

Scenarios for Climate Adaptation: *An International Perspective*

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Acknowledgements: Auroop Ganguly, Roger Jones,
Richard Moss, Willis Shem



U.S. DEPARTMENT OF
ENERGY

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Climate Change
SCIENCE INSTITUTE



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Two approaches to managing an inherently uncertain future

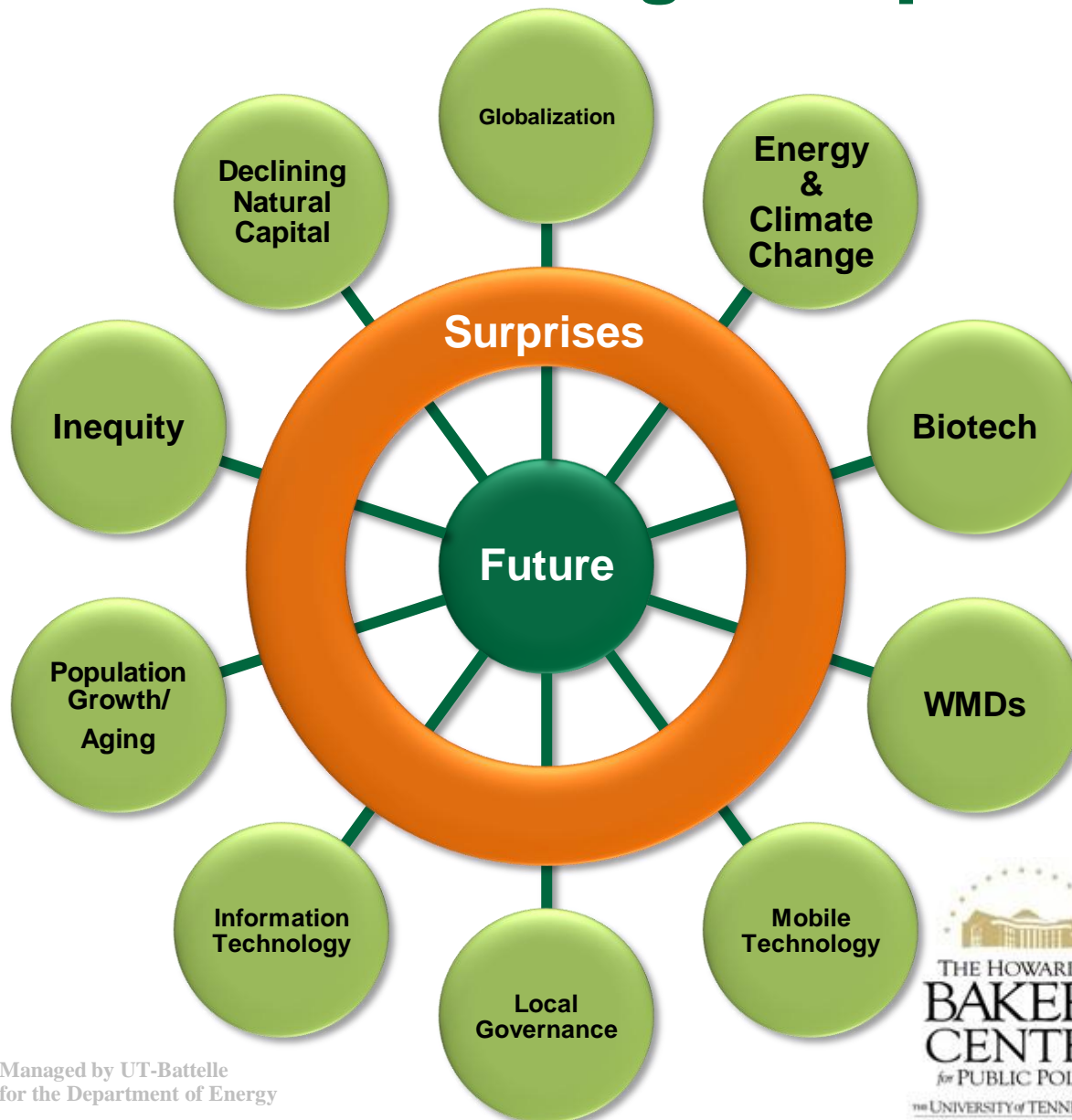
Enhanced Prediction

- *[Climate system science] is the essential system knowledge without which adaptation strategies and mitigation strategies cannot readily be built” (DCC, 2009)*
- **Implications:** Significant investments in modelling capability and improved prediction are needed if society is to adapt

‘Robust’ Planning

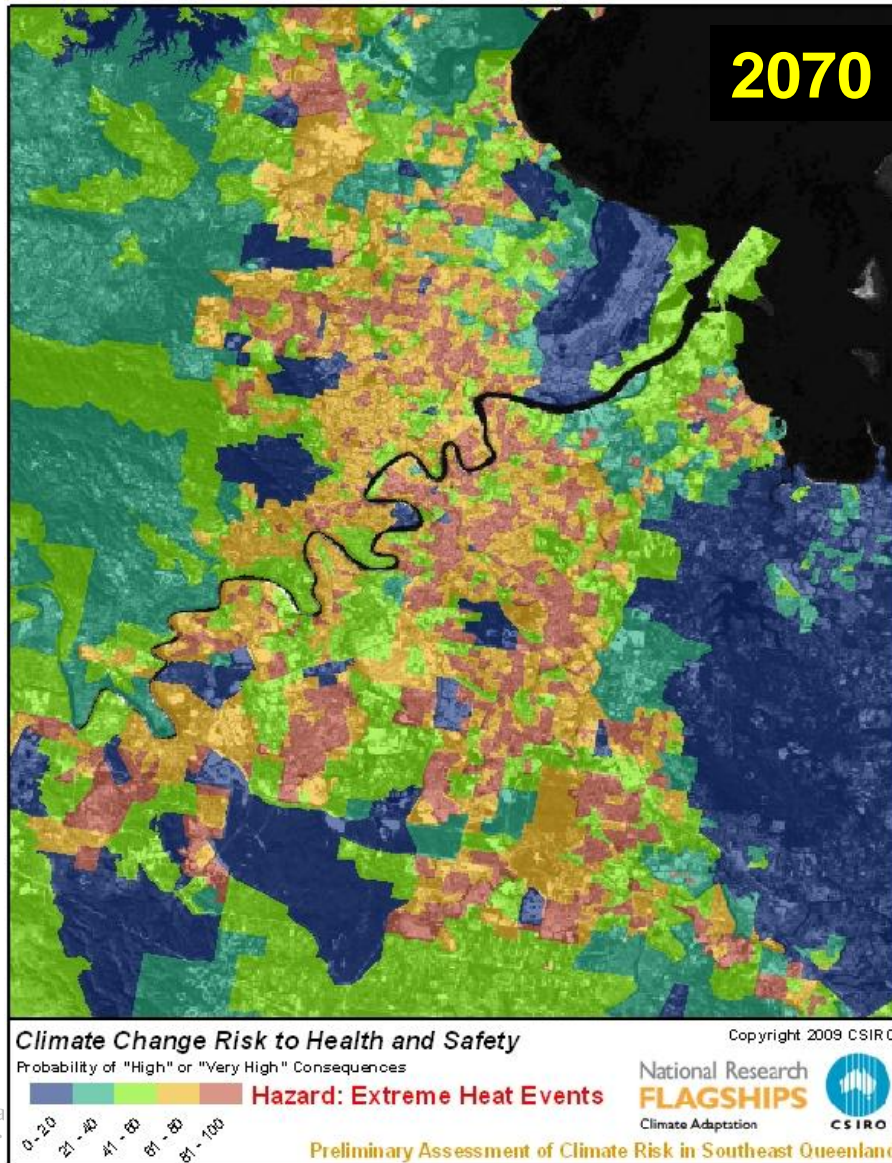
- *“Given the deep uncertainties involved in the prediction of future climate, . . . we believe that the ‘predict-then-act’ approach to science in support of climate change adaptation is significantly flawed” (Dessai et al., 2009)*
- **Implications:** Uncertainty is unavoidable, yet society can move forward with actions that are robust to the range of plausible futures

The future will emerge from the interactions among multiple trajectories



- One can estimate the future trajectory of any one issue or technology
- But, understanding their cumulative effects on societal outcomes is far more difficult
- Scenarios empower us to explore such complexity

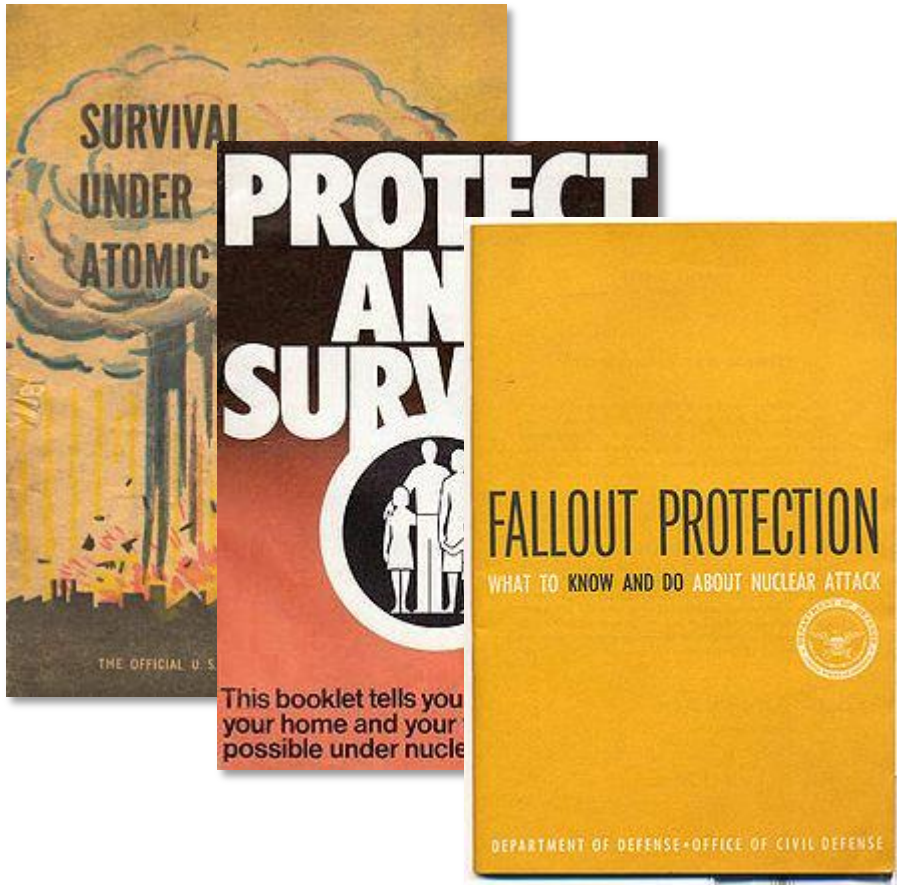
Scenarios can be used to capture complexity with respect to future outcomes



- **Inputs**
 - Climate variability
 - Climate change
 - Climate uncertainty
 - Population
 - Age structure
 - Economic disadvantage
- **Emergent insights**
 - Population aging may be more important than climate change

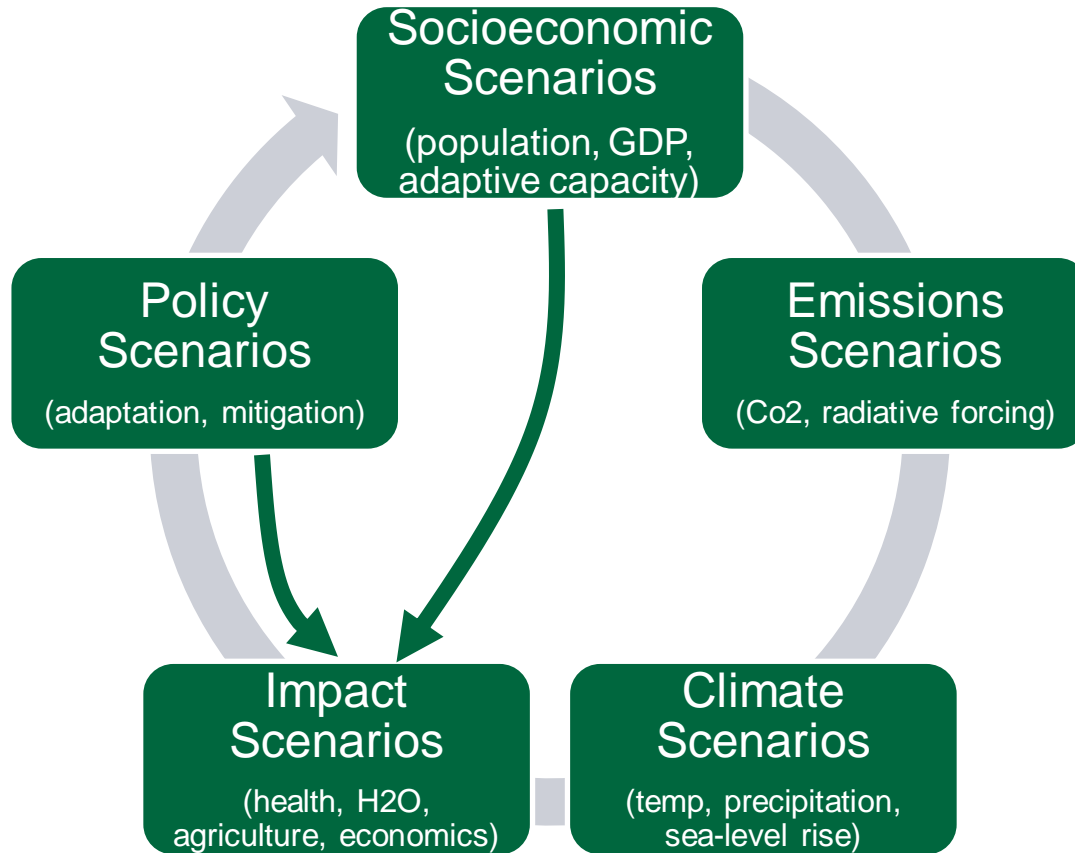
Scenarios also assist in helping us prepare for shocks and surprises

- Defense organizations recognize the importance of planning for all possible futures
- Climate change is another risk for which contingencies must be prepared
 - *U.S. Quadrennial Defense Review*



<http://www.ornl.gov/sci/knowledgediscovery/QDR/>

Each stage of the climate change 'cycle' can be represented by scenarios



“Scenarios, which should contain everything that shapes a society, aim to be coherent, internally consistent and plausible descriptions of these possible future states”

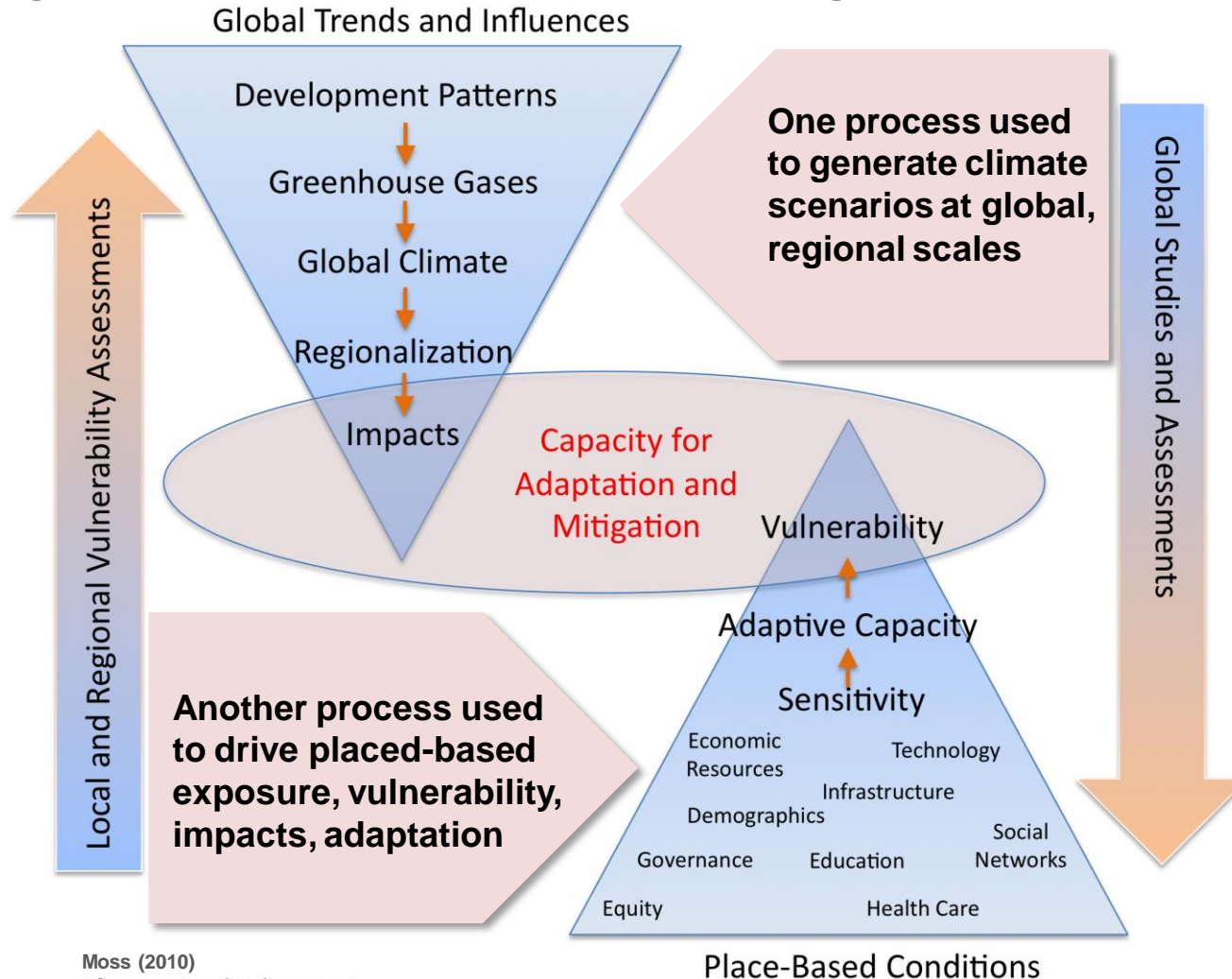
Holman et al. (2005)

- **In practice, scenarios are often unevenly applied**

- Inconsistent assumptions applied at different points in the cycle and/or scales
- Preferential emphasis on climate vs. socioeconomic and policy scenarios

Applications of scenarios are affected by a disconnect between scales

Intergovernmental Panel on Climate Change

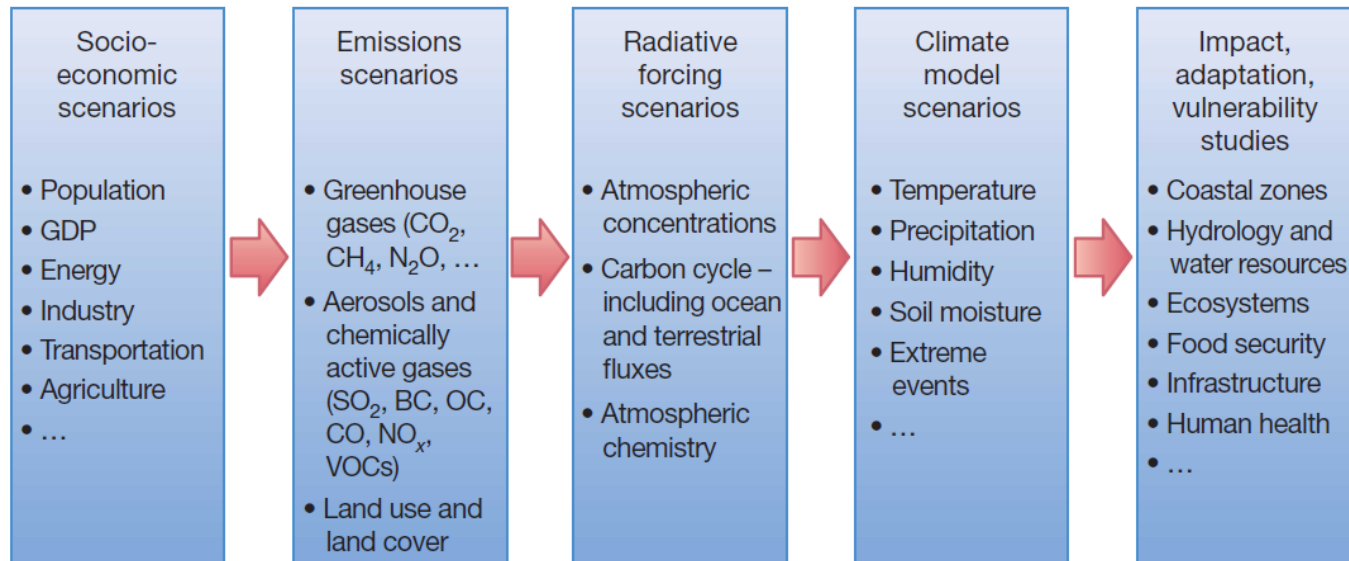


Moss (2010)
After Desai and Hulme, 2003

Community-Based Adaptation Efforts

Global drivers are the starting point for many of our climate change scenarios

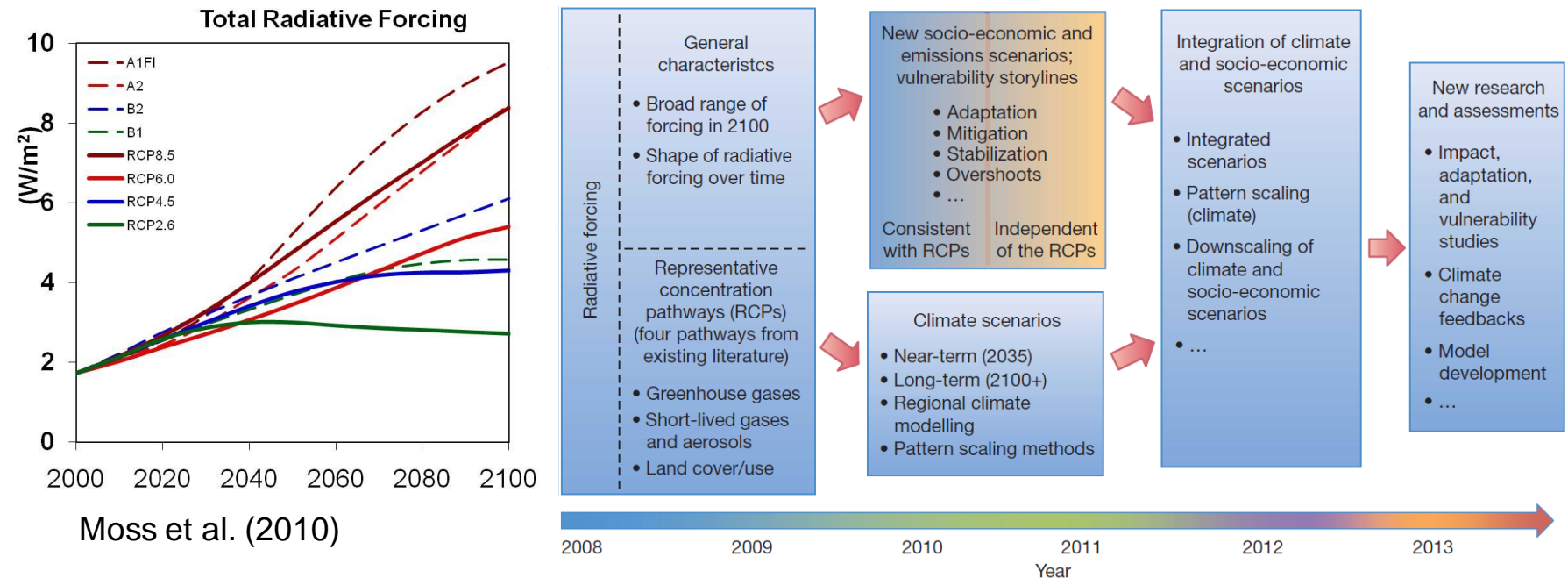
- SA90, IS92 scenarios (*FAR, SAR*)
- Special Report on Emissions Scenarios (SRES) (*TAR, AR4*)
- Representative concentration pathways (RCPs) (*AR5*)



Moss et al. (2010)

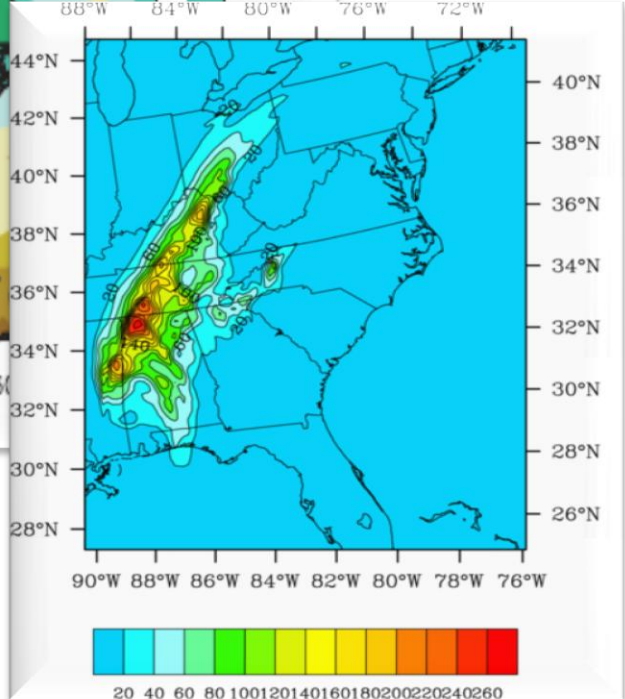
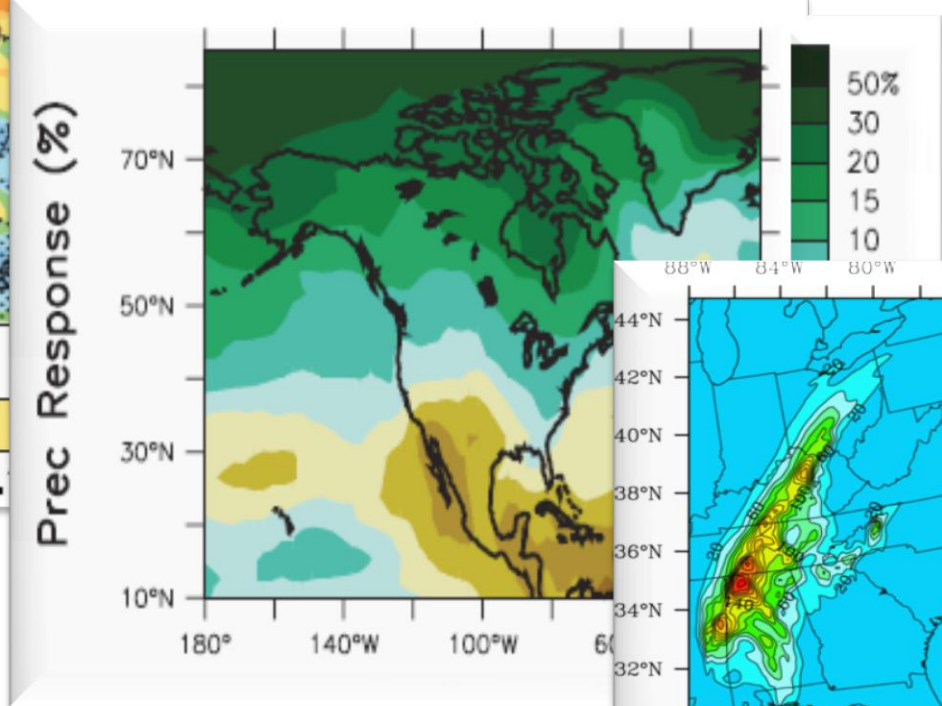
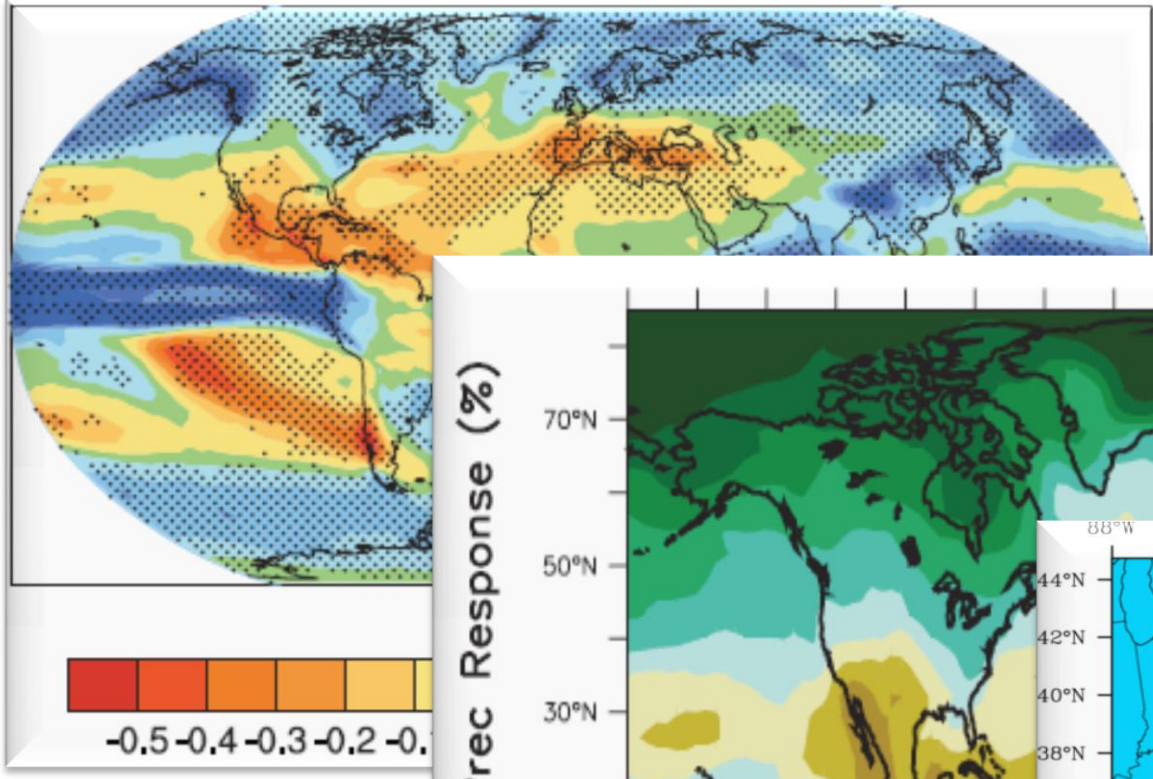
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<http://www.iiasa.ac.at/web-apps/tnt/RcpDb/>

Climate scenarios often propagate from 'top-down' assumptions



- Australia (2007)
- Canada (2009)
- New Zealand (2008)
- Switzerland (2007)
- UK (2009)
- USA (2009)

Global → Regional → Local

'Bottom-up' climate scenarios can also be effective in adaptation planning

SEA-LEVEL RISE VISUALIZATION FOR ALABAMA AND MISSISSIPPI

This pilot project is a collaborative effort of the National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center, Mississippi-Alabama Sea Grant Consortium, and U.S. Geological Survey.



- Relatively simple scenarios about future climate change are useful when placed in a local context
- Simulating the climate itself may be less important than understanding vulnerability and possible solutions

Climate scenarios have dominated the adaptation discourse

Define Problem

Select Method

Test Methods/
Sensitivity

Select Scenarios

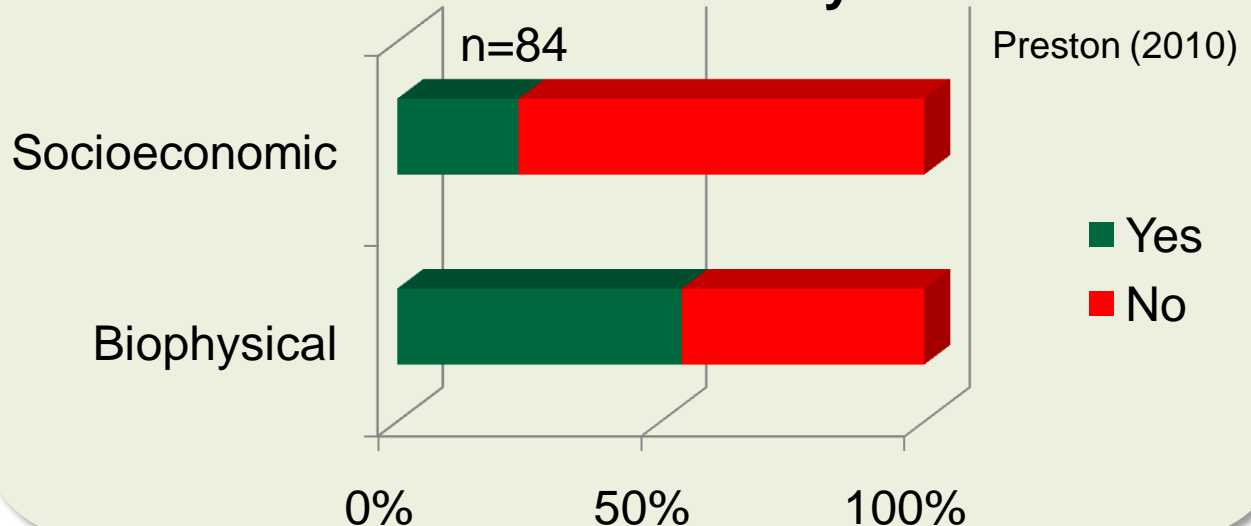
Assess Impacts

Assess
Autonomous
Adjustments

Evaluate Adaptation
Strategies

- Information about future climate has traditionally been the starting point for climate change risk assessment and adaptation planning

Use of Scenarios in Vulnerability Assessment

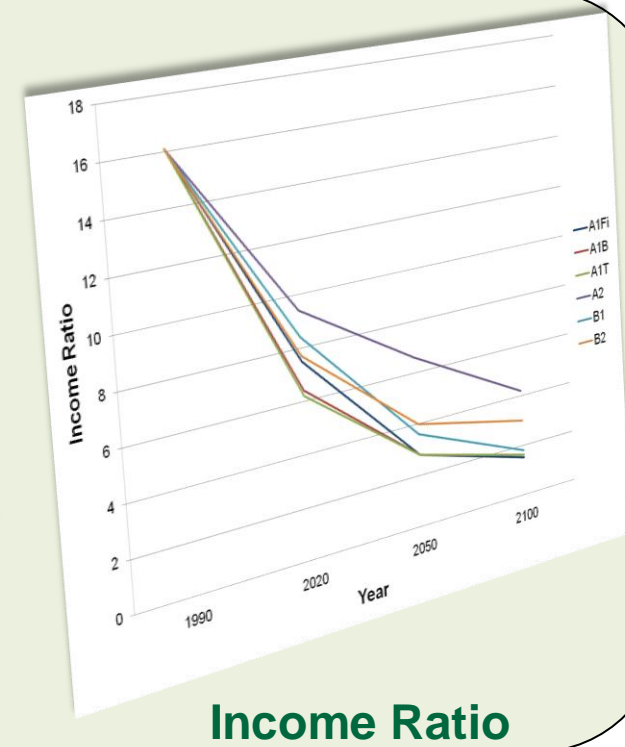
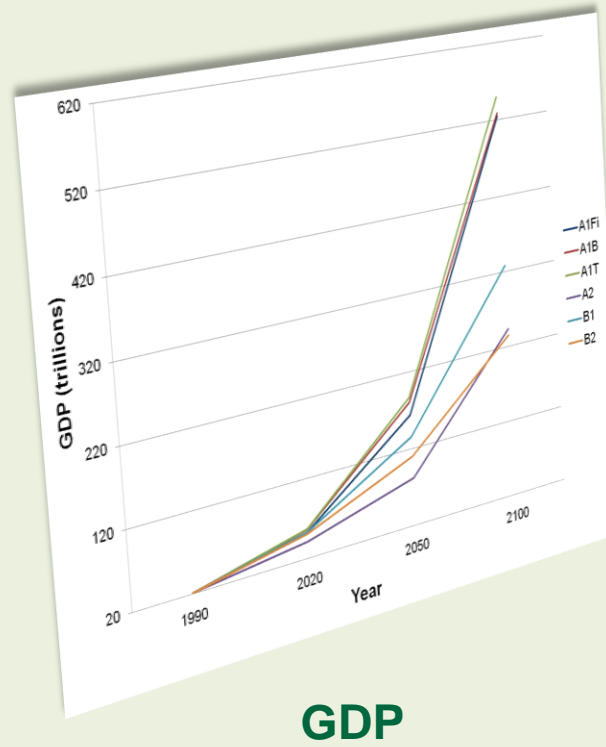
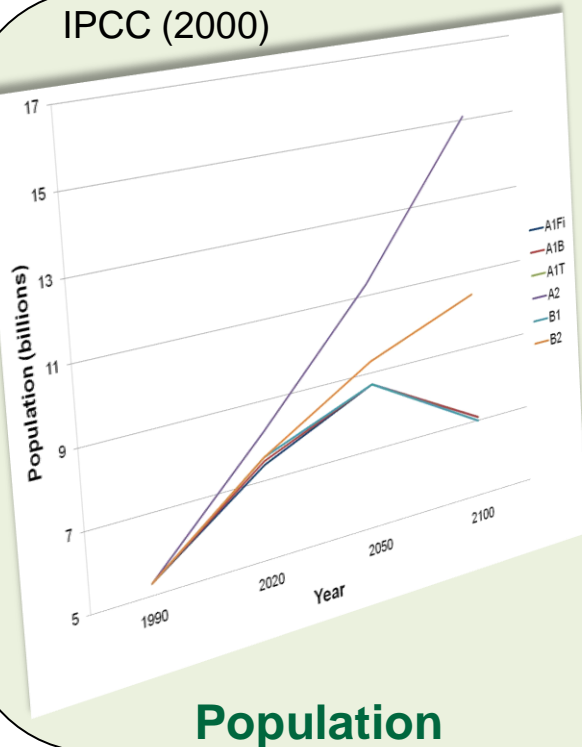


- Effective adaptation requires those scenarios to be nested within a broader context

There is a need for greater use of socioeconomic scenarios in adaptation

- SRES qualitative storylines and quantitative scenarios provide one means of representing different futures
- Yet, global drivers may not be relevant to local context

IPCC (2000)

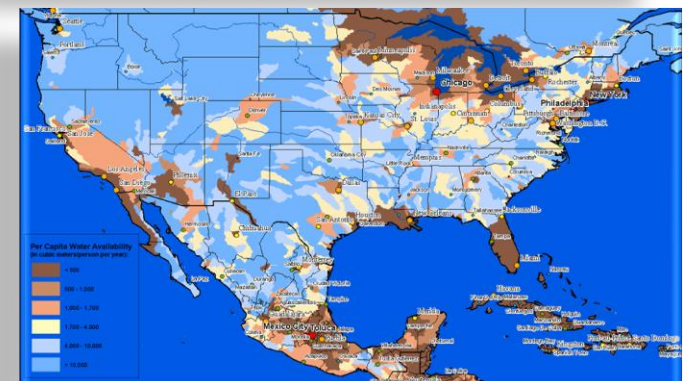
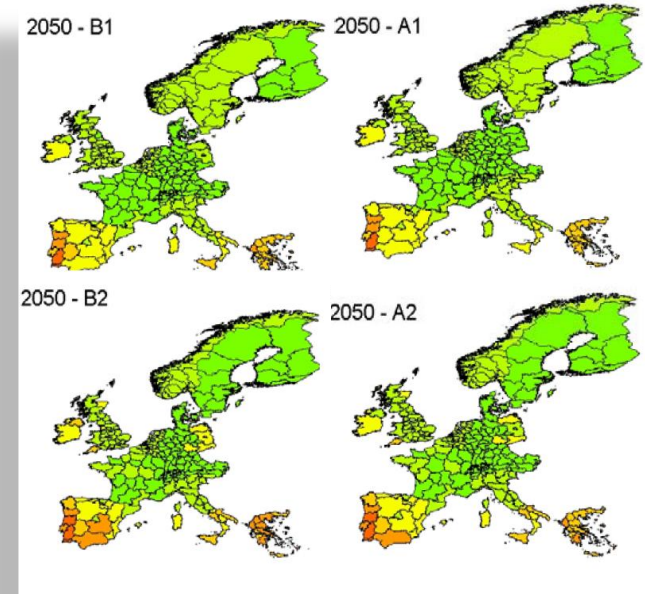
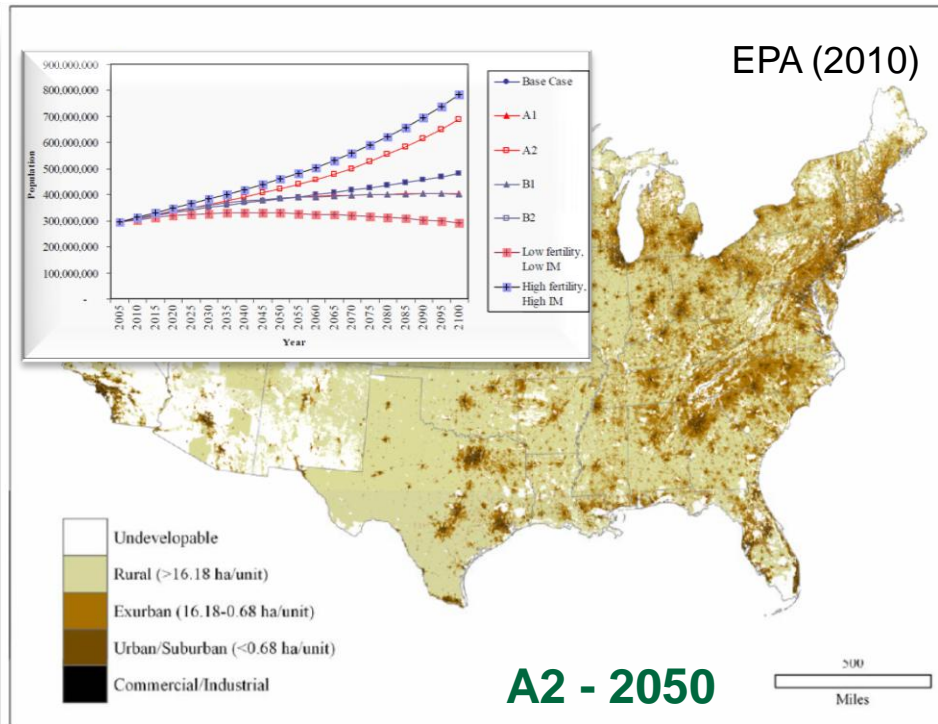


'Downscaling' can help maintain consistency of scenarios across scales

Schroeder et al (2004)

Examples

- U.S. EPA Housing & Population
- 'ATEAM' study
- Quadrennial Defense Review



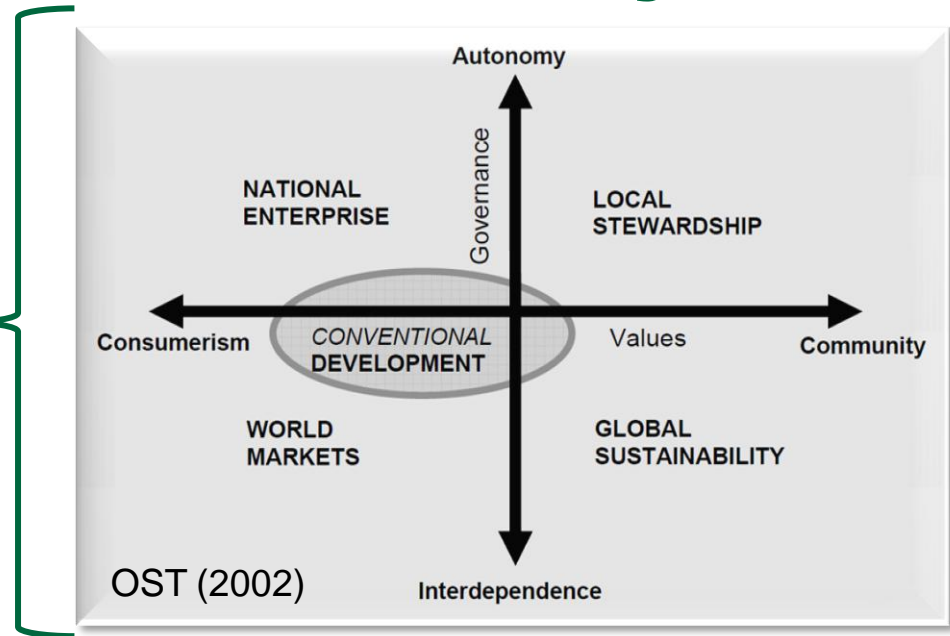
Ganguly et al (2010)

Socioeconomic scenarios can be developed independent of IPCC storylines

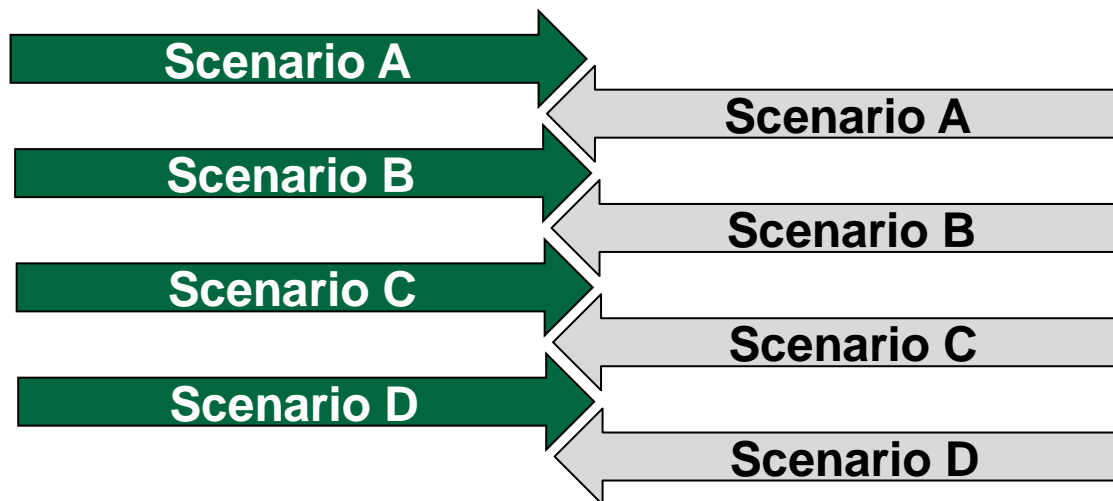
- **Examples (UK):**

- Foresight
- UKCIP
- RegIS

Common Scenario Framework

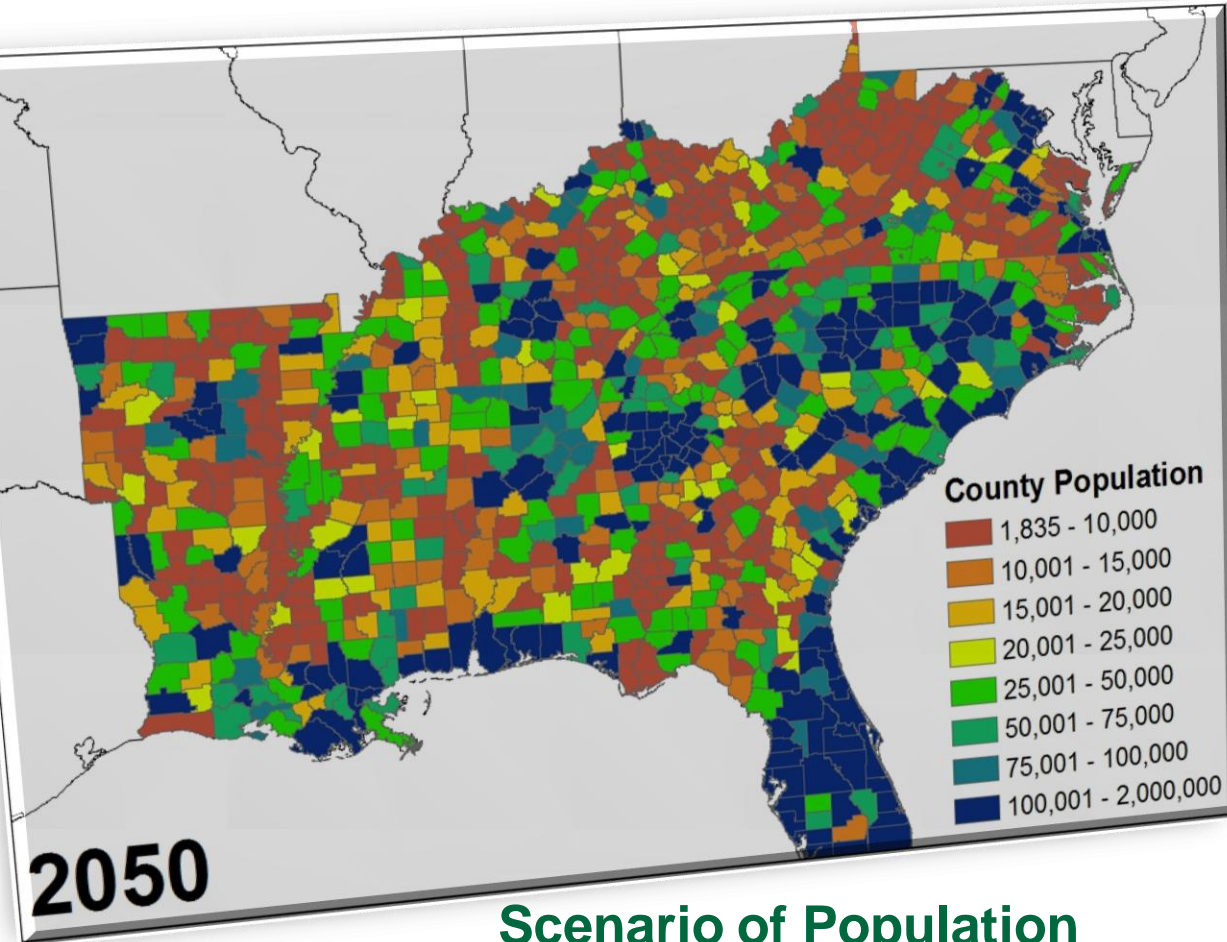


Climate Scenarios



Socioeconomic Scenarios

A scenario's likelihood may have little bearing on its value in adaptation



Data source: EPA (2010)

Scenario of Population Growth in the U.S. Southeast

Uses of Scenarios

- **Problem orientation:** understanding the sensitivity of potential outcomes to different initial conditions and trajectories
- **Decision-making:** understanding how a particular management decision performs under a range of plausible scenarios

Preston et al (2010)

For scenarios to support decision-making, there must be a decision context

Problem

Consequences

Scenarios

Solutions

• Storm-water drainage for a future climate

– Solutions:

- A) Do nothing
- B) Require on-site retention for new development
- C) Expand capacity of new infrastructure
- D) Retrofit

Preferred Options

– Scenarios:

- Climate and rainfall extremes
- Population, housing, impervious surface



• Under which scenarios do the preferred options change?

Thank You

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See:

Jones & Preston (2010) Adaptation and Risk Management. WIRES Climate Change, in press.



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