In Search of Pasteur's Quadrant:

"Use-Inspired" Carbon Cycle Science

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Outline

- The challenge of “usable information”
- Introducing SPARC
- Reconciling supply and demand for info.
- A brief (incomplete) case study: Carbon Cycle Science
- Implications for science policy
- Next Steps

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How do we seek “usable” information?

- Start from “Pasteur’s Quadrant”: Research that is inspired by both
  - the quest for fundamental understanding and
  - considerations of use by society.
- Research intended for use by society must create mechanisms by which user needs are identified and brought into the process. Experiments here include RISAs.

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Introducing SPARC…

Science-Policy Assessment and Research on Climate

SPARC will conduct research and assessments, outreach, and education aimed at helping climate science policies better support climate-related decision making in the face of fundamental and often irreducible uncertainties.

5 Year, $2.4Million, funded under NSF “Decision-Making Under Uncertainty” program (contribution to Climate Change Research Initiative)

PIs: Roger Pielke Jr. and Dan Sarewitz, Arizona State University

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SPARC themes:

- Reconciling Supply and Demand for climate research
  - how research agendas are developed and user demand for research assessed
- Sensitivity Analysis
  - how specific issues are prioritized given the multiple causes of global environmental change

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Reconciling Supply and Demand

Borrowed from classical micro-economic theory

- "product or service" in this case is scientific knowledge
- Supply = research activities as decided by science policies
- Demand = potential or actual societal need for knowledge

Overall goal: to ensure that "use-inspired" scientific efforts meet their societal objectives.

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Method: Reconciling Supply and Demand

- Assess demand
- Characterize supply – what science is being done, how priorities are being set
- Overlay supply and demand- identify missed opportunities
- Institutional analysis and response
  - Ongoing, mediated feedback mechanisms to support effective meeting of demand for information; e.g. RISA program

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“Missed Opportunities”

		Demand: Can user benefit from research?	
		Yes	**No**
Supply: Information being produced?	**Yes**	Sophisticated users taking advantage of well-deployed research	Unsophisticated users, institutional constraints, or other obstacles prevent information use
	No	Opportunity to shape research agenda to meet needs	Non-user

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Evolution of U.S. Carbon Cycle Science Policy

- 1957 Keeling begins Mauna Loa atmospheric CO_2 monitoring under IGY
- 1977 NAS: research "involved in the carbon dioxide problem" to "close gaps in knowledge so that future decisions regarding the exploitation of energy resources can be made on as sound a basis as possible"
- 1978 DOE: "predict the environmental, social and economic costs of increasing atmospheric CO_2 concentrations with sufficient confidence to permit policy decisions to be made on the future use of fossil fuels"
- 1978 U.S. National Climate Program Act; CO_2 research under DOE incorporated in "Responding to impacts and policy implications of climate, carbon dioxide, environment and society,"
- 1990 U.S. passes Global Change Research Act (USGCRP) to produce "usable information on which to base policy decisions relating to global change"
- 2001 U.S. Administration announces Climate Change Research Initiative, of which carbon cycle science is a focus to "best support improved public debate and decision making in the near term"
- 2003 U.S. Administration reorganizes USGCRP under the Climate Change Science Program "to provide the best possible scientific information to support public discussion and decision making on climate-related issues"

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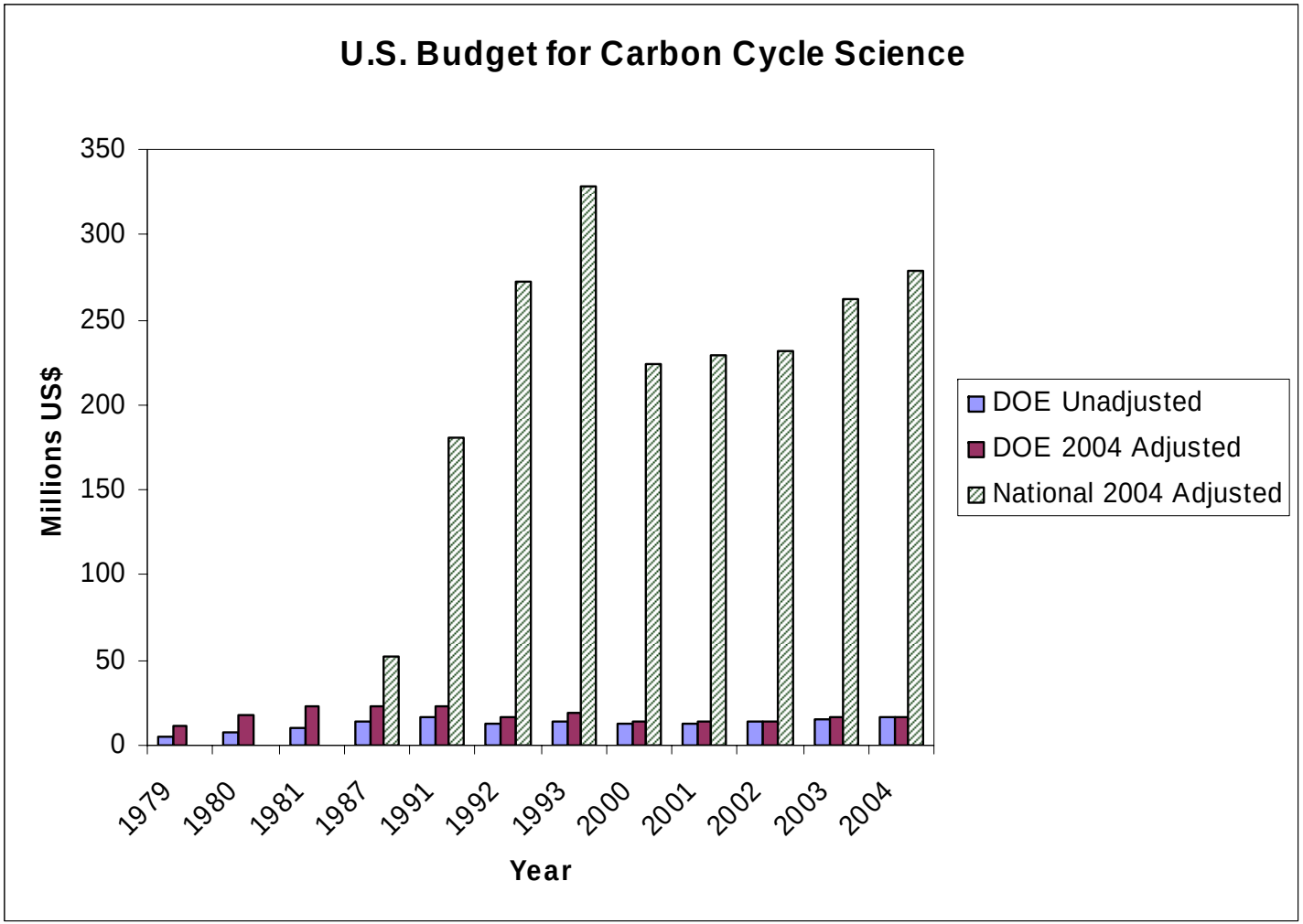

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Assessing Supply

- Quantifying exchanges between reservoirs (ocean, atmosphere, terrestrial)
- Processes controlling exchanges (e.g. air-sea exchange, land use change)
- Quantification of carbon in reservoirs (e.g. ocean budget)
- Spatial discrimination of exchanges (i.e. where carbon sources and sinks are located)
- Research involves observation, modeling, experimentation

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Assessing demand

- How to select potential users to study? Some sample criteria:
  - By magnitude of atmospheric C contribution? e.g. fossil fuel sectors (transportation, industry, utilities, residential) and land use change (agriculture, timber, residential and commercial development)
  - By economic importance? e.g. by Gross Domestic Product categories, exports and imports, by # of jobs in the economy
  - By current practice? e.g. companies and sectors that have a stated interest/investment in C management/sequestration
  - By societal priority? e.g. contributing to national security, food production, availability of jobs
- A continuous, iterative process

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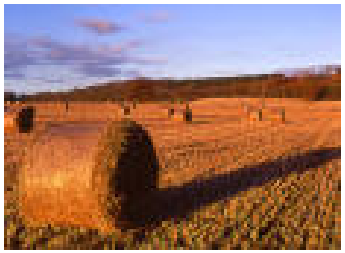
Assessing demand

A wide array of potential users at a variety of scales:

- Land users (agriculture, forestry, urban development)
- Energy providers (utilities, fuel producers)
- Policy makers (local, state, federal)
- Specialized sectors (carbon traders, NGOs)



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Implications

- Decisions are never made solely for carbon purposes
- “Use” is not obvious – research necessary
- “Supply and demand” are dynamic – ongoing effort required
- Science may not always be able to “supply” a demand, e.g. separation/additionality argument in Kyoto formulation
- New mechanisms and institutional arrangements are necessary to facilitate meeting user needs

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Next steps

- Finish pilot work on supply of carbon cycle science, begin to assess demand in more detail
- Examination of priority setting in specific case– the Agricultural Research Service (Nat Logar)
- June 2005 workshop at CU to develop a research agenda on decision support needs for the North American Carbon Program and as contribution to the State of the Carbon Cycle Report (SOCCR/SAR 2.2)

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Thank you!

www.sciencepolicy.colorado.edu/sparc