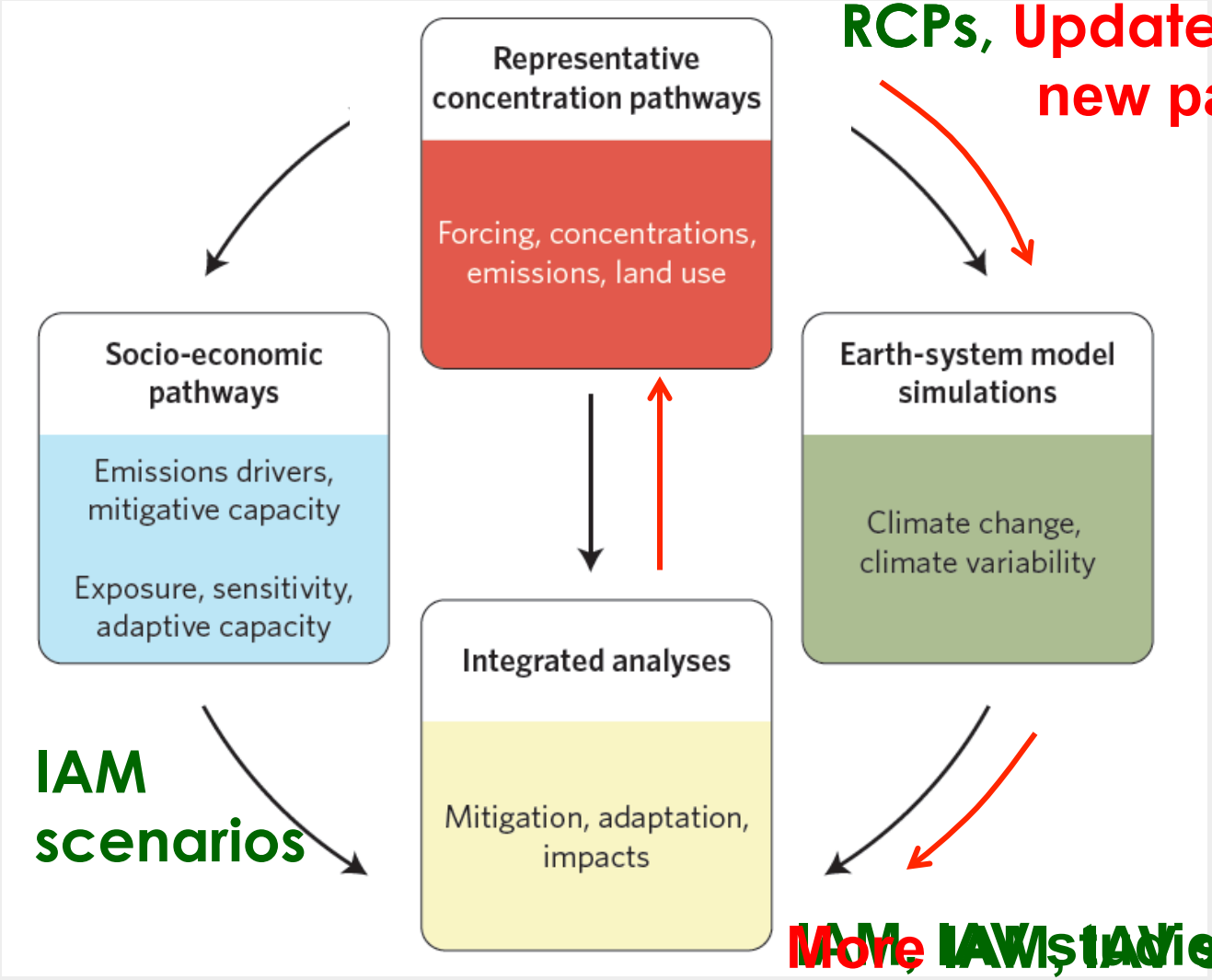
The state of the new scenarios process

Brian O'Neill
NCAR
September 15, 2015
AGCI AgMIP Workshop

The New Scenario Process (Parallel Process)



RCPs, Updated RCPs, new pathways

SSPs

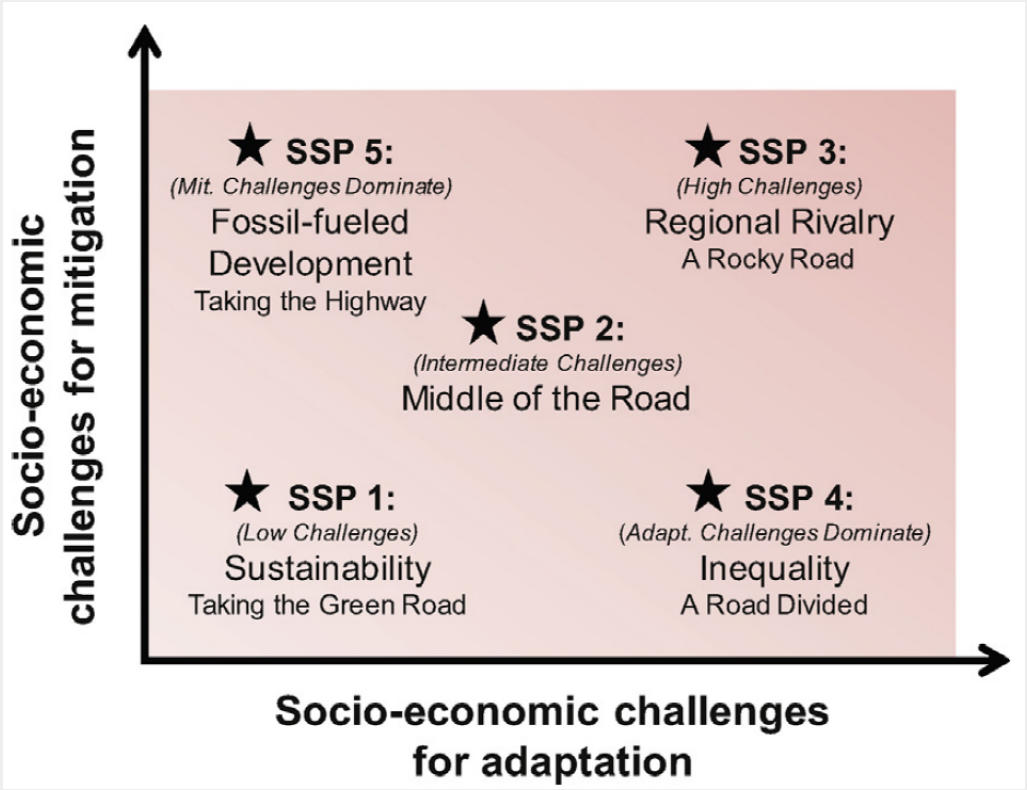
CMIP5, CMIP6

IAM scenarios

More IAV, IAV studies

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

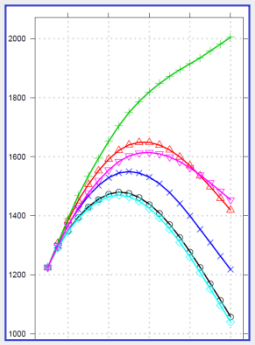
Shared Socioeconomic Pathways (SSPs)



Narrative

Qualitative description of broad patterns of development

Logic relating elements of narrative to each other



Quantitative elements

National:

- Population
- Education
- Urbanization
- GDP

Subnational (under development):

- Spatial population
- Income distribution

ICONICS

International Committee On New Integrated Climate change assessment Scenarios

See website hosted at NCAR for SSP information, publications database, mailing list

Summary of SSP Status

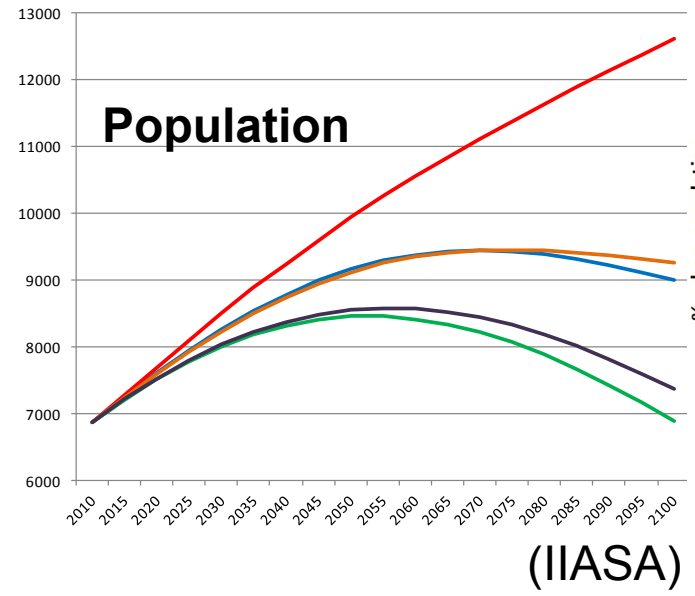
Conceptual framework established

Special issue of *Climatic Change* published (2013/4)

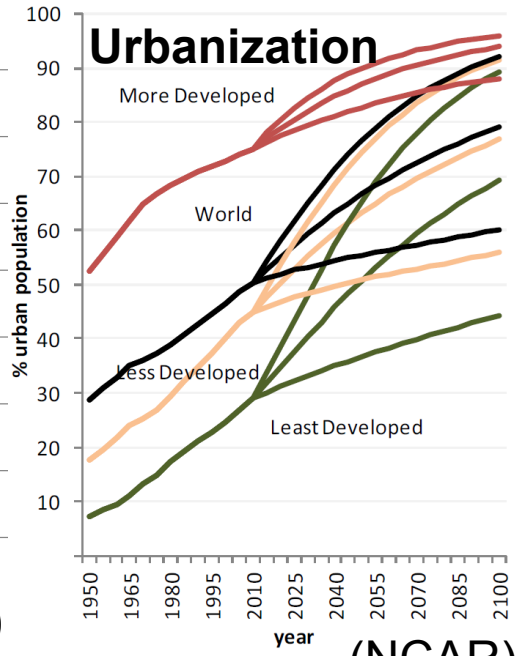
Narratives and quantification of key drivers completed

Published online, Special issue of *Glob. Envtl. Change*

Quantitative drivers available online, IIASA SSP database



(IIASA)



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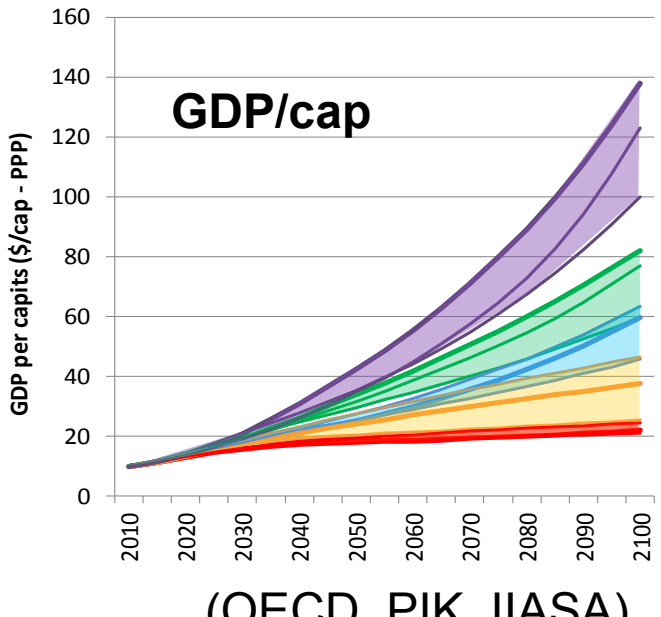


(OECD, PIK, IIASA)

SSPs are not scenarios!

Hypothetical reference development pathway

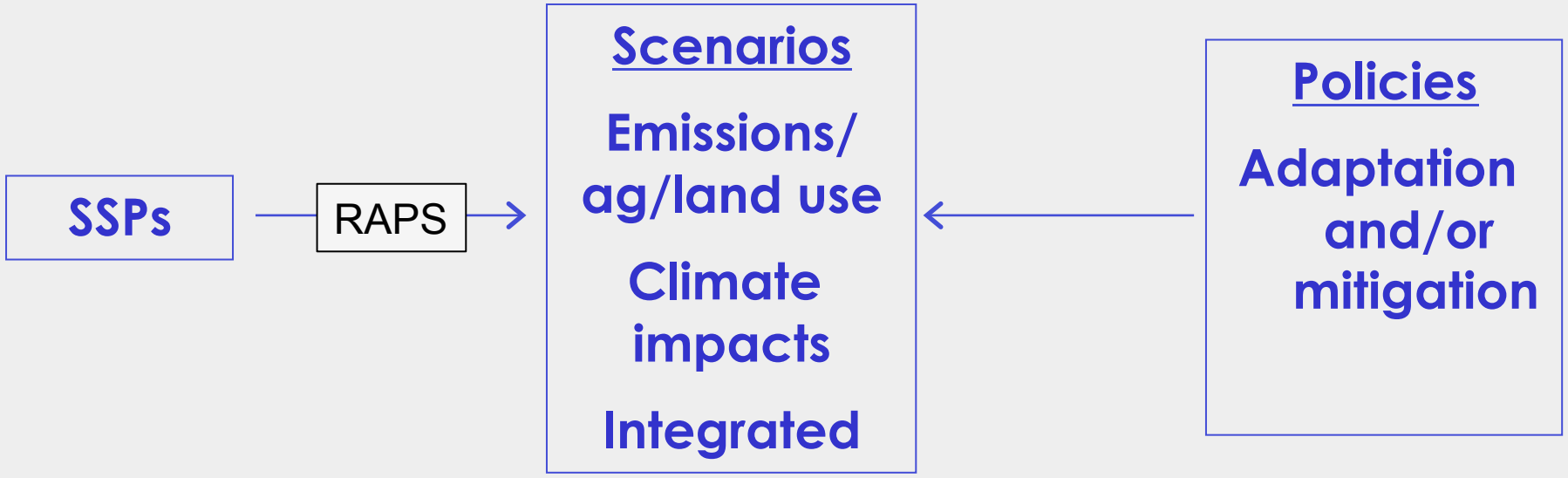
"Development":

Does not include explicit emissions, land use, etc.

"Reference":

No climate policy (mitigation or adaptation)

No effects of climate change



Linking Global and Regional scenarios (or pathways)

Regional scenarios informed by SSPs underway

- Arctic Council scenarios
- European projects (e.g., IMPRESSIONS)
- Adaptation challenges, US Southeast (Absar & Preston, 2015)
- Multi-region CCAFS study (Palazzo, Vervoort, et al.)
- Provia regional workshop?

Types of linkage

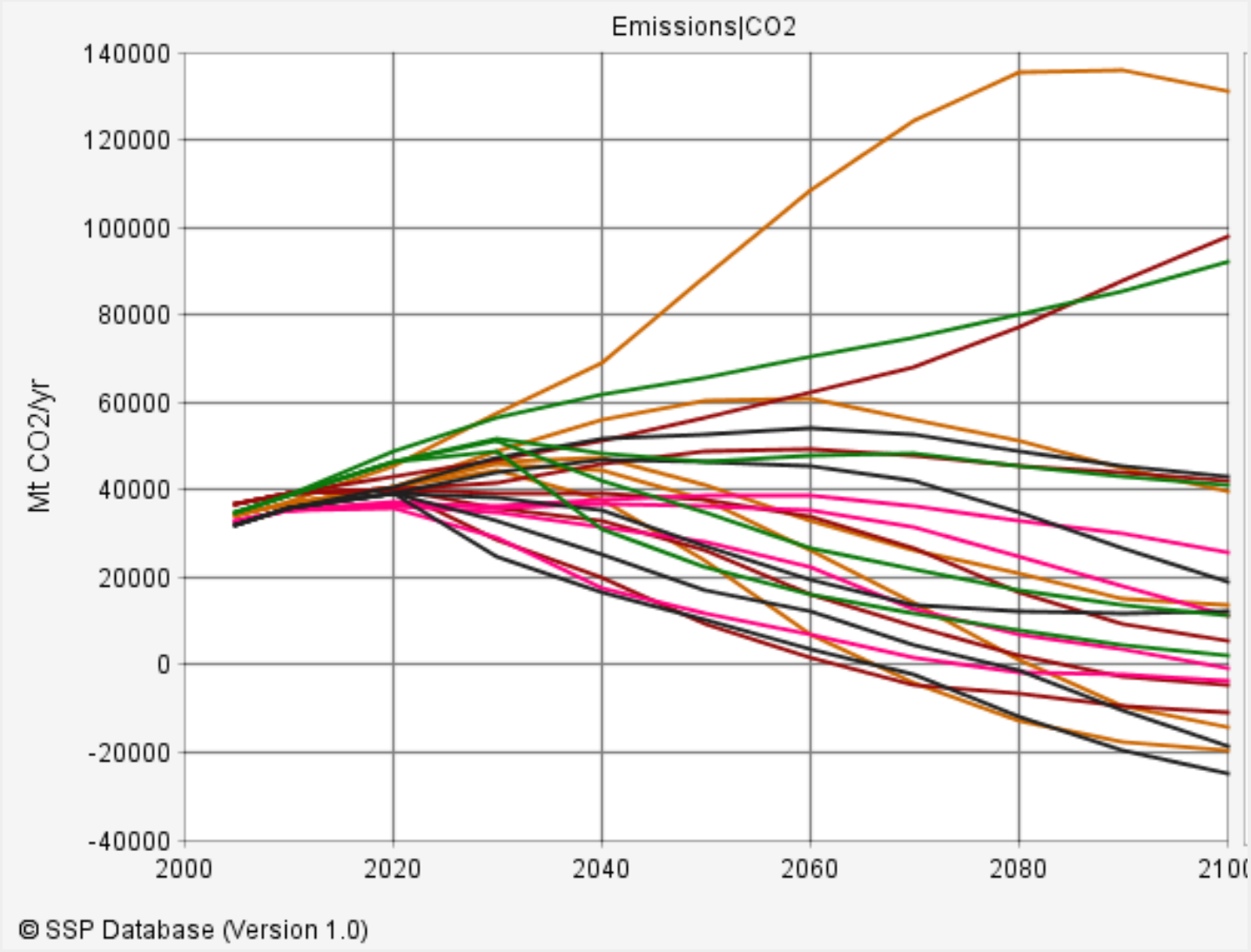
- Use conceptual framework alone
- Develop regional scenarios, map to SSPs later
- Nest regional pathways within global SSPs
- Quantitative (not just qualitative) consistency

SSP-based IAM scenarios:
Energy, agriculture, land use, emissions, concentrations, radiative forcing

No climate impact
With and without mitigation policy

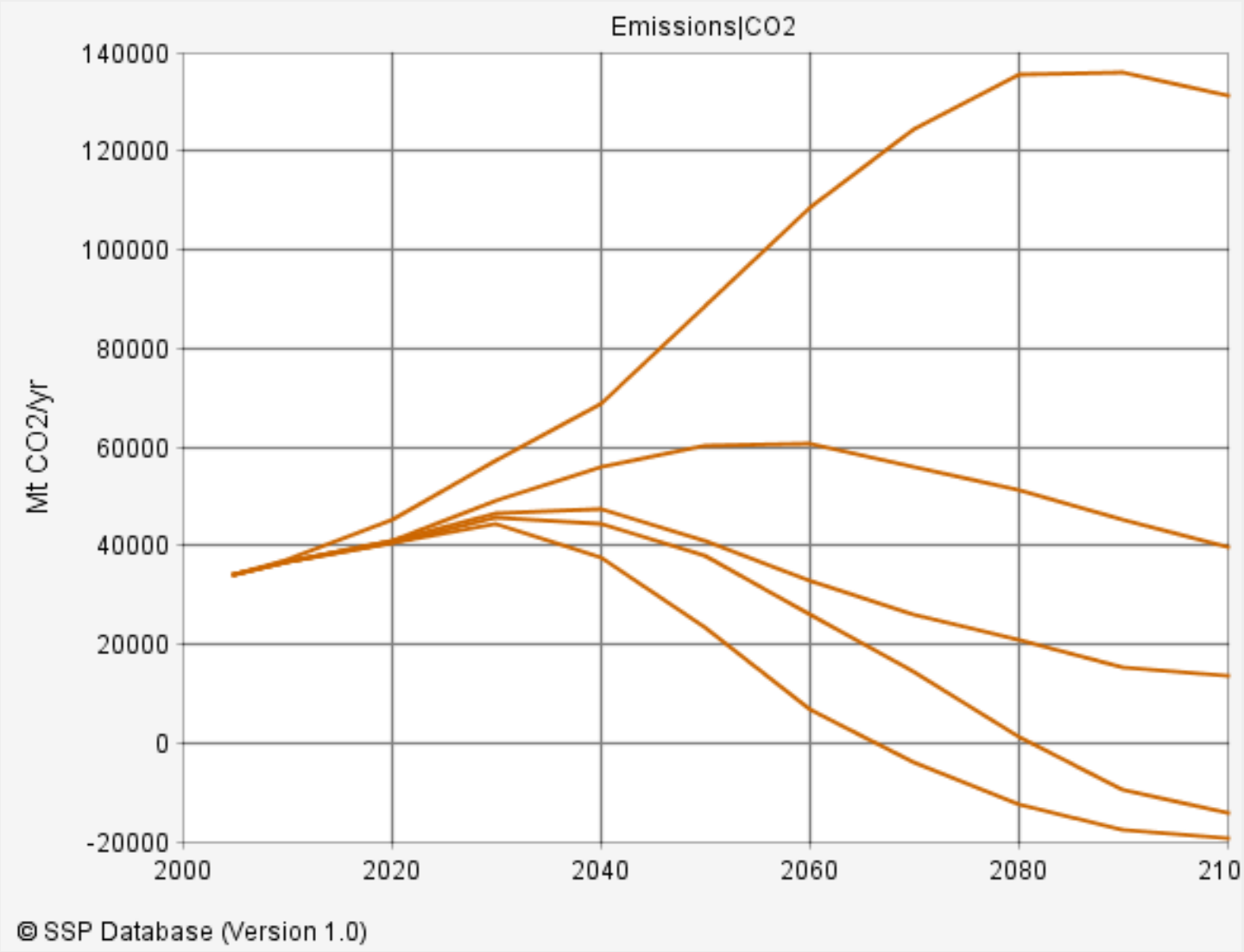
Status:
Preliminary results for all scenarios available on IIASA SSP database
Final versions expected by end of 2015

CO2 Emissions, All Marker Scenarios



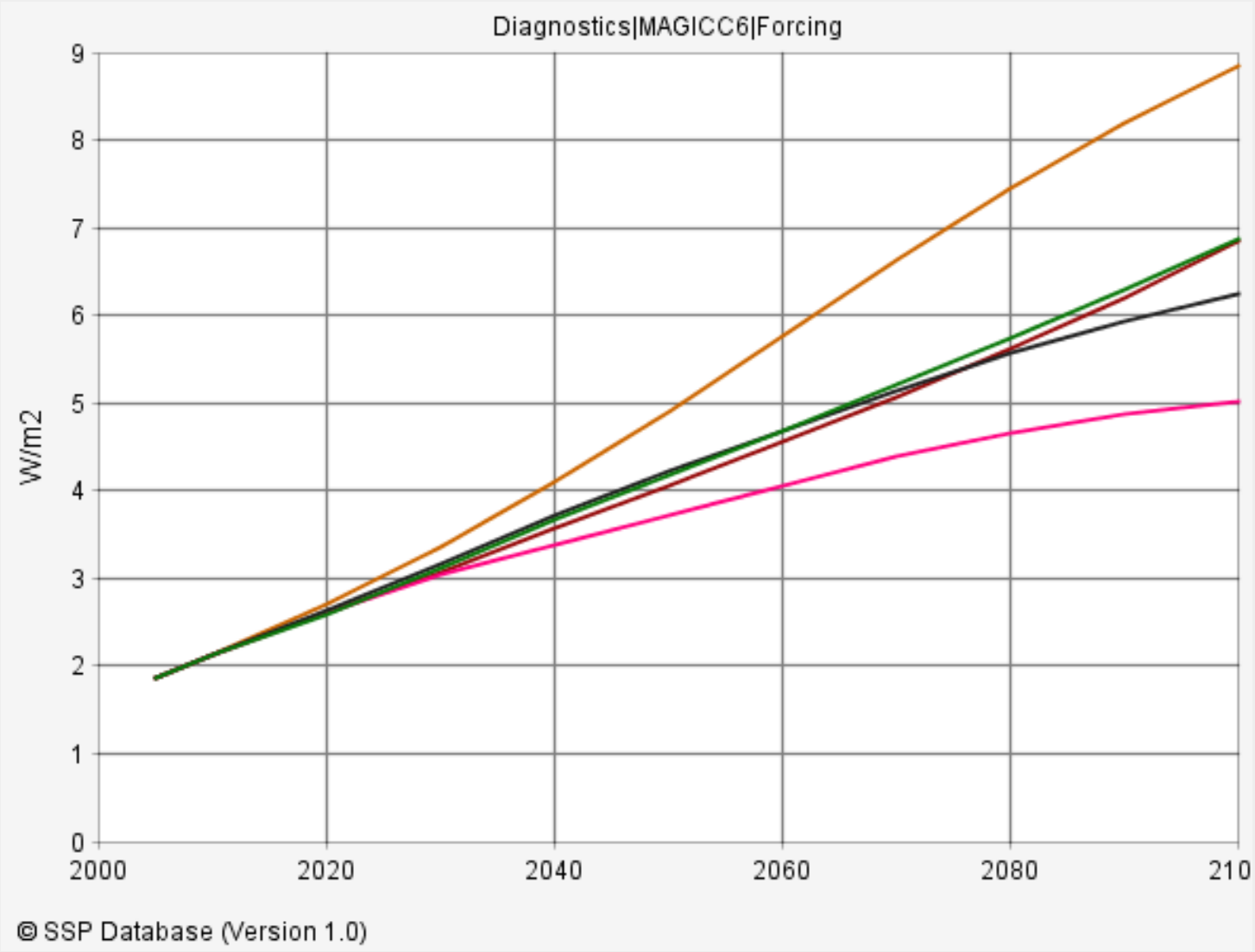
Preliminary Results, IIASA SSP Database, September 2015

CO2 Emissions, SSP5 Marker Scenarios



Preliminary Results, IIASA SSP Database, September 2015

Radiative Forcing, Reference Marker Scenarios



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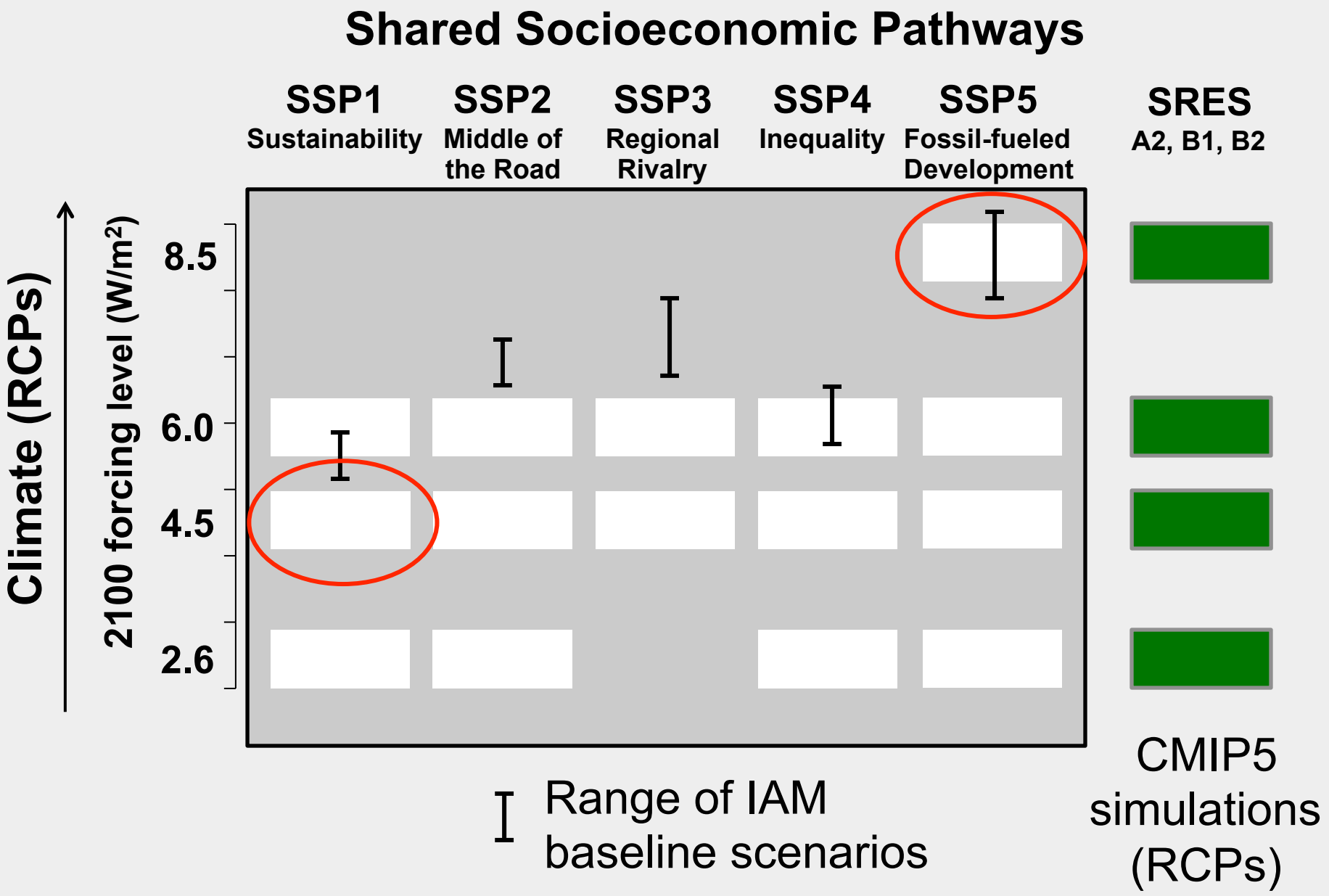
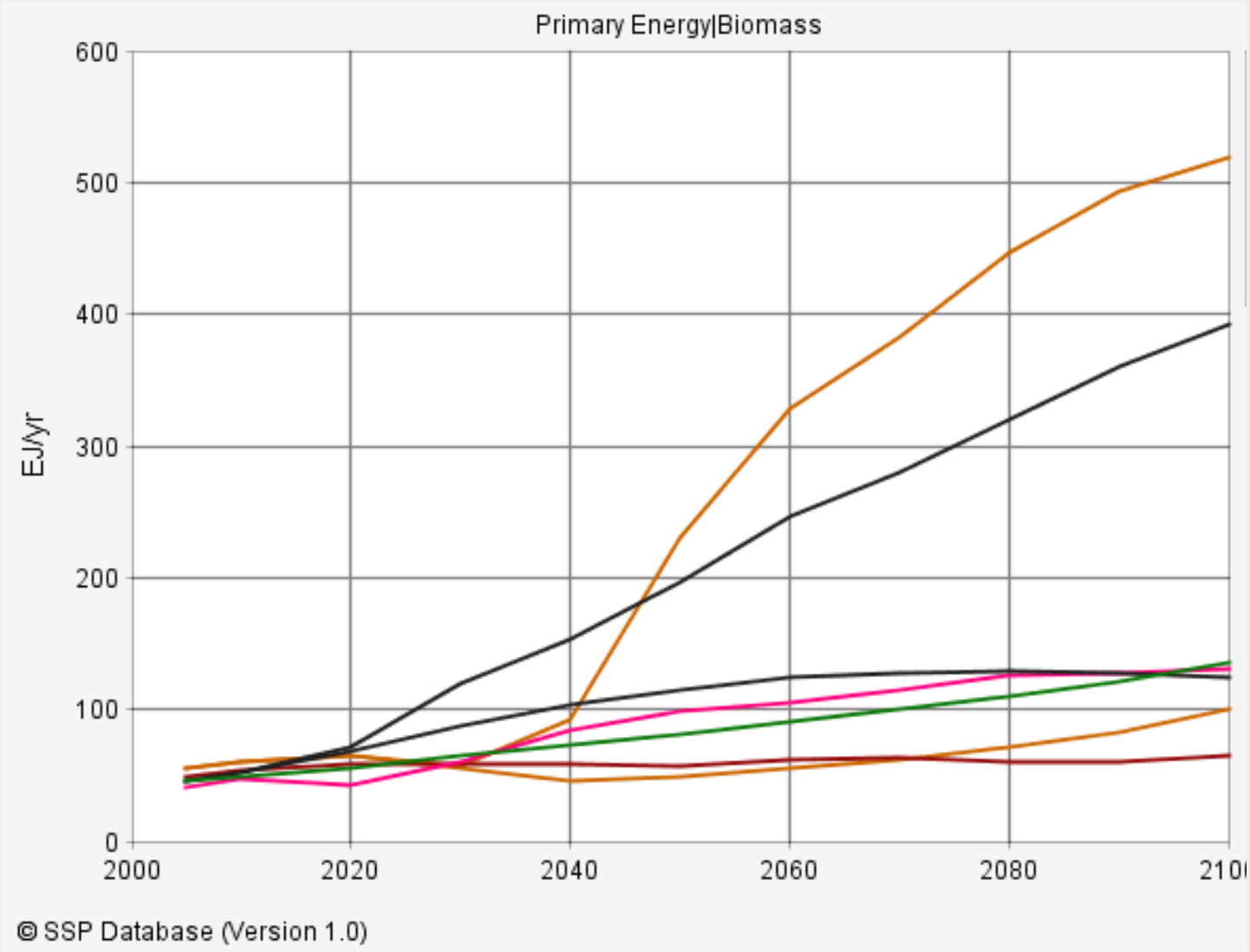

Shared Socioeconomic Pathways
SSP1
Sustainability
SSP2
Middle of the Road
SSP3
Regional Rivalry
SSP4
Inequality
SSP5
Fossil-fueled Development
SRES
A2, B1, B2
Climate (RCPs)
2100 forcing level (W/m²)
8.5
6.0
4.5
2.6
Range of IAM baseline scenarios
CMIP5 simulations (RCPs)

Biomass energy



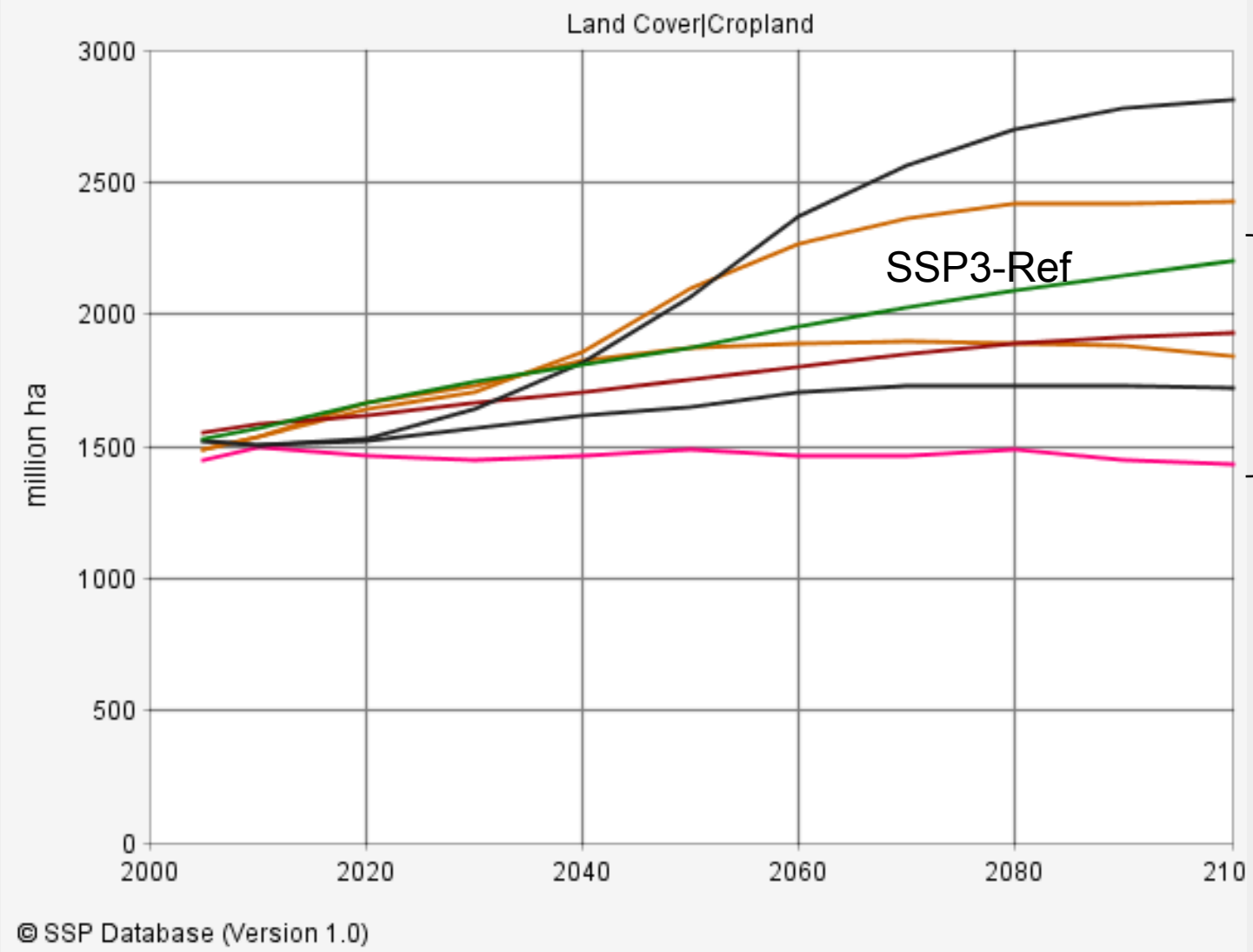
SSP5-2.6

SSP4-2.6

Reference scenarios

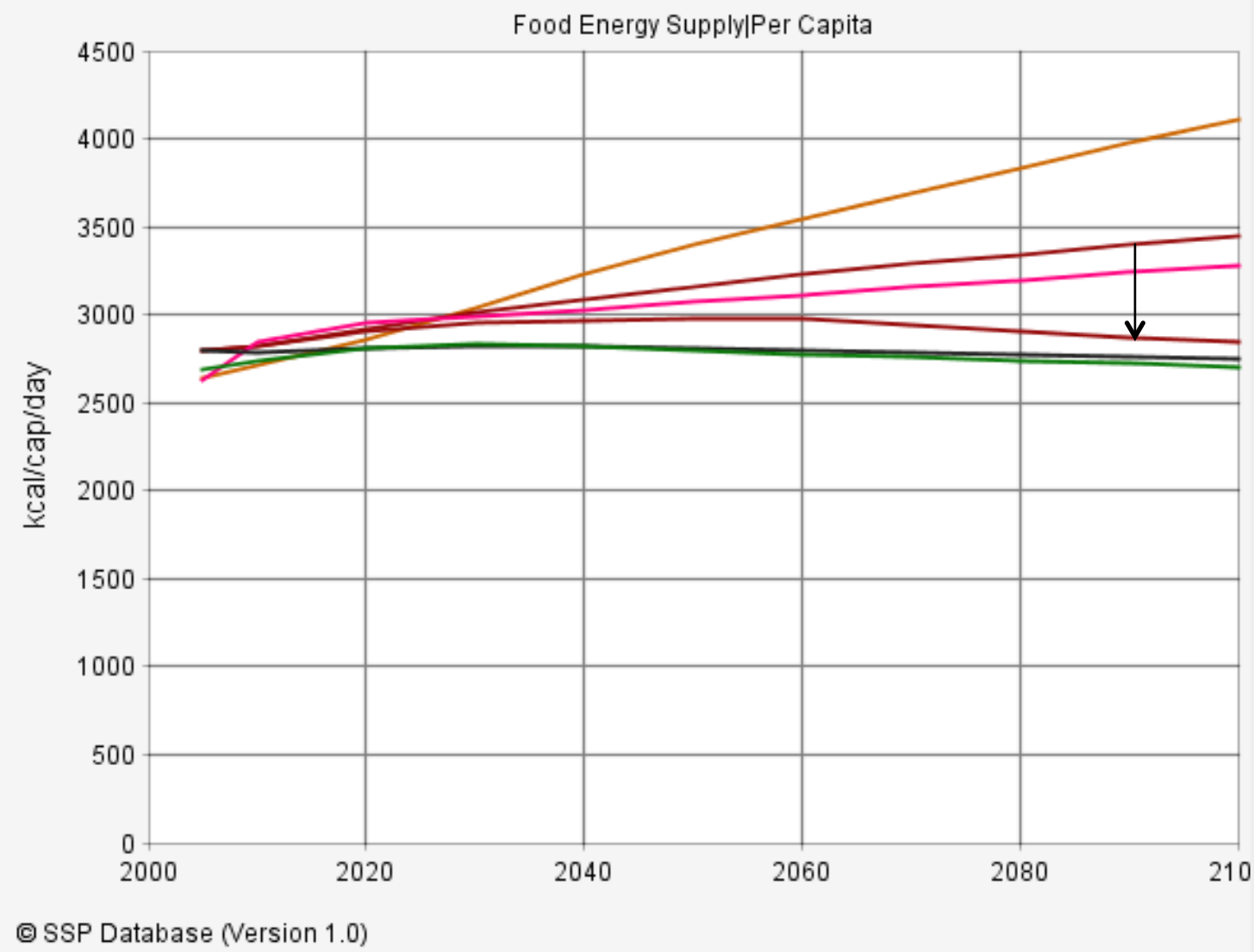
Preliminary Results, IIASA SSP Database, September 2015

Cropland



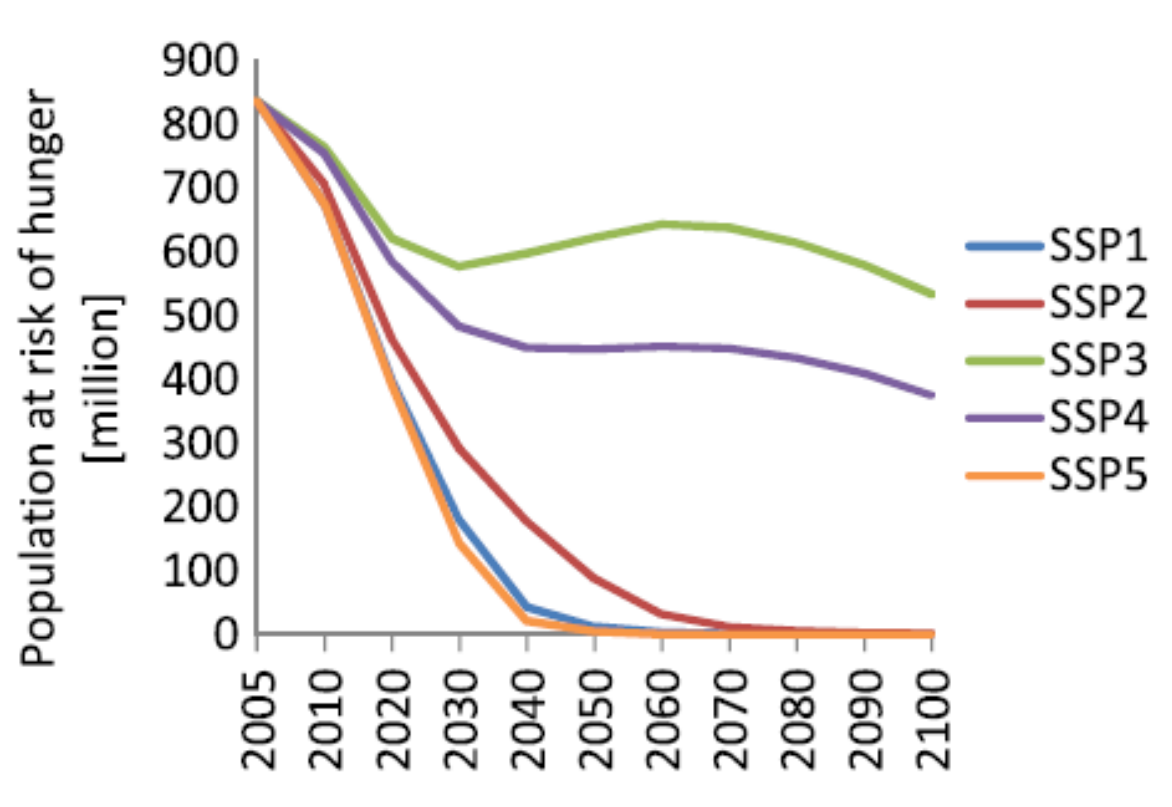
Preliminary Results, IIASA SSP Database, September 2015

Food Energy Supply Per Capita, Reference Marker Scenarios

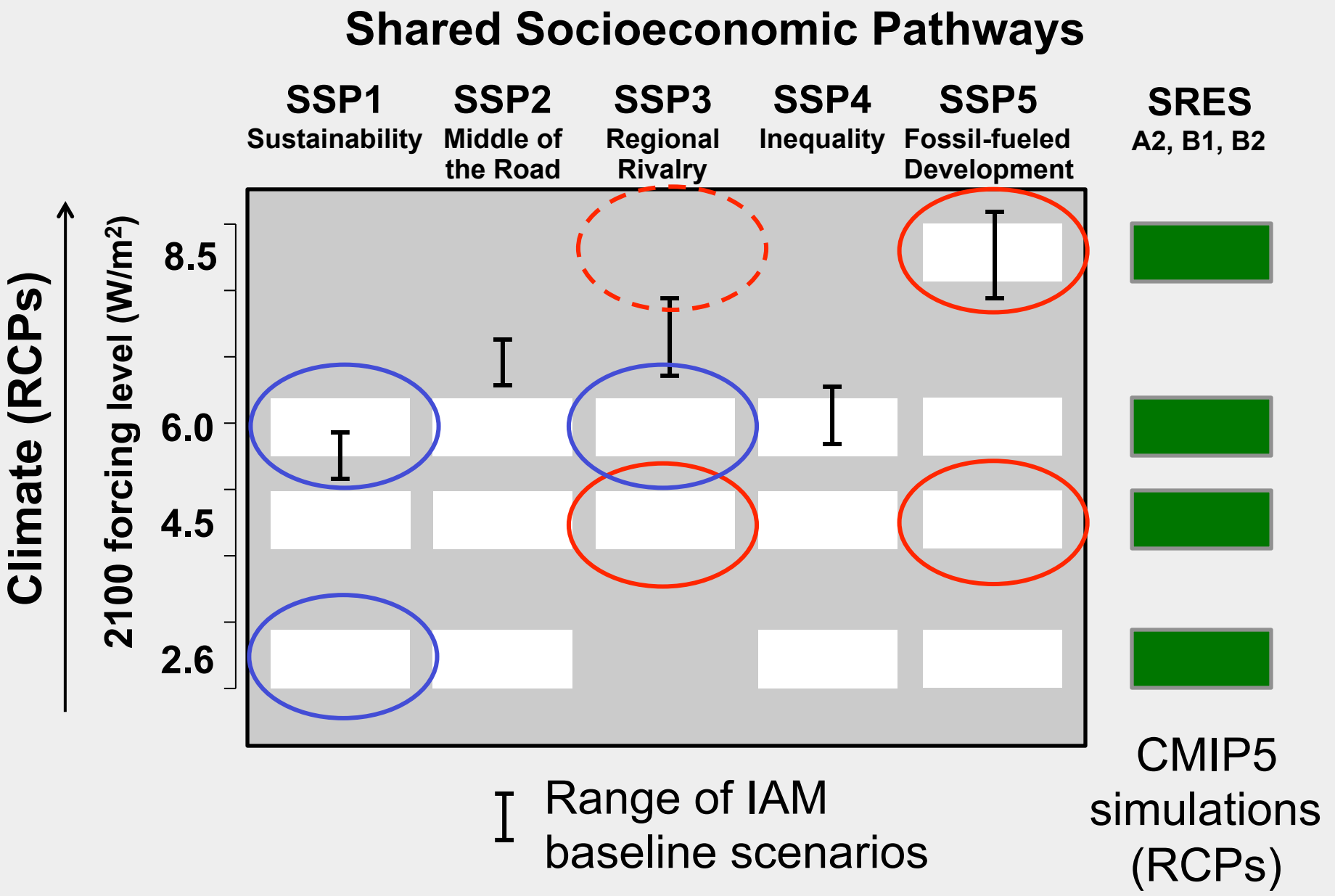


Preliminary Results, IIASA SSP Database, September 2015

Socioeconomic development effects on the risk of hunger (no climate impacts)



Hasegawa et al., 2015.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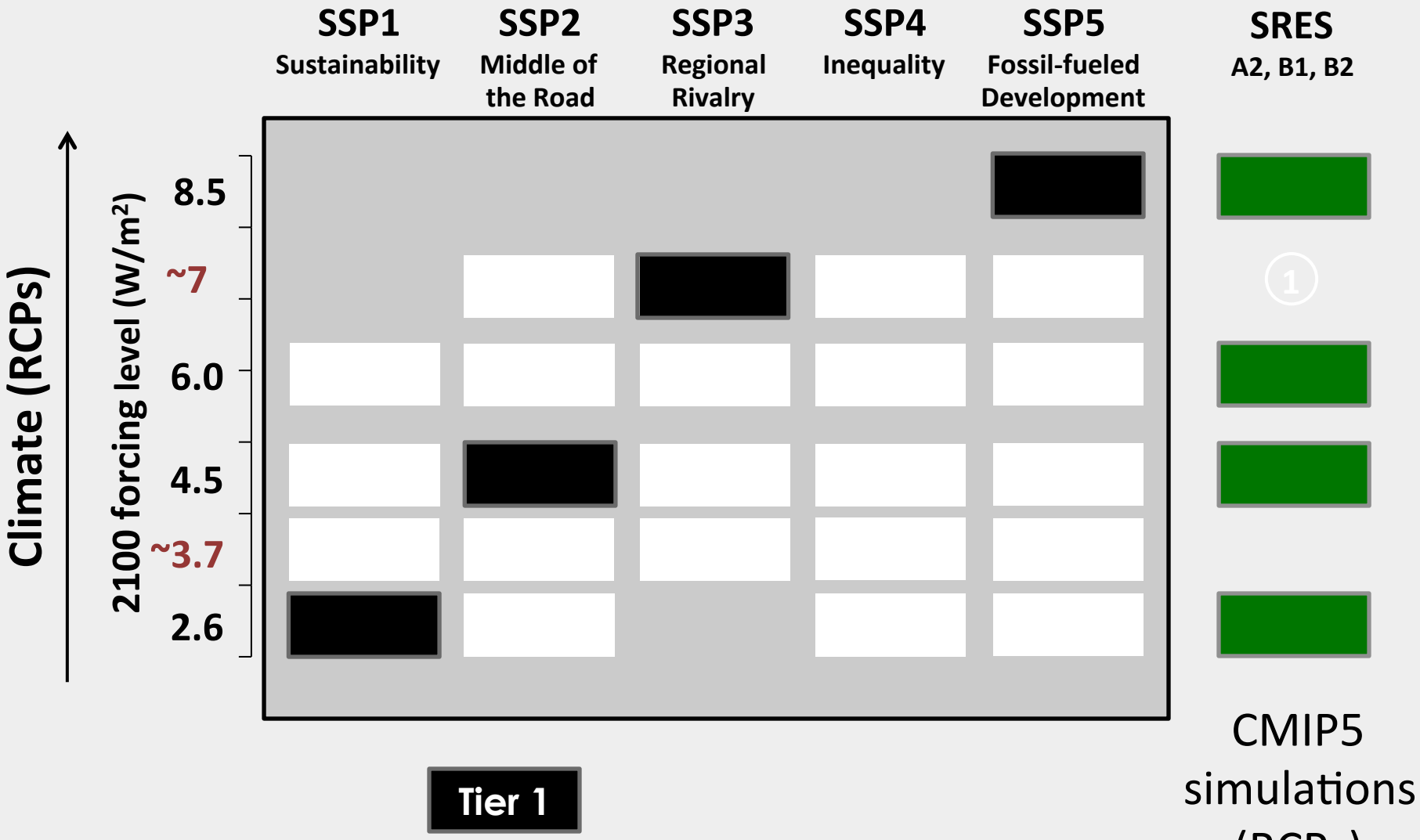
CMIP5 simulations (RCPs)

Recommendations

- Design should follow directly from questions driving the assessment
  - Is it about sustainability?
  - About bounding the range of uncertainty?
  - About evaluating specific options?
- Closer look at SSP narratives and preliminary IAM scenarios to inform design choices
- More interaction with SSP and IAM process going forward

ScenarioMIP design

Shared Socioeconomic Pathways



ScenarioMIP design

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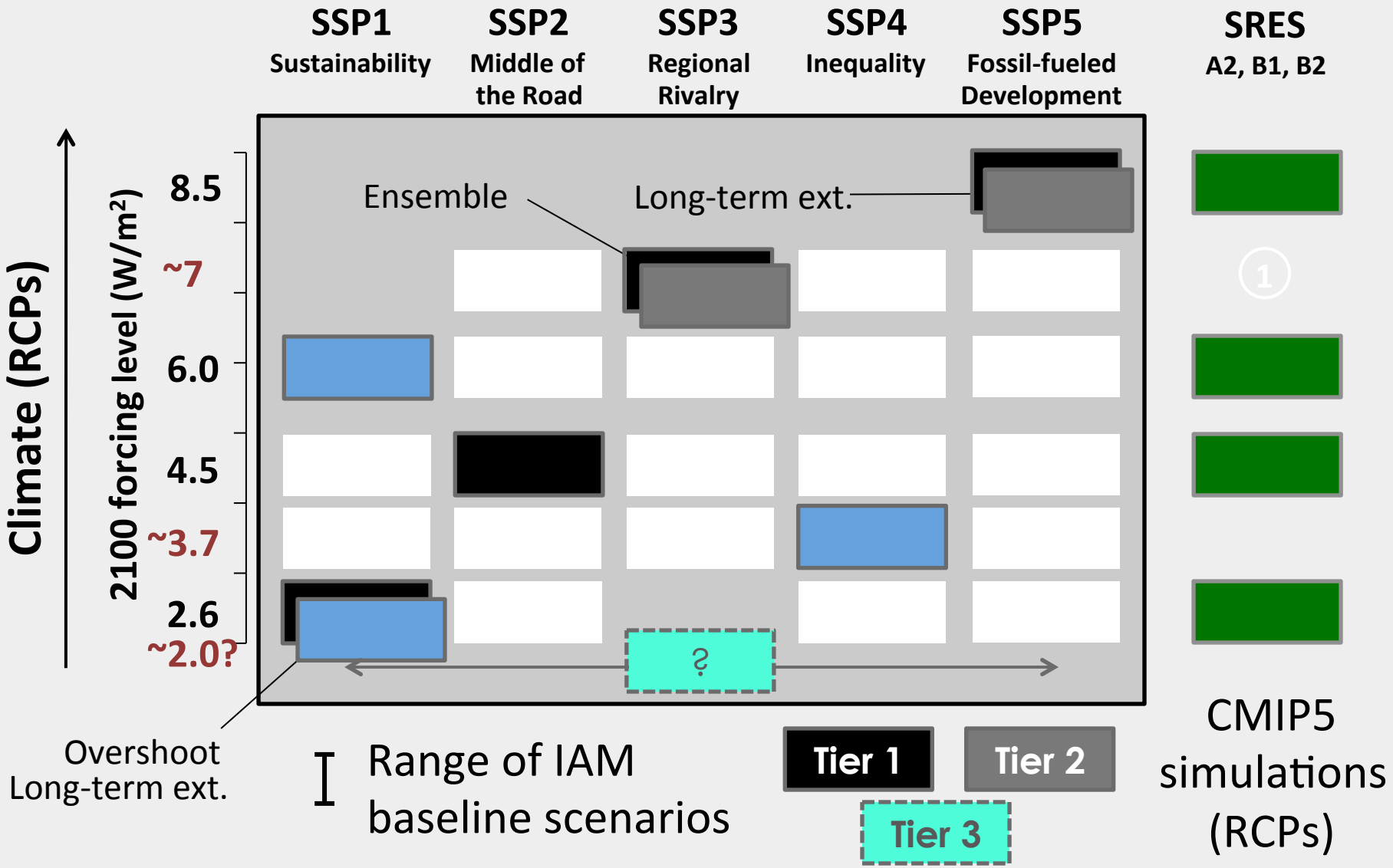


Why use this framework?

Save time and effort in developing new scenarios

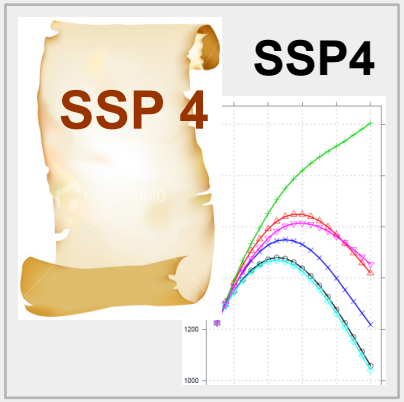
Avoid reinventing the wheel

Improve comparability across studies of different sectors and scales, and therefore improve assessment

But: don't feel locked in, especially to the details

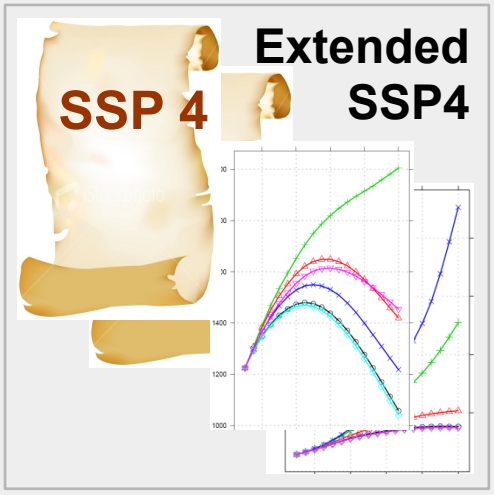
Basic vs Extended SSPs

Basic

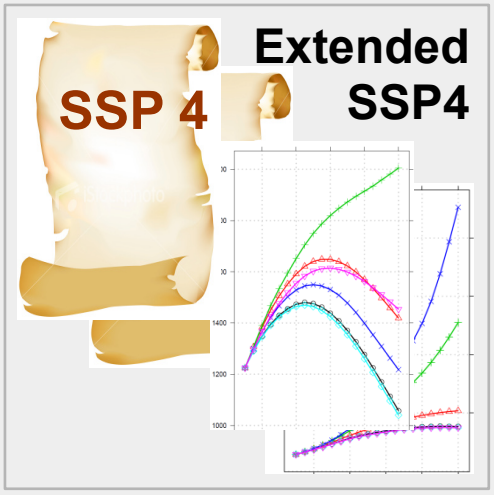


Broad trends in development, limited in regional and sectoral detail

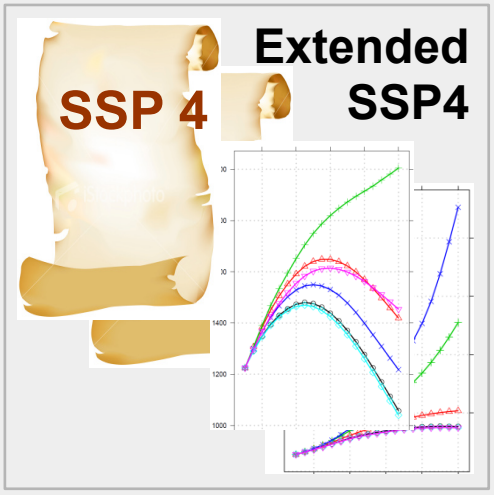
Regional Extension



Sectoral Extension

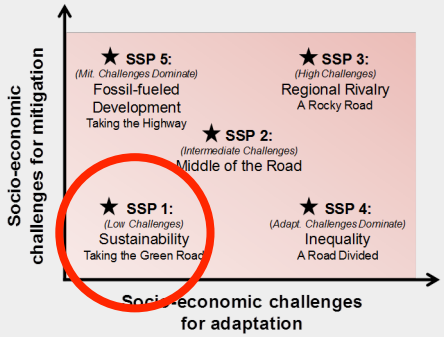


Global Extension



SSP1: Sustainability

The world shifts gradually, but pervasively, toward a more sustainable path, emphasizing more inclusive development that respects perceived environmental boundaries.



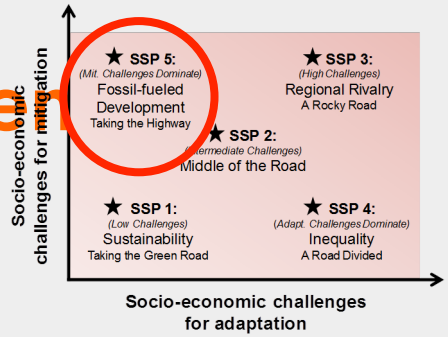
- Increasingly effective cooperation of local, national, and international institutions.
- Commitment to development goals. Reduction of inequality across and within countries.
- Educational and health investments accelerate demographic transition, leading to low population.
- Emphasis on economic growth shifts toward a broader human well-being
- Consumption oriented toward resource and energy efficiency.

Low challenges to mitigation: Development of environmental & renewable energy technologies, international cooperation, and low energy demand.

Low challenges to adaptation: Improvements in human well-being, strong institutions

SSP5: Fossil-fueled developme

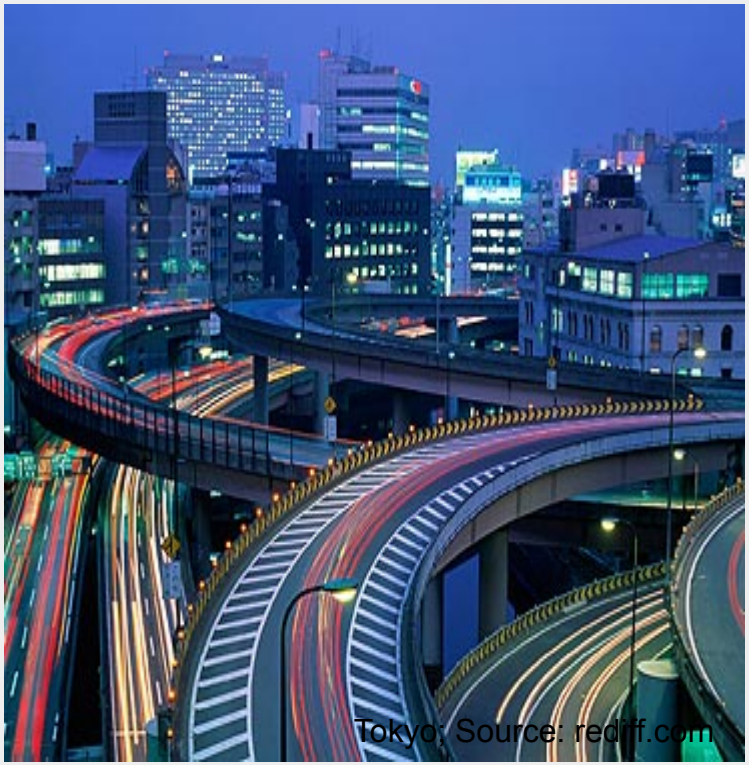
This world places increasing faith in competitive markets, innovation and participatory societies to produce rapid technological progress and development



- Rapid human development, technological progress and economic growth
- Resource intensive lifestyles and extensive fossil fuel use
- Strongly globalizing world with high mobility and peak & decline in population

High challenges to mitigation:
Strong reliance on fossil fuels and lack of global environmental concern

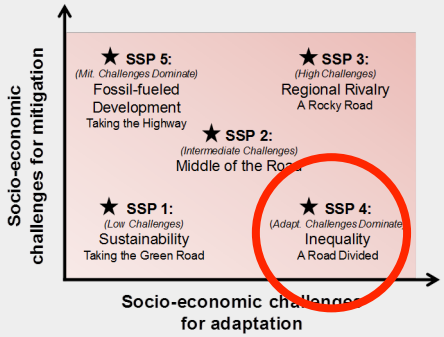
Low challenges to adaptation:
Attainment of human development goals, robust economic growth, and highly engineered infrastructure



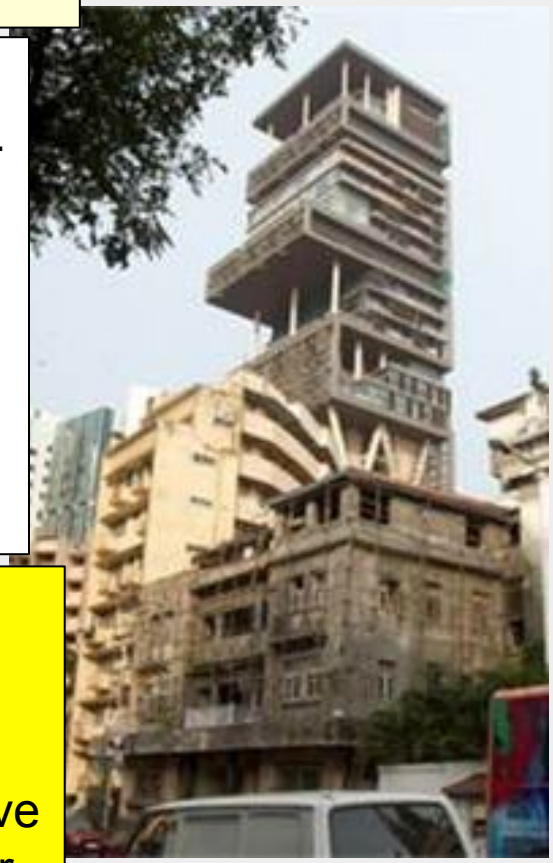
Tokyo; Source: rediff.com

SSP4: Inequality

Increasing disparities in education, economic opportunity and political power lead to growing inequalities across and within countries. A gap widens between a well educated international society supporting a high-tech global economy, and fragmented lower-income, poorly educated societies that work in regional low-tech economies.



- Power becomes more concentrated in a political and business elite. Vulnerable groups have little representation.
- Economic growth is moderate in industrialized and middle-income countries, while low income countries lag behind. Social cohesion degrades and unrest becomes common.
- Technology development is high in the high-tech economy. Uncertainty in fossil fuel markets leads to a diversification of energy sources, incl. investment in low-carbon energy.



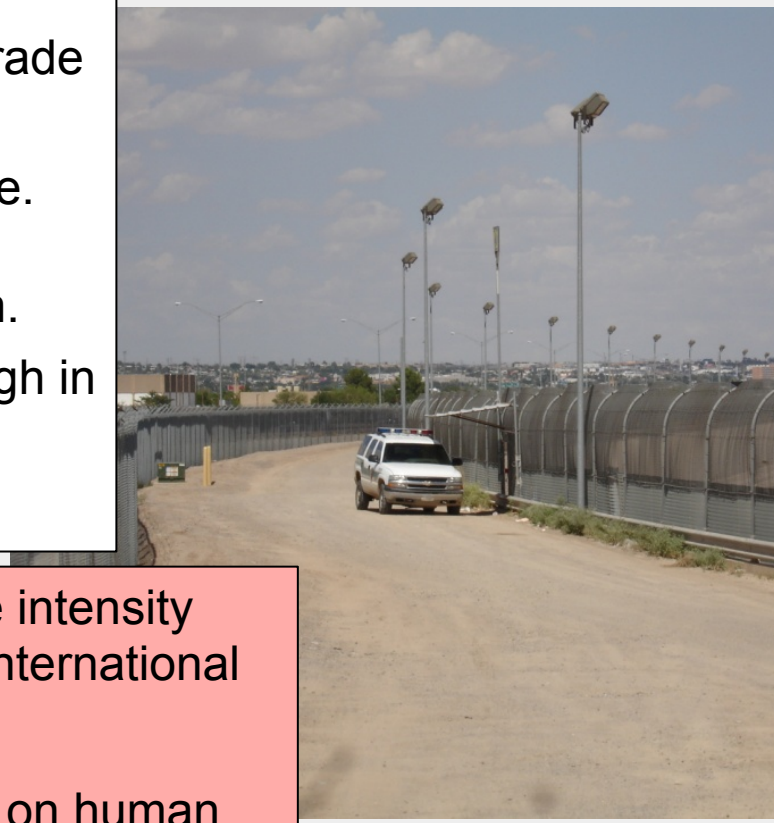
Low challenges to mitigation: Some development of low carbon options. Well-integrated international political and business class capable of acting quickly and decisively

***High challenges to adaptation*:** Large population groups have low levels of development and limited access to institutions for coping with economic or environmental stresses.

SSP3: Regional Rivalry

A resurgent nationalism, concerns about competitiveness and security, and regional conflicts push countries to increasingly focus on national and regional security issues, including energy and food security.

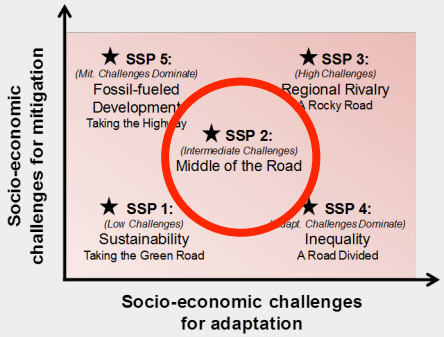
- Move toward more authoritarian forms of government with highly regulated economies. Trade barriers are raised as the world deglobalizes.
- Investments in education and technology decline. Economic development is slow, consumption is material-intensive, inequalities persist or worsen.
- Population growth is low in industrialized and high in developing countries.
- Low priority for environmental concerns



High challenges to mitigation: Growing resource intensity and fossil fuel dependency. Difficulty in achieving international cooperation. Slow technological change.

High challenges to adaptation: Limited progress on human development, slow income growth, lack of effective institutions.

SSP2: Middle of the Road

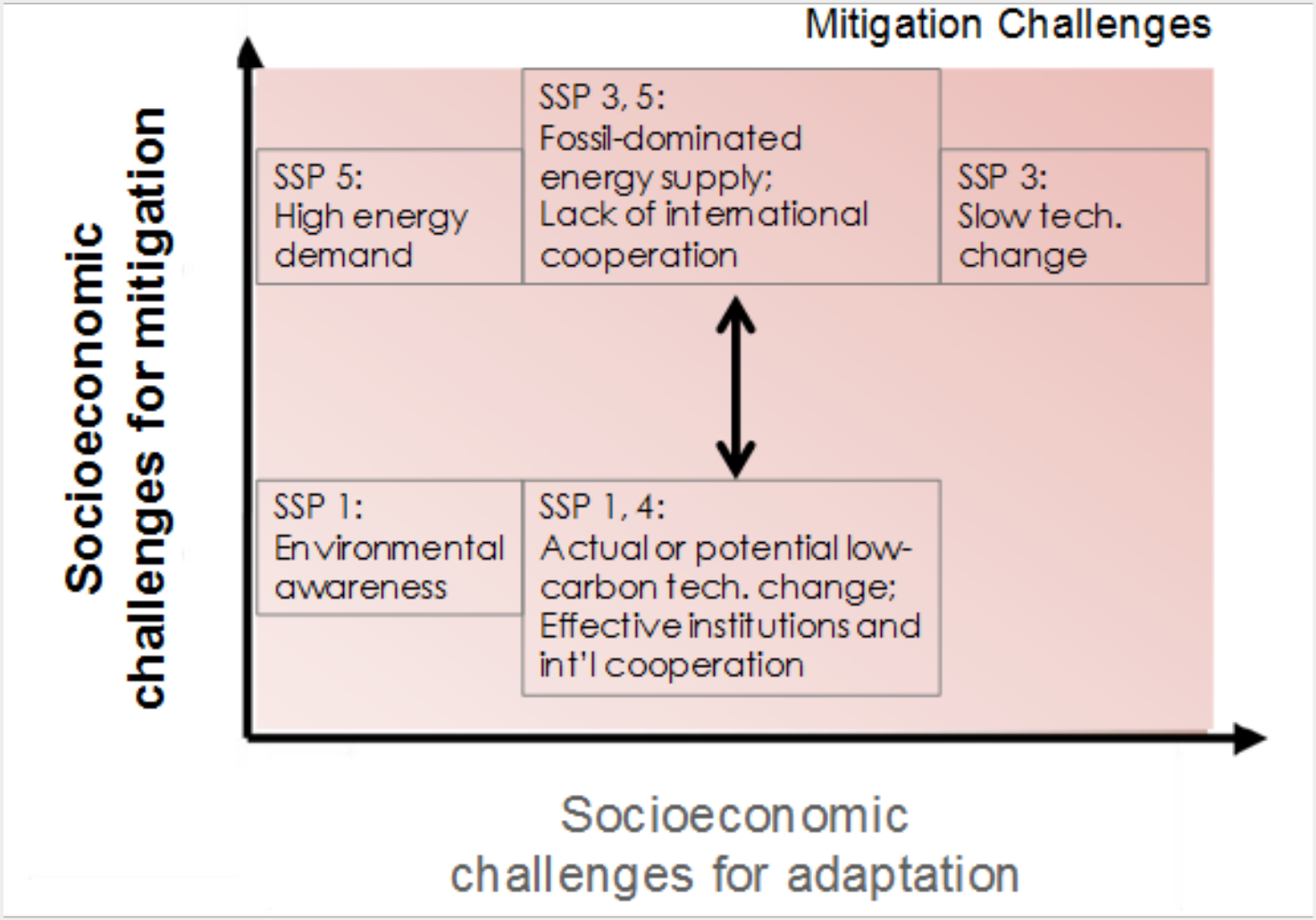


The world follows a path in which social, economic, and technological trends do not shift markedly from historical patterns.

- *Development and income growth proceeds unevenly, and income inequality persists. Globally connected markets function imperfectly.*
- *Global and national institutions make slow progress in achieving sustainable development goals.*
- *Technological development proceeds apace, but without fundamental breakthroughs.*
- *Environmental systems experience degradation, although the overall intensity of resource and energy use declines. Fossil fuel dependency decreases slowly.*
- *Global population growth is moderate and levels off in the second half of the century.*

These moderate development trends leave the world, on average, facing **moderate challenges to mitigation and adaptation**, but with significant heterogeneities across and within countries.

SSP differences in challenges to mitigation



SSP differences in challenges to adaptation