Informing Preparedness and Adaptation to Extreme Event Impacts on Air and Water Quality in California

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EPA RESEARCH FORUM: EXTREME EVENT IMPACTS ON AIR QUALITY AND WATER QUALITY WITH A CHANGING GLOBAL CLIMATE
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Outline

- Project team
- Motivation and hypothesis
- Previous work and background
- Research objectives and approach
- Project scope
- Current research activities

Project Team

- Louise Bedsworth, PPIC
- Phil Duffy, Lawrence Livermore National Laboratory
- Claudia Tebaldi, Climate Central
- Michael Mastrandrea, Stanford University
- Ellen Hanak, PPIC

Motivation and Hypothesis

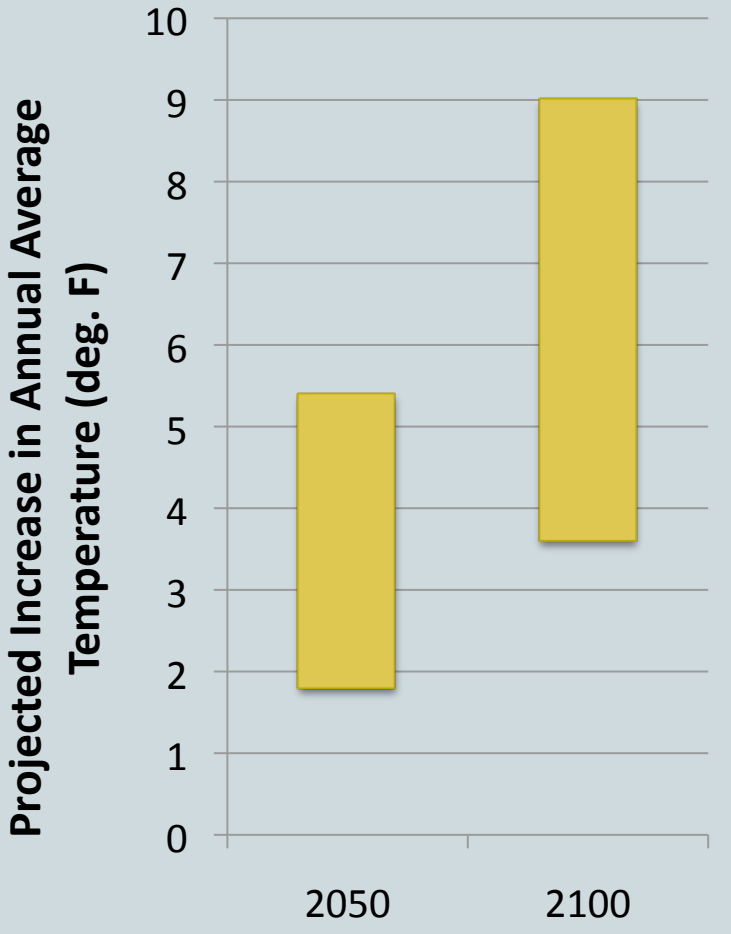
- Local governments and agencies are confronted with a changing climate and are challenged to make management decisions for an uncertain future
- Desire for information geared toward planning and decision-making

- Hypotheses:
  - There is a mismatch between available indicators of extreme events under a changing climate and information desired by regional and local air and water quality managers to respond to those events.
  - A top-down/bottom-up approach to indicator development can improve this information.

Previous Work and Background Literature

- Drawing on several fields of study
  - Climate impacts in California
  - Extreme events literature
  - Policy studies of adaptation barriers and needs

Projected Climate Impacts in California



Source: Cayan et al, 2010

- Some amount of climate change is inevitable
- California is already seeing impacts
- Some of the largest risks include:
  - Reduction in snowpack
  - Increased wildfire risk
  - Sea-level rise
- Increase in extreme events likely to be one of the first impacts felt (Mastrandrea et al, 2009)

Climate Change and Air Quality in California

- California is home to the worst air quality in the nation
  - South Coast Air Basin
  - San Joaquin Valley
- Climate change will reduce the effectiveness of emission reductions
- Could push new areas into non-attainment
- Extreme events such as wildfires could lead to acute events

Climate Change and Water Quality in California

- Risks to the state's water supply – increase pressure on the state's water system
- Sea level rise threatens water infrastructure
  - Combined sewer overflows in San Francisco
  - Sacramento-San Joaquin Delta
- Wildfire threatens watershed health
- Floods and other extreme events

Defining Extreme Events

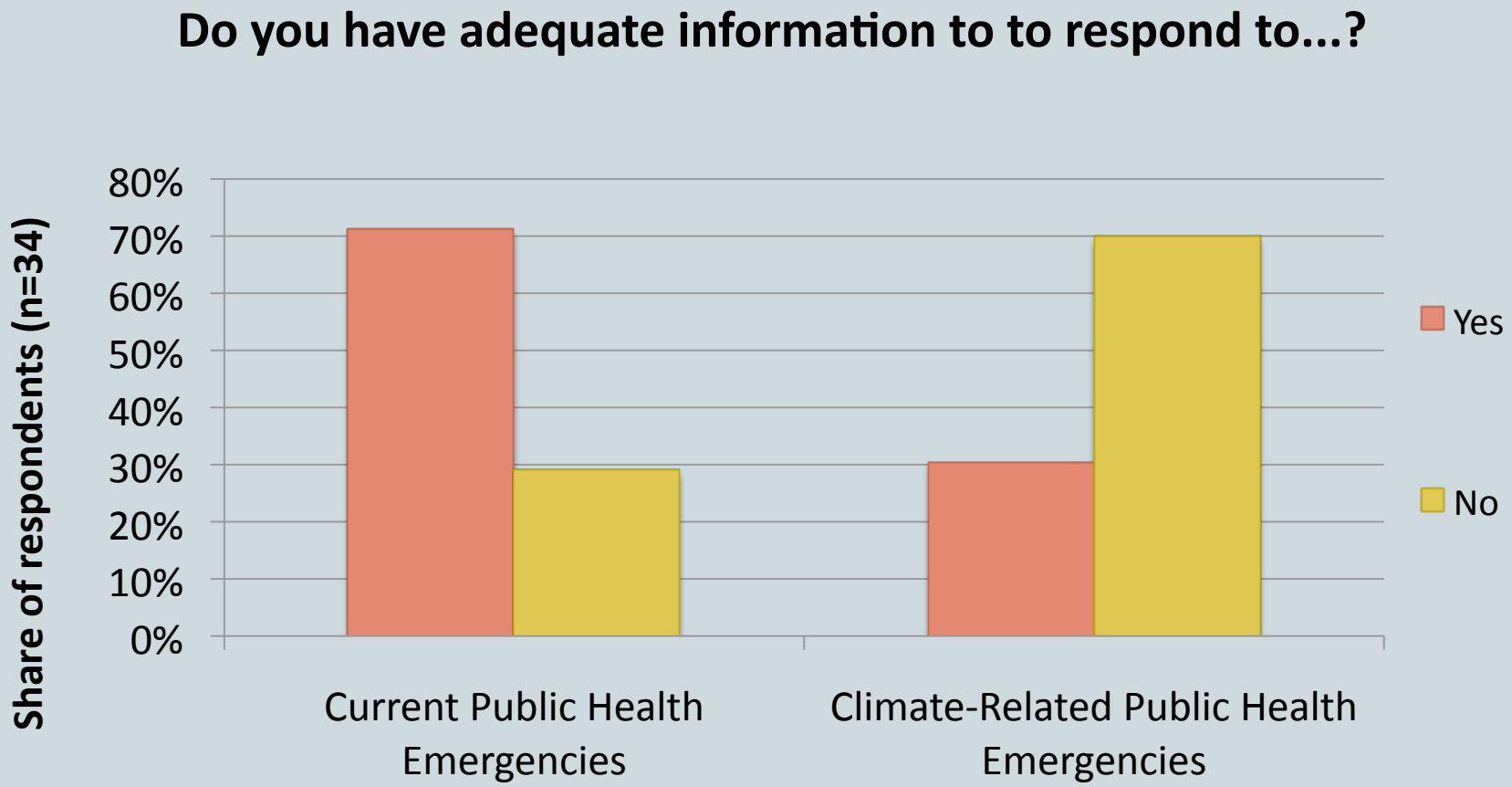
- Most work to date has been *top-down*
- IPCC's Fourth Assessment Report focused on a small number of extreme events (Parry et al, 2007) :
  - Daily maximum and minimum temperature
  - Heat waves
  - Heavy precipitation events
  - Droughts
  - Intense tropical cyclone activity
  - Extreme high sea levels
- These definitions may not be relevant for resource managers

Defining Extreme Events

- Growing recognition of the need to incorporate information from resource managers to better inform adaptation/readiness planning (Mastrandrea et al, 2009; 2010; Moser and Ekstrom, 2010)
- Surveys of resource managers and local officials show:
  - Recognition of the risk climate change
  - Feeling ill-prepared to prepare for the risks

  (Bedsworth, 2009; Maibach et al., 2008; Moser and Luers, 2008; Tribbia and Moser, 2008)

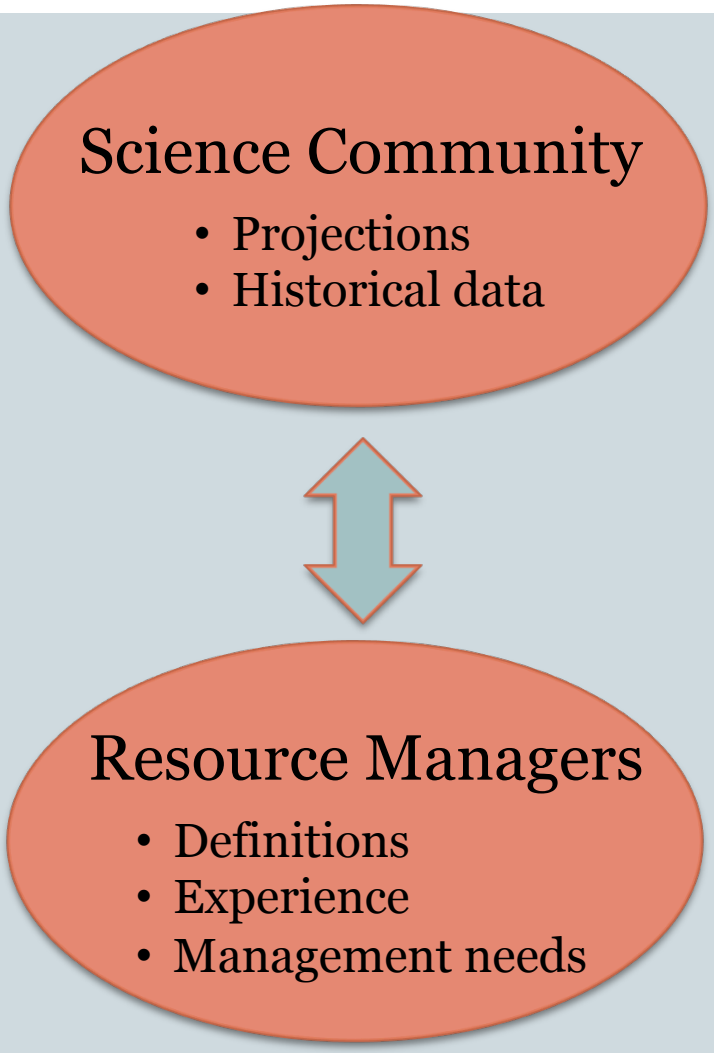
Public Health Officers



Source: Bedsworth, 2009

Research Approach

- Develop and test a bottom-up/top-down method for developing indicators of extreme events.
- Iterative – back and forth between scientific community and resource managers
- Aim for findings that can be extended outside California



Research Objectives

1. Use survey and interview methods to test applicability of available indicators of extreme events and to build "bottom-up" definitions of extremes in consultation with air and water quality managers;
2. Apply regression and qualitative analysis techniques to the results of the surveys to discern relationships between regional characteristics and information needs;
3. Based on survey results, select a diverse sample of case studies for further analysis, to provide more detailed insights and facilitate transferability of the results;
4. Use information gathered from resource managers to inform the analysis of historic climate data and downscaled climate projections in case study areas;
5. Develop a set of indicators of extreme events in coordination with research managers, and analyze their past and current behavior and future projections to inform air and water quality management in the case study areas, with an eye to the potential transferable nature of these indicators to other locations in California and the US; and
6. Throughout the project, work iteratively with air and water quality managers to inform their decisions, better understand their information needs, and align their expectations with the information climate change science can provide.

Research Plan – Year 1

- Survey air and water quality managers to understand on the ground definitions of extreme events and utility of current definitions (UNDERWAY)
- Analyze survey results using to discern relationships between information needs and agency characteristics
  - Community/Agency characteristics
  - Follow-up interviews
- Identify agencies for more in-depth case studies
  - Diversity of agencies
  - Eye toward extension of the results

Research Plan – Year 2

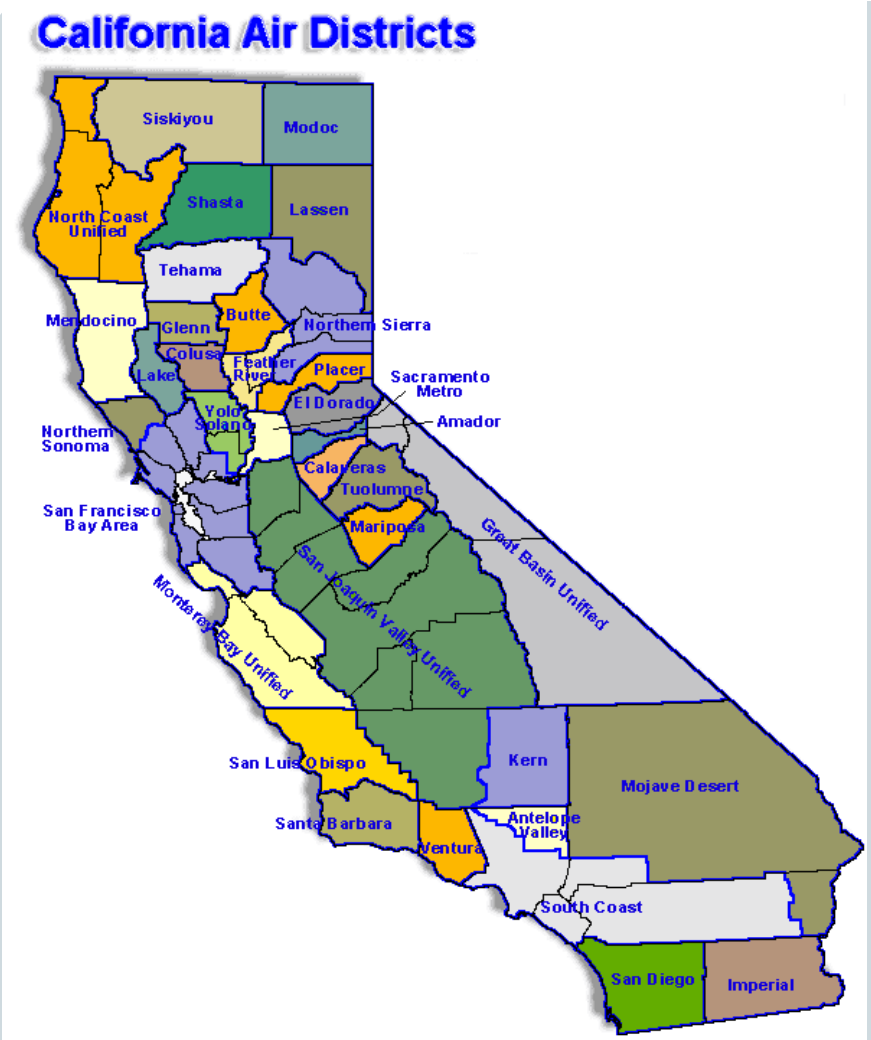
- Conduct case studies in select areas to provide more in-depth analysis of management needs. This will include:
  - Focused engagement with resource managers, including in-depth interviews, participant observation (Team)
  - Analysis of historical data (Tebaldi leading)
  - Application of downscaled CMIP5 climate projections (Duffy leading)
- Work to develop indicators of extreme events useful for case study participants

Research Plan – Year 3

- Conclude case studies and write up findings
- Inventory indicators developed with case study participants
- Return to full survey population to test the utility of the indicators developed

Scope of the Project – Air Quality

- California's 35 air pollution control districts
- Survey all 35
- Case studies to be determined



Scope of the Project – Water Quality

- California is divided into 9 regional water quality control boards
- BUT, within those there are thousands of water agencies
  - Drinking water
  - Storm water
  - Flood control
  - Wastewater
  - Combinations
- Survey population being determined

Current Activities – Survey Development

- Survey is being developed to learn:
  - Current understanding of extreme events – definitions, experience, preparation and planning, etc.
  - Understanding of extreme events under a changing climate
  - Utility of current extreme event indicators
  - Information and resource needs
- Linking survey respondents to community characteristic data for analysis of results
- Surveys will be conducted primarily electronically

Research Applications

- California's Climate Adaptation Strategy
  - Update in 2013
  - Guide for state agencies
- California's Fourth Climate Assessment
  - Planning stages
  - Eye to informing climate adaptation and readiness planning at the state, regional, and local level