

The Future of Integrated Assessment Modeling as a Decision Support Tool for Energy and Climate

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Two answers and a path forward ...

- The climate is changing and humanity is in part responsible, particularly over the last 50 years.
 - “The Detection and Attribution Problem”
- If we are to mitigate the human impact, there must be a substantial change in society’s technological infrastructure, most notably in energy
 - “The Carbon Management Problem”
- We are on the eve of implementing our responses - mitigation and adaptation - how do we decide?

One tool is Integrated Assessment

Integrated Assessment for climate change assembles knowledge from a diverse set of sources, relevant to one or more aspects of the climate change issue, for the purpose of gaining insights that would not otherwise be available from traditional, disciplinary research.

Edmonds, J. 1998. Economics and Policy Issues in Climate Change p. 291.

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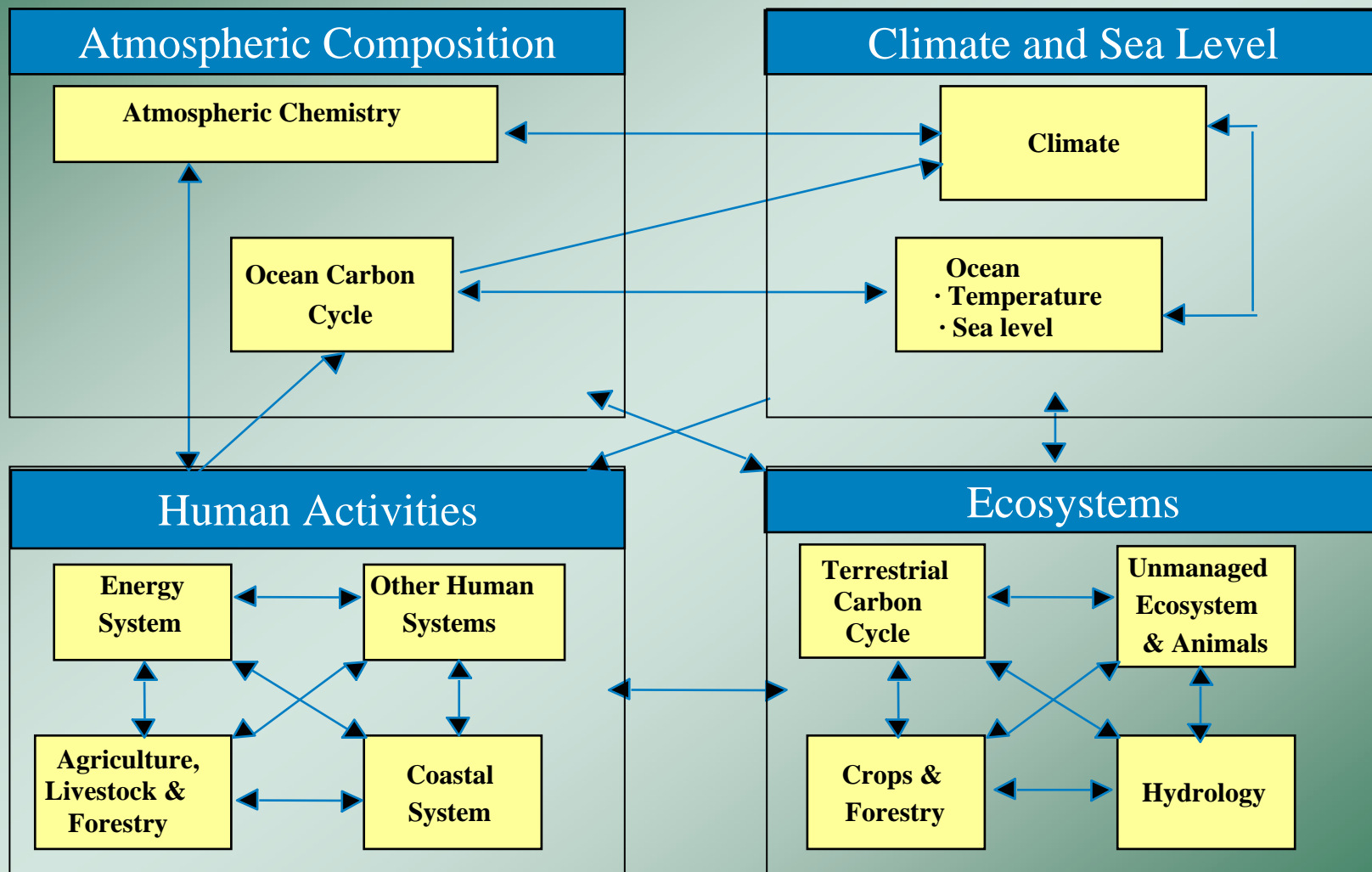
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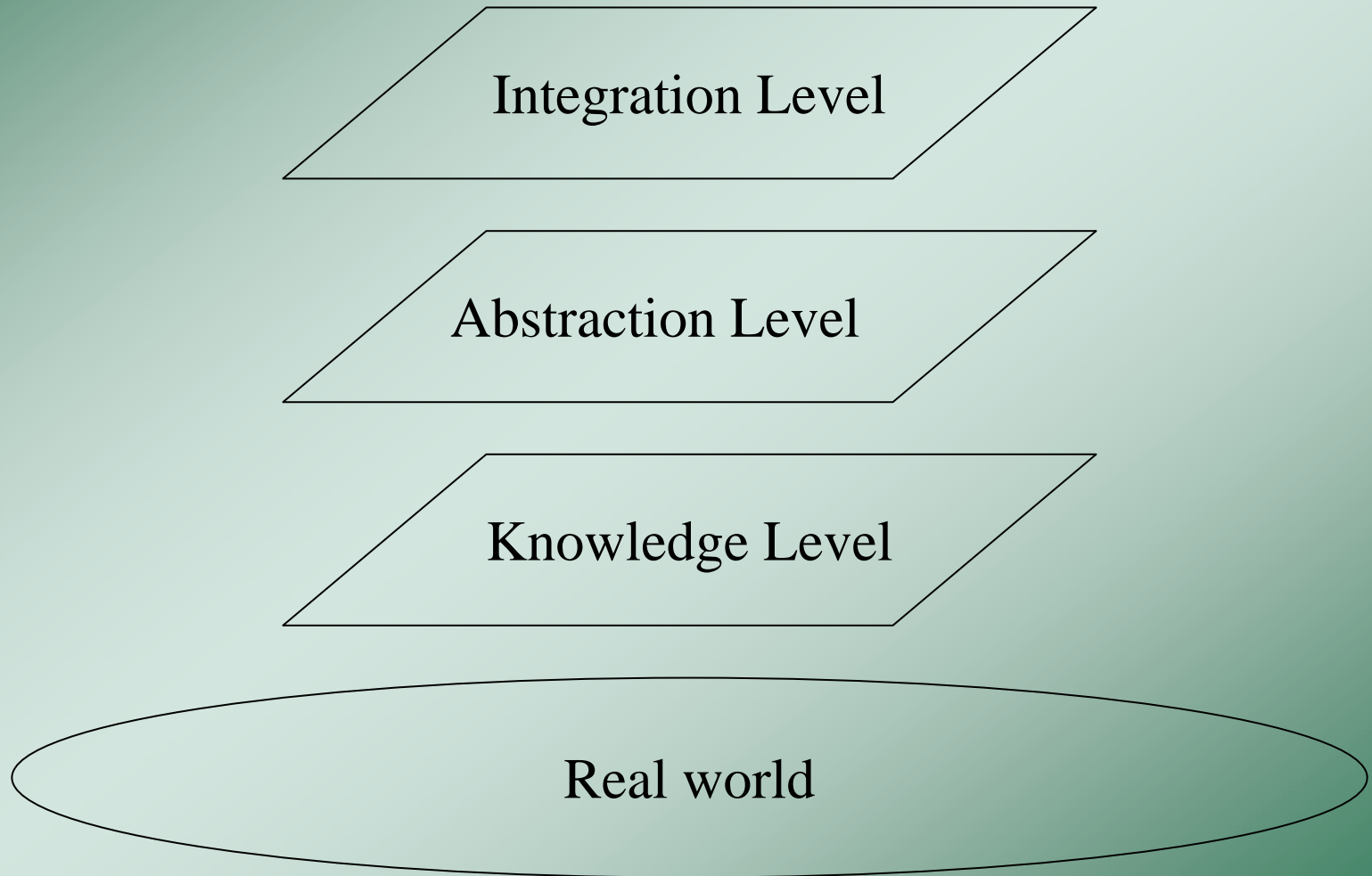
Integrated assessment modeling frameworks usually cover four domains



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Each box and arrow in IA represents a complex intellectual journey ...



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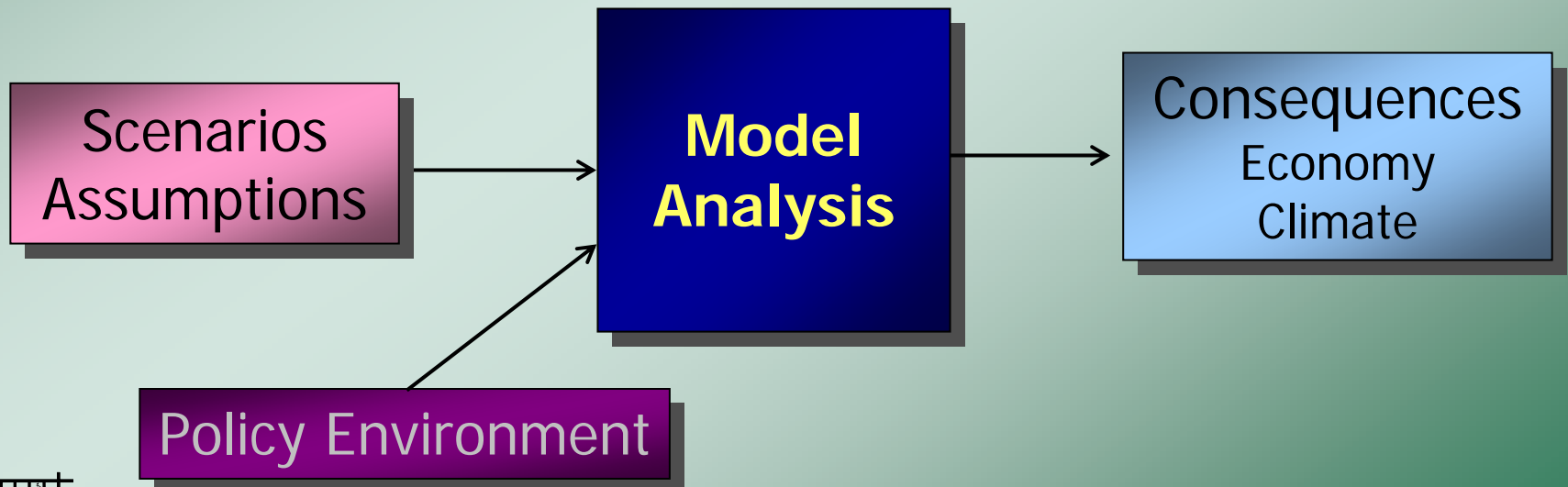
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There are two key uses for IA in the climate community

- Impacts - vulnerability - resilience:
 - Integrated assessment allows the examination of the complex interactions among various components of biogeophysical world as well as their interaction with human systems.
- Economics based decision support
 - Integrated assessment allows the examination of the costs (broadly construed) of attempts to mitigate or adapt to climate change.

Integrated assessment as an economics based tool

- IA integrates by representing and clearing markets: such as, energy demand, energy supply and land
- The results need both global relevance and regional specificity
- ... the key is to capture the trade-offs that the real policy makers have to make and the finiteness of resources they control

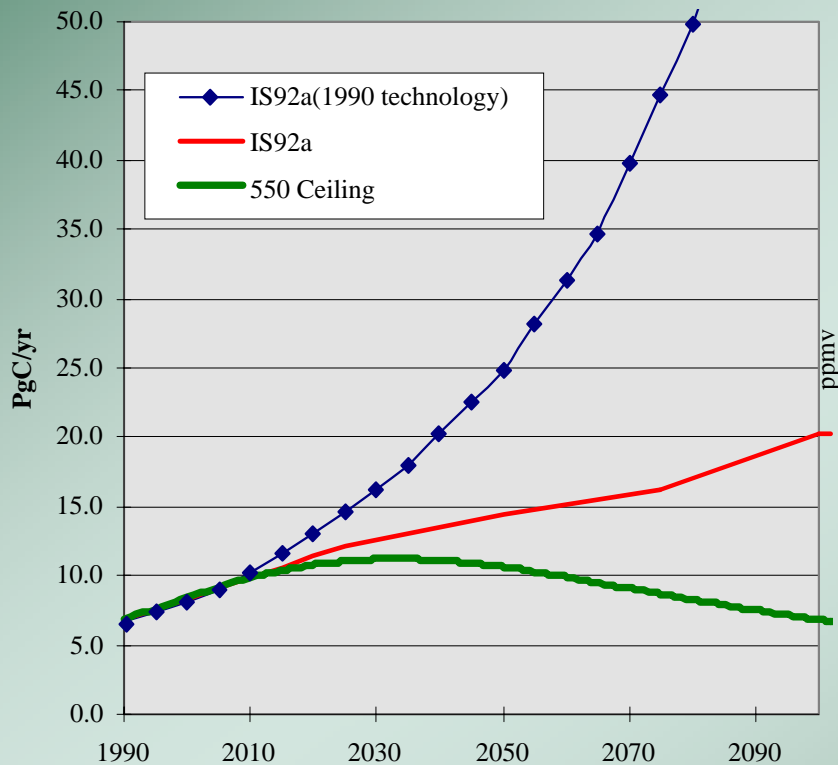


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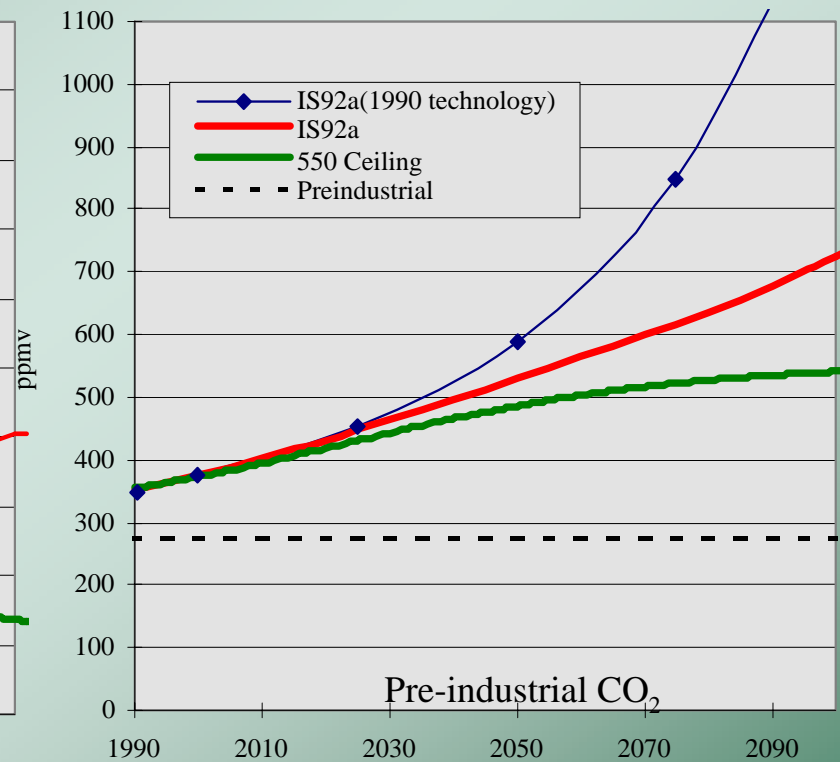
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Scenarios are important ...

Emissions



Concentration



Population, development and technology



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**The interactions captured
in an
Integrated Assessment
framework yield important
insights**

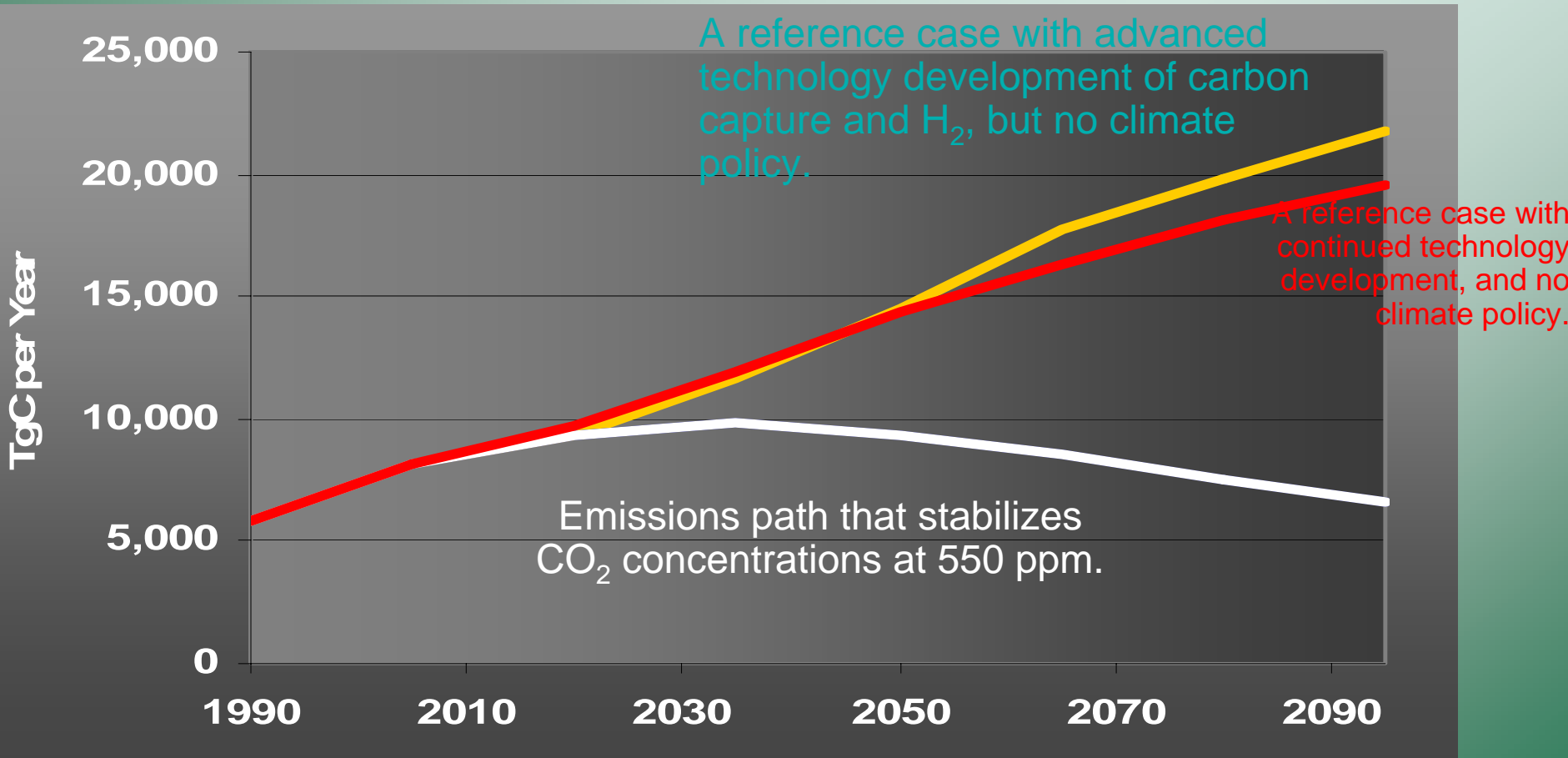


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Technology Alone Won't NECESSARILY Stabilize CO₂ Concentrations

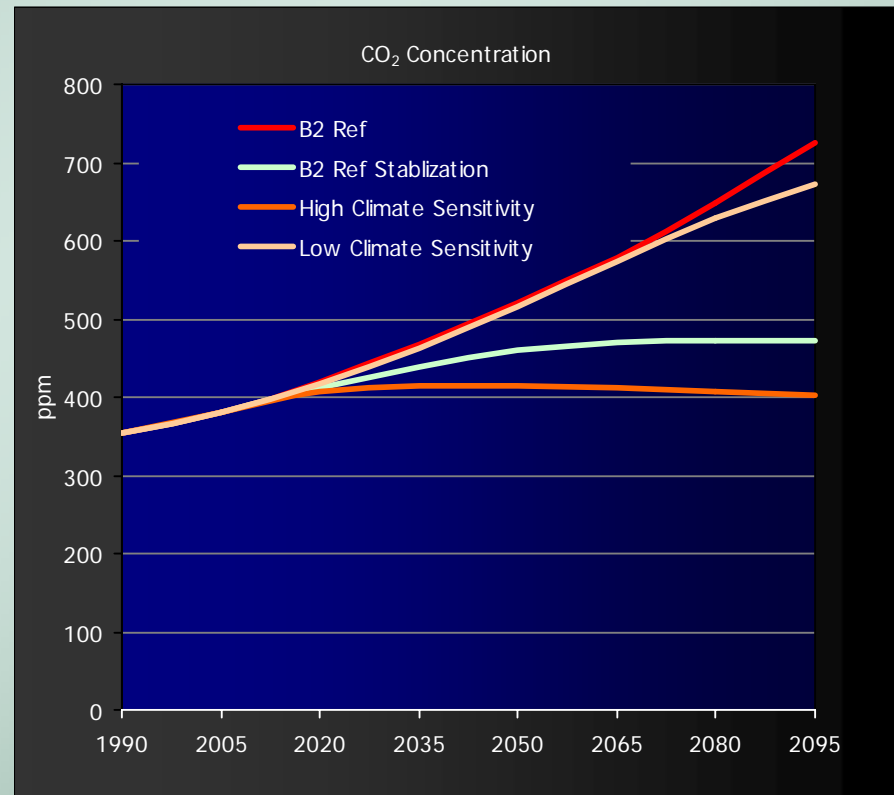
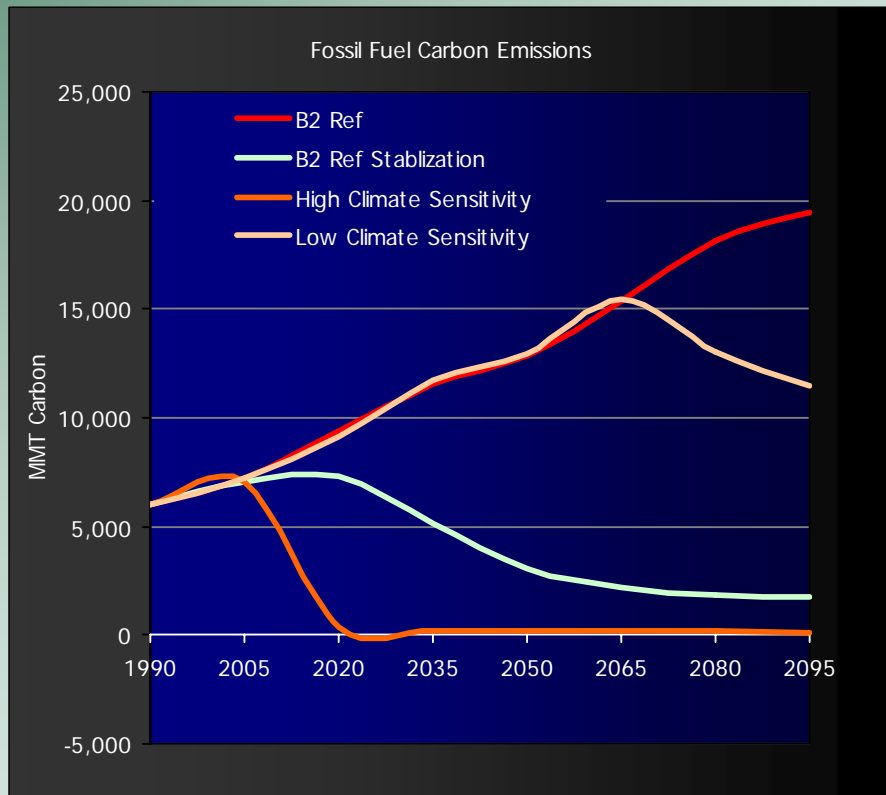
Energy Related Carbon Emissions



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Uncertainty is important - $\Delta T < 2^\circ\text{C}$ as a climate policy constraint -



Courtesy Jae Edmonds and Steve Smith



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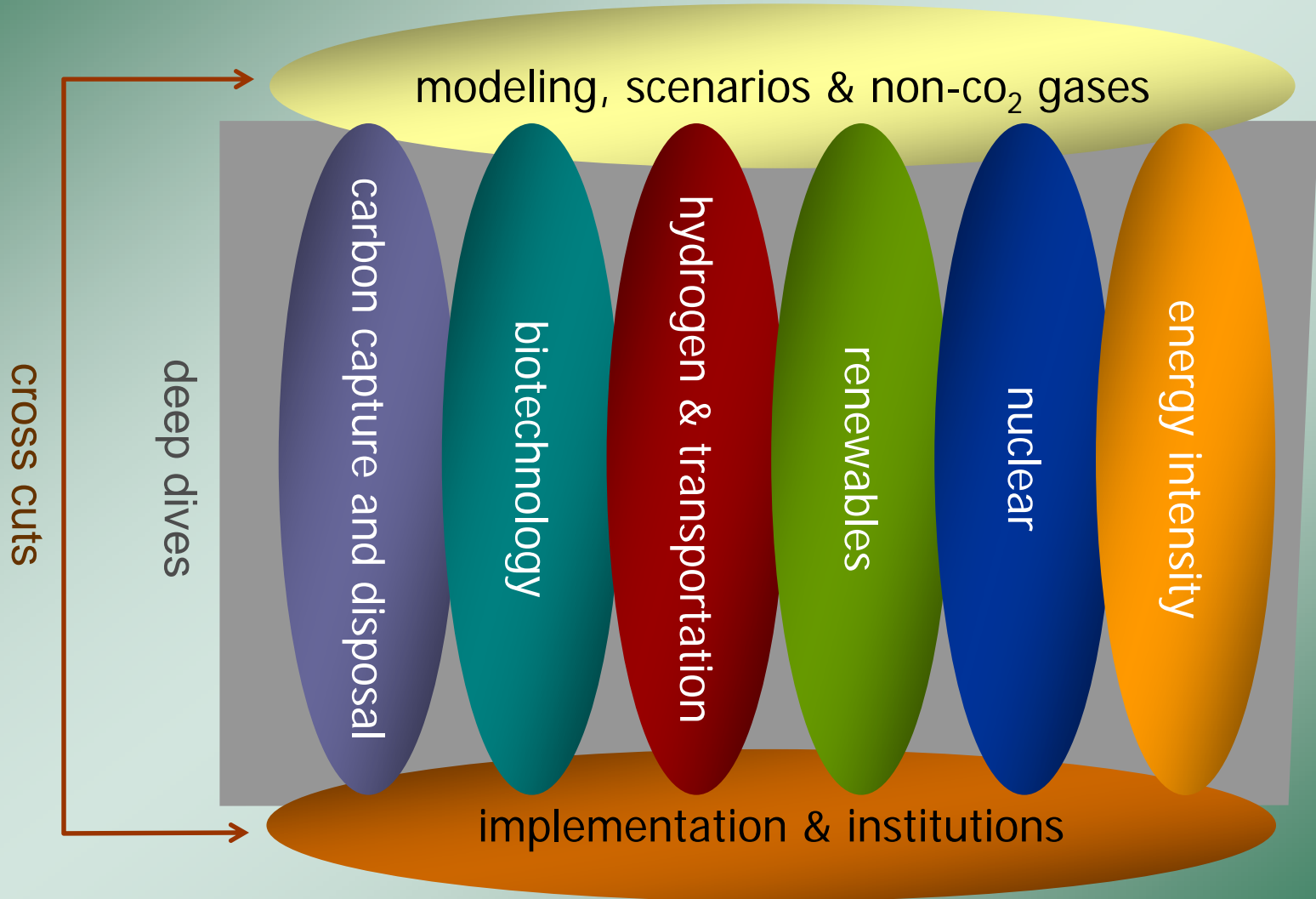
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The path forward is fragmented

- Usually discussed in terms of Kyoto, non-Kyoto, and developing nations ... not the biggest source of fragmentation
- Geography is a much bigger source of fragmentation, particularly when considering implementation of mitigation and adaptation strategies



Most 'climate' mitigation technologies are not uniformly distributed globally ...

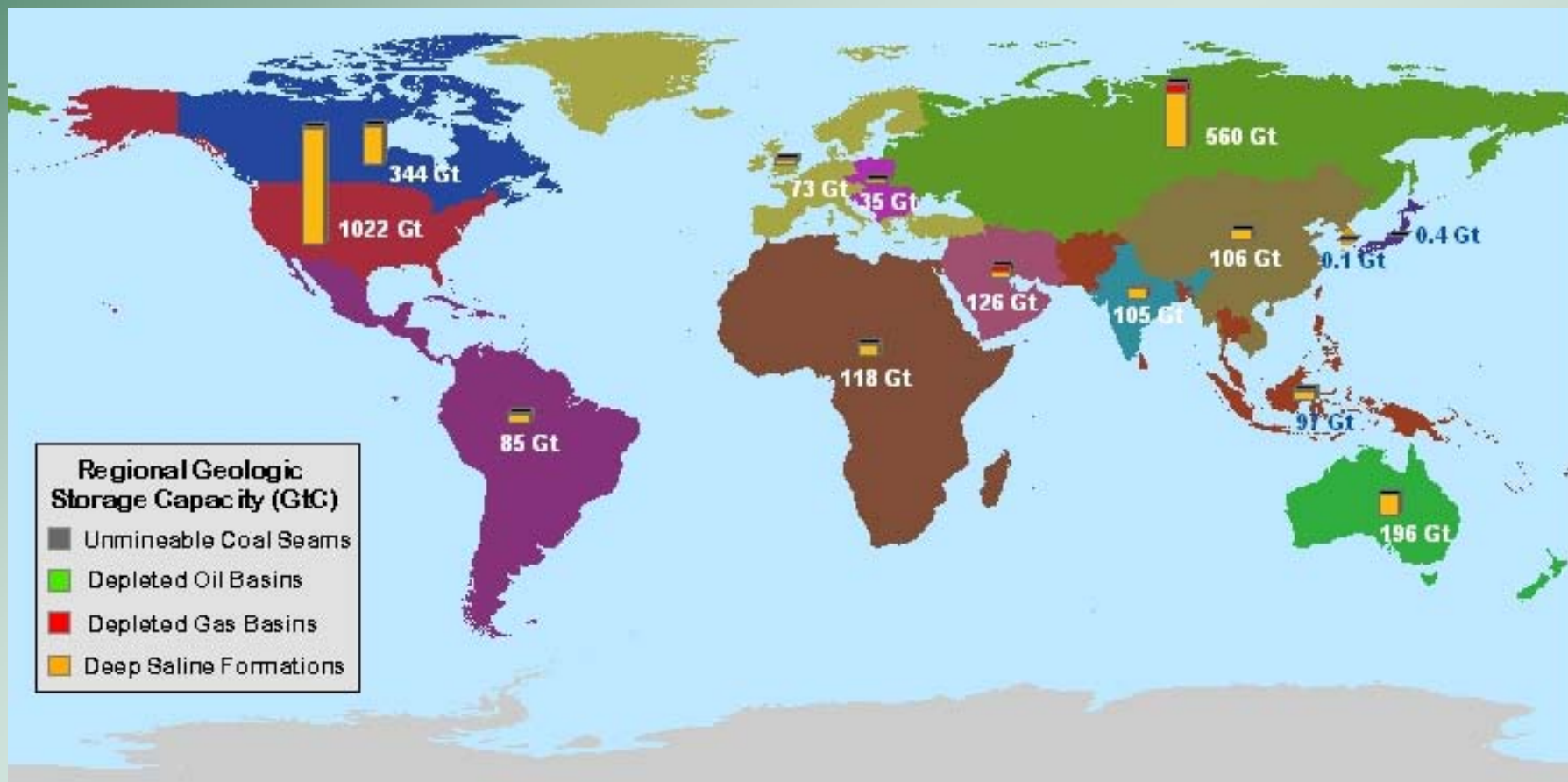


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Global CO₂ Storage Capacity: *A Very Heterogeneous Natural Resource*

Gigatons of Carbon



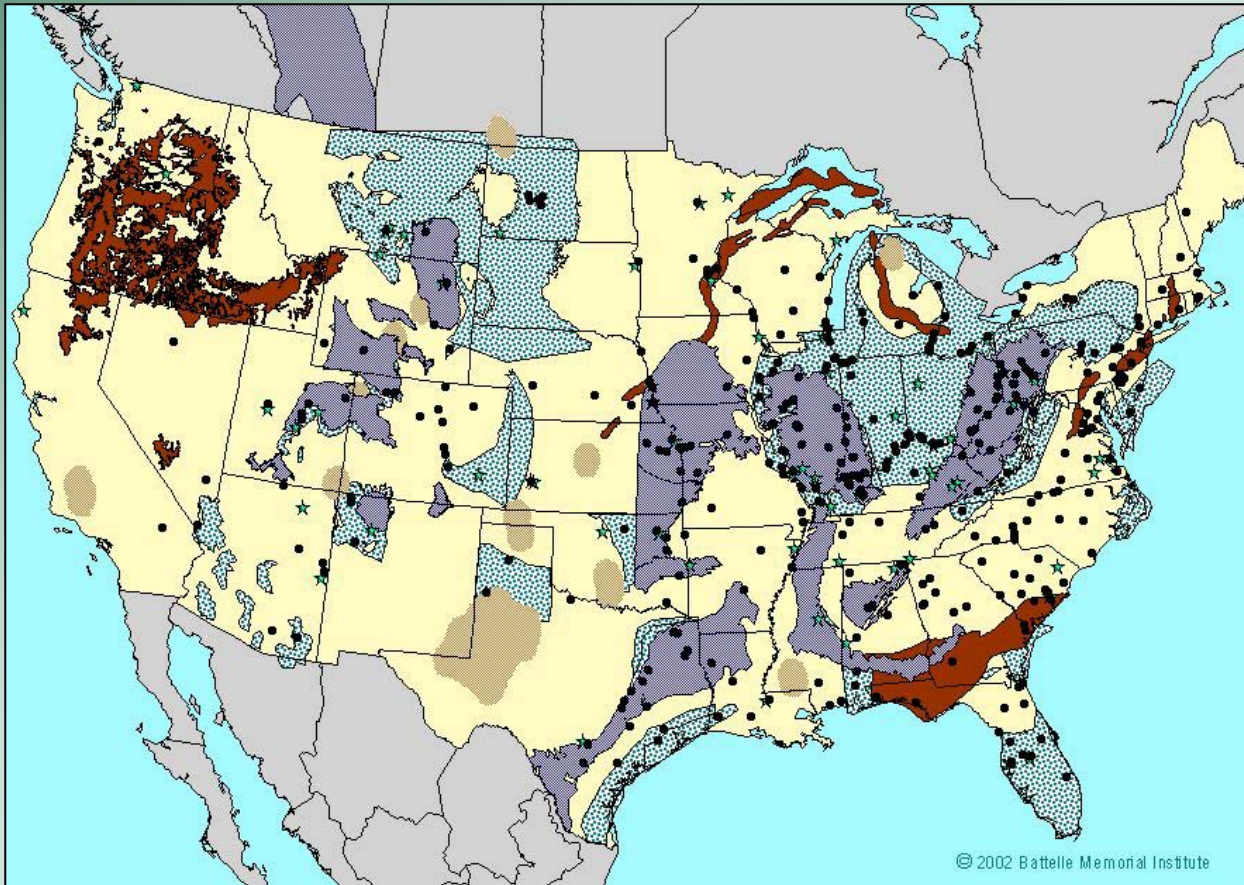
Based on current understanding of reservoirs
Courtesy Jim Dooley



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Even within countries the asset is not uniformly distributed



- There is some mismatch between capture and storage and existing power plants
- Even more so for motor vehicles.

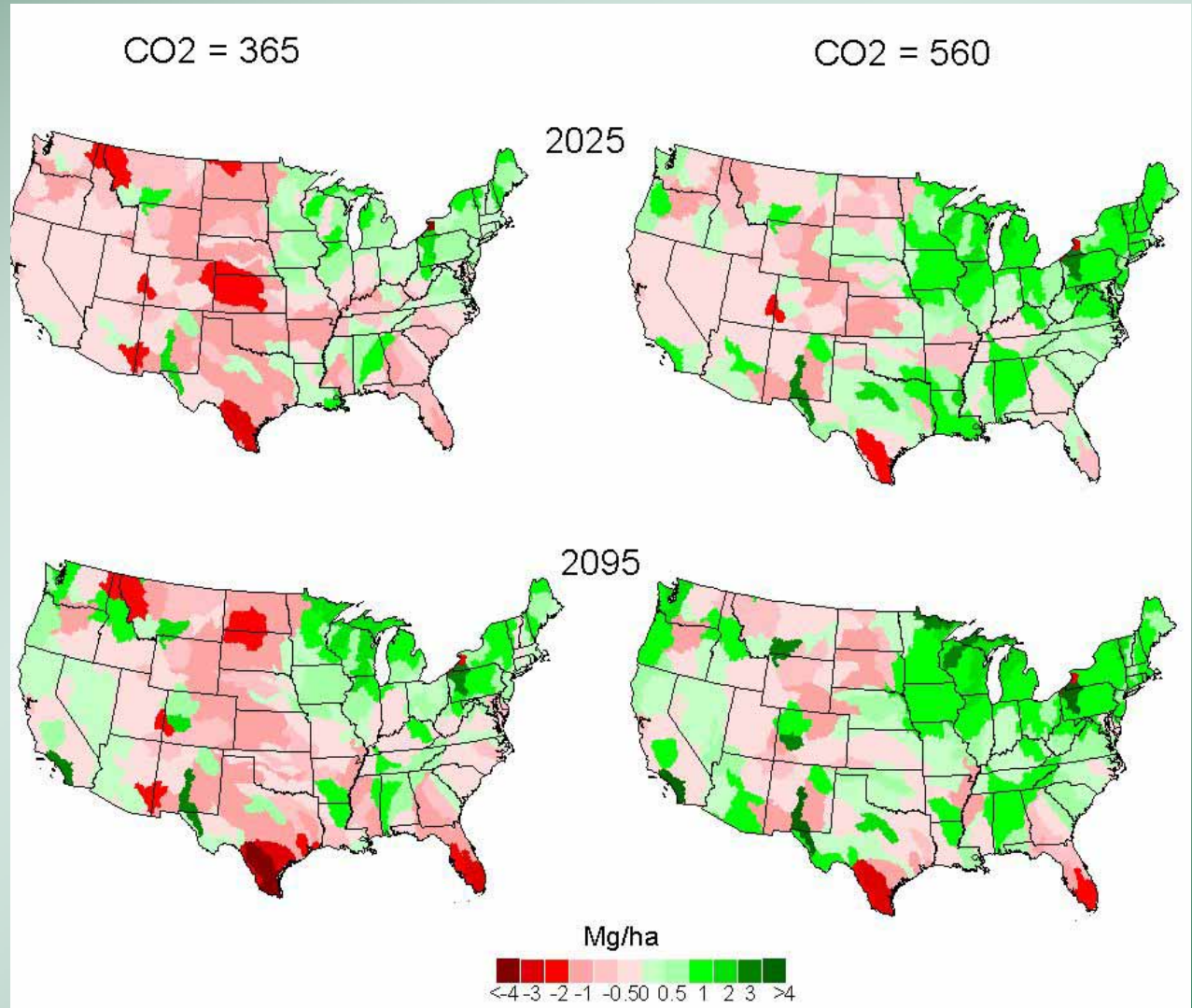


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Impacts are regional as well ...

- From the US National Assessment of the Impacts of Climate Change



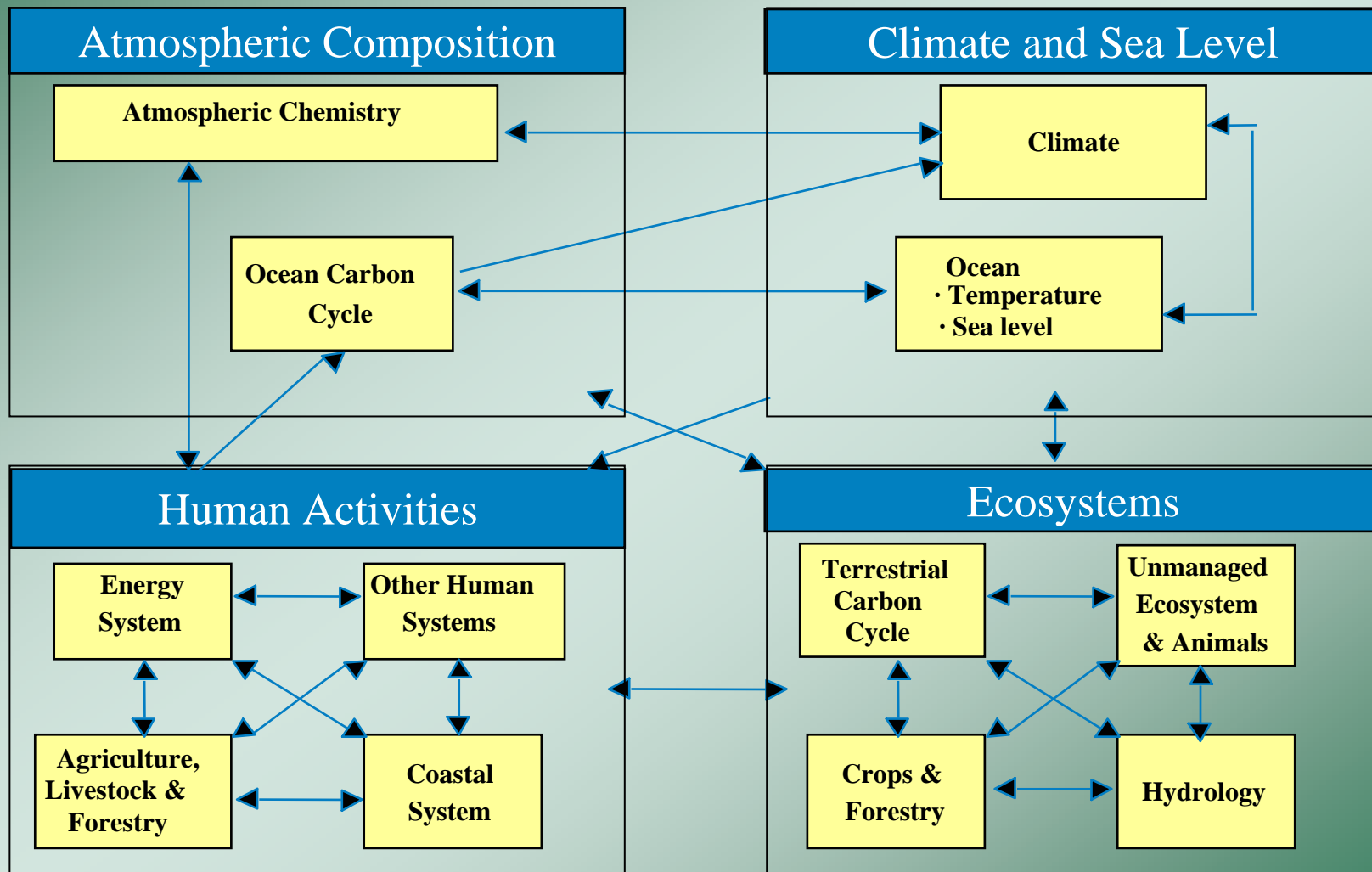
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Key Point: Implementation - mitigation and adaptation- will be regional

- CO2 storage: Local resource
- Renewable Energy: Distinctly regional character
- Externalities (air quality, renewable portfolio standards etc.): regional
- Off-sets like terrestrial sequestration: regional
- Energy demand: regional
- Limiting resources (like water) are regional
- Impacts and adaptation: distinctly regional
- Politics: always local

Prediction: IA will merge with integrated resource planning



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The research agenda becomes regional - some examples

- From the science side ...
 - Regional climate ... tailored to impacts
 - Getting the water right
 - Coupling to managed and unmanaged ecosystems
- From the technology side ...
 - Regional technology supply curves (supply and demand)
 - Getting the water into IA
 - Integrating related policies
- A big agenda ...

