

1. CCSP Uncertainty and  
Scenario Analyses
2. Vulnerability/Adaptation  
Scenarios

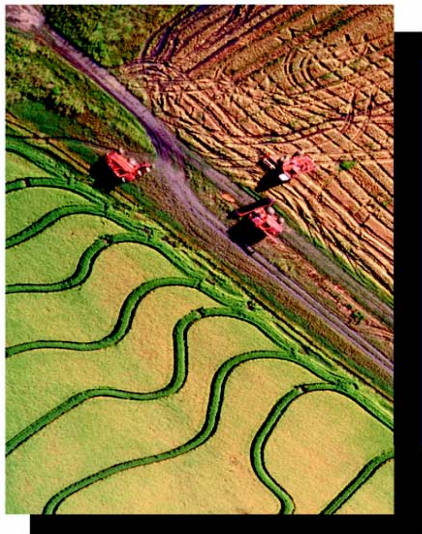
Richard Moss

# Overview of decision support resources development

- Prepare scientific syntheses and assessments
- Develop resources to support adaptive management and planning, and transition these resources from research to application
- Develop and evaluate methods to support policymaking and demonstrate these methods with case studies

# Guidelines for decision support

- Analyses structured around specific questions
- Early and continuing involvement of stakeholders
- Explicit treatment of uncertainties
- Transparent public review of analysis questions, methods, and draft results
- Evaluate ongoing CCSP analyses and build on the lessons learned



## GOAL 5

Explore the uses and identify the limits of evolving knowledge to manage risks and opportunities related to climate variability and change.

### TOPICS FOR PRIORITY CCSP SYNTHESIS PRODUCTS

### SIGNIFICANCE

### COMPLETION

Uses and limitations of observations, data, forecasts, and other projections in decision support for selected sectors and regions.

There is a great need for regional climate information; further evaluation of the reliability of current information is crucial in developing new applications.

within 2 years

Best-practice approaches to characterize, communicate, and incorporate scientific uncertainty in decisionmaking.

Improvements in how scientific uncertainty is evaluated and communicated can help reduce misunderstanding and misuse of this information.

within 2 years

Decision support experiments and evaluations using seasonal to interannual forecasts and observational data.

Climate variability is an important factor in resource planning and management; improved application of forecasts and data can benefit society.

within 2 years

# Uncertainty evaluation and communication guidelines

- Drafted by external specialists through NSF grant
- Build on other experiences and approaches (e.g., IPCC, RIVM, etc.)
- Raise awareness and provide practical advice to teams preparing assessments and synthesis reports in CCSP
  - Develop approach consistent for use (stakeholders)
  - Level of precision
  - Consistent terminology (options)
  - Other pitfalls and biases
  - Documentation/traceable account
  - Advice on graphical approaches

# Objective to increase use of model results in decision support

- Chapter 10 (modeling chapter) includes objective of providing routine, on-demand model-based projections of future climate, including systematic generation of products for impacts research
- Personal view: this should require providing support for application of climate and other data in impacts research and adaptive management (one of the goals of the decision support resources chapter)

# Organizations Providing or Promoting Data and Scenario Support

- IPCC Task Group on Data and Scenario Support for Impacts and Climate Assessment (TGICA)
- UK Project LINK and UKCIP
- Canadian Climate Impacts Scenarios Project
- Australian CSIRO
- START--AIACC
- Many US based activities, but the US has not yet developed a coordinated, systematic approach to supporting use of climate data and scenarios in impacts/adaptation research

# CCSP Scenario-Related Synthesis and Assessment Products

Topics for Priority CCSP Synthesis and Assessment Products	Significance	Completion*
2.1 Updating scenarios of greenhouse gas emissions and concentrations, in collaboration with the CCTP. Review of integrated scenario development and application.	Sound, comprehensive emissions scenarios are essential for comparative analysis of how climate may change in the future, as well as for analysis of mitigation and adaptation options.	Within 2 years
3.2 Climate projections for research and assessment based on emissions scenarios developed through CCTP	Production of these projections will help develop modeling capacity and will provide important inputs to comparative analysis of response options	2-4 years
4.5 Scenario-based analysis of the climatological, environmental, resource, technological, and economic implications of different atmospheric concentrations of greenhouse gases	Knowing how well we can differentiate the impacts of different greenhouse gas concentrations is important in determining the range of appropriate response policies.	2-4 years

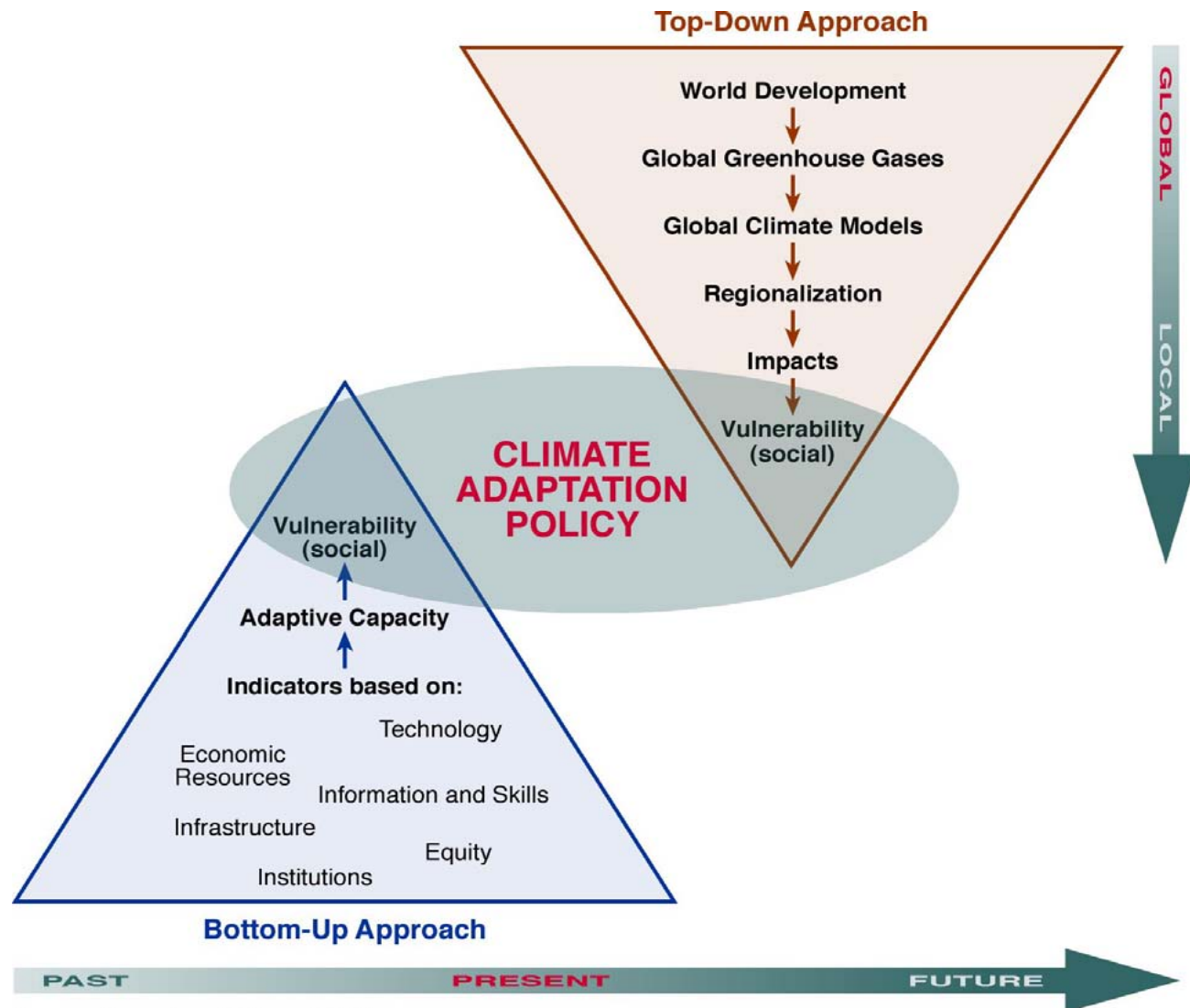


# Possible Approaches to CCSP/CCTP Emissions Scenarios

- ✓ New probabilistically constructed  
“reference scenarios”
- Stabilization scenarios
- Scenarios of short-lived species
- CCTP driven technology scenarios
- ✓ Review of integrated scenario  
development and application

Process: DOE lead, with other agencies

# Scenarios for adaptation and vulnerability



# Complexity of factors that affect vulnerability to climate hazards

- Socio-economic factors: composition of economy; dependence on climate-sensitive resources; education; health care system; technology
- Institutions: markets; kinship ties; land tenure
- Distribution of entitlements: access to resources of groups/regions (demographic, social, geographic)
- Environmental factors: land fragmentation, air & water pollution, etc.

# Research issues in developing adaptation scenarios

- Identify users of adaptation scenarios (scales)
- Characterise sensitivities in priority sectors/domains/regions
- Develop a conceptual framework for adaptive capacity
- Identify proxy variables of vulnerability and adaptive capacity
- Map and measure current adaptive capacity (baseline measurements)
- Develop tools for generating future scenarios: alternative approaches to projecting from baselines using scenario logics

# Potential Proxies

Category	Proxy variables	Proxy for:	Functional relationship
<b>Economic capacity</b>	GDP(market)/capita  Gini index	Distribution of access to markets, technology, and other resources useful for adaptation	Adaptive capacity ↑ as GDP/cap ↑  at present Gini held constant
<b>Human and civic resources</b>	Dependency ratio  Literacy	Social and economic resources available for adaptation after meeting other present needs Human capital and adaptability of labor force	Adaptive capacity ↓ as dependency ↑  Adaptive capacity ↑ as literacy ↑
<b>Environmental capacity</b>	Population density  SO <sub>2</sub> /area  % land unmanaged	Population pressure and stresses on ecosystems Air quality and other stresses on ecosystems Landscape fragmentation and ease of ecosystem migration	Adaptive capacity ↓ as density ↑  Adaptive capacity ↓ as SO <sub>2</sub> ↑  Adaptive capacity [of the environment] ↑ as % unmanaged land ↑

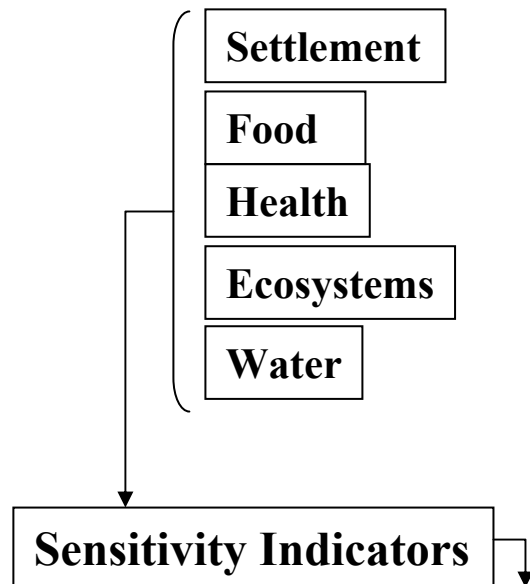
# Recent and ongoing research

- Multiple case studies
- Lorenzini et al., UKCIP downscaling using SRES scenario storylines to examine their implications for adaptation in U.K.
- Moss, Brenkert, and Malone, indicators of vulnerability
- Lim and Moss, UNDP guidelines for socio-economic scenarios in national communications
- Multiple international projects

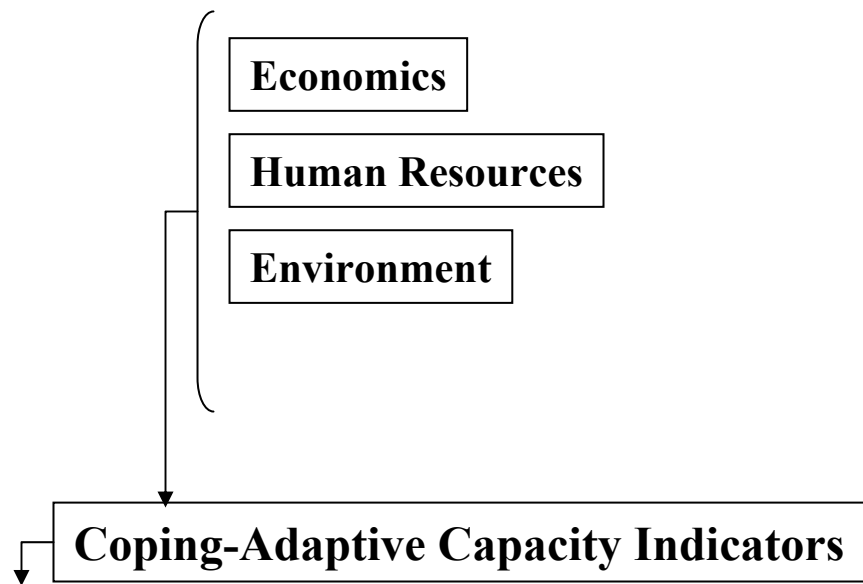
# Quantifying Vulnerability and Resilience to Climate Change

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## Sensitivity sectors

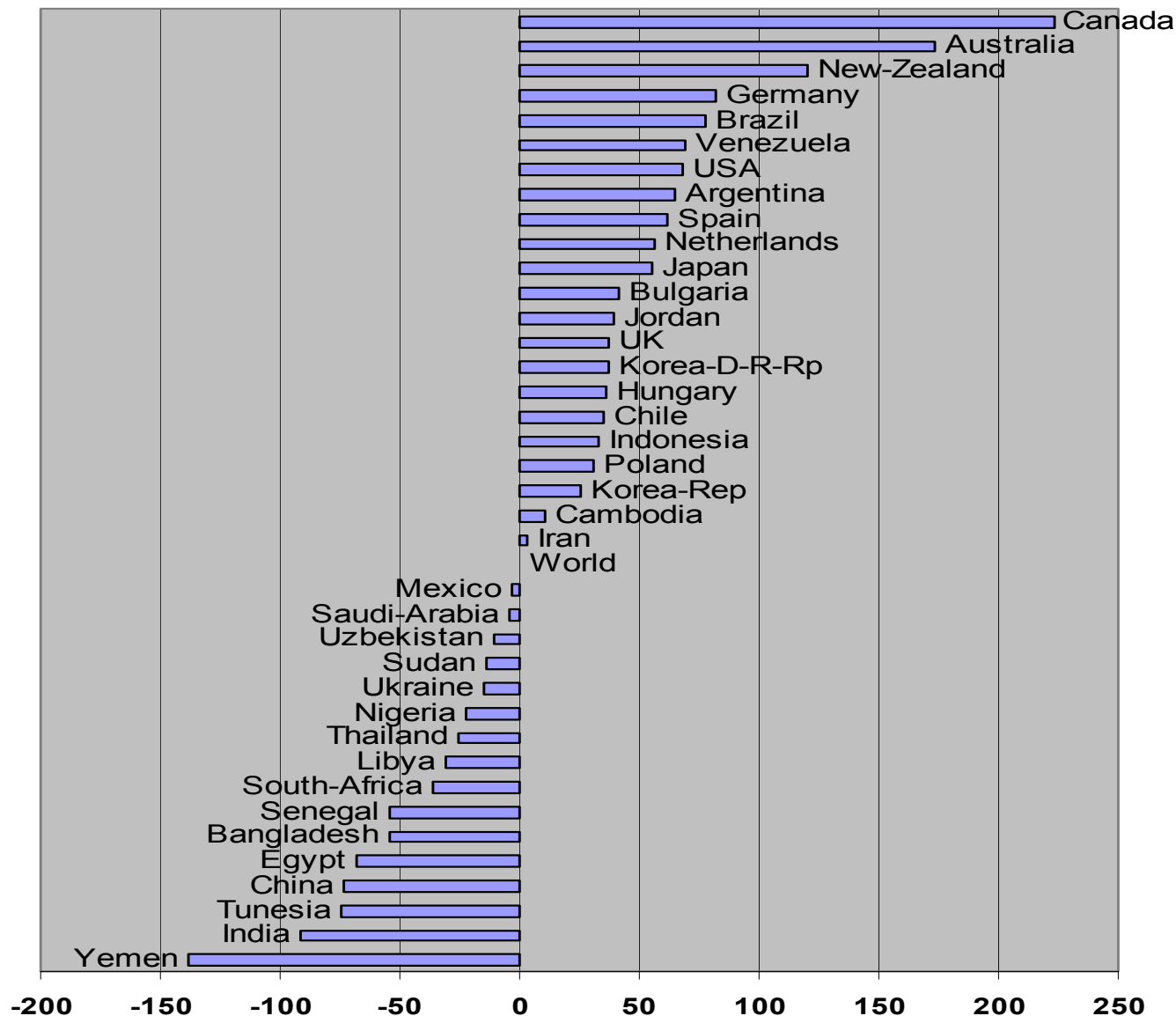


## Coping and Adaptive Capacity sectors



**National Baseline Estimates and Projections of  
Sectoral Indicators,  
Sensitivity and Coping-Adaptive Capacity, and  
Vulnerability-Resilience Response Indicators to Climate Change**

# Baseline Vulnerability-Resilience Indicator Value (World value = 0 for 1990)





# Some conclusions of the VRIP Study

- The prototype yields unique vulnerability pathways for countries and contain some unexpected results. For example, some developing countries are less vulnerable than some developed countries. These unexpected results seem logical or plausible when examined in detail.
- Wealth is neither a necessary nor a sufficient determinant of vulnerability and resilience. Although country vulnerability-resilience indicators correlate with national GDP per capita, more than 20% of the countries studied show no significant correlation.
- Our lack of knowledge about inequality in societies and potential inequality in the future hampers our ability to assess who in a society is vulnerable and to what.

# Why adaptation and vulnerability research can be controversial

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- Trace out causal chains of forces & relations that give rise to vulnerability
- Leads to identification of policy options that redress the causes of vulnerability, rather than just its symptoms
- E.g., farming marginal lands creates a vulnerability. Options:
  - Identify and promote approaches and systems better suited to farming dry, marginal areas
  - Provide social safety net to smooth out societal consequences of climate variability
  - Address forces driving use of marginal lands

# Top-down and bottom-up approaches are compatible

- Integration holds promise of starting from knowledge of baseline conditions and then projecting forward to analyze adaptation needs and relative vulnerabilities of different choices
- More attention to development of scenarios for adaptation/vulnerability assessment is required