United States Environmental Protection Agency

Research Approaches to Assessing Public Health Impacts of Risk Management Decisions

22-23 January 2008

Research Triangle Park, NC

Short- and Long-term Interacting Trends in Environmental Awareness, Policy and R&D.

Herb Fredrickson

Associate Director for Ecology

National Risk Management Research Laboratory

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Gaining a Perspective

Environmental Timeline

"Anthropocene Epoch"

1825 1900 2000

←~1760 – Start of Industrial Revolution

1820 - World population reached 1 B

1849 - Establish U.S. Department of Interior

1854 - Thoreau publishes Walden

1866 - Haeckel coined term Oekologie (Ecology)

1872 - Yellowstone 1st US National Park

1879 - U.S. Geological Survey formed

1892 - John Muir founded Sierra Club

1905 - Des Voeux coined term Smog

1930 - World population reached 2 B

1945 - Hiroshima & Nagasaki bombing

1951 - The Nature Conservancy in US

1956 - Minamata disease

1960 - World population reached 3 B

1962 - Silent Spring

1969 - Last Cuyahoga River fire

1969 – NEPA

http://www.worldwatch.org/node/3944

http://www.ecotopia.org/ehof/timeline.html

http://en.wikipedia.org/wiki/Timeline_of_environmental_events

Environmental Timeline

"Anthropocene Epoch"

1970 1980 1990 2000 2010

1970 - EPA founded

1970 - Clean Air Act

1971 - Keep America Beautiful "Crying Indian" TV ad

1972 - Federal Water Pollution Control Amendments

1972 - Stockholm Conference on the Human Environment

1972 - United Nations Environment Programme

1972 - Apollo 17 "Blue Marble photograph

1972 - Coastal Zone Management Act

1972 - Federal Insecticide, Fungicide, and Rodenticide Act

1973 - OPEC US oil embargo

1974 - Molina & Roland stratospheric ozone CFC publication

1975 - Energy Policy and Conservation Act

1976 - Resource Conservation and Recovery Act

1977 - Clean Water Act

1977 - Surface Mining Control and Reclamation Act.

1979 - EPA response to Love Canal

1979 – Three Mile Island

Environmental Timeline

"Anthropocene Epoch"

1980 1990 2000 2010

1980 - CERCLA

1984 - Bhopal disaster

1986 - Chernobyl

1986 - Emergency Wetlands Resources Act

1987 - World population reached 5 B

1987 - Brundtland report on sustainable development

1987 - Water Quality Act

1988 - Ocean Dumping Ban Act.

1988 - Establish Intergovernmental Panel on Climate Change (IPCC)

1989 - Exxon Valdez

1989 - Montreal Protocol on ozone depletion

1990 - European Environment Agency established

1990 - First IPCC report

1990 - Clean Air Act major amendment

1992 - Rio de Janeiro Earth Summit

1992 - Ecological footprint is coined by William Rees.

1997 – Kyoto Protocol negotiated

1999 - World population reached 6 B

Environmental Timeline

"Anthropocene Epoch"

2000 2004 2006 2008 2008

2001 - IPCC Third Assessment Report.

2002 - Johannesburg Earth Summit

2003 - Begin to fill Three Gorges Dam

2005 - Millennium Assessment

2005 - Hurricanes Katrina, Rita, and Wilma

2005 - Kyoto Protocol signed by Russia and enforced

2006 - "An Inconvenient Truth"

2006 - World population reached 6.5 B

2006 - Tony Blair cites Stern Review

2007 - IPCC Fourth Assessment Report

2007 – 45% of world pop. In urban areas

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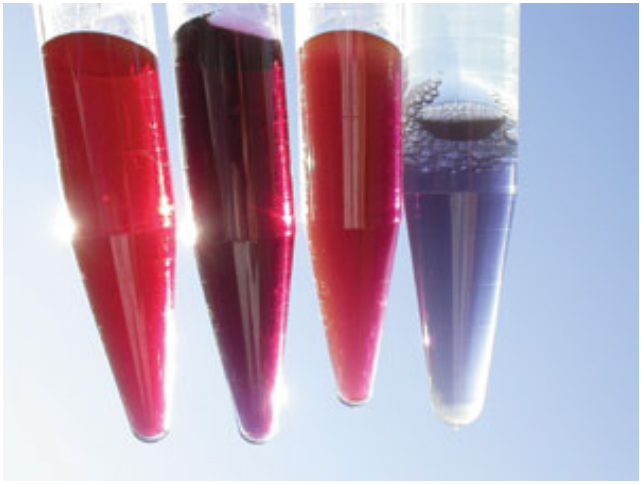
Some Trends

- Increasing breadth and depth of public's environmental knowledge
- Success in remedying more tractable problems
  - Point Source, single contaminant, single jurisdiction
  - 574 new HPV (>1 M lbs/yr) chemicals
    http://www.americanchemistry.com/s_acc/sec_policyissues.asp?CID=432&DID=1493
  - Nanoparticles
- Increasing international regulatory authorities
- Geographic extent of impacts
  - Mississippi R. Basin – Gulf hypoxia
- Increasing population
- Increasing urbanization

Nanogold particles



Properties & reactivities

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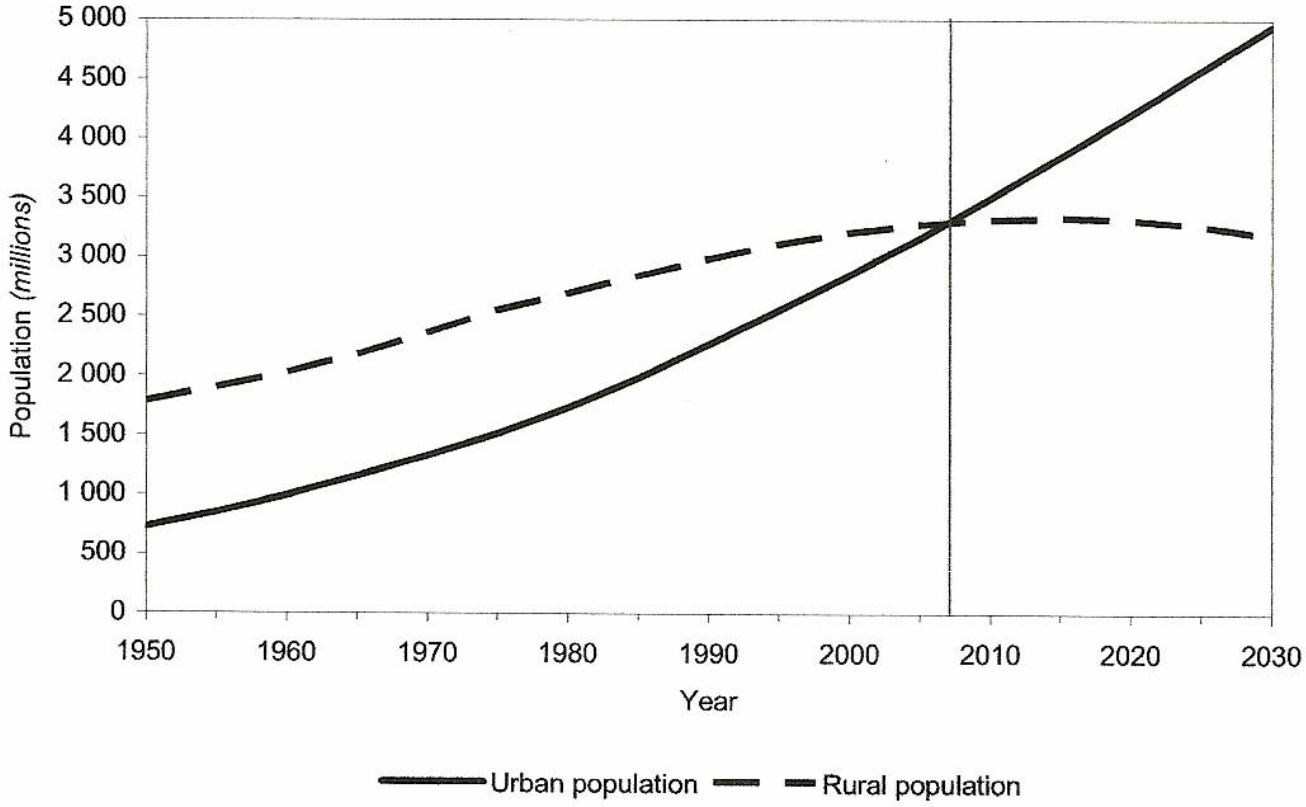
Urbanization

Figure I.1. Urban and rural populations of the world: 1950-2030



2004 UN Report on World Urbanization Prospects

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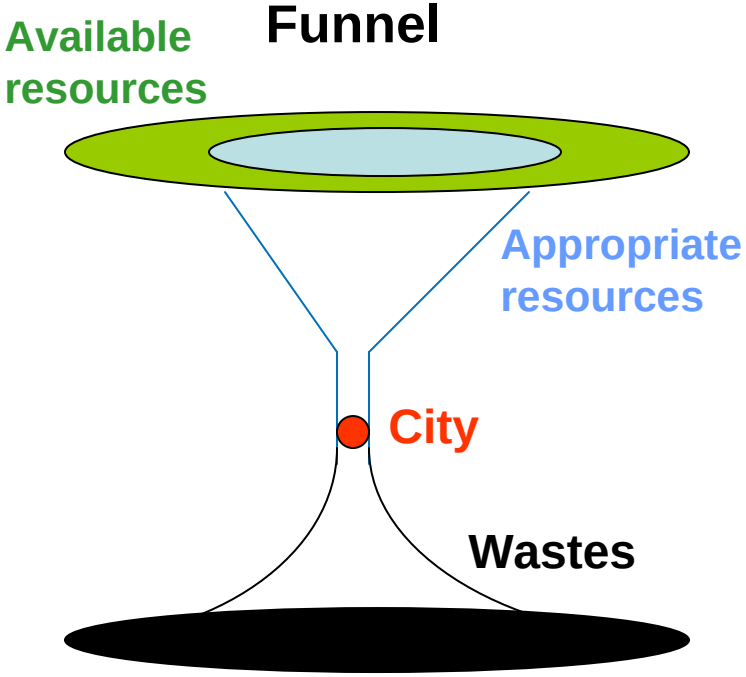
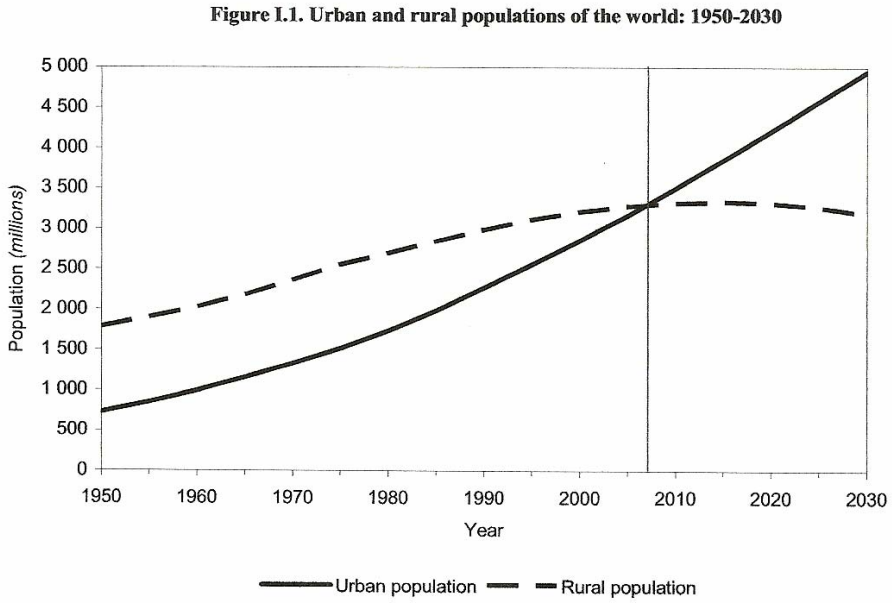
Urbanization

Urban Footprint Funnel



Luck et al., 2001



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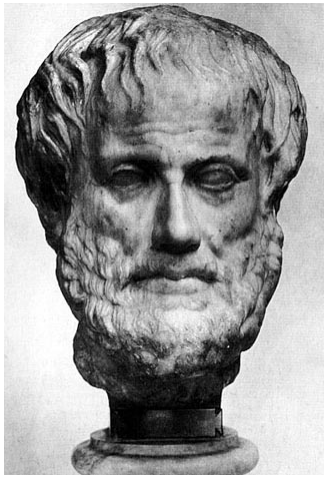

“I can't shake the feeling that we're medieval monks teaching kids Aristotle while around us the Enlightenment is already in full bloom.”

Brad Allenby, professor of civil and environmental engineering at Arizona State University, comment on environmental sustainability education.

EPA's Mission - "To Protect Human Health and the Environment"

National Risk Management Research Laboratory's (NRMRL) Mission

Advance scientific and engineering solutions that enable EPA and others to effectively manage current and future environmental risks.

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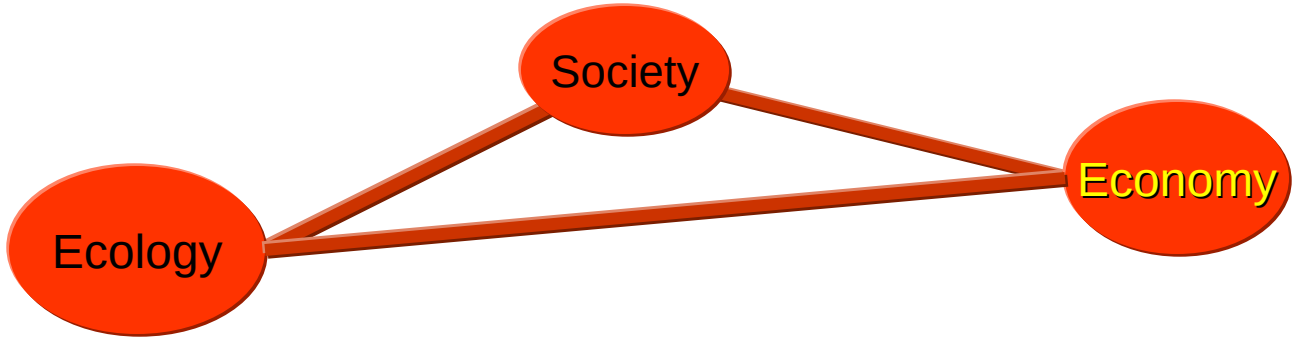
Sustainable Environmental Systems Paradigm



- **Complex, dynamic, coupled systems are continuously evolving**
- **Growth is a “natural” behavior**

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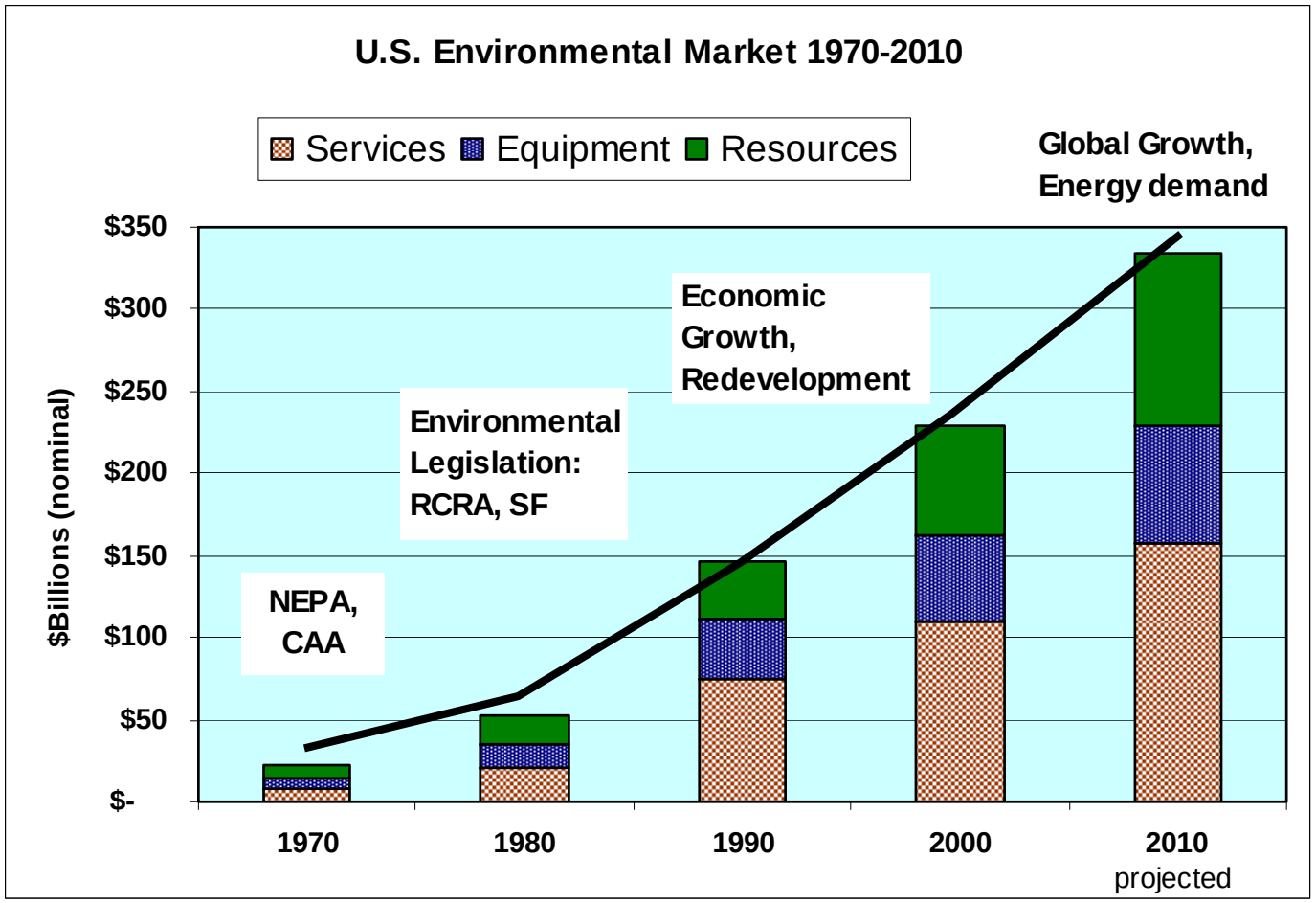
Using U.S. Entrepreneurism and Market Forces "To Protect Human Health and the Environment"



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"To Protect Human Health and the Environment"

Economy and Environment

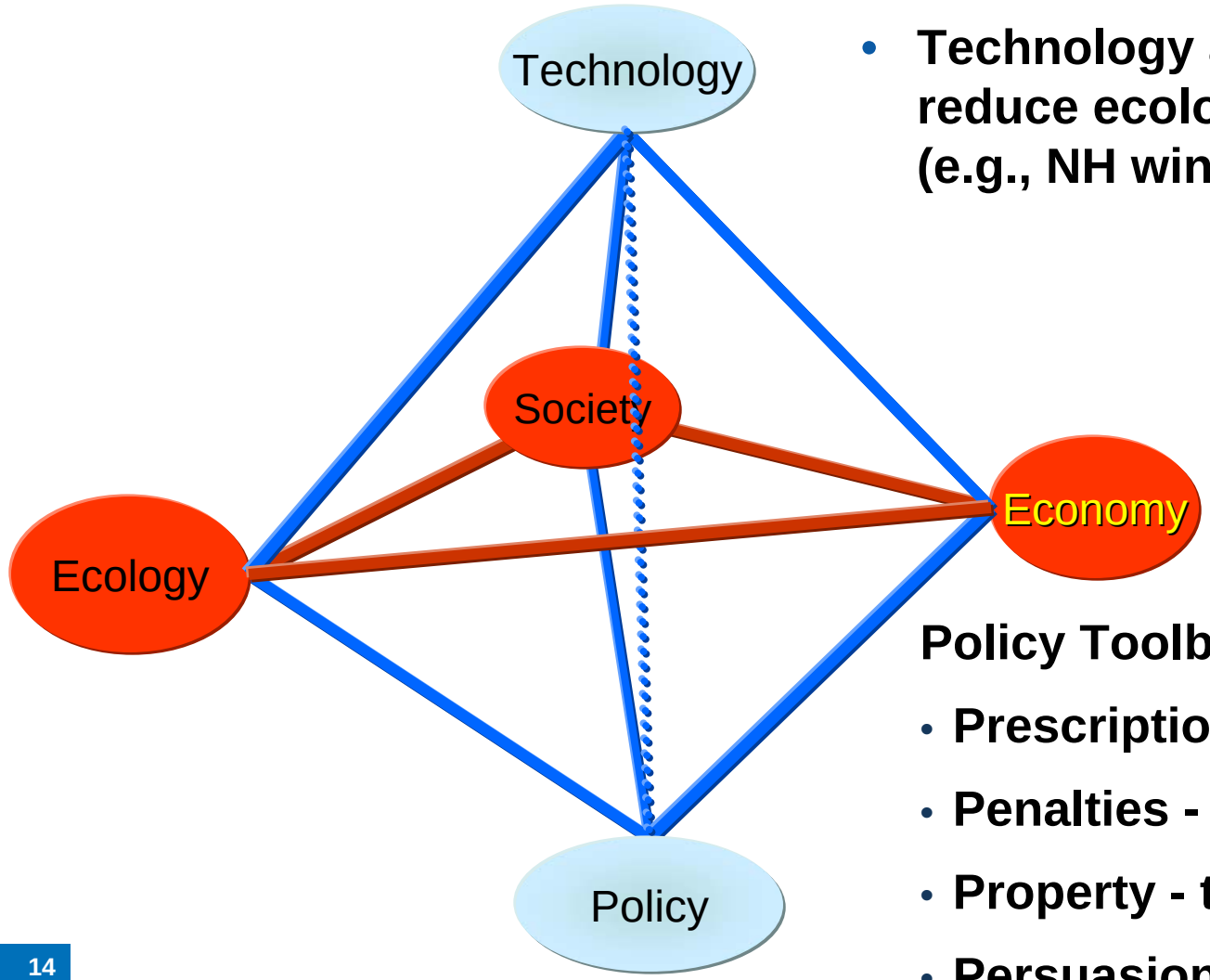
Former paradigm
1970s - mid 1990s

- Regulatory driven market
- Compliance-based purchasing
- "End-of-pipe" tech, e.g. scrubbers on smoke stacks
- Chemical science
- Traditional engineering
- Slow growth markets, e.g. waste management
- "Save the world" mentality
- Low use of IT

Emerging paradigm
Late 1990s – Today

- Economic market drivers
- Productivity-based purchasing
- "Front-of-pipe" tech, e.g. zero emission plants
- Biological & materials science
- Systems design & engineering
- Rapid growth markets, e.g. solar energy
- "Entrepreneurial" mentality
- High use of IT

EPA has a major role in environmental technology and policy development



- **Technology alone may not reduce ecological footprint (e.g., NH wind power, SUVs)**

Policy Toolbox – Jim Salzman

- **Prescription - regulations**
- **Penalties - fines**
- **Property - trade in markets**
- **Persuasion**

Joseph Fiksel – Ohio State U.

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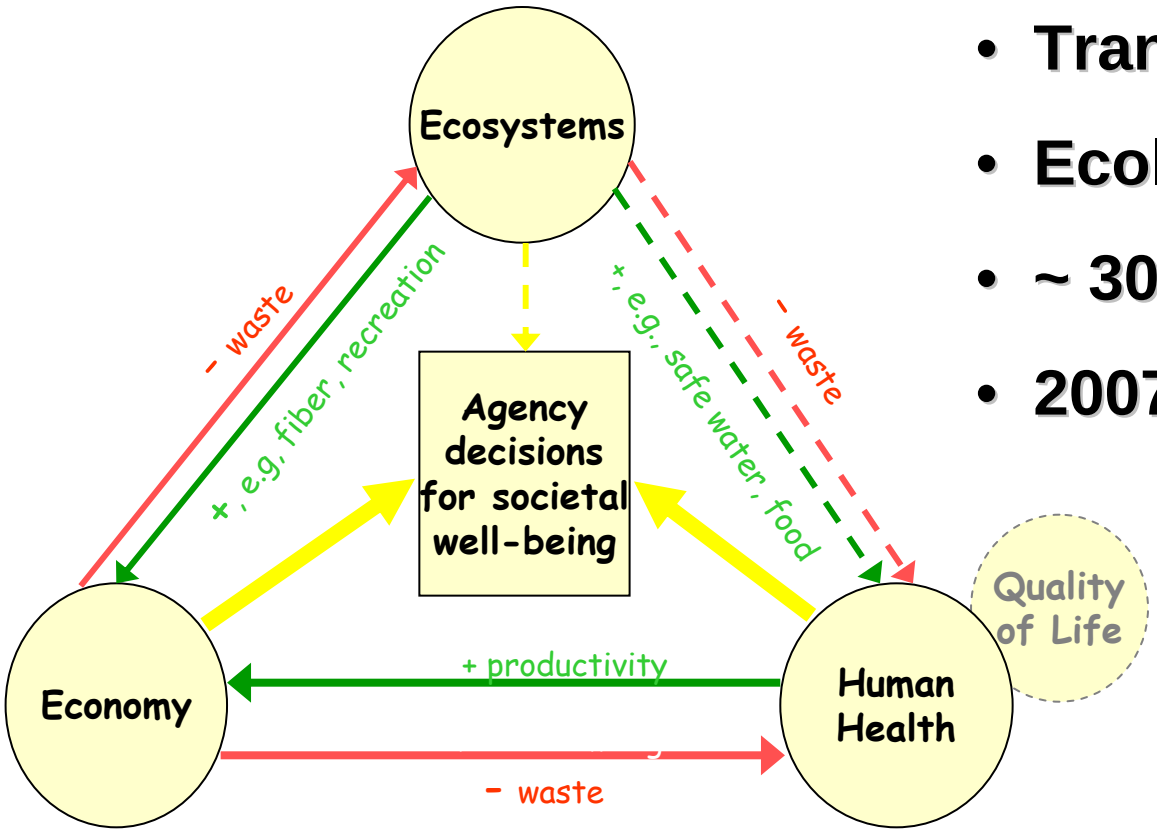
Ecosystem Research Program

- Systems research
- Transdisciplinary
- Ecological sustainability
- ~ 300 FTEs
- 2007 through 2014



Rick Linthurst (closet engineer?)

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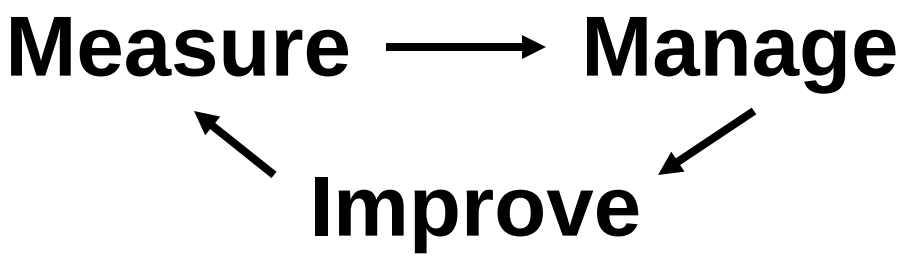
EPA's R&D Challenges



1. **Metrics are needed**
   - **Science-based**
   - **Legally defensible**
   - **Support market trading**

2. **Non-traditional ORD science**
   - **Economics - valuation**
   - **Decision science**
   - **Outreach**
   - **Sociology**
     - ➢ **Quality of life**

Importance of the Social Dimension

"Human needs and desires drive political, social, and economic processes. Engineers provide technological solutions. It is important for the engineering community to educate society about their choices and allow them to make informed decisions regarding political choices and commerce".

DANIEL KAHNEMAN won the 2002 Nobel Prize in Economics for having integrated insights from psychological research into economic science, especially concerning human judgment and decision-making under uncertainty.

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EPA Science Forum 2008

Innovative Technologies

Advancing Environmental and Economic Progress

Ronald Reagan Building and International Trade Center, Washington, DC
May 20-22, 2008

Technology Track will include sessions on environmental monitoring, nanotechnology, arsenic treatment technologies, and more.

Energy, Climate, and the Environment Track will focus on Agency activities in the areas of energy, climate change and the environment…all priority focus areas of the EPA Administrator.

Water Systems Infrastructure and Security Track will introduce technical solutions to improve the Nation's aging water and wastewater infrastructures and advancements in water protection and security.

www.epa.gov/scienceforum

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Unique research opportunities in New Orleans

They bury the dead above ground in New Orleans.

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Unique research opportunities in New Orleans

This makes it easier for them to get out and vote.

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Unique research opportunities in New Orleans

Opportunity for EPA exit surveys that can be used as metrics of outcomes in the OMB PART evaluations.