CMIP5, SSPs, AR5, US NCA are not finished. And yet, it's time to …

...plan scenarios for the next round of research and assessment

- Are we already behind?
- What have we learned in the first round of the new scenario process?
- What are the policy and science questions that will need to be addressed in the AR6 and other assessments?
- What research design for scenarios is appropriate for these questions?
Why work on scenarios “together”*?

* “Together” = ESM+IAM+IAV

- Increasing overlaps in models – research opportunity
- ESMs need them for time dependent response from realistic forcing
- Service to IAV research, which needs integrated climate, socioeconomic, ..., scenarios – implications for regional level analysis
- Service to users – address major scientific and policy-relevant questions that require collaboration
Selecting scenarios ...

- IAM and IAV have been asked to provide input and we’re happy to do that, but
  - … selecting scenarios needs to be a joint decision

- Evaluate ongoing process
  - Consider the questions that motivated the last round, how has the science progressed?
  - What “works” and what doesn’t (e.g., handoffs)?
  - What remains to be done, e.g., work on “pattern scaling”
Parallel process

**RADIATIVE FORCING**

- **GENERAL CHARACTERISTICS**
  - Uncertainty range of forcing in 2100
  - Shape of radiative forcing over time

- **REPRESENTATIVE CONCENTRATION PATHWAYS (RCPs)**
  (Four pathways from existing literature)
  - GHGs
  - Short-lived gases and aerosols
  - Land cover/use

**NEW SOCIO-ECONOMIC and EMISSIONS SCENARIOS; VULNERABILITY STORYLINES**

- Adaptation
- Mitigation
- Stabilization
- Overshoots
- ... (RCP-related)
- Independent of RCPs

**CLIMATE SCENARIOS**

- Near-term (2035)
- Long-term (2100+)
- Regional climate modeling
- Pattern scaling methods

**INTEGRATION OF CLIMATE AND SOCIO-ECONOMIC SCENARIOS**

- Integrated scenarios
- Pattern scaling (climate)
- Downscaling of climate and socio-economic scenarios
- ... (RCP-related)
- Independent of RCPs

**NEW RESEARCH AND ASSESSMENTS**

- Impact, adaptation, and vulnerability studies
- Feedbacks
- Model development
- ...

Source: Moss et al. 2010
Selecting scenarios ...

- IAM and IAV have been asked to provide input and we’re happy to do that, but
  - … selecting scenarios needs to be a joint decision

- Evaluate ongoing process
  - Consider the questions that motivated the last round, how has the science progressed?
  - What “works” and what doesn’t (e.g., handoffs)?

- Identify questions, models, scenario characteristics
  - Examine existing runs/resources that can be used before proposing new work
  - Design scenarios to address more than one question
Overview of policy and IAV information needs and updates on CMIP5 and SSP processes

Three issues that are expected to be important to national and international policy formulation:
- land use
- emissions of short-lived species, and
- “overshoot” futures

Needs for national or subnational assessments which require nesting and integration of different types of scenarios (e.g., climate, socioeconomic, land use, sea level) – several US cases

Scenario ideas for coordination with CMIP6

Improvements for coordination across the three research communities

Other topics or ideas for scenarios: short presentations by participants
Selecting scenarios …

► It needs to be a joint decision
► Evaluate ongoing process
► Identify questions, models, scenario characteristics
► Ongoing dialogue over the next year to develop specifics
  ■ A number of recent and upcoming meetings offer opportunities to refine approach
  ■ Many ideas on the table – can’t focus on all in this short session
► Establish a set of scenarios that
  ■ Enables the three communities to provide information that none could supply individually
  ■ Provides means of addressing research challenges within each community
► Interact with policymakers and funding agencies
On to presentations and discussions
Research community planning: series of workshops, summer 2013

- Sustainable Global Climate Mitigation Scenarios Workshop (May 29-31, National Center for Socio-Environmental Synthesis (SESYNC, Annapolis, MD)
- Societal Dimensions Working Group Meeting, CESM Workshop (June 20, 8:30-12 noon, Breckenridge, CO)
- Feedbacks and Uncertainties in Integrated Assessment Models and Scenarios, Energy Modeling Forum, Climate Change Impacts and Integrated Assessment, July 31-August 2, Snowmass CO)
- Next Generation Climate Change Experiments Needed to Advance Knowledge and for Assessment of CMIP6 (August 4-9, Aspen Global Change Institute)

An additional meeting is needed to integrate results
- NRC BASC-BECS Joint Roundtable? October 2013? (would need funding)
Sustainable Global Climate Mitigation Scenarios

• The current set of normative goals (e.g. food, energy, climate) is an unconstrained challenge.
• Other important characteristics of the system are impacted in future scenarios, sometimes inadvertently (e.g. biodiversity, other ecosystem services, human well being).
• There is an opportunity to pull additional normative considerations forward in scenario planning process to meet goals and reduce and/or avoid impacts?
• 3 year NSF-SESYNC Pursuit, First Workshop May 29-31, 2013, Annapolis, MD

Wise et al. 2009
Past drivers of scenario development

- Method to coordinate synthesis in assessments (IPCC, NCA, …)
- Inputs to CMIP5: Representative Concentration Pathways (RCPs)
- Inputs to diverse CCIAV research (in conjunction with ESM-based scenarios)
- Context for scenario planning (USFS, many others)
Scenarios workshop:
Assessing recent experience and planning next scenarios for research and assessment

- Purpose: Identify potential coordinated experiments and useful scenarios
- Feeds into AGCI workshop on CMIP6 the week following
- Background papers provided:
  - Hibbard et al., 2007
  - Moss et al., 2010
  - van Vuuren et al., 2011
Representative Concentration Pathways (RCPs) are one output (but there are many others)

- The RCPs: 4 levels of radiative forcing that span the emissions literature
- Consistent estimate of historical emissions (from 1850) and projections in 12 source sectors
- Harmonized land use scenarios for 1500-2100
- Shared socioeconomic pathways
- …
Traditional linear approach: previous flows of information among groups of models

- **Socio-Economic Scenarios**
  - Population
  - GDP
  - Energy
  - Industry
  - Transportation
  - Agriculture
  - ...

- **Emissions Scenarios**
  - Greenhouse gases (CO₂, CH₄, N₂O, ...)
  - Particles (SO₂, BC, OC)
  - Chemically active gases (CO, NOₓ, VOCs, NH₃0)
  - Land use & land cover

- **Radiative Forcing Scenarios**
  - Atmospheric concentrations
  - Carbon cycle – including ocean and terrestrial fluxes
  - Atmospheric chemistry

- **Climate Scenarios**
  - Temperature
  - Precipitation
  - Humidity
  - Soil moisture
  - Extreme events
  - ...

- **Impact, Adaptation, Vulnerability Studies**
  - Coastal zones
  - Hydrology and water resources
  - Ecosystems
  - Food security
  - Infrastructure
  - Human health
  - ...
Improve framework for linking socio-economic and climate scenarios

Needed for impact and regional mitigation assessments: integrated socioeconomic and climate scenarios in an accessible format from a distributed scenario archive

Socio-economic Scenarios
- SSPs (reference scenarios)
- Shared Policy Scenarios (stabilization policies)

Infrastructure and process needed to archive and disseminate new integrated scenarios

Consistent socio-economic-climate change scenarios for use in IAV research and assessment

ESM runs with RCPs
- Long-term ensemble runs

Stabilization

CMIP5 Archive (PCMDI)

Institution for archiving SSPs and stabilization scenarios?

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