

Sustained Assessment and Decision Support: Challenges for Science and Society

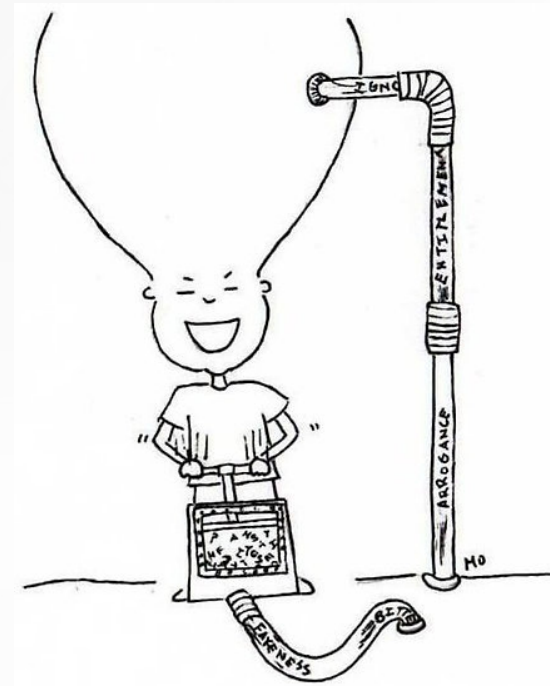
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Two Rules from Energy Modeling Forum Snowmass Workshops

- Its not all about you!



Acknowledgements

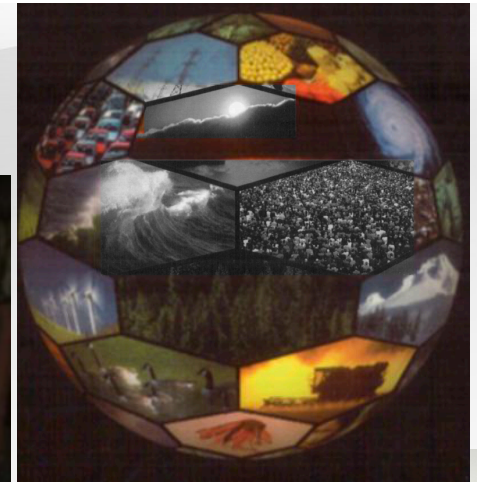


- ▶ Jerry and John
- ▶ The many colleagues from whom I've learned
- ▶ The contributions of these colleagues to the collective products we've produced over the years



Science-Policy Interface 1: IPCC WG II

- ▶ Involved since Second Assessment Report (SAR)
 - WG II TSU Head (Later: LA, RE, chair task group on scenarios)
 - Watson, Bolin, Albritton, Dokken, ...
 - Covered impacts, mitigation, cross-sectoral (land use & geoengineering!)
 - Innovations from SAR to TAR:
 - Technical Papers
 - Regional Impacts SR
 - SRES
 - Synthesis Report
- ▶ Experience gave rise to three personal research interests...



Communicating Confidence and Uncertainty

- ▶ 1996 AGCI
- ▶ Improve communication within author teams as well as external groups
- ▶ Encourage examination of the ‘tails’

Steps:

1. Identify uncertainties that most affect the conclusions
2. Document ranges and distributions in the literature
3. Determine an appropriate level of precision
4. Characterize the distribution of values
5. Rate and describe the state of scientific information
6. Prepare a “traceable account”



Level of Agreement/ Consensus	HIGH	
	Established but Incomplete	Well Established
	Speculative	Competing Explanations
	LOW	HIGH

Amount of Evidence (Observations, model output, theory, etc)

Future research

- ▶ Empirical testing (authors and end users)

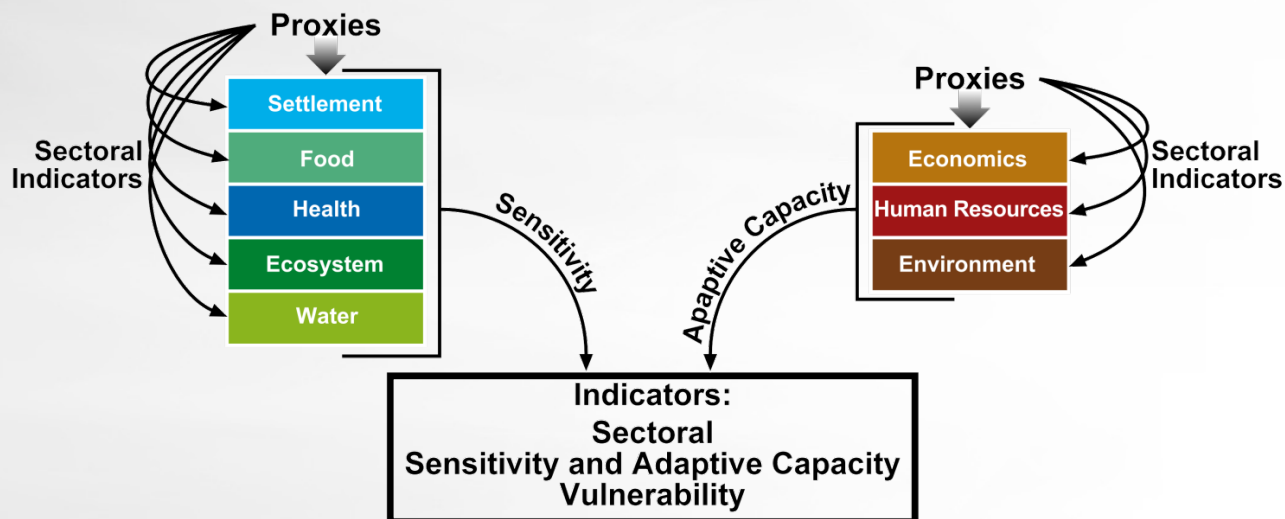
Training

Vulnerability-Resilience Indicator Model (VRIM)

- ▶ SAR Problem: lack of aggregation methods for 'so what?' question
- ▶ Develop indicator of vulnerability/resilience
- ▶ Observations and projections with uncertainty analysis and scenarios; incorporated some SAR results in original
- ▶ Multi-scale, used in IPCC, National Intelligence estimates



Quantifying Vulnerability to Climate Change Exposure

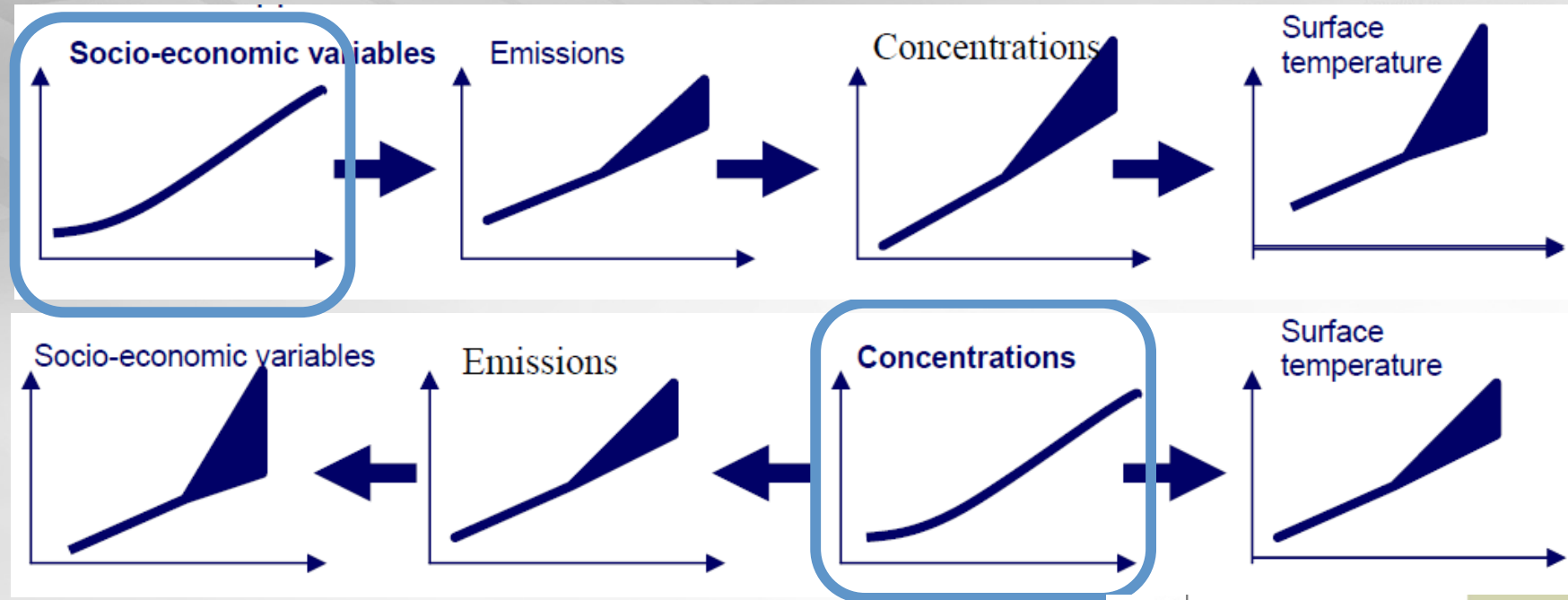


Future:

- ▶ Research on proxies
- ▶ Community engagement/ planning
- ▶ Application with monitoring adaptation and resilience

RCP (or 'Parallel') Scenario Process

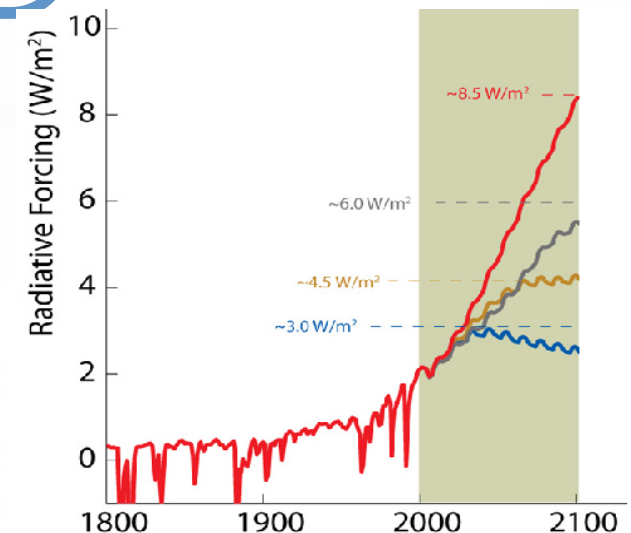
Multiple motivations: add IAV assessment to goal



Meehl et al. 2007, WCRP Report.

Future research:

- ▶ What does this range mean? →
- ▶ Probabilistic information?
- ▶ Socioeconomic scenario development?
- ▶ Integration of scenario components for applications?
- ▶ New scenarios for CMIP6?





Personal Reflection on IPCC

- ▶ IPCC has informed policy makers – the failure to act rests with our institutions and ‘theory of change’
 - “International agreements are a precondition for addressing climate change”
 - “The type of control ... [needed] could scarcely help clashing with some of our cherished notions of free enterprise. ... ordinary international agreements might prove inadequate ... but an international regime that imposed actual penalties would be ‘sure to foster great heat and controversy’” (Yeager and Stark, 1958)
 - “Climate diplomacy will increasingly become a zombie exercise.” (Jamieson, 2014)
- ▶ An updated vision for the IPCC is needed
 - Clearer sense of audience and purpose
 - New WG structure
 - Shorter science foundation reports
 - Special reports/papers on priority topics

Science-Policy Interface 2: US GCRP and CCSP

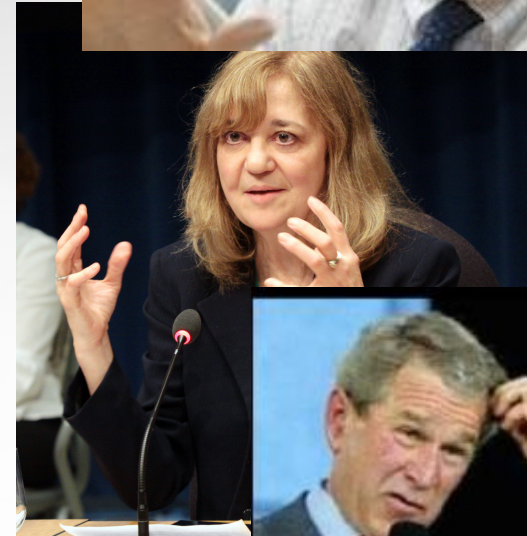
► USGCRP

- Office Director, 2000-2006
- 1st National Climate Assessment
- 'Gore Administration' science plan using NRC "Pathways" framework
- Strong push towards 'regional science'
- Evidently, the Supreme Court didn't like the plan...

► The Climate Change Science Program (CCSP)

- Cheney task force: emphasize WG I science
- Suppression of the 1st NCA/Cooney edits/Piltz leak to Revkin
- Revision of science plan: regional science becomes 'adaptive management'
- Includes 'decision support': SAPs, traditional assessments, DS 'experiments'

June 1, 2015



Opportunities for US Climate Science, IAV Research, and Science of Decision Support

- ▶ Roles: NCADAC ES, Scenarios, UC, CLA
- ▶ NCA3 – a great leap forward thanks to several hundred individuals with leadership from Jerry Melillo, Kathy Jacobs, and others
 - High level messages received, lots of press coverage
 - Closed ‘policy window’ limited ultimate impact
 - How well did we support sectoral/regional users?
- ▶ NACANET identified people who do want to act
 - More institutions and individuals will want to evaluate the implications and possible responses as climate change accelerates and intensifies.
- ▶ These diverse needs cannot be met with a centralized, top-down process. Meeting these needs create some frontiers/opportunities including:
 - Sustained assessment
 - Improvements in IAV Science
 - Decision support tool development



Sustained Assessment

- The NCADAC prepared a special report to the Federal government on how to develop a new assessment approach to meet these needs.
- The goal is to
 - “Enhance the ability of decision-makers at multiple scales throughout the United States to anticipate, mitigate, and adapt to changes in the global environment”
- The report defines the new approach as ‘sustained assessment’ and provides a roadmap for creating it, building on NCA3. Key features:
 - Sustained partnerships
 - Tools and methods
 - Assessment infrastructure
 - Broadened resource base
- Informed by NRC reports and other literature

Contrast with IPCC Approach

- For many, assessment=IPCC
 - Centralized production of approved products
 - Report-focused
 - Linear (one-way) communications
- Sustained assessment:
 - Decentralized: local/regional experts tailor broader range of products, not 'approved'
 - Periodic 'approved' reports provide 'snapshots' of state of knowledge, assess decentralized products
 - Requires new science products and assessment tools (see specific suggestions in 'conclusions')

“Adaptation Science” for Climate Preparedness

Objectives

- Highlight the integrated science required to correct maladaptations to current climate variability and prepare for future climate change.
- Support USGCRP plan.



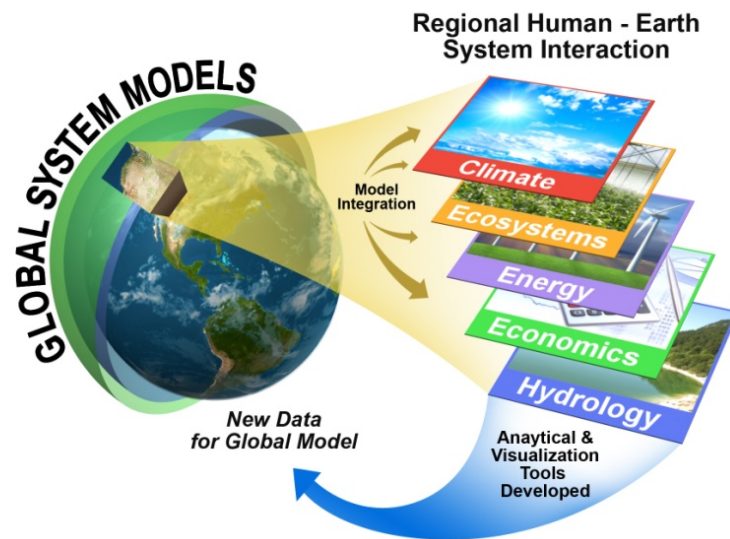
Impacts from extreme weather events such as Hurricane Sandy in 2012, shows the vulnerability of the U.S. and other regions to extreme climate in the present and future. Preparedness measures can cost-effectively increase society's resilience.

Approach

- Through an AGCI workshop, the authors evaluated research and approaches to improve information for climate risk management. Four challenges:
 - 1) characterize decisions and information requirements;
 - 2) identify vulnerabilities;
 - 3) improve projections of climate change and other stressors; and
 - 4) understand barriers and options for adaptation.
- Progress depends on more systematic approach to IAV science: identifying observations, process research, modeling, and decision science for priority risks

Characterizing Uncertainty in Integrated Models

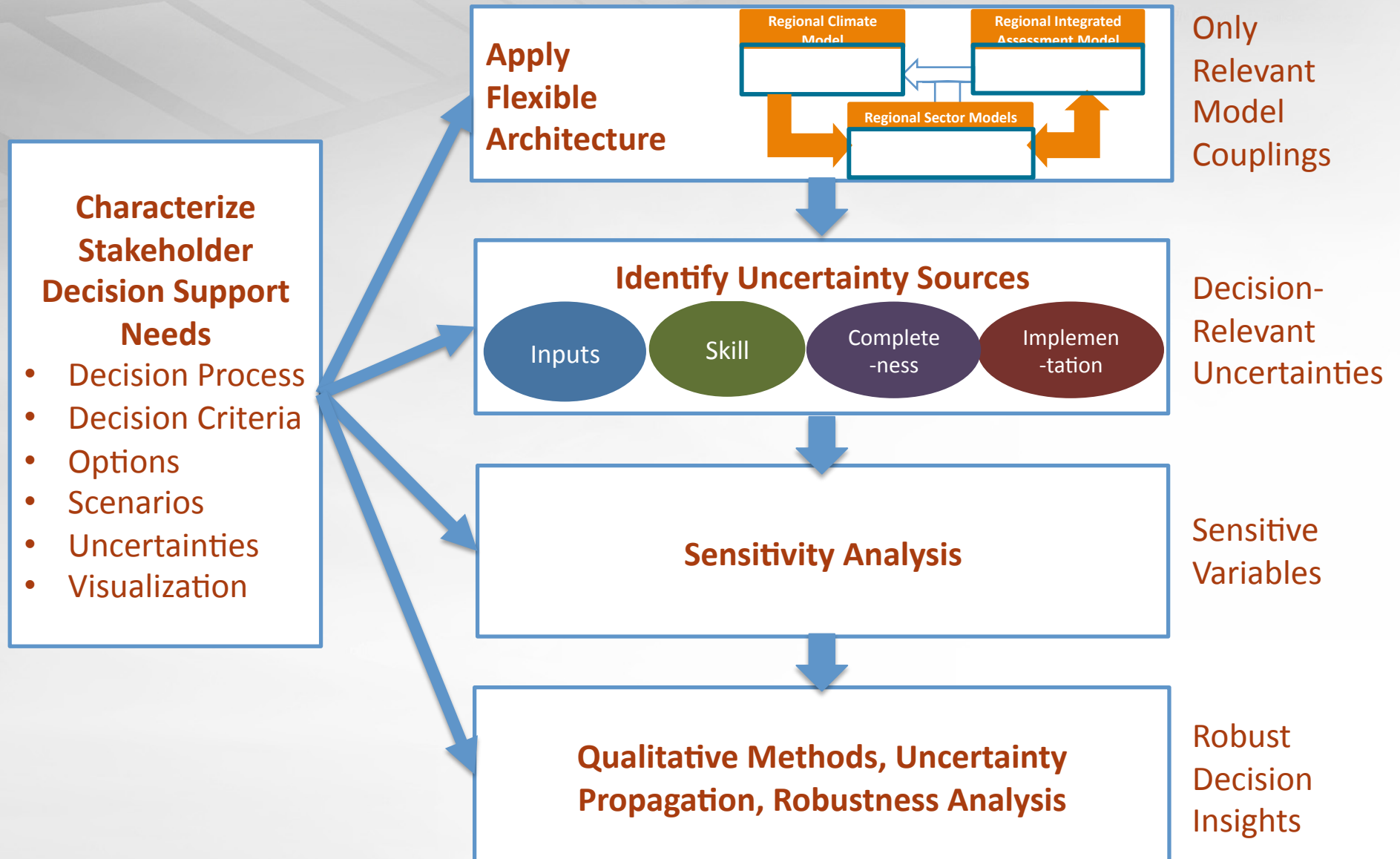
- ▶ How can we manage the complexity and dimensionality of uncertainty characterization (UC) in regional scale modeling?



- **Many Thousands of Uncertain Parameters and Modeling Assumptions**
- **Long Run Times**

- ▶ New approaches are needed to ensure that UC is relevant and tractable.
 - Guide model development with stakeholder input on needs
 - Give robust input to decision makers with decision-focused UC

User Oriented Uncertainty Characterization Process





26. Decision Support

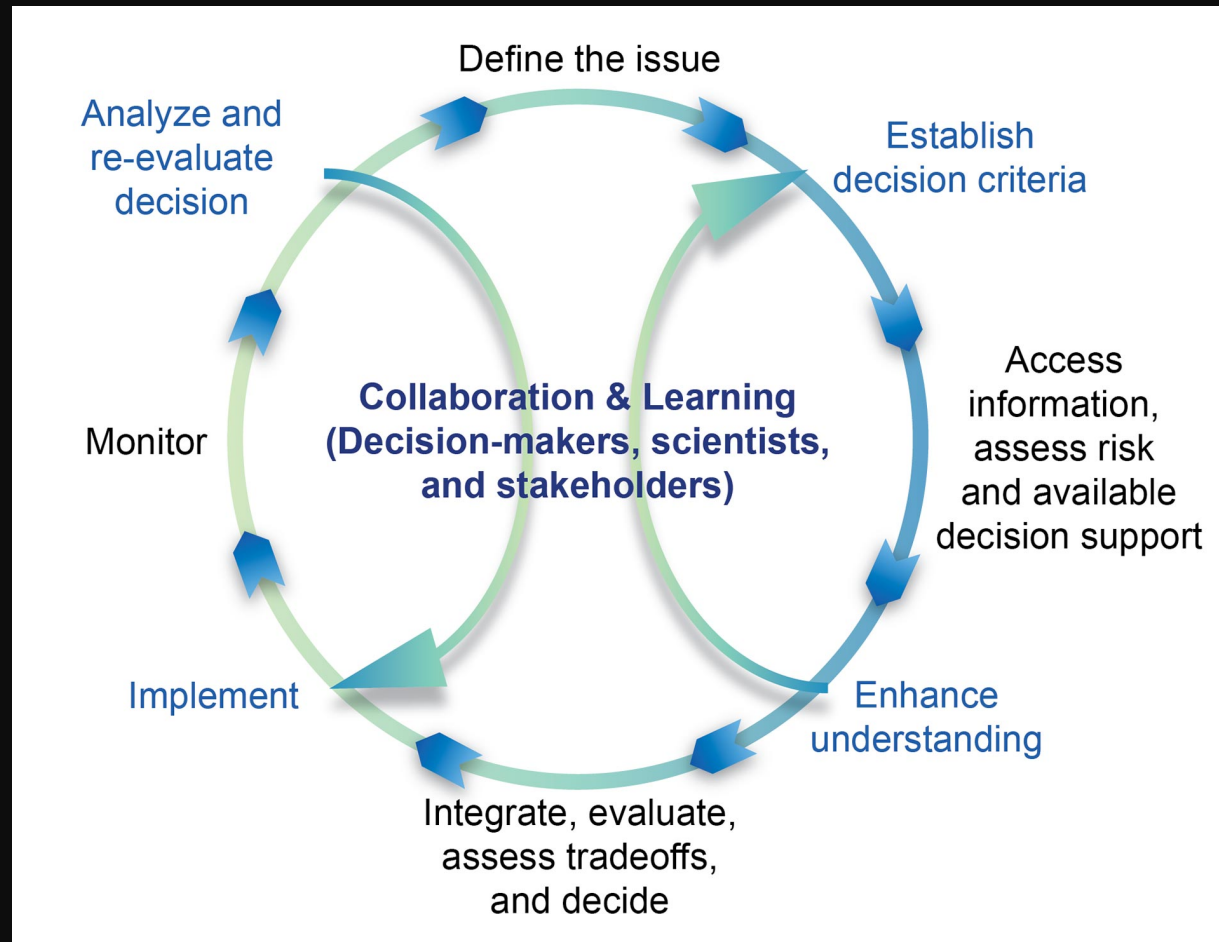
Connecting Science, Risk Perception, and Decisions

nca2014.globalchange.gov/report/response-strategies/decision-support

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Idealized Iterative Risk-Management Framework





Possible Next Steps

- Develop USGCRP vision and strategy for a collective effort to promote DS tool development, assessment, and use
 - Engage private sector
- Establish focal points (overall, sectors, regions)
- Collect information
- Assess DS tools, evolve good practice standards
- Establish fellowships, research grant competitions, etc. to develop human resources

Frontiers

- ▶ Establish process for sustained assessment
- ▶ Research on and methods for assessment (See NCADAC special report)
 - Vulnerability/resilience/risk assessment methods
 - Scenario methods and products
 - Valuation methods
 - Indicators
 - International implications and societal 'teleconnections'
 - Methods and training for assessing confidence and uncertainties
- ▶ IAV research
 - Consider approach that identifies needed observations, process research, modeling, and applications for priority IAV issues
- ▶ Research in decision sciences using global change science



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Thank you!

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