Welcome!
Arkansas Natural Hazards Resilience Discussion
September 29, 2017
Bentonville, AR
Motivation for a Natural Hazards Resilience Discussion

Rachel Riley
Associate Program Manager
Southern Climate Impacts Planning Program
Resilience

Godschalk et al. (2009):

Instead of repeated damage and continual demands for federal disaster assistance, resilient communities proactively protect themselves against hazards, build self-sufficiency and become more sustainable.

Resilience is the capacity to absorb severe shock and return to a desired state following a disaster.
Let’s get on the same page...

- Hazard mitigation can = climate adaptation
  
  - **Adaptation:** Increase culvert size to accommodate heavier rain events in the future.
  - **Mitigation:** Increase culvert size to address existing flooding issues.

  - **Adaptation:** Make odd/even watering rules the norm because of more drought expected in the future.
  - **Mitigation:** Make odd/even watering rules the norm because of water challenges that arise during existing droughts.

- Today, mitigation = hazard mitigation, not carbon emissions mitigation.
Motivation: Arkansas experiences many climate extremes and hazards and they can be expensive to deal with.
100-Degree Days

Average Annual Number of Days where Tmax >= 100 F (1981-2010)

100 Degree Days in 2012

100 Degree Days in 2011
Daily Rainfall Events of 2 Inches or Greater (Fort Smith)
Tornado Climatology

Source: NWS Little Rock
1.5-3.0 days per year with large hail

Source: H. Brooks, T. Grazulis, and NWS
Climate Change Creates Additional Challenges

Arkansas Observed Changes:

- Climate signal still dominated by natural variability
- Warmer, wetter winters
- Extreme precipitation frequency has increased
- Rainy season shifting to late-spring and summer

Arkansas Future Changes:

- About 30 more days per year of days over 95°F by mid century
- Naturally occurring droughts projected to be more intense due to higher temperatures and decreased soil moisture
- Heavier downpours and longer dry spells are expected
- Intensity of extreme cold events projected to decrease
Hazards are Costly

Arkansas Disasters, 2000-2017: 29

FEMA Assistance, 2012-2016: $69 Million! (and that’s *just* FEMA $$)

<table>
<thead>
<tr>
<th>Date of Event</th>
<th>Hazard(s)</th>
<th>Total FEMA Assistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8/16-3/13/16</td>
<td>Severe Storms, Tornadoes, Straight-line Winds, and Flooding</td>
<td>$2,105,934.33</td>
</tr>
<tr>
<td>12/26/15-1/22/16</td>
<td>Severe Storms, Tornadoes, Straight-line Winds, and Flooding</td>
<td>$11,404,364.20</td>
</tr>
<tr>
<td>5/7/15-6/15/15</td>
<td>Severe Storms, Tornadoes, Straight-line Winds, and Flooding</td>
<td>$12,370,019.31</td>
</tr>
<tr>
<td>4/27/14-4/28/14</td>
<td>Severe Storms, Tornadoes, and Flooding</td>
<td>$12,611,701.98</td>
</tr>
<tr>
<td>12/5/13-12/7/13</td>
<td>Severe Winter Storm</td>
<td>$5,587,008.61</td>
</tr>
<tr>
<td>8/8/13-8/14/13</td>
<td>Severe Storms and Flooding</td>
<td>$8,171,830.52</td>
</tr>
<tr>
<td>5/30/13-6/3/13</td>
<td>Severe Storms, Tornadoes, and Flooding</td>
<td>$8,395,922.32</td>
</tr>
<tr>
<td>5/25/12-5/26/12</td>
<td>Severe Winter Storm</td>
<td>$8,548,088.10</td>
</tr>
<tr>
<td>Total, last 5 years (2012-2016)</td>
<td></td>
<td>$69,194,869.37</td>
</tr>
</tbody>
</table>

$4 are saved for every $1 FEMA spends on hazard mitigation (National Institute of Building Sciences 2005).
Why should emergency managers and planners work together?
EMs and Planners Have Complementary Strengths & Weaknesses

- EMs have local hazard knowledge (though not always long term climatological perspective) but think and plan on operational timescales.

- Planners think comprehensively about communities and on longer timescales but don’t necessarily have the hazard knowledge.
Sound Easy?

From online survey of hazard planners in SCIPP region (Riley et al. 2013):

<table>
<thead>
<tr>
<th>Challenge of Limitation</th>
<th>2009 (N = 213)</th>
<th>2013 (N = 257)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited or no funds available to support hazard planning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>** Limited or no staff available to support hazard planning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Higher work priorities in other areas</td>
<td></td>
<td></td>
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<tr>
<td>Lack of community or political interest</td>
<td></td>
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<td>Not enough time to be involved in the process</td>
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<tr>
<td>Lack of knowledge or expertise</td>
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<tr>
<td>Too much time required to periodically refresh/renew plans</td>
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<td></td>
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<tr>
<td>** Other</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Challenges & Limitations to Developing Hazard Plans](chart)

Figure 10: Challenges and limitations to developing hazard plans for the respondents' area of responsibility. Two new categories were added to the 2013 survey, hence the data gap for “lack of community or political response” and “lack of knowledge or expertise.” *p < .05; **p < .01.
Overcoming Challenges

- Start up a conversation
- Listen
- Show the similarities
- Have learning/teaching meeting with those needed
You say Hazard Mitigation, I say Climate Adaptation

- Goals for both are the same, protect:
  - People
  - Property
  - Economy
  - Natural Resources

- Use hazard mitigation plans to drive climate adaptation planning!
  - Supports the required Hazards Identification and Risk Assessment
  - State hazard mitigation plans are required to consider future conditions
  - Future conditions = increased risk and vulnerability should be assessed in local hazard mitigation planning efforts
Figure 5: The intersection of Hazard Mitigation and Climate Adaptation Planning

SOURCE - Integrating Hazard Mitigation and Climate Adaptation Planning: Case Studies and Lessons Learned, ICLEI
Example of a Large City EM/Planner Collaboration

Oklahoma City, OK
Office of Emergency Management & Planning Department

Planners can assist Emergency Managers during:
• Preparedness and Planning
• Mitigation
• Response
• Recovery
Planners Assisting EMs in OKC

Assist EMs in situational awareness, planning and decision making

1. In-depth knowledge of the community

2. Assist with Development of Plans
   • Emergency Operations Plan
   • Hazard Mitigation Plan (Updates)
   • Integration of plans

3. GIS Capabilities
   • Heat Maps
   • Plot Hazard Impacts and Damages

4. Public Outreach

5. Mitigation Grant Application and Management Support
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Local Examples of Using Climate Data

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Local Examples of Using Climate Data

**Hazard Mitigation Planning: The perfect ‘Nexus’ of Emergency Operations and Long Range/Strategic Planning**

County Hazard Mitigation Plan Amendments:

1. **Enhanced identification of flood risk**
   a) Public Assets - Roads
   b) Private Property - Repeat Loss Analysis (related to CRS program activities)

2. **Identify risk based on DATA**
   a) Use of publicly available/private source precipitation event data
   b) Use of publicly available stream gauge network arrays
   c) Use of local list of “At Risk” structures and/or bridges and roads

3. **Document DATA idiosyncrasies and accuracy standards**
   a) All data has its limitations, but not using it is not an option in long range planning!
Relevance of Climate Data for Planning

Leah Kos
Climate Assessment Specialist
Southern Climate Impacts Planning Program
Using Climate Information to Help Prepare for Natural Hazards

Daily Rainfall Events of 1 Inch or Greater
(Fort Smith)
How to get your community involved

NOT ONE SIZE FITS ALL
Community Examples of Using Climate Data


A Sectoral Applications Research Program 2 year project

Worked with 4 communities to:
1. Provide a local hazards climatology
2. Identify critical thresholds for extreme weather events
3. Create and review downscaled projections
4. Identify and implement a resilience action plan to increase city’s resilience to extreme events using $10,000 grant funding
Community Examples of Using Climate Data

San Angelo, TX

Managing water in a region prone to both droughts and extreme weather events

The City used the grant funding to purchase and install:
(1) A weather monitoring station near some recreational fields
(2) A rainwater harvesting system at the Bosque Park in downtown San Angelo.

Additionally, the station and harvesting system raised public awareness on water management challenges
Las Cruces, NM

Lessening the impacts of extreme heat events, lower the Urban Heat Island effect, and reducing impacts of flooding

The City used the grant funding to:
(1) Develop and install a demonstration rainwater harvesting project at a low income neighborhood community center
(2) Create a green infrastructure plan for the same neighborhood

Leveraged San Angelo’s plan and received $400,000 in matching funds and grants to enhance green infrastructure.
Bedford, NY is promoting landscape alternatives such as the use of native plants and drought resistant grasses, planting trees to shade buildings and reduce runoff, and the use of rain water collection systems such as rain barrels to divert water from the sewer system.
Joe Taylor Park in Grand Rapids, Michigan is a 2.2 acre community park that provides green space to an underserved area while simultaneously managing stormwater for the entire neighborhood (site can manage the 1st inch of rainfall directly on site).

Courtesy: Missy Stultz, University of Michigan
In 2013, the City of Saint Paul organized a workshop for local government staff focusing on what a climate resilient Saint Paul would look like and the steps needed to achieve that vision. They specifically focused impacts associated with flooding and temperature increases.

In 2015, the city secured a grant to develop a Resilience Framework, focusing on improving stormwater management and communication on reducing hazard impacts on the city.

Courtesy: Missy Stultz, University of Michigan
In 2006, Ann Arbor updated the rate structure for its stormwater utility to charge owners based on the amount of impervious surface and to include incentives to manage stormwater.

The utility funds many things in the city including projects that provide credits when taking action to reduce strain on the system.

Courtesy: Missy Stultz, University of Michigan
Following a major flooding event in 2007, the City of Keene, New Hampshire began working to replace dilapidated culverts and resizing them based on rainfall projections under a changing climate.

Courtesy: Missy Stultz, University of Michigan
Lewes, Delaware combined a hazard mitigation update with climate adaptation planning carried out in partnership with non-profit, academia, the community and NOAA.

The process included synthesizing relevant climate data on hazards, using climate data to help with future planning, incorporating stakeholder knowledge and local priorities into the decision-making process, and collaborating with city administration to integrate into other planning processes.
Tulsa, OK

Flood Risk Management

Cost/Benefit Analysis
FEMA paid over $100,000 to repair a repetitive loss property valued at $30,000.

Flood Risk Reduction ➔ Motivated by the city’s history of flooding
Building Resilience to Tornadoes:
Moore, OK → Residential building codes improved design for high winds in 2014
• First city in nation to adopt building codes based on tornadic impact to homes

Courtesy: Lisa Holliday, OU
Building Code Improvements

New codes are for EF2 Tornadoes (~135mph)
• Previous requirements were for 90 mph

New homes will require:
• Roof sheathing
• Hurricane clips or framing anchors
• Continuous plywood bracing
• Wind-resistant garage doors
Insurance companies in **Central Oklahoma** started offering discounts for installing Class IV Shingles with SureNail Technology:

- Resistant up to 2” diameter hail
- SureNail Technology → extra fabric helps prevent shingles from ripping away as easily (resistant up to 130mph winds)
- Incentives: Cost upfront is ~$2000 more than a regular roof, will gain a $500/year home insurance deduction
  - Receive a full investment return in only 4 years
Thank You!

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Roundtable Discussion

- As a table, please discuss the questions on the handout.
- Assign someone to be the reporter who will share 1-2 responses per question with the large group later.
Next Steps:

- Arkansas Natural Hazards Resilience Working Group
- Simple Planning Tool
- APA Hazard Mitigation and Disaster Recovery Division
## Flood (from rain or rivers)

Data Limitations: Text on data limitations, including built environment and preceding events impacting flood potential.

<table>
<thead>
<tr>
<th>Historical Climatology</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Precipitation Extremes</strong> [Varies by station] – Southern Regional Climate Center</td>
<td><a href="http://extremes2.srccllslu.edu/">http://extremes2.srccllslu.edu/</a></td>
</tr>
<tr>
<td>High precipitation records by month: On left side of screen select Records In A Month → High Precipitation → Month of Interest. Mouse over icon for record details (date of occurrence and station record). All-time records: 1. Select All-Time Records → High Precipitation. <em>Limitation: Limited number of stations, which doesn’t necessarily capture all rainfall extremes.</em></td>
<td></td>
</tr>
</tbody>
</table>

| Long-term Precipitation Averages – Oklahoma Mesonet | [http://www.mesonet.org/index.php/weather/mesonet_averages_graphs#series%5B%5D=nrnn%3Arainx-cumu%3Aaverage%3AN%3A0%3A%73%7d%ed%3AY%3A2%26series%5B%5D=nrnn%3Arainx-cumu%3Acurrent%3AN%3A%23%3A%23%23%23%3A%23%3A%23%3A2](http://www.mesonet.org/index.php/weather/mesonet_averages_graphs#series%5B%5D=nrnn%3Arainx-cumu%3Aaverage%3AN%3A0%3A%73%7d%ed%3AY%3A2%26series%5B%5D=nrnn%3Arainx-cumu%3Acurrent%3AN%3A%23%3A%23%23%23%3A%23%3A%23%3A2) (shorten crazy link) | Useful? |

| Shows precipitation trends. One may be able to interpret years with very high precipitation totals as years with flooding during one or more parts of the year. On the left side from top to bottom choose Oklahoma → Climate division of interest → Annual → Precipitation. |
## Tornado

<table>
<thead>
<tr>
<th>Historical Climatology</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tornado Tracks Tool</strong> (1950-present) - Midwestern Regional Climate Center</td>
<td>[<a href="http://mrcc.isws.illinois.edu/gismaps/cntytor">http://mrcc.isws.illinois.edu/gismaps/cntytor</a> n.htm#](<a href="http://mrcc.isws.illinois.edu/gismaps/cntytor">http://mrcc.isws.illinois.edu/gismaps/cntytor</a> n.htm#)</td>
</tr>
<tr>
<td><strong>Storm Prediction Center WCM Page</strong></td>
<td><a href="http://www.spc.noaa.gov/wcm/">http://www.spc.noaa.gov/wcm/</a></td>
</tr>
<tr>
<td><strong>Tornado Risk Assessment</strong> (1950-2015) - Storm Prediction Center</td>
<td><a href="http://www.spc.noaa.gov/climo/online/probs/">http://www.spc.noaa.gov/climo/online/probs /</a></td>
</tr>
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### Projected Trend

It is difficult to account for tornadoes in climate models because they occur on a very small scale. Therefore, more research is needed to understand how climate change is influencing tornadoes (NCA 2014). Progress has recently been made, however, in understanding how the large-scale climate system relates to the conditions that support tornadoes. Future climate projections show an increase in those environments in the USA (Tippett et al. 2015).
Next Steps:

• Arkansas Natural Hazards Resilience Working Group
• Simple Planning Tool
• APA Hazard Mitigation and Disaster Recovery Division
Additional Resources


2. Southeast technical input report to the NCA: [www.cakex.org/NCAreports](http://www.cakex.org/NCAreports)

3. Arkansas State Climate Summary: [http://stateclimatesummaries.globalchange.gov](http://stateclimatesummaries.globalchange.gov)

4. APA Hazard Mitigation Disaster Recovery Division: [https://www.planning.org/divisions/hazardmitigation/](https://www.planning.org/divisions/hazardmitigation/)

5. APA/FEMA Hazard Mitigation Publication: [https://www.fema.gov/media-library/assets/documents/19261](https://www.fema.gov/media-library/assets/documents/19261)