Matching climate, socioeconomic, and environmental scenarios in applications

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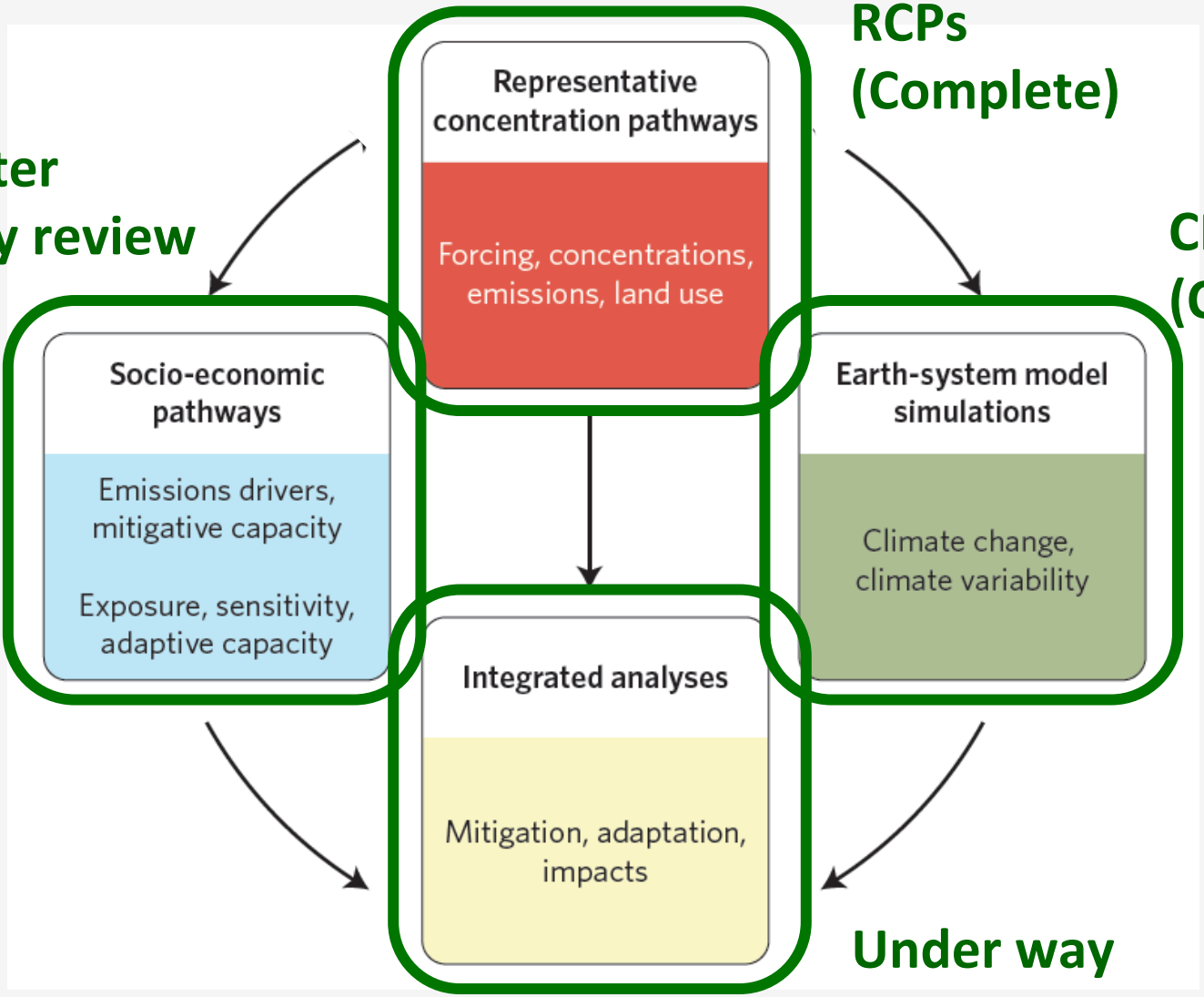
The Parallel Process



RCPs (Complete)

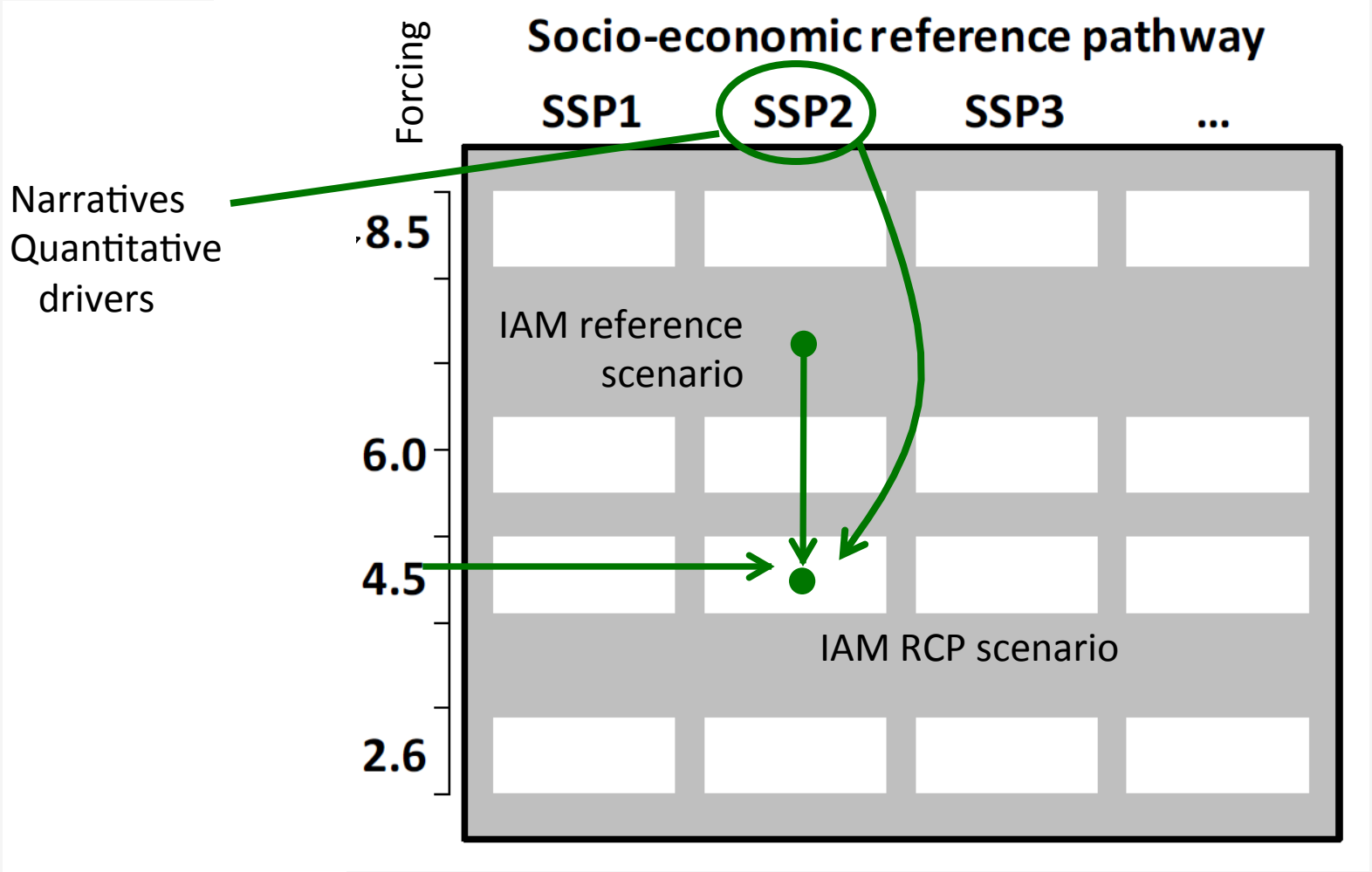
Refined after community review

CMIP5 (Complete)

Under way

O'Neill & Schweizer, 2011; based on Moss et al., 2010.

Integrated analyses

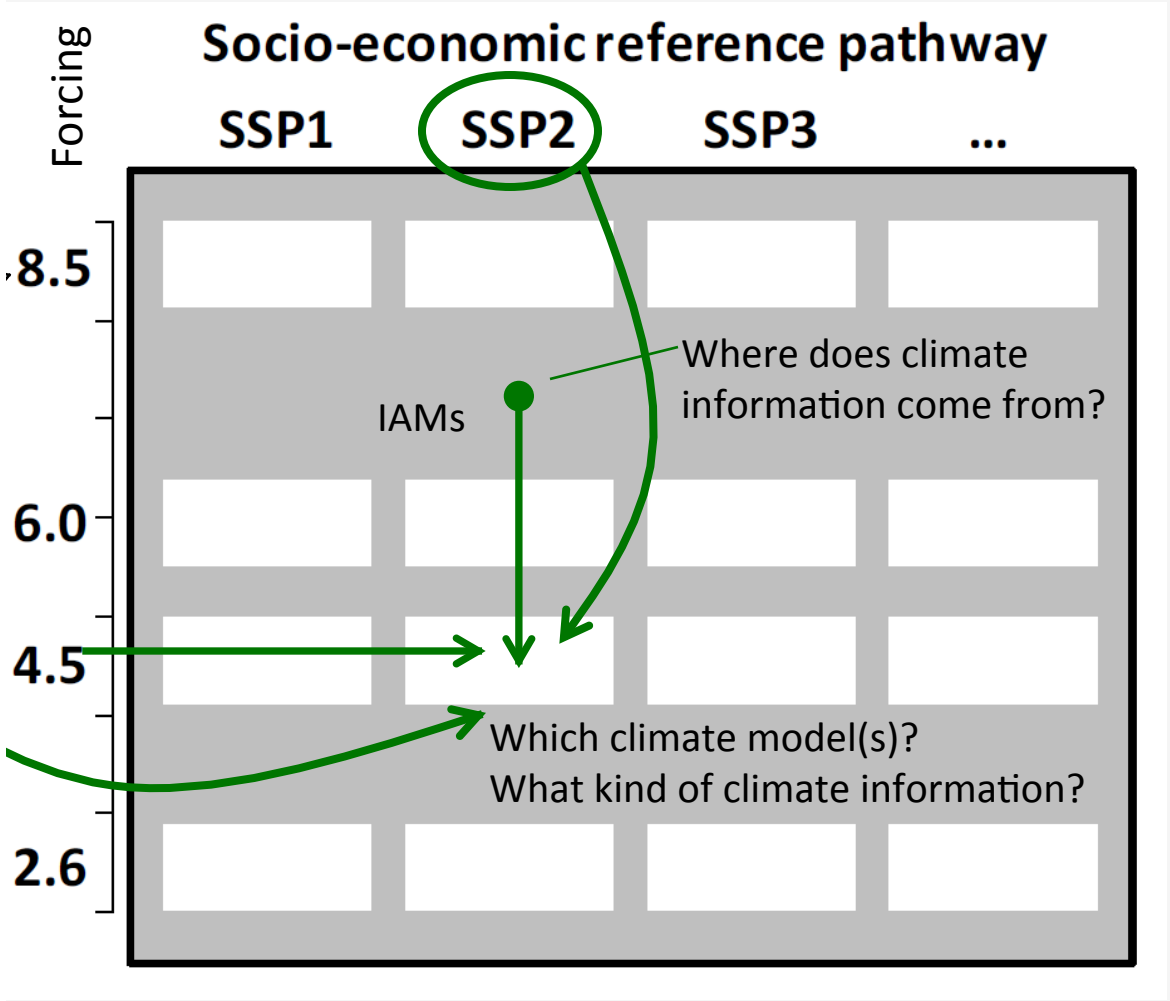


Challenges to integration

- Climate model information
- Consistency of IAM scenarios with CMIP5 outcomes
- Integration with the IAV community
- Complication and communication

Climate model information

Full ranges, CMIP5. Based on Knutti and Sedlacek, 2012.



Climate model information

- Climate model uncertainty
  - Which simulations should be used for a particular application?
  - Are certain models more credible at projecting some regions or variables than others? E.g. statistics of extremes?
  - Marker models? Wet/dry, hot/cold models?
- CMIP6 simulations of SSP reference scenarios?
- Model emulation: Pattern scaling and beyond
- Post-processing climate model output
  - Bias correction
  - Downscaling

Consistency

- CMIP5 based on RCP pathways for radiative forcing
  - Level in 2100
  - Pathway to 2100
  - Spatial distribution of forcing (especially due to SLCFs and LUC)
  - Mixture of components (long-lived GHGs, SLCFs, land use)
- SSP-based scenarios will have different pathways of radiative forcing
  - How different is too different?
- Two messages
  - Statistical question, depends on outcome of interest, we don't know the answer yet
  - Tradeoff between greater consistency and greater flexibility of the scenario framework

Judging whether two RF pathways are “consistent” in terms of climate change outcomes is a statistical question that depends on the particular outcome of interest (variable, region, season), and we do not yet have clear idea of what types of pathways are (in)consistent

Is this a good target for a CMIP6 experiment?

- Scenario design that allows for statistical testing for differences in outcomes driven by specific aspects of forcing?

SSPs

Development Pathway

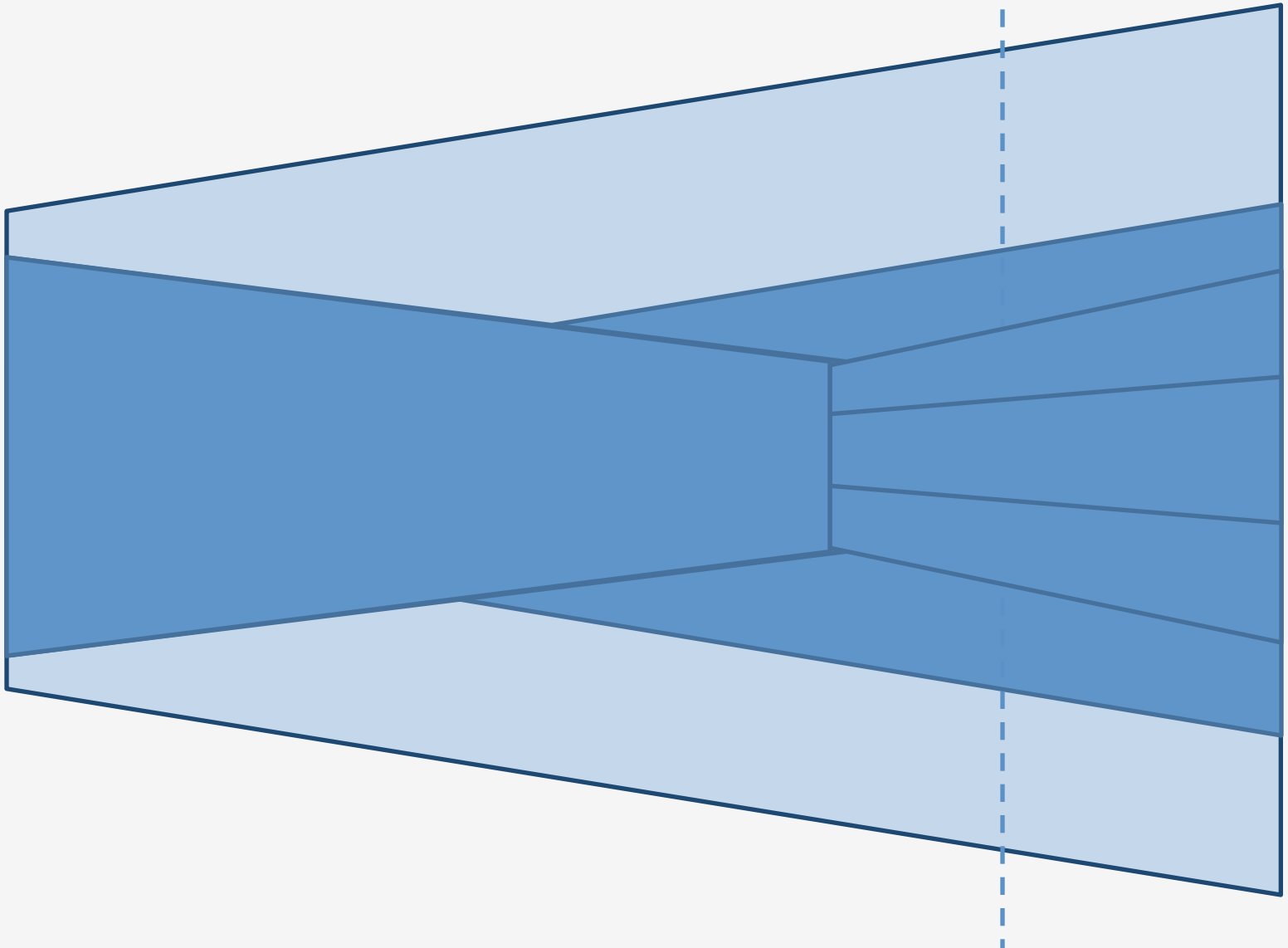
IAM scenarios

Emissions Land use

Forcing

CMIP5/RCPs

Climate Change



Greater consistency between SSP-based RCPs and original RCPs has benefits (more consistent climate change outcomes), but it also has costs (smaller variation in consistent development pathways)

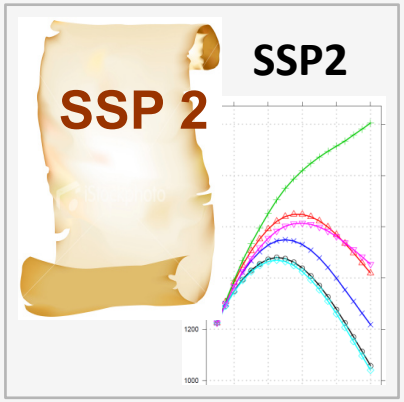
Some types of consistency (spatial patterns of RF) likely have larger costs than others (more comprehensive global average forcing)

Integration with IAV community

- Continued and expanded joint involvement and collaboration
- Extensions of SSPs to provide additional IAV-relevant information

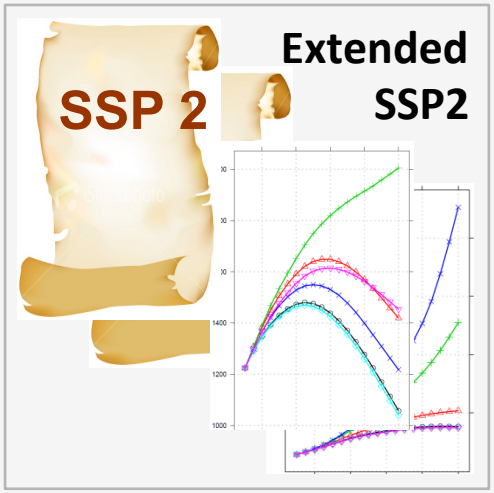
Basic vs Extended SSPs

Basic



Information sufficient to locate SSP in Domain 4 of the challenges space

Regional Extension

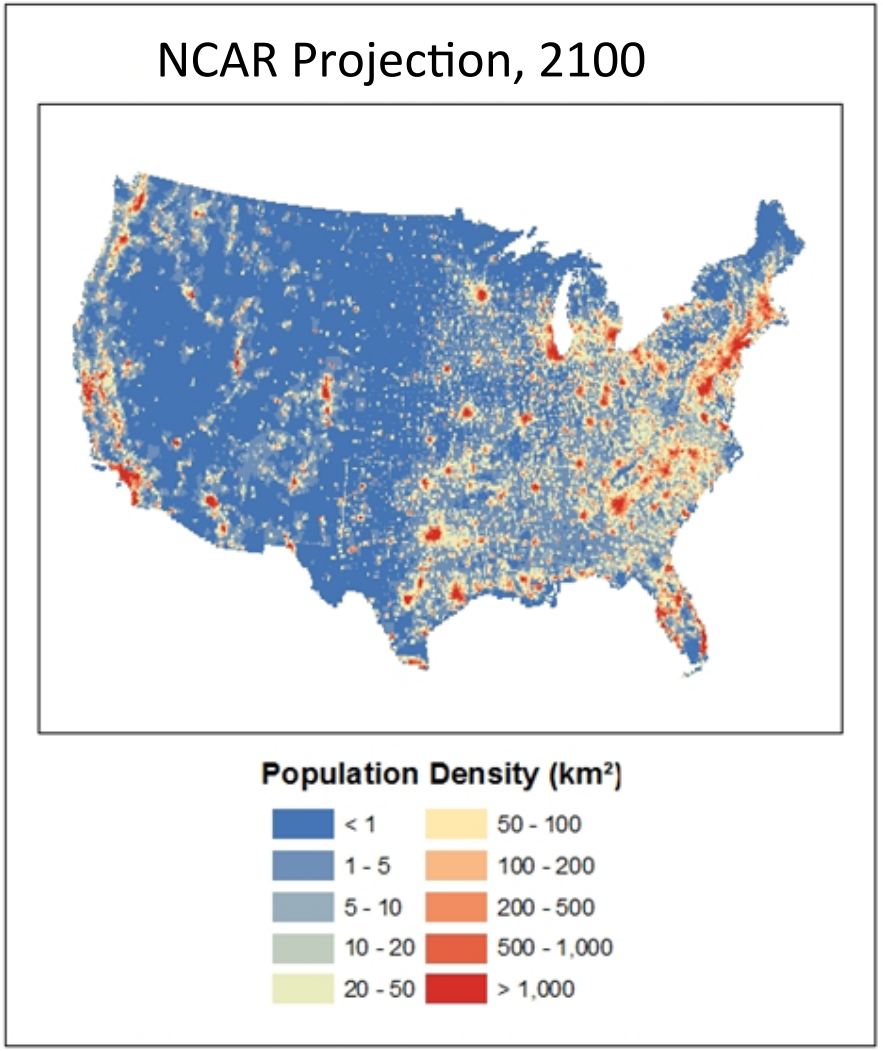


Sectoral Extension

Global Extension

SSP-based Spatial Population Projections

see also:
EPA
MIT
IIASA



Jones & O'Neill, subm.

Integration with IAV community

- Continued and expanded joint involvement and collaboration
- Extensions of SSPs to provide additional IAV-relevant information
- Guidance documents (jointly produced)
  - Understanding and using the scenario framework
  - Downscaling narratives
  - Climate information
- Bridging scales

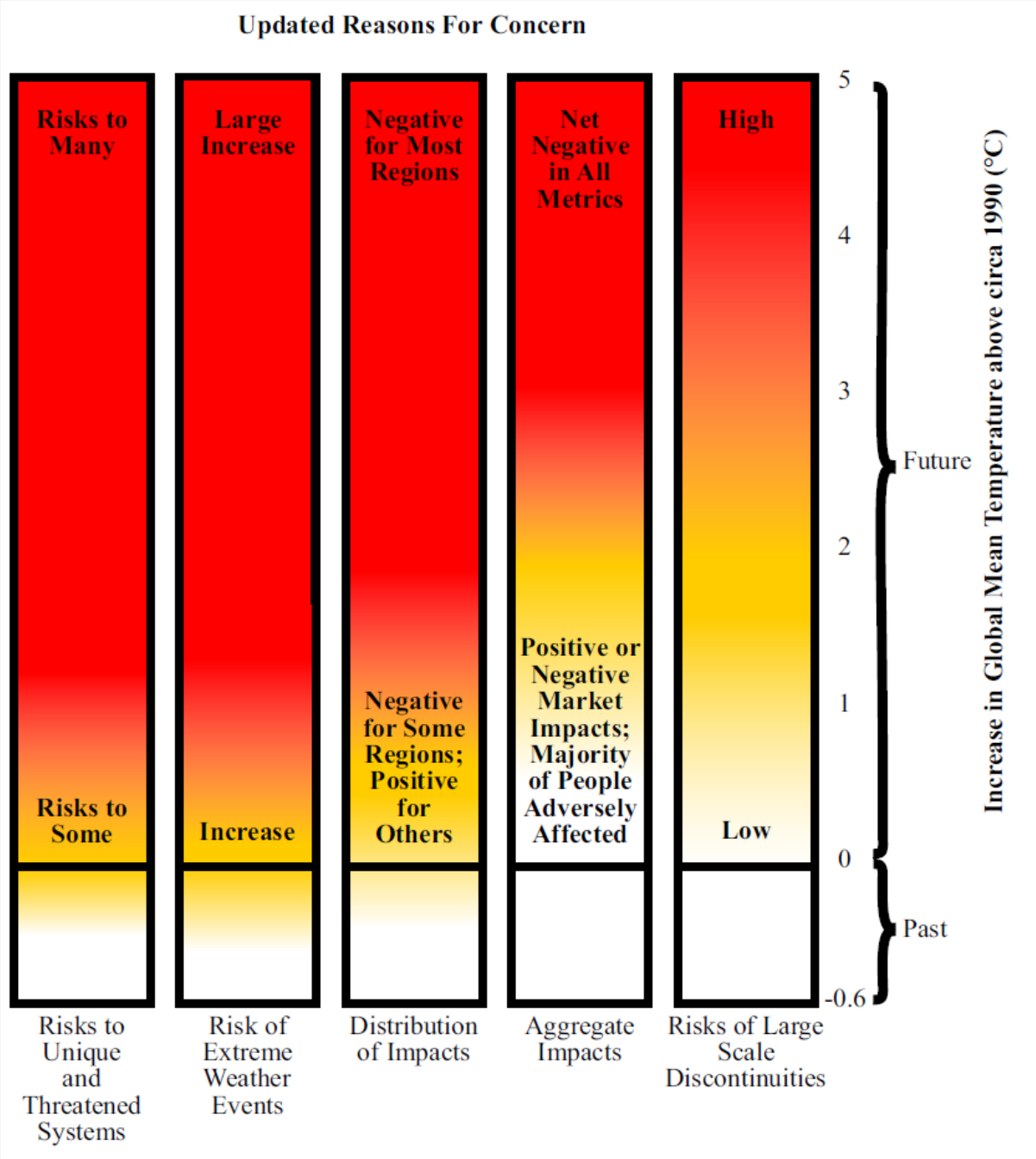
Bridging Scales

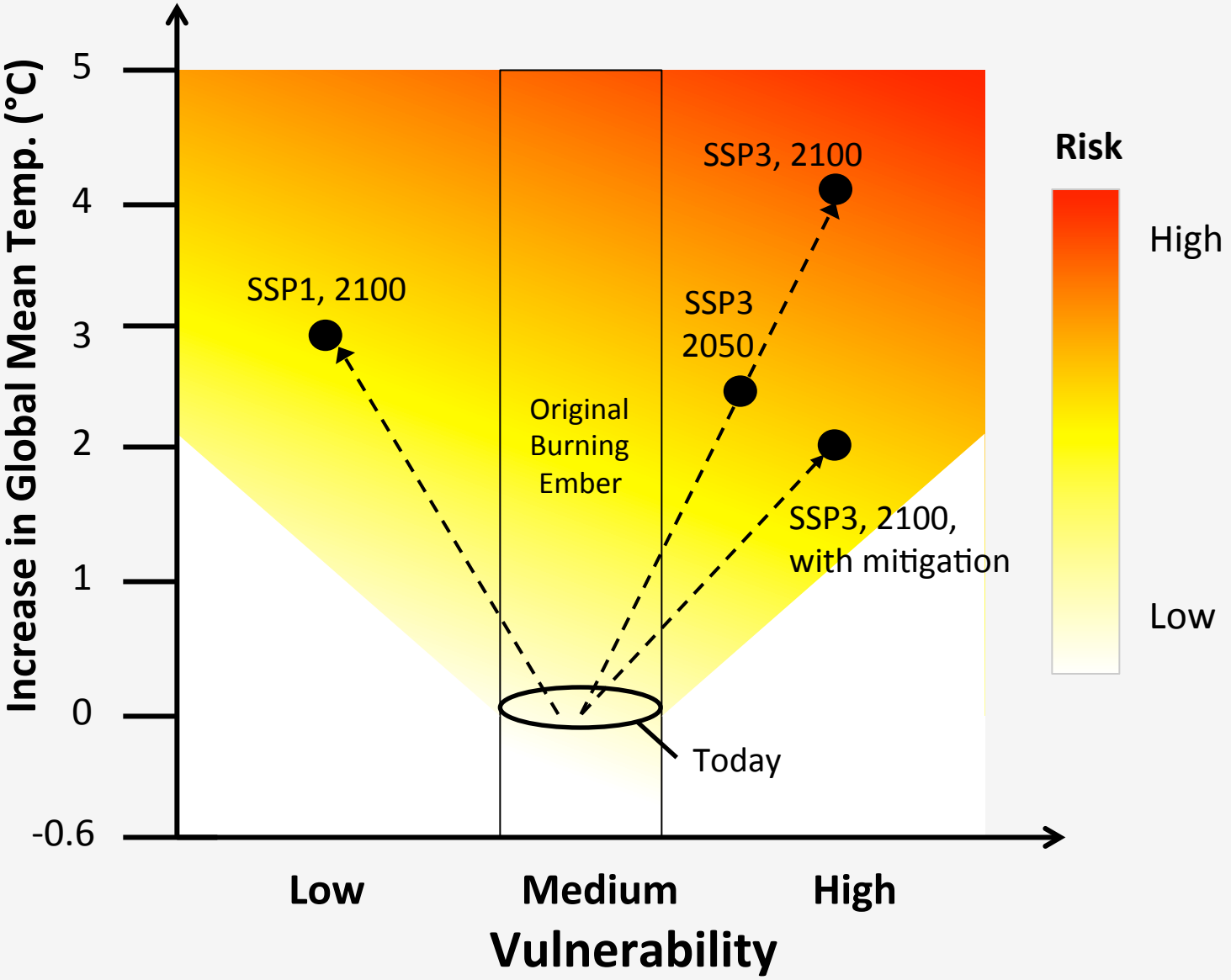
- Not all local scale studies need global scale scenarios as context!
- National scenarios/assessment are likely key bridging scales (SSPs and scenarios inform national level scenarios, which in turn serve as context for local studies)

Communication

- Communicating results based on research that uses the scenario framework
  - To researchers, policymakers, the public
- Communicating the scenario framework itself
  - Primarily to researchers, particularly across communities
  - Is a matrix complicated?
  - Have we seen a matrix before?

Burning embers
Smith et al., 2009




Increase in Global Mean Temp. (°C)
5
4
3
2
1
0
-0.6
SSP1, 2100
SSP3, 2100
SSP3
2050
Original
Burning
Ember
SSP3, 2100,
with mitigation
Today
Risk
High
Low
Low
Medium
High
Vulnerability

Communication

Scenario framework may or may not be complicated

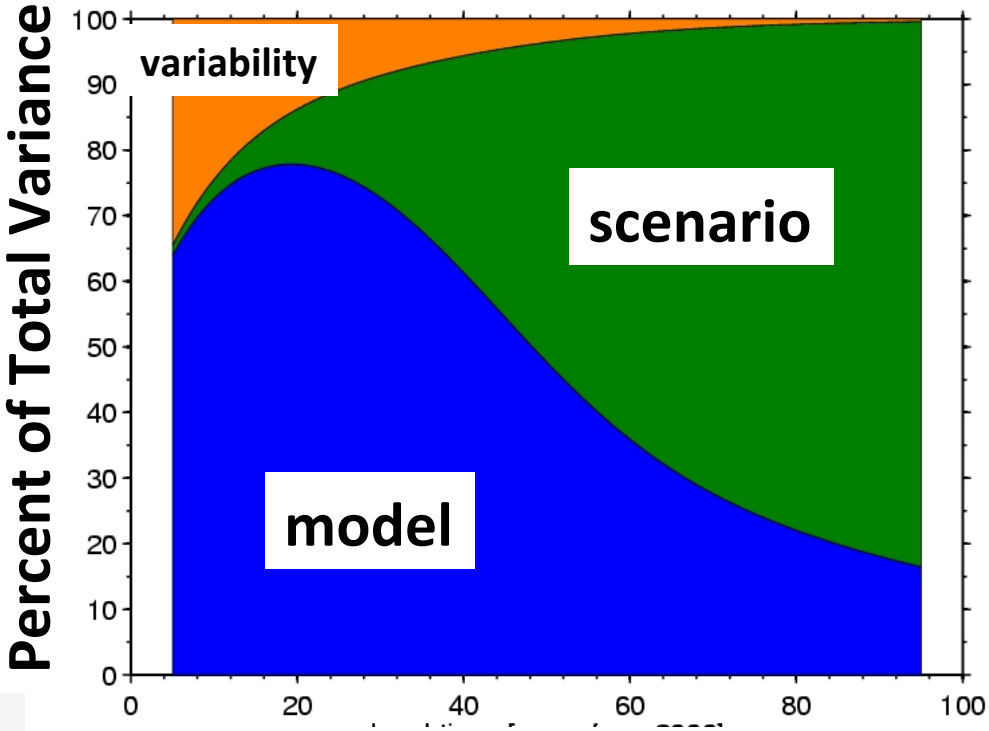
Communicating results based on it does not have to be

We could use a few examples of clearly communicated results as illustrations

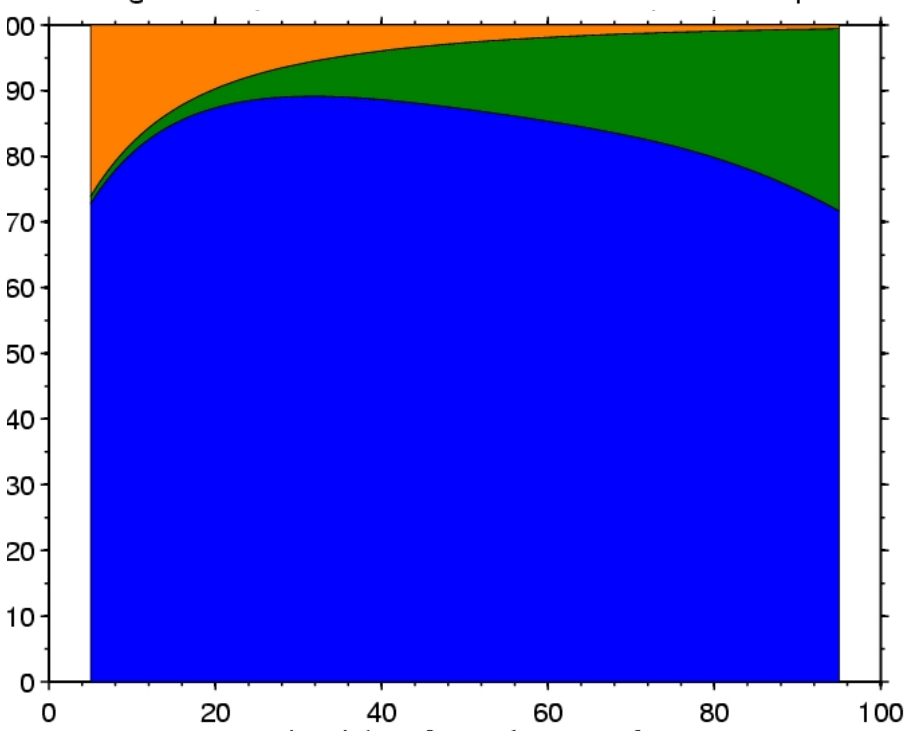
Challenges to integration

- Climate model information
  - CMIP6: SSP baselines?
- Consistency of IAM scenarios with CMIP5 outcomes
  - CMIP6: Ensembles sufficient to support detection of differences?
- Integration with the IAV community
- Complication and communication

Global, annual decadal mean temperature



Global, annual decadal mean precipitation



Hawkins and Sutton 2009, BAMS