

# ADDRESSING HEAT IN DELAWARE

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**JULY 18, 2013  
CITIZEN'S ADVISORY COMMITTEE MEETING  
CENTER FOR THE INLAND BAYS**

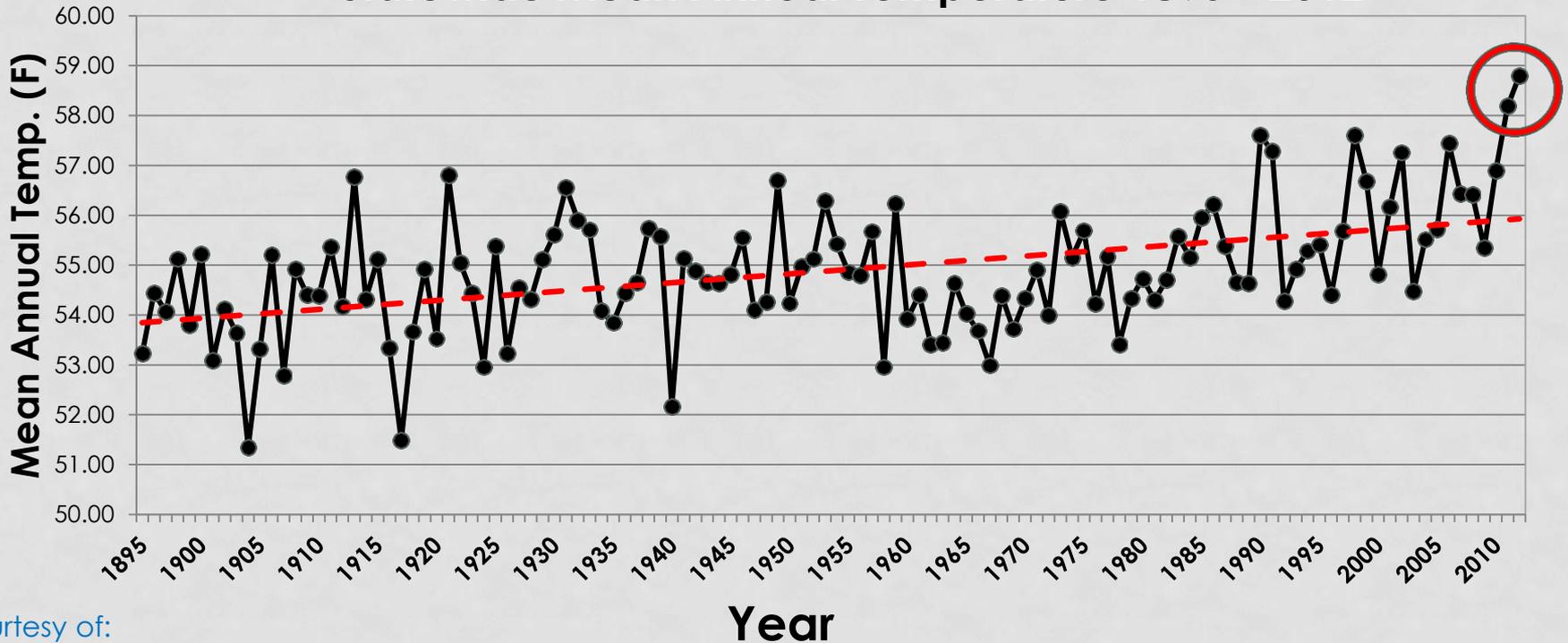
# ADDRESSING HEAT

- **Issue:** Historic and Future Temperature Trends in Delaware
  - Courtesy of UD's Dept of Geography and Office of the State Climatologist
  - Courtesy of Dr. Katherine Hayhoe
- **Short-term Adaptation Solution:**
  - Statewide Heat Health Warning System
- **Long-term Mitigation and Adaptation Solutions:**
  - Measures to Cool Communities

# HEAT IN DELAWARE: ANNUAL TEMPERATURE PATTERNS FROM 1895 - 2012

An upward trend in mean annual temperature since 1895.... +0.2°F / decade

## Statewide Mean Annual Temperature 1895 - 2012

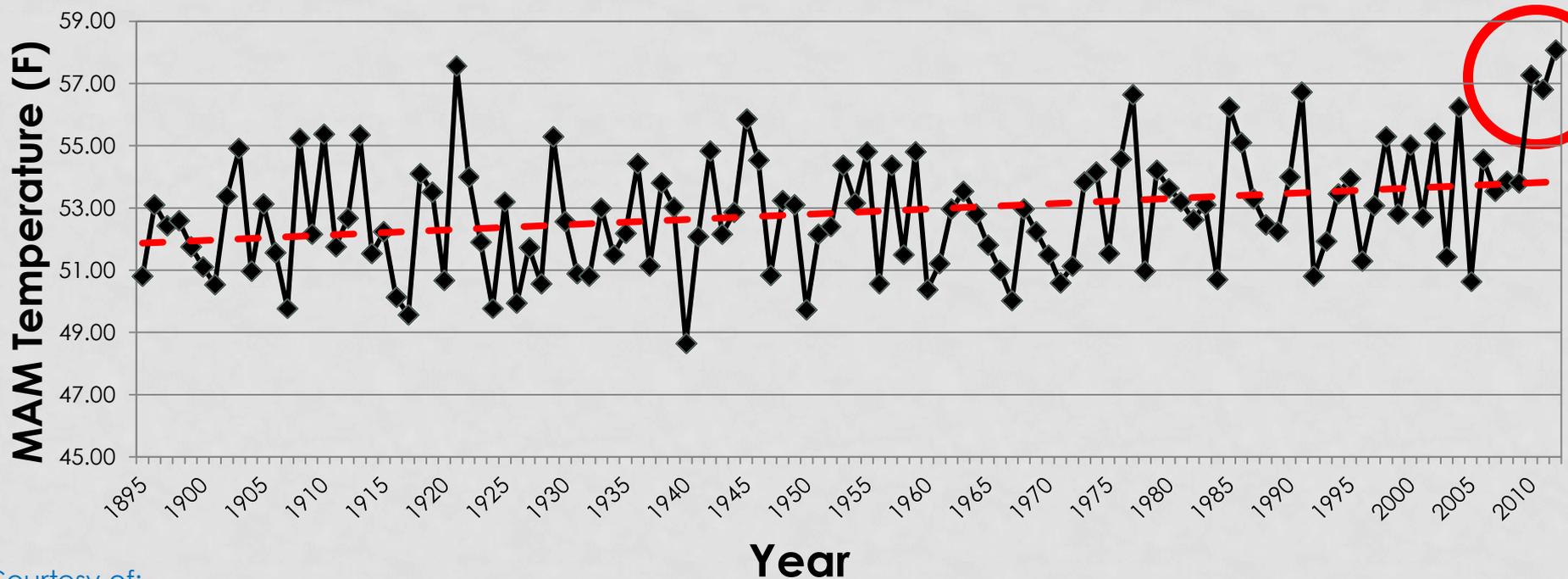


# DELAWARE'S HISTORIC SPRING TEMPERATURE PATTERNS: 1895-2012



An upward trend in spring temperature since 1895.... +0.2°F / decade

## Regional Spring (MAM) Temperature 1895 - 2012

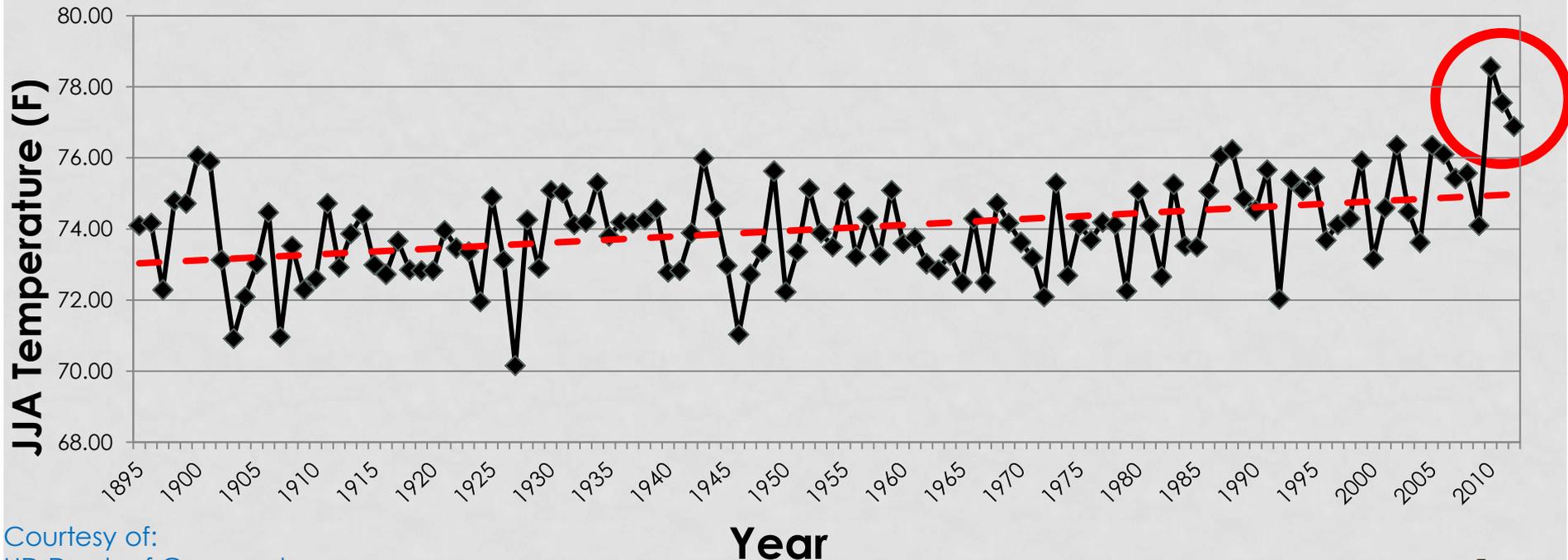


# DELAWARE'S HISTORIC SUMMER TEMPERATURE PATTERNS: 1895-2012



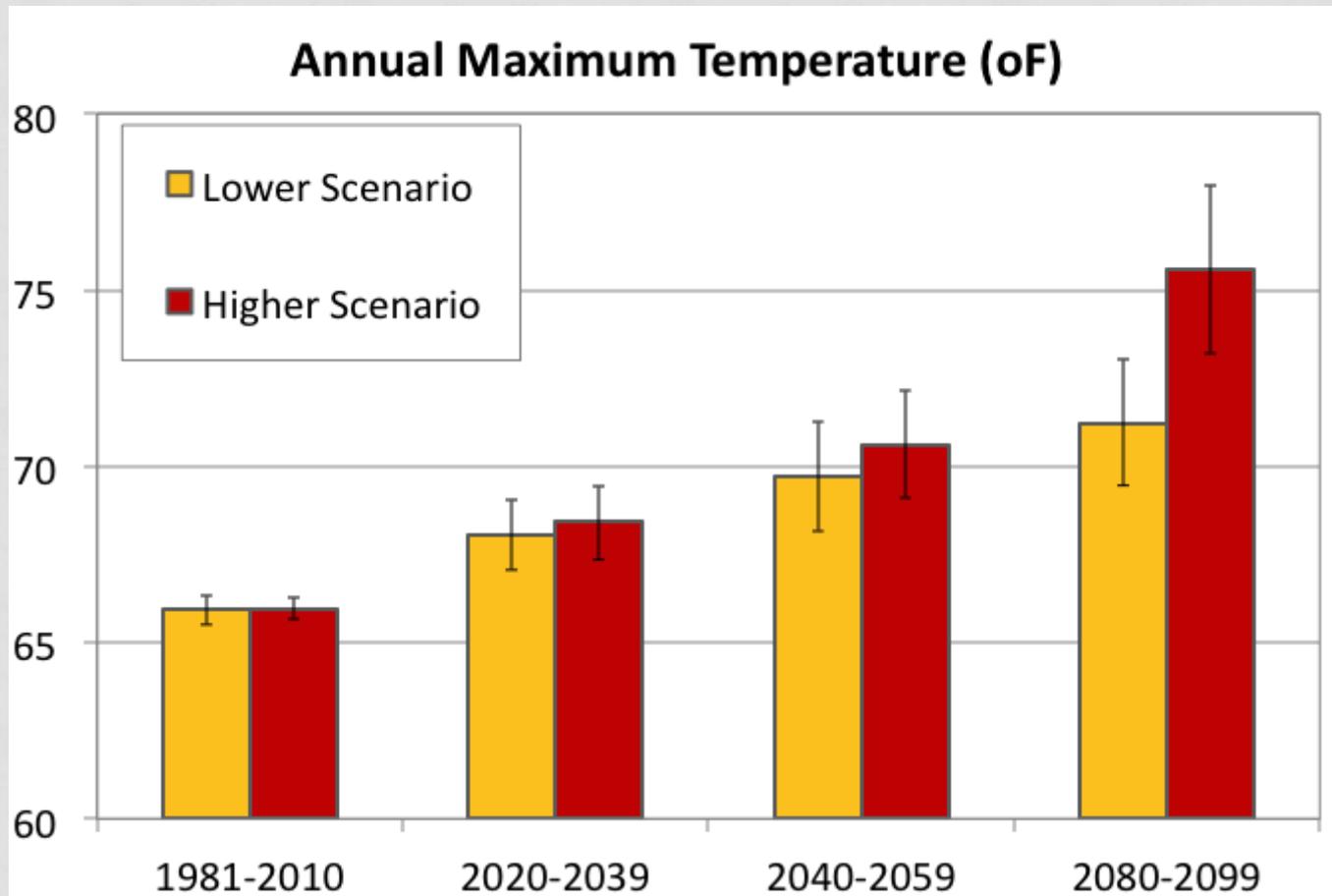
An upward trend in summer temperature since 1895.... +0.2°F / decade

## Regional Summer (JJA) Temperature 1895 - 2012

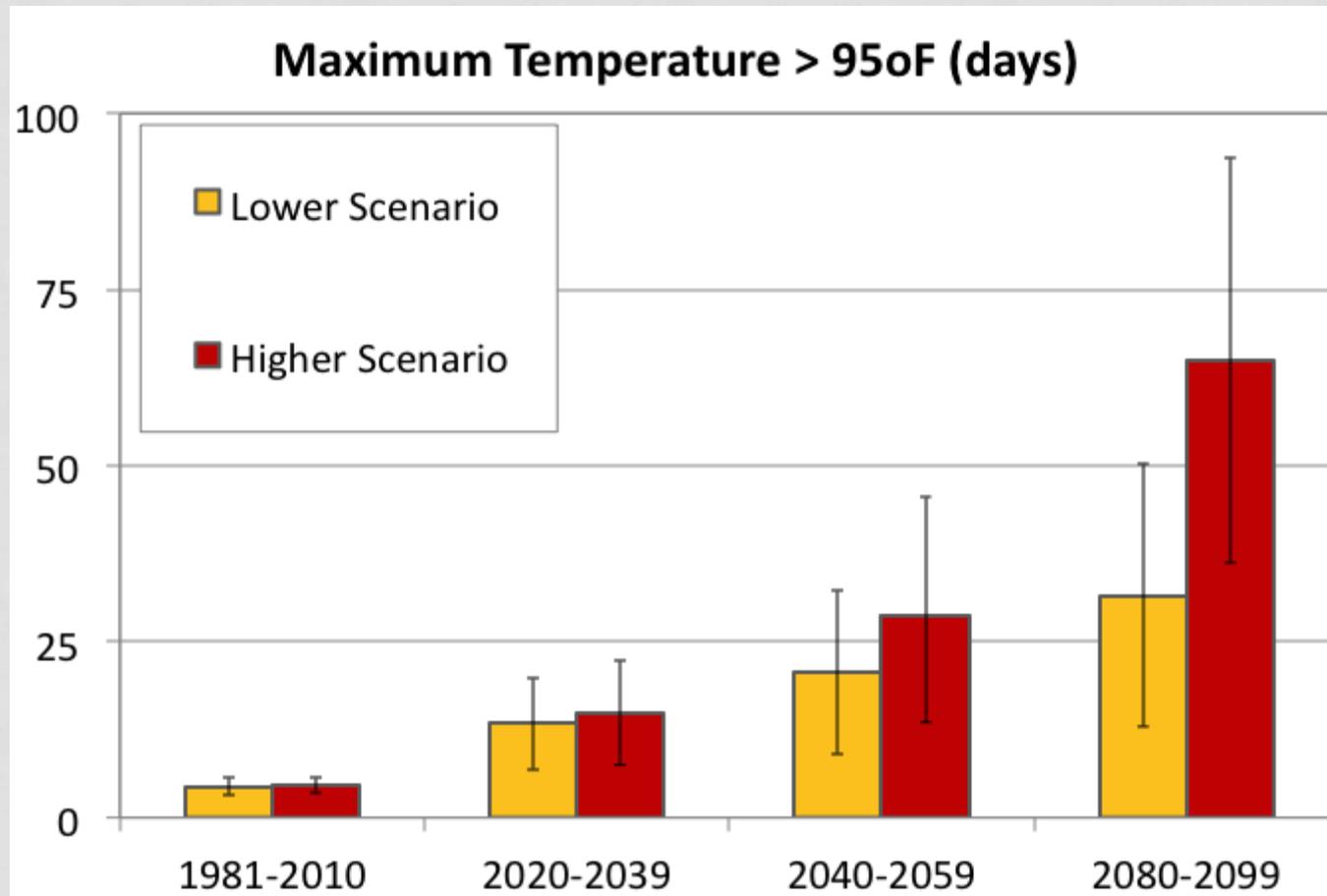


Courtesy of:  
UD Dept. of Geography  
Office of the Delaware State Climatologist

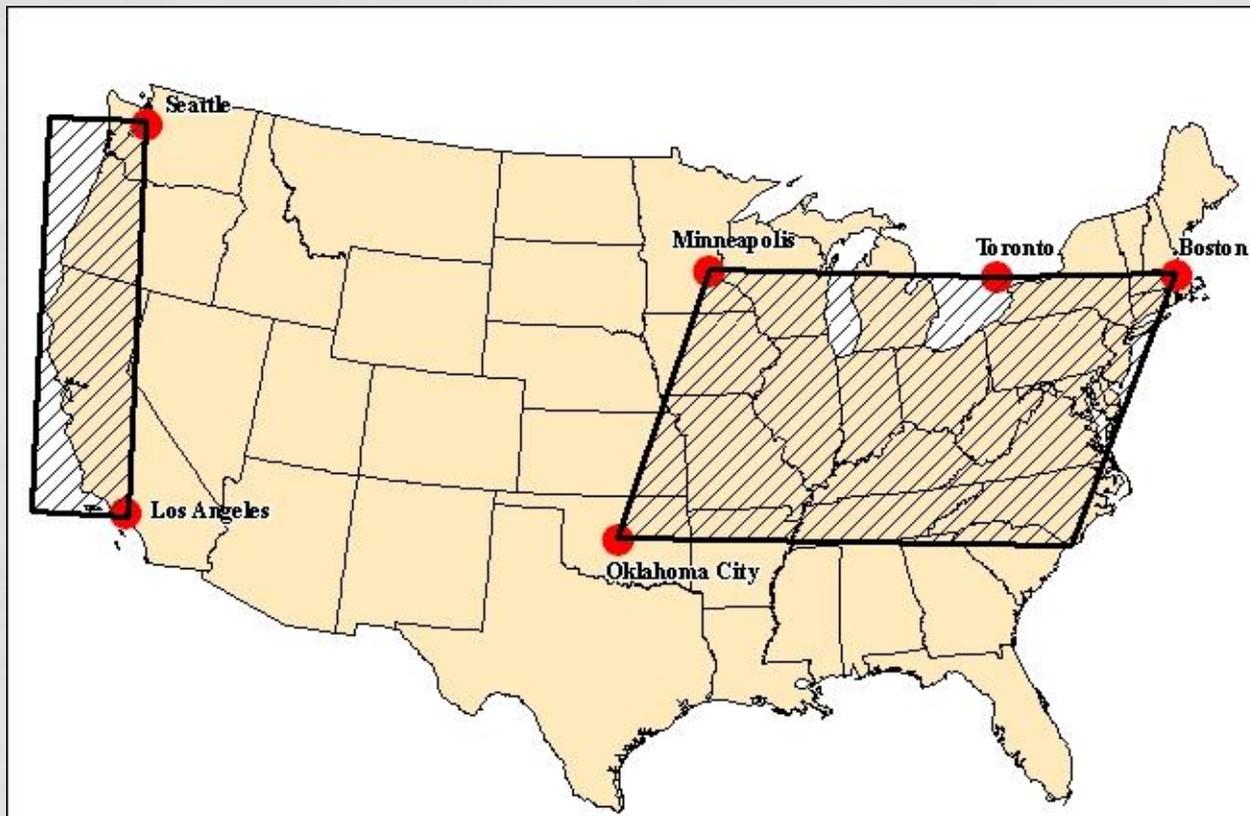
# FUTURE PROJECTIONS: ANNUAL MAXIMUM TEMPERATURE THROUGH 2099



# FUTURE PROJECTIONS: MAXIMUM DAYS OVER 95 DEGREES F THROUGH 2099



# AREAS IN THE U.S MOST VULNERABLE TO HEAT-RELATED MORTALITY



The key: highly variable day-to-day summer weather.

# HEAT HEALTH WARNING SYSTEMS

- A custom-made forecasting system based on actual weather-health relationships, as determined by daily variations in human mortality

The screenshot displays the Synoptic Health Watch-Warning Network website. The page is titled "Synoptic Health Watch-Warning Network" and is for Phoenix | Yuma (PSR). It shows a forecast issued on 07/01/2008 at 14:50:08. The forecast is organized into a table with columns for Time (09Z, 15Z, 21Z, 03Z) and rows for each day from July 1 to July 5. Each day's forecast includes a warning level (e.g., EXCESSIVE HEAT WARNING, HEAT WATCH, NO ADVISORY) and maximum temperature near record levels. The website also includes a section for "System levels" with color-coded boxes for EXCESSIVE HEAT WARNING (red), HEAT ADVISORY (orange), HEAT WATCH (yellow), HEAT OUTLOOK (brown), and NO ADVISORY (green). A copyright notice at the bottom states: "Copyright 2008. This webpage was developed and is maintained by Scott Sheridan, Kent State University (ssherid1@kent.edu). This network of systems has been developed by Laurence Kalkstein, University of Miami (larryk@miami.edu) and Scott Sheridan."

**System levels:**

- EXCESSIVE HEAT WARNING**  
Dangerous heat stress conditions, which historically have led to excess mortality, are forecast to occur within the next 24 hours.
- HEAT ADVISORY**  
Heat stress conditions, which might be associated with excess mortality, are forecast to occur within the next 24 hours.
- HEAT WATCH**  
Potentially life-threatening heat stress conditions are forecast to occur in the next 24 to 48 hours.
- HEAT OUTLOOK**  
Potentially life-threatening heat stress conditions are forecast to occur in the next 48 to 120 hours.
- NO ADVISORY**  
Weather conditions are not forecast to be oppressive.

The synoptic-based heat-health watch warning network is based on evaluating the negative health impact of oppressive air masses, as expressed by excess mortality, in each locality. Forecast data, as defined by PFMs, are compared to historical meteorological conditions that have led to such mortality increases, and advisories, watches, and warnings are called accordingly.

These systems utilize the Spatial Synoptic Classification, about which more can be learned [here](#). Where oppressive conditions are forecast to occur, the consecutive day run of such conditions will appear in parentheses following the SSC type.

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Time	09Z	15Z	21Z	03Z
<b>July 1</b> <b>WARNING</b> Maximum temperature near record levels Temperature / Dew Point	91 / 51	93 / 51	110 / 49	105 / 48
<b>July 2</b> <b>WATCH</b> Maximum temperature near record levels Temperature / Dew Point	93 / 46	93 / 51	109 / 48	105 / 45
<b>July 3</b> <b>OUTLOOK</b> Maximum temperature near record levels Temperature / Dew Point	92 / 46	92 / 48	110 / 45	111 / 43
<b>July 4</b> <b>OUTLOOK</b> Maximum temperature near record levels Temperature / Dew Point	98 / 43	88 / 45	103 / 46	111 / 44
<b>July 5</b> <b>OUTLOOK</b> Maximum temperature near record levels Temperature / Dew Point	98 / 47	89 / 51	103 / 49	110 / 47

# POSITIVE OUTCOMES RESULTING FROM SYSTEM IMPLEMENTATION

- Lives have been saved <sup>A</sup>
- Effectiveness can be checked
  - forecasting effectiveness (false positives or negatives)
  - accuracy in estimating health impacts of offensive weather <sup>B</sup>
  - noting if we are saving lives
- Increased NWS/Stakeholder cooperation
  - More sophisticated intervention activities developed

<sup>A</sup> Ebi, KL, 2004. Heat watch warning systems save lives. *Bull. Am. Met. Soc.* 85:1067-74

<sup>B</sup> Michelozzi, P. 2004. Impact of heat waves on mortality - Rome. *J. of Am. Med. Assn.* 291:2537-38

# NEXT PHASE: DEVELOPING INTERVENTION ACTIVITIES

- Coordinate public broadcasts by the media; coordination between the Weather Service and Health Departments
- Public distribution of tips to the population on how to stay cool
- Opening a “heatline”, run by medical personnel for citizen to call in for advice
- Extra personnel in emergency rooms
- Utilization of the “buddy system”
- Suspend utility cutoffs
- Open air conditioned shelters; outreach to the homeless
- Development of a city heat/health task force
- Many more.....



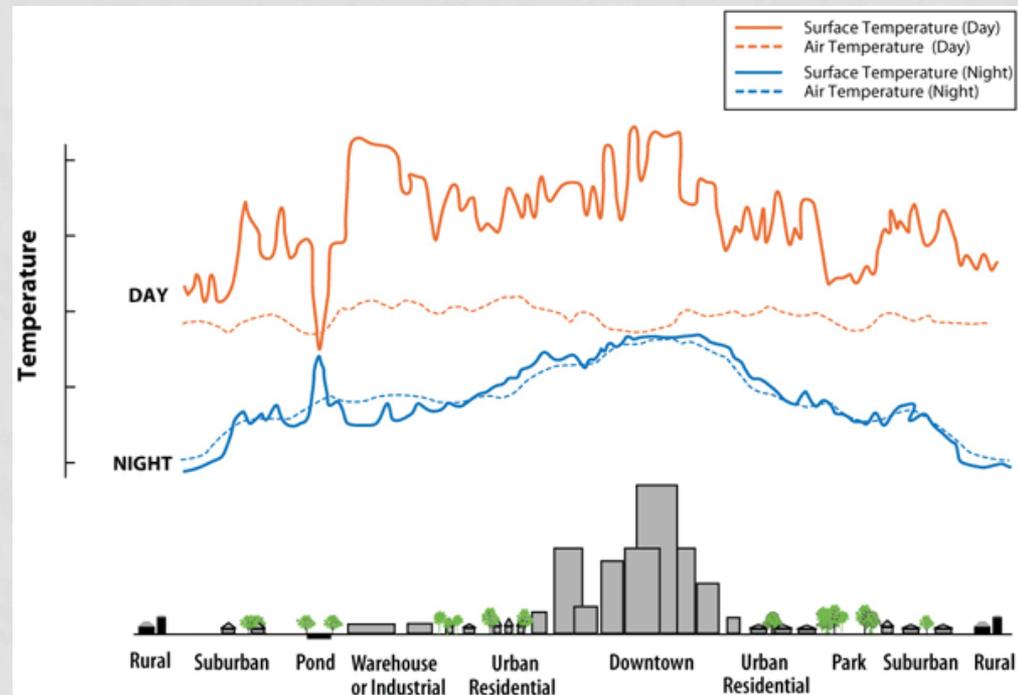
# HEAT ISLAND EFFECT

## Definition

- Micro-scale temperature differences between urban and rural areas
- Urban areas can be 9 – 27 ° F higher than rural areas

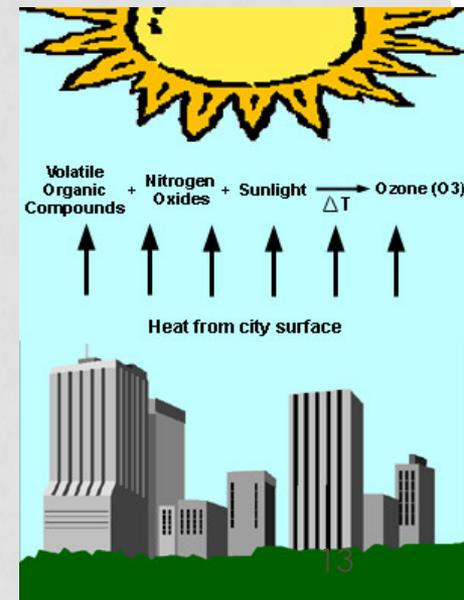
## Causes

- Reduced vegetation
- Materials used to build urban infrastructure
- Urban geometry

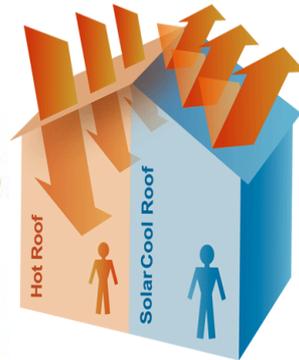
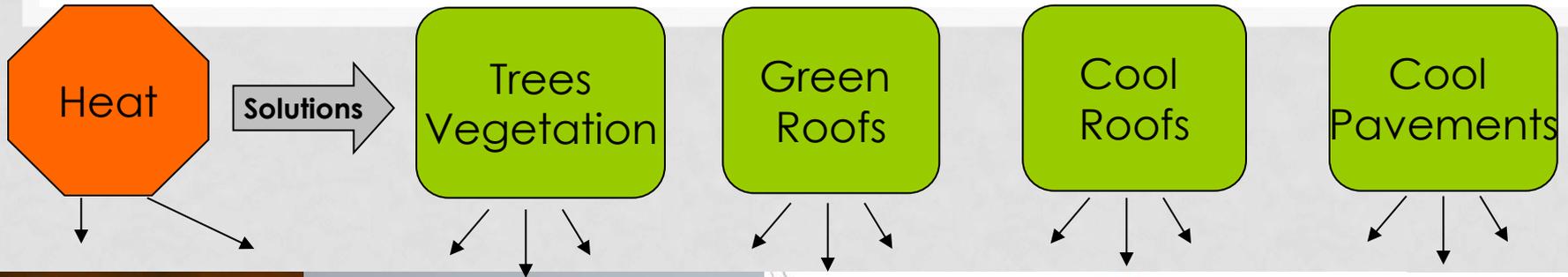


# HEAT ISLAND IMPACTS

- **Increased energy use**
  - 5 – 10 % of summertime electricity demand is used to cool heat islands
  - 1.5 – 2.0% E demand ↑ for every 1 °F ↑ in the summer
  - Longer peak periods; pressure on E grid; brownouts, blackouts
- **Air quality and greenhouse gas (GHG) emissions**
  - Increased GHG emissions
  - Increased air pollution
  - Increased ground-level ozone formation
- **Water quality**
  - Warmer water runoff = ecological shock in waterways
  - Increased water runoff = more pollutants in waterways
- **Human health**
  - Respiratory difficulties
  - Heat cramps, heat exhaustion
  - Non-fatal heat stroke/sun stroke
  - Heat related mortality



# LINKAGES = MORE COOLING OPPORTUNITIES



# SCALES FOR IMPLEMENTATION STRATEGIES (HELPFUL FOR MEASURING CO-BENEFITS)

- Individual building
  - Roofs (green and reflective)
  - Vegetation (shade trees and more)
- Community/Neighborhood
  - Street design (e.g., tree lined, vegetation, pavements)
  - Open vegetated land use (e.g., parks, green spaces)
- City/Regional
  - All mitigation strategies (e.g., pavements, trees, vegetation, roofing)
  - Integrate into land use plans, selection of materials

# GREEN ROOFS IN DELAWARE

- Girl Scout Lodge, Hockessin
- Baywood Greens Golf Course, Long Neck
- Barclays Headquarters, Wilmington
- Colburn Lab at University of Delaware, Newark
- B'nai B'rith Temple, Newark
- Dover Public Library, Dover
- Bethany Blues Restaurant, Bethany Beach



# IMPLEMENTATION MECHANISMS

## **Policy Mechanisms**

- Procurement
- Resolutions
- Tree and Landscape Ordinances
- Comprehensive Plans and Design Guidelines
- Zoning Codes
- Green Building Programs and Standards
- Building Codes
- Air Quality Requirements

## **Voluntary Mechanisms**

- Demonstration Projects
- Incentive Programs
- Urban Forestry and Community Tree Planting Programs
- Weatherization
- Outreach and Education
- Awards

# CONTACT INFORMATION

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