Challenges and Opportunities of Using Satellite Data for Water Resources: Economic and Policy Issues

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March 2007

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Longstanding Economic and Policy Issues in Access to and Use of Satellite Data

- Costs of access to data (where are they, how to get them – costs of “logistics” can be relatively high)
- Costs of using data (formats, validation and verification protocols, merging other data)
- Cost of uncertainty about a sustained source of data for purposes other than limited experimental exploration
- Benefit of “devising professional rewards for those who develop and sustain applications”**

(*see also* National Research Council, 2001, *Transforming Remote Sensing Data into Information and Applications;* ** *from* National Research Council, 2007, *Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond*, chapter 5)

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Failure of Earth Science Community to “Make the Case”

- How useful are earth observation satellite data?
  - going beyond the adjectival superlatives to demonstrate quantitative value
  - acknowledging special costs of required ancillary capabilities to use these data
  - acknowledging that data have value only in circumstances where actions can be taken in response
- Neither investment costs nor, of course, “prices” for publicly provided data are a guide to their value
- Value of information methods are appropriate and practical to implement

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Other “Value of Information” Factors – The Case of Freshwater

- Quantity and quality of freshwater matter, enabling the relevance of a variety of satellite data (example: satellite data can include related observations on ag, land use, air quality, weather, climate, and energy resources – all affecting water)
- Real-time, 3-D, and other visualization tools informed by satellite data and earth science research can improve public understanding of the human footprint – residential, commercial, industrial uses as well (science on a sphere; *Virtual Earth*) (see “Supporting an Informed Citizenry,” in National Research Council, 2007, *Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond*, chapter 5)

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Water Policy Issues 2010-2020 from NASA/RFF/SAIC Workshop, February 2005

- General trend toward less gov't intervention, more decentralized, property-rights' based approaches to management
- Opportunity for a role of monitoring of possibly smaller geographic scale entities as well as larger synoptic view
- Concern that better information may not help "at the margin" unless there are institutions for conflict resolution
- Concern that who has information can be contentious
- Enthusiasm for "holistic" depictions of say, a new transportation corridor on watersheds and ecosystems – for planners and citizen participation
- Water *quantity* as key

(participants included international focus and addressed freshwater and other water/oceans issues – Organization of American States, US Commission on Ocean Policy, overseas projects of US Army Corps of Engineers)

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Some examples of possible value of information studies: The Everglades

- A large investment is being made to restore the Florida Everglades; small variations in water surface elevations over this large area signal large changes in environmental quality but are difficult or impossible to observe using *in situ* methods (National Research Council, 2007, *Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond*, chapter 11)

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Example: Environmental Services

- **“Payments for Environmental Services in the Florida Everglades” (**Len Shabman, RFF and Sarah Lynch, WWF)

  USDA and the state of Florida -- quantify and then set up a payment scheme for environmental services provided by working ranches north of Lake Okeechobee (b/c services cannot be secured by regulatory instruments affecting land use, such as zoning):

  -- the phasing of water delivery to the Lake

  -- reducing P loads to the Lake

  -- increasing the area of wetlands habitat for wetlands dependent species

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Example: Markets for Watershed Protection

- Watershed commodities: water flow, quality (sediment, nutrient, chemical, salinity), erosion control, maintenance of aquatic habitats
- 22 countries, including the US

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Watershed Services and their Commodities*

- Water quality (watershed protection, land acquisitions, conservation easements
- Water table regulation (credits for salinity, transpiration, stream flow)
- Aquatic habitat protection (salmon safe products, land leases, habitat restoration credits)
- Soil contaminant control (eco-tree plantings)
- Water regulation (land acquisition, drawing rights, watershed lease)

Buyers: Private individuals and corporations. Sellers: Land owners, producers (hydropower suppliers)

In US, early impetus from EPA draft framework for watershed-based trading, 1996

* Natasha Landell-Mills and Ina T. Porras, 2002 *Silver Bullet or Fool's Gold? A Global Review of Markets for Forest Environmental Services and their Impact on the Poor,* chapter 10, "Markets for Watershed Protection" (London: Institute for Environment and Development)

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Issues and perhaps a role for satellite data?

- Hydrological linkages between upstream actions and downstream water impacts
- Perceived links by beneficiaries and suppliers (downstream vs. upstream communities)
- Watersheds span political boundaries
- Visualization, informed by good earth science, for various publics – not just science

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To pick up on last point…

- http://www.rff.org/rff/Events/Frontiers-of-Environmental-Economics.cfm

"Virtual Experiments and Environmental Policy" (by Fiore, Harrison, Hughes, and Rutstrom) (see paper and the video)

This example of a 3-D flythrough is for public valuation of the impact of wildfires, but one could imagine an analogous use of satellite data to construct a flythrough to describe a watershed and environmental impacts – transforming our ability as analysts to understand valuation in surveys of public willingness to pay for benefits or accept costs. Also: communities, stakeholders, decisionmakers, and other publics.

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