

# INTRODUCTION TO TODAY'S SESSION

## Integrating SSPs, SPAs, RCP-based Climate Scenarios: What's Next?

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

31 July 2014

## A note on Snowmass at 20

- ▶ Snowmass can change things pretty dramatically.



- ▶ The Integrated Assessment Modeling community owes an enormous debt to John Weyant.

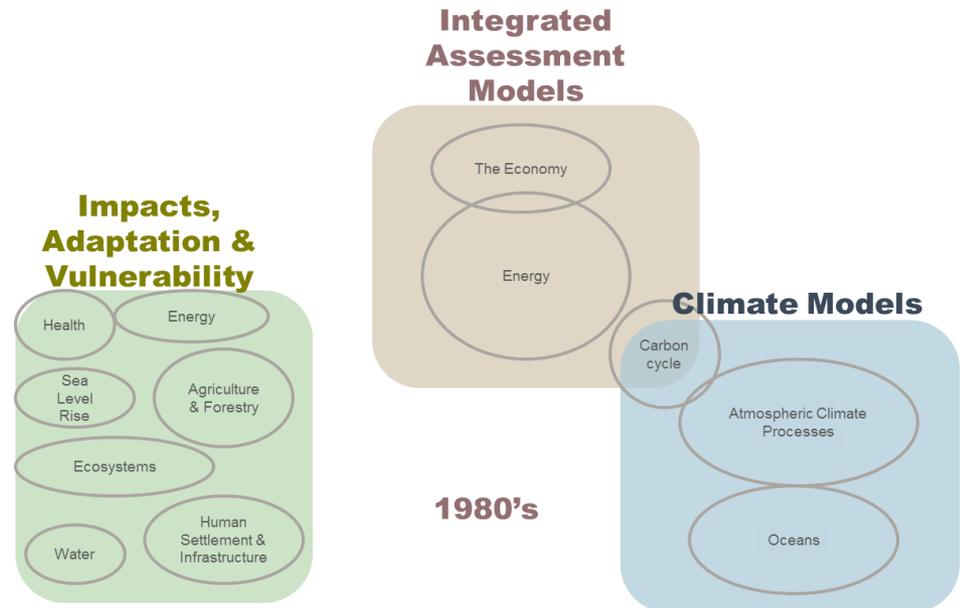
# What has Snowmass done for us lately?

- ▶ In part its about the numbers.
- ▶ But, its much more about the connections
  - Across disciplines
  - Across the researchers

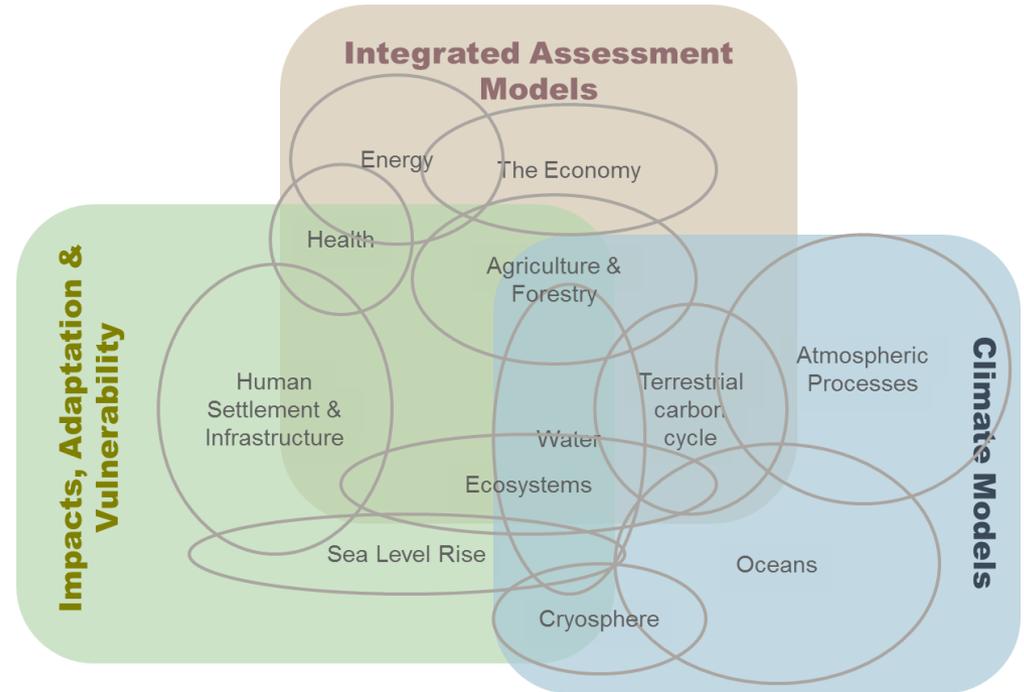


# Thanks John

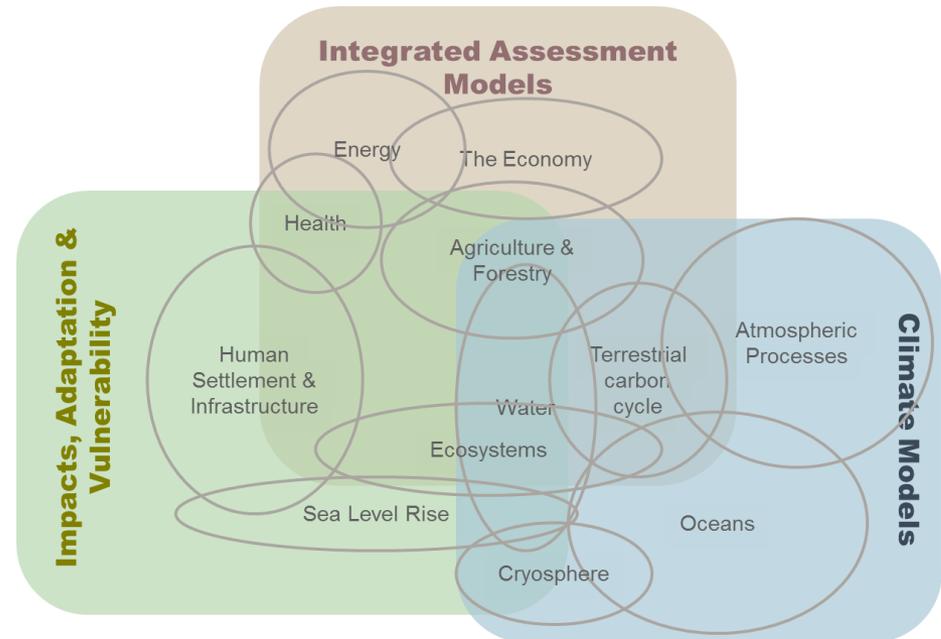
- ▶ The IAM community has traditionally produced scenarios to serve two communities:
  - ▶ Biogeophysical science (carbon cycle & climate; e.g. RCPs)
  - ▶ Policy analysis (emissions mitigation; e.g. EMF 22, 27, AMPERE, LIMITS)



- ▶ The climate research is much larger than IAM and CM.
- ▶ One of the largest research communities conducts research on Impacts Adaptation and Vulnerability (IAV).
- ▶ In addition, IAV decision makers need scenarios.
- ▶ Finally, the climate research community has evolved to the point where it is no longer a set of isolated disciplinary domains.



- ▶ This session is intended to continue a discussion about how we move to a world in which scenario development serves the larger climate research and decision support communities with particular emphasis on IAV.
- ▶ What will the new SSP-based scenarios look like and what information will be available?
- ▶ What information do IAV researchers need/want?
- ▶ What has been the experience of those brave IAV researchers who have used or at least tried to use scenarios?



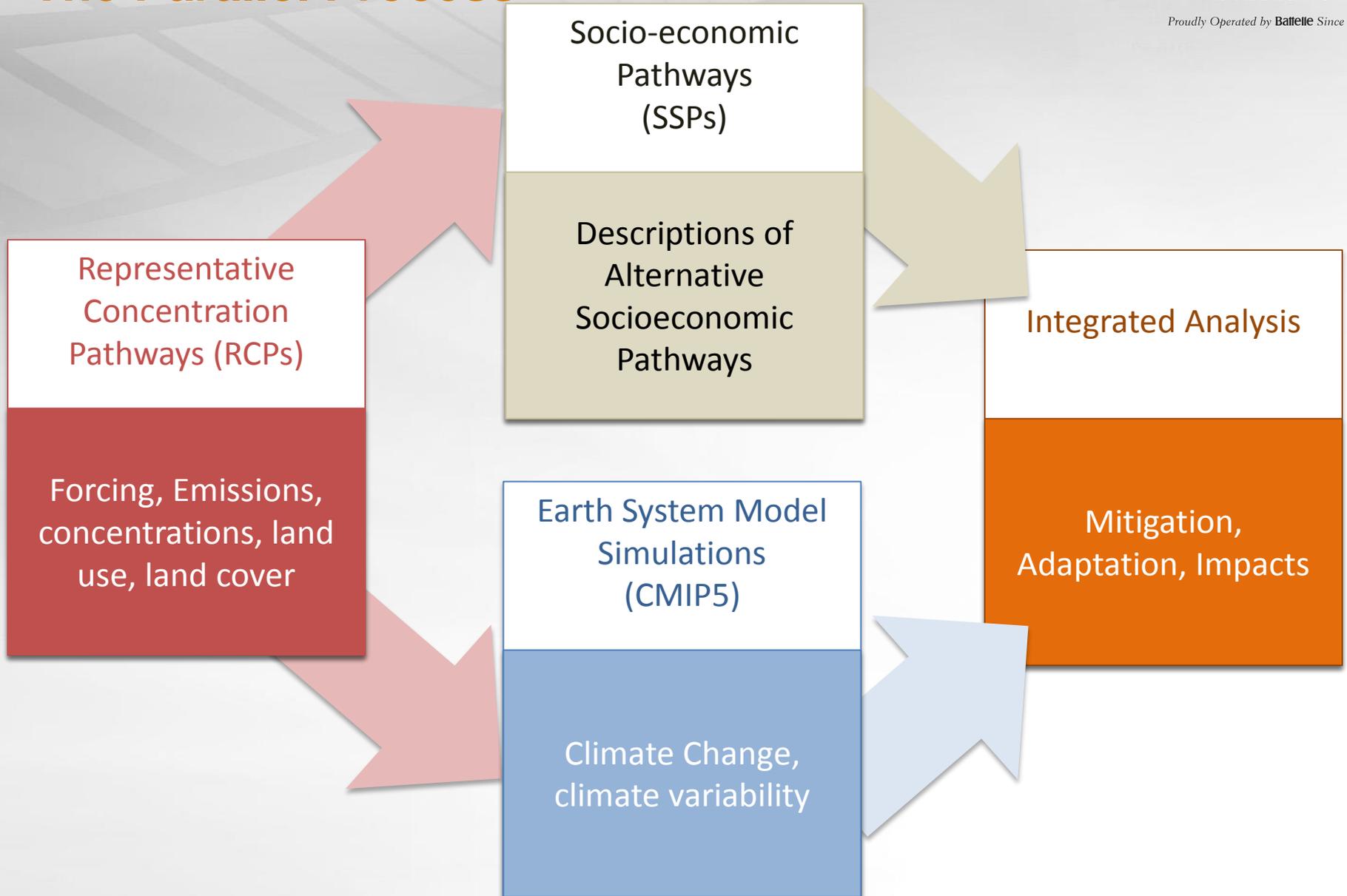
# The Story the Present Generation of Scenarios Begins in 2006 ...

- ▶ ... at an AGCI session to plan CMIP5.
- ▶ It continued in a 2007 EMF CCI-IA workshop and a workshop on scenarios in Noorwijkerhout, The Netherlands in Sept. 2007.
- ▶ *“The principal objective of the meeting is to identify requirements and plans for the development of new scenarios of emissions, climate change, and adaptation and mitigation (including underlying socioeconomic conditions that shape emissions and vulnerability).”*
- ▶ That meeting set the architecture for community scenario development process that continues through the present.
- ▶ Snowmass has played a major role in the process.
- ▶ One byproduct of the process was the Integrated Assessment Modeling Consortium (IAMC).



Noordwijkerhout, Koetshuis uit 1884

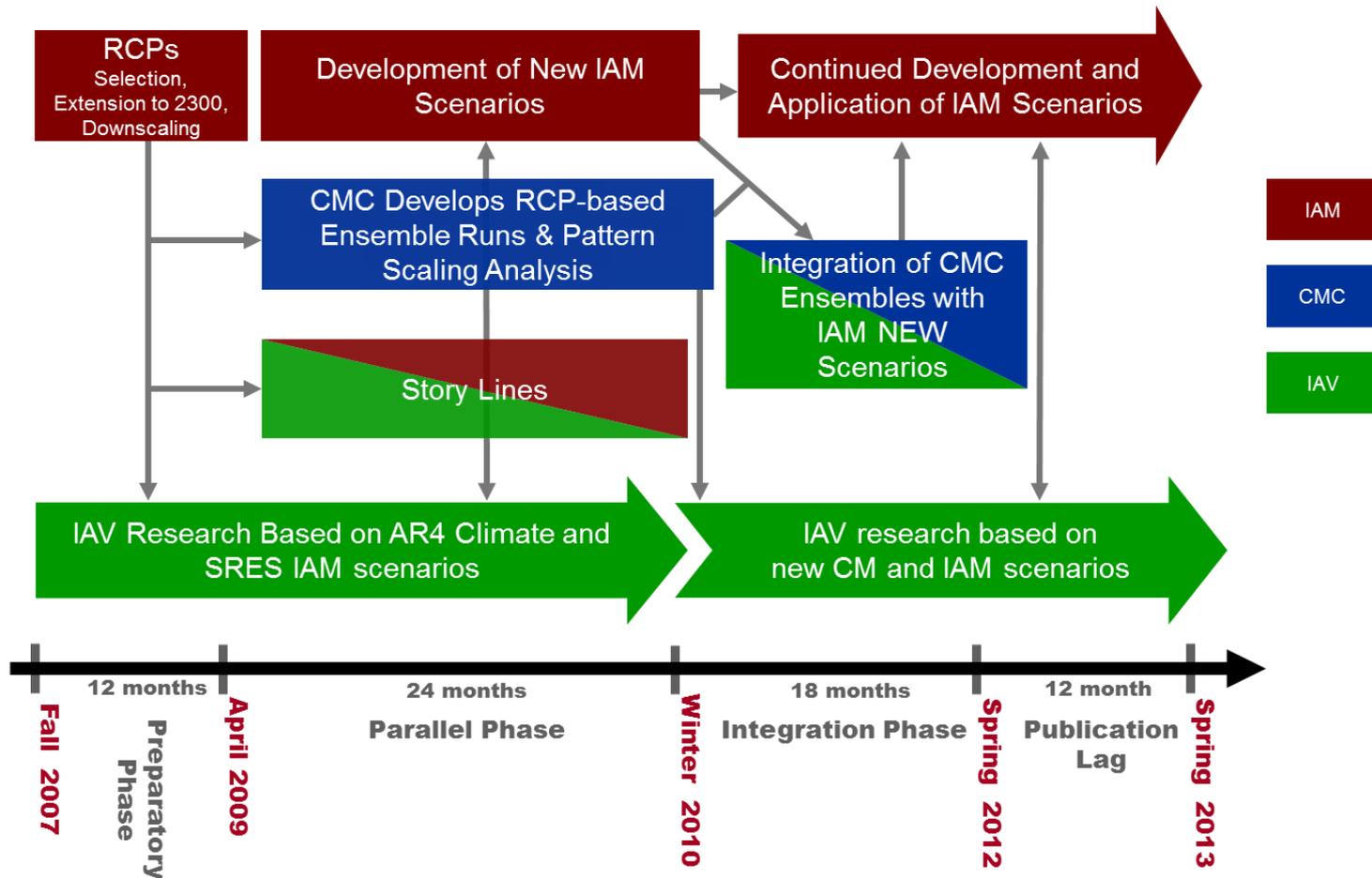
# The Parallel Process



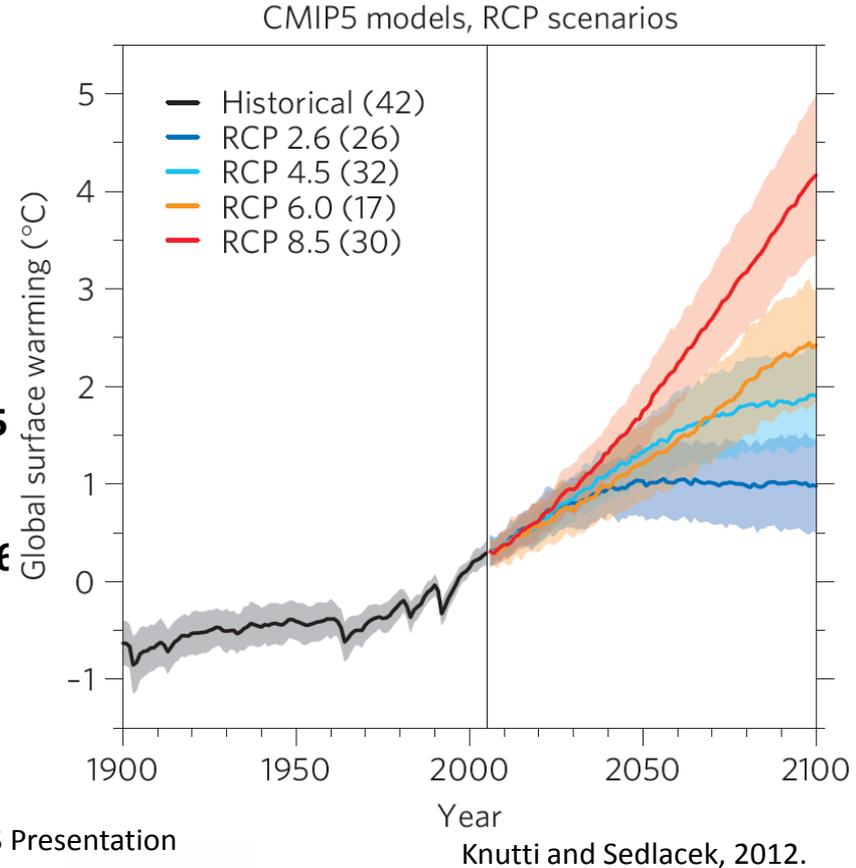
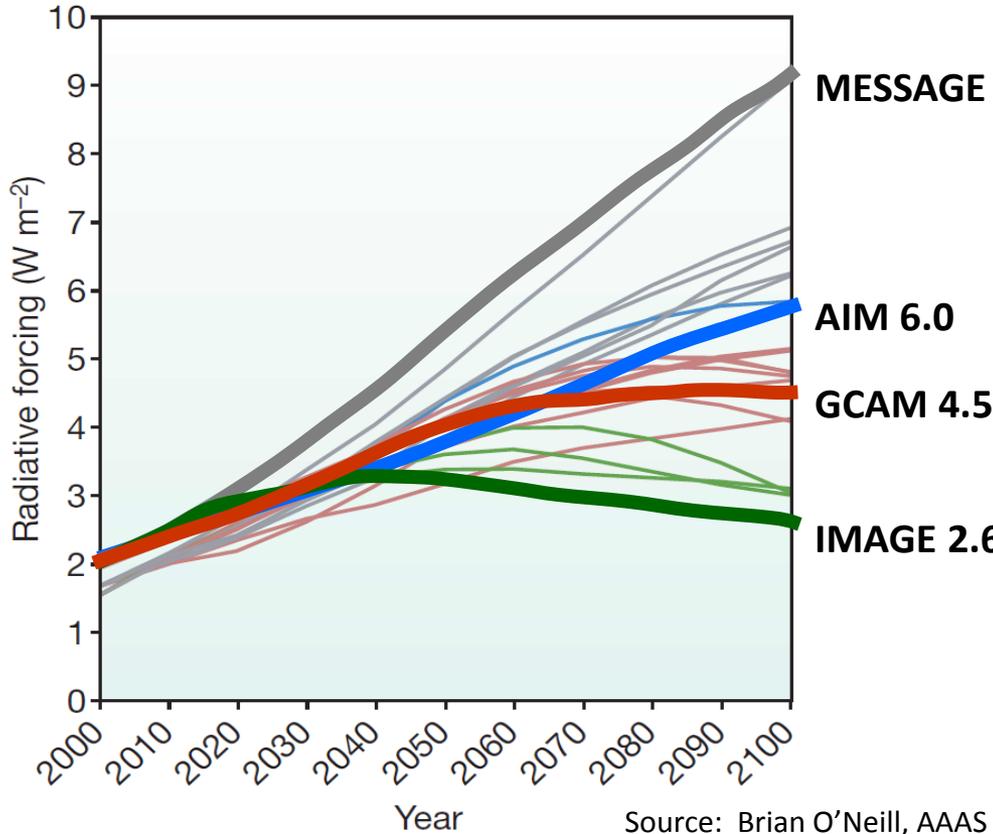
After Moss, Edmonds, et al. (2010)

# Scenarios are Easier to Charter than to Develop

## Time Line & Critical Path of Scenario Development



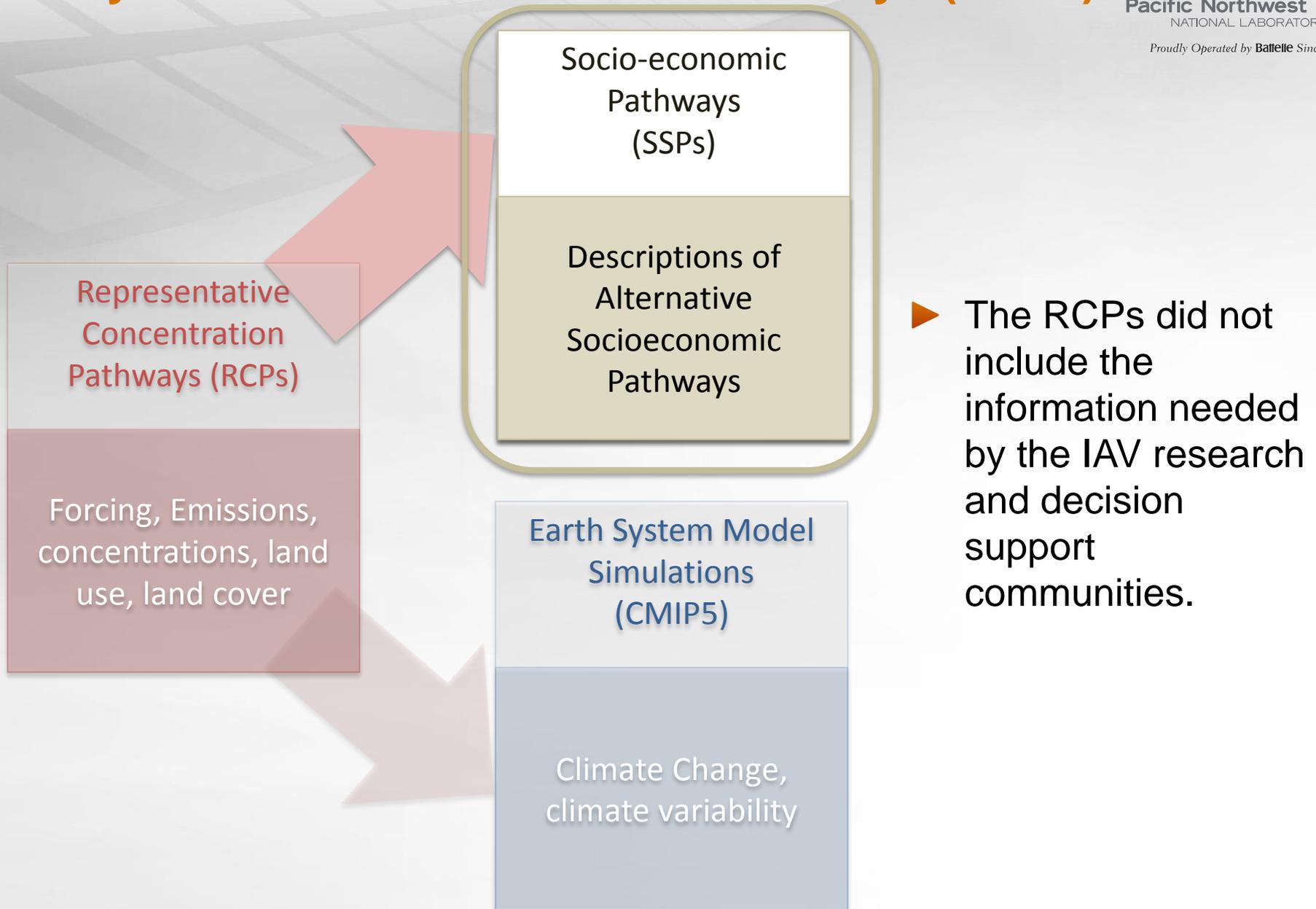
# Representative Concentration Pathways (RCPs)



- ▶ Spanning the range of radiative forcing in the literature
  - Four emissions, concentration and climate forcing
  - Included emissions mitigation scenarios for the first time
- ▶ Target audience: Climate Modelers (CMIP5)

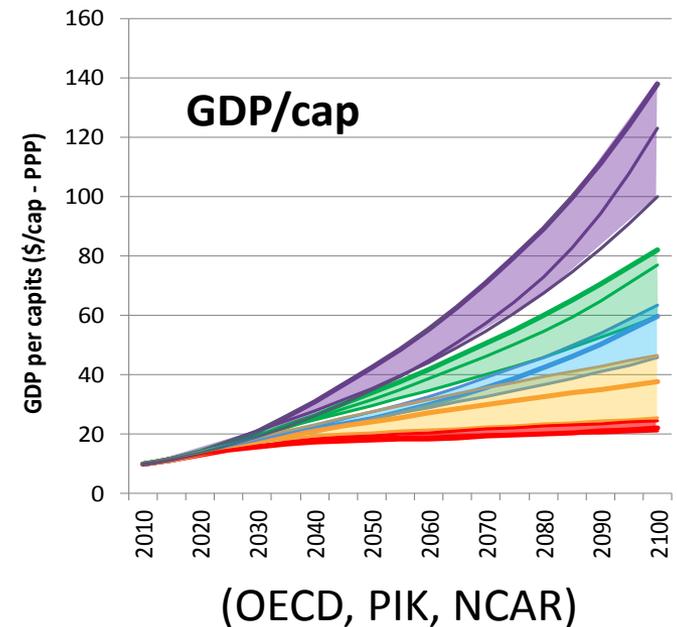
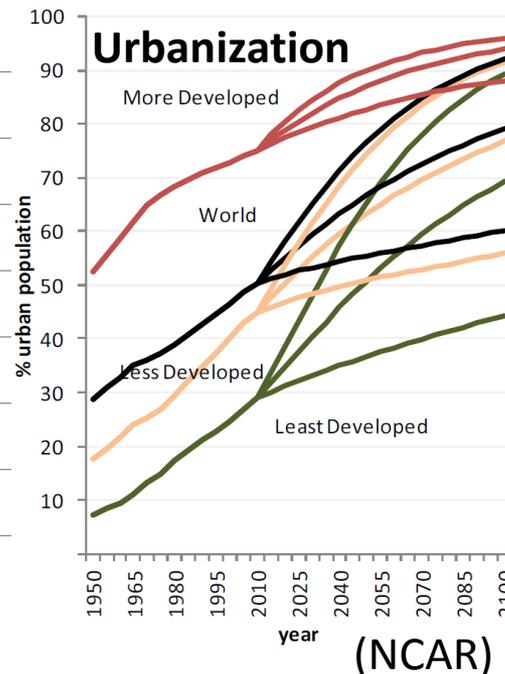
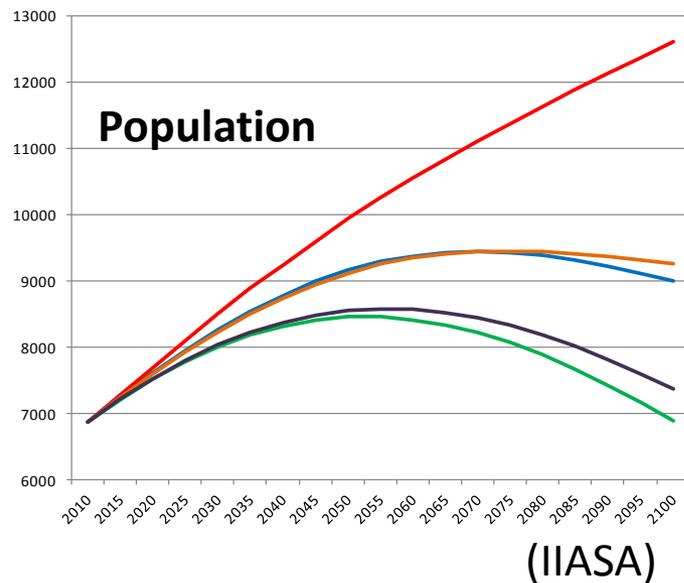
- ▶ RCP 8.5 is **NOT** the reference scenario for the other RCPs.
- ▶ RCP 8.5 is **NOT** the “most likely” scenario.
- ▶ RCP 8.5 is the high end of the scenario literature at the time of the Noordwijkerhout meeting in 2007.

# Why Shared Socioeconomic Pathways (SSPs)?



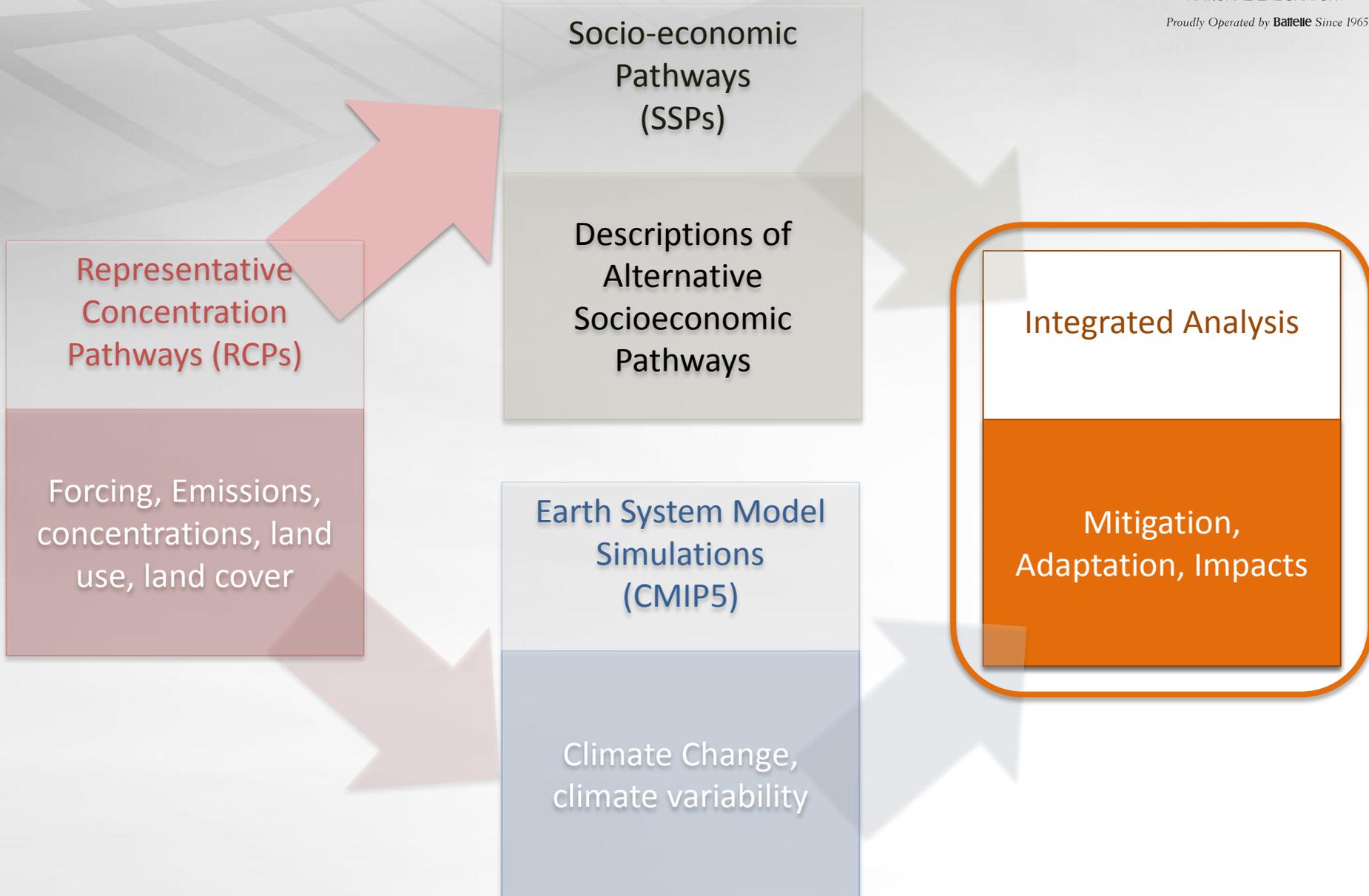
# SSPs Are Five New Reference Scenarios

- ▶ Designed to cover a range of future developments
  - Larger and smaller populations
  - Richer and poorer worlds
  - Varying degrees of inequality
  - More and less urban development paths
  - Greater and lesser challenges to mitigation of and adaptation to climate change



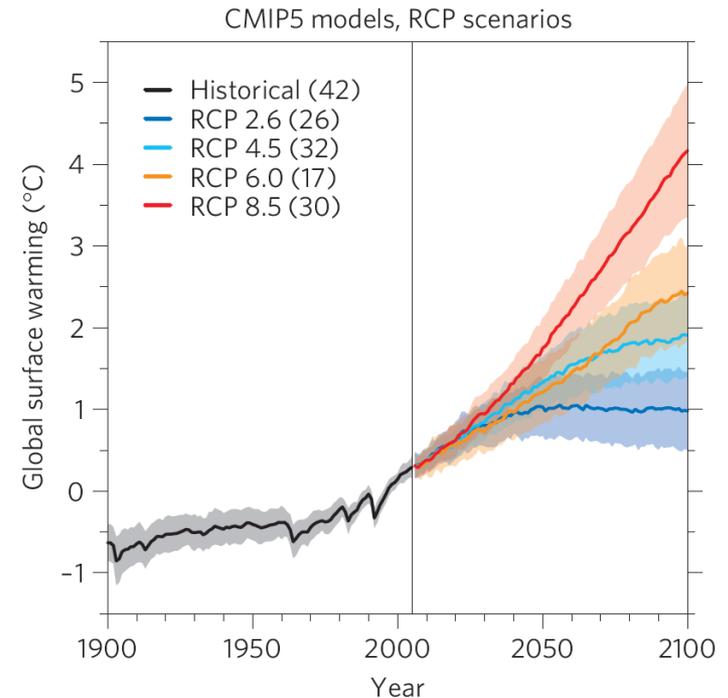
- ▶ The SSPs were created to provide a range of socioeconomic **narratives** (descriptions) and **quantitative socioeconomic assumptions** (e.g. population, economy, technology, and non-climate policy) used to create five new **REFERENCE** scenarios.
  - SSP1: Sustainability
  - SSP2: Middle of the Road
  - SSP3: Regional Rivalry
  - SSP4: Inequality
  - SSP5: Fossil Fuel Development

# SSPs and Integrated Analysis



# SSPs were designed to provide information for IAV researchers as well as IAM & CM

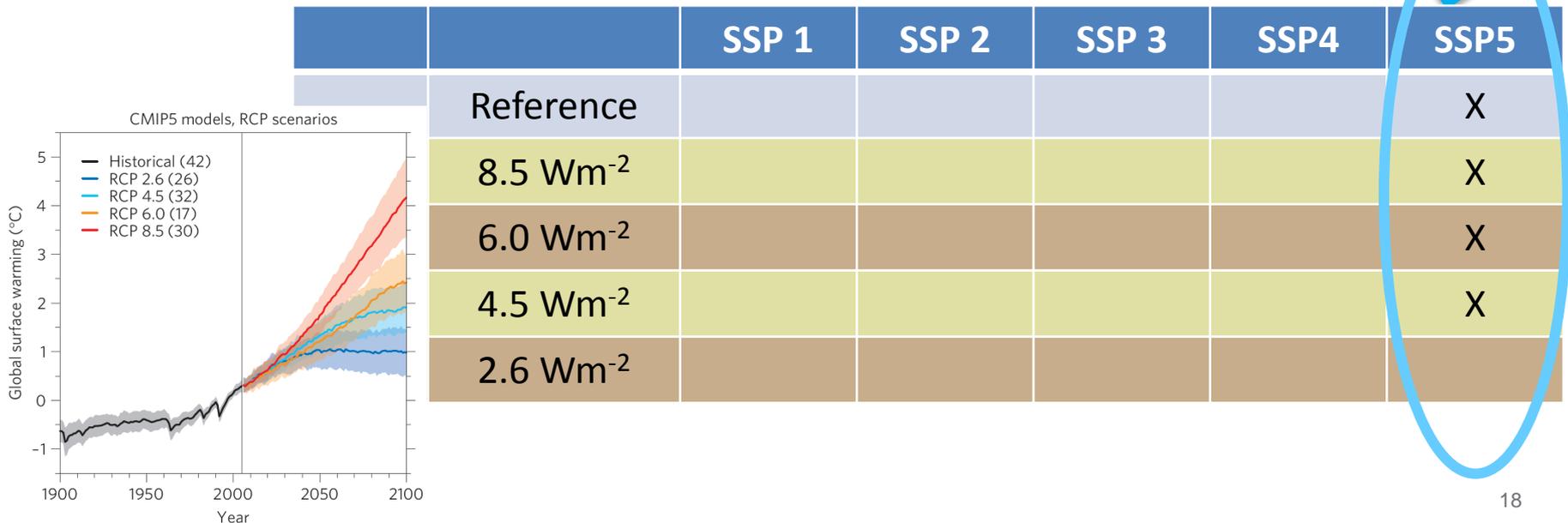
- ▶ The **RCPs** were developed to provide scenarios for the climate modeling community.
  - Defined in terms of year 2100 climate forcing—8.5, 6.0, 4.5, and 2.6  $\text{Wm}^{-2}$
  - Note that RCPs 6.0, 4.5, and 2.6 were emissions mitigation scenarios
- ▶ The **SSPs** were developed to provide information that might be used by IAV community as well as the IAM and Climate Modeling communities.
  - That means designed with an eye to providing the ability to employ the CMIP5 scenarios produced in the parallel process.



# Each SSP Scenario Will Have Both Reference and Mitigation Variants

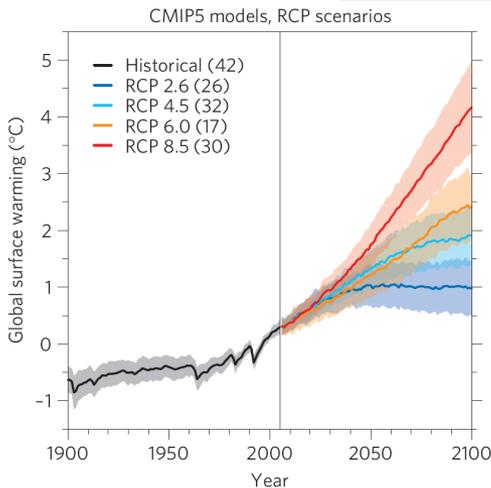
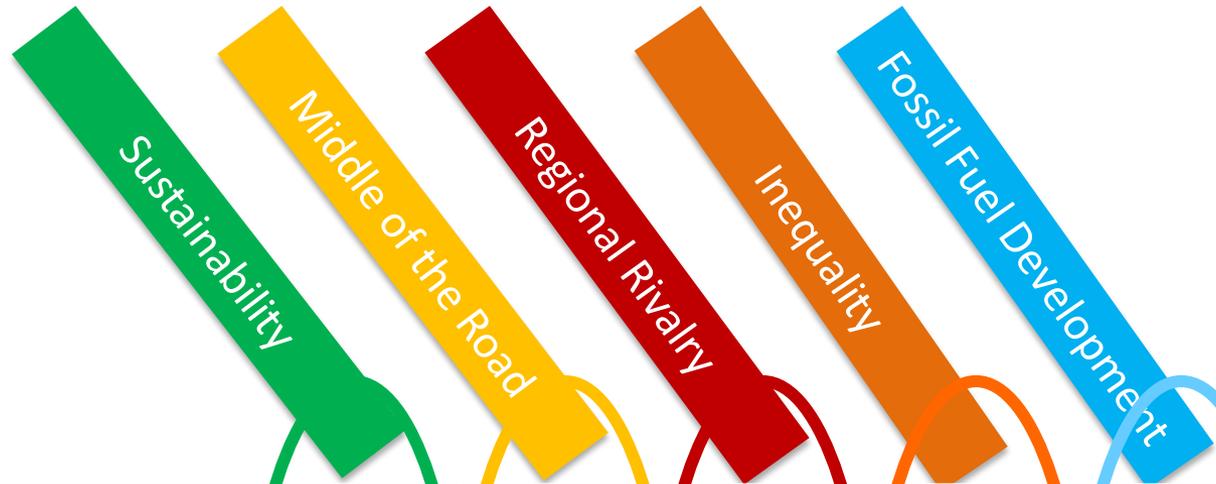
- ▶ Each SSP will have a reference scenario
- ▶ Each SSP will also have mitigation scenarios designed to match RCP mitigation levels AND thereby allowing IAV researchers to match up with an RCP/CMIP5 climate scenario
  - Defined in terms of year 2100 climate forcing—8.5, 6.0, 4.5, and 2.6  $\text{Wm}^{-2}$

Fossil Fuel Development



# Each SSP Scenario Will Have Both Reference and Mitigation Variants

- ▶ Not every SSP based scenario will have a variant that maps to every RCP.

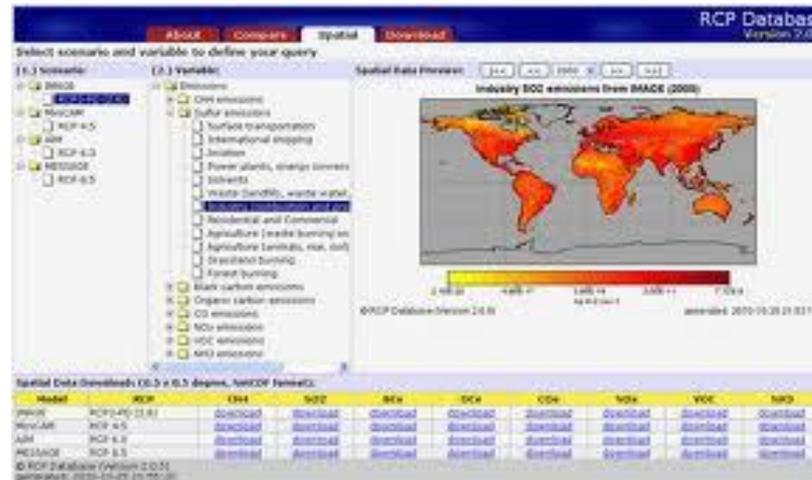


	SSP 1	SSP 2	SSP 3	SSP4	SSP5
Reference	X	X	X	X	X
8.5 Wm <sup>-2</sup>					X
6.0 Wm <sup>-2</sup>		X	X	X	X
4.5 Wm <sup>-2</sup>	X	X	X	X	X
2.6 Wm <sup>-2</sup>	X	X		X	

# Modeling Teams, Timing and Availability

- ▶ Six IAM teams are working to develop scenarios based on the SSPs

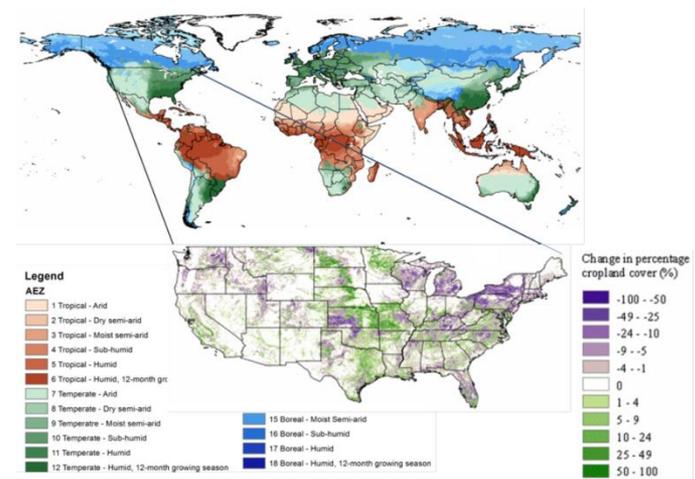
- AIM
- GCAM
- IMAGE
- MESSAGE
- ReMIND
- WITCH



IIASA RCP Data  
Archive

- ▶ SSP Reference Scenarios AND Mitigation Scenarios designed to allow matching to CMIP5 climate scenarios should become openly available for **Beta test use January 1, 2015.**
- ▶ **Finalized versions locked in March 31, 2015.**

- ▶ This session is intended to begin a discussion about how we move to a world in which scenario development serves the larger climate community with particular emphasis on IAV, both decision support .
- ▶ What will the new SSP-based scenarios look like and what information will be available?
- ▶ What information do IAV researchers need/want?
- ▶ What has been the experience of those brave IAV researchers who have used or at least tried to use scenarios?
- ▶ Should we begin to think about a future with multi-scale, interoperable models in which scenarios are no longer drop-box data dumps, but rather plug-and play models?



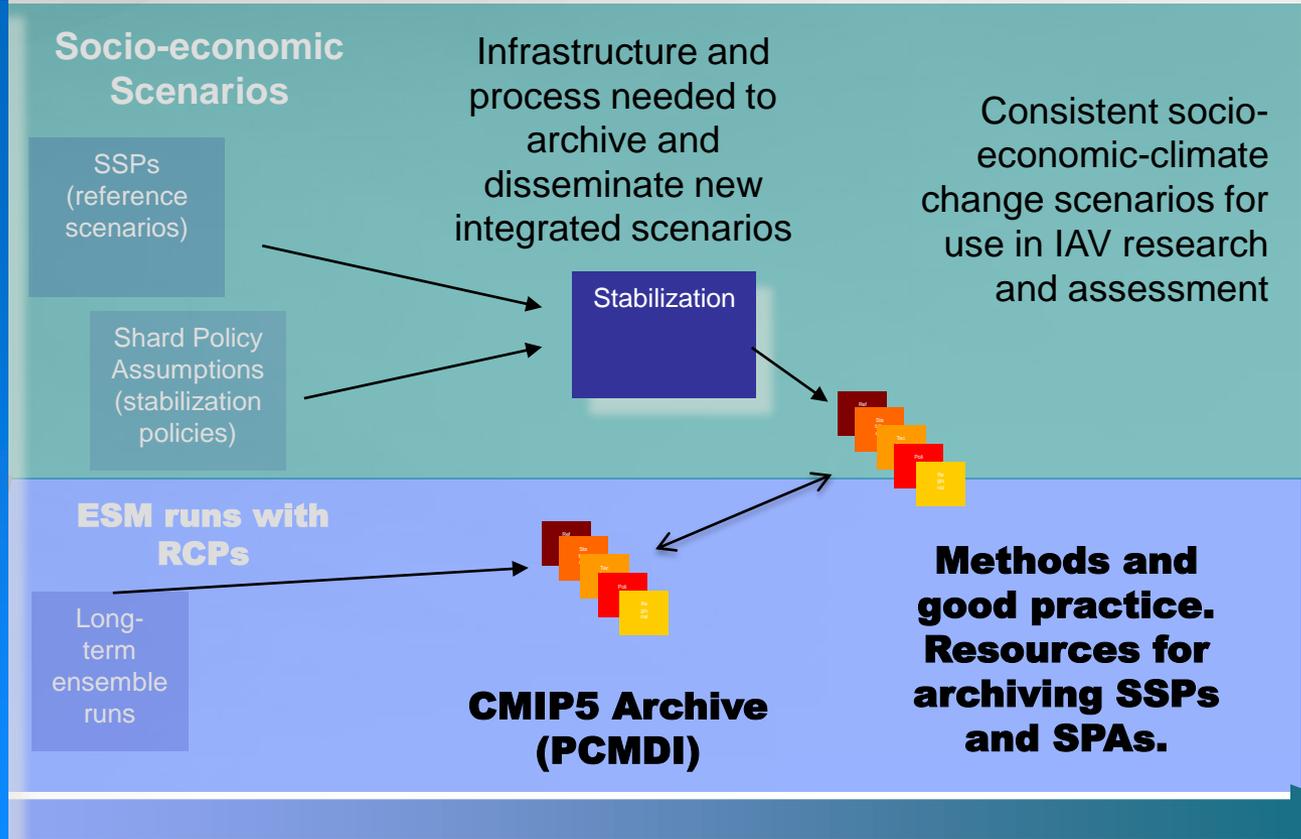
# Integrating socio-economic, climate, and environmental scenarios



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# Discussion

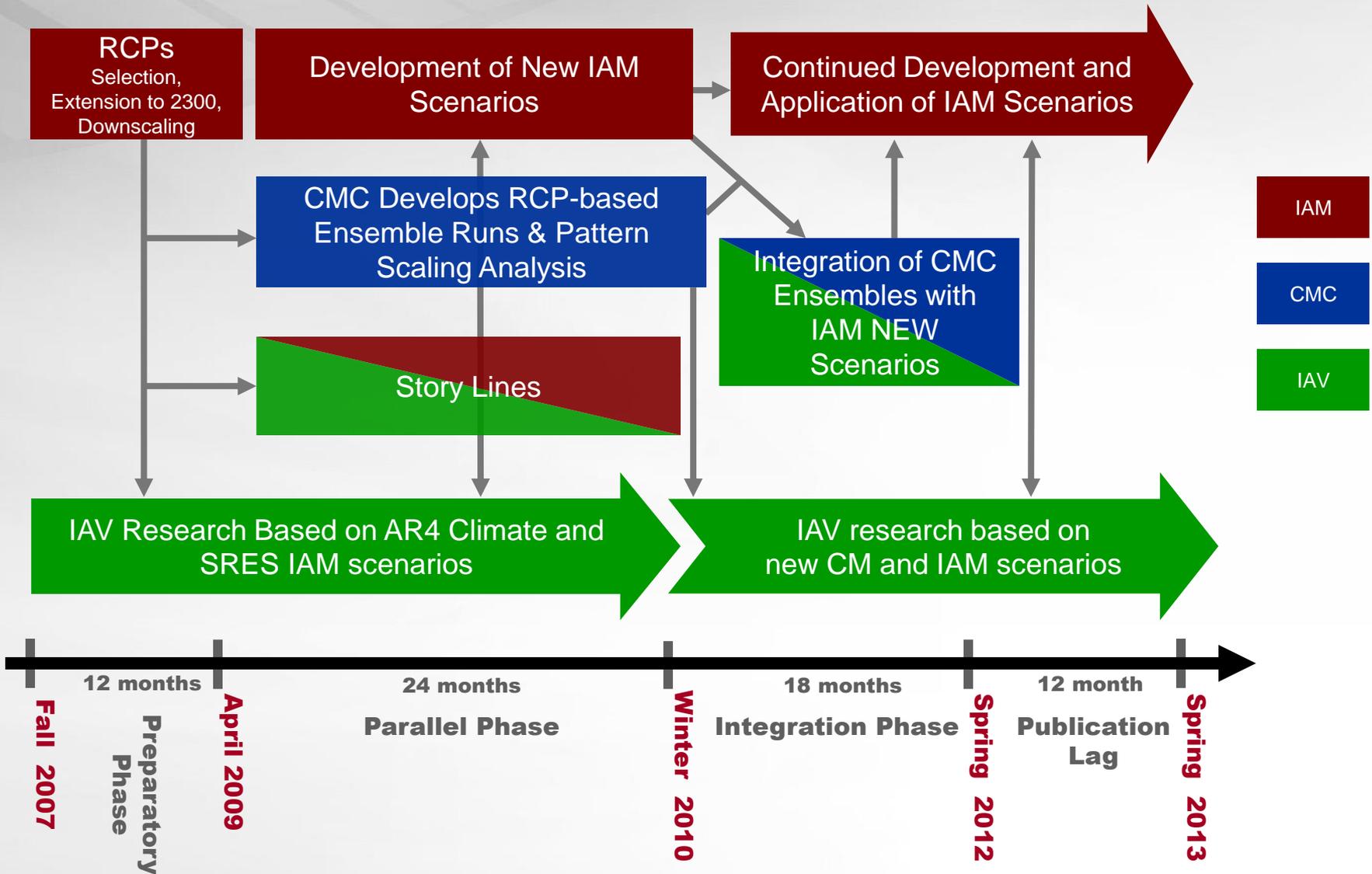


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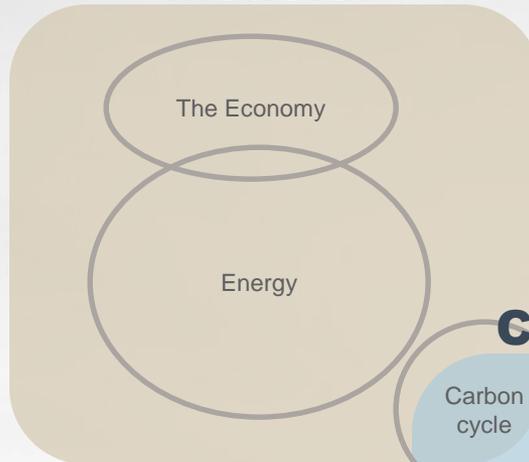
# Backup Slides

# Time Line & Critical Path of Scenario Development

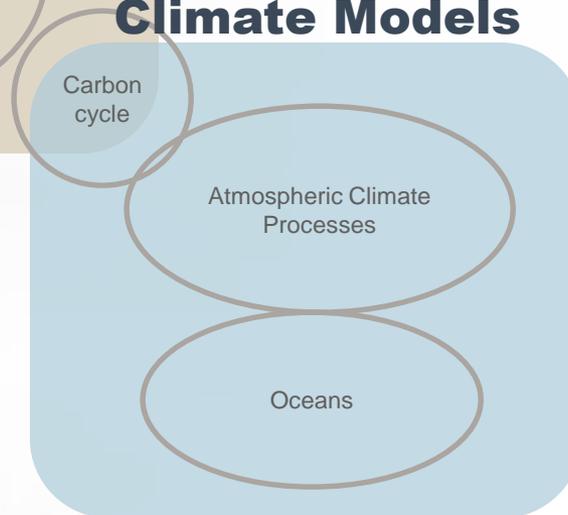


# Growing Overlap in Research Domains

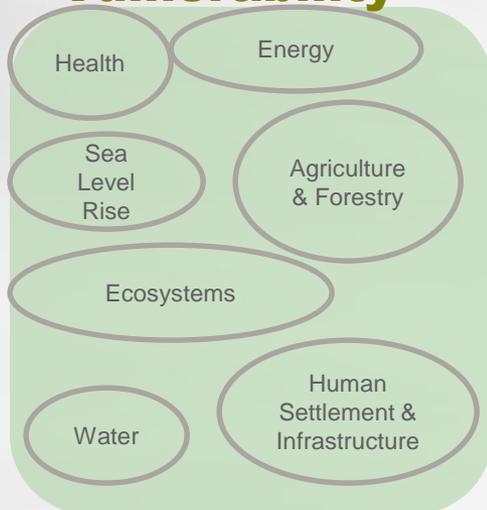
## Integrated Assessment Models



## Climate Models



## Impacts, Adaptation & Vulnerability



1980's

# Where IAMs Are Headed



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