A Threshold Approach to Climate Change Vulnerability Assessment

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In the face of uncertainty…what to do…and what NOT to do?

- The sky is NOT falling. We are not all doomed.

- However, the risks are real and cannot be ignored

- Careful and strategic planning combined with medium and longer-term monitoring and recalibration can lead to more prepared and resilient communities
The challenge of adaptation at local scales

- Many impacts assessments “begin” with model-generated projections of future climate conditions
- Projections of future climate stress are not “decision-ready,” especially at the local scale
  - Available at coarse geographic scales and can require technical knowledge to interpret
  - Provided on time horizons that do not match the timeframes for planning
  - Described by variables that are often unrelated to the decision-making process
  - Rarely address issues related to current climate variability
Instead of starting with climate, consider thresholds of sensitivity, then add climate

- Analysis of *current* sensitivity/current climate stress eliminates a major source of uncertainty
- Decision makers/stakeholders are familiar with and buy into the results
- Level of effort necessary for model projections is constrained

- Threshold/frequency analysis provides direct estimate of the cost of inaction, highlighting near-term adaptation opportunities
- Cannot overstate the value of advancing the discourse, esp. w/in organizations
Case Study: Regional Transit Provider

- Southeastern Pennsylvania Transportation Authority (SEPTA)
- Projected supported by a grant from the Federal Transit Administration (US DOT)
- Focus on single regional rail line
- Start with historical disruption data to identify weather/climate-related sensitivities
Observed weather impacts on transit

**Extreme heat events**
- Supporting equipment (e.g., electrical systems, air conditioning) failures
- Vehicle breakdown
- Catenary sagging
- Acceleration of pavement degradation
- Rail buckling
- Reduction in construction speed

**Heavy rain events / Flooding**
- Slowing of bus service due to re-routing
- Flooding of bus or rail right-of-ways
- Flooding of underground tunnels and track
- Flooding of underground equipment rooms
- Disruptions in underground electrical systems due to flooding
- Flooding of track beds

*Snow and wind impacts as well*
Characterizing sensitivity using delay minutes and weather thresholds

- Percentage of days above threshold with delays
- Percentage of days above threshold with annulments
- Percentage of days above threshold with delays OR annulments
- Baseline frequency of weather-related delays or annulments

- 93.0 °F 98.1 °F 1.4 inches rain (non TS) 2.5 inches rain (non TS) Snow (any) 7.5 inches snow 11.5 inches snow Tropical Storm
Applying climate projections to threshold information

**CGCM example results**

5-percentile (1-percentile) event occurs 2.6 (4.6) times more frequently by mid century under B1 scenario.

For A2 scenario, the ratio jumps to 3.0 (6.3).
Connecting findings to adaptation strategies

Advantages

• Thresholds enabled a focused analysis of climate data, saving time and resources
• Impacts that have been characterized offer near-term opportunities for adaptation, along with some assessment of the consequences of inaction
• Impact “narrative” has been extremely useful in engaging internal stakeholders. These stakeholders will likely be responsible for adaptation initiatives

Limitations

• Ignores “novel” impacts, especially those that might be catastrophic
• Not well suited for transformative action
• Inward focused, not integrative across sectors
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