Significant Findings from the Climate's Long-Term Impacts on Metro Boston (CLIMB) Case Study and Follow-on Research

Paul Kirshen, Battelle

kirshenp@battelle.org

(781) 869-1402

July 29, 2009

Urban IAV Program, EMF Snowmass CO

CLIMB Project

Climate's Long-Term Impacts on Metro Boston

- Tufts University, University of Maryland, Boston University

Paul Kirshen, Project Manager, PI, paul.kirshen@tufts.edu

Matthias Ruth, Co-PI, mruth1@umd.edu

William Anderson, bander@bu.edu, T.R. Lakshmanan, laksh@bu.edu

- Metropolitan Area Planning Council

Judith Alland, jalland@mapc.org

Martin Pillsbury, mpillsbury.org

US EPA STAR
Grant 1999-2004

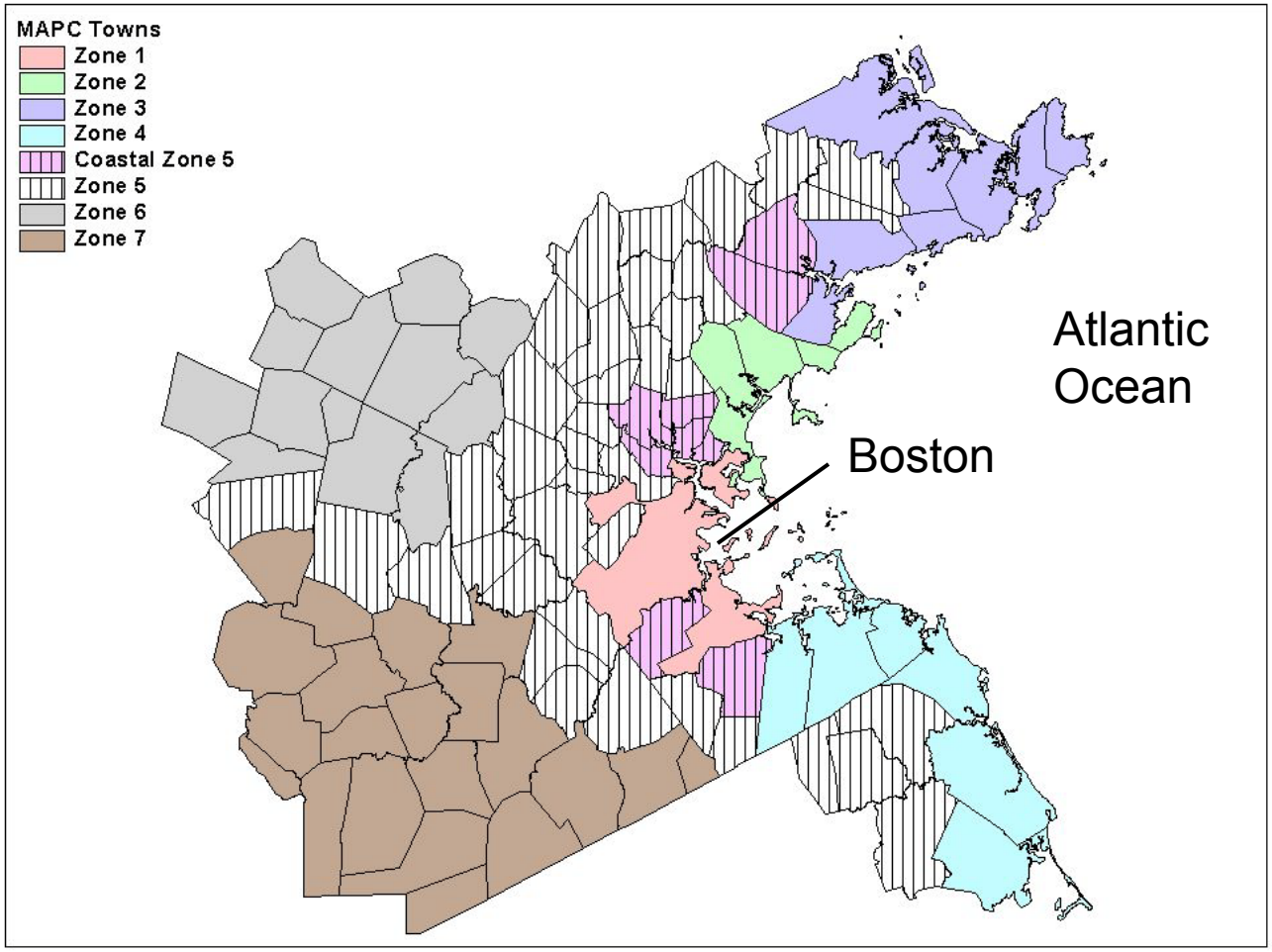
CLIMB Objectives

- Investigate impacts on urban infrastructure systems and services from future uncertain climate, and socioeconomic, environmental, and technological conditions – particularly the vertical impacts from climate to users in each infrastructure sector, and the horizontal linkages across sectors
- Work with stakeholders to develop short- and long-term resilient policies and programs to adapt to impacts
- Inform research community on key

CLIMB Clarification

- This was a research grant to Tufts from the US EPA to do a case study. Generally the cities and towns, NGOs etc were willing research participants but only recently have Boston, Cambridge, the state and others started considering adaptation –partly inspired and informed by CLIMB. Previous interest always on mitigation.
- No direct attention paid to ecosystem impacts

Study Area – 101 Cities and Towns in Metro Boston USA



Research Approach

- Determined expected dollar values of impacts on most of the infrastructure sectors for each year from 2000 to 2100 under 2 climate change scenarios, one population scenario, and the adaptation options of doing nothing, structural approach, and green/less structural approach. No discounting was applied but could be added – assumed equal property appreciation.

Summary of CLIMB Quantified Impacts

Energy	Summer: More electricity Demand Winter: Less gas demand
Health	Summer: Increased rate of heat-related mortality Winter: Less cold related mortality
Vehicle Transportation (due to flooding)	Increased travel time, Loss of trips, More travel miles
River Flooding	Temporary loss of land and land activity
SLR	Permanent loss of some coastal land, Temporary loss of land and land activities
Water Supply	Less reliable local supply
Water Quality	Less Dissolved Oxygen, More Non-point source pollution, Warmer Water
Tall Buildings	Wind induced sways can cause human discomfort, and costly architectural and fire protection damage

Some CLIMB Publications

- Suarez et al, Impacts of Flooding and Climate Change on Urban Transportation, Transportation Research Part D 10, 231-244, 2005.
- Kirshen, P., Ruth, M., and Anderson, W., Climate's Long-term Impacts on Urban Infrastructures and Services: The Case of Metro Boston, Chapter 7 of Ruth, M., Donaghy, K., and Kirshen, P.H., (eds.) Climate Change and Variability: Local Impacts and Responses, Edward Elgar Publishers, Cheltenham, England, 2006.
- Ruth, M., Amato, A., and Kirshen, P., Potential Impacts on Heat Related Mortality of Changing Temperatures in Urban Areas: Methodology and Application to Metropolitan Boston, in Smart Growth and Climate Change: Regional Development, Infrastructure and Adaptation, M. Ruth (editor), Edward Elgar, 2006.
- Kirshen, P., Ruth, M., and Anderson, W., Integrated Impacts of and Adaptation Strategies to Climate Change in Metropolitan Areas; A Case Study of the Boston Metropolitan Area, in Urban Dimensions of Environmental Change: Science, Exposures, Policies, and Technologies, H. Feng, L. Yu, and W. Solecki (editors), Science Press USA Inc, New Jersey, 2005.
- Kirshen, P., Ruth. M., and Anderson, W., Responding to Climate Change in Metropolitan Boston: The Role of Adaptation, New England Journal of Public Policy, Spring/Summer 2005.
- Amato, A., Ruth, M., Kirshen, P., and Horwtiz, J., Regional Energy Demand Responses to Climate Change: Methodology and Application to the Commonwealth of Massachusetts, Climatic Change, 71(175-201), 2005.
- Kirshen, P., Ruth. M., and Anderson, W., Interdependencies of Urban Climate Change Impacts and Adaptation Strategies: A Case Study of Metropolitan Boston USA, Climatic Change, 86:105-122, January, 2008
- Kirshen, P.H., Knee, K., Ruth, M., Adaptation to Sea Level Rise in Metro Boston, Climatic Change, 90(4), pages 453-473, October 2008.
- Ruth, M., Kirshen, P., and Coelho, D., Climate Change and Cities: Differential Impacts and Adaptation Options in Industrialized Countries in M. Ruth and M. Ibarraran (eds.), Differential Impacts of Climate Change, Edward Elgar, Cheltenham, UK, in press.
- Ruth, M, and Kirshen, P., Integrated Impacts of Climate Change upon Infrastructure Systems and Services in the Boston Metropolitan Area, World Resource Review 13(1), pgs 106-122, 2001.

CLIMB Findings

- Stakeholder's have a lot to contribute- problems, data, ground-truthing results, solutions
- Some adaptation actions have significant no regret actions
- Extremes events are important
- Interaction of impacts and adaptation actions across infrastructure sectors can be important
- Doing nothing is worst possible adaptation action

Climate's Long-term Impacts on Metro Boston (CLIMB) Project

CLIMB Findings

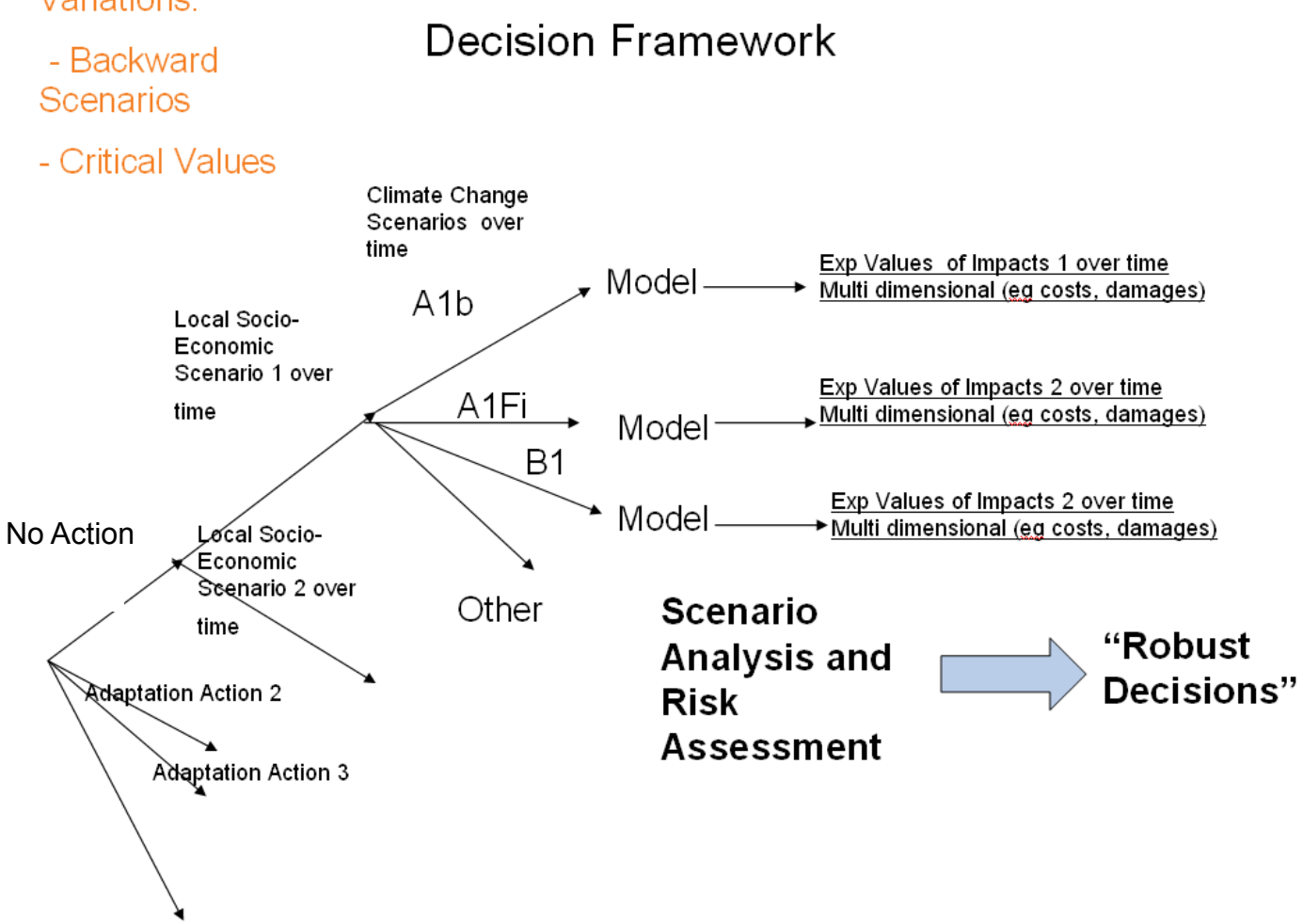
- Finding “Robust Decisions” by combining scenario analysis with risk assessment is good approach

Scenario- Based Risk Assessment Framework

Variations:

- Backward Scenarios

- Critical Values



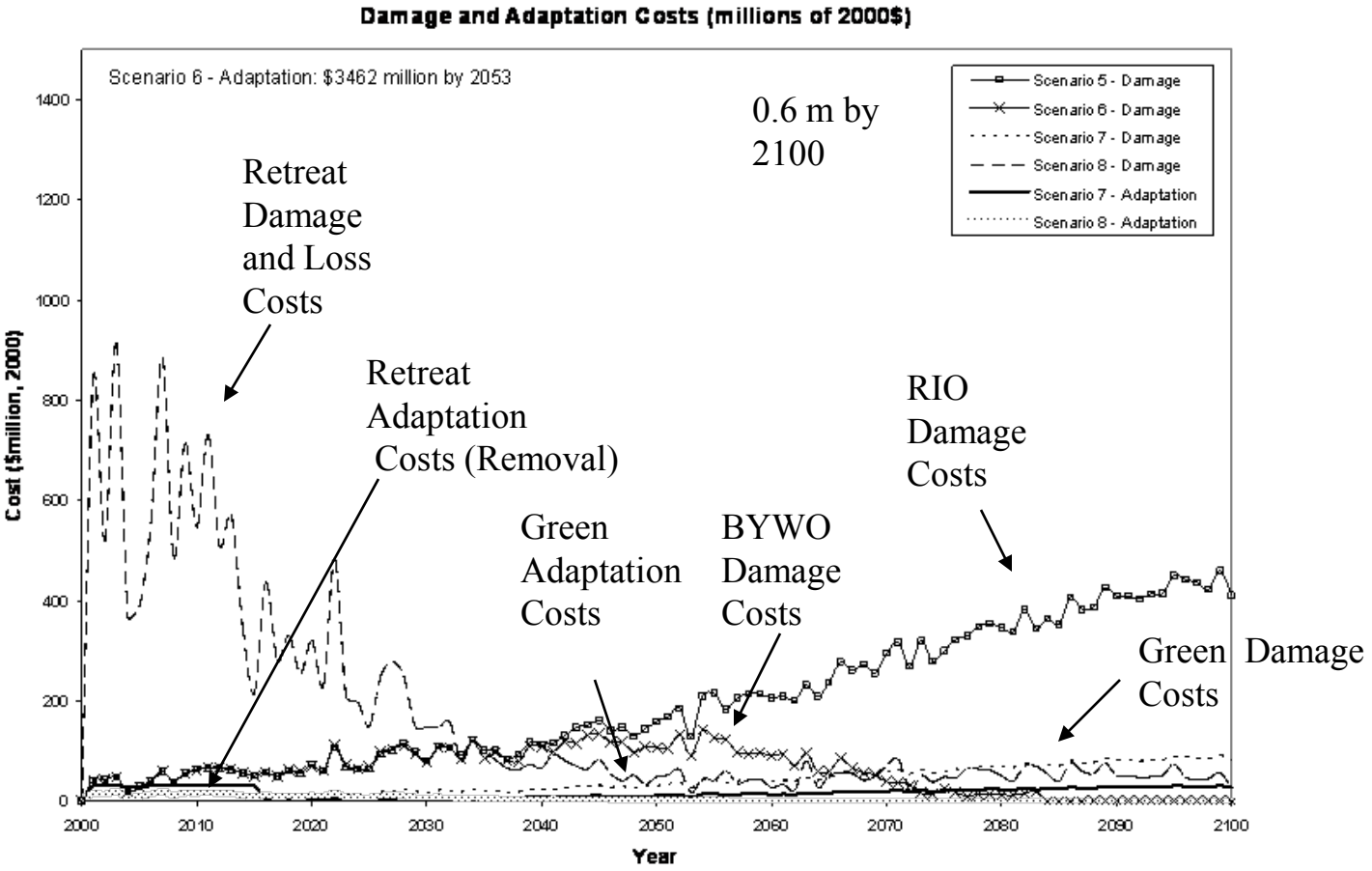
CLIMB Findings

- Dynamics/Timing of impacts and adaptation actions matter

SLR and Storm Surge Adaptation Example of Temporal Impacts

Details are not important here.

For each adaptation scenario, we show the expected value costs and residual damages over time. Can be compared to the costs of "doing nothing" (called RIO here) . BYWO is constructing seawalls.



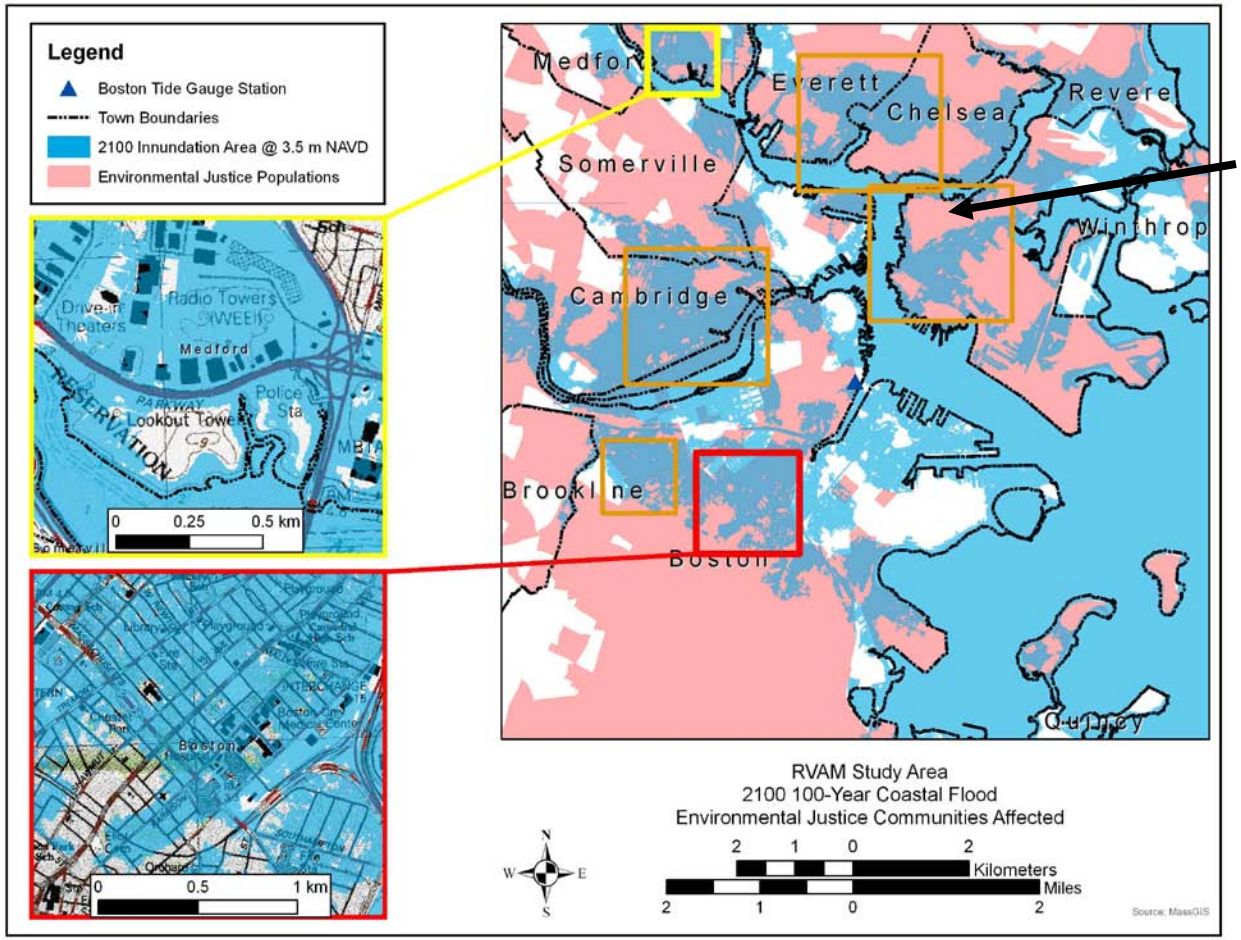
Source: CLIMB Study

Current Research to Filling in Some of the CLIMB Research Gaps

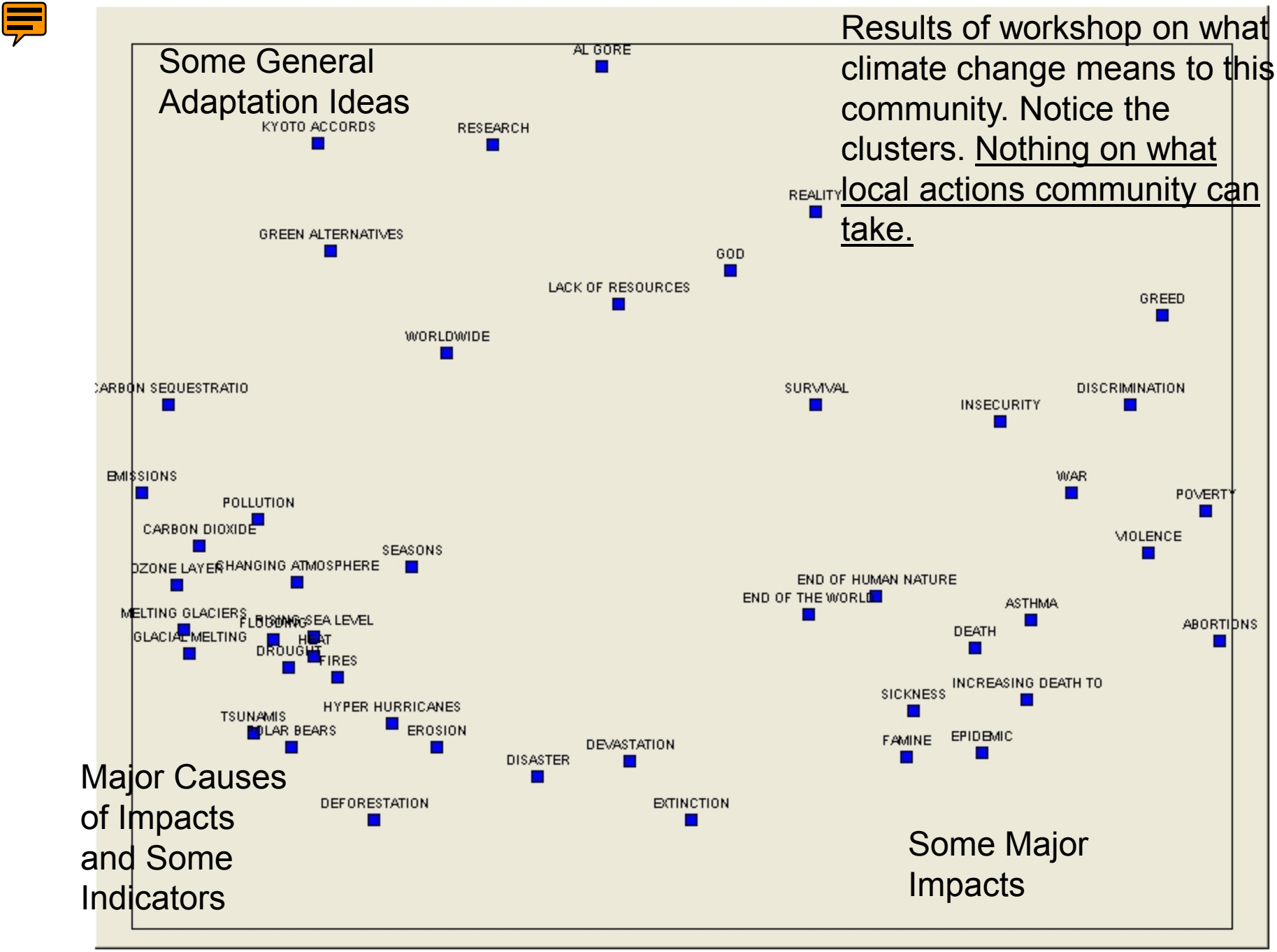
- Distribution of Impacts among socio-economic groups

- Current research in coastal East Boston mainly poor immigrant EJ community on impacts and adaptation options. Finding they are aware of climate change in general but at loss of how to adapt. Biggest issue is not to impact their few environmental amenities and how to pay for adaptation.

Distributional Impacts



Source: Watson, 2007


Some General Adaptation Ideas
Results of workshop on what climate change means to this community. Notice the clusters. Nothing on what local actions community can take.
AL GORE
KYOTO ACCORDS
RESEARCH
REALITY
GREEN ALTERNATIVES
GOD
LACK OF RESOURCES
GREED
WORLDWIDE
CARBON SEQUESTRATIO
SURVIVAL
DISCRIMINATION
INSECURITY
EMISSIONS
WAR
POVERTY
POLLUTION
CARBON DIOXIDE
VIOLENCE
SEASONS
OZONE LAYER
CHANGING ATMOSPHERE
END OF HUMAN NATURE
END OF THE WORLD
ASTHMA
MELTING GLACIERS
RISING SEA LEVEL
FLOODING
ABORTIONS
GLACIAL MELTING
DEATH
HEAT
DROUGHT
FIRES
INCREASING DEATH TO
SICKNESS
HYPER HURRICANES
TSUNAMIS
EROSION
POLAR BEARS
FAMINE
EPIDEMIC
DEVASTATION
DISASTER
DEFORESTATION
EXTINCTION
Major Causes of Impacts and Some Indicators
Some Major Impacts

Current Research to Filling in Some of the CLIMB Research Gaps

- Urban Drainage management

- Work with Ken Strzepek on methods to manage urban drainage in both developed areas (Somerville MA) and developing areas (Aurora CO). Solution in Somerville seems to retrofitting Low Impact Development storm water management techniques. Will it work ? Will residents accept “less” drainage management ?

Current Research to Filling in Some of the CLIMB Research Gaps

- Communication in Adaptation Planning

- Working with the New England Environmental Finance Center at the University of So. Maine, we are writing a manual aimed at city planners in coastal ME on how to apply scenario- based risk assessment in planning for SLR and higher storm surges. Being tested in Old Orchard Beach. Also, in conjunction with Industrial Economics we are designing a coastal SLR

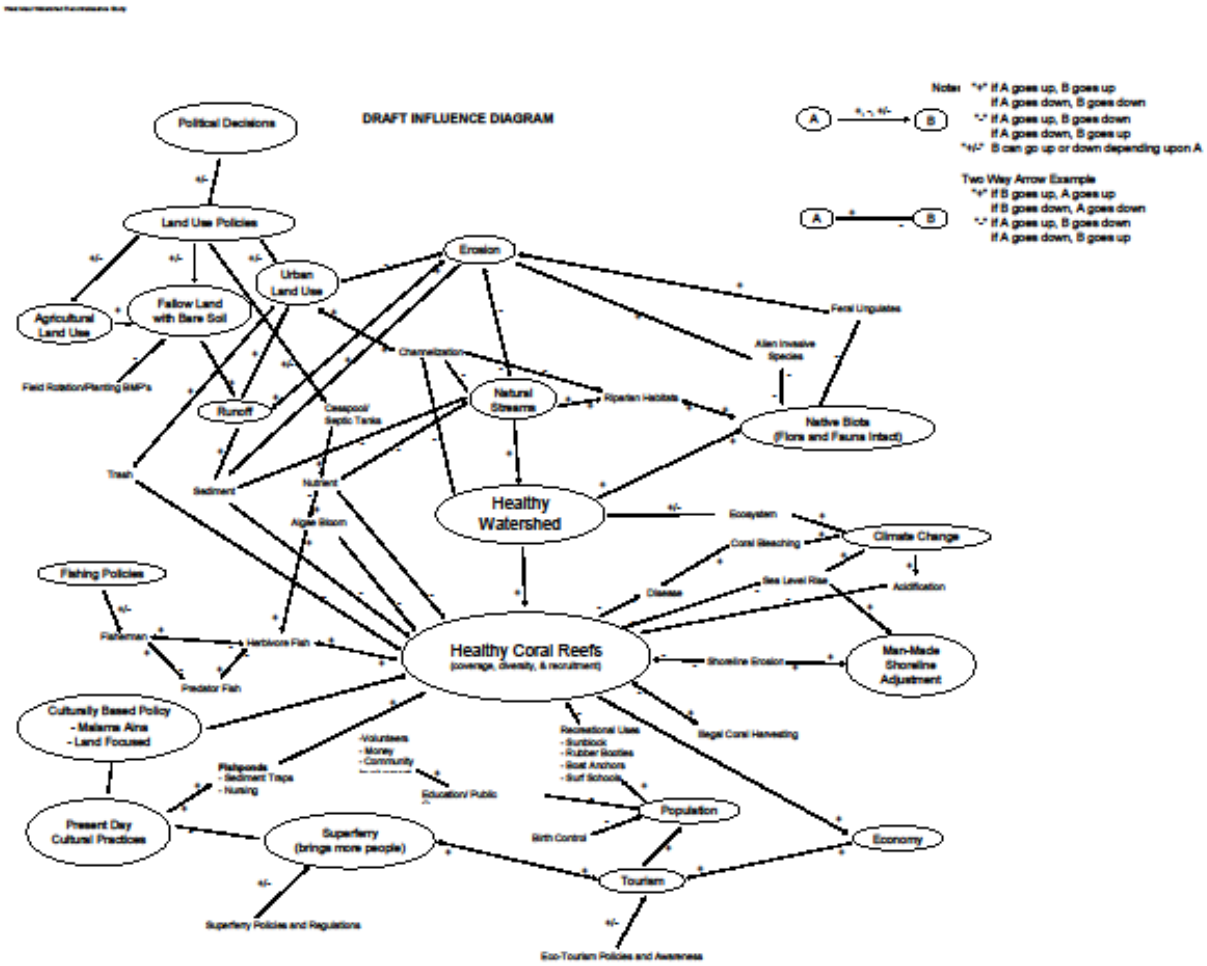
Current Research to Filling in Some of the CLIMB Research Gaps

- Improving Stakeholder Involvement

- Working with the US Army Corps of Engineers Institute for Water Resources (IWR), we have done some research in using their Shared Vision Planning (SVP) approach in participatory stakeholder planning in W. Maui. Found stakeholders developed new insights about the complexity of the interaction of watersheds and the coastal zone

Composite Influence Diagram Drawn by Stakeholders in W Maui

- .



This diagram is a compilation of the five group diagrams created at the US Army Corps of Engineers West Maui Reconnaissance Study workshop on March 4, 2009. Additional arrows have been added to show the interrelatedness of factors from the various group diagrams. However, no new factors have been added.

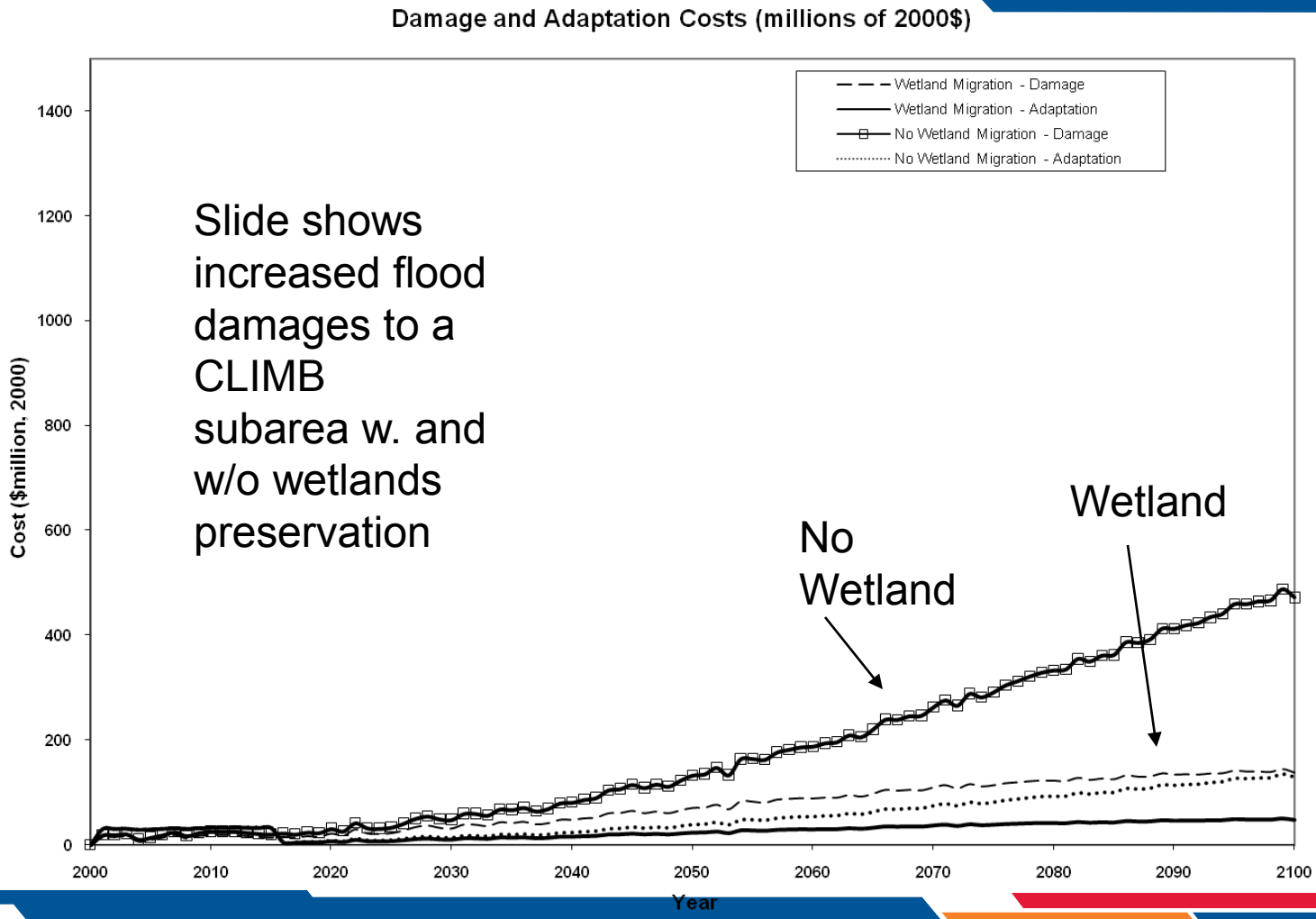
Current Research to Filling in Some of the CLIMB Research Gaps

- Interaction/Integration of Adaptation Planning of the Natural and Built Environment

  - Preliminary research in one CLIMB subarea using modeling found that preserving a wetland significantly decreased urban flood damages.

Flood Mitigaton Value of Wetlands

Battelle
The Business of Innovation



Current Research to Filling in Some of the CLIMB Research Gaps

- Role of water reuse/recycling in urban water supply.

- As part of project with the UNFCCC, determined increased importance of these water sources under climate change in the future.

Thank you Organizers and in particular, Gary Yohe and Tom Wilbanks

- Glad to answer any questions
- kirshenp@battelle.org