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Scenarios: Background and Update for Workshop Participants

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Pre-Workshop Webinar
Population and Land use/cover Interagency Workshops
28 May 2014

The author gratefully acknowledges the U.S. Department of Energy's Integrated Assessment Research Program.

May 28, 2014

PNNL-SA-



U.S. DEPARTMENT OF
ENERGY

Office of
Science

- ▶ Rationale for scenarios, example uses of scenarios in global change research and assessment
- ▶ Update on ‘parallel’ scenario process
 - Status
 - Socioeconomic scenarios
 - Integration
- ▶ National and Subnational Scale Scenarios for the United States
 - Motivation and uses
 - Population and land use workshops
- ▶ Update on Shared Socioeconomic Pathways (Brian O’Neill)

Rational for Scenarios

- ▶ Nobody responsible for planning can afford the luxury of assuming a static environment for their analyses and decisions
- ▶ Analysts and decision makers need tools to help them think in a rigorous and creative fashion about opportunities and risks in the future
- ▶ Scenarios provide a foundation for ‘if-then’ analysis about change that considers inter-relationships and feedbacks across multiple environmental and socioeconomic processes at varied geographical scales
- ▶ Many people won’t use model-produced climate scenarios so a fusion approach that incorporates observations, modeling, and qualitative research is needed
 - Multiple sources of observations across socioeconomic and physical systems
 - Narratives, e.g., climate outlooks, socioeconomic pathways
 - Quantitative scenarios (emissions, climate, sea level, land use, ...)

Decision Makers Confront Many Uncertainties



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National or Regional
Climate Policy

Regional Socioeconomics

Regional Climate

Population
Growth?
Migration?
GDP?

Regional Resources and
Technologies

Energy Costs?
Non-Energy Costs?
Availability?
New Technologies?

Hotter?
Colder?
When? How Much?
Drier?
Wetter?

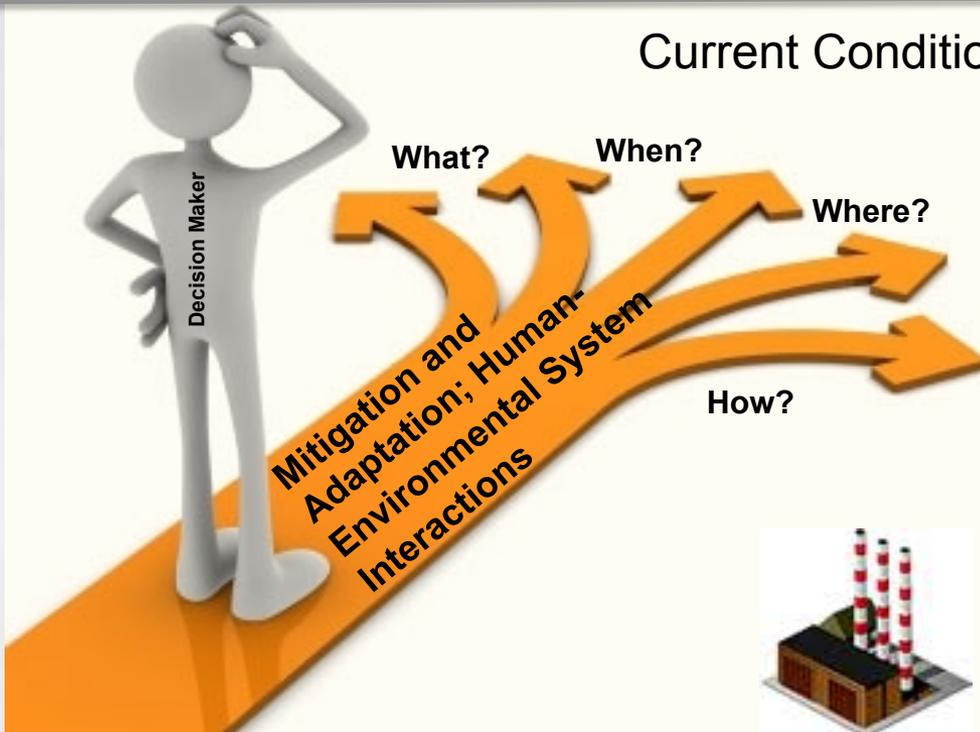
Regional Impacts
and Interactions

Economic?
Health?
Ecosystems?
Natural Resource
Conflicts?

None?
Cap and Trade?
AFOLU?

Future

Current Conditions



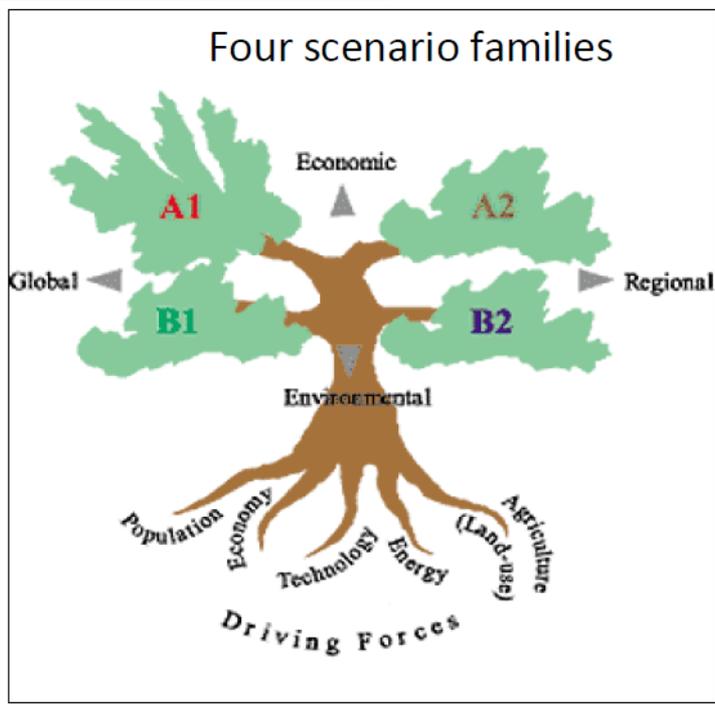
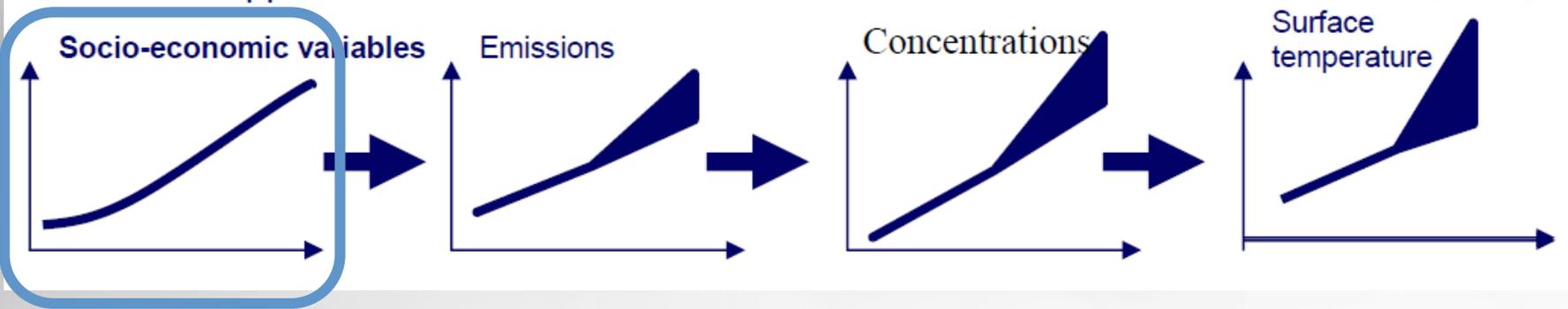
Scenarios...

- ▶ ... are plausible descriptions of how aspects of the future might unfold
- ▶ ... help broaden thinking about the future
- ▶ ... have two general uses in climate science/assessment
 - Integrate different areas of science
 - Inform decision support and planning
- ▶ ... are NOT predictions (although some use them as if they were)

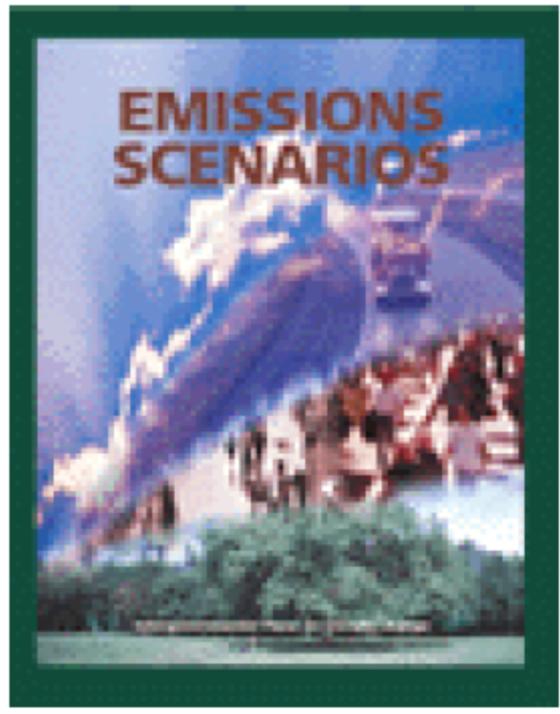




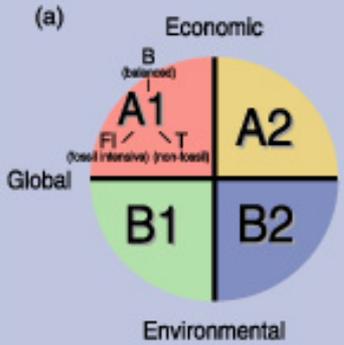
Traditional/Sequential Scenario Process



SRES Scenarios

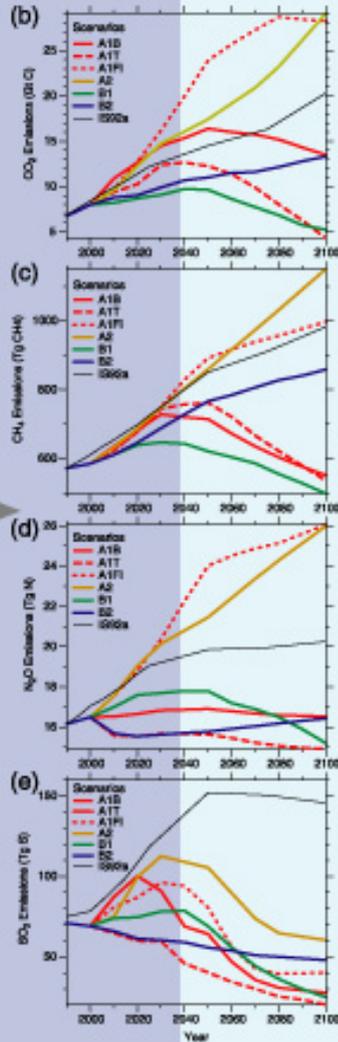


Socio-Economic Scenarios

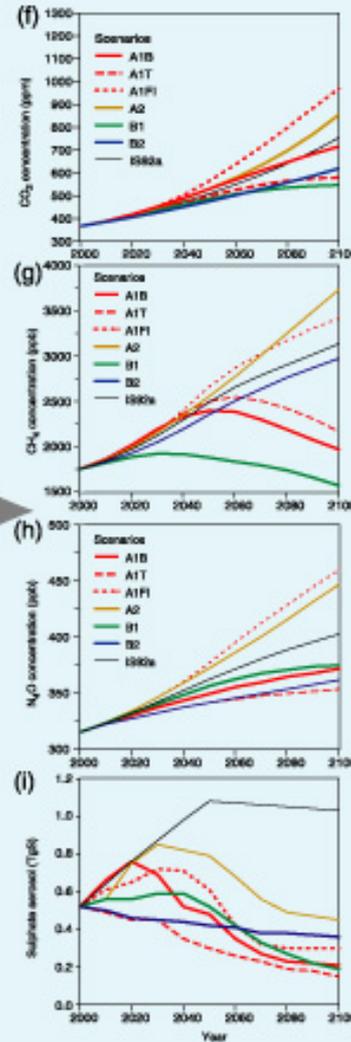


WGIII

Emissions

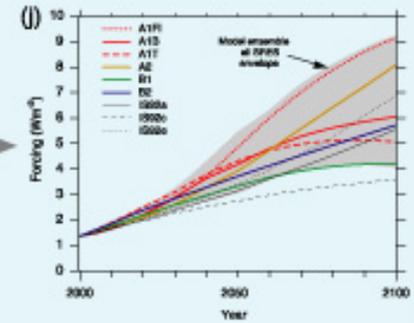


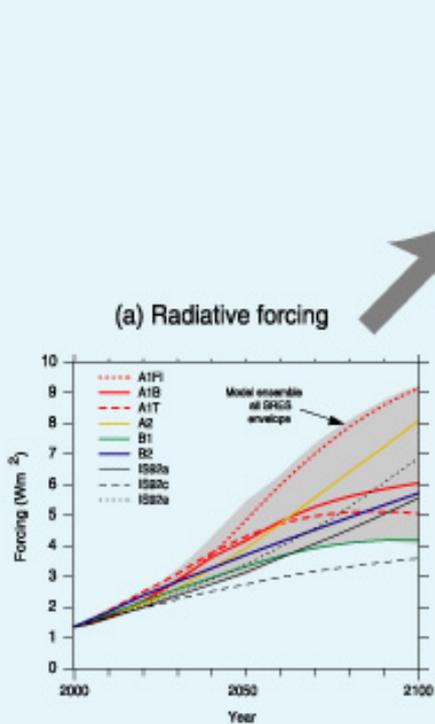
Concentrations



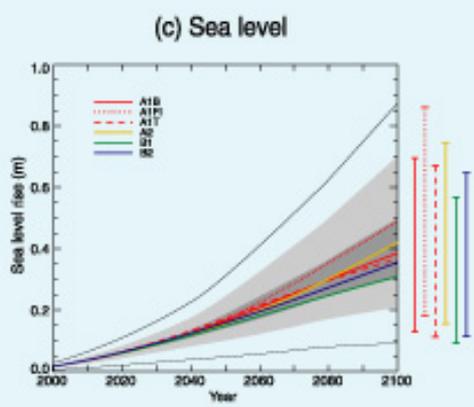
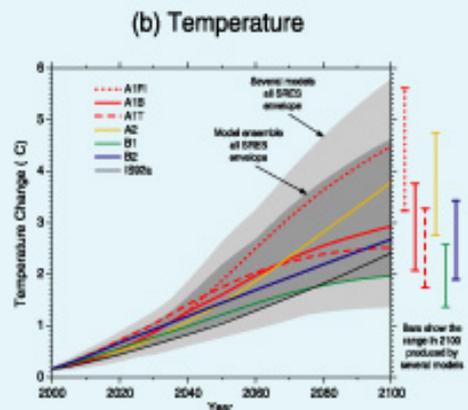
WGI

Radiative forcing



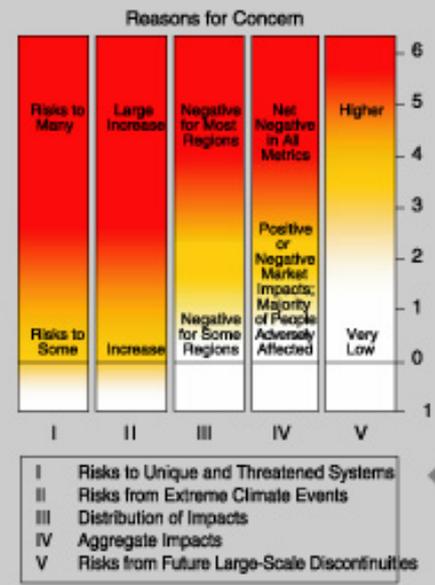


WGI



WGII

(d) Impacts



Adaptation

Mitigation

WGIII

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC)



Scenario families



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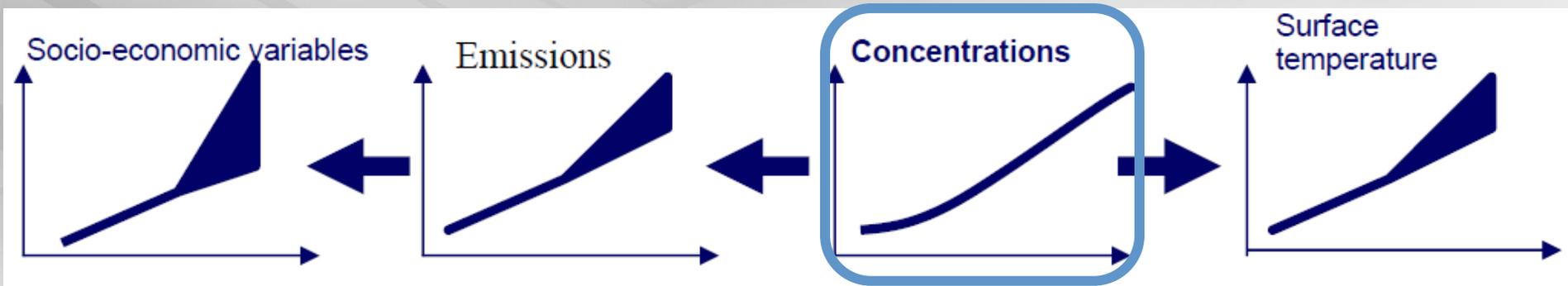
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	IPCC-SRES	GEO-3	Millennium Ecosystem Assessment	FAO
Economic optimism, market liberalisation	A1	Markets First	<i>Global Orchestration</i>	
Reformed market scenario		Policies First	<i>Global Orchestration</i>	
Global sustainable development	<i>B1 (B1-450)</i>	Sustainability First	TechnoGarden	
Regional competition, low growth	A2	Security First	Order from Strength	
Regional sustainable development	<i>B2</i>		Adapting Mosaic	
–Business as usual” (medium	<i>B2</i>			AT2015/2030
Main interest	Greenhouse gas emissions	Global environmental change	Changes in ecosystem services;	Changes in agricultural production

Characteristics of Main Scenario Features

	Economic optimism	Reformed markets	Global sustainable development	Regional competition	Regional sustainable development	FAO
Economic development	Very rapid	Rapid	Slow-rapid	Slow	Slow/medium	Medium
Population growth	Low	Low	Low	High	Medium	Medium
Technology development	Rapid	Rapid	Medium-Rapid	Slow	Slow-medium	Medium (Rapid in some regions)
Main objectives	Economic growth	Various goals	Economy, Environment, Equality	Security	Local sustainability	-
Attitude towards env. Protection	Reactive	Pro-active – reactive	Pro-active	Reactive	Pro-active	Medium
Trade	Globalisation	Globalisation	Globalisation	Trade barriers	Trade barriers	Globalisation
Policies/institutional development	Policies create level playing fields for markets	Policies help reducing market failures	Strong global governance	Strong national governments	Local steering; local actors	

New Parallel Scenario Process



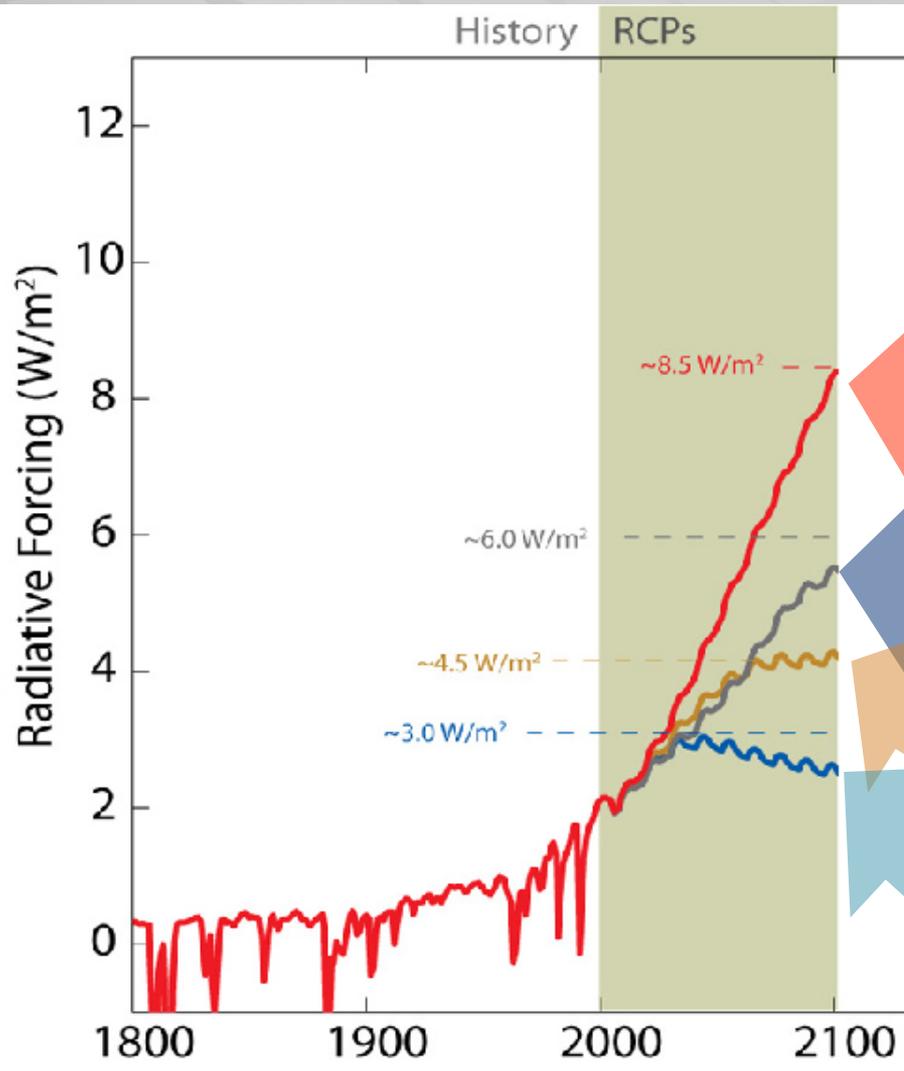
Shared Socio-economic Pathways (in process)

RCPs (Complete)

CMIP5 (Complete)

- Small number
- Shared across RCPs

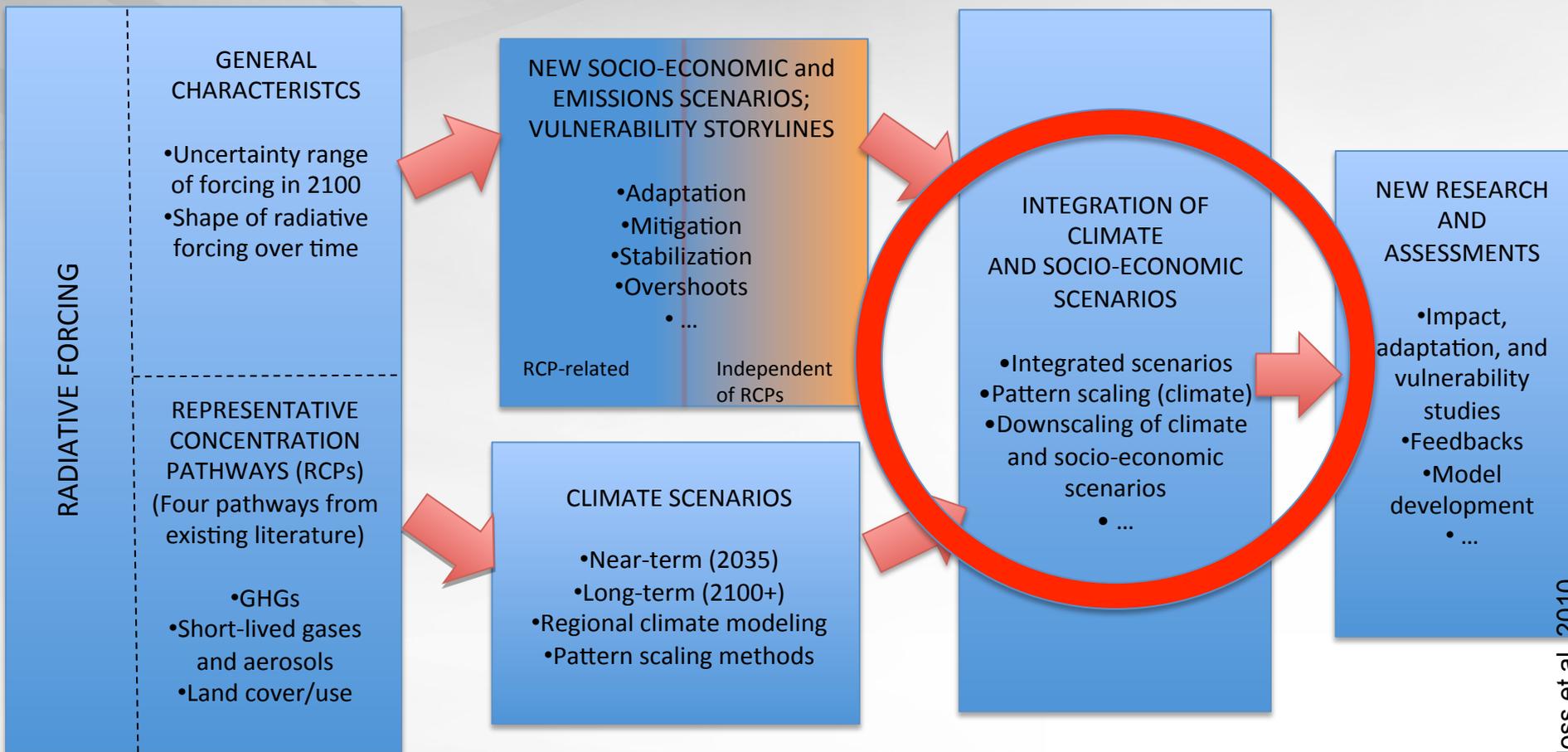
Representative Concentration Pathways (RCPs)



► The climate modeling community wanted 4 levels of radiative forcing that would span the emissions literature.

- 8.5 Wm⁻² (RCP 8.5, 1350ppm CO₂-e)
- 6.0 Wm⁻² (RCP 6.0, 850ppm CO₂-e)
- 4.5 Wm⁻² (RCP 4.5, 650ppm CO₂-e)
- 2.6 Wm⁻² (RCP 2.6, 450ppm CO₂-e)

Next steps: integration and data sharing





Increasing Interest in National and Subnational Scale Scenarios in US Agencies

- ▶ Numerous federal agencies are interested in using global change scenarios to support their research and management missions
- ▶ Interest is driven by fundamental science opportunities and ‘considerations of use’ (federal to local)
- ▶ There are needs for integrated, higher resolution information
 - Scale matters to IAV and mitigation implementation
- ▶ Subnational scenarios can provide common assumptions but shouldn’t be rigid
 - Facilitate comparison across agencies and analyses
 - Agencies want to customize scenarios to meet their specific needs and support their external stakeholders



Box. 6.1. User/Societal Needs

People, communities, states, resource management agencies, and private-sector companies across the country face varied but important planning decisions that will affect the livability and competitiveness of the nation.

National and regional-scale assessments

- Impacts on power plant cooling, hydropower, bioenergy, and other regional energy systems
- Implications for electricity and other national and regional energy distribution systems
- Cascading, multi-sector dependencies and vulnerabilities
- Energy for future water management
- Aggregate damages and economic implications
- Water transfer and boundary issues

Sustainable development planning

- Integrated resource planning
- Sustainability options analysis

Investment and siting decisions

- Facility siting and environmental and economic analysis
- Technology selection and deployment
- Retrofit and/or capital turnover
- Integrated systems designs/perspectives
- Operational reliability

Adaptation strategies

- Implications of adaptation strategies and options
- Global change and other stressors
- Means, extremes, and the implications for vulnerable systems
- Mitigation versus adaptation and search for co-benefits
- Indicators of change

Technology analysis and R&D insights

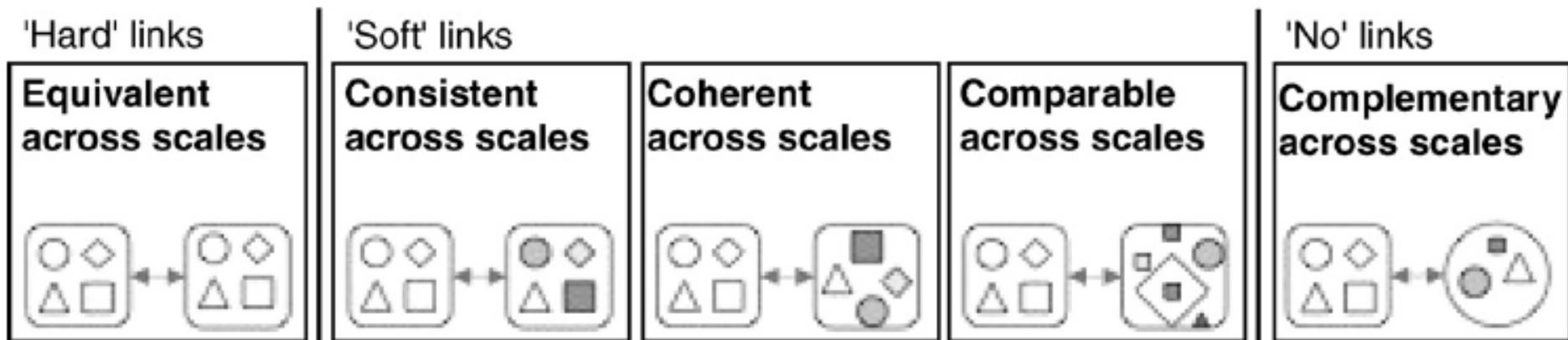
- Technology performance (including economic), water efficiency, and demands
- Technology penetration constraints

▶ Water-energy related
←

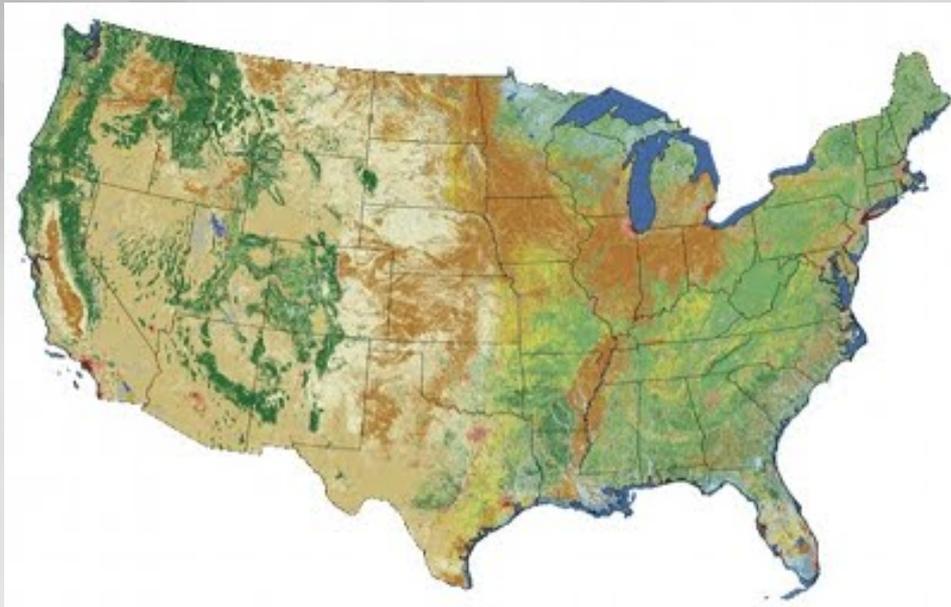
- ▶ Needs also include:
- Vulnerability assmt
 - Forest resources
 - Carbon stocks
 - Fire management
 - Public health
 - Coastal development
 - Economic planning
 - ...

Scientific and Methodological Questions

- ▶ Understanding coupled Earth-human systems?
 - E.g., carbon cycle, hydrology, reg. climate, ...?
 - Regional and sectoral integration/feedbacks?
- ▶ Observational and modeling challenges?
 - Which data sets, predictability, which methods, UQ, extremes, ...?
- ▶ Scenario issues?
 - Level of consistency across scenario types and scales?
 - Degree of difference or 'separation' between scenarios that is 'significant'?
 - 'Probabilistic' ('plausibilistic'?) information for decision making and planning methods?



Interagency Workshops on Subnational Population and Land Use/Cover Scenarios



NLCD Land Cover Classification Legend

11	Open Water
12	Perennial Ice/Snow
21	Developed, Open Space
22	Developed, Low Intensity
23	Developed, Medium Intensity
24	Developed, High Intensity
31	Barren Land
41	Deciduous Forest
42	Evergreen Forest
43	Mixed Forest
51	Dwarf Scrub*
52	Shrub/ Scrub
71	Grassland/ Herbaceous
72	Sedge/ Herbaceous *
74	Moss *
81	Pasture Hay
82	Cultivated Crops
90	Woody Wetlands
95	Emergent Herbaceous Wetlands

* Alaska Only

- ▶ Objectives: Evaluate needs and methods for preparation of subnational land use and population scenarios
- ▶ Topics:
 - Desired characteristics and potential uses?
 - Attributes of land use/cover and population of interest?
 - Spatial scales?
 - Time scales?
 - What uncertainties are most important?
 - Existing data and scenarios?
 - Methods?
 - Programmatic needs/issues?
- ▶ Possibly have initial discussion of narratives or logical structure
- ▶ June 2014, scheduled back-to-back
 - Dan Brown (U Mich), Brian O'Neill (NCAR), Richard Moss (PNNL)

Additional USGCRP Activities

1. Evaluation of scenarios for NCA3
2. Development of improved scenario capacity included as a priority for the “Sustained National Climate Assessment”



Take Aways

- ▶ Global change research requires integrated, multi-faceted scenarios
- ▶ International scenario activities have evolved to facilitate closer collaboration across research communities and research on a range of specific topics
- ▶ US Agencies and users want to explore development of subnational scenarios of key drivers of environmental change and capacities for response
 - Integrated science
 - Support for resource assessments and other mandated activities
 - Adaptation and mitigation planning
- ▶ There is an opportunity to improve application of social, environmental, and climate science to develop these scenarios in methodologically sound ways
- ▶ The population and land scenario workshops will explore user needs, data/methods, and programmatic requirements, focusing on social and environmental science components



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Discussion

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