Scenario Needs for Vulnerability Assessment and “Strategy Differentiation”

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This presentation ...

- Update—new directions
- Scenarios: status and challenges
- Vulnerability assessment: integrating environmental and socio-economic information
New directions for research

- CCRI-USGCRP
- “Because of the scientific accomplishments [of] USGCRP and other research programs during a productive ‘period of discovery and characterization’ since 1990, we are now ready to move into a new ‘period of differentiation and strategy investigation’....”

James R. Mahoney
Congressional testimony
10 and 11 July 2002
Increasing importance of scenarios

- Scientific analysis should address “if ..., then ...” questions, and should focus on
  - Comparisons of suggested mitigation strategies (economic growth, emissions, technology, energy, ...)
  - Environmental implications (climate, land use, ...)
  - Interactions of coupled human-environment systems at scales relevant to enhancing resilience (adaptation)
  - Uncertainties
  - National policy makers as distinguished from decision makers
Scenarios

“... a coherent, internally consistent, and plausible description of a possible future state of the world.” IPCC TAR, WG II, Chapter 3

- Climate scenarios (different methods and scales)
- Socio-economic scenarios (emissions and vulnerability)
- Land use and land cover change scenarios
- Environmental scenarios (atmospheric composition, pollutant loading, ...)
- Sea-level rise scenarios
- ...

...
Challenges

- Improve observations, modeling, and data/information systems to support analysis of anomalies in climate and impacts sectors
  - Accelerate transfer of climate info to impacts work
- Develop common framework to facilitate consistency but that also allows flexibility
  - Common framework (e.g., SRES) establishes trends to make individually-developed scenarios consistent
  - Different inputs for different models/sectors
  - Different development paths for different regions, constrained by global trends
- Improve interactions with stakeholders to develop climate information for specific needs
- Improve socio-economic scenarios
Vulnerability/Resilience

Propensity to suffer harm or damage

- Vulnerability integrates biophysical and socio-economic factors: exposure, sensitivity, adaptation/coping capacity
- Considers interactions across sectors
- Include “bottom-up” perspective

“Climate impact assessment addresses the magnitude and distribution of the consequences of climate variability and change. Vulnerability assessment extends the impact assessment by highlighting who ... is susceptible, how susceptible they are, and why.” Ribot, et al., 1996
Approaches to vulnerability assessment

- Qualitative case studies
  - Research mode
  - Stakeholder-driven processes
- Assessments that integrate quantitative impacts models and qualitative analysis
- Risk assessment (incorporation of probabilities)
- Indicators (n.b. J.C. Watts vulnerability reduction legislation)
Coping Range Vulnerable Stationary Climate &

Changing Climate Vulnerable

Coping Range

Vulnerable

Adaptation

Coping Range

Vulnerable

Planning Horizon

Jones and Boer, in draft
Quantifying vulnerability and resilience

Sensitivity sectors

- Settlement
- Food
- Health
- Ecosystems
- Water

Coping and Adaptive Capacity

- Economics
- Human Resources
- Environment

Baseline Estimates and Projections of Sectoral Indicators, Sensitivity and Coping-Adaptive Capacity, and Vulnerability-Resilience Response Indicators to Climate Change
# Sample proxy variables

| Settlement sensitivity | Population at flood risk from SLR  
| | % Population with access to safe water  
| | % Population with access to sanitation  
| Food sensitivity | Cereal production/area crop land  
| | Animal protein consumption per capita  
| Human health sensitivity | Completed fertility  
| | Life expectancy  
| Ecosystem sensitivity | % Managed land  
| | Fertilizer use/area cropland  
| Water sensitivity | Water supply from internal resources and inflow from rivers  
| | Withdrawals to meet current and projected needs  
| Economic capacity | GDP (market) per capita  
| | Income distribution equity (Gini coefficient)  
| Human resource capacity | % Population in the workforce (age dependency)  
| | Illiteracy  
| Environmental capacity | % non-managed land  
| | SO₂ emissions  
| | Population density  

Baseline Vulnerability-Resilience Indicator Value
(World value = 0 for 1990)
Sampling is done from probability distributions of proxy values.

(Definite limits result in triangular distributions)

The model:

\[ F(p_1 \text{ through } p_{17}) \]

Calculation result:

Mean value, which is not necessarily the same value.
Concluding thoughts

“Differentiation and strategy investigation” creates new demands and opportunities for global change research community (include local/regional)

Emphasis on improving development and application of scenarios

Set up integrated analyses from emissions to vulnerability (tradeoffs and synergies, “what-if”)

Provide coordination across sectors and regions
Program initiative on scenario development and application

- Climate observations, modeling, analysis
- Dedicated assessment modeling capability for climate, including improved delivery systems (uncertainties)
- Socio-economic scenario development
  - Address factors affecting vulnerability as well as those influencing emissions
  - Integration of state of knowledge in contributing fields
  - Combine top-down and bottom-up
- Education effort on what scenarios are and how they should be interpreted