



Increasing Resilience to Climate Change: A Community Perspective

Ways Communities Can Respond

Andrea Braga, PE, CPESC | Principal

Outline

- ▶ Climate Change Primer
- ▶ The MVP Process - how MA communities are preparing
- ▶ Nature-Based Solutions

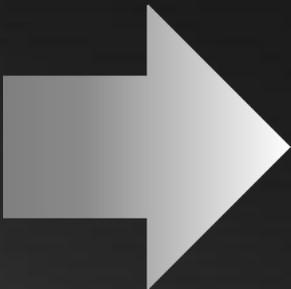
How Does Climate Change Work?

The heat-trapping blanket metaphor.

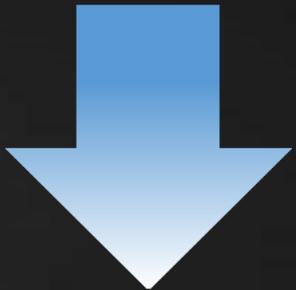


- The atmosphere is like a blanket that surrounds the earth.
- When we burn fossil fuels like coal and oil for energy, we add too much carbon dioxide to the atmosphere, which is like making the blanket thicker.
- The blanket has become too thick. It's trapping in too much heat, and the planet is warming up too fast.

**More
evaporation**

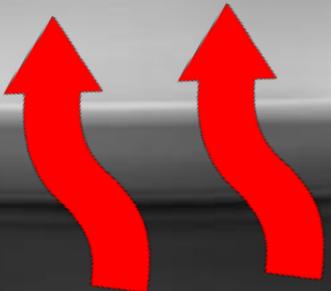


**More
fuel for storms**

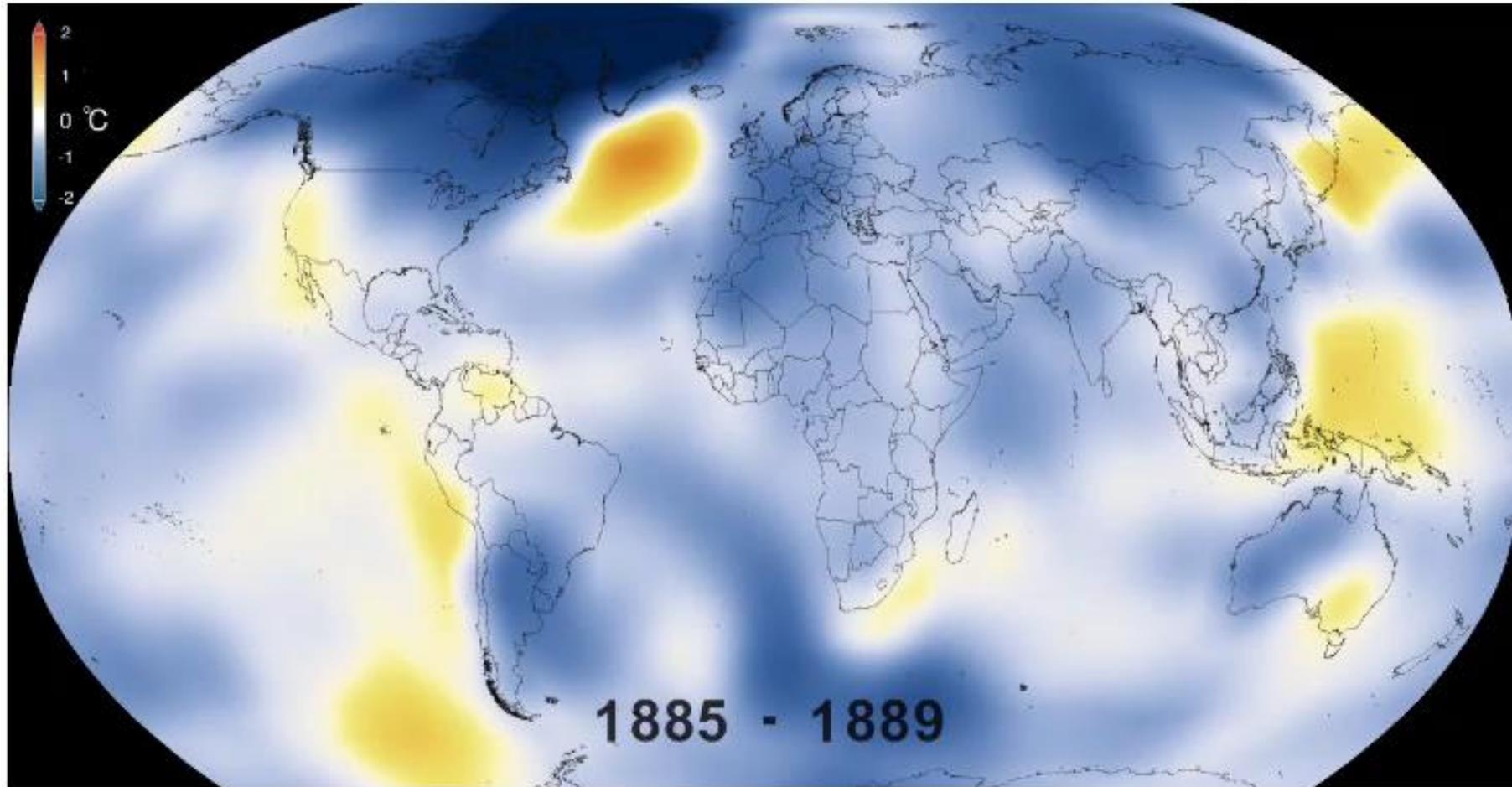


**More
precipitation**

**More
Heat**



Observed Change: Global Temperature



Source: <https://svs.gsfc.nasa.gov/4419>

More Precipitation

**Total annual precipitation
has increased by:**

15%

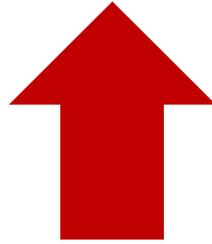
***1.2 trillion more gallons of
water or equivalent snow falling
on Massachusetts each year.***

~9,700 filled Prudential Towers



Key Observed Climate Changes in Massachusetts

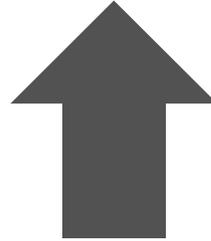
Temperature:



2.8°F

Since 1895

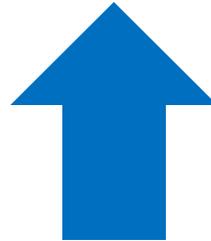
Growing Season:



10 Days

Since 1950

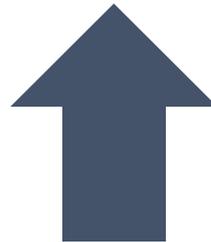
Sea Level Rise:



10.4 inches

Since 1922

Strong Storms:

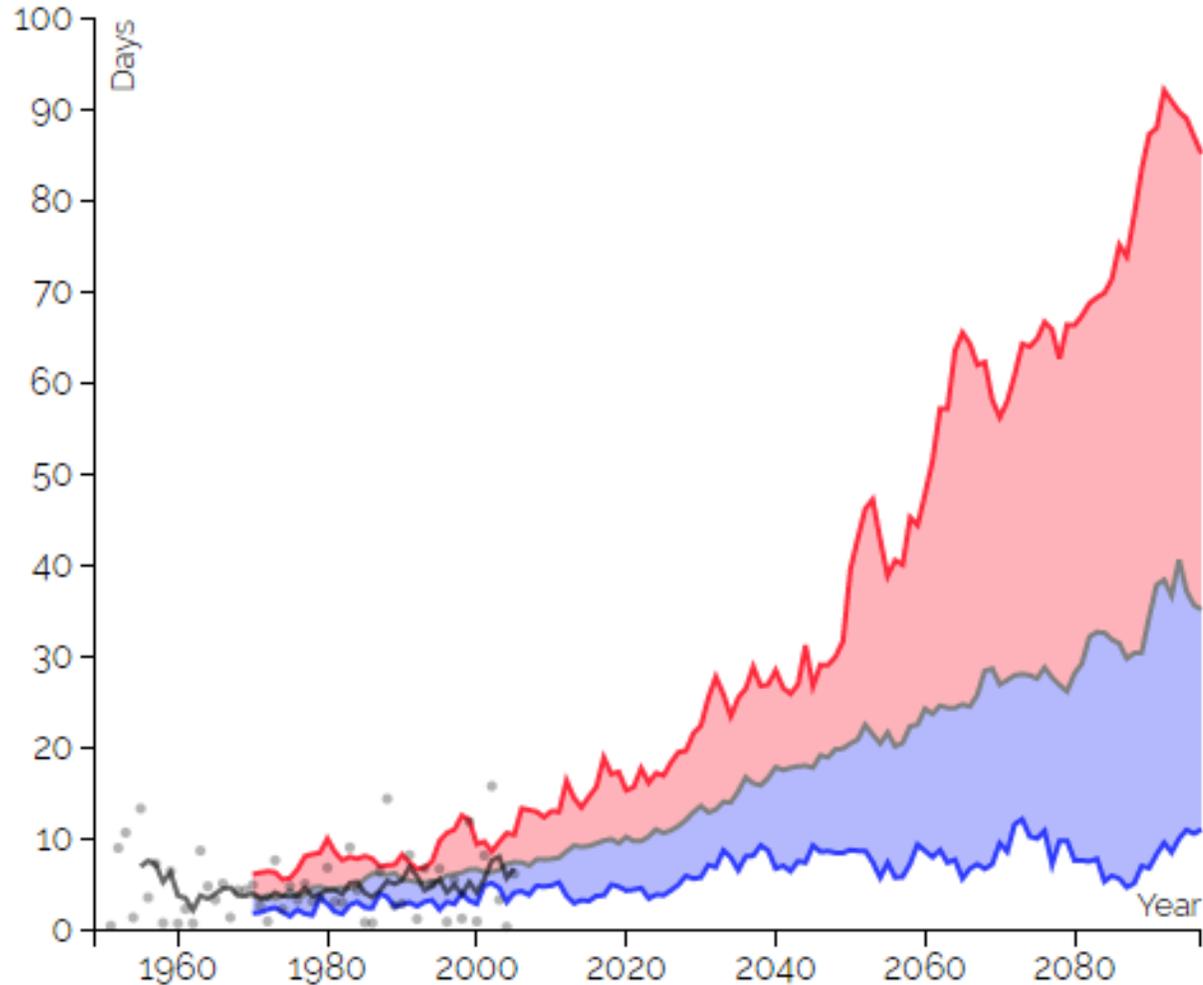


71%

Since 1958

Days Greater than 90 Degrees

Annual Days with Maximum Temperature Above 90°F
Massachusetts



- ▶ Climate Change Clearing House for the Commonwealth
- ▶ <http://resilientma.org/>

Finding Common Ground on Climate Change: Common Values

- ***Protect*** our natural resources for *future generations* and *public health*.
- ***Responsibly manage*** our natural and fiscal resources.
- ***Sense of place*** encourages people to invest locally and overcome challenges.

Preparing for climate change through nature-based solutions satisfies each of these values

The Municipal Vulnerability Preparedness (MVP) Process



State and local partnership to build resiliency to climate change



The MVP Process



CHARLES D. BAKER
GOVERNOR

OFFICE OF THE GOVERNOR
COMMONWEALTH OF MASSACHUSETTS
State House • Boston, MA, 02133
(617) 725-4000

SECRETARY OF STATE
REGULATORY DIVISION
THU SEP 16 PM 2:14

KARIN E. POLITO
DEPUTY GOVERNOR

By His Excellency
CHARLES D. BAKER
GOVERNOR

EXECUTIVE ORDER NO. 569

ESTABLISHING AN INTEGRATED CLIMATE CHANGE STRATEGY FOR THE COMMONWEALTH

WHEREAS, climate change presents a serious threat to the environment and the Commonwealth's residents, communities, and economy;

WHEREAS, extreme weather events associated with climate change present a serious threat to public safety, and the lives and property of our residents;

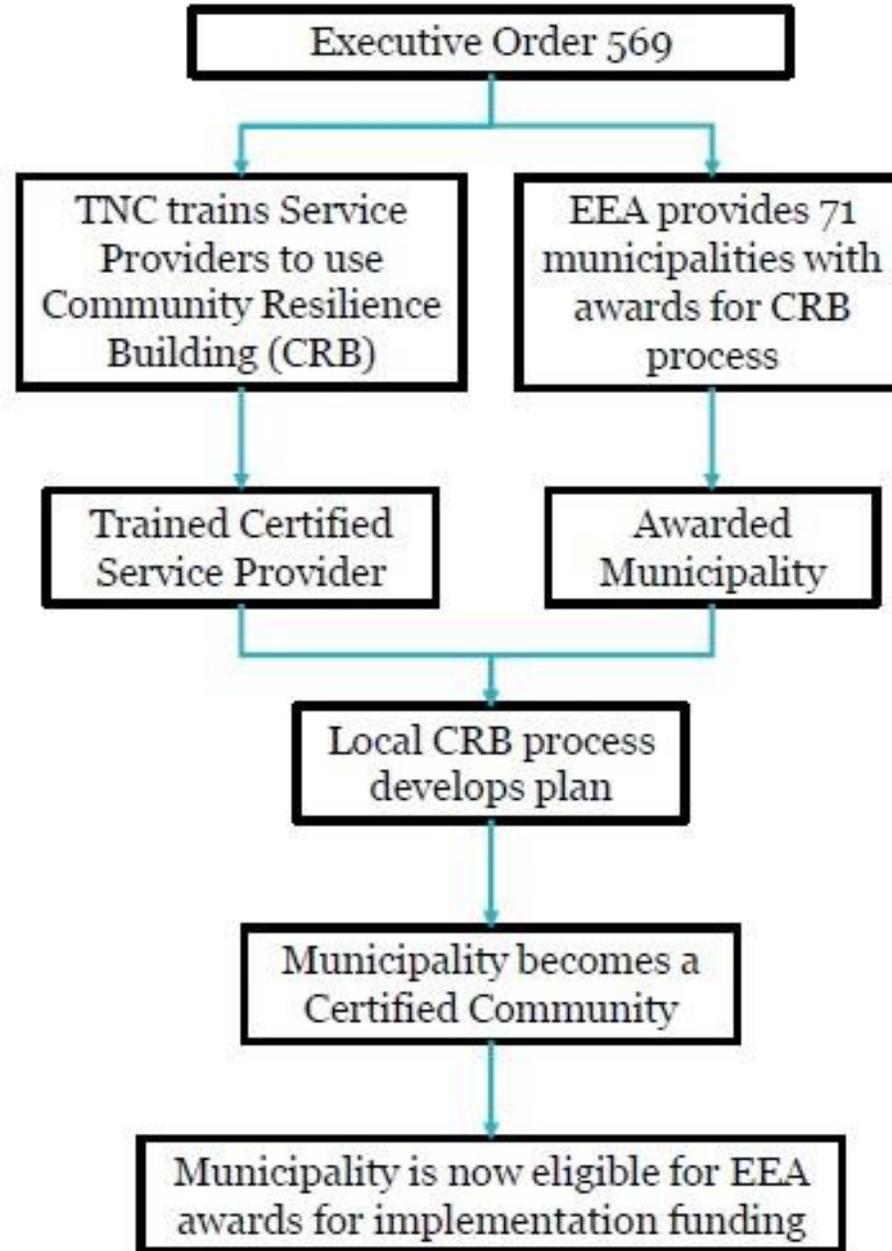
WHEREAS, the Global Warming Solutions Act (the "GWSA") directs the Secretary of Energy and Environmental Affairs and the Department of Environmental Protection to take certain steps to reduce greenhouse gas emissions and prepare for the impacts of climate change, including setting statewide greenhouse gas emissions limits for 2020, 2050, 2040 and 2050;

WHEREAS, the statewide greenhouse gas emissions limit for 2020 is 25% below the 1990 level of emissions and the corresponding limit for 2050 is 80% below the 1990 level of emissions, but no interim limits have yet been set for 2030 or 2040;

WHEREAS, the Commonwealth can provide leadership by reducing its own emissions from state operations, planning and preparing for impending climate change, and enhancing the resilience of government investments;

WHEREAS, the transportation sector continues to be a significant contributor to greenhouse gas emissions in the Commonwealth, and is the only sector identified through the GWSA with a volumetric increase in greenhouse gas emissions;

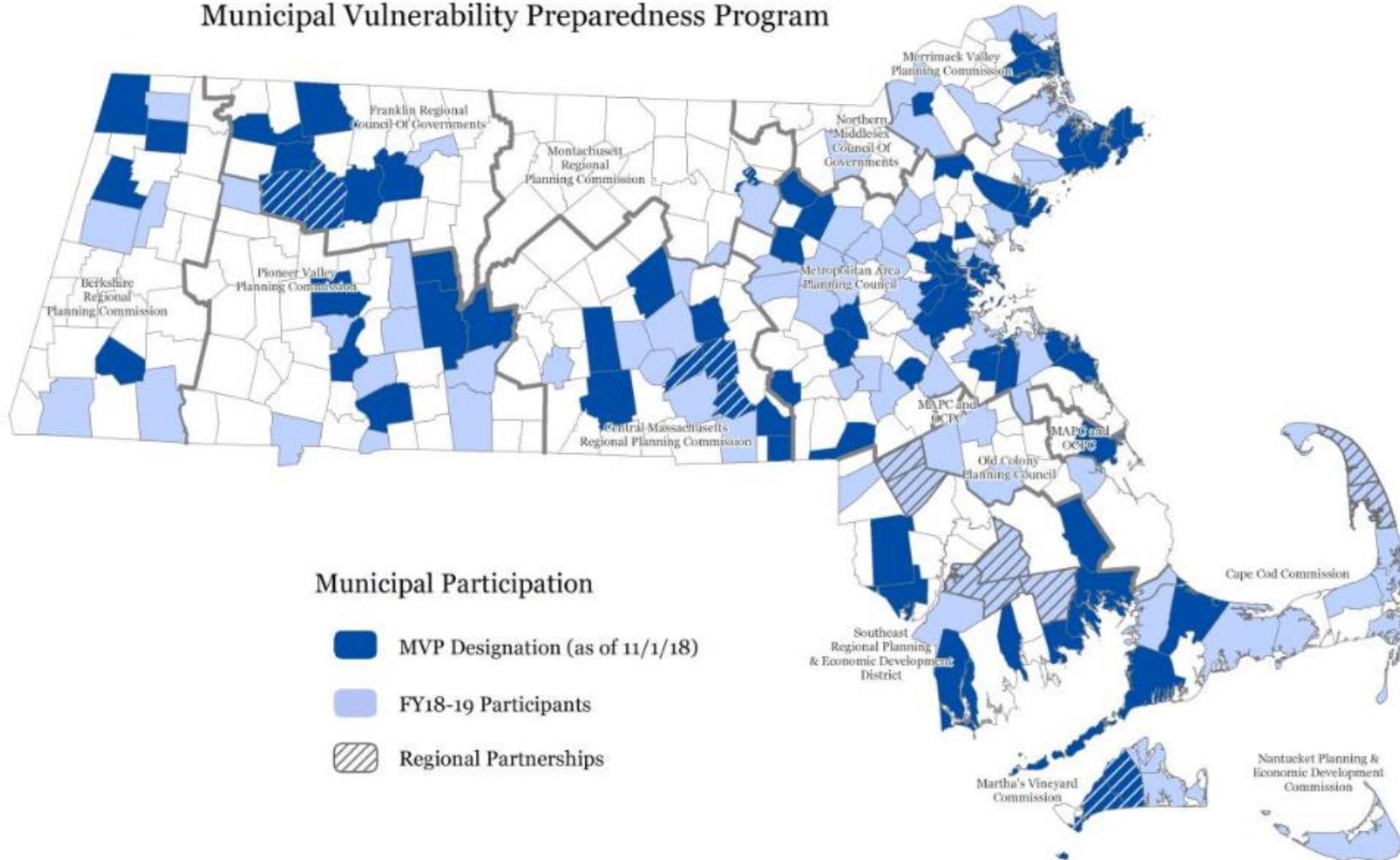
WHEREAS, the generation and consumption of energy continues to be a significant contributor to greenhouse gas emissions in the Commonwealth, and there is significant potential



\$\$\$

MVP Program Participants (as of 11/1/2018)

Municipal Vulnerability Preparedness Program



MVP Aspirations and Next Steps

- ▶ **Mobilize:** Local knowledge, climate change data and existing plans to identify vulnerabilities and strengths and prioritize action steps
- ▶ **Incentivize:** Designated communities will receive advanced standing in EEA grant programs (i.e., MVP Action Grants)
- ▶ **Mainstream:** Incorporate climate change into existing municipal planning frameworks
- ▶ **National Model:** The Nature Conservancy is looking to MVP as a national model and EEA is sharing through U.S. Climate Alliance

MVP Scope

- ▶ Prepare for the workshop(s)
- ▶ Characterize hazards
- ▶ Identify Community Vulnerabilities and Strengths
- ▶ Identify and Prioritize Community Actions
- ▶ Determine the Overall Priority Actions
- ▶ Put it All Together
- ▶ Move Forward

Nature-Based Solutions

Nature-Based Solutions



Nature-Based Solutions *use* natural systems, *mimic* natural processes, or *work in tandem with* traditional approaches to address natural hazards like flooding, erosion, drought, and heat islands.

Nature-Based Solutions

Problems facing towns



Nature-based solutions

Open space preservation

Ecosystem restoration

Green Infrastructure

Additional benefits



Infrastructure benefits
Nature-based solutions can save \$5 on every \$1 spent, increase property value by up to \$20, and create local jobs and capital inflows.



Societal benefits
Natural areas can reduce the likelihood of obesity by 40%, improve air and water, and draw people together to strengthen community ties.



Environmental benefits
Most natural systems rely on linkages with others. By prioritizing natural solutions, communities can provide restored links that augment biodiversity.

Low Impact Development

An ecosystem-based approach to land development and stormwater management.

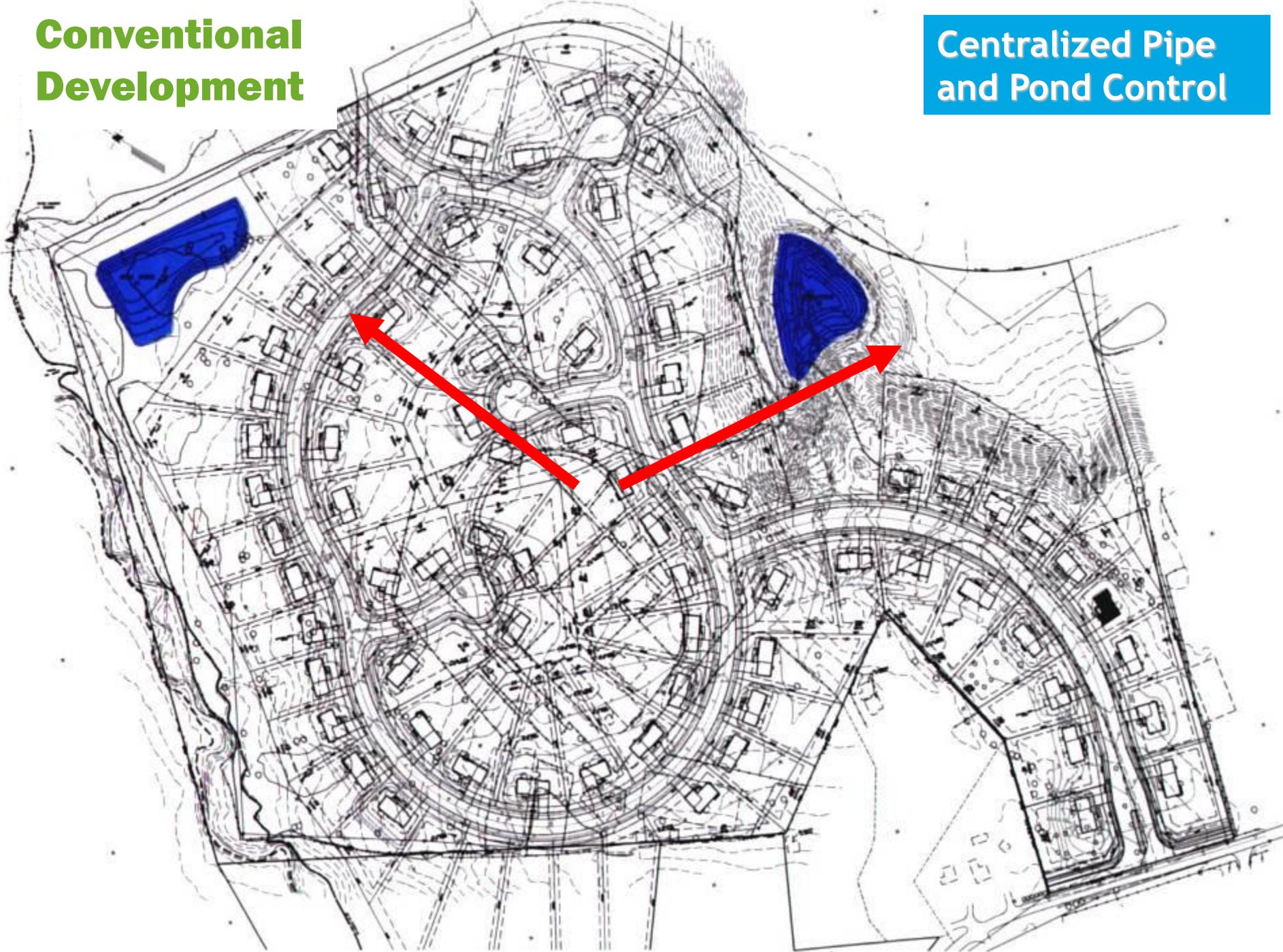
Goal: Mimic pre-development site hydrology

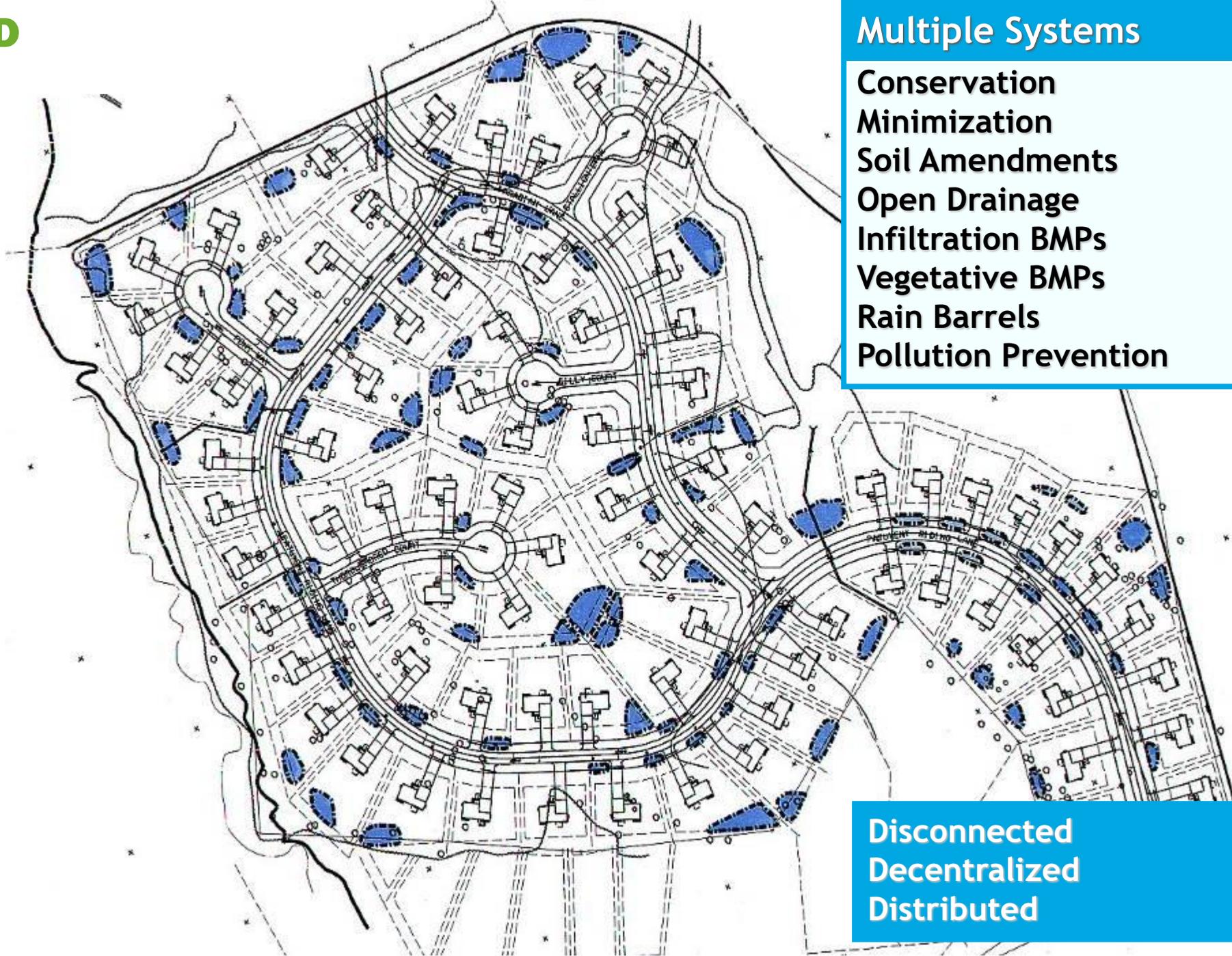
Basic Principles of LID

- ▶ Conserve natural areas
- ▶ Minimize development impacts
- ▶ Maintain site runoff rate
- ▶ Use integrated stormwater management practices
- ▶ Implement pollution prevention, proper maintenance and public education programs

**Conventional
Development**

**Centralized Pipe
and Pond Control**





- Multiple Systems
- Conservation
- Minimization
- Soil Amendments
- Open Drainage
- Infiltration BMPs
- Vegetative BMPs
- Rain Barrels
- Pollution Prevention

Disconnected
Decentralized
Distributed

Bioretention



Raingardens/barrels

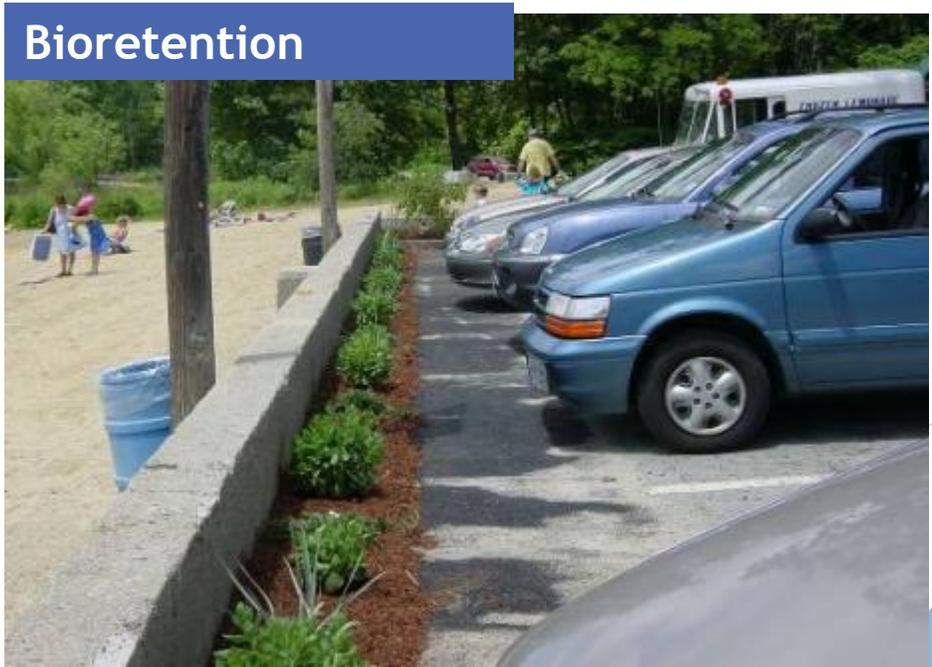


Green Infrastructure Stormwater Controls

Porous surfaces



Bioretention



Raingardens

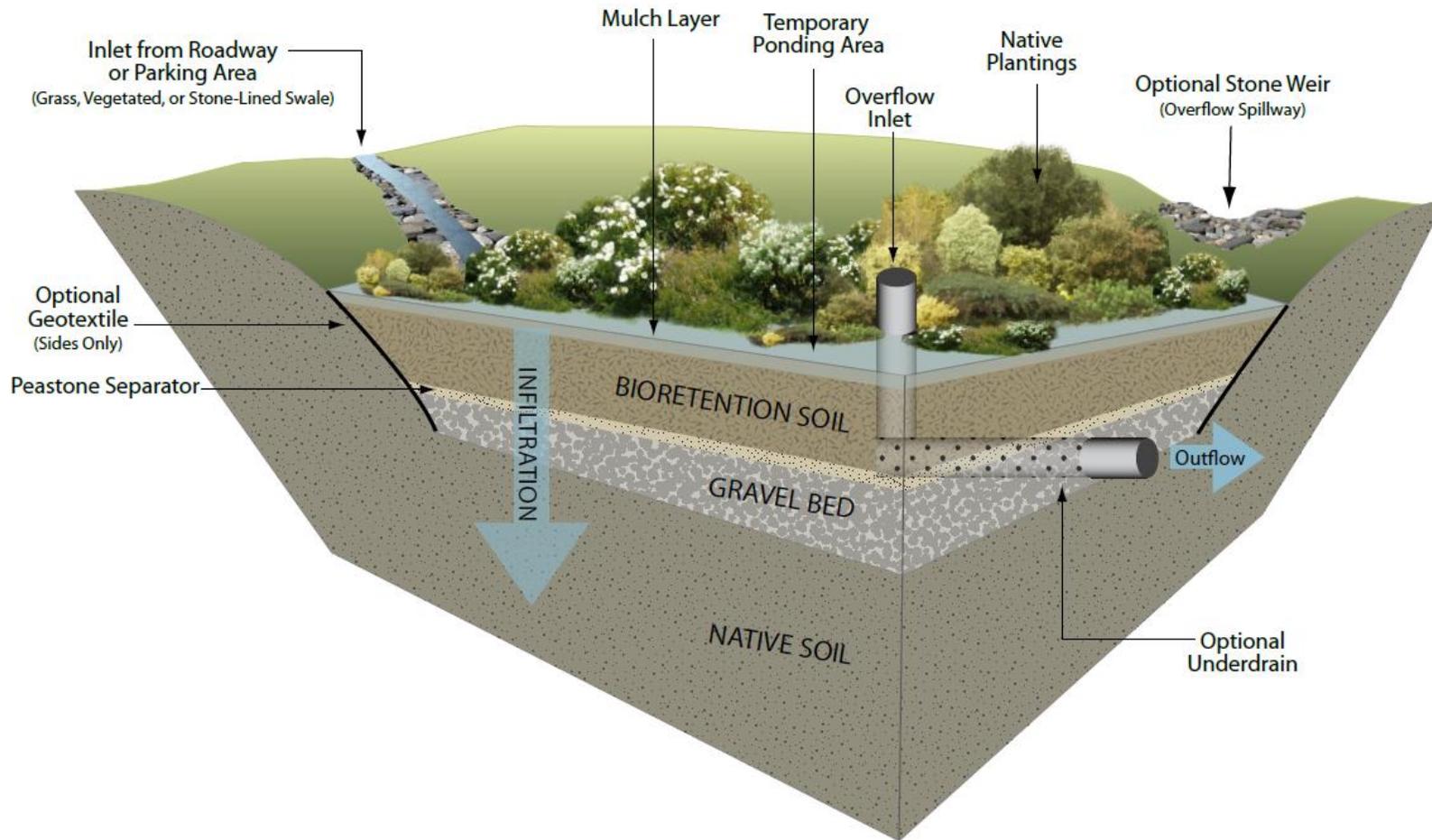
A bowl-shaped garden designed to capture and absorb stormwater.



Bioretention

Similar to raingarden, more highly engineered:

- underdrain/riser pipe
- gravel bed
- engineered soils







SEP 14 2005



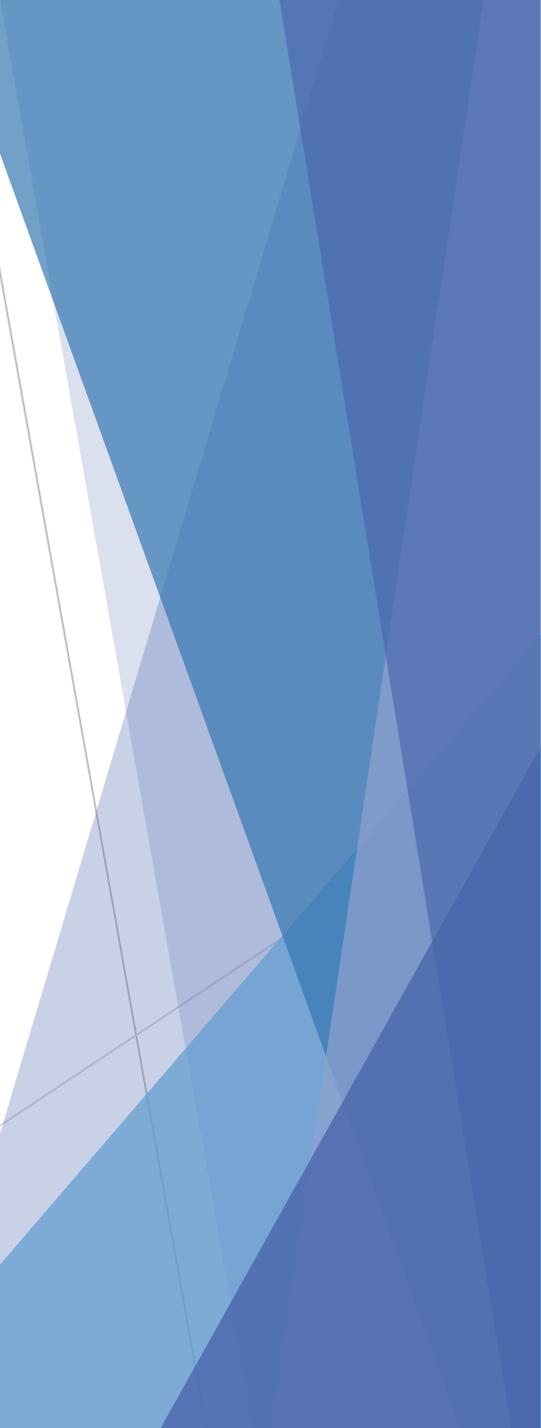


09.15.2005 10:50



SEP 14 2005









AUG 1 2005

Vegetated Buffers

- Pollutant Uptake /Filtering
- Habitat / Wildlife Food Source
- Shading
- Aesthetics
- Physical deterrent to geese

Before



After



Permeable Pavement



Other Nature-Based Solutions

Floodplain Buyout: Middleborough, MA



- ▶ 10 homes in Taunton River floodplain
- ▶ Buyout funded by FEMA's Hazard Mitigation Grant Program (HMGP). Total cost ~\$1,003,745, with FEMA grant covering 75%
- ▶ Resilience benefits:
 - ▶ Avoided emergency evacuation and property recovery costs.
- ▶ Additional benefits:
 - ▶ High quality habitat is restored, floodplain and ecosystem services recovered.

Other Nature-Based Solutions

Land Conservation and Habitat Preservation: Swansea Marsh



- 37 Acres purchased and conserved by the Town of Swansea, Wildlands Trust, and Blount Fine Foods in the Palmer River Corridor for \$110,000.
- Major storms in 2010 and 2012 damaged stormwater and transportation infrastructure.
- Resilience Benefits:
 - Dissipated energy from storm, tide, and flood events
 - Avoided cost of infrastructure repair and replacement
- Additional Benefits:
 - Protected water quality
 - Future marsh migration

<http://wildlandstrust.org/news/2016/3/1/publicprivate-partnership-saves-22-acr>

Other Nature-Based Solutions

Dam Removal: Whittenton Dam, Taunton, MA



Whittenton Mill Dam was removed in 2013

- Costs
 - Estimated Cost of Dam Repair = \$1.9 Million
 - Ongoing Cost of Dam maintenance = variable
 - 2005 Evacuation Costs = \$1.5 Million
 - Dam Removal Costs = \$440,000
- Benefits
 - Increased revenue from river based recreation
 - Increased Property Values
 - Water quality benefits

Other Nature-Based Solutions

The power of a bylaw: Westford

- Adopted a Conservation Subdivision bylaw in 1978
- Requires conservation and conventional plans

Benefits

- 1,700 Acres of land protected
- Preserved local habitat and water resources
- Created 13 miles of hiking trails & public recreation
- Town saved millions of dollars



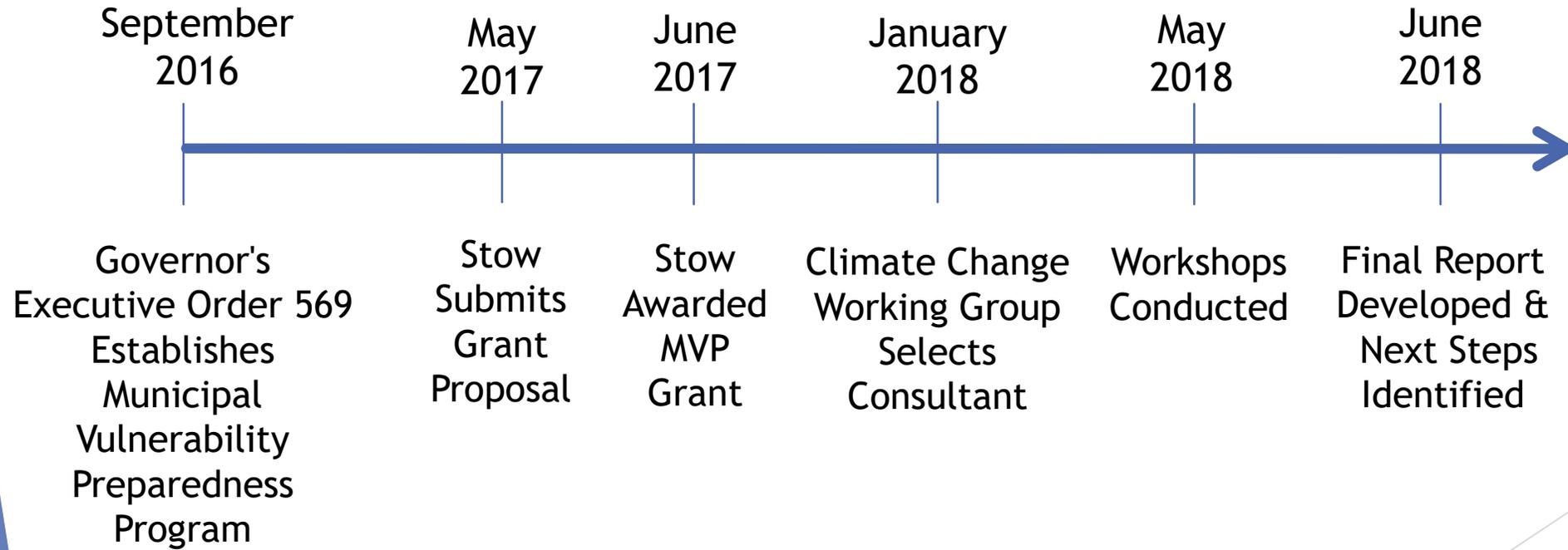


Municipal Vulnerability Planning in the Town of Stow

Building an Enduring Process

Jesse Steadman | Stow Town Planner

The Planning Process



Purpose of MVP Planning

Complete a baseline climate change and natural hazard vulnerability assessment and develop specific actions for dealing with priority hazards.

Goals of the Local Planning Process

- Build stakeholder partnerships in Stow across interests and jurisdictions
- Create a community based process that can shape other planning efforts
- Gain State MVP designation for implementation efforts

Building Consensus

Town of Stow Community Resilience Building Workshop Summary of Findings		
CRB Workshop Stakeholders		
Name	Department/Committee	Position
Jacque Goring	Town of Stow - Conservation Assistant	Red Team
Vicki Blake	Stow Community Housing Corp.	Red Team
Laura Greenough	Town of Stow- Recreation Department	Red Team
Mike Clayton	Town of Stow- Superintendent of Streets	Red Team
Rebecca Quinones	Mass Wildlife	Red Team
Marcia Rising	Board of Health	Red Team
Amie Epstein	Energy Working Group	Green Team
Rosemary Monahan	Gleasondale Subcommittee	Green Team
Carol Lynn	Sustainable Stow	Green Team
Jim Salvie	Board of Selectmen	Green Team
Rick Lent	Elders for Climate Action	Blue Team
Sharon Brownfield	Sustainable Stow	Blue Team
Merrily Evdokimoff	Board of Health	Blue Team
Joe Landry	Town of Stow- Fire Chief	Blue Team
Kathy Sferra	Town of Stow - Conservation Coordinator	Red Team
Sandra Grund	Town of Stow- Conservation Commission	Red Team
Alison Field-Juma	OARS	Red Team
Ashley Davis	Sudbury Valley Trustees	Green Team
George Peterman	Energy Working Group	Blue Team
Rebecca Stadolnik	Medical Reserve Corps	Blue Team



Building Consensus

Held two 4-hour workshops

- First session used to identify hazards and vulnerabilities
- Second session used defined opportunities and action steps to mitigate vulnerabilities



Community Resilience Building Risk Matrix



www.CommunityResilienceBuilding.org

H-M-L priority for action over the **Short** or **Long** term (and **Ongoing**)
V = Vulnerability **S** = Strength

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S	Top Priority Hazards				Priority	Time
				Strong Storms	Extreme Temps	Drought	-	H - M - L	Short Long Ongoing
Infrastructural									
Roads	Townwide	Town of Stow	V	Inventory of high risk areas for flooding	Investigate other materials when repairing	N/A		H/M	L
Dams/Culverts	Townwide	Private/Public/Town of Stow	V	Evaluate/repair and identify cost	N/A	Assess low flow passage		H	O
Schools	Town Center	Town of Stow	S	Develop transport. Plan	N/A	Assess well capacity (back up plan)		L	L
Community Center	Town Center	Town of Stow	S	Develop transport. Plan	Develop transport. Plan	Assess well capacity (back up plan)		H	S
Wells	Townwide	Private	V	Develop plan for addl. Sources of power	Develop plan for well management	ID other water sources message to reduce		H	O/L
Power Grid	Townwide	Hudson Light & Power	V/S	Right of way maintenance plan	Demand management plan	N/A		M	O
Societal									
Low Income/Senior	Multiple	Private	V	Transport. And comm. Plan	Access to AC & reserve power	assess well capacity		H	O
Disability Community	Multiple	Private	V	Transport. And comm. Plan	Access to AC & reserve power	assess well capacity		H	O
COA/Neighbor Brigade/Networks	Multiple	Private	S	Comm./coord. Plan development	ID high risk/outreach	plan development for water delivery		M	O
Public Health	Multiple	Town of Stow/State of MA	V/S	Develop plan for trans. To medical care	Develop plan for trans. To medical care	N/A		M	O/S
Emergency Response	Multiple	Town of Stow	S	N/A	N/A	N/A		-	-
Hazard Mitigation Plan	Multiple	Town of Stow/Fire Dept.	V/S	Update Plan	Update Plan	Update Plan		H	S
Environmental									
Wetlands/Waterways	Multiple	Multiple	V/S	Assess dam removal reassess use of berms develop plan to introduce/encourage use	ID oppor. For thermal pollution	Comply w/ state stream cleaning standards		M	L
Species Diversity	Multiple	?	V	Develop plan to introduce/encourage use	Tree planting	Tree planting		M	L
Open Space/Forests	Multiple	Multiple	V/S	Develop plan to introduce/encourage use	Tree planting	Tree planting		M	L
Farms	Multiple	Private/Town of Stow	V	Use Ag. Comm. To get farmer input on needs	encourage diversity of crops	develop alt. water sources & soil mgmt.		H	L/S
Public Health	Multiple	Town of Stow/State of MA	V/S	N/A	Education on risks & solutions	Access to water & distribution		M	S
Beach/Recreation Fields	Townwide	Town of Stow	V	Develop erosion control plan & ID use opport.	Manage access to water	Diversify/resilient grass		M/L	L



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Next Steps

Action Grant Funds for Implementation of Priority Projects

- Need to determine the process for creating grant applications
 - Who is responsible for moving the project to implementation phase?
 - Who will coordinate multiple interests to determine potential workload for implementation?
 - How can resiliency planning result in benefits outside of specific grant funding?



Resilience and Climate Change: A Community Perspective

The Role of the Public Health Nurse

Merrily Evdokimoff, RN, PhD

4th NACCHO National Climate Assessment Tenets:

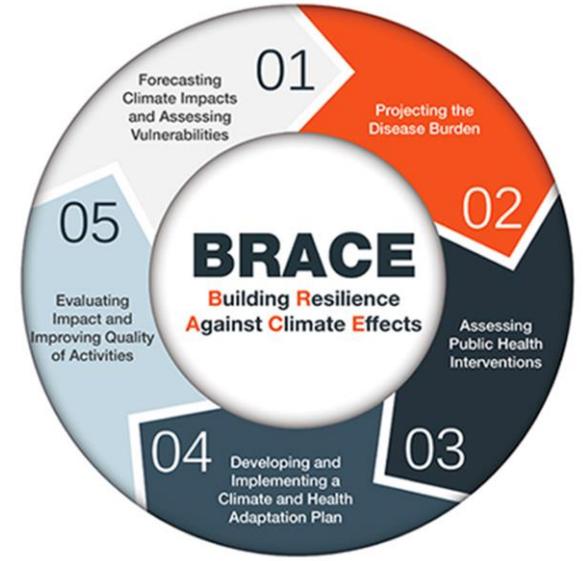
- ▶ Climate change affects the health of all Americans.
- ▶ Exposure and resilience vary across populations and communities.
- ▶ Adaptation reduces risk and improves health.
- ▶ Reducing greenhouse gas emissions results in health and economic benefits.

<http://essentialelements.naccho.org/archives/12740>



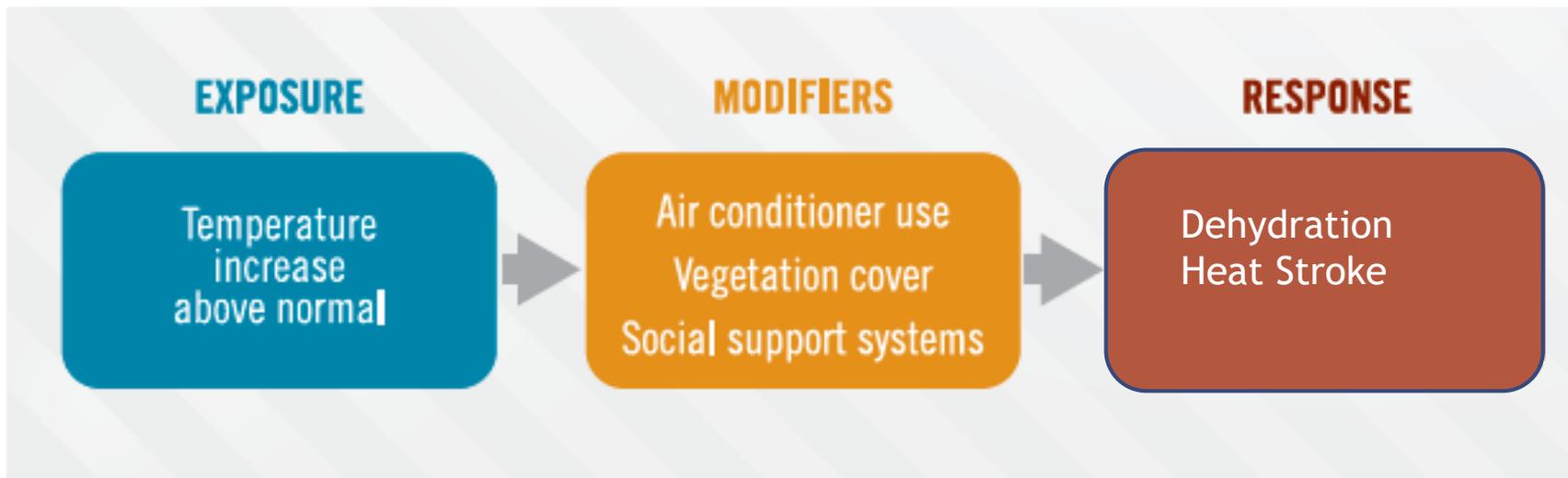
1) Determine the scope of the climate vulnerability assessment

Identify potential areas of climate change in your community and the associated health risks, and the associated health risks and modifiers



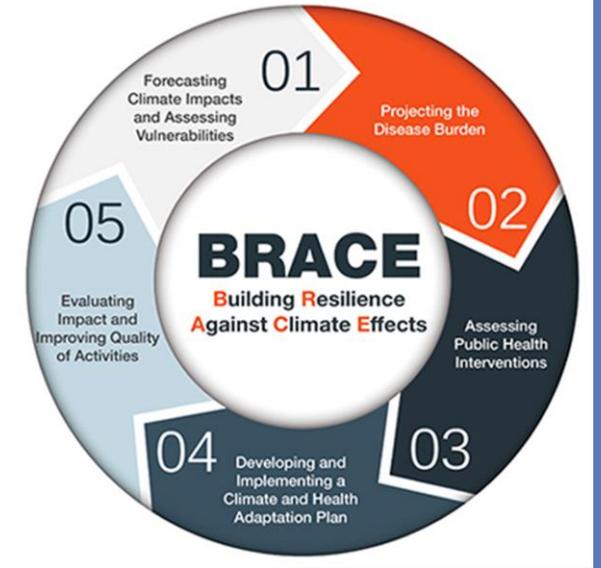
Case Studies: Heat Related Illness

Causal Pathway



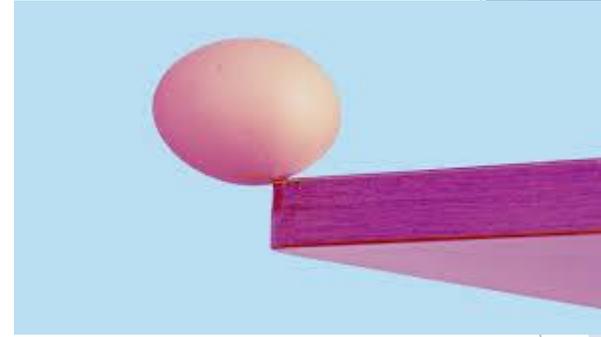
BRACE

2. For these health outcomes, identify the known risk factors (e.g., socioeconomic factors, environmental factors, infrastructure, pre-existing health conditions). Upstream and down stream



Vulnerability

In you community



- ▶ Cultural
- ▶ Commercial
- ▶ Social Determinants of Health (SDH)
- ▶ Populations
 - ▶ Children
 - ▶ Elderly
 - ▶ Chronically Ill
 - ▶ Immigrants

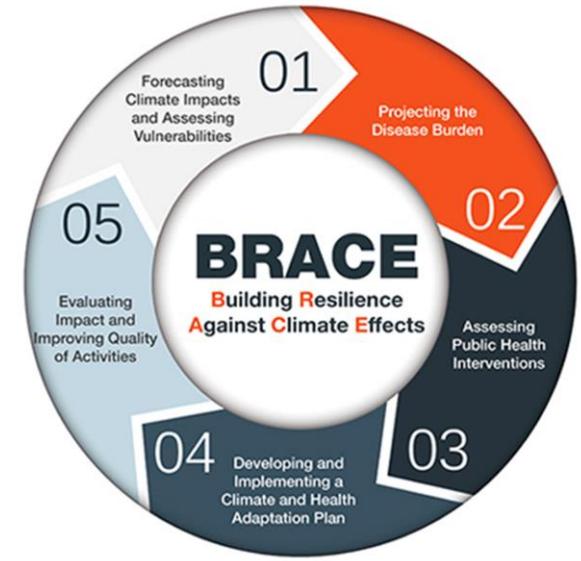
Elders and Special Needs

▶ Preventative

- ▶ Community Engagement-all ages
- ▶ Social Support Systems
- ▶  engagement and  social support lead to increased confidence in community
- ▶ Developing working relationship with COA, Fire Dept. LEPC
 - ▶ Educational programs
 - ▶ Collaboration

BRACE

3) Acquire information on health outcomes and associated risk factors at the **smallest possible administrative unit** (e.g., census block group, census tract, county) in accordance with data privacy regulations and availability.



Social Vulnerability Index



Agency for Toxic Substances & Disease Registry

A-Z Index [A](#) [B](#) [C](#) [D](#) [E](#) [F](#) [G](#) [H](#) [I](#) [J](#) [K](#) [L](#) [M](#) [N](#) [O](#) [P](#) [Q](#) [R](#) [S](#) [T](#) [U](#) [V](#) [W](#) [X](#) [Y](#) [Z](#) <#>

The Social Vulnerability Index (SVI)

What is the SVI?

Social vulnerability refers to the resilience of communities when confronted by external stresses on human health, stresses such as natural or human-caused disasters, or disease outbreaks. Reducing social vulnerability can decrease both human suffering and economic loss. ATSDR's Social Vulnerability Index uses U.S. census variables at tract level to help local officials identify communities that may need support in preparing for hazards, or recovering from disaster.

Replay ↺

SVI Fact Sheet

Data and Tools

Publications

Download Publications

GO»

Email page link

Print page

CDC on Facebook

CDC on Twitter

Get email updates

Saving Lives. Protecting People.™

LEARN MORE ABOUT HOW CDC WORKS FOR YOU.

SVI Mapping

Check the social vulnerability of your community

Zip code: *

Submit

SVI Topics

Fact Sheet
Learn about Social Vulnerability, the SVI, and its uses.

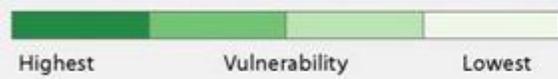
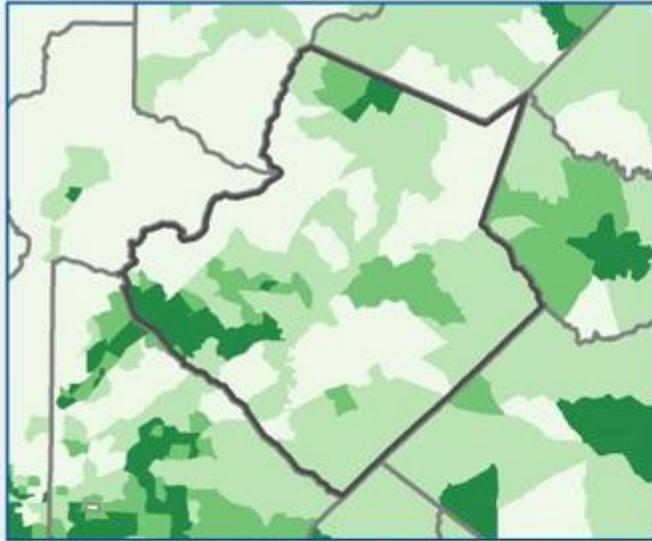
Interactive Map
Click through to select a theme, location, layers (hospitals, etc.), and tract info. Export or print your customized map.

Contact Us:

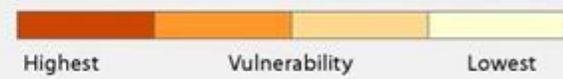
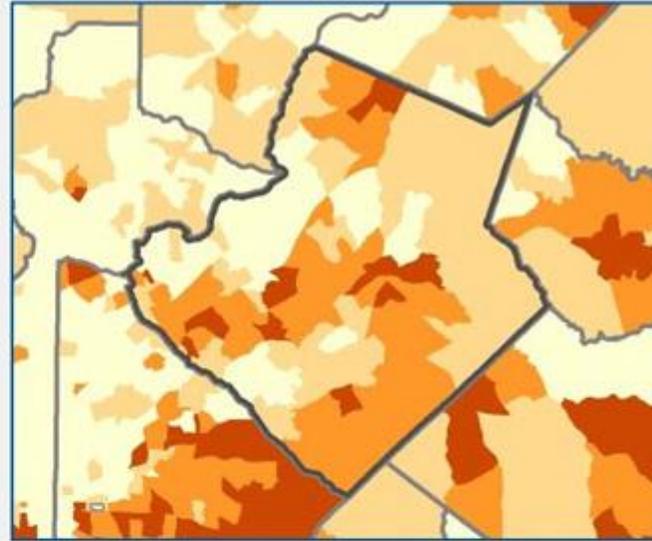
Agency for Toxic Substances and Disease Registry
4770 Buford Hwy NI

<https://svi.cdc.gov/>

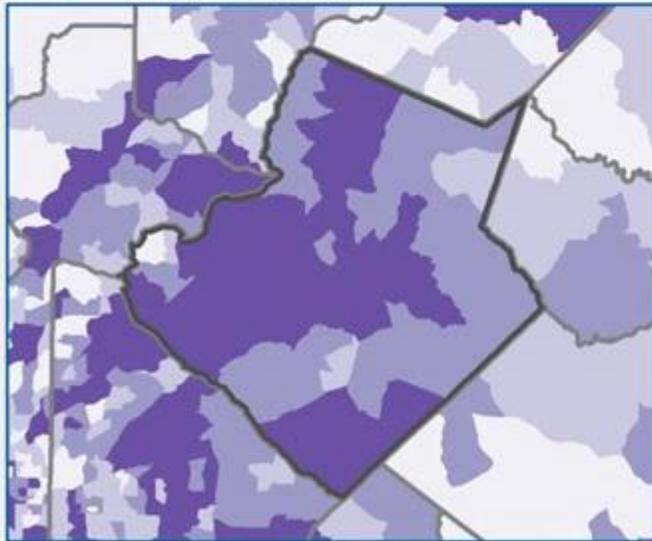
Socioeconomic Status



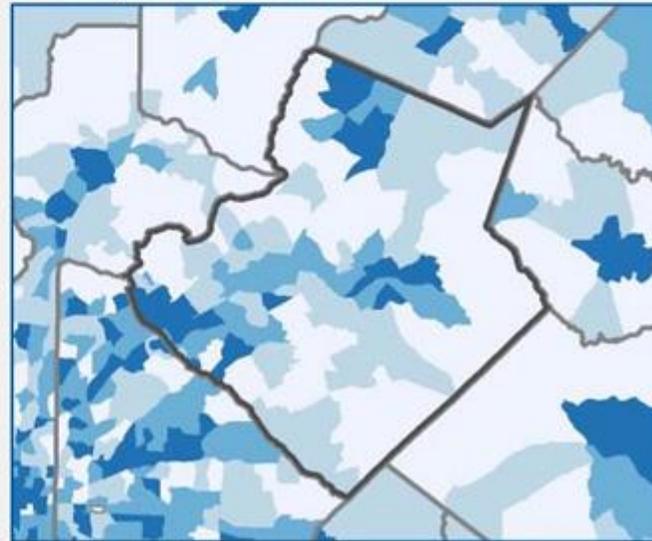
Household Composition



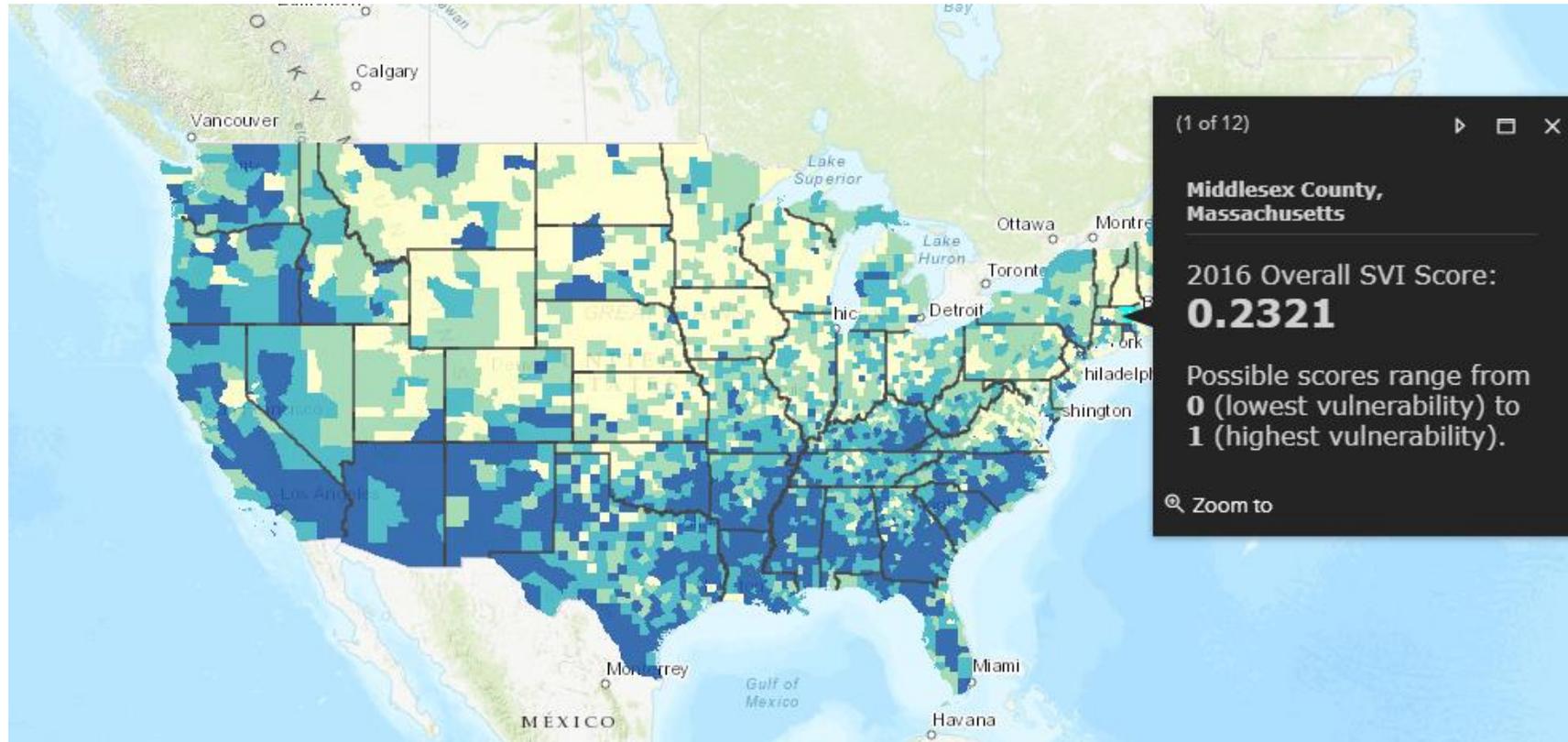
Race/Ethnicity/Language



Housing/Transportation



Social Vulnerability Score by county/zip code



BRACE

- ▶ 4) Assess adaptive capacity in terms of the system's (e.g., communities, institutions, public services) ability to **reduce hazardous exposure and cope with the health consequences** resulting from the exposure.



Resilience

Community Resilience

- ▶ (1) the ability of a community to withstand adverse exposures and the range of associated impacts; and (2) physiological (e.g., co-morbidities or disabilities) and socioeconomic (e.g., poverty) factors that increases the susceptibility of individuals to the exposure.



Resilience

- ▶ Community Support
 - ▶ Collaboration
 - ▶ Disaster Planning
 - ▶ Communication
 - ▶ Education

General Communication Recommendations:

1. Find areas of agreement
2. Acknowledge ambiguity
3. Make it real; focus on positives
4. Emphasize solutions
5. Focus on personal benefits
6. End with your “ask”.



Drought

- ▶ Stow has no public water supply-all private wells
- ▶ Focus on maintaining green spaces, low moisture plantings
- ▶ Implementation of water saving methods: rain barrels, low flow toilets in new construction
- ▶ Use of emergency plans from other departments
- ▶ Lessons learned!



Education:

- ▶ Focus on:
 - ▶ Most vulnerable
 - ▶ Issues in your area
 - ▶ Anticipatory Guidance: Dirty dozen, PBA's in children dishes
 - ▶ Support bills that decrease carbon footprint: plastic bags, bottles
 - ▶ All politics is local!

Educate Yourself

ANHE: Association of Nurses for Healthy Environment



<https://envirn.org/>

References

ANHE (Accessed at CDC, (2018). CDC's Building Resilience Against Climate Effects (BRACE) Framework. Accessed 3/26/18 at <https://www.cdc.gov/climateandhealth/BRACE.htm>

McLain, G. (2018). Global Climate Change in Your Community: Take Action Now Accessed 3/26/18 at <http://essentialelements.naccho.org/archives/12740>

Hess, J., Saha, S., Schramm, P. , Conlon, K., Uejio, C. & Luber, G. (2018). **Projecting Climate-Related Disease Burden: A Guide for Health Departments.** Accessed 3/26/18 at https://www.cdc.gov/climateandhealth/pubs/projectingclimaterelateddiseaseburden1_508.pdf

Madsen, W., Ambrens, M. & Ohl, M. (2019) Enhancing resilience in community-dwelling older adults: A Rapid review of the evidence and implications for Public Health Practitioners. *Frontiers in Public Health*, 7(14), 1-14.

Questions?

▶ Contact

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