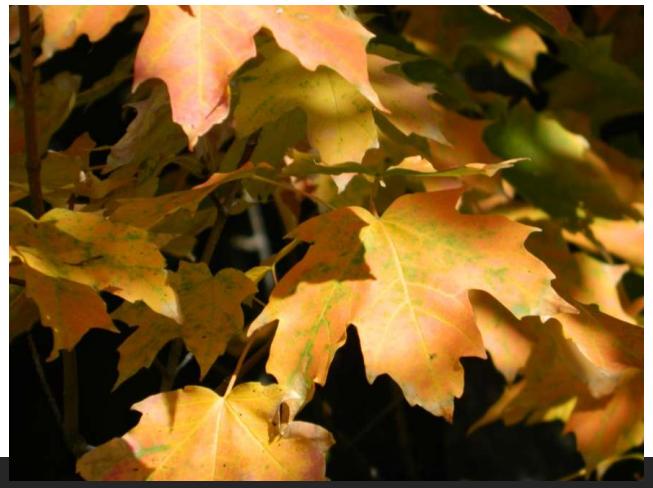
Drought-induced mortality on young spruce. Plymouth, VT, April 2026.

Drought-induced mortality of balsam fir sapling. Barnet, VT, March 2026.

Courtesy: Josh Halman, VT ANR/Forests, Parks & Recreation

Concurrent stressors – Sept. 2016

Photos: L-A. Dupigny-Giroux



Concurrent stressors in 2006

Photos: L-A. Dupigny-Giroux

Implications for climate change on forests

Dr. L-A. Dupigny-Giroux

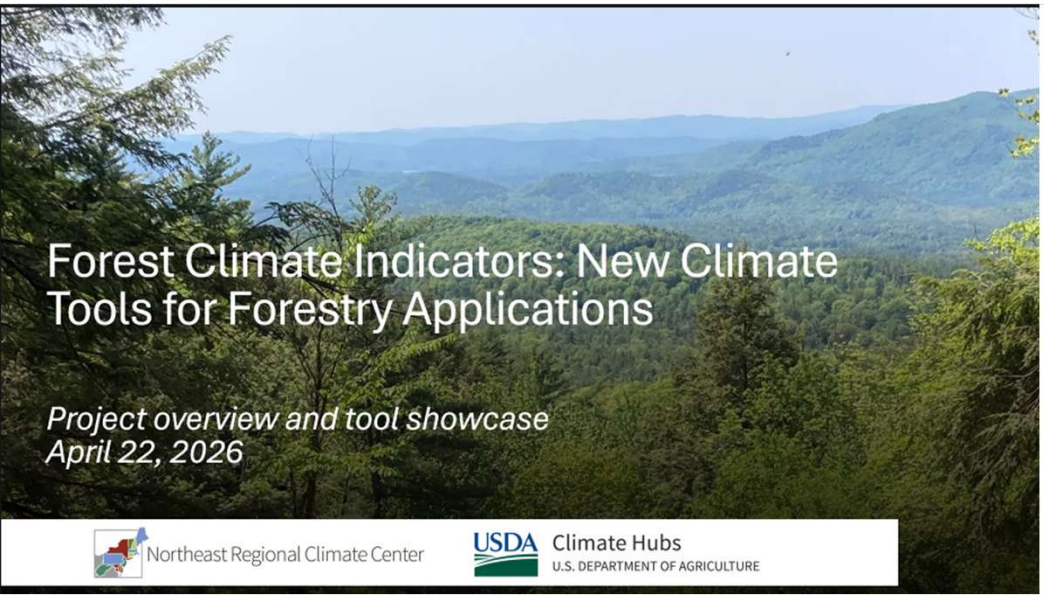
Compounding stressors

acid rain deposition

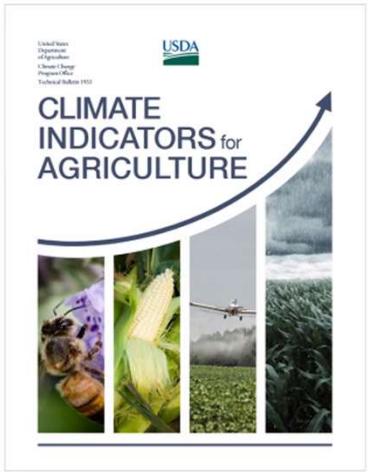
introduced species

changes in phenology

changes in monitoring & modelling of impacts

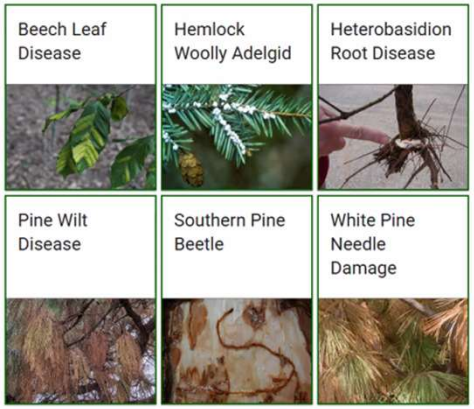


Linking to Management



- Despite a wide range of climate indicators in the literature, relatively few tools directly link them to forest management decisions.
- There is a need to contextualize climate data for forestry-specific applications.

Suite of Tools

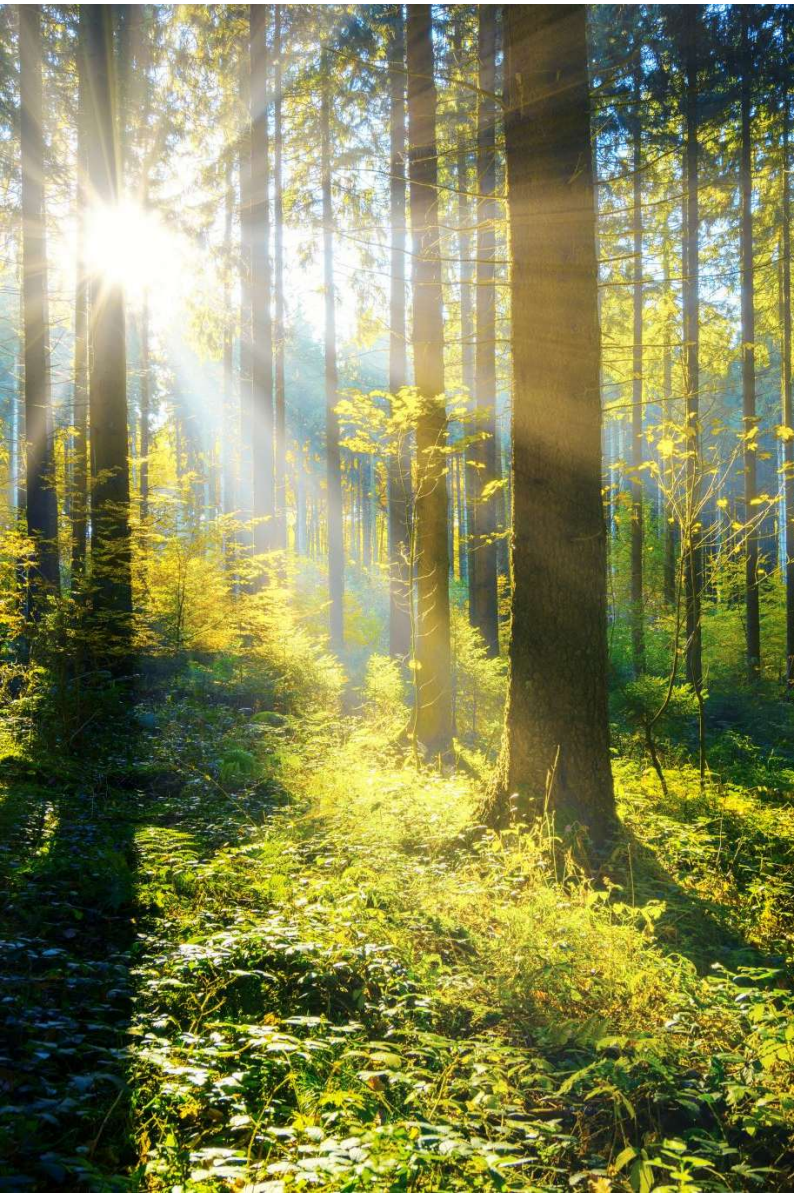


Connection to Climate

Three climate indicators are used to predict Hemlock Woolly Adelgid survival:

- exposure to a mean winter (DJFM) temperature of -5°C/23°F, *or*
- 93 days in which the daily minimum temperature is below -10°C/14°F, *or*
- an absolute minimum winter temperature of -40°C/-40°F.

Based on Paradis et al. 2008



Concluding remarks & next steps

Indigenous ways of knowing & access to forests

Stewardship

Ecosystem services & co-benefits afforded by forests

mixture of working lands and natural lands

preservation of our wetlands & nature-based solutions

Compound, consecutive, complex stressors

Importance of topography and elevation

Land-use history & site-specific factors

Species-specific considerations

Dr. L-A. Dupigny-Giroux

6. Climate and Climate Change in Vermont

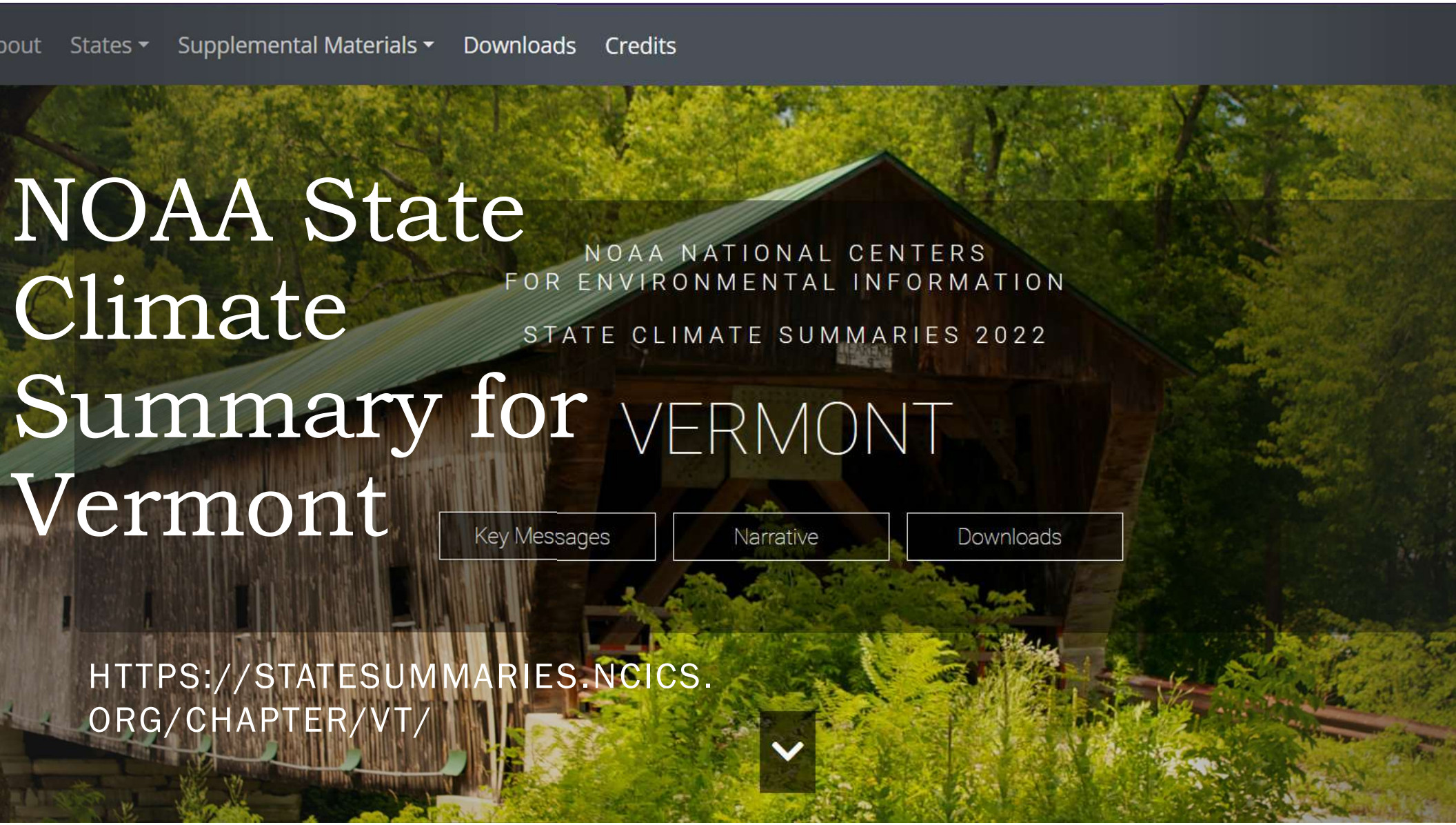
Citation: Dupigny-Giroux, L.A., Shafer, J., Kulkani, T., Bowden, B., Dow, J., Paske, C., Dejong, B., Kim, J., Myrick, E. "Climate and Climate Change in Vermont," *Vermont Climate Action Plan 2025*. Montpelier, VT, 2025.

Preface

This section of the *Vermont Climate Action Plan 2025* presents the land, air, water and plant dimensions of climate change in Vermont and the interconnected ways that we as peoples both affect and are impacted by such changes. From the homelands of the Abenaki and the Mohican, we honor all ways of knowing[3] and present mitigation, adaptation and resilience through the overlapping lenses of natural hazards, inclusion and vulnerability of peoples, the natural environment, and human infrastructure, as we seek to do no harm. For consistency with other state-level Climate Action Plans, this section uses data, methodologies and results developed in support of the 2023 Fifth National Climate Assessment (NCA5)[4] as well as those from multiple federal and State of Vermont agencies. Following the presentation style used in NCA documents, information here will be organized into Key Messages that highlight updates and developments made since the Initial Vermont Climate Action Plan of 2021.

Vermont Climate Action Plan 2025

https://outside.vermont.gov/agency/anr/climatecouncil/Shared%20Documents/VermontClimateActionPlan2025-Chapter6.pdf?_gl=1*1qvmrfr*_ga*MTkyMzQwNDgzLjE3NzMxNjcwNTI.*_ga_V9WQH77KLW*czE3NzMyNDIzNzUkbzEkZzAkdDE3NzMyNDIzODMkajUyJGwwJGgw


bout
States
Supplemental Materials
Downloads
Credits
NOAA State Climate Summary for Vermont
NOAA NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION
STATE CLIMATE SUMMARIES 2022
VERMONT
Key Messages
Narrative
Downloads
HTTPS://STATESUMMARIES.NCICS.ORG/CHAPTER/VT/

Thank you!

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