

Integrated Assessment Modeling: Where Do We Want to Be in Five Years?

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Workshop on Climate Change Impacts and Integrated Assessment (CCI/IA)
Snowmass, CO

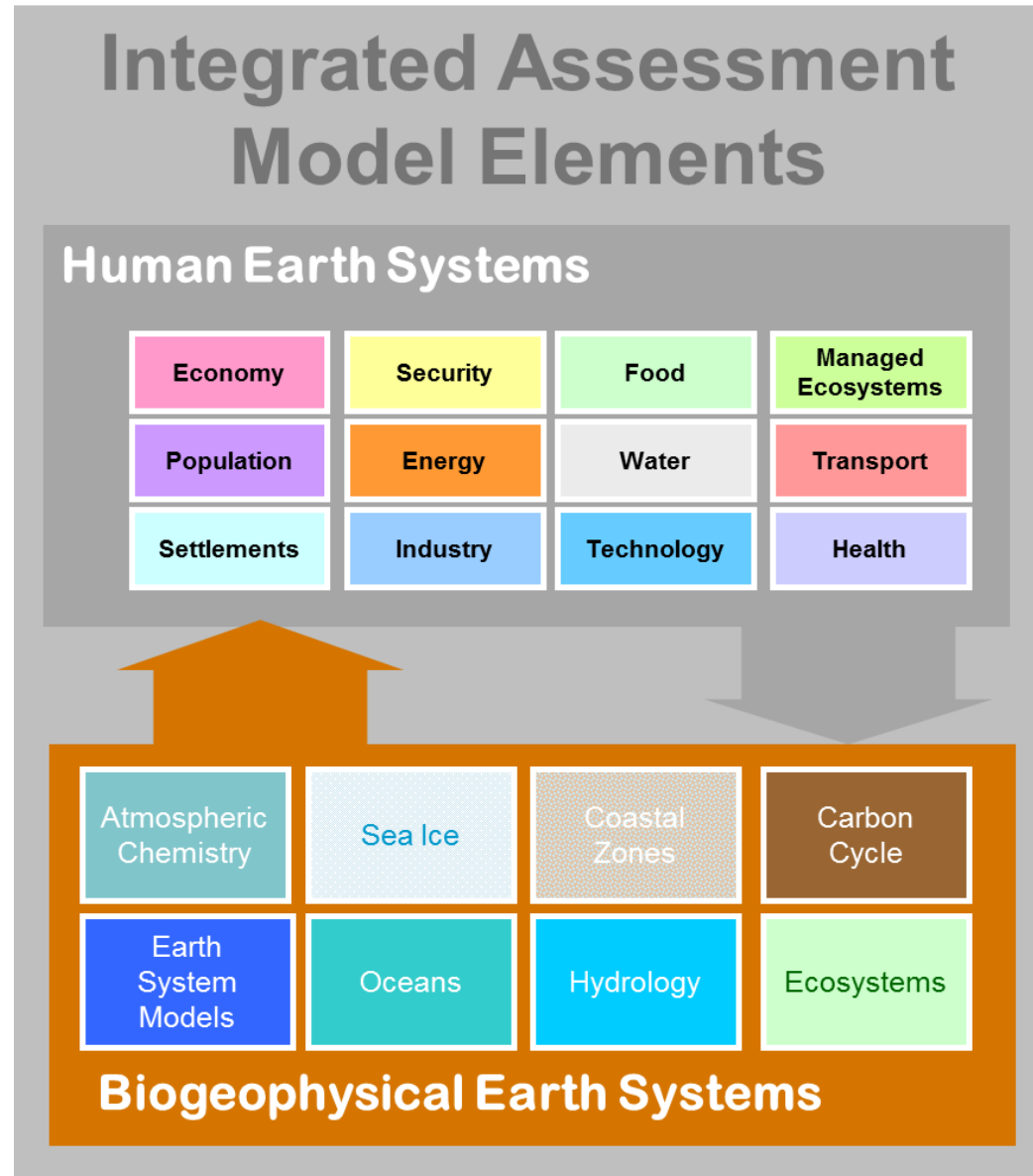
26 July 2013

The First Question: Which Integrated Assessment Models?

- ▶ There may have been a time when the question was irrelevant, but that time has long since passed.
- ▶ As John Weyant pointed out in his opening remarks for this 19th assemblage of the *Workshop on Climate Change Impacts and Integrated Assessment (CCI/IA)*: the IAM community has evolved into many communities focused on very different goals and objectives.
 - Aggregated Social Cost of Carbon IA Models
 - Computable General Equilibrium IA Models
 - Energy Systems Oriented IA Models
 - Full “Star Cruiser” RCP Class Structural IA
- ▶ **DO WE NEED TO THINK ABOUT NEW NAMES?**

My remarks are going to be limited to the perspective of an RCP-Class IAM modeling team

- ▶ Provide the human Earth system drivers for biogeophysical models.
- ▶ Bring all of the pieces of the climate puzzle together to provide insights that would not have been available from disciplinary research alone.
- ▶ Science-based decision support tools, historically for the analysis of emissions mitigation.



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- ▶ Emissions mitigation analysis is presently and will continue to be an important use of RCP-class IAMs.

Integrated Assessment Model Elements

Human Earth Systems

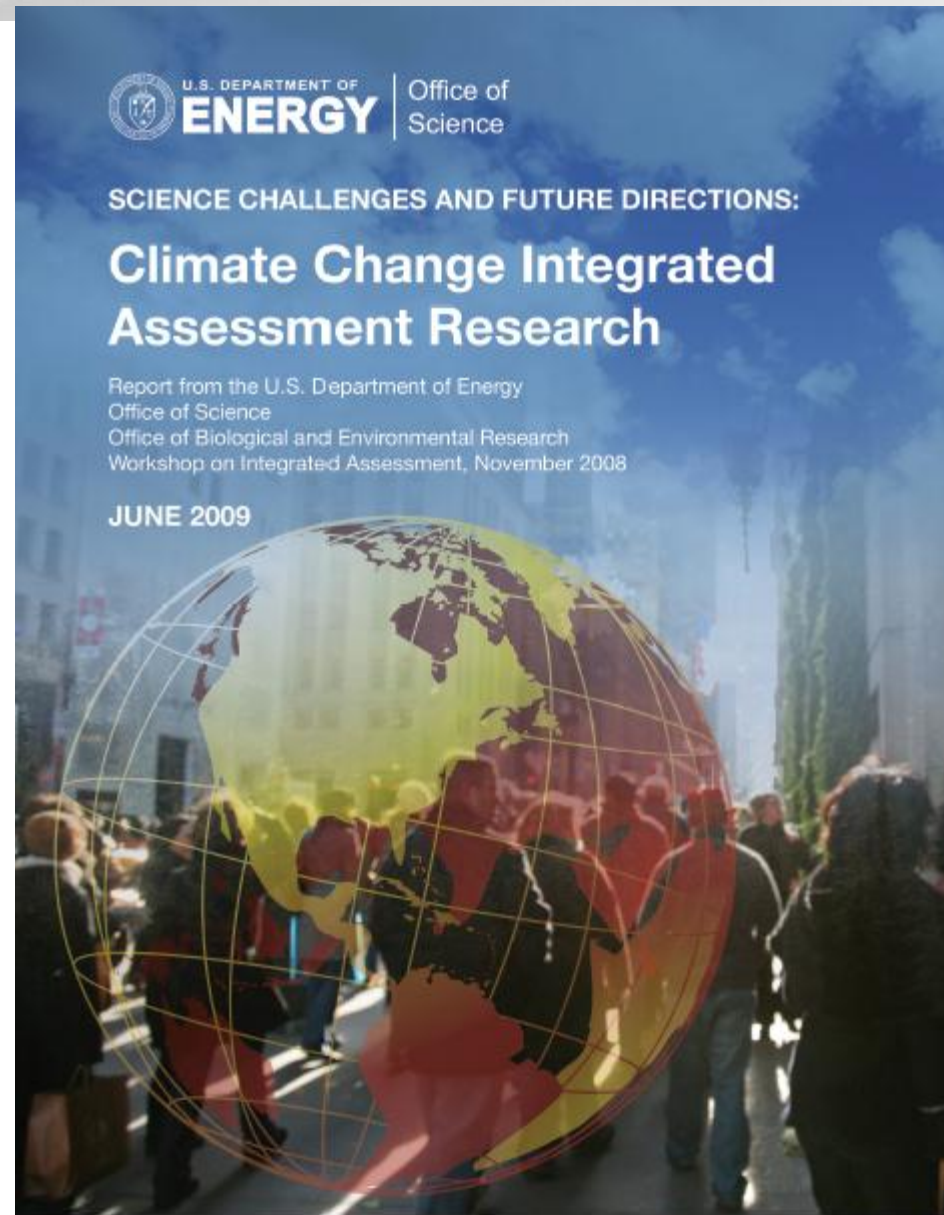
Economy	Security	Food	Managed Ecosystems
Population	Energy	Water	Transport
Settlements	Industry	Technology	Health

Atmospheric Chemistry	Sea Ice	Coastal Zones	Carbon Cycle
Earth System Models	Oceans	Hydrology	Ecosystems

Biogeophysical Earth Systems

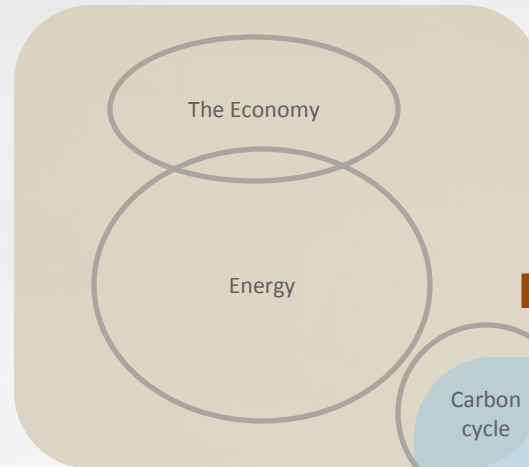
June 2009 DOE Report on Scientific Challenges and Future Research Directions

- ▶ This report reviewed the, then current state-of-the-art with regard to integrated assessment models.
- ▶ Looked forward to think about the future scientific research challenges and directions.

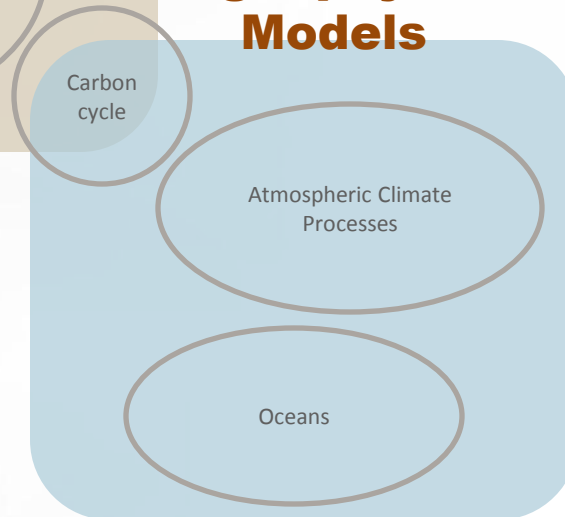


Growing Overlap in Domains

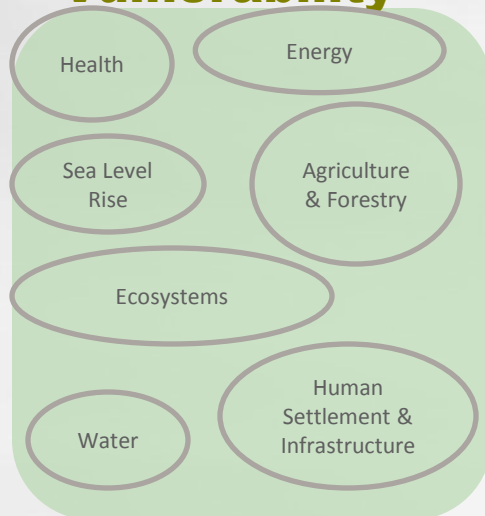
Integrated Assessment Models



Biogeophysical Models



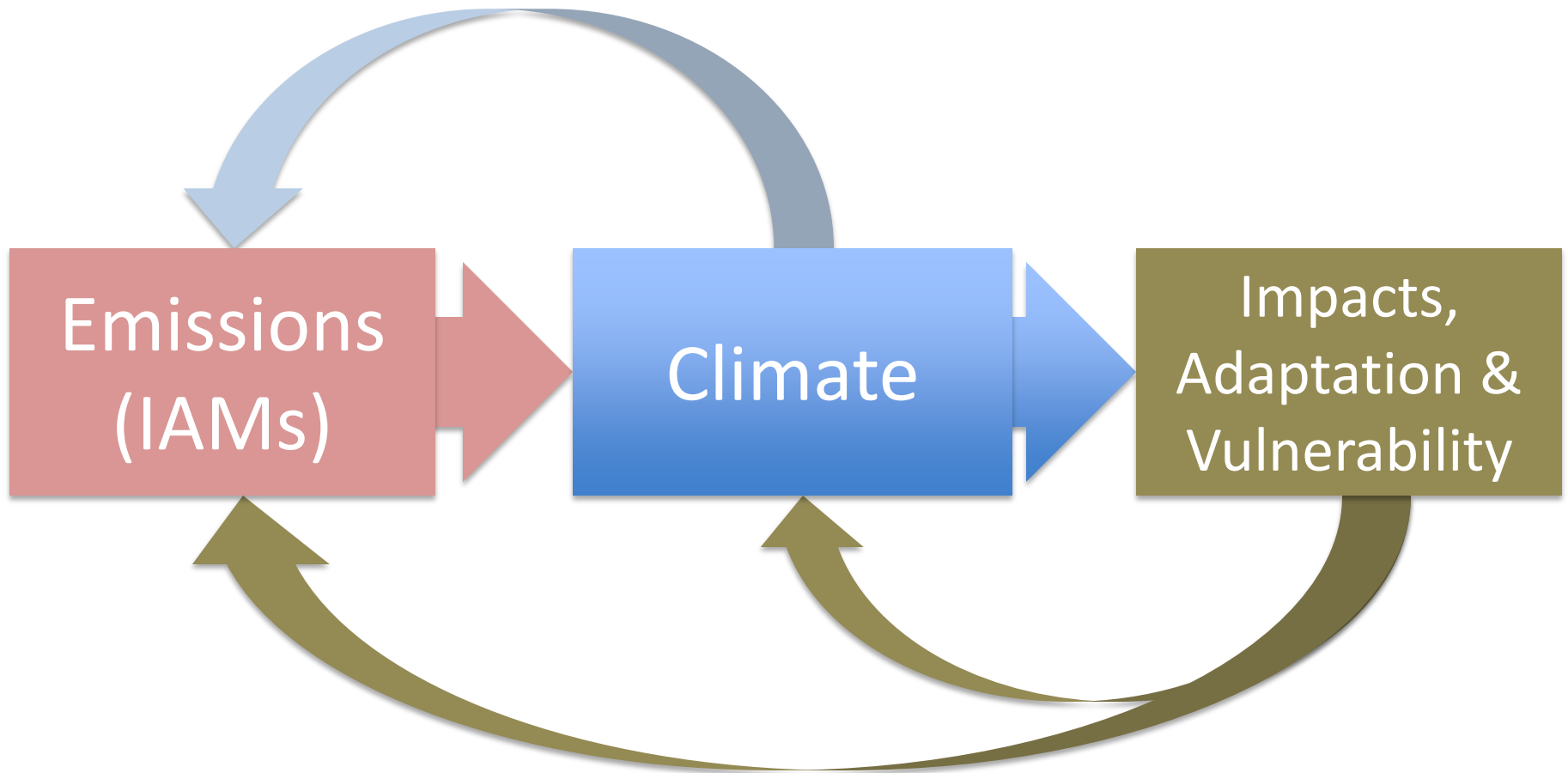
Impacts, Adaptation & Vulnerability



The Linear Approach to Climate Assessment and Research



The Real World is Not Neatly Linear

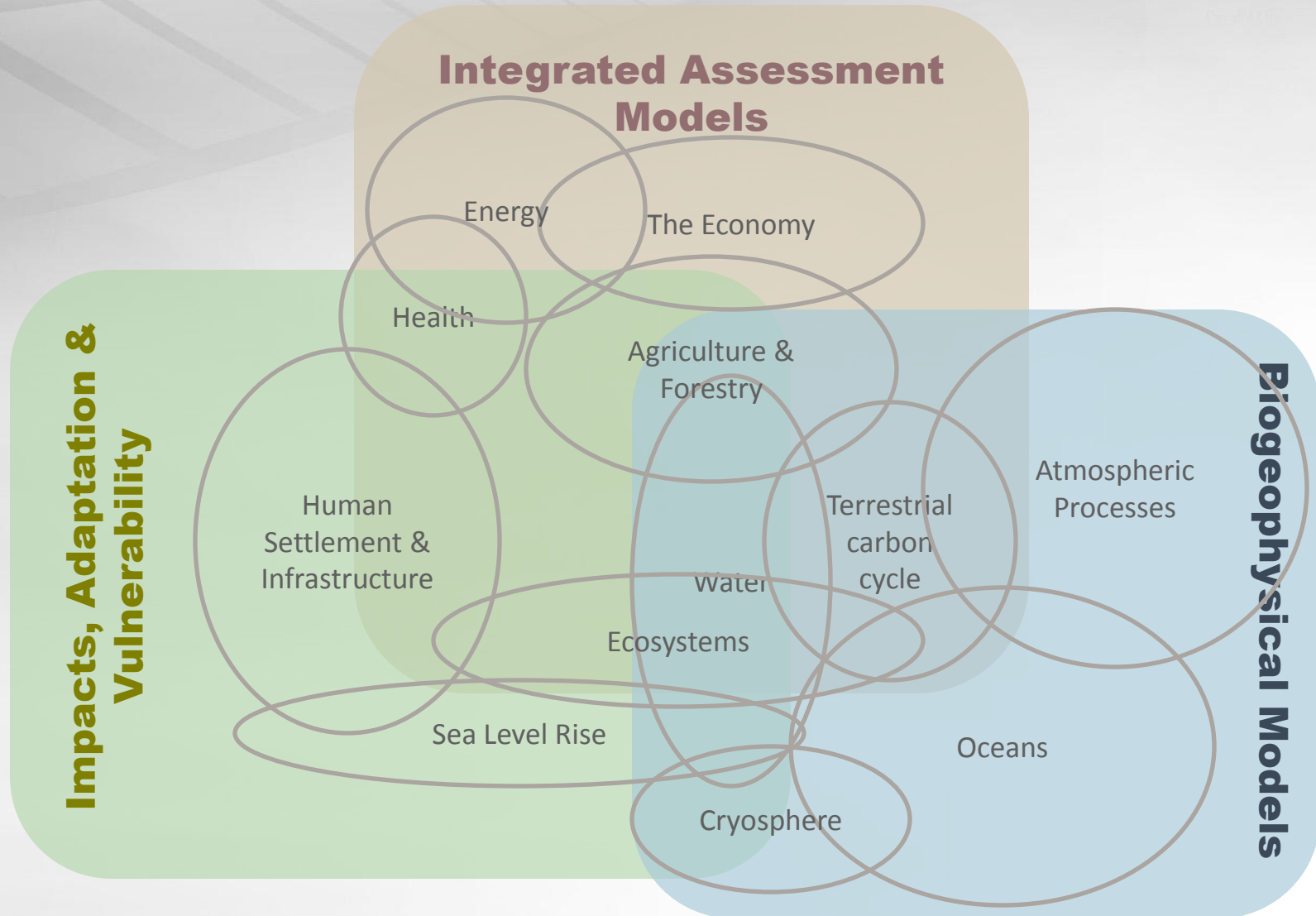


Growing Overlap in Domains

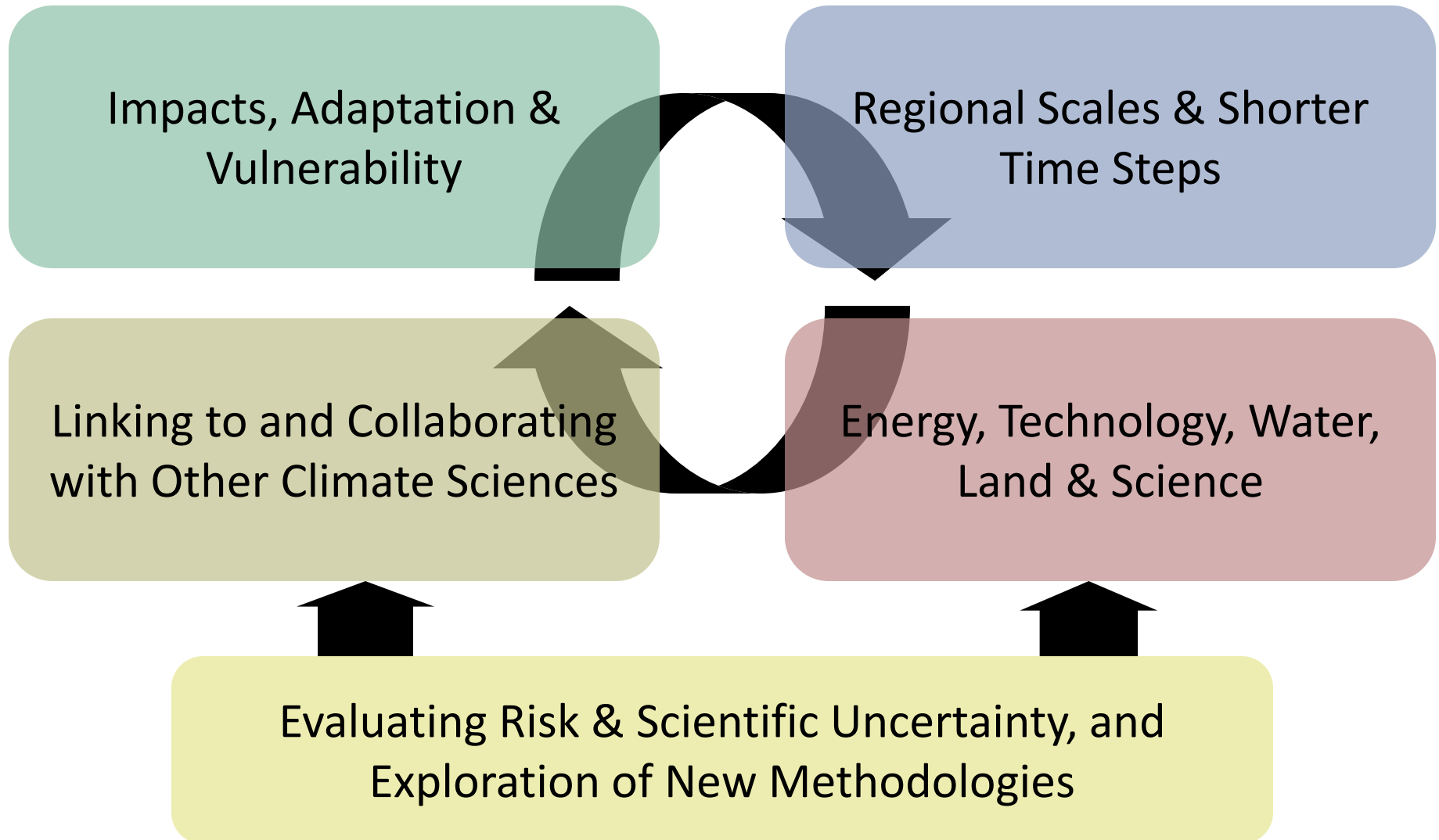


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Major Scientific Challenges



Some Progress and But Much Remains to Be Accomplished Over the Next 5 Years



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- ▶ **IAV**—links are being built in IAMs, e.g. building sectors with HDD & CDDs, links to Wind and Solar resources, Agriculture, Land Use, and Bioenergy. Need to move toward building stronger links back to the biogeophysical science and models. (See below.)
- ▶ **Links to Biogeophysical Sciences**—continued collaboration with biogeophysical modelers (RCPs, SSPs), CMIP6?; closer coupling, e.g. collaboration between PNNL, LBNL, & ORNL to develop an integrated Earth System Model (iESM) based on GCAM, GLM, CLM, & CESM.

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- ▶ **Finer Spatial & Temporal Resolution**—*movement to develop higher resolution; nested high-resolution regional disaggregation (regional integrated assessment; links to regional infrastructure models; and regional climate, hydrology, land.)*
- ▶ **Energy, Land & Water**—*IAMs have made good progress on the energy-land connections, e.g. IAMs are increasingly requiring bioenergy crops to compete with other land uses, and explicitly consider biological waste streams. And, IAMs have begun the development of usable hydrology models, but the full integration, where water resources represent a meaningful determinant of crop yields remains to be done.*

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- ▶ **Uncertainty and Risk**—*we have a long tradition of exploring uncertainty and risk, e.g. Monte Carlo, scenarios, sensitivity, & ensemble calculations; but just as we cannot predict the future with certainty, we won't be able to predict the distribution of future uncertainty. We will still need to continue to characterize risk and uncertainty, but we need to do in light of methodological limitations.*

What Else? Making the IAM community a stronger community

- ▶ **Models have become increasingly open**—IAMs are increasingly open, available and designed for model interoperability.
- ▶ **Model documentation**—developing standards for model documentation
- ▶ **Development of conventions** for data reporting, regions, time, and outputs
- ▶ **Model diagnosis and evaluation**—developing the time series data that will allow models to be tested in “spin-up” mode against history. Development of figures of merit for model performance

Summing Up

- ▶ We've made progress.
- ▶ We have a robust research agenda for the IAM community.
- ▶ But, there an enormous amount of work ahead.



TOWN OF
SNOWMASS VILLAGE

ESTABLISHED

1967

ELEVATION

8388

POPULATION

2826

TOTAL

13,181

DISCUSSION