

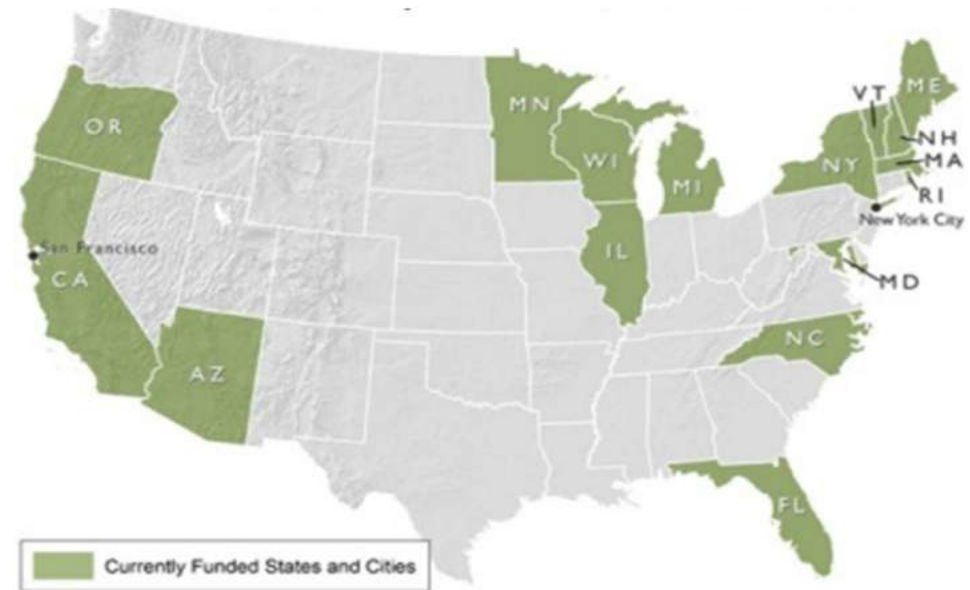
Building Resilience Against Climate Effects in Vermont



Climate Change and Health Adaptation Program

- Implemented by the Vermont Department of Health in summer 2013
- 4-year grant from the CDC's Climate Ready States & Cities Initiative to:

“help state and city health departments investigate, prepare for, and respond to the health effects that climate change may have on people”

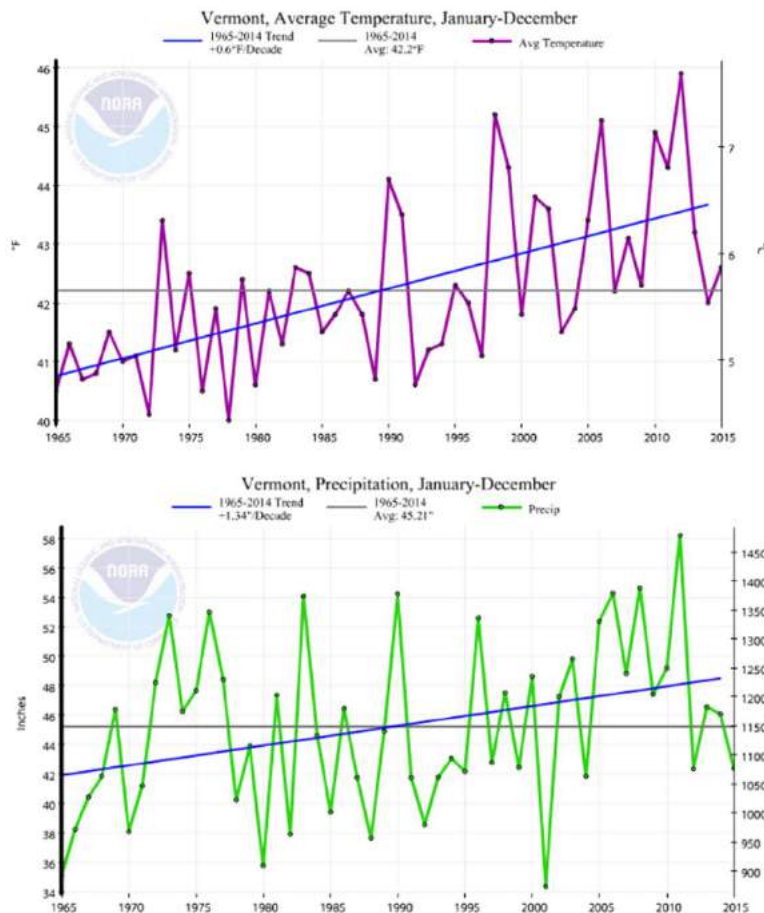


16 states, 2 cities

Key message #1:

**Climate change is
already happening, and
is expected to continue**

Vermont is already getting warmer & wetter...



□ Since 1965:

■ Temperature:

- + 2° F in summer
- + 4° F in winter
- 4th largest rate of warming in U.S.

■ Precipitation:

- + 7" rain per year
- 4th largest increase in precipitation in the U.S.

Source: National Oceanic and Atmospheric Administration, *Climate at a Glance, Time Series data*

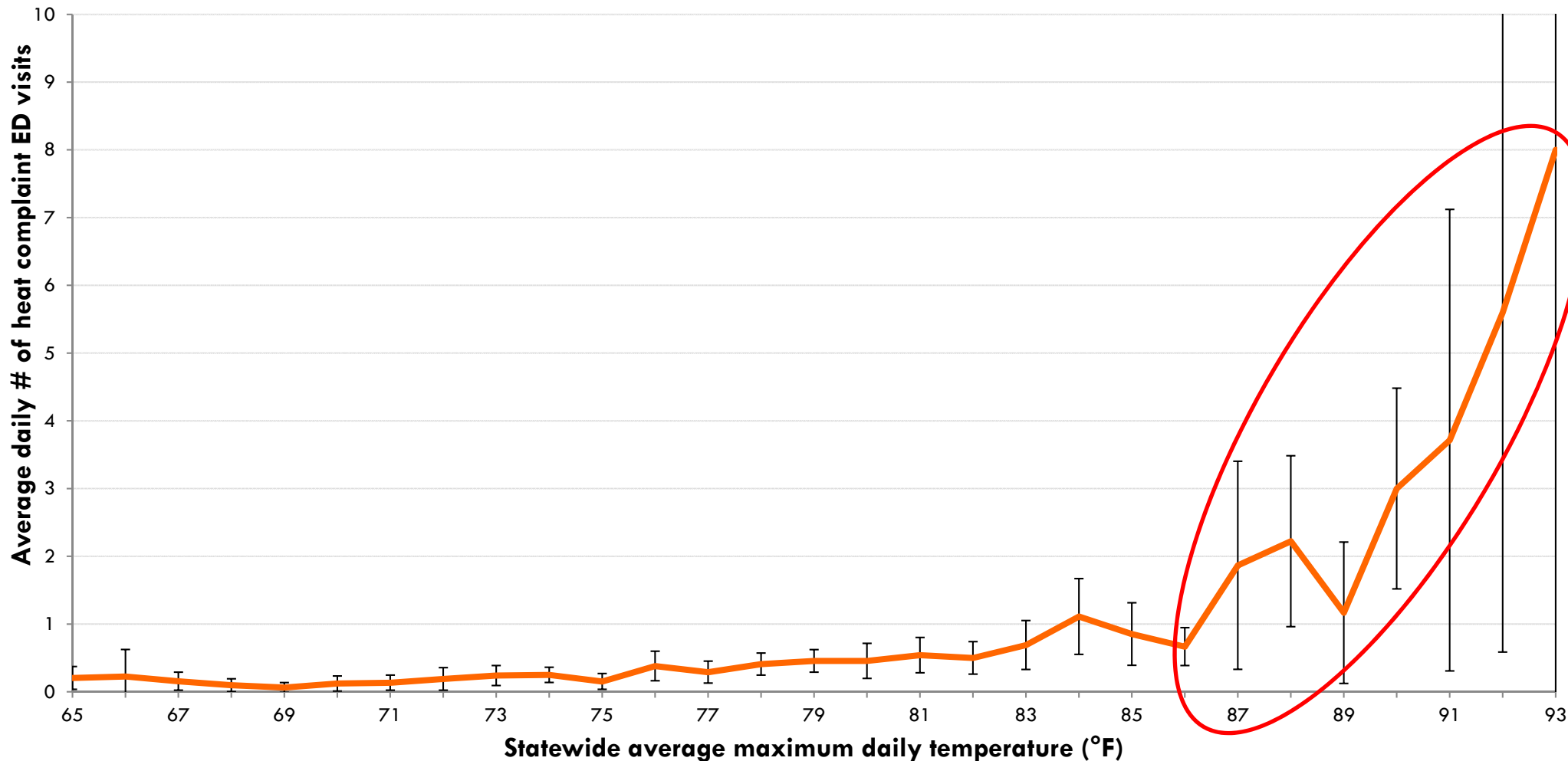
...and we expect these trends to continue in the future

Key message #2:

**Climate change is
increasing health risks
in Vermont**

Hot weather already leads to increased illness & death in Vermont

Average daily emergency department visits for heat complaints in Vermont, by maximum daily temperature, 2004 - 2013

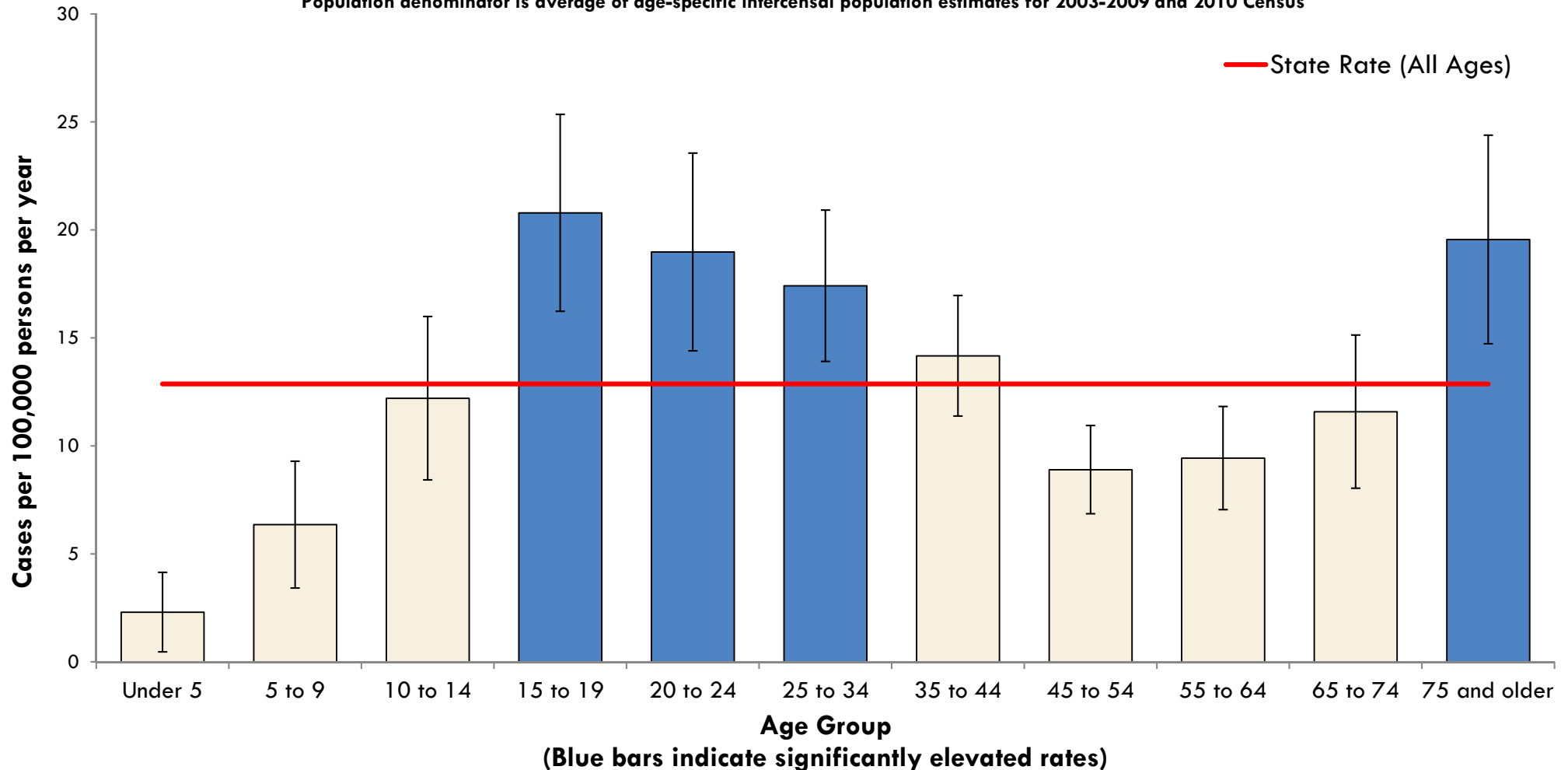


Source: Vermont Department of Health

Hot weather already leads to increased illness & death in Vermont

Annual Incidence of Heat Illness Emergency Department Visits in Vermont, by Age Group, 2003 - 2010

Population denominator is average of age-specific intercensal population estimates for 2003-2009 and 2010 Census



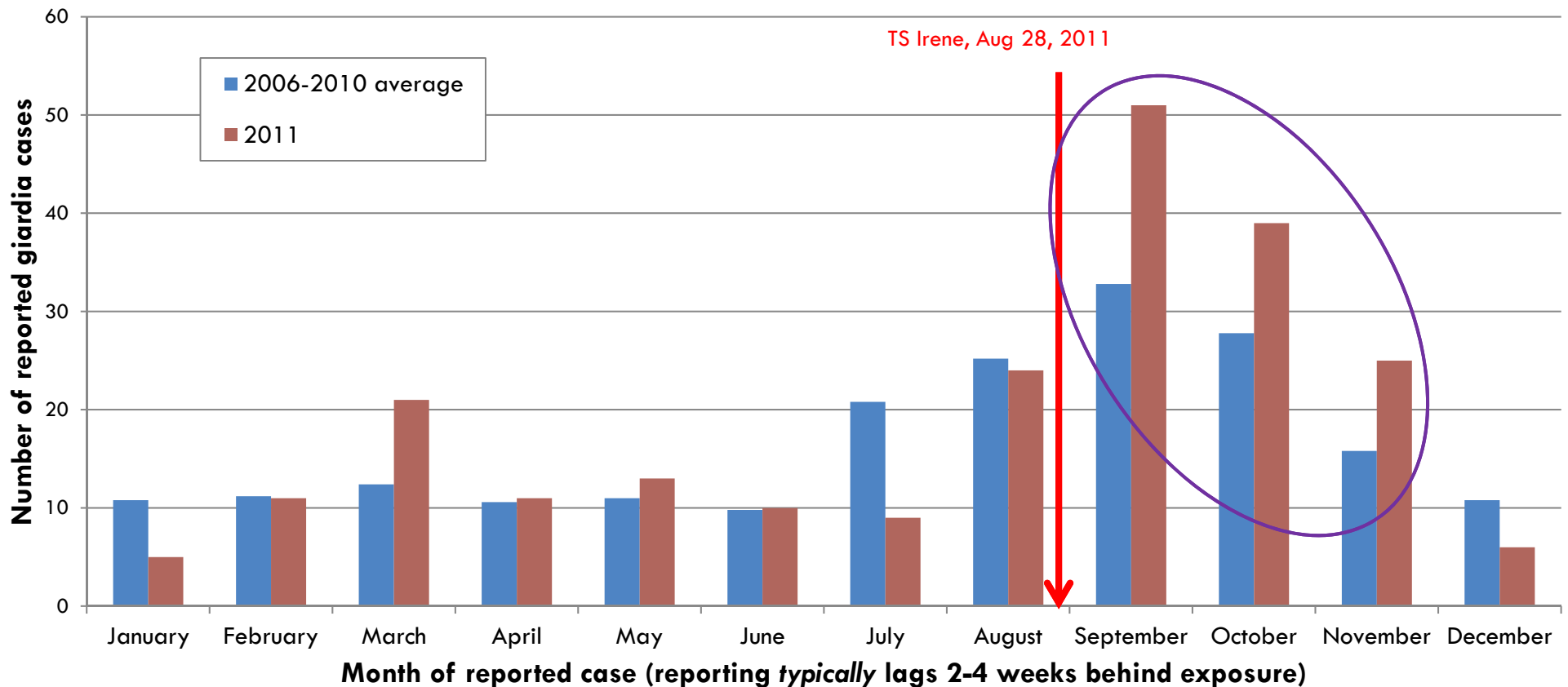
Extreme weather events have become more frequent and some have had serious health consequences

- Vermont had 18 federally-declared disasters in the past 10 years, up over 50% from the previous 10 years
- Health impacts from Tropical Storm Irene
 - 6 deaths
 - Extensive property/infrastructure damage, power outages, and other service disruptions
 - Wellheads submerged by floodwaters
 - 30 public water systems issued Boil Water Notices
 - 17 wastewater treatment facilities reported compromised operations
 - Septic system failures, fuel spills, other hazardous contamination
 - Over \$10 million estimated damage to crops and farmlands



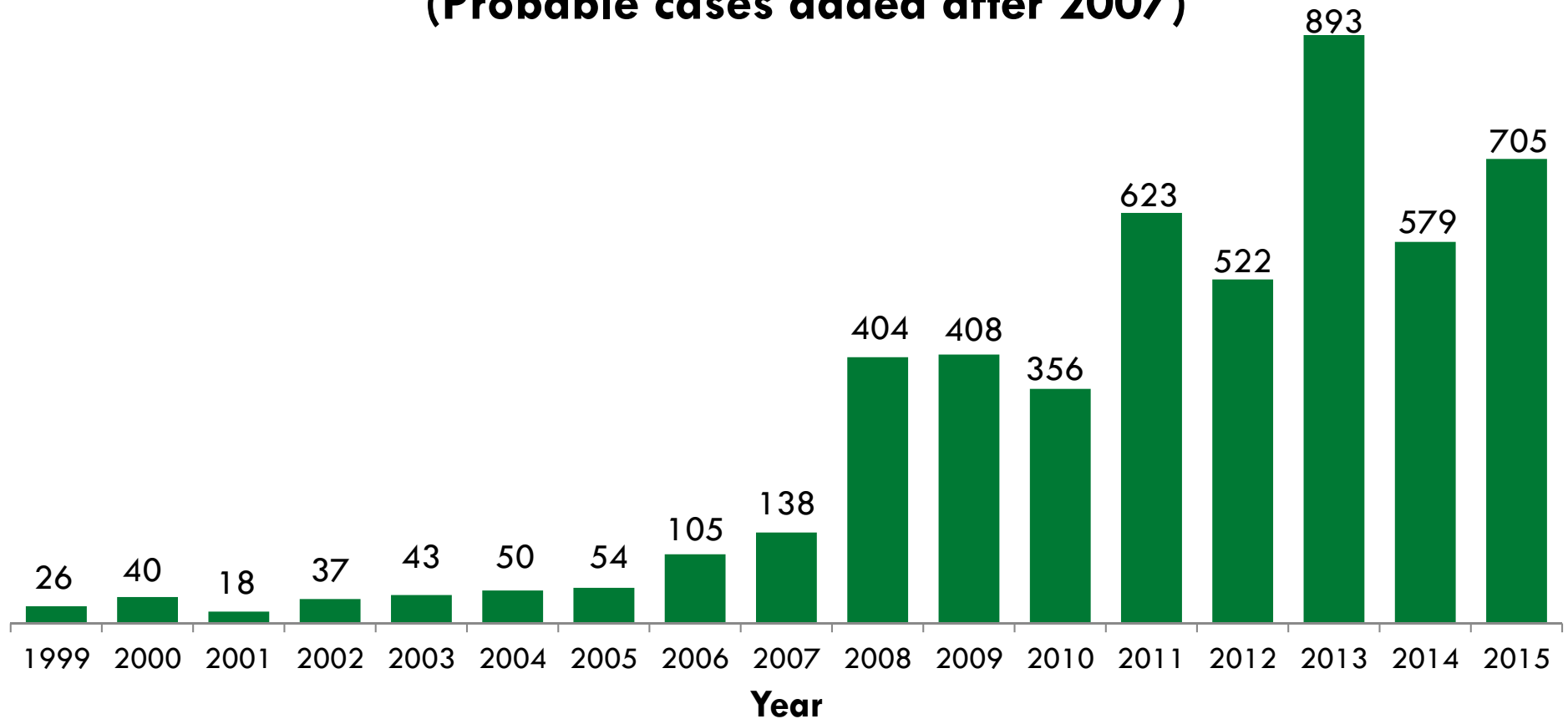
Heavy rains can increase contaminated runoff into drinking and recreational waters, leading to illness

Count of Giardia cases reported to Health Department by month



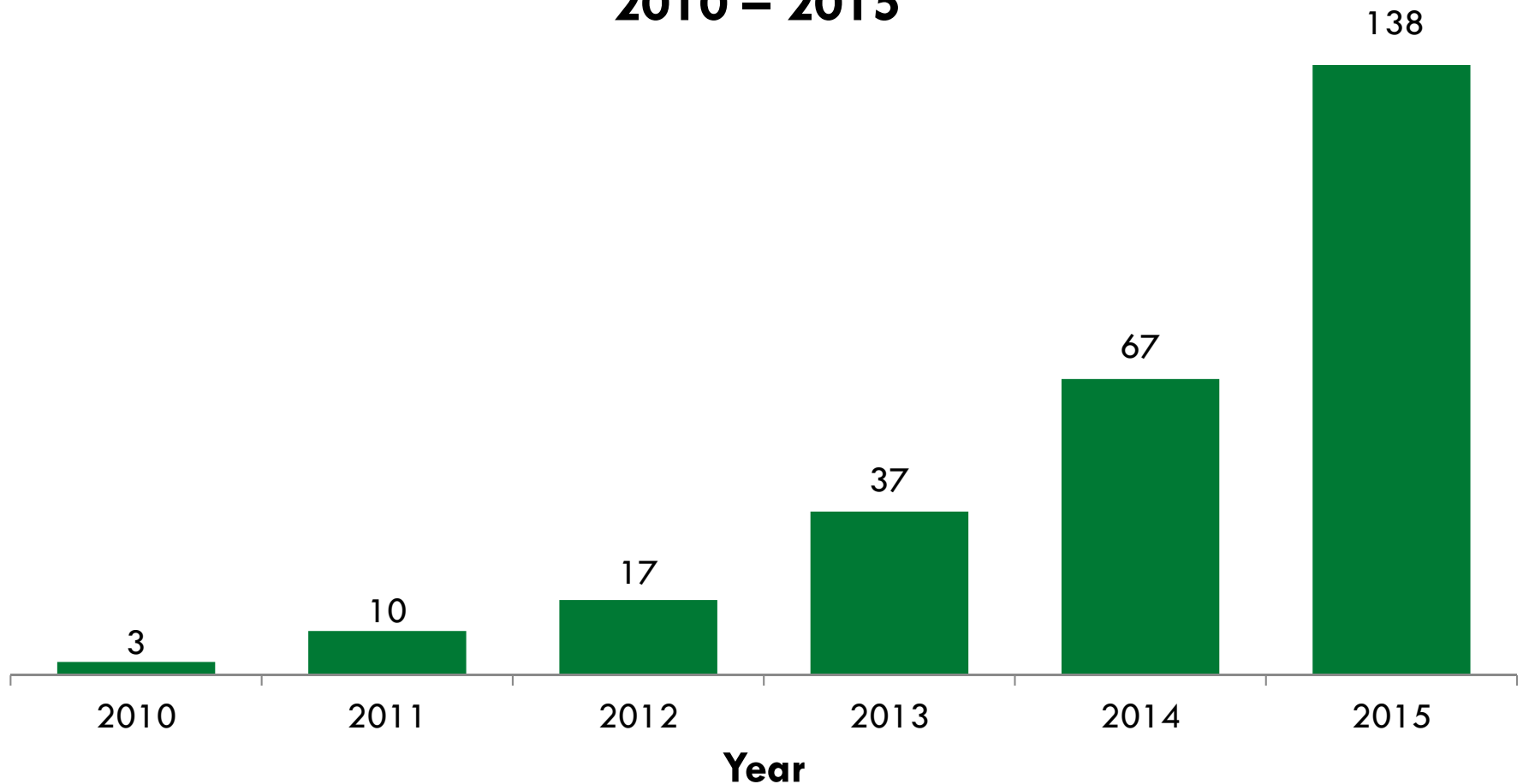
Lyme disease & anaplasmosis have increased rapidly in recent years

Confirmed and Probable Lyme Disease Cases 1999 – 2015 (Probable cases added after 2007)



Lyme disease & anaplasmosis have increased rapidly in recent years

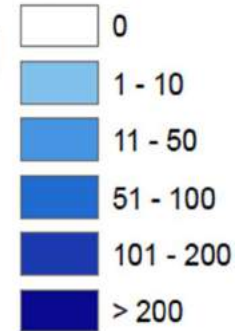
Confirmed Vermont anaplasmosis Cases, 2010 – 2015



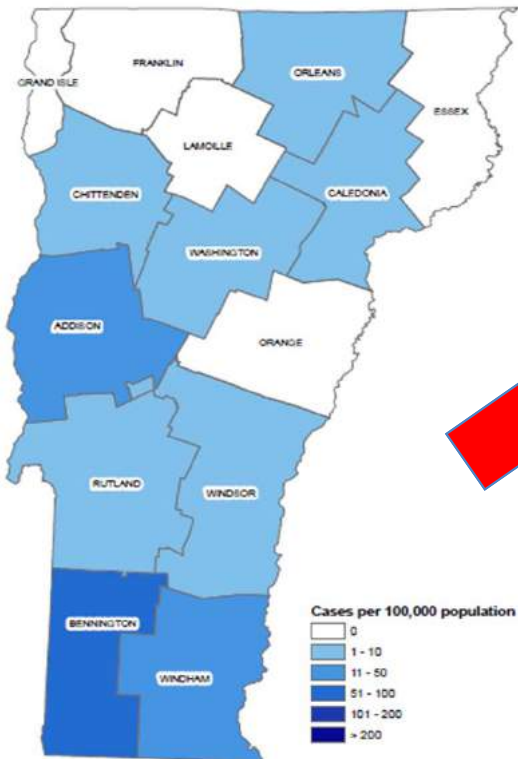
Lyme disease & anaplasmosis have increased rapidly in recent years

- Lyme disease incidence has been steadily moving northeastward

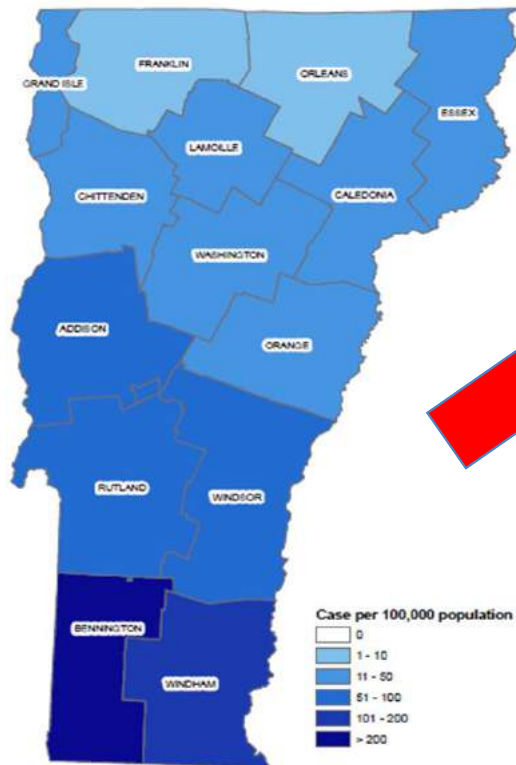
Cases per 100,000 population



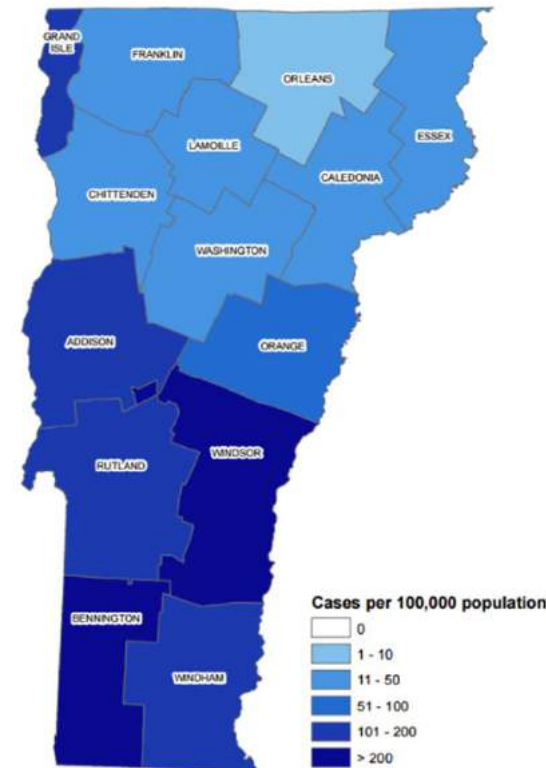
2005



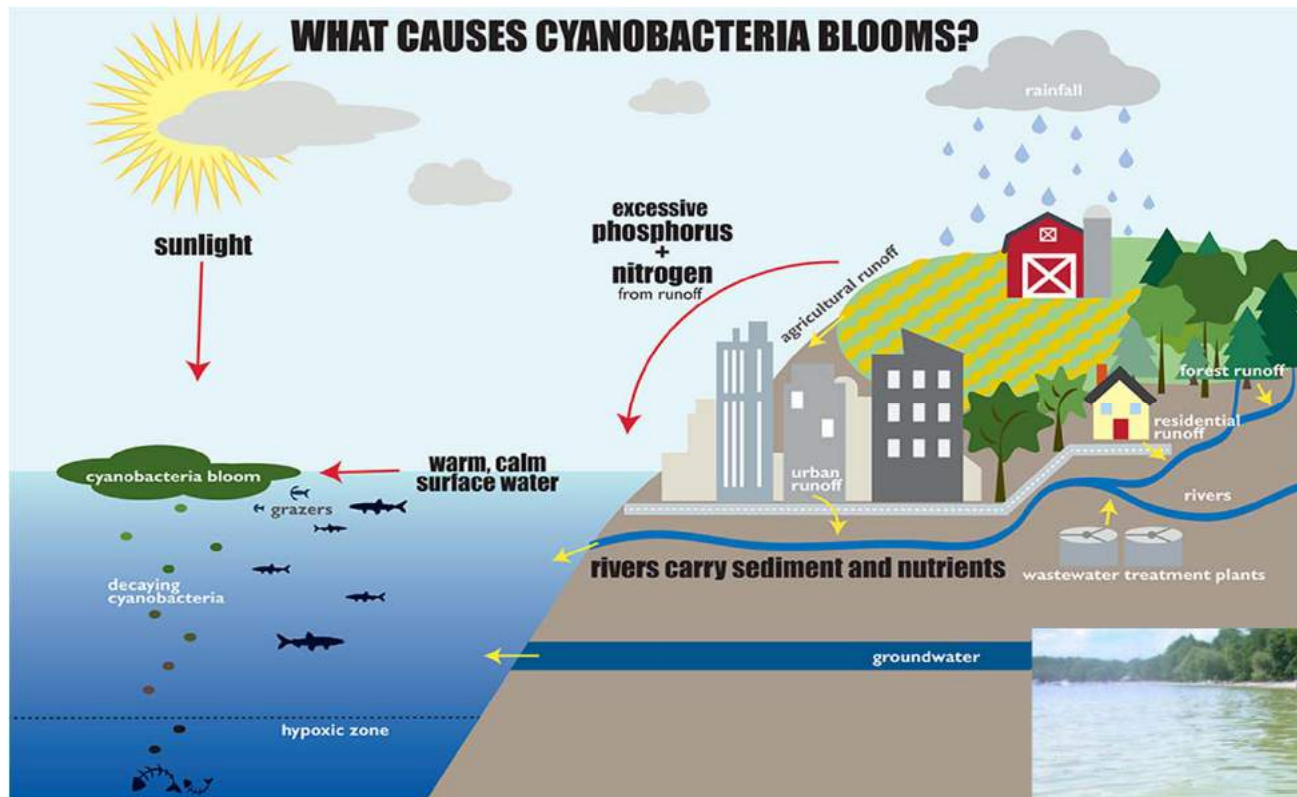
2008



2014



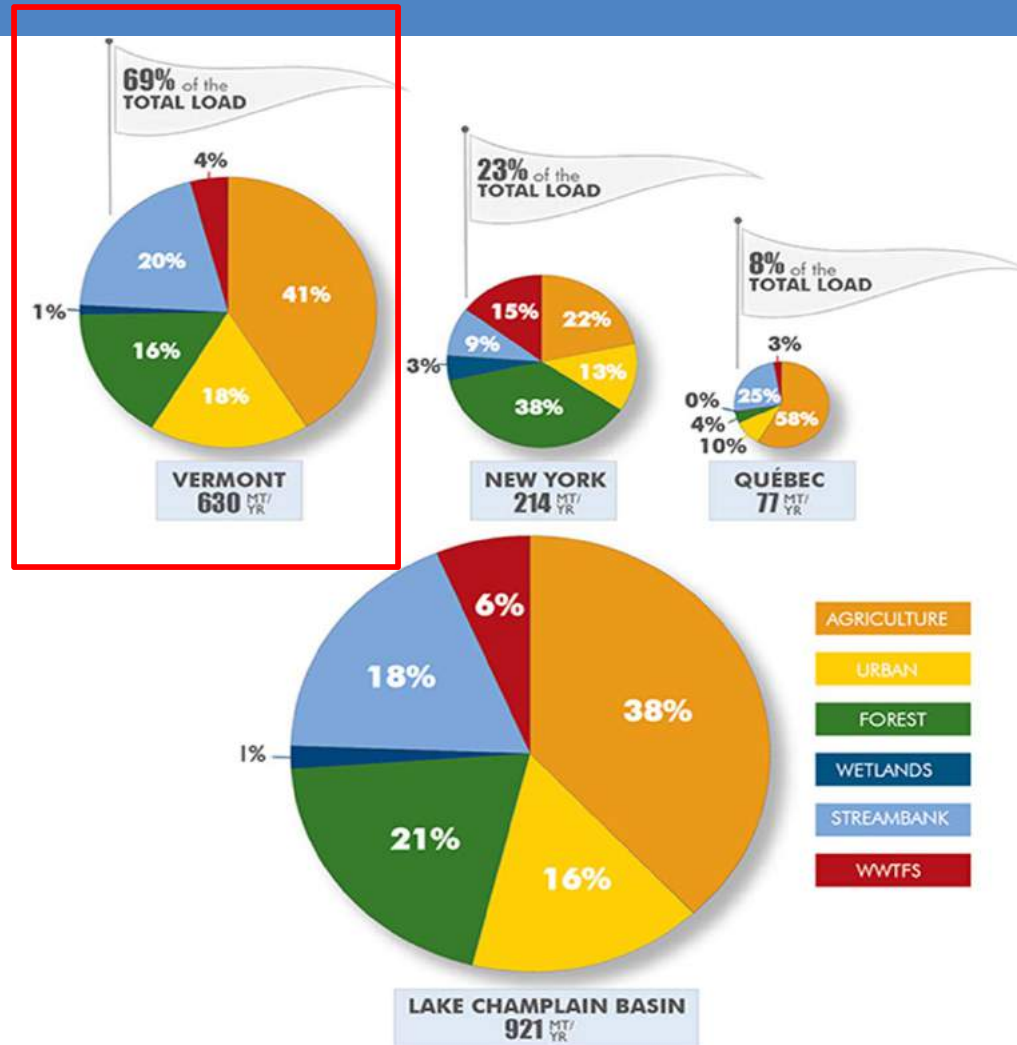
Cyanobacteria (blue-green algae) blooms occur each summer and can produce harmful toxins



Change in Lake Champlain temperature, 1964-2009:



Nutrient flows to Lake Champlain



NOTE: Grass/Shrub was included in the analysis but excluded from this graphic due to the comparatively low percentage of phosphorus.
DATA SOURCE: Tetra Tech, 2015.

Other health concerns:

- Water and food-borne illnesses
- Pollen & seasonal allergies
- Air pollution
- Mental health
- Household mold



Source: Town of Charlotte, VT

Key message #3:

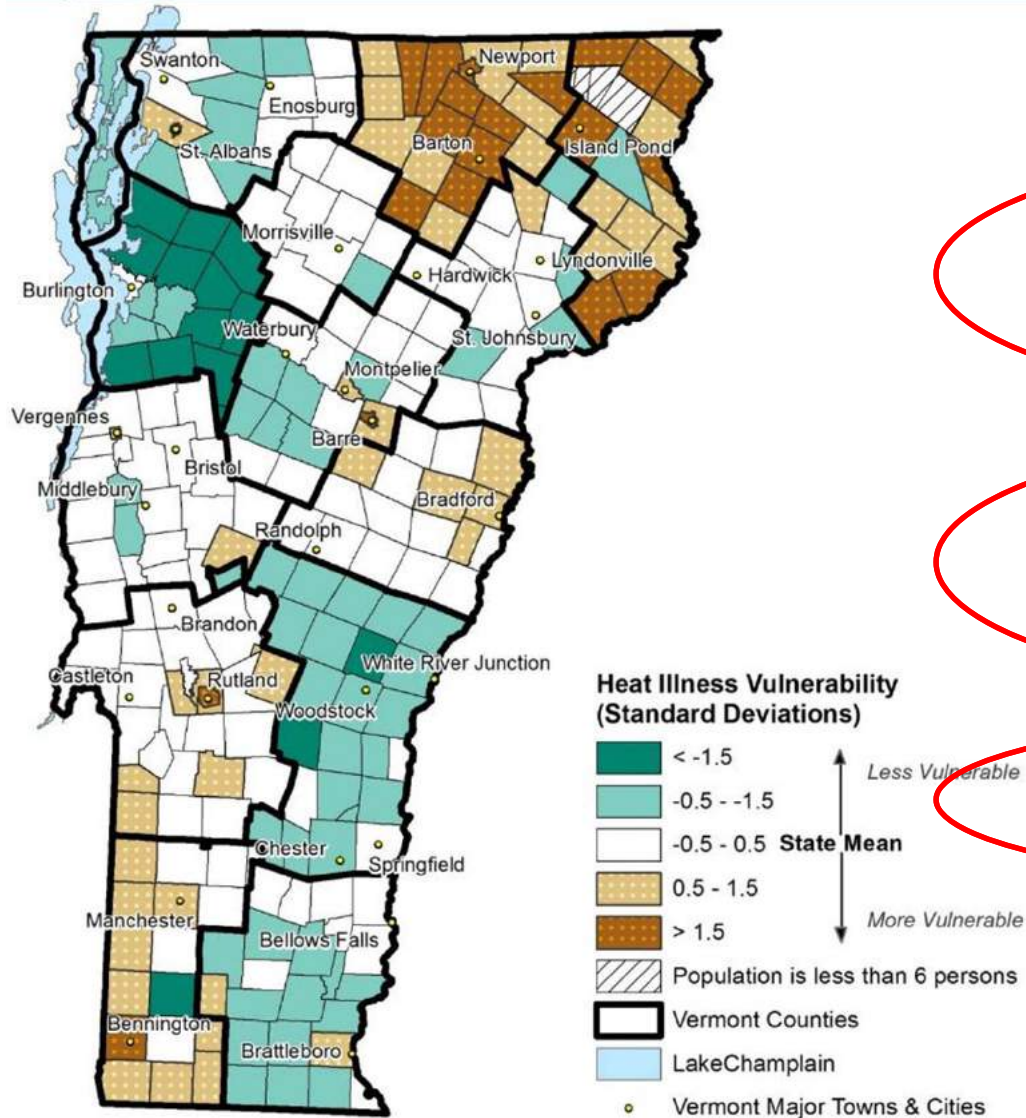
Everyone's health is threatened by climate change, though the threat is greater for some

Climate & health vulnerability

- Climate change will disproportionately affect those with:
 - higher exposure risk
 - pre-existing health vulnerabilities
 - limited resources for adaptation

- It is critical to identify individuals and communities that may be particularly vulnerable, and take actions to ensure that they do not suffer unjustly from climate impacts

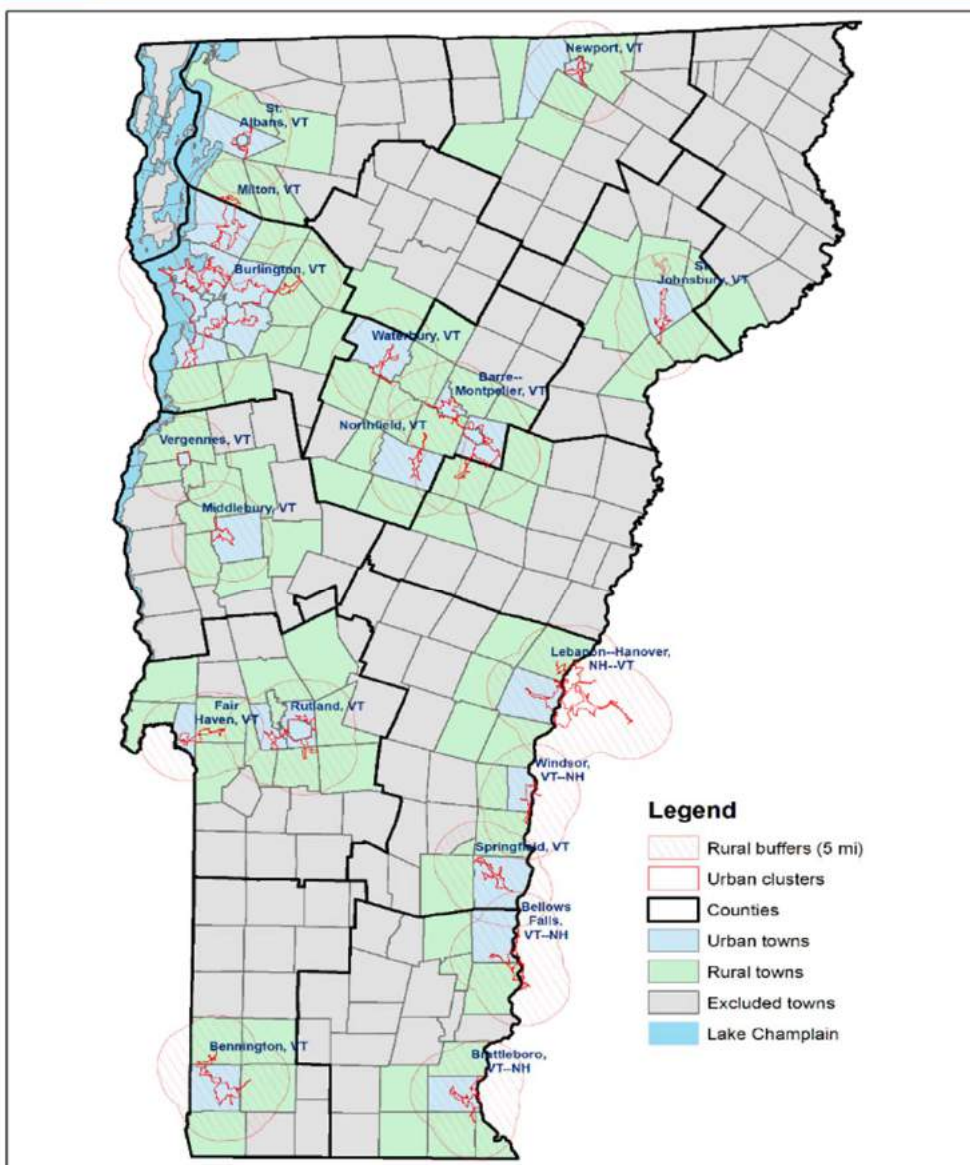
Heat Vulnerability Index



Factors:

- Environmental characteristics **Exposures**
- Climate acclimation
- Age **Vulnerabilities**
- Pre-existing medical conditions **Barriers to adaptation**
- Socioeconomic status
- Isolation
- Historic heat illness

Urban heat islands in Vermont???



- Average urban-rural temperature difference (weighted by urban area size): **+3.9° F**

□ Heat illness rate:

- All urban cluster towns and adjacent rural towns

Area Type	Population Estimate (2010 Census)	Age-adjusted incidence rate, per 100k persons per year
Urban	285,904	14.1 (12.6, 15.6)
Rural	165,331	11.6 (9.7, 13.5)

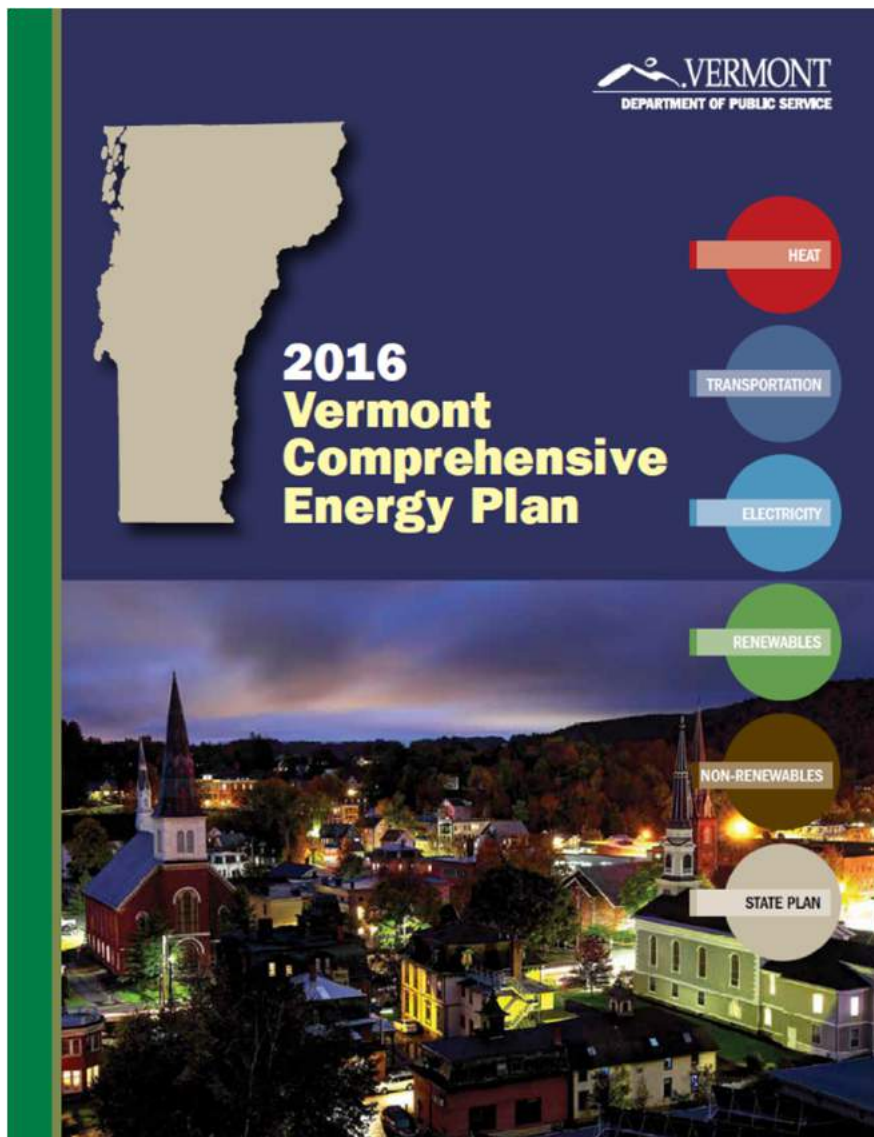
- Excluding Chittenden County towns

Area Type	Population Estimate (2010 Census)	Age-adjusted incidence rate, per 100k persons per year
Urban	155,468	18.9 (16.5, 21.3)
Rural	142,372	10.7 (8.7, 12.6)

Key message #4:

**Responding to climate
change can benefit
health now and in the
future**

“Win-win” actions can reduce GHG emissions and provide immediate environmental, economic, and health benefits



Comprehensive Energy Plan 2016

Guiding Goals When Developing and Evaluating Energy Policy

A Vibrant and Equitable Economy

- Ensure an affordable and stable cost of living through improving the energy fitness of Vermont homes, strategic electrification, focusing development in compact villages and urban centers, and substituting fossil fuels with renewable alternatives that have lower long-term costs.
- Ensure an affordable and stable cost of doing business through improvements in commercial and industrial building and process energy efficiency, strategic electrification, and the substitution of renewable alternatives for fossil fuels.
- Increase entrepreneurship opportunities by supporting market demand for renewable energy and energy efficiency services, as well as encouraging research and commercialization of new energy services and technologies.
- Improve labor market conditions by creating well-paying jobs in industries that supply renewable energy commodities and energy efficiency services.
- Ensure an equitable distribution of benefits and burdens by assisting those least able to pay the increasing costs of energy and the upfront costs for investments in efficiency and fuel switching.
- Maintain revenue to support government functions by replacing the reduction in income from the sale of taxable fuels, such as motor fuels, with appropriate new revenue sources.

Healthy Ecosystems and a Sustainable Environment

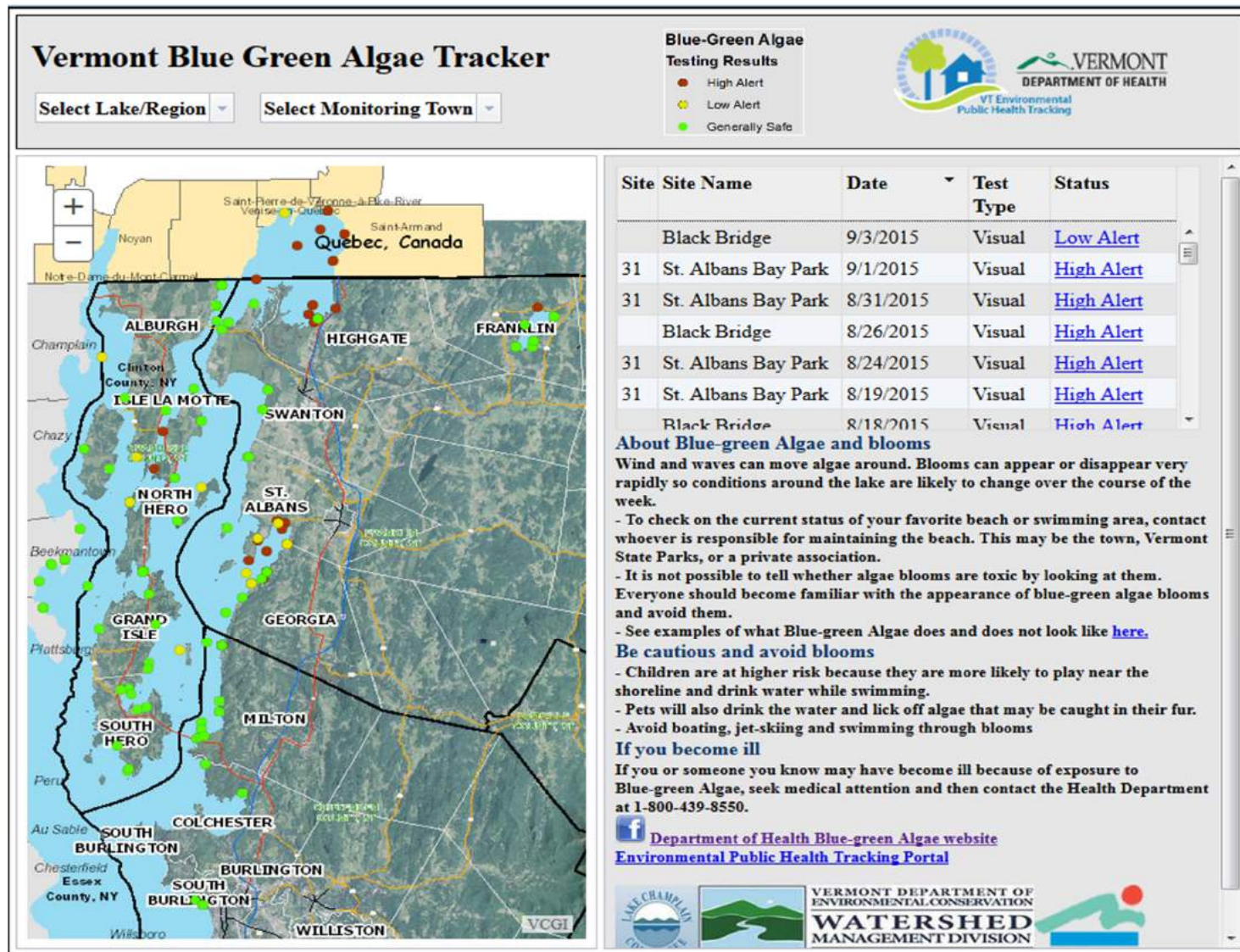
- Reduce greenhouse gas emissions, consistent with the state's emission-reduction goals, by reducing fossil fuel use and efficiently using renewable energy sources.
- Reduce local air pollutants, including particulates and toxins, by using efficient and clean combustion technologies, along with shifting away from fossil fuels.

- Bring a global and life-cycle perspective to the analysis of costs and benefits.
- Retain healthy, functional forest and agricultural systems through responsible use of forest and agricultural resources for energy and non-energy-related applications.
- Maintain water quality throughout Vermont's ecosystems through responsible land and water use.
- Optimize land use choices to minimize local and global environmental impact, including balancing land use among competing needs in the state for energy, non-energy development, housing, transportation, working lands for agriculture and forestry, and other purposes.

Healthy Vermonters

- Encourage active lifestyles and reduced energy use through compact development and by providing safe opportunities for walking, biking, and using public transit.
- Improve outdoor air quality by reducing emissions from transportation, home and business heating and energy usage, and energy production.
- Improve the health of indoor environments and reduce energy bills through improved building weatherization and the use of advanced heating and ventilation technologies.
- Reduce negative health impacts expected to occur as a result of climate change.
- Assess health impacts of our energy system in order to avoid or mitigate potential negative impacts, especially for the most vulnerable population groups such as the elderly, low-income households, and those with chronic or pre-existing medical conditions.

Actions should be taken now to prepare for the health impacts of climate change





Actions should be taken now to prepare for the health impacts of climate change

BE TICK SMART

REPEL • INSPECT • REMOVE

What you should know about tick bites & Lyme disease





To report a tick sighting:

1. Zoom to location on map.
2. Click on "New Report" icon.
3. Click on map to mark location.
4. Fill out the form, then submit by clicking "X".

[Tick Identification Help](#)
[More help with tick ID here](#)


New Report

Hover over or click on a tick icon to view report detail.

-  Deer tick
-  Dog tick
-  Lone star tick
-  Other
-  Don't know

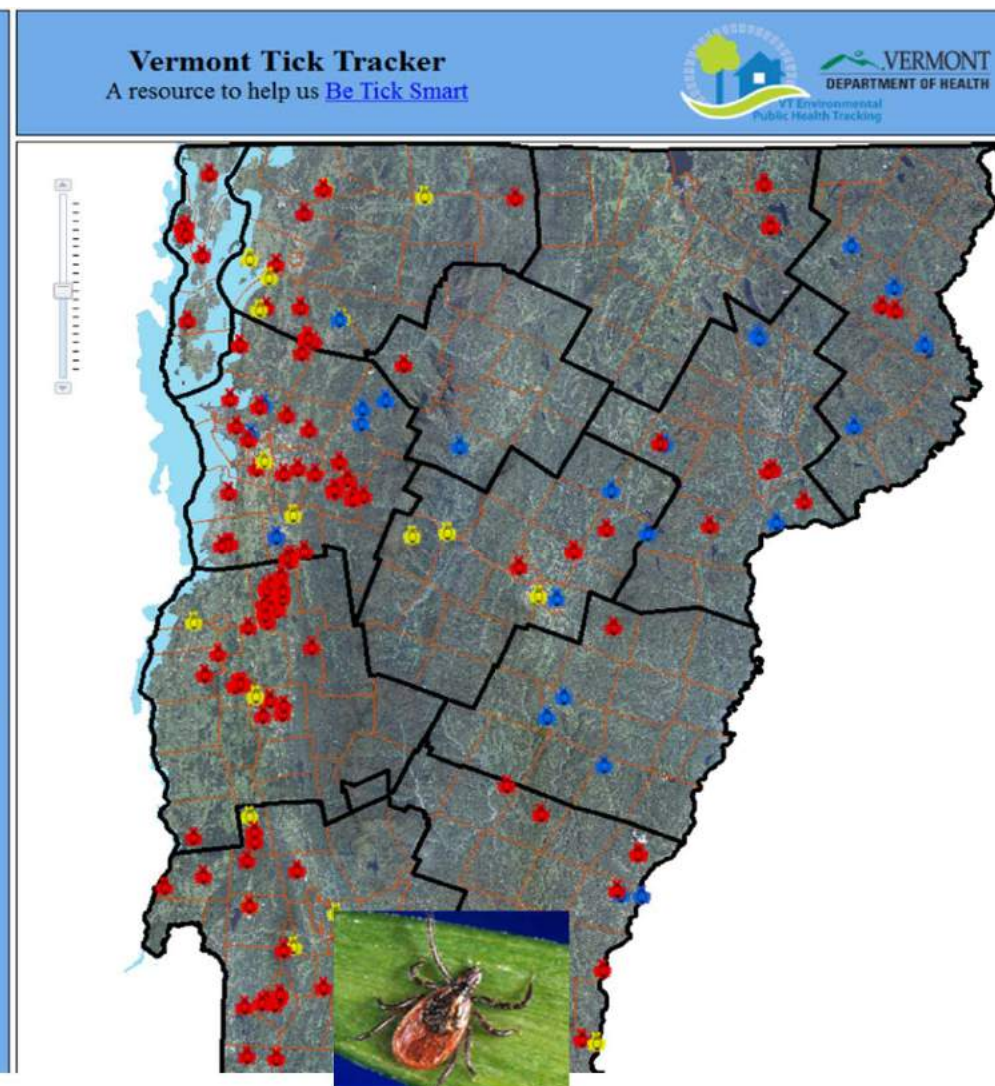
Enter a town name:

Quick Links

[Deer Tick Seasonality Chart](#)
[Deer Tick Life Cycle](#)

You will leave Tick Tracker site using the links below:

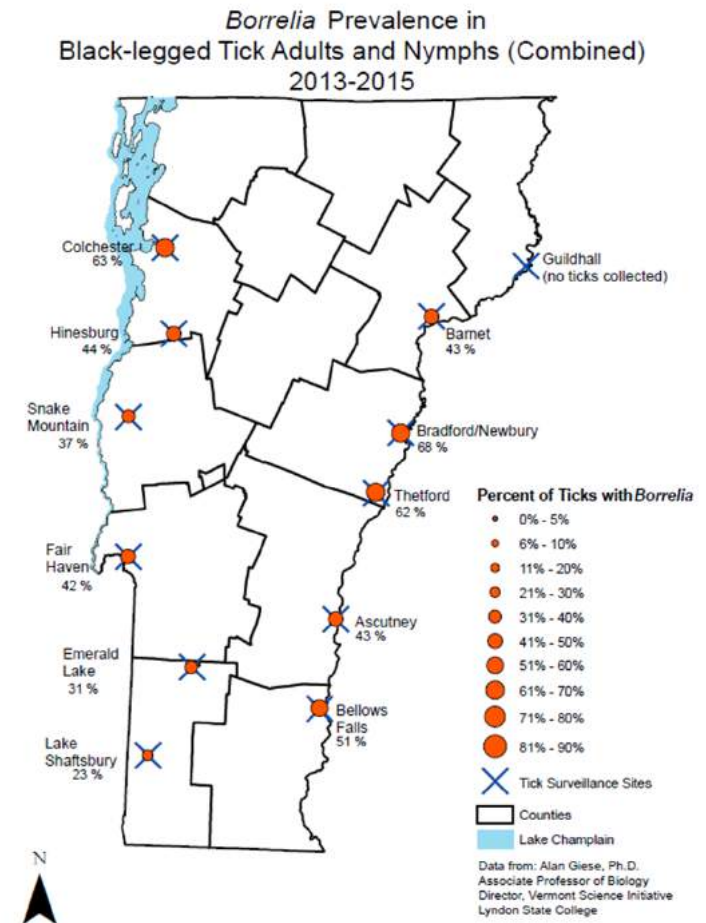
[Tickbite Prevention Tips](#)
[Vermont Tracking Portal](#)



Actions should be taken now to prepare for the health impacts of climate change



Credit: Alan Giese, Lyndon State University





Next steps

Next steps

- Additional analyses and disease projections
- Identify potential interventions
- Develop & implement **Adaptation Plan**
 - Outreach – risks and prevention strategies
 - Enhanced surveillance of risks and health impacts
 - Heat Response Plan
 - Local Adaptation Planning Toolkit
 - Support initiatives with climate & health co-benefits
- Evaluating effectiveness of interventions

Acknowledgments

- Centers for Disease Control and Prevention, Climate and Health Program
- Vermont Department of Health
 - Nate Schafrick, Climate Change Adaptation Program Epidemiologist
 - David Grass, Environmental Health Surveillance Chief
 - Heidi Hales, Vermont Agency of Natural Resources (former Climate Change Adaptation Program Coordinator)
 - Martin Fogl, McGill Medical School (former Climate Change Adaptation Program Epidemiologist)
 - Many others...
- Vermont State Climate Office
 - Lesley-Ann Dupigny-Giroux, Vermont State Climatologist
 - Evan Oswald, PACE Post-doctoral Fellow, University of Vermont

30

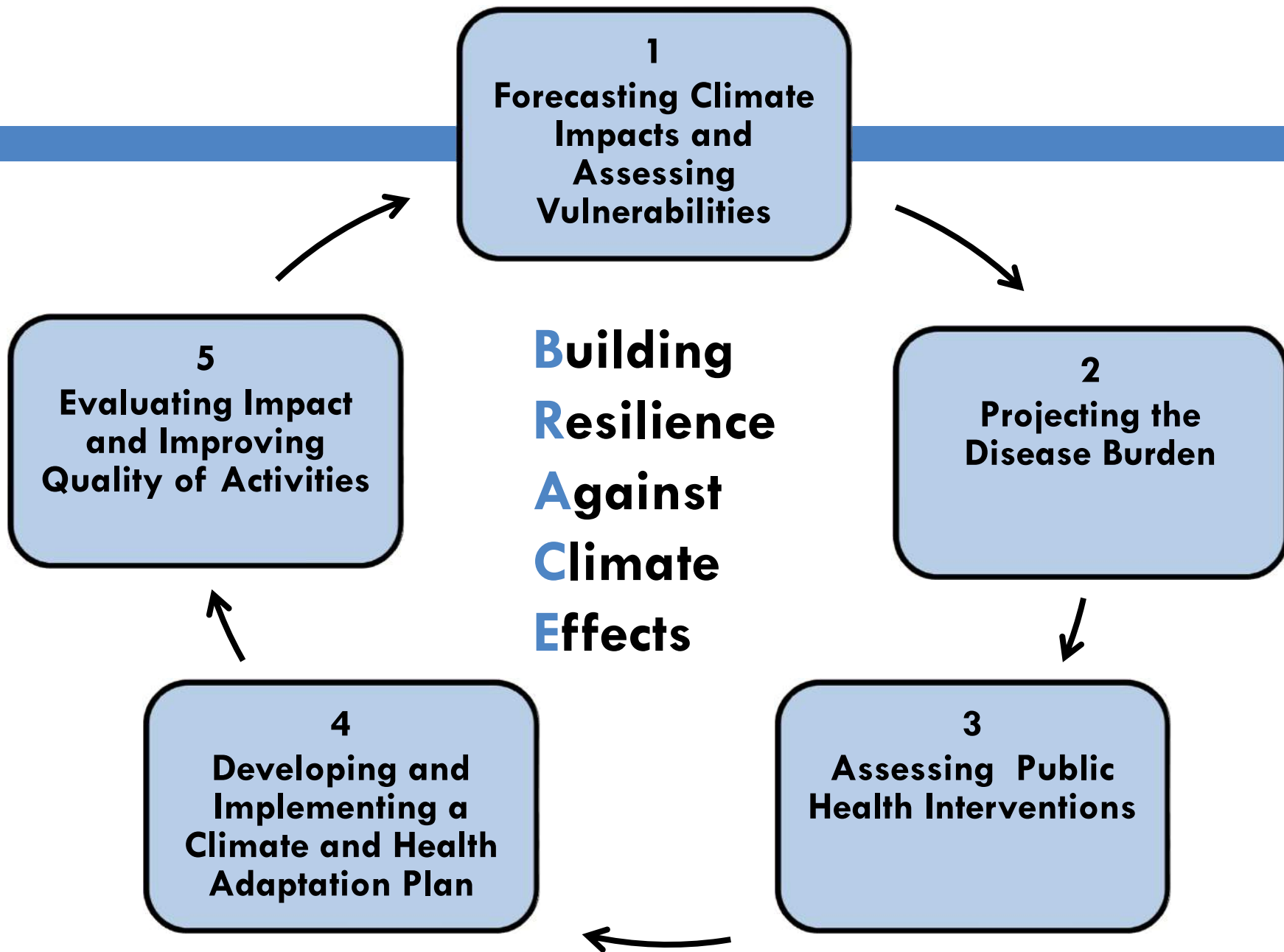
Contact information:
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Climate Change Adaptation Program
Vermont Department of Health





W Tackling climate change: the greatest opportunity for global health

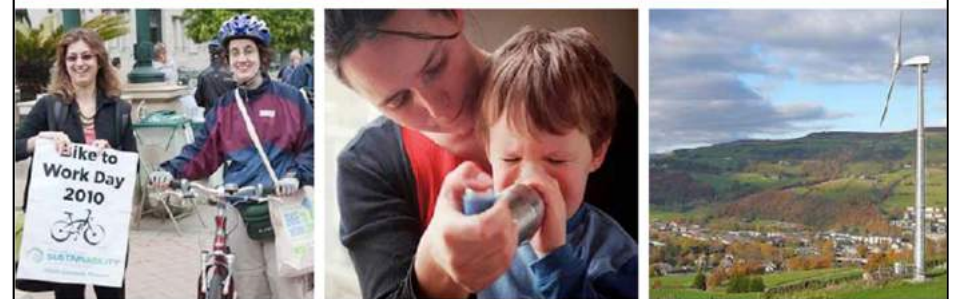
THE PREPARATION FRAME

A Guide to Building Understanding of Climate Impacts and Engagement in Solutions



Cara Pike, Sutton Eaves, Meredith Herr, Amy Huva, David Minkow

March 2015



Conveying the Human Implications of Climate Change

A Climate Change Communication Primer for Public Health Professionals

Edward Maibach, MPH, PhD
Center for Climate Change Communication
George Mason University

Matthew Nisbet, PhD
School of Communication
American University

Melinda Weathers, MA
Center for Climate Change Communication
George Mason University



George Mason University
Center for Climate Change Communication

Human activity causes climate change

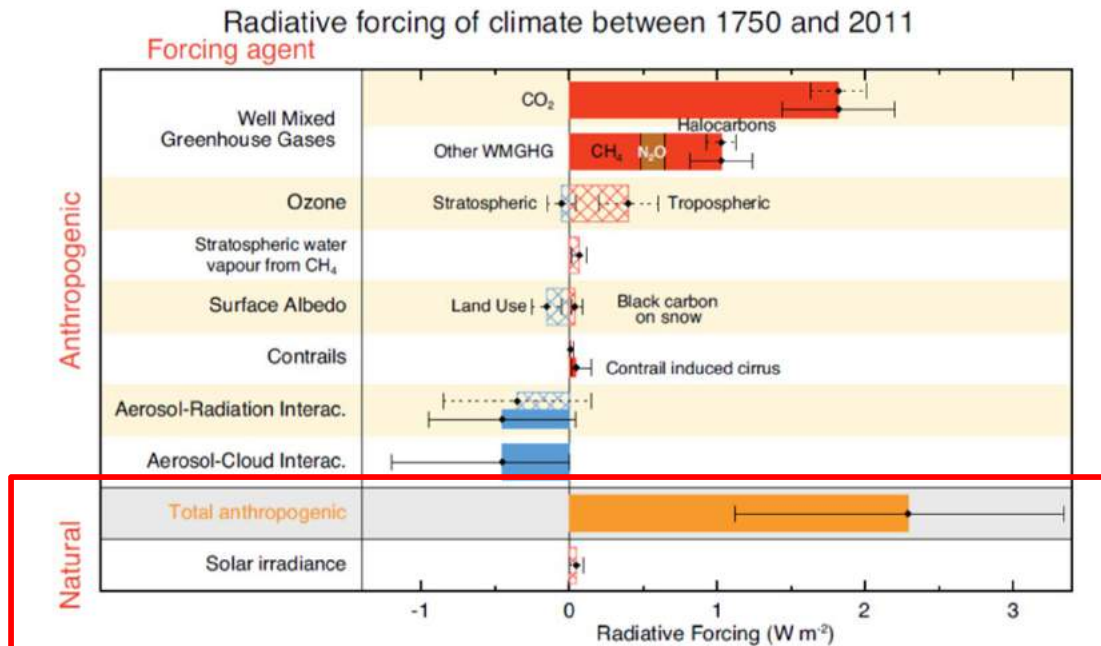


Figure 8.15 | Bar chart for RF (hatched) and ERF (solid) for the period 1750–2011, where the total ERF is derived from Figure 8.16. Uncertainties (5 to 95% confidence range) are given for RF (dotted lines) and ERF (solid lines).

OPEN ACCESS

IOP PUBLISHING

Environ. Res. Lett. 8 (2013) 024024 (7pp)

ENVIRONMENTAL RESEARCH LETTERS

doi:10.1088/1748-9326/8/2/024024

Quantifying the consensus on anthropogenic global warming in the scientific literature

John Cook^{1,2,3}, Dana Nuccitelli^{2,4}, Sarah A Green⁵, Mark Richardson⁶,
Bärbel Winkler², Rob Painting², Robert Way⁷, Peter Jacobs⁸ and
Andrew Skuce^{2,9}

Abstract

We analyze the evolution of the scientific consensus on anthropogenic global warming (AGW) in the peer-reviewed scientific literature, examining 11 944 climate abstracts from 1991–2011 matching the topics 'global climate change' or 'global warming'. We find that 66.4% of abstracts expressed no position on AGW, 32.6% endorsed AGW, 0.7% rejected AGW and 0.3% were uncertain about the cause of global warming. Among abstracts expressing a position on AGW, 97.1% endorsed the consensus position that humans are causing global warming. In a second

These trends are expected to continue

	1981-2010 average	2021-2050 projection	2070-2099 projection
Length of growing season	134 days	+9-12 days	+19-38 days
Average winter low temp	9°F	+2.2-2.9°F	+5-10°F
Average summer high temp	75°F	+1.7-2.1°F	+4-7°F
Days with max temp > 87°F	5 days	+5-6 days	+13-28 days
Yearly total precipitation	44"	+0.9-1.4"	+3-10"
Days/year of precipitation > 1"	8 days	+0.3-0.4 days	+0.7-1.4 days
Frequency of heaviest 0.1% precipitation events	Once every 7 years	Once every 3- 6 years	Once every 2- 3 years

Future expectations for heat impacts

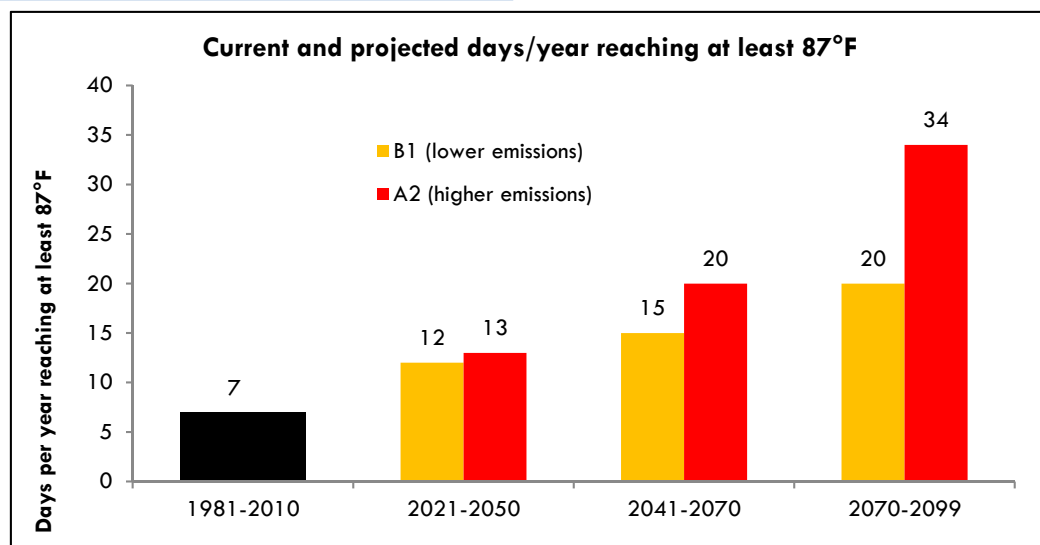
Current health burden

- Average of 80 emergency department visits per year for heat complaints
 - 26 occurred on days 87°F and warmer
- For those aged 65+, estimated 6 excess deaths per year on days 87°F and warmer

Exposure – outcome associations

- Emergency department visits were **8x more likely** on days when temperature reaches 87°F
- For those aged 65+, about **one additional death** on days 87°F and warmer

Expected change in exposure

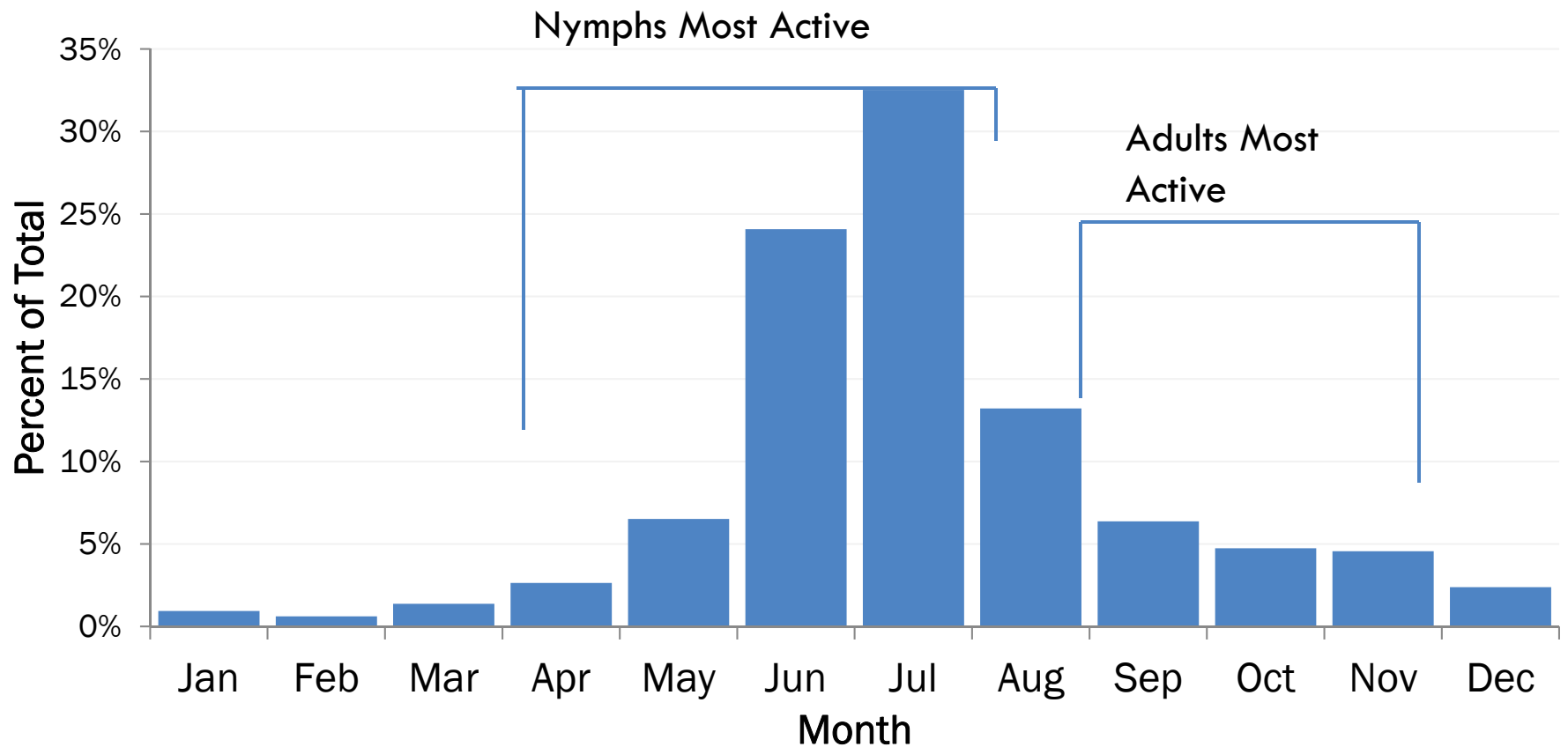


Future health burden

Time period	Excess emergency department visits/year for heat complaints	Excess deaths/year attributable to heat
Baseline (2012)	26	6
2021-2050	44-48	10-11
2041-2070	55-73	12-17
2070-2099	73-125	17-28

Seasonality

Lyme disease cases by month, 2005-2013



A longer growing season and more atmospheric CO₂ increases airborne pollen that cause seasonal allergies

Recent warming by latitude associated with increased length of ragweed pollen season in central North America

Lewis Ziska^{a,1}, Kim Knowlton^b, Christine Rogers^c, Dan Dalan^d, Nicole Tierney^e, Mary Ann Elder^f, Warren Filley^g, Jeanne Shropshire^h, Linda B. Ford^g, Curtis Hedberg^h, Pamela Fleetwood^h, Kim T. Hovankyⁱ, Tony Kavanaugh^j, George Fulford^j, Rose F. Vrtis^k, Jonathan A. Patz^k, Jay Portnoy^l, Frances Coates^m, Leonard Bieloryⁿ, and David Frenz^o

4248–4251 | PNAS | March 8, 2011 | vol. 108 | no. 10

www.pnas.org/cgi/doi/10.1073/pnas.1014107108

□ Asthma in Vermont:

- Asthma prevalence in Vermont adults from 1999-2013 increased by about 50%
- About 67,000 Vermonters report having asthma, including about 13,000 children
- Vermont has the 7th highest adult asthma prevalence in the nation



Source: Town of Charlotte, VT

Climate change impacts and uncertainties can lead to stress, anxiety, and other mental health concerns

THE GRAPEVINE

Climate Change Isn't Just Impacting Crops; It's Taking A Physical And Psychological Toll On Farmers

Dec 10, 2014 03:10 PM By John Fischer

Study: Climate change causing farmers mental anguish

"Farmers have always worried about the weather but today that worry is becoming detrimental to their mental health and wellbeing," researcher Neville Ellis said.

By Brooks Hays | Dec. 11, 2015 at 12:03 PM [Follow @upi](#)