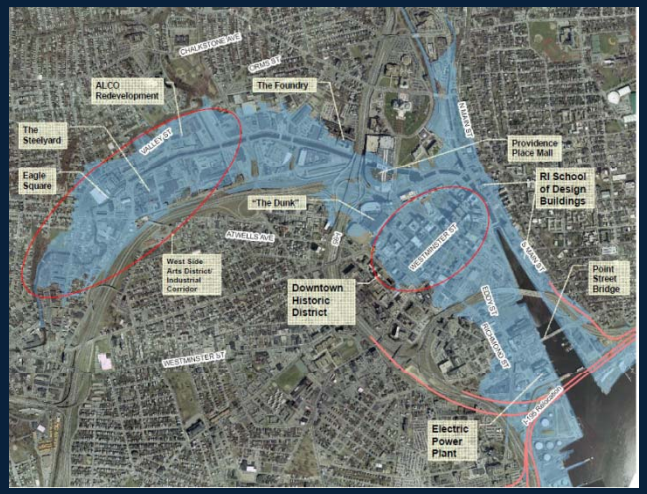

Photo Credit: Six Meter Rise: Implications for Providence. Providence Plan, 2008. http://provplan.org/data-and-information/map-entry/sea-level-rise

Building Resilience to the Public Health Impacts of Climate Change

A Review of Existing Strategies and Recommendations for the City of Providence

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Presentation Outline

1. Project Overview & Model
2. Indicators of the Public Health Impacts of Climate Change in Providence
3. Existing Strategies for Mitigation and Adaptation
4. Building Resilience: Where to Focus
5. Review of Best Practices
6. Recommendations
7. Resources and References

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1. Project Overview

Building Resilience to the Public Health Impacts of Climate Change in Providence

Background: Providence

- Has one health department for entire state; no separate agency at the city level
- Hosts a wide diversity of neighborhoods, in terms of residents' socio-economic status, access to resources, and environmental quality.
- Serves as a major industrial marine port
- Recently launched an Office of Sustainability, the first of any government in Rhode Island (municipal or statewide)
- Benefits from existing momentum across multiple organizations and community groups for a more sustainable city
- Until the establishment of the Office of Sustainability, the lead agency regarding climate change management in Providence has been the Providence Department of Planning and Development (PDPD). The PDPD created the city's climate change management plan, *Greenprint*, a comprehensive review of the activities the city is taking to mitigate and adapt to global climate change and environmental pollution (http://providenceri.com/greenprint/greenprint.pdf).

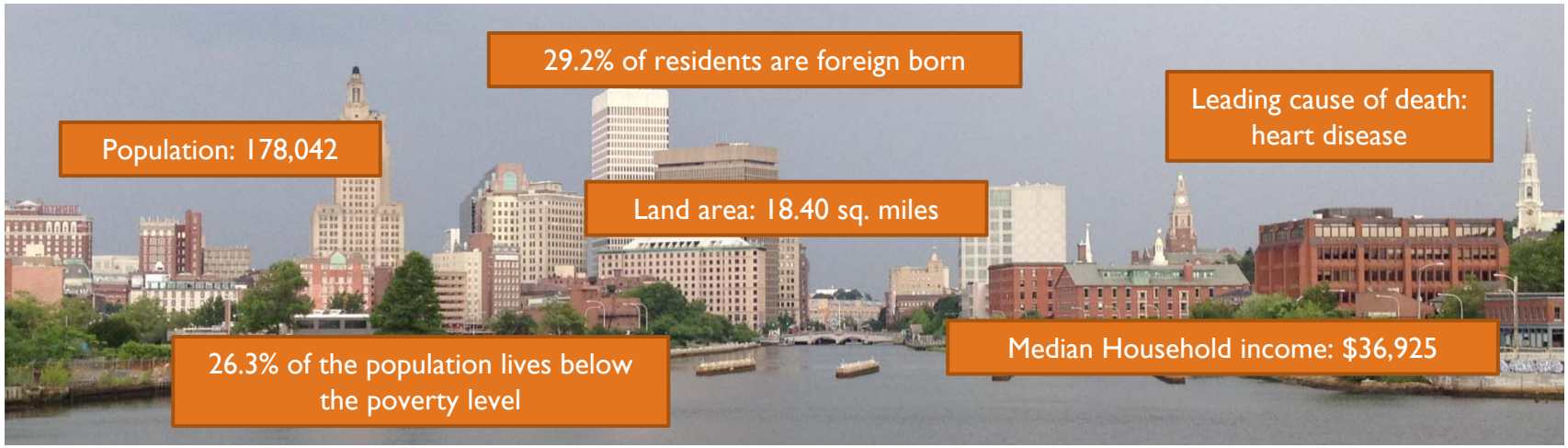

Photo Credit: Emily Koo, 2012

Our project in Providence serves as a model for other RI municipalities.

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Purpose and Approach

Purpose

- Create a cross-sectoral forum to:

1. Exchange ideas
2. Develop recommended priority actions to address the health implications of climate change
3. Lay the foundation for a more resilient Providence.

Approach

- Engage the public health approach to disease prevention and health promotion
  - Primary prevention: Prevent onset of illness/injury (immunizations, building resilience)
  - Secondary prevention: Diagnose problems early to control its advance
  - Tertiary prevention: once problem is diagnosed or understood, move quickly to restore functions and avoid complications.
- While it may be too late to prevent climate change entirely, there is much to be done to (a) reduce the scale of climate change and (b) prepare for and mitigate the negative public health impacts.

Our purpose was to create connections among city agencies and enable a collaborative approach to prevention.

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Model

Premise

Because there is no city-level department of health, other city agencies can support public health promotion by recognizing which of their programs have public health implications.

Model

1. Interview city agencies to map out existing work
   - Use specific examples of climate change problems we have already seen, such as extreme weather events, flooding, and heat waves.
   - Create a case for involvement: what we anticipate each agency is likely to be doing that could help prevent the public health impacts of climate change
2. Research best practices
3. Engage state DOH officials to identify appropriate indicators for monitoring the public health impacts of climate change
4. Engage data and mapping resources from the Providence Plan and ProvStat to create maps showing where to prioritize programs and services
5. Share with all participants and city/state level decision-makers.

Our model builds on work that city agencies already have in place and integrates best practices from other cities and states.

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Key Success Factors

- Define the case for involvement for each city agency in specific terms
- Give specific examples from recent memory of severe weather events and other climate change impacts
- Use the term "resiliency planning" in order to be more accessible
- Recognize that there may be more initiatives that align with mitigating public health problems than agencies realize, simply due to the wording of our questions
- Collecting best practices from other cities helped guide the questions and analysis of our project; even if the model cities in other states (i.e. California) share few of Providence's unique attributes

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People Interviewed

- Bob Vanderslice, Department of Health, Division of Environmental Health
- Garry Bliss, Department of Planning and Development
- David Everett, Department of Planning and Development
- Ken Ayars, Department of Environmental Management, Division of Agriculture
- Peter Susi, Department of Environmental Management, Division of Agriculture
- Scott Millar, Department of Environmental Management, Sustainable Watersheds
- Terry Gray, Department of Environmental Management-Air, Waste Compliance
- Bill Bombard, Department of Public Works
- Josh O'Neill, Providence Emergency Management Agency
- Mike Roles, Environment Council of Rhode Island
- Mark Kravatz, Green and Healthy Homes Initiative
- Chief Michael Dillon, Providence Fire Department, and Local Emergency Planning Committee
- Peter Gaynor, Providence Emergency Management Agency
- Jim Lucht, Providence Plan
- Joe Spremulli, Providence Water
- Pam Rubinoff, RI Climate Change Commission
- Patricia Nolan, RI Public Health Institute/Brown University
- Sunshine Menezes, Metcalf Institute for Marine and Environmental Reporting

We interviewed thirteen agencies and institutes involved in managing city resources and services.

Framing Questions Part 1: How resilient is Providence to damages from severe weather events?

1. How many days of water do we have?
   - Who has access to the water?
   - How is it distributed?
2. Where are cooling/heating centers located?
   - Who has access to them?
   - How do they get there?
   - How do people find out where they are?
3. How many days of food do we have?
4. What happens if the power goes down?
   - In Hospitals?
   - In cooling/heating centers?
5. How well does our infrastructure withstand extreme heat, water, or snow?
6. How are more vulnerable populations evacuated?
7. How do city officials communicate about the resources and support available?

Questions were designed to determine how resilient Providence is to the public health impacts of climate change.

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Framing Questions Part 2: How well do Providence public agencies engage mitigation strategies?

1. What is each agency doing regarding climate change and its public health impacts?
2. How much does each agency know about relevant programs to mitigate climate change and its public health impacts?
3. How well do the agencies communicate with each other about initiatives that may be relevant to others?
4. How well do the agencies communicate to the larger population about the programs they offer?

Questions were designed to determine how well City agencies are prepared to manage the public health impacts of climate change.

Project Outcomes

Proposed

1. Communications tools to inform their stakeholders on health-related climate risks
2. Indicator measures of climate change impacts on public health
3. Action plans to mitigate these public health concerns
4. Awareness of similar related efforts to encourage collaboration through meetings and web sites.
5. A model: the City of Providence serves as a pilot community.
6. Stronger relationships between city agencies.

Achieved

1. PowerPoint presentation to share with key stakeholders
2. Proposed list of indicators for RI Department of Health and city agencies to track
3. List of current city agency activities will form the foundation for action plans
4. Review of best practices, establishment of City Office of Sustainability "Green Team" and website to promote cross-agency communications
5. The attached presentation describes the model and how it can be applied to other RI municipalities
6. Our method of in-person meetings built and strengthened relationships between the Providence Office of Sustainability, the DOH, and Providence City agencies.

Our team was able to achieve our stated goals and lay an important foundation to promote public health and sustainability in Providence.

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2. Indicators of Public Health Impacts of Climate Change in Providence

Building Resilience to the Public Health Impacts of Climate Change in Providence

Effects of Climate Change in RI

Climate Parameter	Late century low emissions scenario	Late century high emissions scenario
Summer temperature rise	3-7°F	6-14°F
Winter temperature rise	5-8°F	8-12°F
Days over 90°F	30 days	60 days
Days over 100°F	3-9 days	14-28 days
Sea level rise	7-14 inches	10-23 inches
Sea-surface temperature rise	4-5°F	6-8°F
Intensity increase once-a-year extreme precipitation events	20% more rain	10% more rain

Source: Roberts T, et al. *Summary: Preliminary Assessment of Rhode Island's Vulnerability to Climate Change and its Options for Adaptation Action*. P 12.

Providence will feel increasingly like the Mid-Atlantic coast under low emissions, or like coastal South Carolina in the high emissions scenario.

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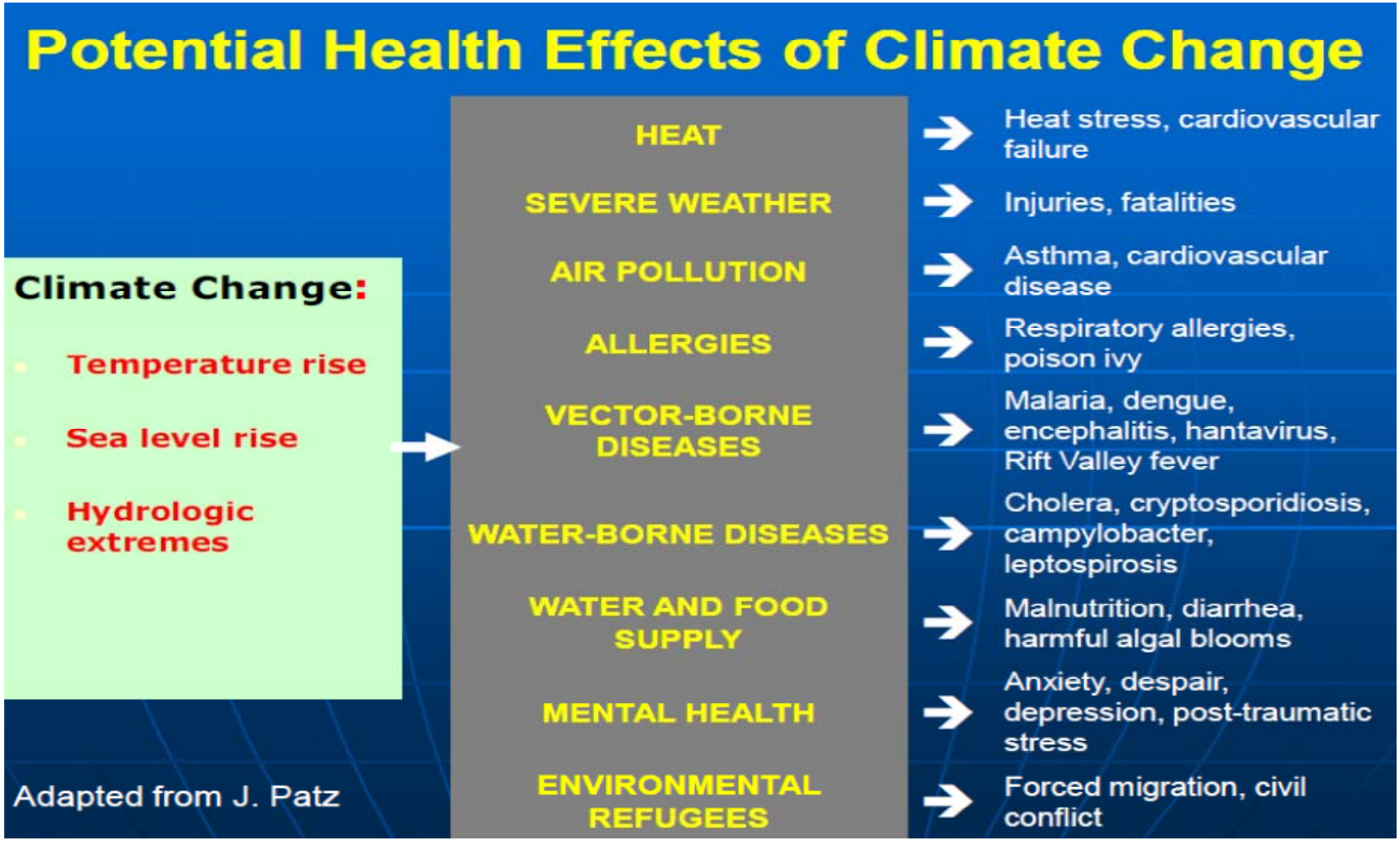
National Model for Understanding the Public Health Impacts of Climate Change (CDC)



Source: George Luber, Climate Change Adaptation in the Public Health Sector: The BRACE Framework, EPA Webinar, Oct. 2011

The public health impacts of climate change are hard to predict and will affect a wide range of populations.

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Public Health Impacts of Climate Change: Providence

Climate Change Effect	Public Health Issues
Extreme Temperatures • Heat Waves • Drought • Urban Heat Islands • Winter Weather Anomalies	*Heat* •Heat related illness (heat stroke, heat rashes, etc) •Water and food-borne diseases •Food safety and availability *Cold* •Injuries and car crashes from ice/winter conditions •Loss of heat, power, and communications at home or work •Limited mobility/access to resources during winter months •Hypothermia and frostbite
Sea Level Rise	•Storm and flood damages to infrastructure •Sewage and septic system problems •Saltwater intrusion to drinking water supply
Extreme Weather Events • Extreme Rainfall/flooding	•Injury from storm-related accidents •Storm and flood damages to infrastructure •Sewage and septic system problems •Housing damages •Limited mobility/access to resources in any large storm •Disruption of food and water supplies •Social unrest
Poor Air Quality	• Asthma, cardiovascular disease, allergies, respiratory problems
Disrupted Ecosystems	•New opportunities for diseases to thrive, such as Lyme disease •Displaced populations seeking refuge in RI •Changes in local agriculture and seafood production, shift in pathogens

The most vulnerable populations will be the elderly, non-English speakers, and people with inadequate access to healthcare and transportation

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Indicators of the Public Health Impacts of Climate Change

Public Health Issue	Indicator	Notes on Quality and Accessibility
Extreme heat	1. Heat-related deaths, 2. Heat-related morbidity; 3. Use of cooling centers	Hospital discharge data meets national standard for reporting (may not capture all deaths from heat-related illness).
Extreme Cold	4. Cold-related deaths, 5. Cold-related morbidity; 6. Use of homeless shelters	Hospital discharge data meets national standard for reporting (may not capture all deaths from heat-related illness).
Injuries/Mortality from extreme weather events	7. Injuries co-occurring with extreme weather events, as identified in emergency discharge data or medical examiner data	Need to track along with NOAA weather data
Air pollution/cardiovascular disease	8. Asthma cases from COPD data	Track along with air quality data
Water quality	9. Events of road closing and sewage overflow	Waterborne disease: watch for first transmission
Mental Health status	10. 211 calls for assistance; 11. Crime data	Track along with NOAA data

There are strong data sets in Providence at ProvStat and the Providence Plan, however we need stronger data in some areas.

Observations from Indicator Discussion

- ***Attributable Risk:*** It can be difficult to ascertain which portion of risk can be explained by climate change; it is better to understand the health impacts of climate change as an interconnected web
  - These are not independent variables; most effects will show up where there is overlap
- ***Insufficient Data:*** many of the surveys that include the data we need to track are inadequate; this report documents where public health/climate change data is lacking and which agencies or organizations can provide that data
- ***Relative Risk:*** none of these are major issues yet; better to recommend that we watch these for the first case of transmission
- ***Use of Mapping:*** A map of vulnerable populations could help agencies prioritize service during emergencies or disease outbreaks

Assessment and monitoring not only provides important data; it enables stronger leadership capacity within city agencies.

3. Existing Strategies

Building Resilience to the Public Health Impacts of Climate Change in Providence

Existing Strategies Among City Agencies

- The following slides review the strategies and resources already in place City agencies that were interviewed
- Many agencies did not realize the extent to which existing programs help mitigate the public health impacts of climate change
- This project did not entail a comprehensive review; some city agencies may have further resources relevant to climate change beyond those reviewed in this report.

Key to Agencies Listed

DEM- Department of Environmental Management

DOE- Rhode Island Department of Education

DOH- Rhode Island Department of Health

DPW- Department of Public Works

GHHI- Green and Health Homes Initiative

PDPD- Providence Department of Planning and Development

Parks- Rhode Island Parks and Recreation

PEMA- Providence Emergency Management Authority

PVD Water- Providence Water

PHA- Providence Housing Authority

RIPTA- Rhode Island Public Transit Authority

Providence has many excellent programs in place, however more resources and support are needed to achieve the best preparation.

Extreme Cold and Heat-Related Illnesses

Resource	Agency
Cooling Centers- variable: some don't cool well, some at risk if power goes down, poor communication to most vulnerable populations about locations	PEMA, DPP
Shelter during extreme temperatures- the emergency management teams recommend that homeless shelters stay open during the day	Fire Dept., DOH
Using City Water for Cooling • There are 9 city water play parks • Fire hydrants located within high vandalism areas are equipped with a custodial lock which requires a specialized wrench to operate (provided to the fire department).	PVD Water, Fire Dept., Parks
Water for Swimming- lake and beach closures can be an issue after rain storms because of sewage drainage	Parks, DPW
Tree-Canopy Cover- Some efforts are underway to benchmark current tree-cover; two programs to increase street trees and trees in parks and on private property, but their availability is poorly communicated.	Parks
Housing Quality- poor quality housing can be too hot or too cold in extreme events.	PHA, GHHI, PDPD

City agencies need to continue to prioritize programs for populations that need shelter in extreme weather events, heat waves and cold snaps.

Emergency Preparedness, Injuries and Accidents from Storms or Floods

- PEMA has a state of the art emergency management control facility that is above flood levels, and includes a special office for the mayor and a press room.
- Most city agencies have a plan for handling emergencies such as severe storms, contagious disease, and terrorist attack.
  - Plans are integrated into the state planning/response network
  - Annual (and often more frequent) drills
- Most plans depend on individual households keeping 2-3 days of food, water and supplies at hand
  - People dependent on electric medical devices are at high risk during electrical outages

Emergency Support	Agency
Shelters	DPP
Communication	PEMA, DOH, Schools [STEP program*]
Evacuation, transportation, road clearing	Fire Dept., DPW, RIPTA, PEMA, DEM
Manage contamination from hazardous materials	DEM, Fire Dept.
Hurricane Barrier	DPW
Prioritization of more vulnerable populations	PEMA Special Needs Registry; DOH

* Student Tools for Emergency Planning (STEP) is a national program that is embraced by the RI school department to help kids prepare for emergencies and support their family's safety (www.riema.ri.gov/step/).

Providence has extensive emergency preparedness planning that involves collaboration with multiple city agencies.

Water Supply and Water-Borne Illness

Resource	Agency
Water Supply • Providence has 400 days of supply, 75% of the system is gravity fed • All pumping and storage are facilities are above flood stage, have emergency generators and can monitor and control pumping stations and storage facility water levels remotely. • Such large surface water supply is difficult to contaminate • Providence Water serves 60% of the population of Rhode Island, and is the back-up water supplier for most of the state. • Conservation plans in Providence would benefit other parts of the state who do not have as robust a supply.	PVD. Water
Water supply infrastructure • With the development of the current Infrastructure Replacement Program, sections/areas of older water mains are planned for relining or replacement • Road drainage outlets may be blocked by floods and higher sea levels; • Long-term submersion would be a problem for crews to access valves and mains, and could cause a threat to fire protection	PVD. Water
Water Quality • Providence Water is working on compliance with lead and copper treatment • OWR Storm Water Manual (Dec 2010) revised design standards for engineering storm water transportation and retention systems • Do not know what would happen if hurricane barrier is breached	PVD Water; DEM
Sewage Systems and Storm Water Management • During floods or power outages, poor storm water management systems mean sewage can get backed up and release onto city streets	DPW, DEM

While Providence Water has a resilient infrastructure, it supports most of the state and must be a resource during drought and emergency.

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Vector-Borne Disease

Resource	Agency
Mosquito Abatement- spraying to prevent growth in mosquito population	DEM, DPW
Mosquito Abatement Coordinator- oversees state plan for spraying, traps and evaluates mosquitoes for Lyme disease	DEM
Programs- Education and outreach programs regarding WNV, Lyme disease, and other vector-borne illnesses	DOH
Animal-related Diseases- DEM is the lead agency for animal health issues, including pets, during incidents such as floods or other natural disasters	DEM

An urban center, Providence has systems in place for insect-borne diseases, and has not yet had need for systems regarding other vectors.

Cardiovascular Disease

Resource	Agency
Housing Quality Control- poor indoor air quality, paired with high temperatures, can trigger asthma or other cardio-vascular diseases	PHA, GHHI, PDPD
Air Quality Control- poor air quality alert days trigger free rides on RIPTA; cap and trade effort to reduce GHG and improve air quality; current effort to inventory GHG emissions (DEM)	DEM, RI-DOE, DOH, RIPTA
Access to Green Space- the Providence Department of Planning and Development has a plan (Comprehensive Plan) that includes increasing the amount of green space accessible to city residents.	PDPD

Providence has some important resources in place to prevent cardiovascular disease triggers, but these need to be better publicized.

Profile of Food Supply and Agricultural Resilience in Rhode Island and Providence

- City has 2-3 days of supply in grocery stores in the event of transportation closures
- 1% of food consumed in RI is produced in RI; 10% is produced in NE.
  - DEM states a goal of 80% sourcing of food in RI in 30 years.
- Majority of food is from California and Florida, and is dependent upon cheap fossil fuel
- Rhode Island is in the top 5 states in the U.S for support of local agriculture
- RI has 50 summer farmers markets, 5 winter markets
- RI is the only state with division of agriculture within the larger DEM command and regulatory structure, which makes it easier to coordinate programs and support systems for local agriculture

- Providence has 42 community gardens, 20 home gardens, and 10 school gardens in the Community Grower's Network
  - 900 families grow food through the Community Growers Network.

Rhode Island Agencies Supporting Agricultural and Seafood Resilience

- DEM, Division of Agriculture
- Rhode Island Food Council
- Southside Community Land Trust
- Rhode Island Seafood Marketing Collaborative
- Farm Fresh Rhode Island
- Community Grower's Network

While Providence and RI are national leaders for local agricultural and food system supports, we have a high reliance on unsustainable practices.

Food Supply and Agricultural Resilience

Resource	Agency
Progressive regulation supports farmers: (a) Support for small local agriculture such as raising chickens and bees (b) State legislation states that plant-based agriculture is a right (c) Simple process for selling home-grown vegetables, eggs, honey, etc.	DEM, Parks Department, Providence City Council
Inexpensive land leases for farming: (a) DEM leases plots to eligible communities (e.g. Hmong) at $1/year (b) Parks department coordinates community gardens in City parks (c) Public Properties leases city property to urban farmers	DEM, Parks Department, Public Properties
Urban markets and access to healthy foods • Providence has 6 urban farms selling directly to consumers at City farmer's markets, and through Community Supported Agriculture (CSA) shares and Providence restaurants. • The Environmental Justice League (EJLRI) operates the Healthy Corner Store Initiative, a community-led campaign to add healthy options and variety to the food available at small markets in Providence, and educates community residents to build consumer demand for healthier items.	EJLRI
Additional Initiatives: • the City is beginning a feasibility study to promote composting of food waste. • Plant Providence is a calendar of educational workshops on growing food. This year, 20 workshops were offered free to city residents, with total attendance at 350, up from 280 in 2010. Twenty-five workshops will be offered in 2012.	Office of Sustainability, Southside Community Land Trust, Urban Ag Task Force

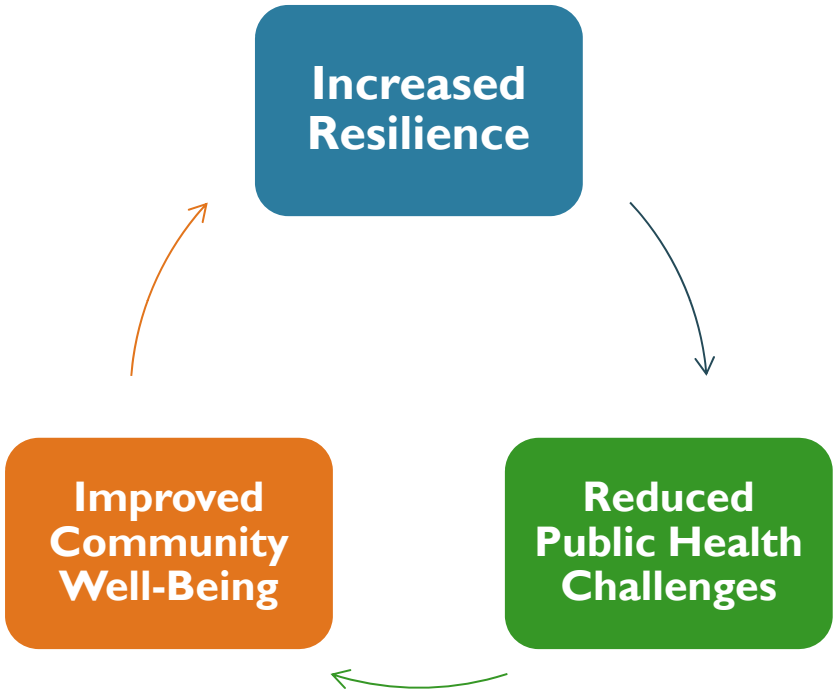
The strong connections between city/state agencies and local food movement are a key asset for the City's public health goals.

4. Building Resilience: Where to Focus

Building Resilience to the Public Health Impacts of Climate Change in Providence

Pathways to Resilience

- Populations who are vulnerable to the public health impacts of climate change are those who are already vulnerable to many other public health challenges
- Many city agencies already have initiatives in place that will also help the City prepare for the public health impacts of climate change
- In particular, city programs that address the needs of certain vulnerable populations (outlined on the following slide) will have access to those populations for primary prevention



The public health model focuses on primary prevention to stop problems before they start.

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Identifying Vulnerable Populations

Vulnerable Populations

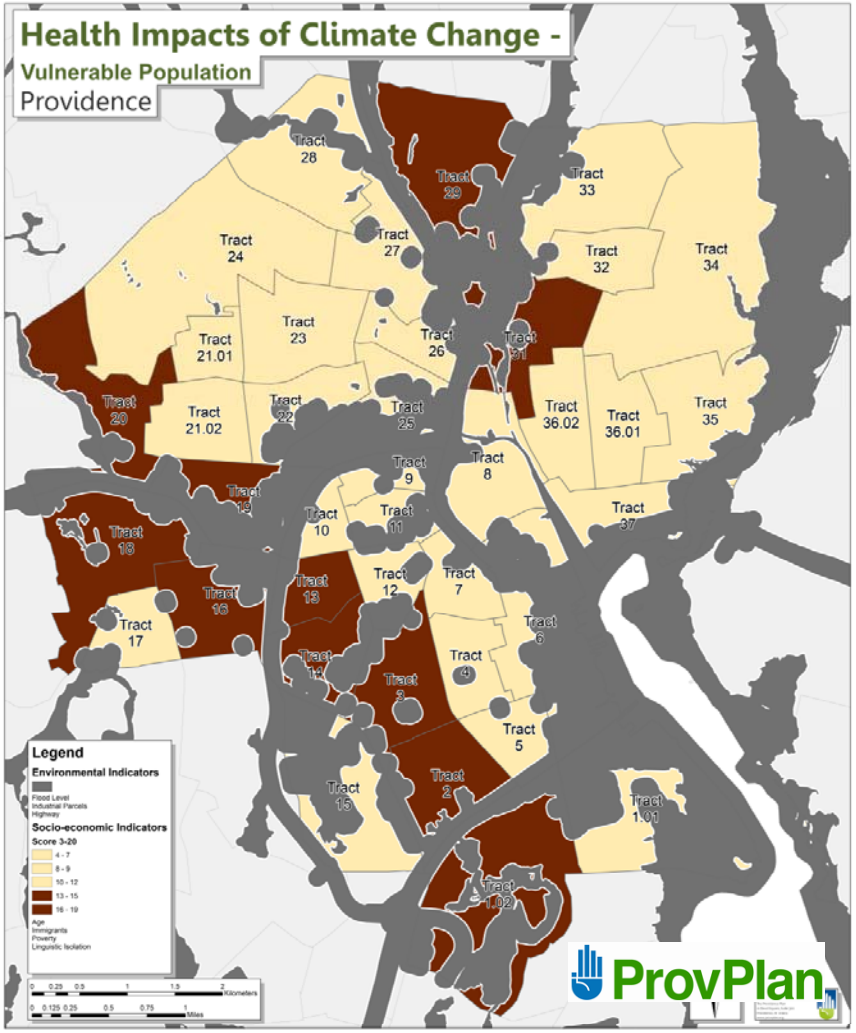
- Low-income families
- Homeless
- Non-English language speakers
- Elderly
- Socially isolated
- Recent immigrants

Where are they?

- PEMA Special Registry of 3000 self-identified vulnerable individuals
- GHHI partnerships with vulnerable neighborhoods
- In flood zones
- In poor quality housing

Knowing where most vulnerable populations are located helps city agencies prioritize resources and support during emergencies.

Using GIS to Identify Vulnerable Populations



- GIS is an important tool for finding the physical intersection of socioeconomic and environmental determinants of health, and prioritizing in high-risk areas.
- Resources such as the Providence Plan provide access to a vast collection of information and data-analysis tools.
- The following slides demonstrate the construction of a GIS map that could be used to focus city programs by overlaying socioeconomic and environmental determinants of health.

GIS tools can integrate social, economic and geographic data to help city agencies prioritize their support services.

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Socio-Economic Indicators of Vulnerability

- The elderly: the number of people older than 70 years in every tract of Providence
- Immigrants: the number of immigrants that came to the USA after 2000
- Poverty: the number of households living at 150% of poverty
- Linguistic isolation: the number of households where no one aged 14+ speaks English only or speaks English very well

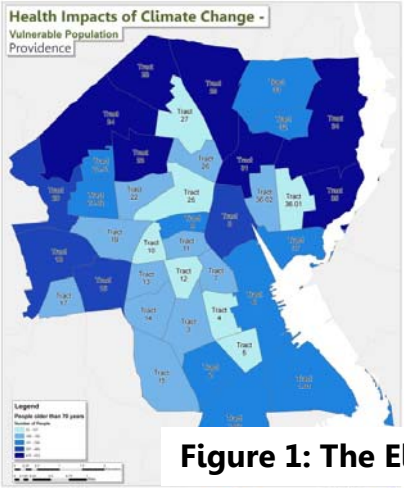

Figure 1: The Elderly

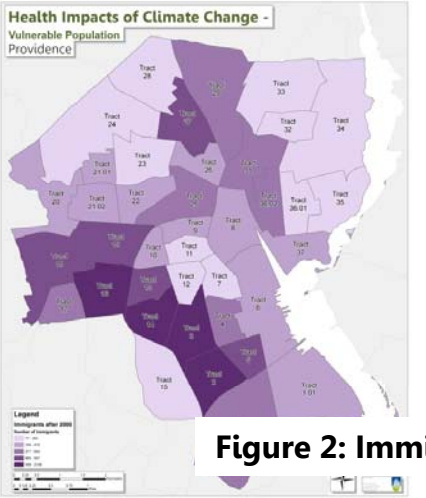

Figure 2: Immigrants

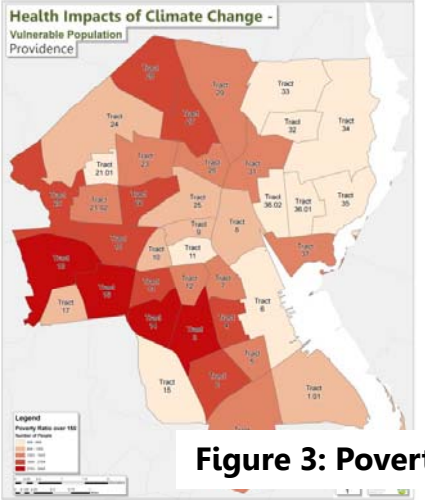

Figure 3: Poverty

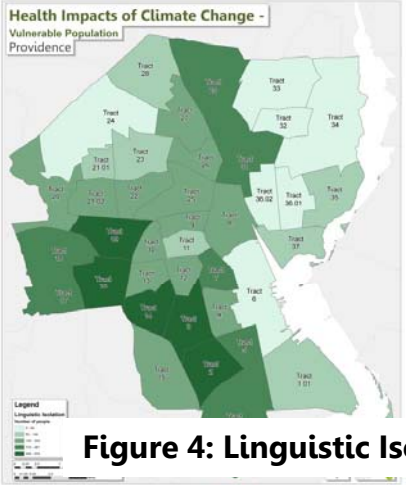

Figure 4: Linguistic Isolation

The first layer of the map shows four socio-economic indicators of vulnerability.

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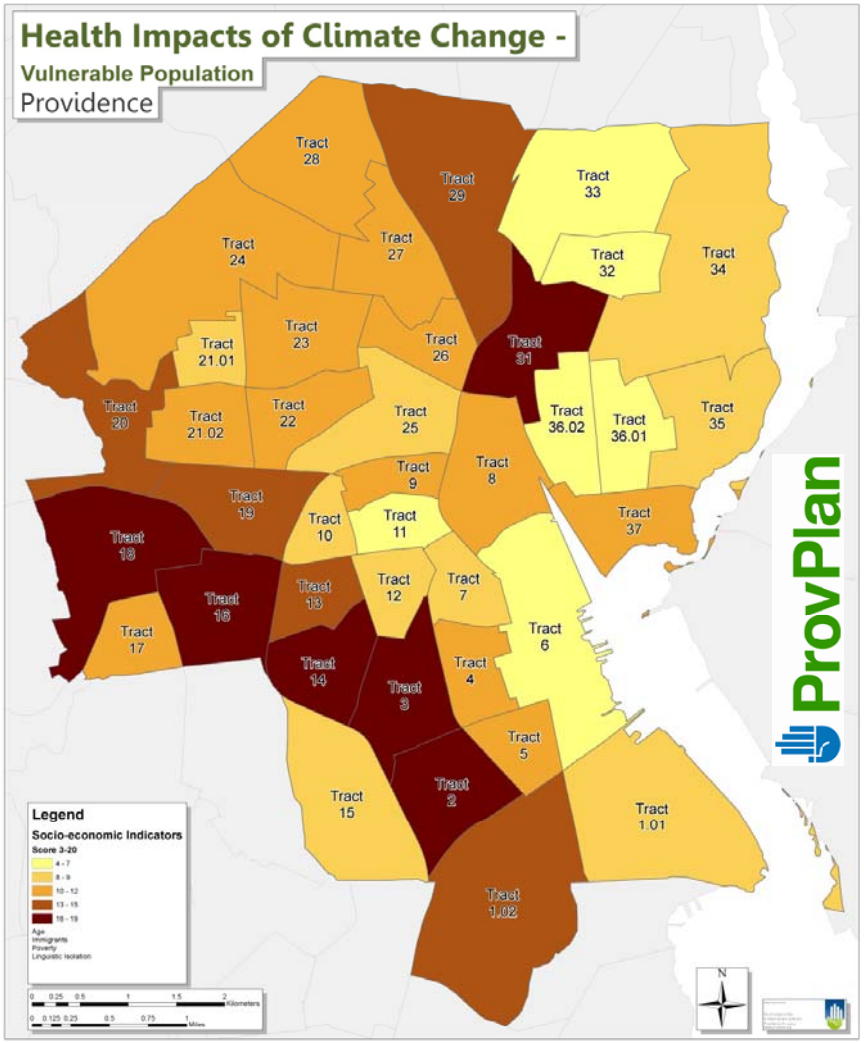
Aggregation of Socio-Economic Factors



- This map shows the composite result of combining the four indicators: the elderly, immigrants, poverty, and linguistic isolation.
- Darker colors indicate the populations who are most vulnerable to climate change.
- The final map (page 34) highlights tracts in the top two scoring categories.

Aggregating multiple indicators of vulnerability reveal the areas that will need the most assistance during severe weather or disease outbreaks.

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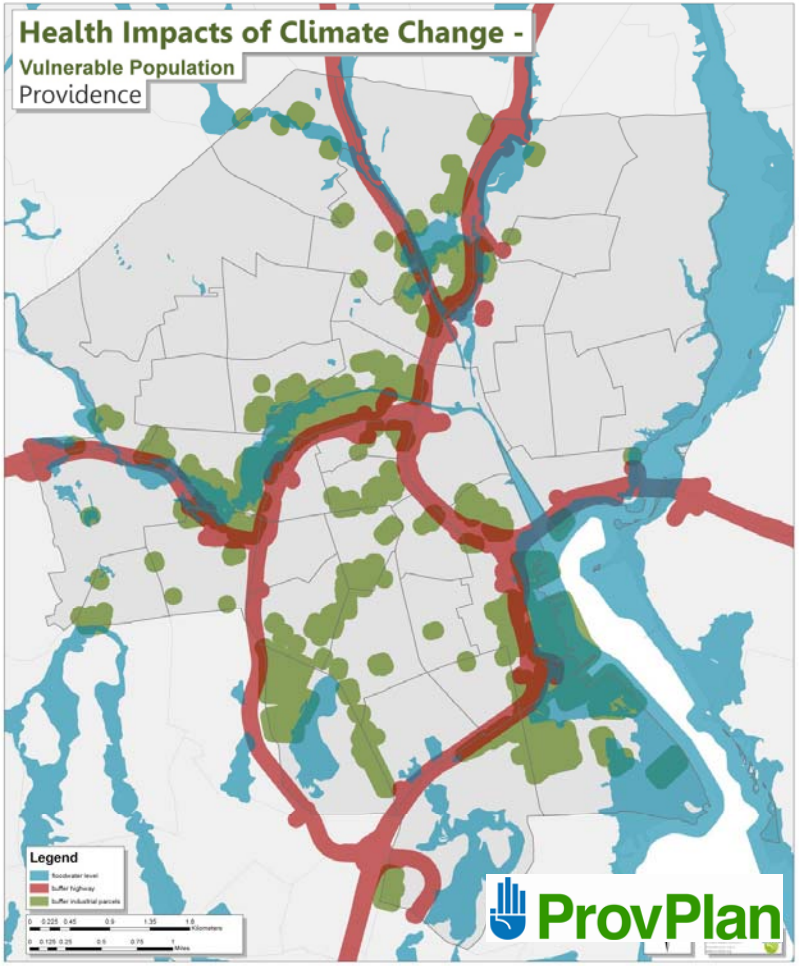
Environmental Indicators of Vulnerability

- Areas in blue have a 0.2% chance of a flood event or higher per year.
- Red areas are the highways with a 300 foot buffer.
- Green areas are industrial parcels with a 300 foot buffer.
- The final map (page 34) shows a gray merged layer of all these spatial and environmental influences.



It is easier to see the importance of environmental indicators of vulnerability when maps show their proximity to vulnerable populations.

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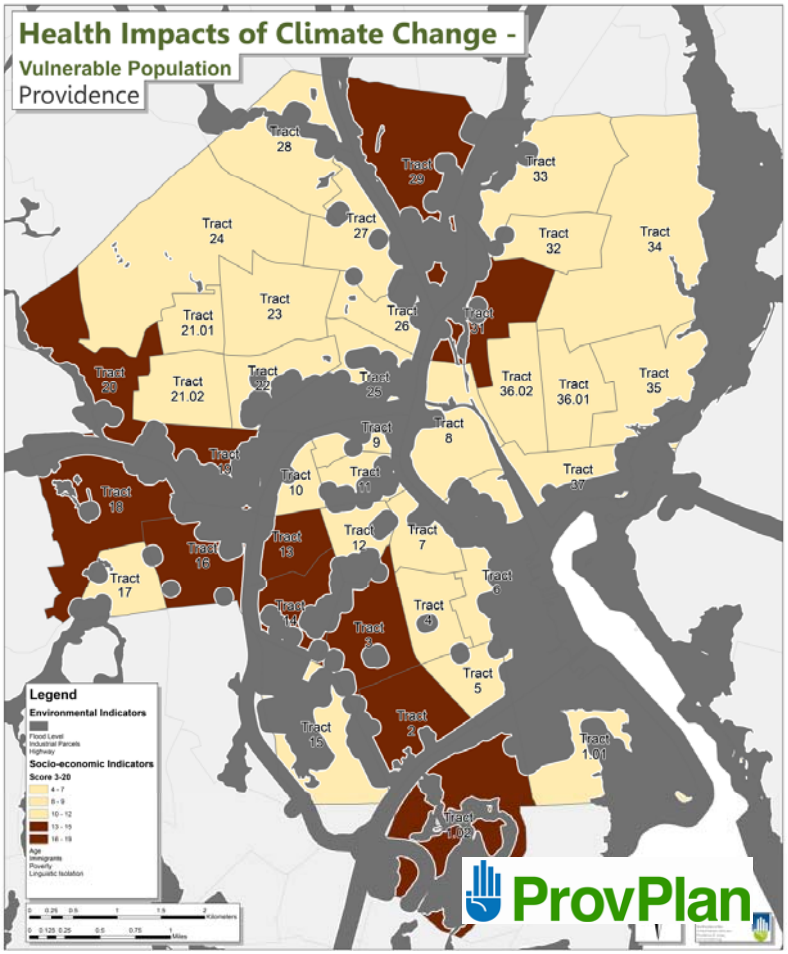
Composite Map: Highest Vulnerability to Climate Change



- The composite map consists of two elements: a tract level base map of socio-economic determinants of health and an overlay of environmental determinants of health.
- Mapping various combinations of socio-economic, health, and environmental data helps identify areas that are most vulnerable to climate change – in this case, gray regions which overlap maroon tracts.
- However, these analyses demand a comprehensive set of indicator data with more effective mechanisms for both surveillance and management.

Maps such as these can be used to help city agencies prioritize service to vulnerable communities during severe storms or disease outbreaks.

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Initiatives that Build Resilience to the Public Health Impacts of Climate Change

- Providence Interdepartmental Green Team
- Providence Environmental Sustainability Task Force
- Green and Healthy Homes Initiative
- RI Climate Change Commission
- Environment Council of RI
- Providence Department of Planning and Development
  - Comprehensive Plan
  - GreenPrint
- I-195 Commission will include plans for sustainable development
- DEM/Division of Agriculture's programs to promote production and consumption of locally grown agricultural products
- Environment Council of Rhode Island's (ECRI) recommendations to the State Climate Change Commission on urban adaptation, vulnerability and resilience to climate change
- Communication channels through DOH-supported minority health centers

Many City agencies and non-profit service organizations have excellent programs in place; they need to coordinate efforts.

5. Review of Best Practices

Building Resilience to the Public Health Impacts of Climate Change in Providence

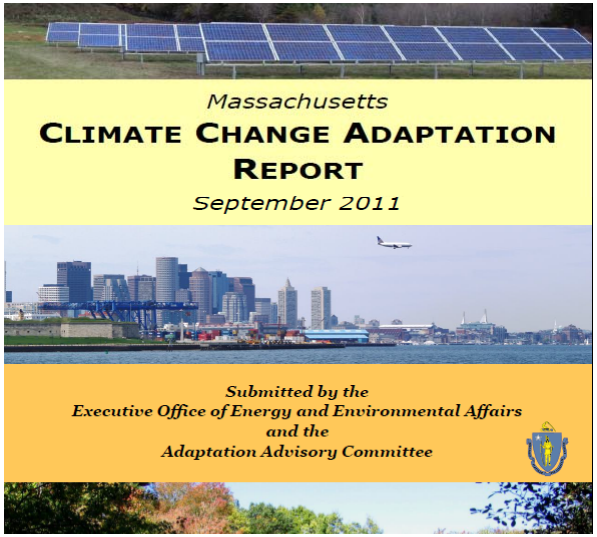
Selected Best Practices

- This section reviews selected best management practices and provides links to reports for more detailed information
  - Massachusetts statewide adaptation planning with prioritized steps
  - Michigan strategies to coordinate surveillance and communication between state and local health officials
  - Santa Cruz, CA adaptation plan: detailed strategies for infrastructure planning and improvement
- More detailed examples are available in the references and resources

Several states and Municipalities have developed adaption plans and resilience strategies that can inform Providence planning

Adaptation Planning in Massachusetts

- Statewide Planning for Infrastructure and Health
  - Review of impacts and vulnerabilities similar to RI
  - Includes prioritization of strategies
    - No Regrets, Short-term, Long-term
    - "No Regrets" strategies have benefits for mitigation and positive financial returns even in the absence of increased climate impacts
    - Example: Retrofitting buildings to passively heat and cool reduces carbon emissions, and improves their ability to provide comfort and shelter during power outages



  - Ch. 5: Key Infrastructure
    - We have significant need and opportunity to collaborate with MA communities on watershed, energy, transportation and communications infrastructure
  - Ch. 6: Human Health and Welfare
    - Many of the vulnerabilities in neighboring MA communities are similar to Providence. Many opportunities exist for collaboration and coordination between health professionals in RI and MA.
  - Report: http://www.mass.gov/eea/air-water-climate-change/climate-change/climate-change-adaptation-report.html

Massachusetts has many similarities to Providence; it is a resource for preventing and preparing for the public health impacts of climate change.

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Michigan Climate and Health Adaptation Plan

- Planning for Public Health Officials – Michigan Goals
  - 1. Climate change is recognized as a public health issue & integrated into public health practice.
    - (Currently, climate change and its public health impacts are not understood or appreciated by most Michigan health officials, according to this study.)
  - 2. Public health agencies will have the tools, resources, and activities to respond to climate change impacts within existing programs.
    - (Public health programs in Michigan currently deal with many of these health impacts, but lack resources to respond adequately).
  - 3. Vulnerable populations are to be explicitly considered in programs and policies addressing climate change impacts.
    - (Michigan public health systems are not sufficiently prepared to identify and respond to disproportionate impacts on vulnerable populations).
  - Report: http://www.michigan.gov/climateandhealth/

The Michigan plan emphasizes the importance of integration of climate change priorities and assessment to monitor progress.

Michigan Climate and Health Adaptation Plan

Example of detailed objectives related to each primary goal

- Goal #1: Climate change will be recognized as a public health issue and integrated into public health practice.
  - Objective 1.1: State leadership. The key stakeholders will demonstrate support to the issue of climate change's impact on health.
  - Objective 1.2: Training. A training plan and curriculum will be developed and delivered to Health staff and to local public health staff. Pre- and post--testing will document improvement in knowledge.

- Goal #2: Public health agencies will have the resources, tools and activities for responding to climate change impacts integrated /included in their existing programs.
  - Objective 2.1: Surveillance, assessment. Stakeholders will build a data repository for data to be used in statewide environmental health assessments and health surveillance and will conduct surveillance utilizing these data sources.
  - Objective 2.2: Assessment, tool development. Health Impact Assessment (HIA) conceptual models will be developed for several topic areas, beginning with heat events and air pollution.

A complete plan for Providence could include directives as succinct and clear as this plan for Michigan.

Public Works Infrastructure Santa Cruz, CA

Summary of action items by priority		Lead dept.
Very High Priority Actions		
# A-1	Upgrade/Relocate City buildings and infrastructure to protect and prepare for sea level rise, flooding and storm events from climate change	City Manager
# A-2	Prepare for potential sea level rise throughout the City	City Manager
# A-3	Evaluate decisions through a climate change impact lens	City Manager
# A- 4	Protect wastewater facility from ground water infiltration	Public Works

High Priority Actions		
# B-1	Monitor wastewater facility ground water	Public Works
# B-2	Engineer a cut off wall to protect wastewater treatment facility	Public Works
#B-3	Protect adjacent neighborhoods & commercial areas from creek/stream flooding	Public Works
# B-4	Prepare for water emergency supply for climate related events	Water

Report: http://www.cityofsantacruz.com/Modules/ShowDocument.aspx?documentid=23643

The Santa Cruz plan lists clear priority for actions and assigns lead responsibility.

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Public Works Infrastructure Santa Cruz, CA

Prioritized action items estimate costs and funding sources

A-18 ..... **Protect and preserve tree canopy**
Proposed activities ..... Evaluate, preserve and protect tree canopy including species evaluation and replacement with resilient trees that can withstand extreme weather events, salt water intrusion, and drought.
Hazard ..... Drought, salt water intrusion, extreme weather events, sea level rise, and heat
Environmental concerns .... Animal habitats
Lead department ..... Parks and Recreation
Additional departments ..... Redevelopment and Economic Development, Planning
Timeline ..... Ongoing with annual status reviews
Resources required ..... Staff time, outside experts and consultants, funding
Funding source ..... General Fund and unidentified outside funding
Priority ..... **Very high**

Action Items rated "High Priority"

B-1 ..... **Monitor wastewater facility ground water**
Proposed activities ..... Provide ground water monitoring wells to monitor level of ground water rise.
Hazard ..... Sea level rise
Environmental concerns .... Ability to treat raw sewage to required discharge standards for safe ocean disposal
Lead department ..... Public Works
Timeline ..... Ongoing
Resources required ..... $1 – 2 million
Funding source ..... Unidentified grant funds, sewer fund, storm water fund
Priority ..... **High**

A complete plan for Providence could include directives as succinct and clear as this plan for Santa Cruz (CA).

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Applying Best Practices to Providence

- Currently, City agencies do not have fully-developed climate action and adaptation plans, although many have relevant activities in place
  - There could be greater emphasis on public health impacts of increased intensity and frequency of extreme weather events
- DEM does not have a system-wide climate action plan and the State Planning Office is at the initial stages of developing a plan
- Prioritized planning, as used in the best practices above, can aid institutions that interact with more vulnerable populations in planning to support them during extreme weather events or other emergencies
  - Such as homeless shelters; could offer daytime stays during emergencies, set up quarantine spaces during epidemics like WNV.
- Need assessment of cultural competency of emergency response systems

While Providence has some solid resources in place, better coordination and collaboration would help us become a more resilient community.

6. Recommendations

Building Resilience to the Public Health Impacts of Climate Change in Providence

Recommendations – Immediate

Recommendations	City Office of Sustainability	Public Health Officials	City Agencies
Communications: a) Share this report with city agencies, public health and environmental action communities b) Improve communications among city agencies and COS about existing programs	Share with City Agencies via Green Team, the ECRI network, and the Providence Environmental Sustainability Task Force	DOH communication channels	Share with own agency
Plan and Program Priorities: a) Integrate the public health impacts of climate change into emergency response planning. b) Work across DOH and city agencies to Implement a regional storm water utility district plan to control sewage overflow	COS will integrate public health issues into the Sustainability Action Plan for planning, monitoring and implementation.	Recommended	Recommended
Surveillance: a) Establish monitoring program for indicators listed above b) Use maps to evaluate and locate vulnerable populations	Work with DOH and Providence Plan to establish and with city agencies for reporting	Establish program; work with city agencies and COS	Report data to DOH and COS

City agencies can make immediate improvements by better communicating their existing programs and establishing surveillance.

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Recommendations – Long Term

Adopt and Continue to Research Best Practices

- Continue to research what comparable cities are doing (i.e. Worcester, Hartford, Somerville, Holyoke, Newark, Bridgeport)
- Specific research questions:
  - (a) how accessible (language, culture, transportation) are Providence's programs for immunizations and other preventive measures to more vulnerable populations?
  - (b) how culturally appropriate are the emergency management resources?

Strengthen Public-Private Partnerships

- As outlined in the ECRI urban resilience report, city government should work closely with community leaders and organizations that could conduct more effective education and outreach
  - Build on communication channels through DOH-supported minority health centers
  - Identify other connections between government and community centers

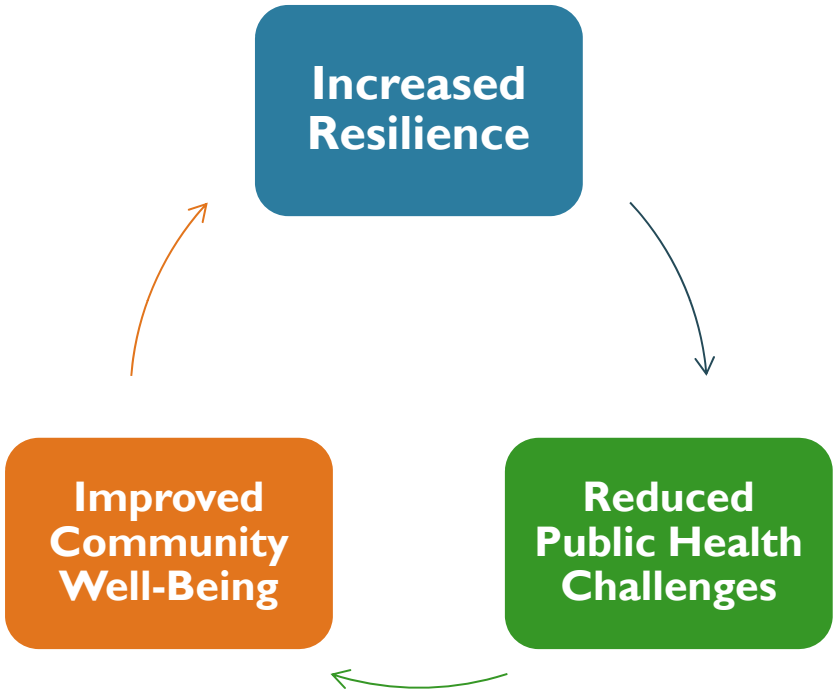
On-Going management

- Public Health Officials: DOH has submitted a proposal for funding for on-going monitoring and integration
- City Agencies: continue to support participation on the COS Green Team
- City Office of Sustainability: Include public health concerns as part of the annual report on the Sustainability Action Plan

The implementation of these longer-term recommendations will ultimately improve all agency programs, and create a more resilient city.

Integrating the Findings

- This report can serve as a communication tool across city agencies.
- The DOH and the Providence Office of Sustainability can monitor and obtain feedback about our progress.
- The Providence Office of Sustainability's Sustainability Action Plan should incorporate our findings and build on:
  - Relationships the Office of Sustainability has built through this project
  - Understanding the Providence context
- This model for building relationships among city agencies and integrating plans should be shared with other cities and towns across Rhode Island



Our goals will be achieved through communication, continued study of best practices and establishing good relationships among city agencies.

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Closing

- Providence has a number of programs in place that were designed for other purposes but are very helpful in preparing the city for some of the public health impacts of climate change.
- City agencies can be most helpful by integrating concerns about the public health impacts of climate change into their decision-making processes about allocation of resources and service program design.

Photo from New England Magazine, accessed July 19, 2012 at: http://www.newenglandmagazine.com/rhode-island/providence/

This project was made possible through a grant from the Association of State and Territorial Health Organizations (ASTHO).

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7. Resources and References

Building Resilience to the Public Health Impacts of Climate Change in Providence

Communicating Health Impacts

- Summary: Preliminary Assessment of Rhode Island's Vulnerability to Climate Change and its Options for Adaptation Action (Center for Environmental Studies, 2010)
  - http://envstudies.brown.edu

- Northeast Regional Highlights from Global Climate Change Impacts in the United States
  - http://www.globalchange.gov/images/cir/region-pdf/NortheastFactSheet.pdf
  - http://www.globalchange.gov/images/cir/pdf/northeast.pdf

- Environmental Health Indicators of Climate Change for the United States: Findings from the State Environmental Health Indicator Collaborative (English, et al, 2009)
  - http://ehp03.niehs.nih.gov/article/info:doi/10.1289/ehp.0900708#af1-ehp-117-1673

- Heat waves, floods and the health impacts of climate change: A prototype training workshop for city officials (WHO, 2010)
  - A training package, which targets city officials as its primary users aimed at developing competencies in:
  - The package is designed to accompany a face-to-face workshop, but it can also be used for self-paced learning in a less structured setting. After going through this training program, the learner will be able to develop action plans at the city level to address the health impacts of climate change. The learner will also be able to draft resolutions that city councils and leaders can adopt in support of these actions.
  - http://www.who.int/kobe_centre/publications/climate_media/2010_climate_change_manual.pdf
  - http://www.who.int/kobe_centre/publications/climate_media/2010datasheets.pdf

Readiness Assessment

- CDC's Climate-Ready States & Cities Initiative
  - CDC's Climate-Ready States and Cities Initiative is helping 10 states and cities develop ways to anticipate these health effects by applying climate science, predicting health impacts, and preparing flexible programs. CDC will help states and cities partner with local and national climate scientists to understand the potential climate changes in their areas.
  - http://www.cdc.gov/climatechange/climate_ready.htm

- The BRACE (Building Resilience Against Climate Effects) model, developed by the Climate and Health Program at the Centers for Disease Control and Prevention, is a framework for agencies to use in developing climate change adaptation plans. The model consists of five steps:
  - Forecasted Impact and Vulnerability Assessment
  - Health Risk Assessment
  - Intervention Assessments
  - Health Adaptation Planning and Implementation
  - Evaluation
- http://www.epa.gov/region2/climate/pdf/EPA_Region_2_Webinar_BRACE.pdf

Indicators and Action Plans

- Environmental Health Indicators of Climate Change for the United States: Findings from the State Environmental Health Indicator Collaborative
  - http://ehp03.niehs.nih.gov/article/info:doi/10.1289/ehp.0900708
- Massachusetts Climate Change Adaptation Report
  - http://www.mass.gov/eea/air-water-climate-change/climate-change/climate-change-adaptation-report.html
- Michigan Climate and Health Adaptation Plan 2010 – 2015 Strategic Plan
  - http://www.michigan.gov/climateandhealth/
- Santa Cruz, CA adaptation plan: detailed strategies for infrastructure planning and improvement
  - http://www.cityofsantacruz.com/Modules/ShowDocument.aspx?documentid=23643