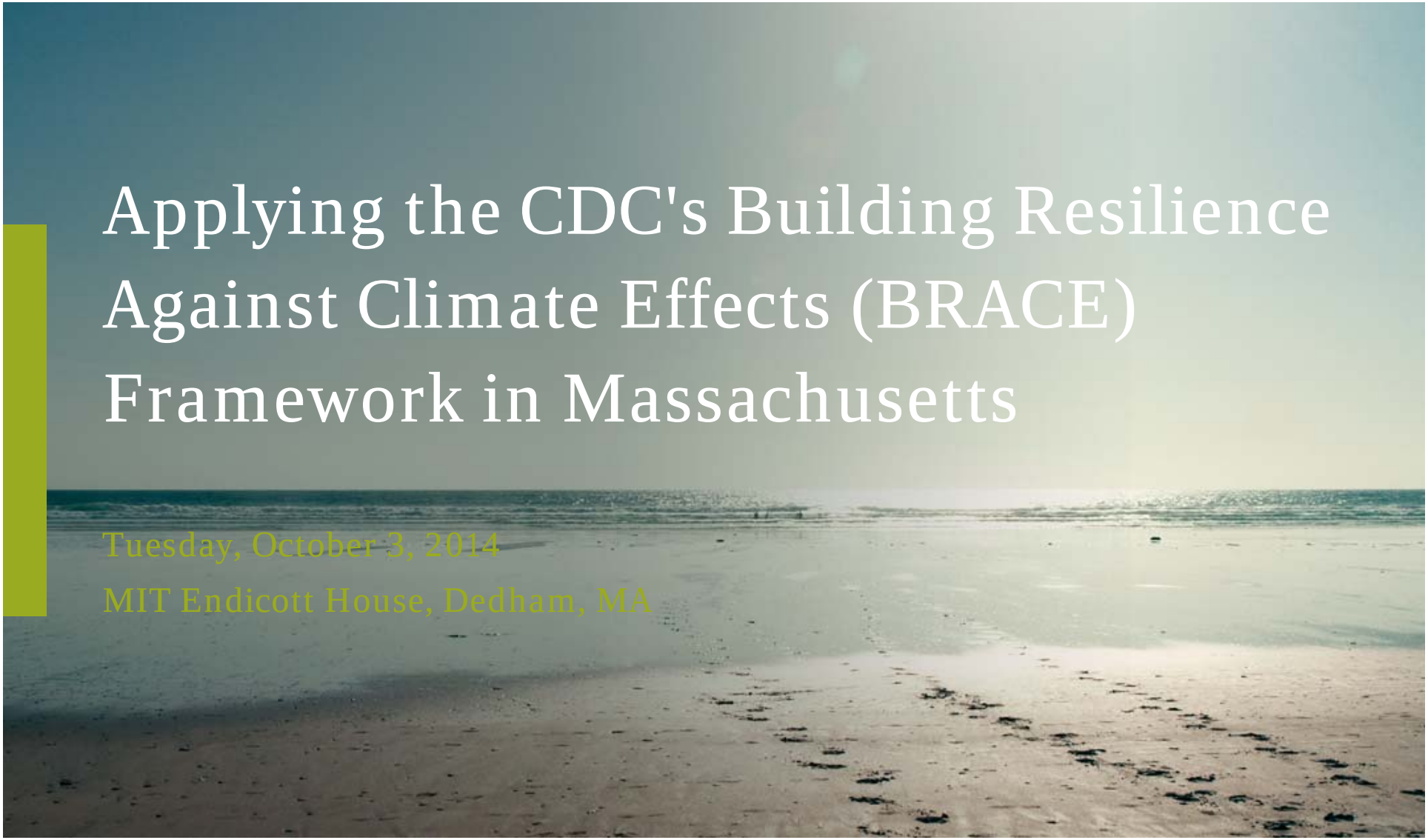

Applying the CDC's Building Resilience Against Climate Effects (BRACE) Framework in Massachusetts

Tuesday, October 3, 2014

MIT Endicott House, Dedham, MA

Marc A. Nascarella, Ph.D.
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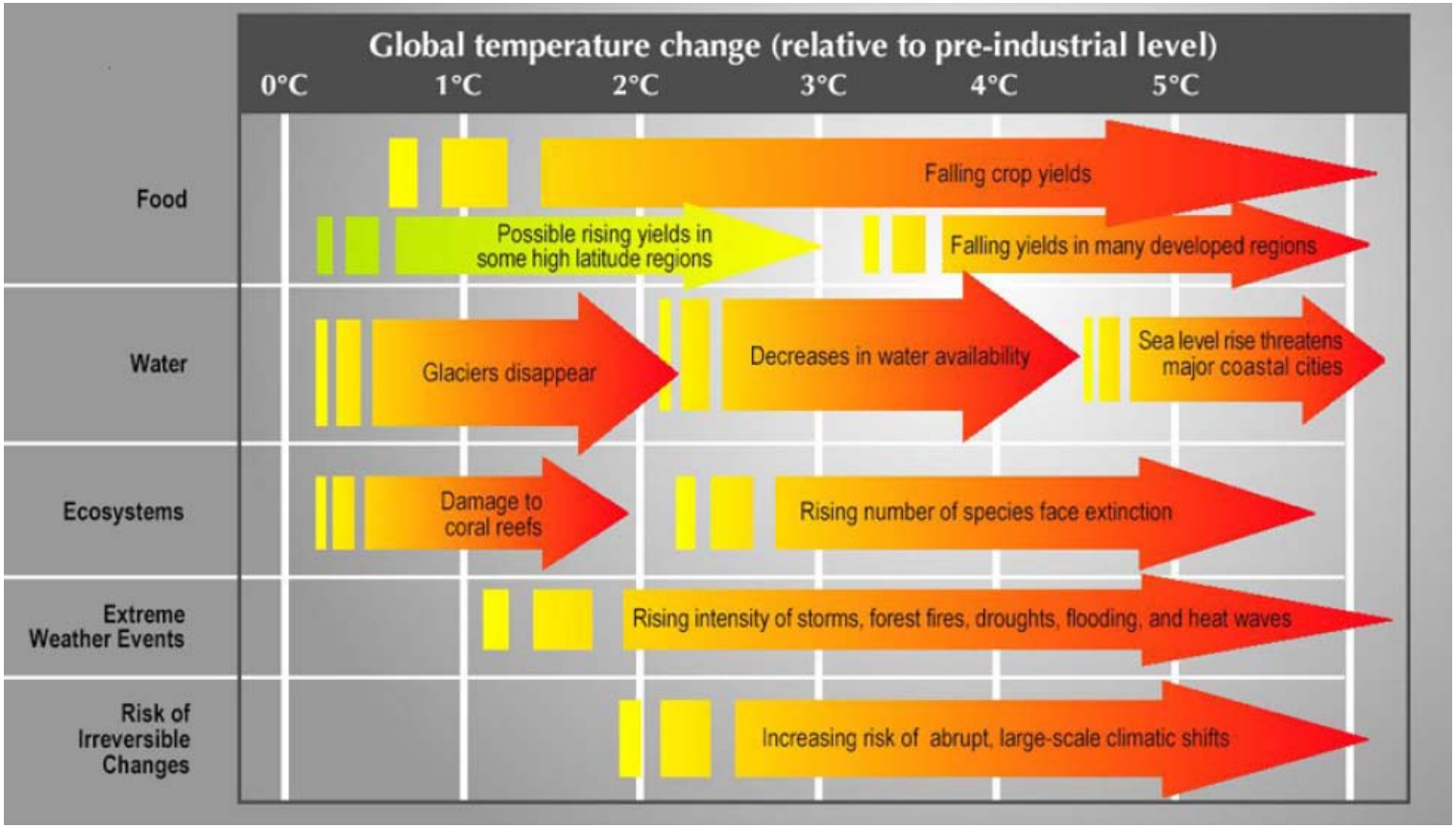
Commonwealth of Massachusetts Department of Public Health

Bureau of BEH Environmental Health

Outline

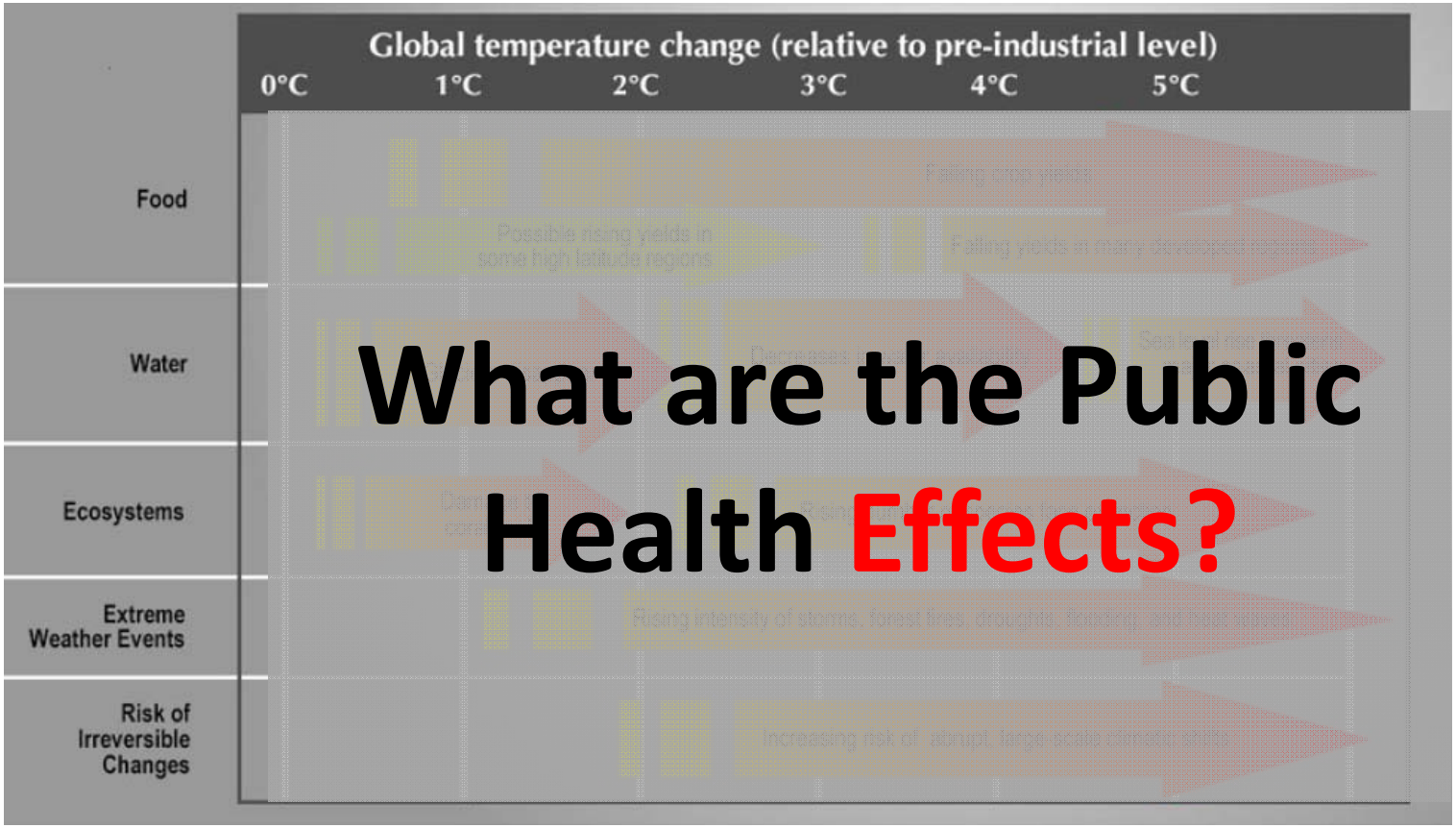
1. Climate Change Health Hazards
2. Introduction to the CDC BRACE Framework
3. Applying BRACE to Evaluate Public Health Risk
4. Available Tools
5. Questions

Climate Change Hazards



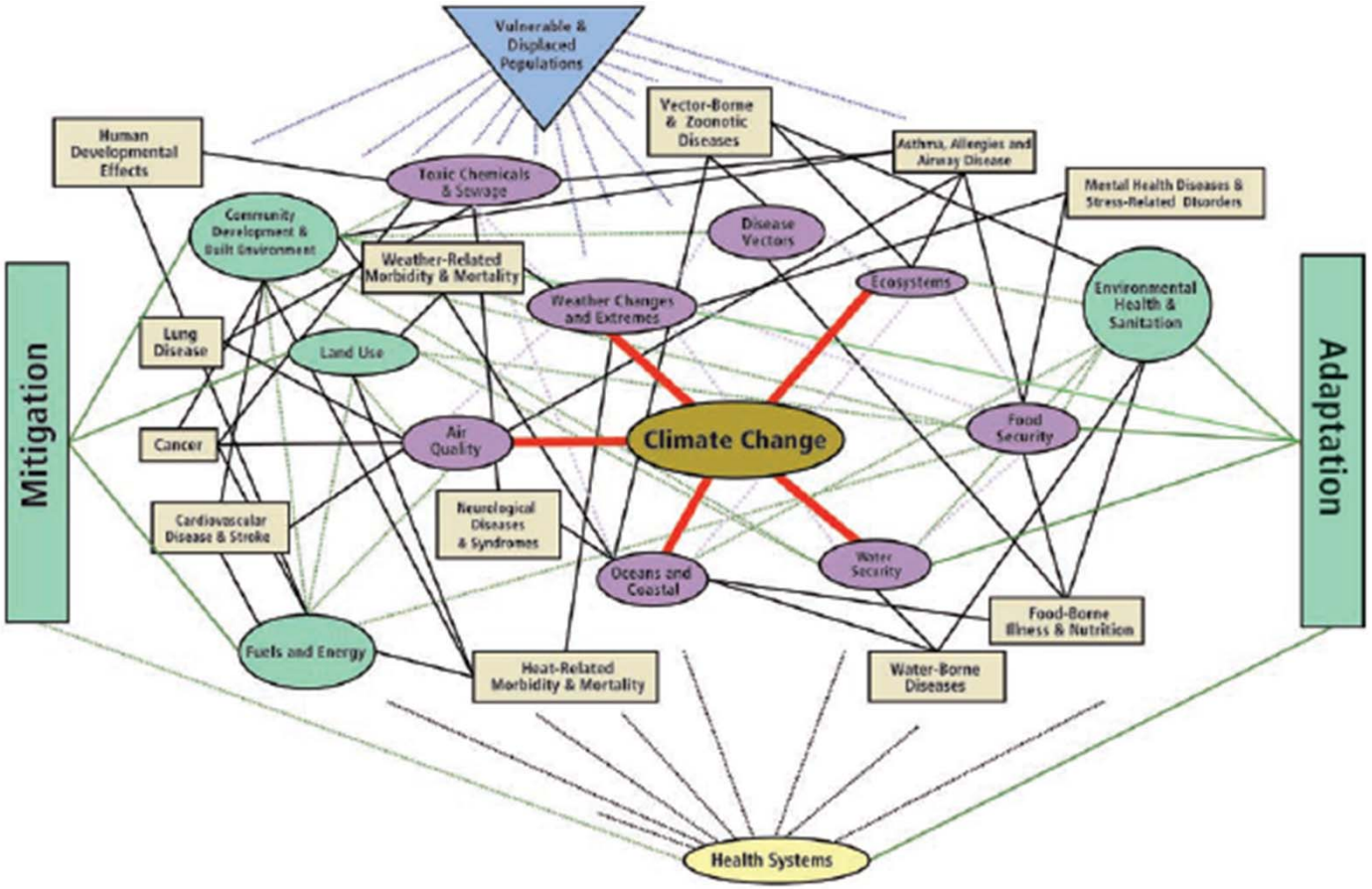
(Source: Nicholas Stern (2006), “Stern Review on the Economics of Climate Change”)

Climate Change Effects



(Source: Nicholas Stern (2006), “Stern Review on the Economics of Climate Change”)

Climate Change Health Effects



(Source: NIEHS "A Human Health Perspective on Climate Change", EHP, 2010)

BRACE Framework

PURPOSE: **Couple climate projections with health data to more effectively anticipate, prepare, and respond to climate sensitive health impacts.**

STEP 1:	**Forecast Climate Impact and Assess Vulnerabilities**
STEP 2:	**Project Disease Burdens from Climate Change**
STEP 3:	**Assess Public Health Interventions**
STEP 4:	**Develop & Implement Climate Adaptation Plan**
STEP 5:	**Evaluate Impact and Improve Framework**

BRACE Framework

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Article

Building Resilience against Climate Effects—A Novel Framework to Facilitate Climate Readiness in Public Health Agencies

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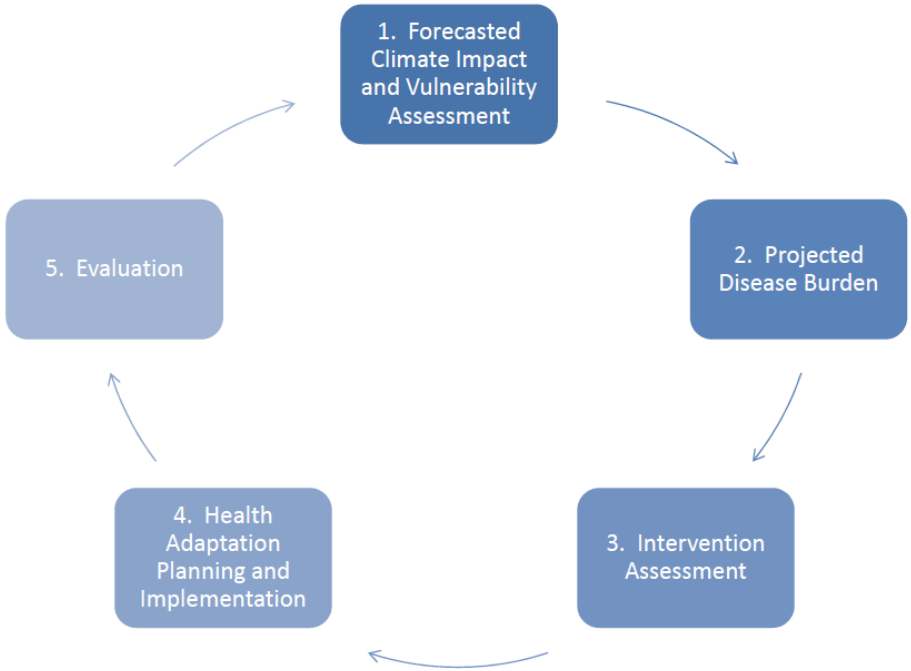
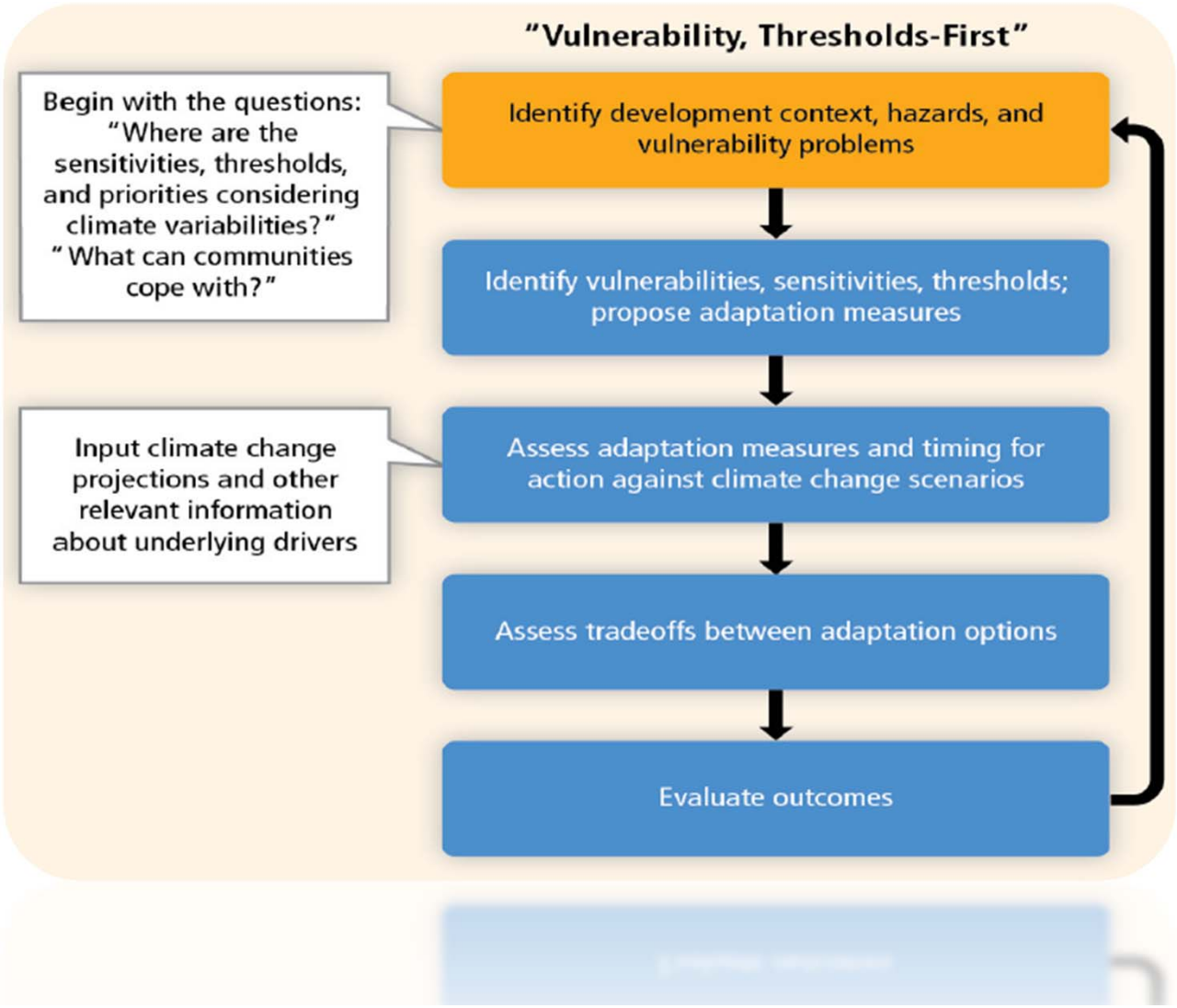


Assessing the health effects of climate change…where to begin?



Basic Public Health Risk Assessment

- Public health **risks** are a function of the type of **hazard** and our **exposure** to them.
- e.g., health hazard such as an air contaminant:
  - STEP 1 - Determine inherent toxicity of the contaminant (e.g., “imminent **hazard** value”)
  - STEP 2 - Determine **exposure** (i.e., what level are people breathing).
  - Estimate **risk** based on:

RISK = HAZARD X EXPOSURE

Climate Risk Assessment

- Public health **risks** of climate change are similar
- **Risks** are directly related to specific climate **hazards** and our **exposure** to them.
- Using the **CDC BRACE** framework we:
  - Predict climate-related **hazards**
  - Predict human vulnerability of **exposure**
  - Estimate **risk** based on:

RISK = HAZARD X EXPOSURE

Risk of Climate Effects

HAZARD
Probability
Magnitude

EXPOSURE
Vulnerability
Susceptibility

RISK
Damage
Valuation

Hazard x Exposure = Risk

Example: Risk of Flooding

RISK = HAZARD x VULNERABILITY

Risk = Flooding in a Coastal Home

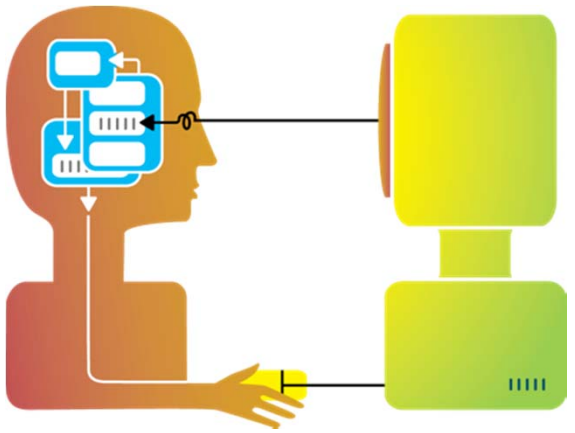
Hazard = Sea Level

Vulnerability = Elevation of Home

Predicting Hazards

1. **Current Health Effects**
   Determine relationship between suspected hazard (i.e., extreme heat) and population experiencing adverse heath outcomes.

2. **Future Health Effects**
   Based on relationship between vulnerable population and number of hot days in the future (i.e., population and temperature in 2030).



Predicting Hazards: Extreme Heat

RISK = HAZARD x VULNERABILITY

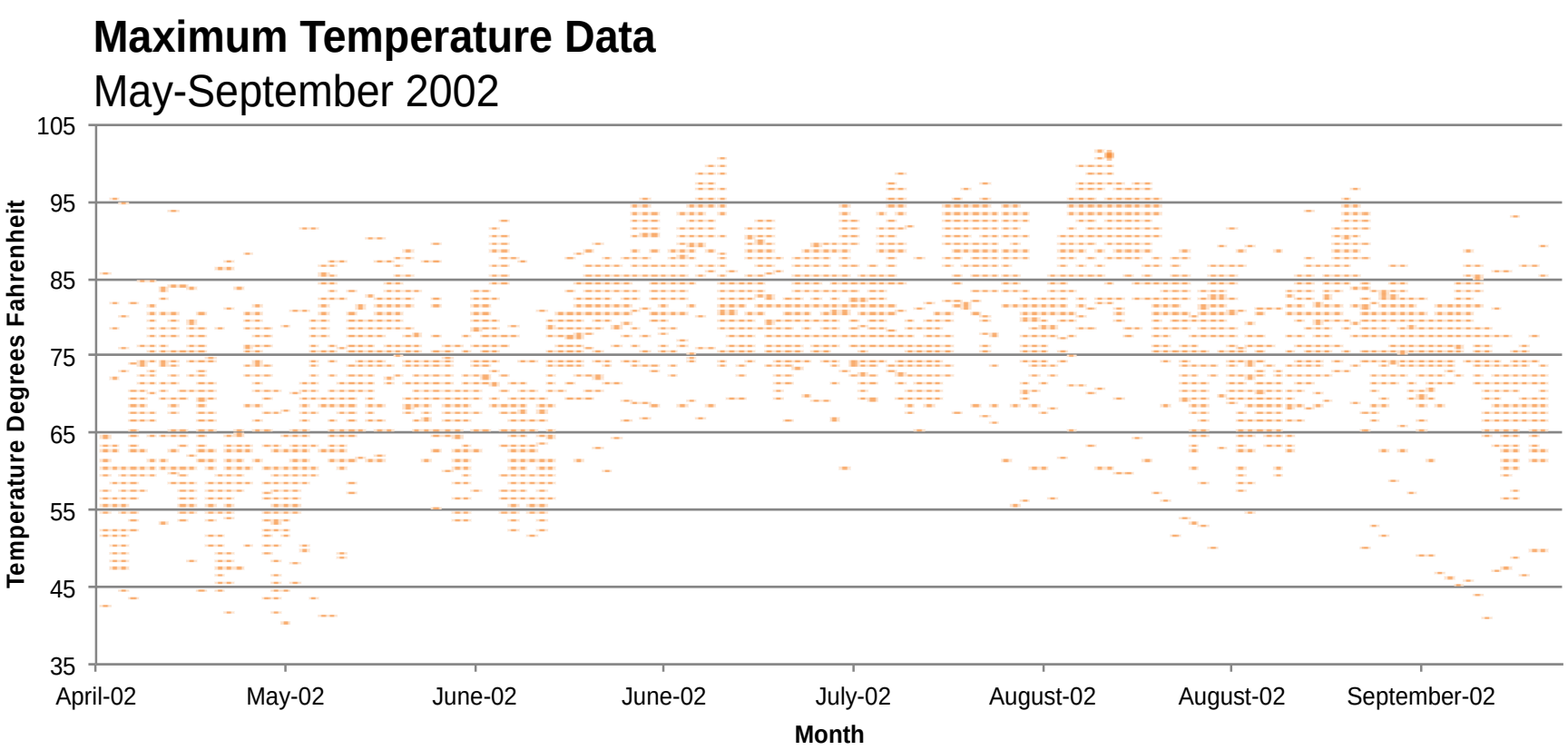
Risk = Acute Heat Injury Requiring Medical Services

Hazard = Days where Temp. $\geq$ 93ºF

Vulnerability = Social Isolation + Age $\geq$ 65 years old*

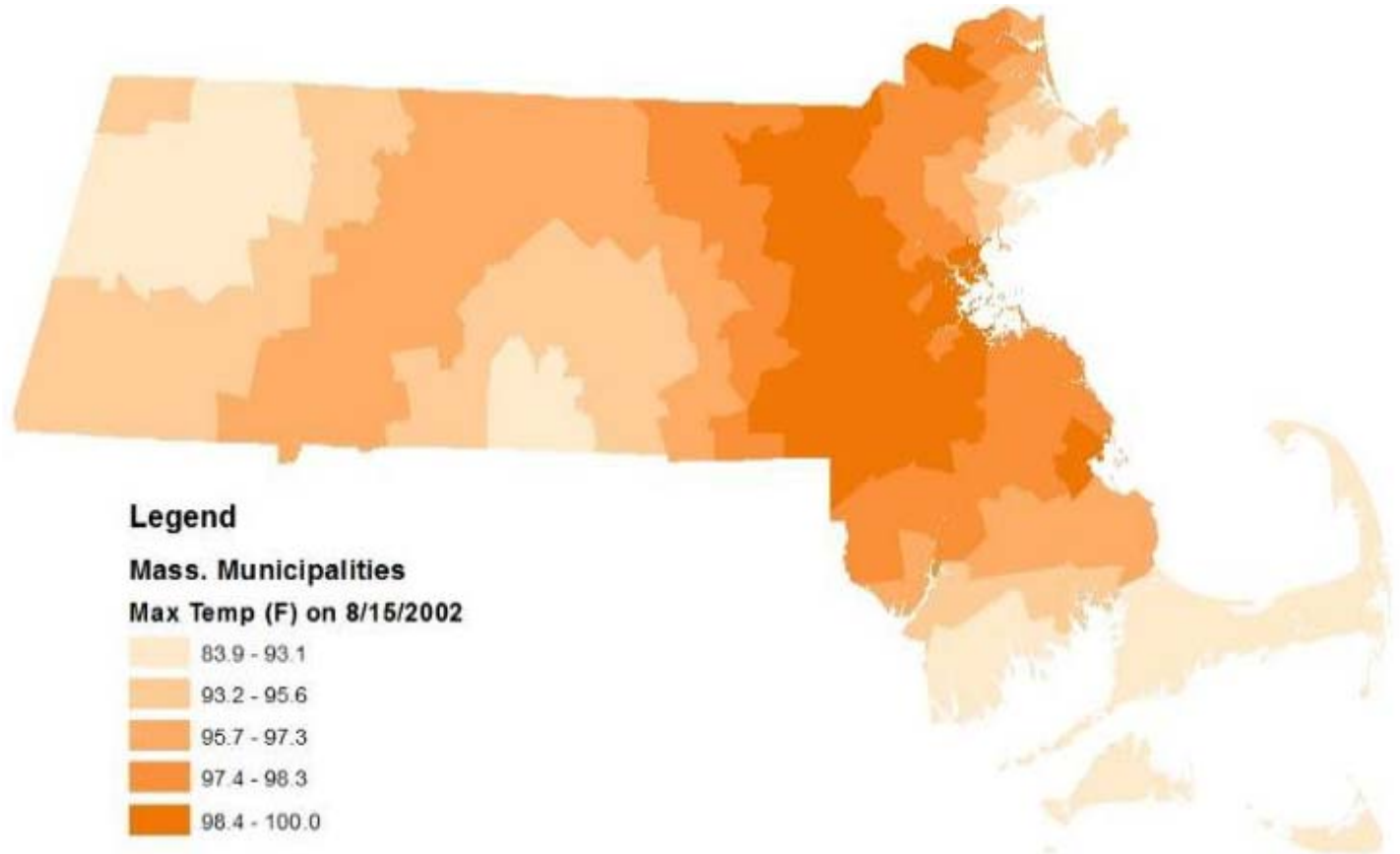
*see Health Vulnerability Index; Reid et al. (2012). Environmental Health Perspectives, 120(5), 715-719.

Massachusetts Weather Data



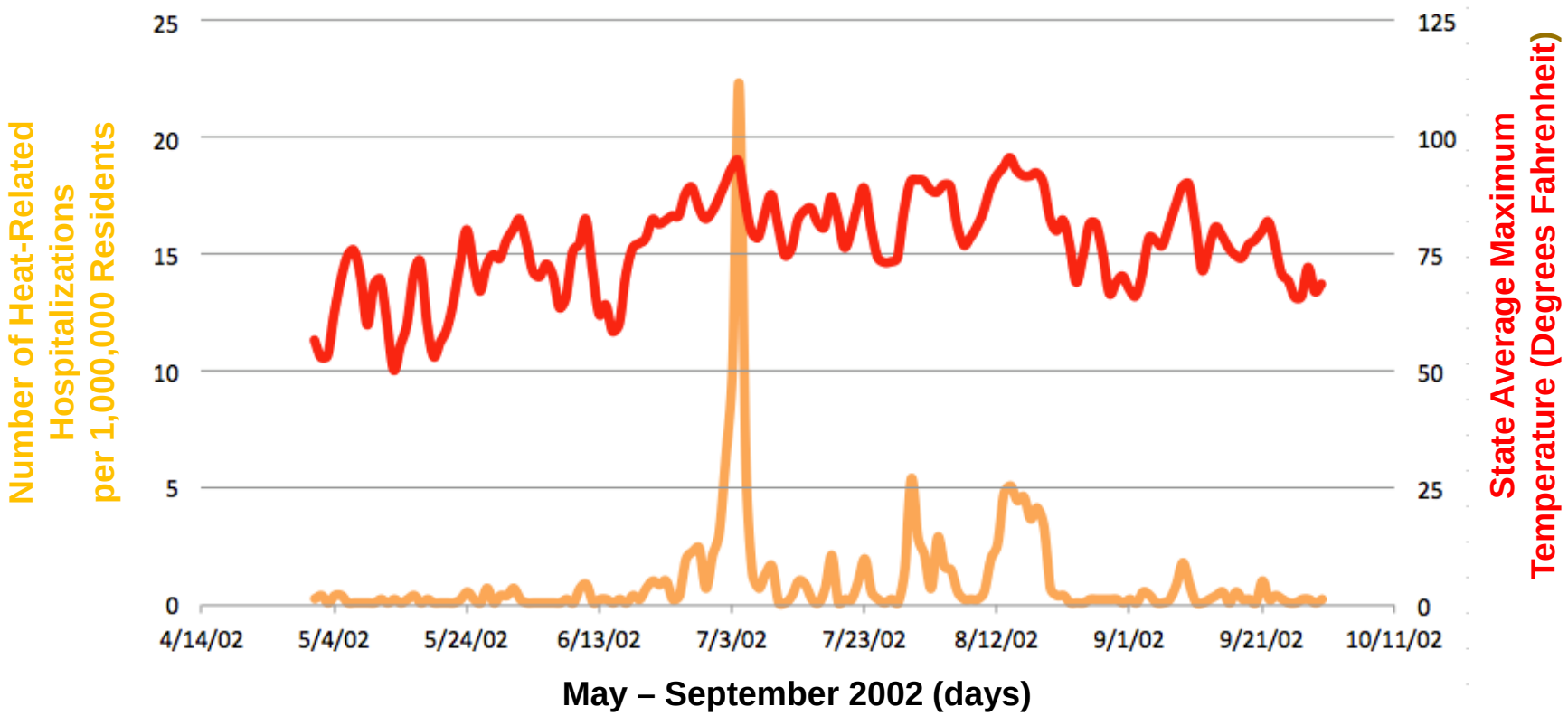
DRAFT ILLUSTRATION FOR PRESENTATION PURPOSES

Maximum Temperature in MA



DRAFT ILLUSTRATION FOR PRESENTATION PURPOSES

Combine Weather and Health Data



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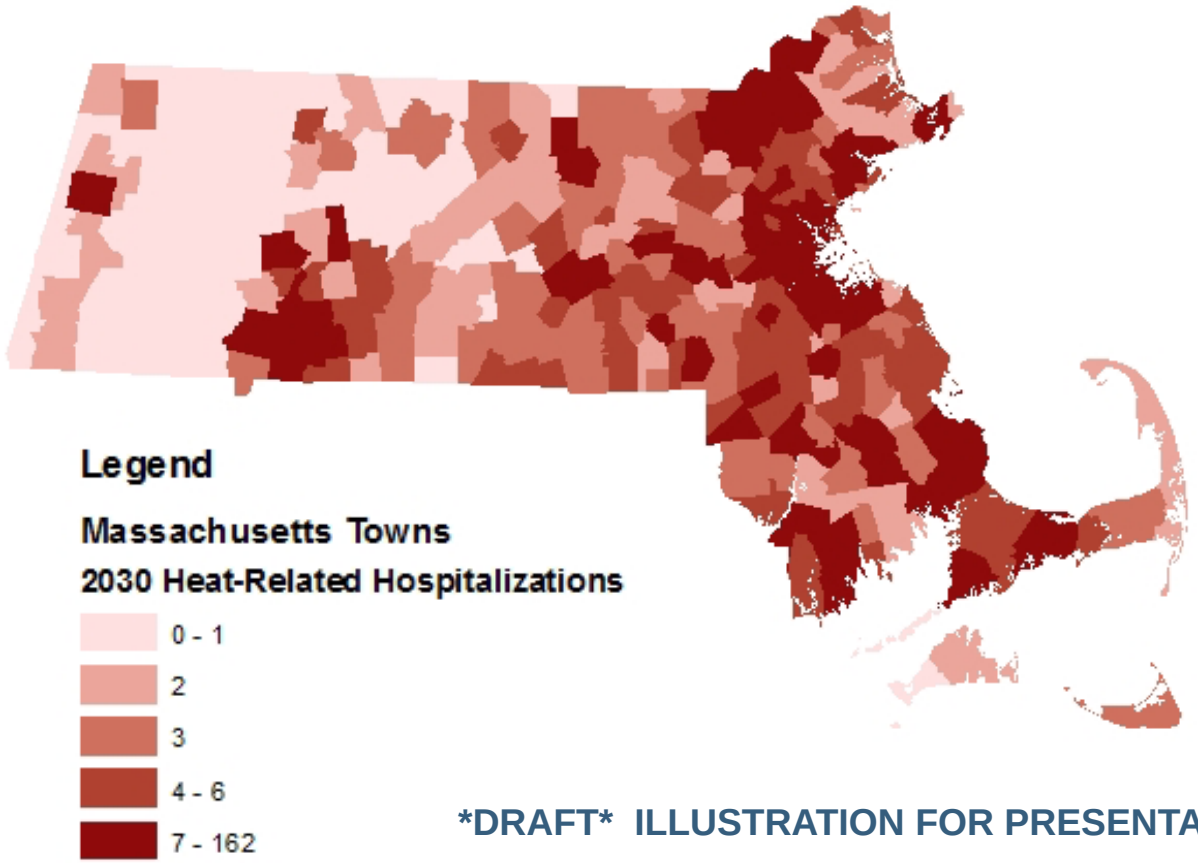
Massachusetts Health Data

Heat-related Health Burden in MA Communities

- Community level heat-related hospital admissions, per community, per day
    - Population Data
        - Percent age 65 or older
        - Percent > 65 and live alone
        - Percent of homes with no Air Conditioning
    - Health Data
        - Heat related illness
        - Electrolyte imbalance
        - Diabetes
        - Nephritis and nephritic syndrome
        - Respiratory Disease

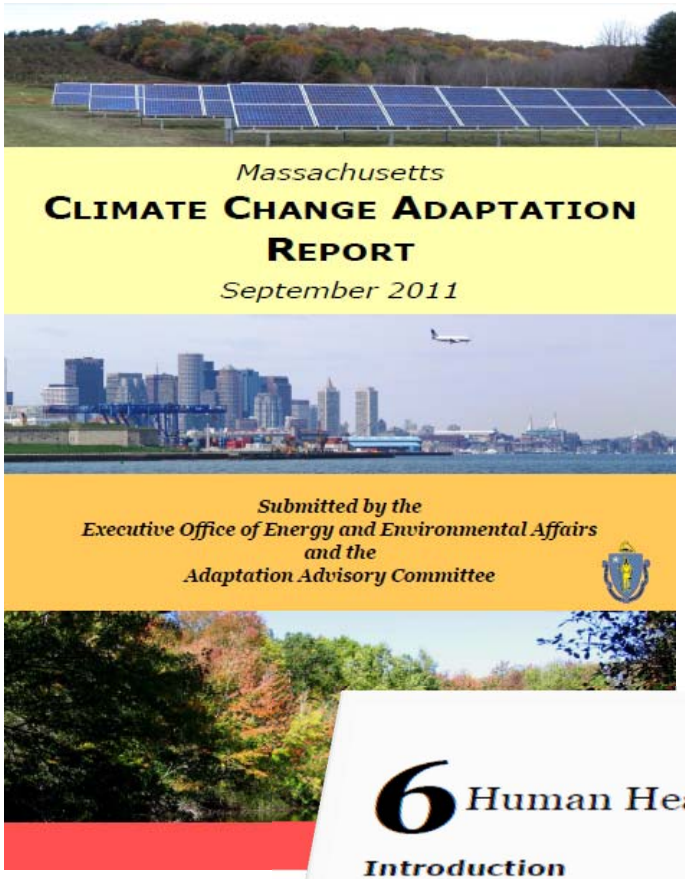
Risk of Heat-Related Hospital Visits

- Estimated 1°- 3°F temperature increase by 2030
- 0 - 162 additional heat-related hospital visits/town/year



DRAFT ILLUSTRATION FOR PRESENTATION PURPOSES

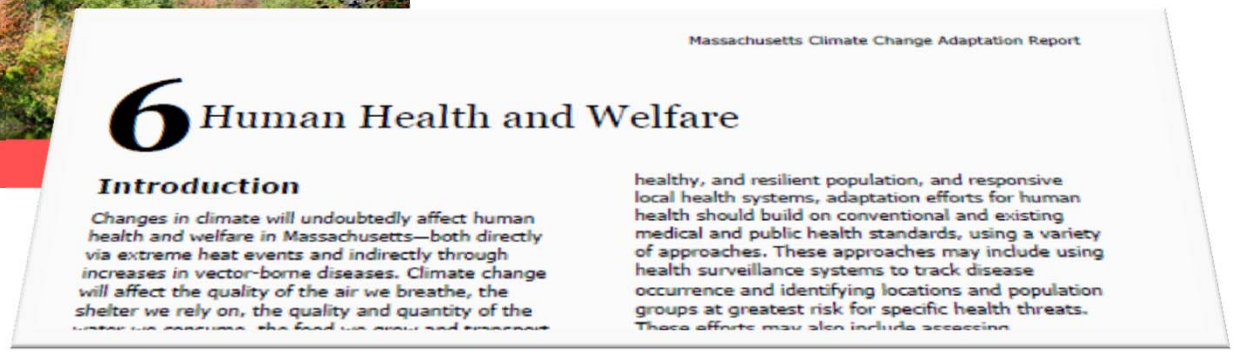
Planning for Climate Adaptation



Parameter	Current Conditions (1961–1990)	Predicted Range of Change by 2050	Predicted Range of Change by 2100
Annual temperature[1] (°C/°F)	8/46	2 to 3 / 4 to 5	3 to 5/5 to 10**
Winter temperature[1] (°C/°F)	-5/23	1 to 3 / 2 to 5	2 to 5 / 4 to 10**
Summer temperature[1] (°C/°F)	20/68	2 to 3 / 4 to 5	2 to 6 / 4 to 10**
Over 90 °F (32.2 °C) temperature[2] (days/yr)	5 to 20	–	30 to 60
Over 100 °F (37.7° C) temperature[2] (days/yr)	0 to 2	–	3 to 28
Ocean pH[3,4]	7 to 8	–	-0.1 to -0.3*
Annual sea surface temperature (°C/°F)	12/53[5]	2/3 (in 2050)[5]	4/8
Annual precipitation[1]	103 cm/41 in.	5% to 8%	7% to 14%**
Winter precipitation[1]	21 cm/8 in.	6% to 16%	12% to 30%**
Summer precipitation[1]	28 cm/11 in.	-1% to –3%	-1% to 0%**
Streamflow—timing of spring peak flow[1] (number of calendar days following January 1)	85	-5 to -8	-11 to -13**
Droughts lasting 1–3 months[1] (#/30 yrs)	13	5 to 7	3 to 10**
Snow days (number of days/month)[1]	5	-2	-2 to –4**
Length of growing season[1] (days/year)	184	12 to 27	29 to 43

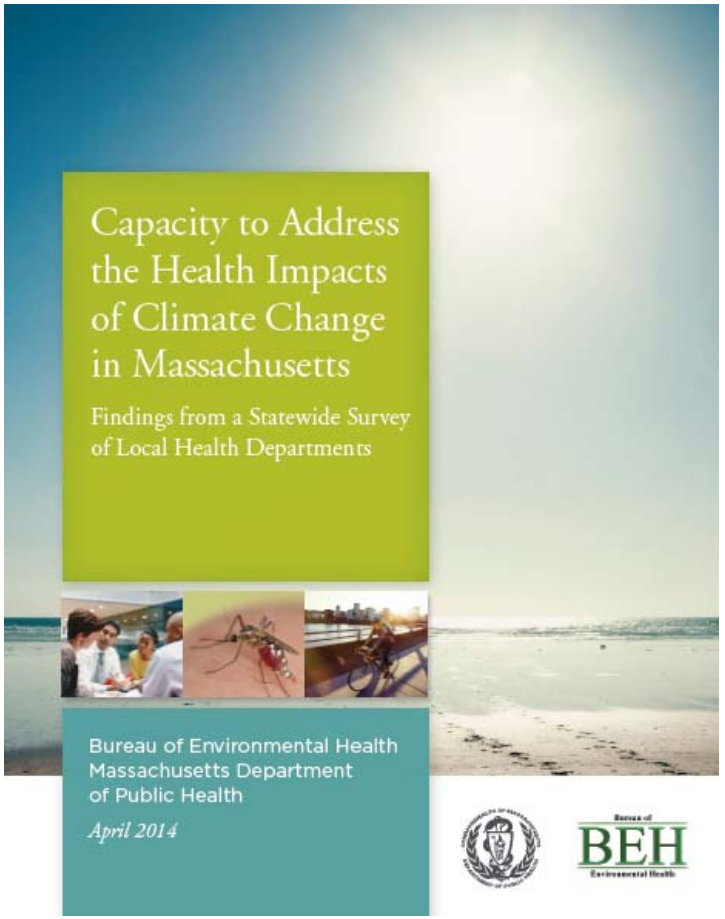
Table 1: ***Changes in Massachusetts' Climate***

Sources: 1-Hayhoe et al., 2006; 2-Frumhoff et al., 2007; 3-IPCC, 2007; 4-MWRA, unpublished; 5-Nixon et al., 2004
Note: All numbers have been rounded to the nearest whole number. Unless otherwise indicated, the predictions for the year listed as 2050 are for the period between 2035–2064. * *Global data;* ***Predictions for period between 2070-2099*



Capacity to Respond to Climate Adaptation

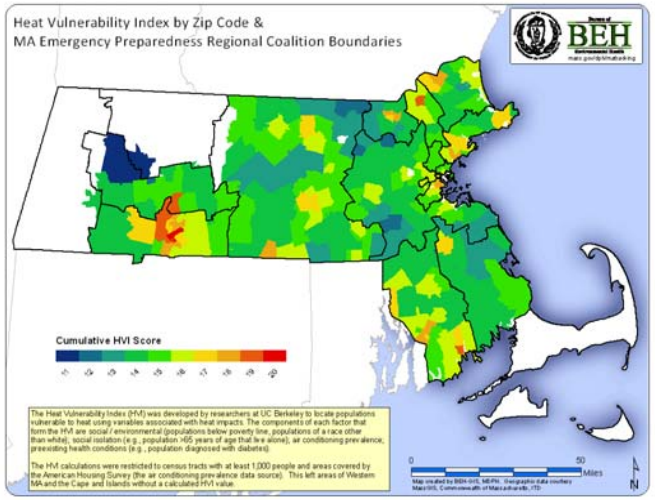
"…comprehensive survey aimed at assessing the capacity of local health departments in Massachusetts to respond to the public health impacts of climate change…"

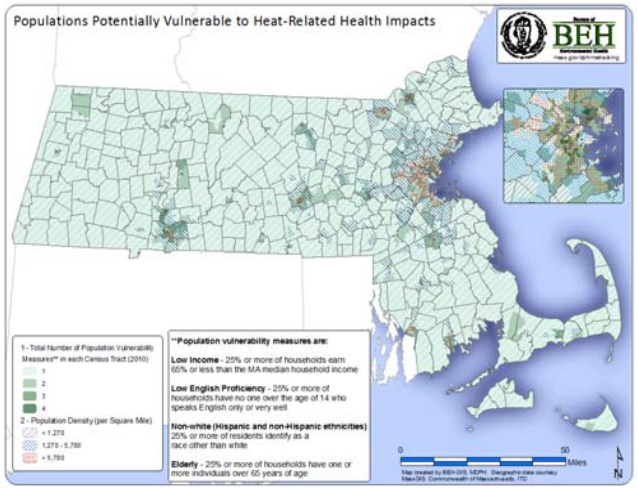


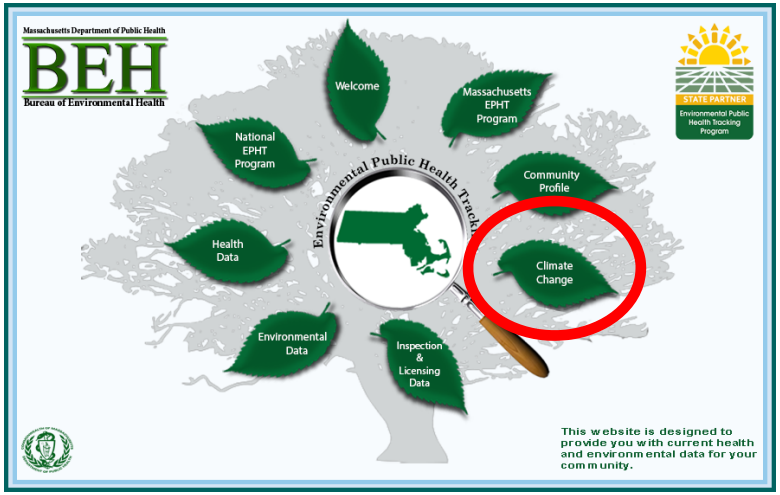
http://www.mass.gov/eohhs/docs/dph/environmental/exposure/climate-change-report-2014.pdf

MA Environmental Public Health Tracking

https://matracking.ehs.state.ma.us/#







Research

Evaluation of a Heat Vulnerability Index on Abnormally Hot Days: An Environmental Public Health Tracking Study

Colleen E. Reid,[1] Jennifer K. Mann,[1] Ruth Alfasso,[2] Paul B. English,[3] Galatea C. King,[3] Rebecca A. Lincoln,[4] Helene G. Margolis,[5] Dan J. Rubado,[6] Joseph E. Sabato,[2] Nancy L. West,[7] Brian Woods,[8] Kathleen M. Navarro,[1] and John R. Balmes[1,9]

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BACKGROUND: Extreme hot weather conditions have been associated with increased morbidity and mortality, but risks are not evenly distributed throughout the population. Previously, a heat vulnerability index (HVI) was created to geographically locate populations with increased vulnerability to heat in metropolitan areas throughout the United States.

OBJECTIVES: We sought to determine whether areas with higher heat vulnerability, as characterized by the HVI, experienced higher rates of morbidity and mortality on abnormally hot days.

for specific metropolitan areas (Johnson et al. 2009; Lindley et al. 2006; Loughnan et al. 2009; Rinner et al. 2009; Sister et al. 2009; Vescovi et al. 2005), the HVI is the only vulnerability map that is national in scope. The HVI suggests substantial variability in heat

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Thank you

Questions?

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