EPA/ORD Global Change Research Program

Briefing for

Dr. James R. Mahoney

Assistant Secretary (NOAA)

by

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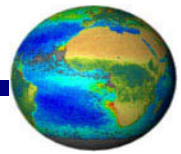
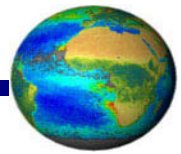
National Program Director

July 24, 2002



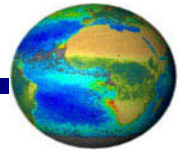
Key Messages

- EPA has been a member of the USGCRP since its inception
- EPA's Global Program must be responsive to its customers & the Agency's mission
  - Agency is a complex regulatory organization
  - Program Offices; Regional Offices
  - States and municipalities
  - Tribes



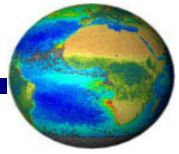
Key Messages (cont.)

- EPA program went through major reorientation in 1998
  - Responsive to external peer review
  - Coincided with need to produce decision-support tools and products
  - Shift from process-based research program to assessment- and decision-support orientation
  - Eliminated research that was duplicative of other USGCRP agencies, *e.g.,*
    - climate modeling
    - carbon sequestration
    - biogenic emissions
    - vegetative change modeling
- Focus on those things most consistent with EPA's mission and expertise
- Program now has a peer-reviewed Research Strategy and Multi-Year Plan for implementation
- Current program consistent with CCRI and President Bush's view of a program producing decision-support tools

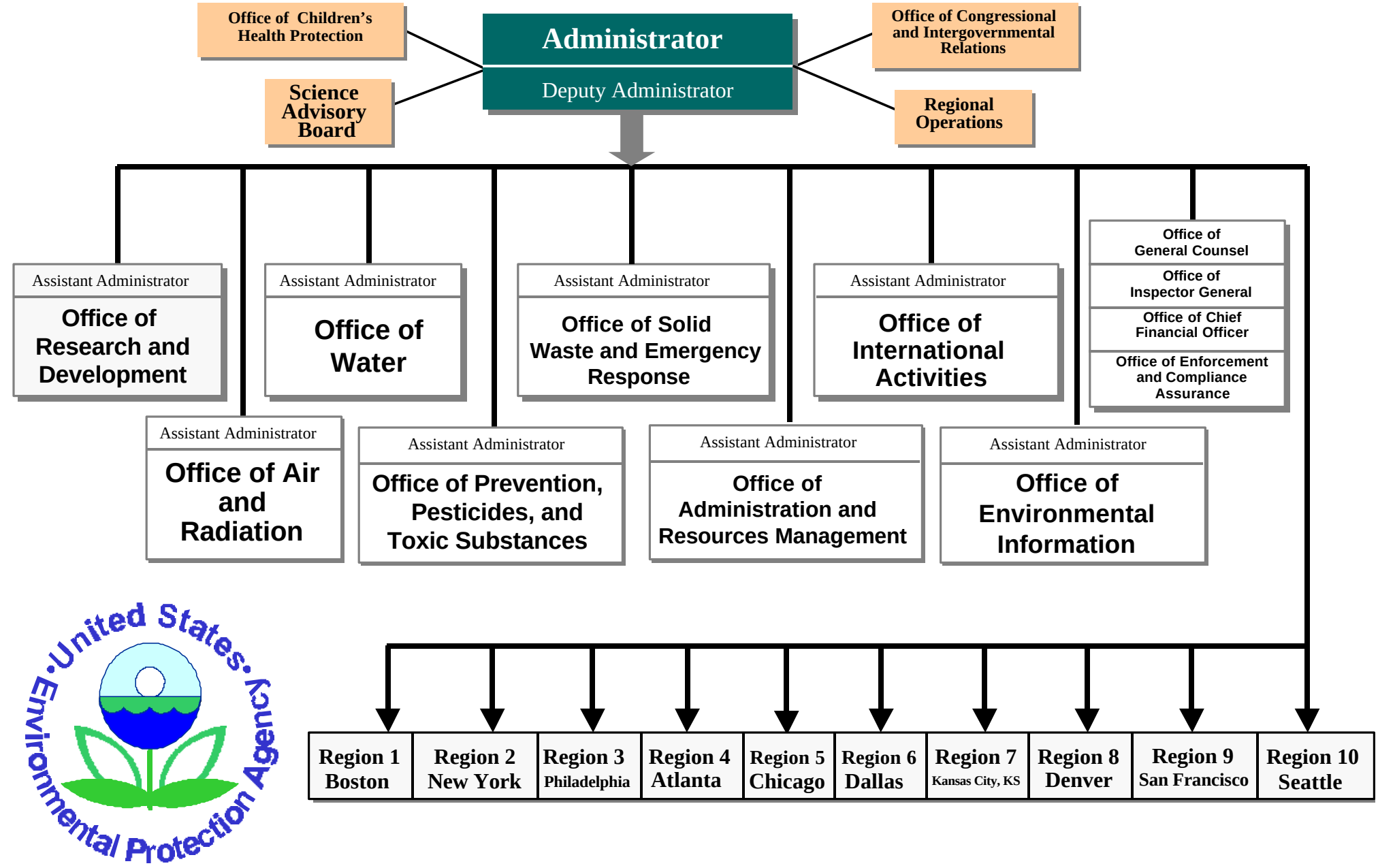


Key Messages (cont.)

- Career managers must be responsive to political leadership
  - Significant cuts made to program in 1994
  - Significant funding shifted to STAR grants program
  - IAGs with other USGCRP agencies discouraged
  - Program changed from a line-managed to a matrix-managed organization

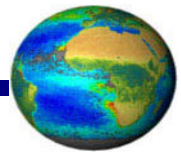


U.S. EPA Organization Chart

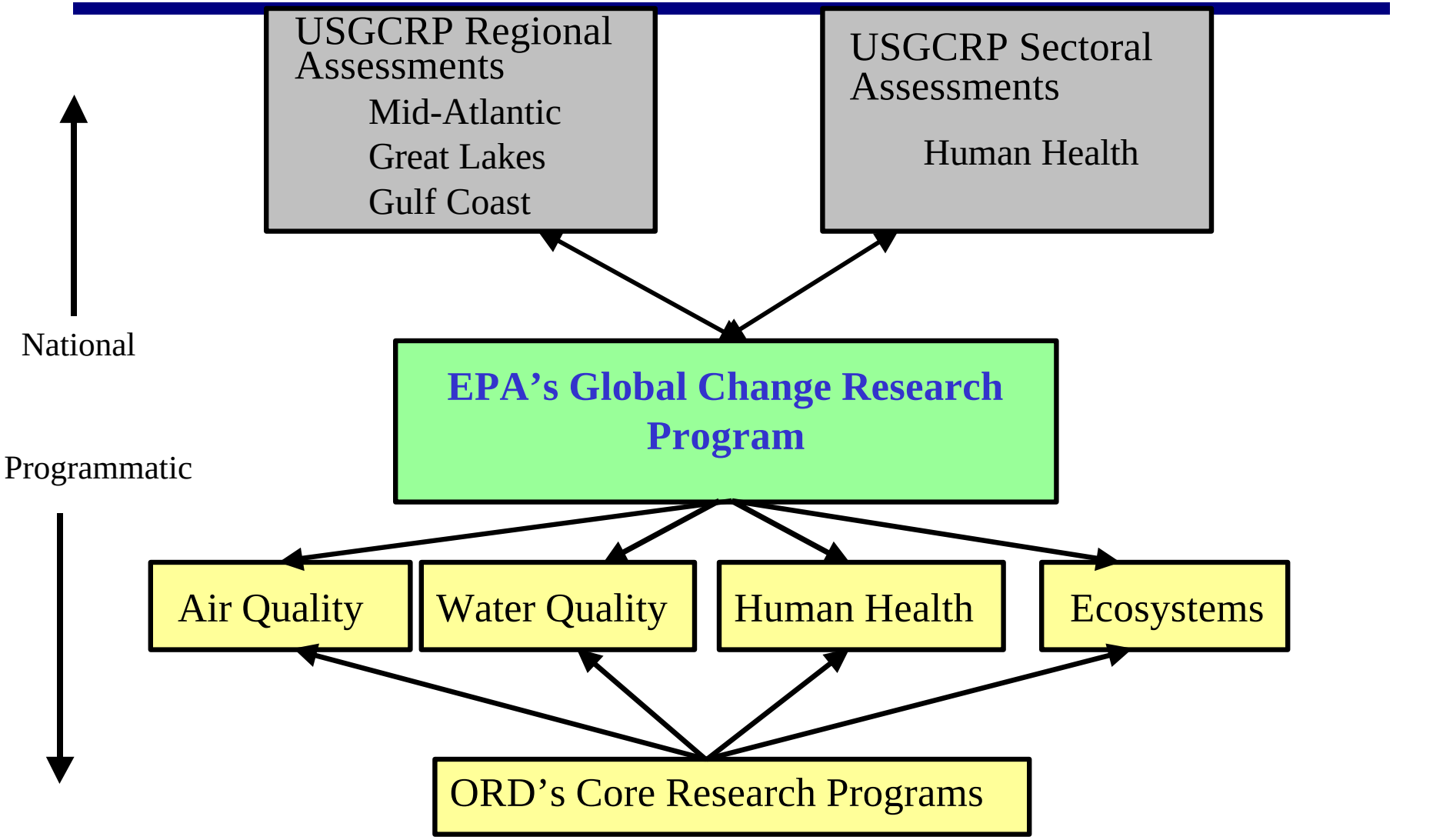


What We Promised the Congress

- Focus entire EPA program on the assessment of consequences of global change for the United States
- Commit entire budget increase ($4M) received in FY'00 and FY'01 to sponsorship of public-private Regional & Sector Assessments as part of USGCRP assessment activities
- Create a stakeholder-oriented program
- Closely coordinate with other member agencies of the U.S. Global Change Research Program (USGCRP)

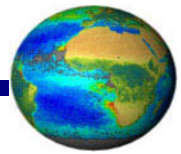


Multiple Perspectives of the Program



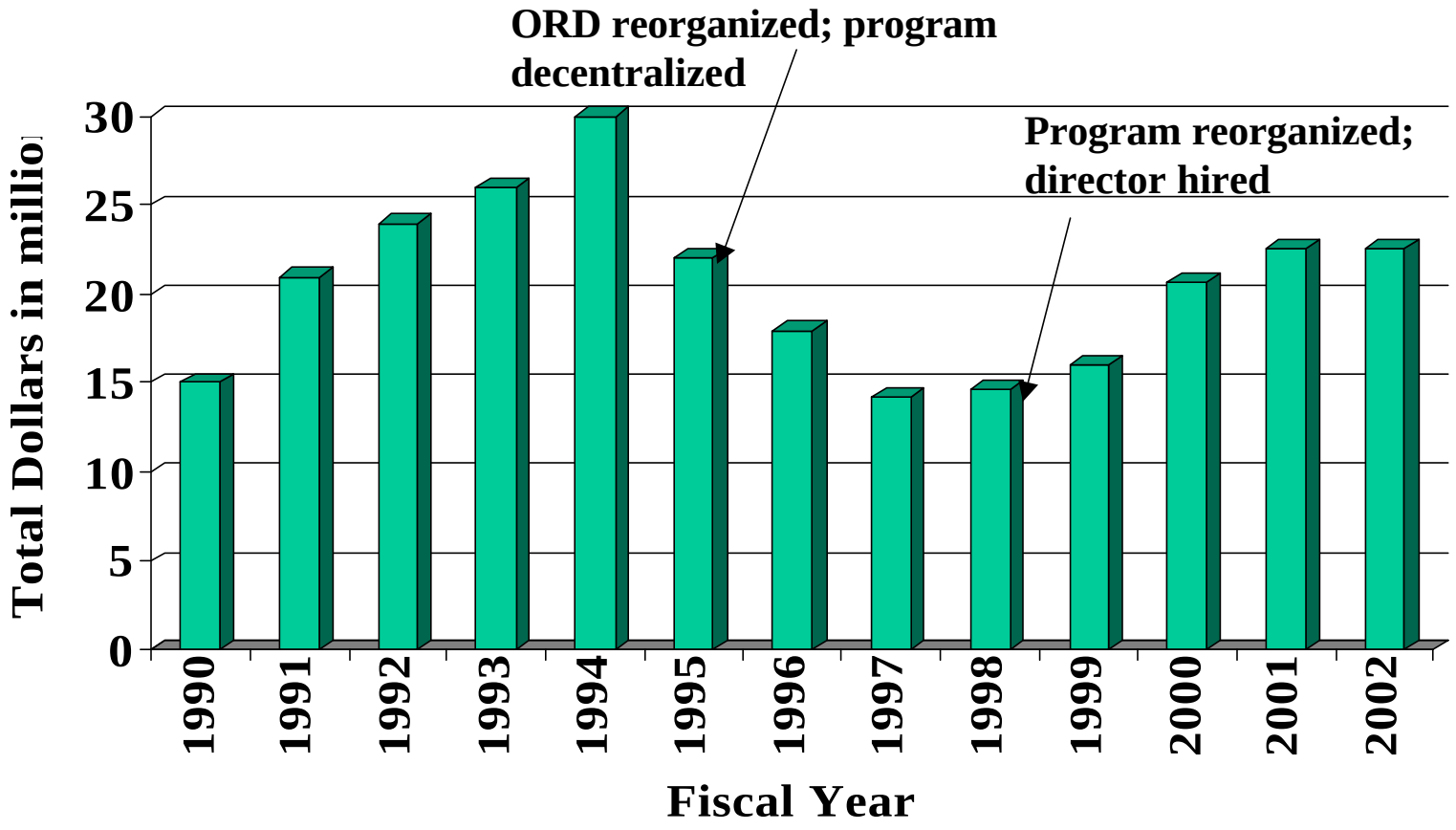
Response to 1997 Peer Review Comments

Peer Review Comments	Response
• Lack of strong program leadership; need to appoint program leader	• Program reoriented; centrally managed; program director hired
• Should focus on assessments, integration, and synthesis	• Program is assessment oriented
• Many projects seem to be repackaging of ongoing research	• Assessment orientation provides guidance for lab-based work
• Difficulty understanding STAR role in program	• STAR integrated into strategy
• ORD should divest of process-based research	• Lab-based work geared towards assessments
• Focus on consequences of global change	• Program orientated towards assessment of consequences



EPA's Global Change Research Budget

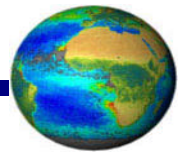
(includes extramural and personnel costs)



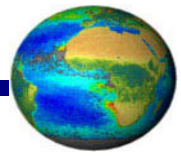
Where Our Funding Goes

$23M (FY2002)

- Research in EPA laboratories to support assessments ($11M)
- Support for Regional and Sector Assessments with private/public partners ($4M)
- Competitive grants to leading institutions ($8M)

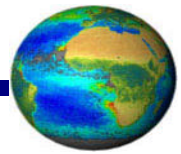


- EPA is proud of the success of its stakeholder-oriented program
- EPA's program is meeting its customers' needs – particularly EPA Program and Regional Offices
- Research conducted in program has resulted in peer-reviewed journal articles
- We have a Plan:
  - Peer-reviewed, long-term *Research Strategy*
  - Multi-Year Implementation Plan that puts program into GPRA context
- We are meeting our GPRA goals
- Program is consistent with CCRI and President Bush's objective of providing decision support and satisfying stakeholder needs



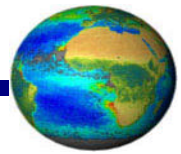
Inventory of Activities for EPA's Global Change Research Program

- EPA's inventory identifies 3 major programmatic areas:
  - Assessment of regional impacts of global change and adaptation options
  - Biology and biochemistry of ecosystems
  - UV monitoring network
- This briefing flows from the inventory – and provides greater detail on the activities being undertaken in each of these categories.
- Briefing also highlights how EPA's program fulfills specific criteria for developing the CCRI/USGCRP program; specifically:
  - Enhance the science base needed to measurably improve decision support tools
  - Enhance monitoring systems to support scientific and trend analyses and to improve decision support tools
  - Improve decision support tools
  - Enhance exploratory research
  - ➢ Commitment to scientific excellence



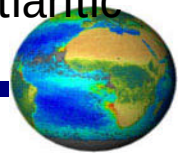
Key Messages

- EPA's program is focused on assessment of consequences of global change
  - Evaluation of adaptation strategies
  - Development & provision of decision-support tools (*i.e.,* stakeholder-oriented)
- We have a Plan:
  - Peer-reviewed, long-term *Research Strategy*
  - Assessment orientation endorsed by peer review panel
  - EPA program is consistent with NRC recommendations
  - Multi-Year Implementation Plan that puts program into GPRA context



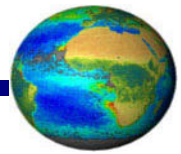
Key Messages (cont.)

- EPA/ORD Global Change Research Program is distinct from OAR's climate policy and energy efficiency programs
- EPA Program serves multiple clients:
  - USGCRP/CCRI
  - EPA Program Offices
  - EPA Regional Offices
  - Regional, state, and tribal partners
- EPA program is issue-based:
  - air quality
  - water quality
  - ecosystem health
  - human health
- Focus on four areas is consistent with EPA mission, strengths of EPA researchers
- EPA program is place-based: Great Lakes; Gulf Coast; Mid- to Upper-Atlantic



Key Messages (cont.)

- EPA's program is committed to maintaining its UV monitoring network and effects research
- Program is committed to highest standards of scientific excellence
- Program is committed to managing data and information resources
- EPA/ORD's Global Program is already informing decisions and providing decision-support tools
- We are receiving strong support from our stakeholders
- Program is consistent with draft USGCRP 10-Year Plan, CCRI, and President Bush's objective of providing decision support and satisfying stakeholder needs



Key Elements of the EPA Global Change Research Program

Assessment of Consequences

Assess the potential consequences of global change for human health, ecosystems, and social well-being in the U.S.

Science for decision making

Provide scientific information to support decision making by policy makers, resource managers, and other stakeholders.

Independent & Interactive Effects of Multiple Stressors

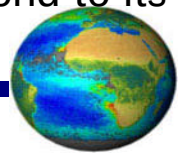
- Variability in climate (*e.g.,* El Nino, droughts, floods)
- Climate change
- Land-use change
- UV radiation

Adaptation Strategies

Focus on adaptation – building resilience to global change, while responding to both risks and opportunities.

Human Dimensions

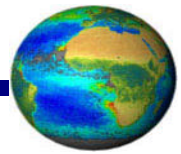
Examine how humans contribute to global change and respond to its consequences.



Consistency of EPA Program with NRC Recommendations

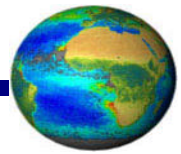
The Science of Regional and Global Change: Putting Knowledge to Work, (National Research Council, 2001)

- Key actions recommended by NRC:
  - Define and carry out programs of **regional and sectoral multiple-stress research** and demonstration projects
  - Develop **improved assessment capabilities** for integrating scientific knowledge into effective decision support systems
  - Ensure an "intimate connection" between research, operational activities, and the **support of decision making**
  - Participate in and support **interdisciplinary research** relating physical, biological, and human systems



ORD's Program Within EPA

- ORD's Global Change Research Program is distinct from EPA's climate policy programs and energy efficiency programs
- ORD's program does not focus on greenhouse gas mitigation policies, technology development, carbon cycle analysis, etc.



Global Change Research Program

Responsive to GPRA Goal 6 objective

RESEARCH STRATEGY

Global Change Research Program

Peer Review Draft, September 2000

Office of Research and Development

U.S. Environmental Protection Agency

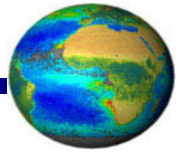
By 2010, EPA will conduct assessments, including developing assessment methods and conducting attendant research, of the consequences of global change on human health, ecosystems, and social well-being.

Responsive to the Global Change Research Program Strategy

Strategy Externally Peer Reviewed on February 15-16, 2001

Revised Strategy completed in December 2001

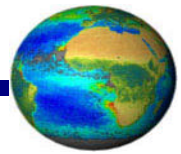
Opportunity for public release at Administration "Event"



Comments from Peer Review Panel on Assessment Orientation

"Panel enthusiastically supports Agency's decision to shift the rationale for its global change research program from a process-basis (e.g., studies on carbon sequestration) to an effects assessment basis."

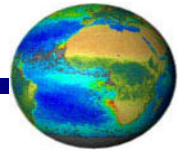
- Assessment-driven program better reflects the capabilities and interests of EPA
- Assessment-driven program better fits into the national program.



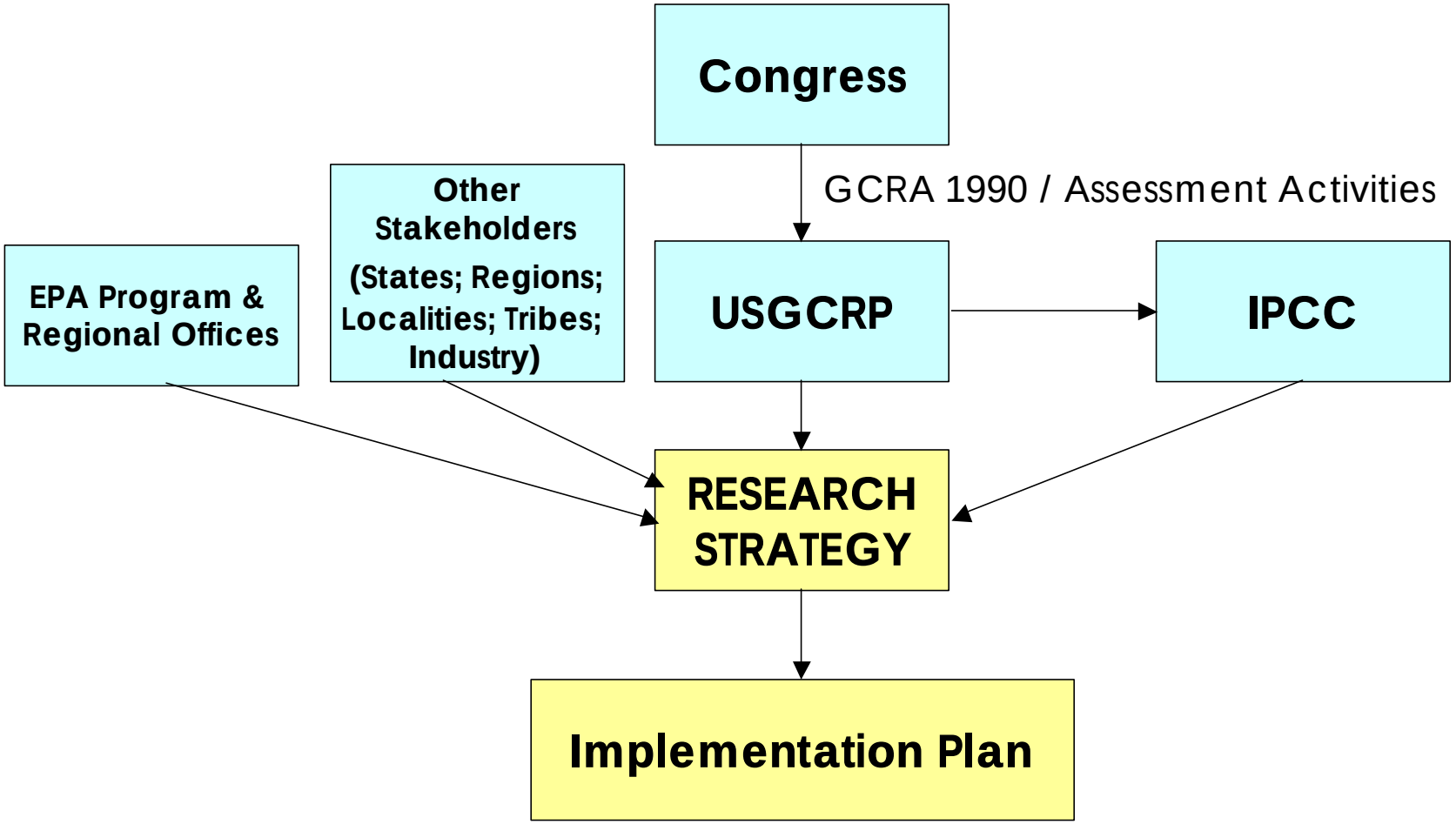
Commitment to Highest Standards of Scientific Excellence

- Extensive independent peer review of:
  - Long-term Strategy for Global Program
  - Ongoing research and assessment activities
  - Final products

- Strong support for extramural research:
  - Awards made through peer-reviewed competitive process
  - Designed to complement intramural research and assessment programs

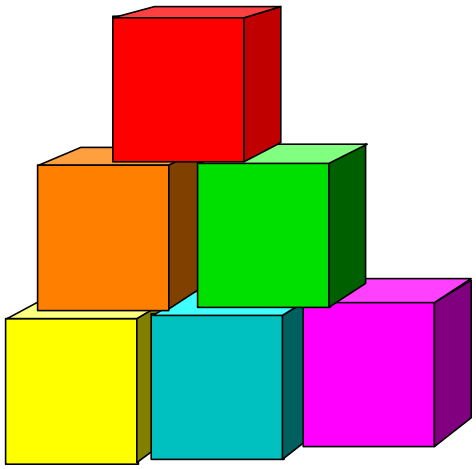


Our Clients


Congress
GCRA 1990 / Assessment Activities
Other Stakeholders (States; Regions; Localities; Tribes; Industry)
EPA Program & Regional Offices
USGCRP
IPCC
RESEARCH STRATEGY
Implementation Plan

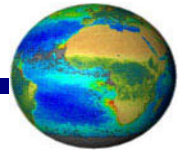
STAKEHOLDER INVOLVEMENT

- The EPA GCRP knows that development of science to support decision making hinges on the inclusion of stakeholders throughout the assessment process.
- Stakeholders include private citizens, corporations, state and local governments, regions, NGOs, etc.
- Stakeholders help to establish the goals of the assessment by
  - identifying specific information needs
  - providing expertise
  - providing data and information on a variety of topics including public values, equity considerations, and relevant decision processes.
- The uncertainties and information needs that stakeholders help to identify become the basis for prioritized research agendas.



EPA's Well-Defined Role within the USGCRP/CCRI

- EPA is part of a larger family of 11 federal agencies
  - DOC/NOAA
  - EPA
  - NSF
  - DOE
  - HHS/NIH
  - SI
  - DOI/USGS
  - NASA
  - USDA
  - DOD
  - **DOT**
- EPA has a specific niche focusing on assessment of consequences for decision makers, evaluating adaptation options, and developing decision-support tools
- Close coordination and leveraging of activities, *e.g.,*
  - ecosystem research
  - EPA key supporter of joint RFA focusing on human health (with NOAA, NASA, NSF and EPRI)
  - EPA cooperating with DOE/Battelle on downscaling efforts
- Elimination of duplication, *e.g.,*
  - EPA moved out of climate modeling, agriculture, forestry



Critical Linkages with Other USGCRP Programs

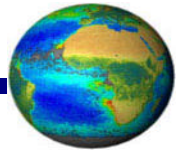
- As noted by peer review panel, it is impossible for EPA to conduct all of the research necessary to complete its assessments.
- EPA's Global Program benefits from research conducted in other USGCRP agencies.

<u>Related USGCRP work supporting EPA ecosystem assessments</u>:

- Understanding terrestrial ecosystems: *e.g.,* DOI/USGS, USDA, NASA
- Understanding marine ecosystems: *e.g.,* NOAA, NASA
- Biology and biogeochemistry of ecosystems: *e.g.,* DOE, DOI/USGS, NSF, SI, USDA

<u>Related USGCRP work supporting EPA air quality assessment</u>:

- Modeling long-range transport of pollutants: *e.g.,* NASA (Joint workshop planned)
- Atmospheric composition and chemistry: *e.g.,* DOC/NOAA, DOE, NASA, NSF, USDA
- Understanding the Earth's Climate System (including the development of General Circulation Models): *e.g.,* NASA, NSF, DOE, DOC/NOAA, DOI/USGS



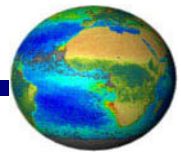
Critical Linkages with Other USGCRP Programs

Related USGCRP work supporting EPA water quality assessments: Global water cycle (*e.g.,* NASA, NOAA, USGS)

Related USGCRP human dimensions research in areas not covered by EPA: *e.g.,* NOAA, DOE, HHS/NIH, SI (Joint workshop planned with DOE & EPRI on development of health status scenarios required for future assessments)

Other related USGCRP general "climate science" support for EPA assessments:

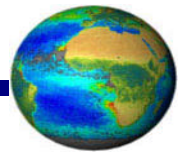
Carbon cycle science: *e.g.,* DOC/NOAA, DOE, DOI/USGS, NASA, USDA

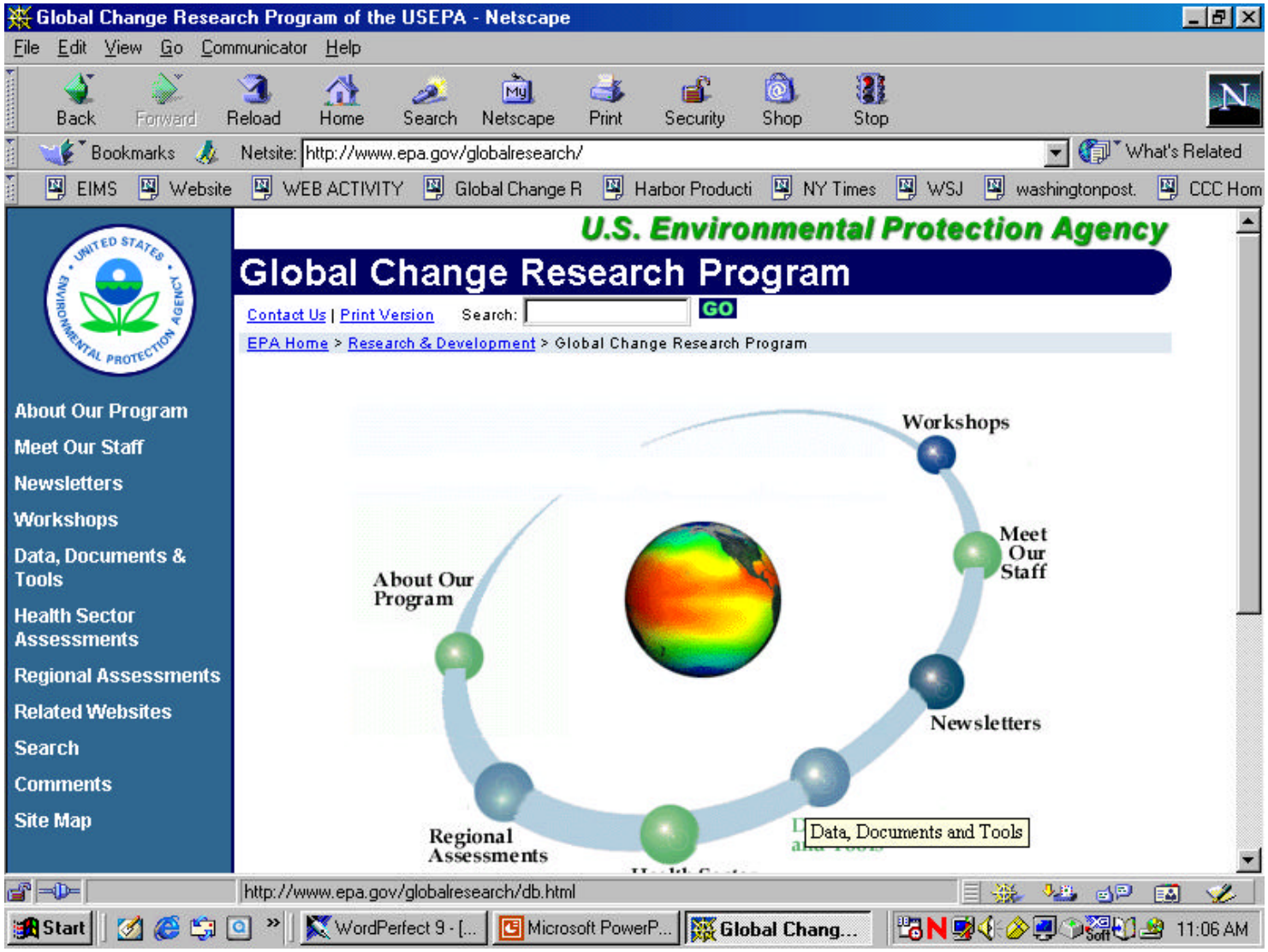


Commitment to Managing Data and Information Resources

New website: www.epa.gov/globalresearch

- Portal through which scientists, policy analysts, and the public can access
    - research data
    - documents
    - project descriptions and updates
    - workshop announcements and proceedings
    - presentations
    - analytic & decision-support tools
- Information produced by the Global Change Research Program's intramural and extramural researchers.




Global Change Research Program of the USEPA - Netscape
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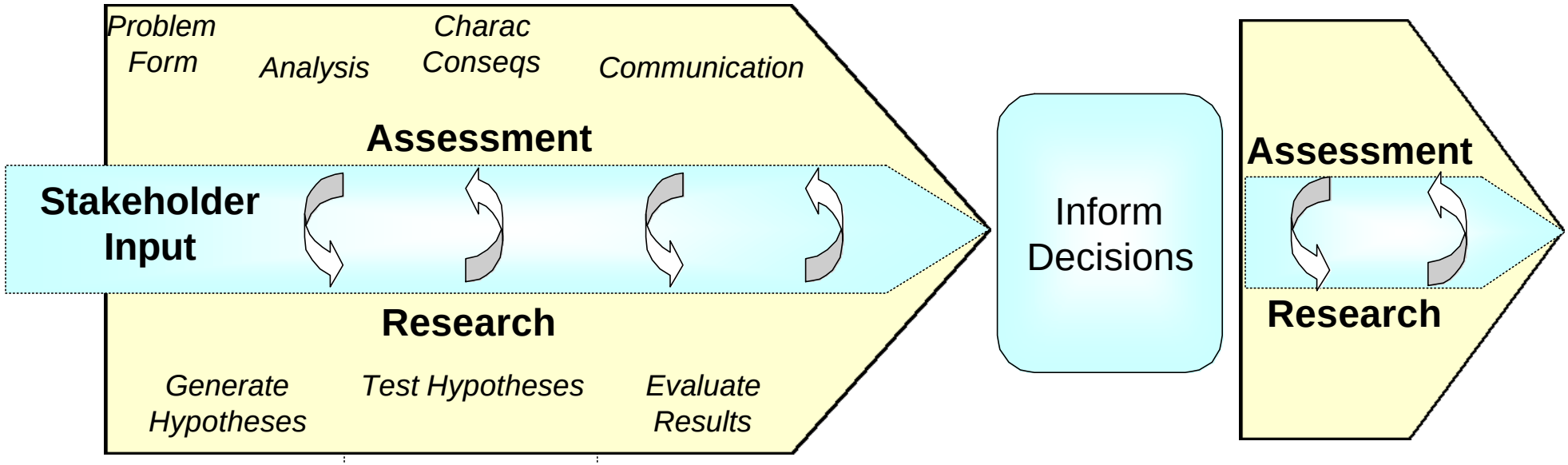
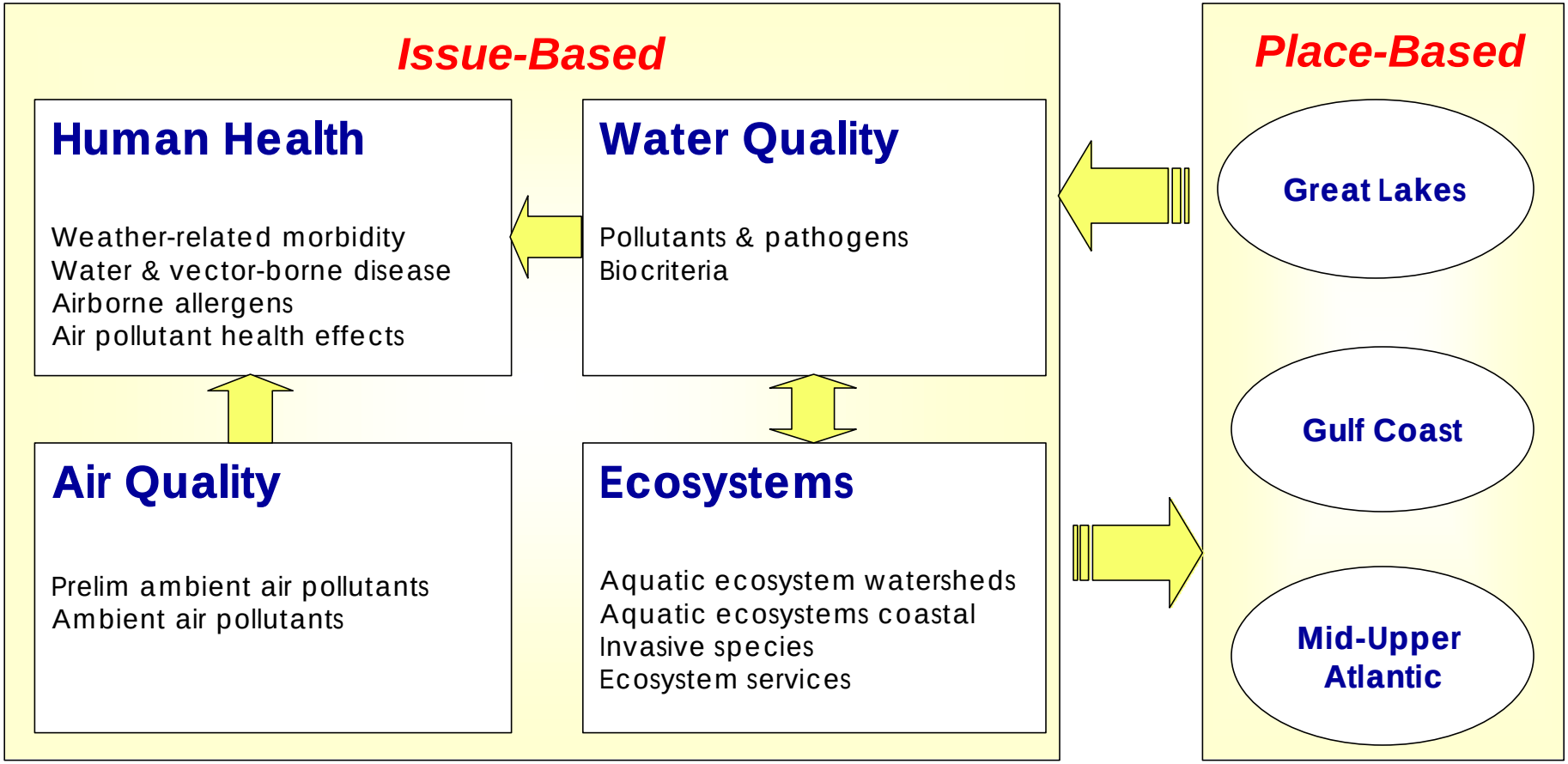
Global Change Research Program's Conceptual Framework

KEYS to the FRAMEWORK:

- Interaction with stakeholders throughout the research and assessment process.
- The goal is to develop a credible science base to inform decision making.



Integrated Plan for Issue & Place-Based Research and Assessment



EPA's Support of USGCRP Assessment Activities

Why EPA support? Because of Regional and Sector context…

Great Lakes
University of Michigan

Mid-Atlantic
Pennsylvania State University

Human Health
Johns Hopkins University

Gulf Coast
Southern University

Ongoing Focus on Regional and Sector Assessments

Maintain commitment to assessment of global change within regions and sectors:

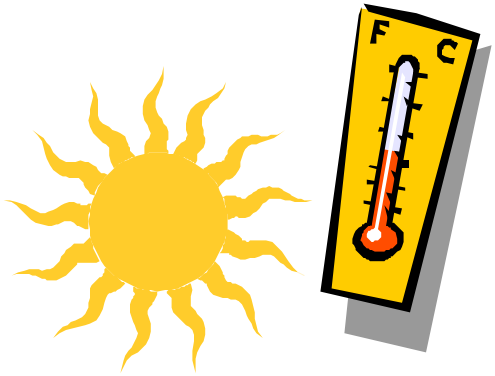
- Great Lakes region
- Mid-Upper Atlantic region
- Gulf Coast region
- Human Health sector

- Special emphasis on examining the interface of science and decision making.

- Continued integration of stakeholders into the process of research and assessment.

Global Change & Air Quality (NRMRL, NERL, NCEA, NCER)

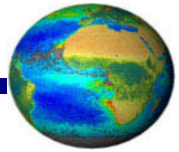
- Regional Weather Patterns under Climate Change.



- Global Change Effects on Emissions (anthropogenic and biogenic).

- Societal Change, Technological Advance, and Emissions.

- Global Change and Air Quality.



Global Change & Water Quality (NRMRL, NCEA)

- Climate Change and Land Use Change Effects on Pollutant Loads.

- Impacts of Storm Surge and Sea Level Rise on Water Supplies.

- Global Change and Implications for Biocriteria.

Global Change & Human Health (NCEA - National Assessment)

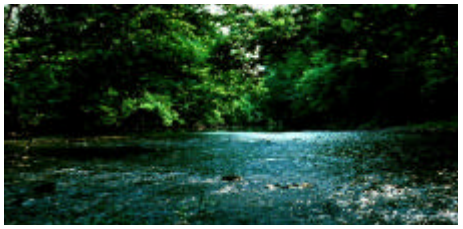
- Weather-related Morbidity: Heat Stress / Accidental Injury

- Water and Vector-Borne Diseases.

- Airborne Allergies.

- Air Pollution Health Effects.

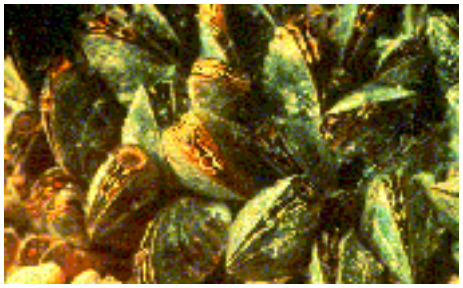
Global Change & Ecosystems (NHEERL, NERL, NCEA, NCER)



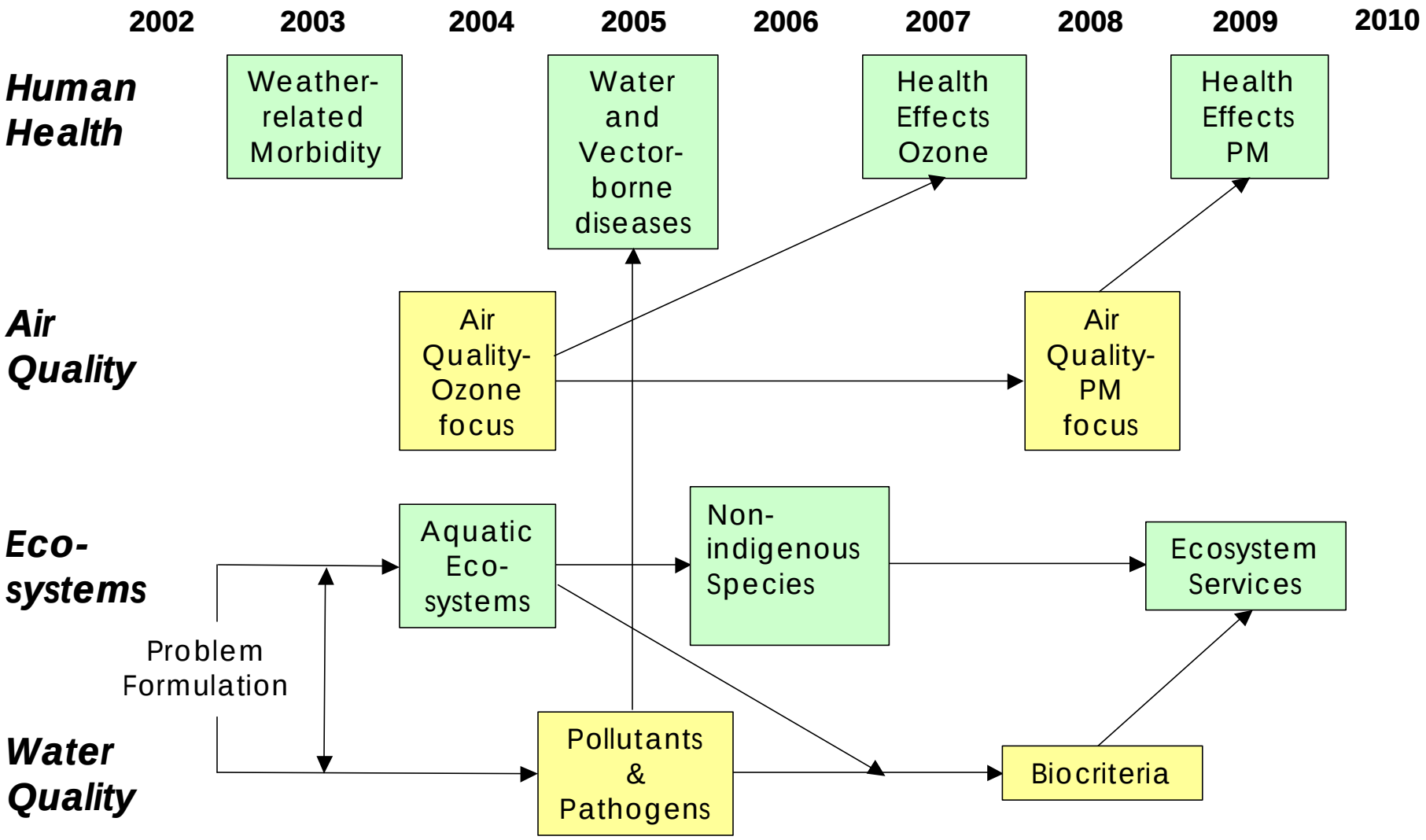
- Aquatic Ecosystems
  - watersheds
  - estuaries
  - corals

- Protection of Ecosystem Services

- Invasive Nonindigenous Species

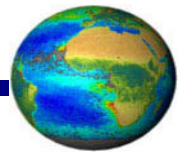


Sequencing of Assessments



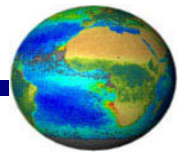
STAR Grants for Global Change Research

- Provide ongoing, long-term support for selected topic areas
- Augment areas in which ORD has expertise
- Focus on limited number of topic areas consistent with long-term Global Change Program *Research Strategy*
  - Science to Support Assessment
  - Human Dimensions Research
- Examples:
  - FY2002 RFA: Assessing the Consequences of Global Change for Air Quality: Sensitivity of U.S. air quality to climate change and future global impacts
  - FY2000 RFA: Assessing the Consequences of Interactions between Human Activities and a Changing Climate



EPA/NPS UV Network: Purpose

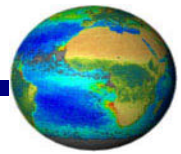
- Evaluate human and ecosystem exposure to surface UV radiation across the US,
- Assess the impact of changes in stratospheric ozone and tropospheric pollution on surface UV
- Assess effectiveness of control strategies (e.g. Montreal Protocol) on reducing green house gases and stratospheric ozone
- Part of EPA National Monitoring strategy



Purpose (cont.)

- Provide sites that will allow evaluation of UV climatologies, trends, and effects with
  - High/low elevation
  - Humid/dry conditions
  - Latitude/Longitude variation
  - Major ecosystems
  - Fresh and marine water

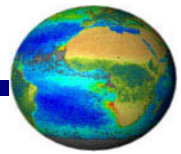
- Provide spectrally resolved data so effects research can correlate cause and effect with wavelength
  - *e.g.,* Human effects: Sunburn, skin cancer, immune deficiency, cataracts
  - *e.g.,* Ecosystem effects: marine and freshwater organisms (amphibians and corals), plant effects (e.g. Saquaro cacti)



What is the EPA/NPS UV Network ?

- A network of 21 sites
  - 7 Urban
  - 14 rural in National Parks (PRIMENet, NPS collects additional air quality data)

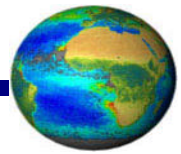
- Uses Brewer Spectrophotometers- spectrally resolved continuous data



EPA/NPS UV Monitoring Network

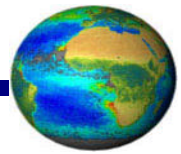
EPA/NPS UV Network Research

- EPA, NPS, USGS: Amphibian effects studies
- EPA: Coral studies
- EPA: Human effects studies
- EPA: Effects of clouds and Atmospheric chemistry on UV, geographical variability, trends analysis



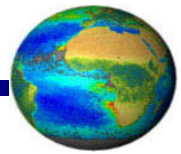
Status and Future

- *Trends analysis for assessment of control strategies will take 7-12 years (based on 5 or 10% recovery in stratospheric ozone)*
- FY03: Tools for assessment of vulnerability of coastal ecosystem services in SE US to changes in UV and global climate
- FY03: Evaluation of exposure of coral ecosystems in Florida Keys to UV radiation
- FY04 Report on geographic and seasonal variation in biologically effective UV reaching the surface of aquatic ecosystems in SE.



Status and Future (cont.)

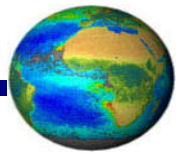
- FY04: Climatology of Mid-Atlantic region
- FY05: Assessment of the impacts of clouds and haze on UV exposures in Mid-Atlantic aquatic ecosystems.
- FY06: Report on current and future impacts of global change (including UV radiation, temperature and nutrient loadings) on coastal aquatic ecosystems.
- *Currently re-evaluating network design to improve effectiveness of investment*



Success Stories

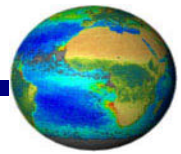
EPA/ORD's Global Program is already informing decisions

and providing decision-support tools



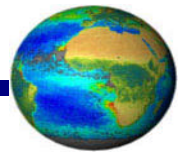
Success Story: TEAM Web-based Decision-Support Tool

- TEAM: Tool for Environmental Assessment and Management
- Interactive, web-based tool
- Purpose: Help water resource managers include considerations of climate change in their day-to-day decision making
- Employs multi-criteria decision making approach
  - Decision criteria defined by user
  - Objectives defined by user
- Case studies (*e.g.,* Egypt) already conducted
- Tool ready for public release
- Opportunity to tie public release to an Administration “event”

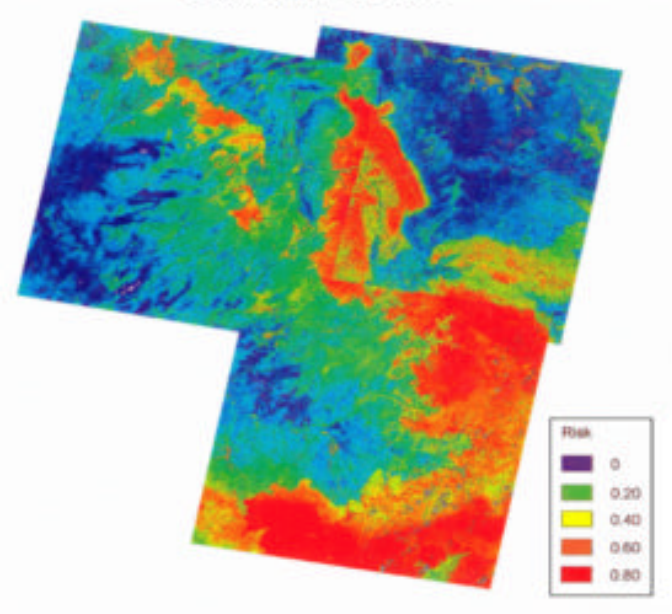


Success Story: Informing Public Health Interventions to Prevent Hantavirus Pulmonary Syndrome in the Southwestern United States

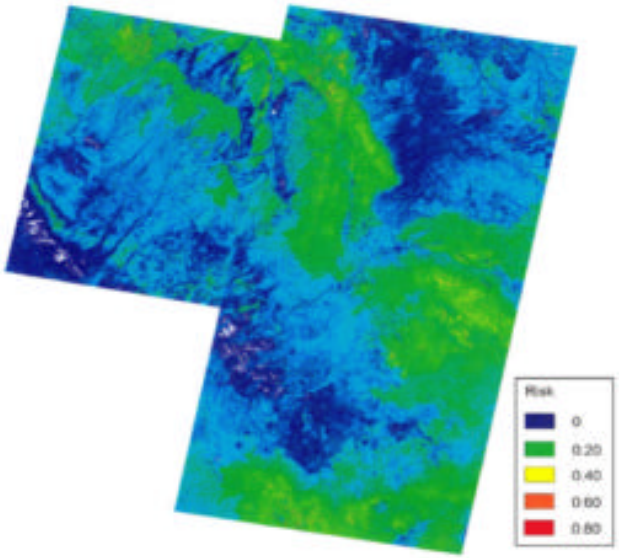
- Illustrates how ORD health-impacts assessment can ultimately lead to on-the-ground interventions to prevent disease and protect the public's health
- 1993: HPS outbreak in SW with high death rate (>50%)
- Hypothesis: outbreak due to environmental conditions and increased rodent populations caused by unusual weather associated with 1991-92 ENSO
- EPA-sponsored study at The Johns Hopkins School of Hygiene and Public Health explored this hypothesis
- Found that high-risk areas for HPS can be predicted over 6 months in advance based on satellite generated risk maps of climate_dependent land cover.
- **Risk maps**, developed in partnership with CDC and the Indian Health Service, are already being implemented for disease prevention in the southwest by the U.S. Department of Health and Human Services.



Hantavirus Pulmonary Syndrome
Southwestern, USA - 1992



Hantavirus Pulmonary Syndrome
Southwestern, USA - 1995



Success Story: Bartonellosis and Climate Variability

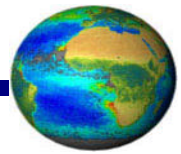
Investigators funded jointly by EPA, NOAA, NASA, NSF and EPRI are involved in a comprehensive study of the epidemiology of bartonellosis in Peru.

The study site is in the Peruvian Andes, where the disease has been known since the 1600s. The first dramatic epidemic of the disease was documented in the 1870' s during construction of a railroad in the area, when nearly 7000 workers died from the acute form of the disease.

Studies currently underway are investigating the relationship between bartonellosis epidemics and el Niño-induced regional climate variation. Preliminary results suggest that even slight changes in rainfall and temperature influence disease outbreaks during the warm season.

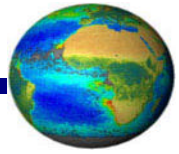
Success Story: Vulnerability of Drinking Water Systems to Sea Level Rise

- "Good news" story
- Geographic scope of assessment: Gulf and Atlantic coasts in the U.S.
- Sample of about 1000 systems
- Results suggest:
  - 9 million people served by coastal surface water systems that are unprotected (by a dam or other structure) from sea-level rise
  - 6 surface water systems serving over 500,000 people are ranked highly vulnerable to salt water intrusion

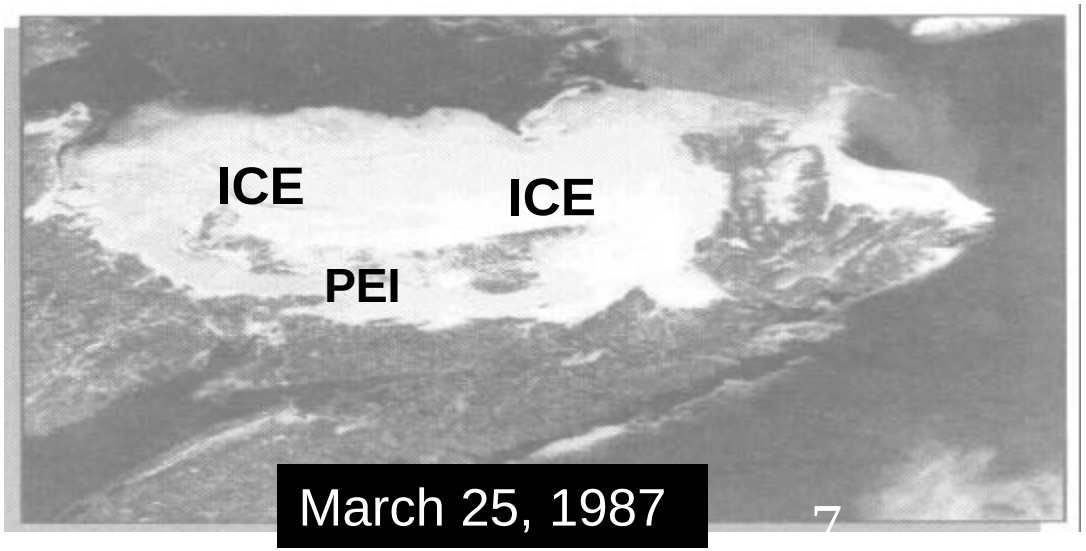


Success Story: Partnership with International Joint Commission

- IJC Great Lakes Water Quality Board charged with focusing on potential impacts of climate change (2002-2003)
- EPA/ORD invited to brief IJC Water Quality Board on potential consequences of climate change (February 2002)
  - through efforts of EPA Region 5
  - joint briefing with Environment Canada
- EPA/ORD invited to brief IJC Commissioners (April 2002)
- EPA & Environment Canada invited by Water Quality Board to prepare white paper on:
  - potential consequences of climate change for “beneficial uses” in the Great Lakes Region;
  - adaptation options
- Water Quality Board to host workshop in Spring 2003



Ice in the Gulf of St. Lawrence



1987:
Sea ice reduces wave action and amount of shore erosion.

1999:
Little sea ice is present. (Most white areas are clouds.)

Shore exposed to wave action of winter storms.

Source: Environment Canada

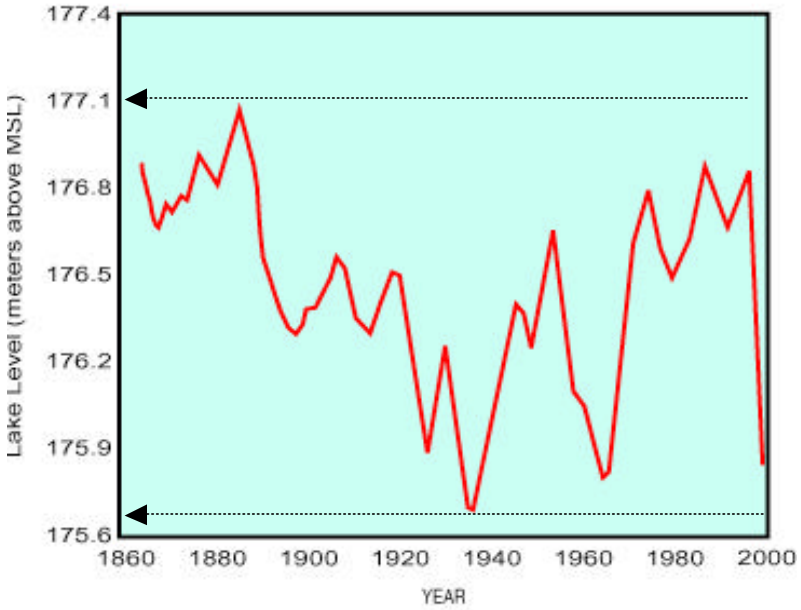
Success Story: EPA Assessments Already Informing Stakeholder Decisions in Great Lakes Region

The Great Lakes Regional Assessment team is hosting workshops to evaluate how assessment findings can inform decision processes and to elicit new information needs.

- **Great Lakes Water Levels** (March 2001)
  - Focus on shipping, recreational boating, safety, infrastructure
- **Lake Ecology** (June 2001)
  - Focus on Productivity and fishing
- **Agriculture** (March 2002)
  - Focus on farming, insurance, adaptation
- **Terrestrial Ecology** (June 2002)
  - Focus on forests, wildlife, and timber industry
- **Recreation** (October 2002)
  - Focus will be on winter recreation and economy

Stakeholder Concerns: Lake Levels and Infrastructure

Historic Lake Michigan-Huron Water Levels



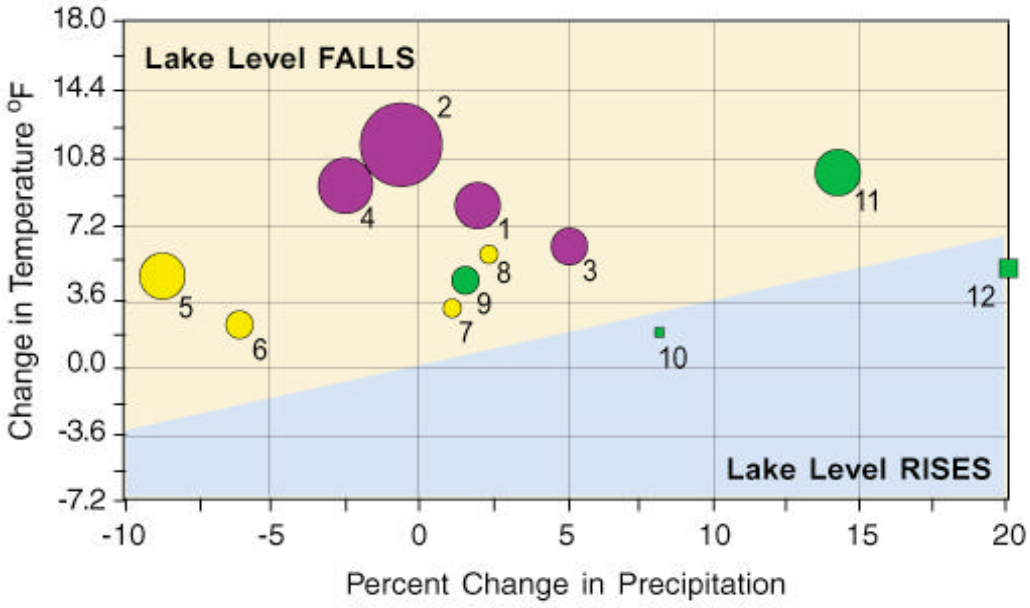
- Over 40 plants rely on Lakes for drinking water.
- Plants are designed for “100 year” extremes, which we’ve seen several times in the past few decades.
- Power plants rely on lakes for cooling .
- We have no experience with low water regimes.

Research Needs

- *What are the risks to utilities?*
- *Will efficiencies and costs change as water levels drop?*
- *How many of each type of plant are at risk?*
- *Will adaptations in some areas affect infrastructure?*

Stakeholder concerns: Climate Change Impacts on Lake Levels and Shipping

Lake Michigan-Huron

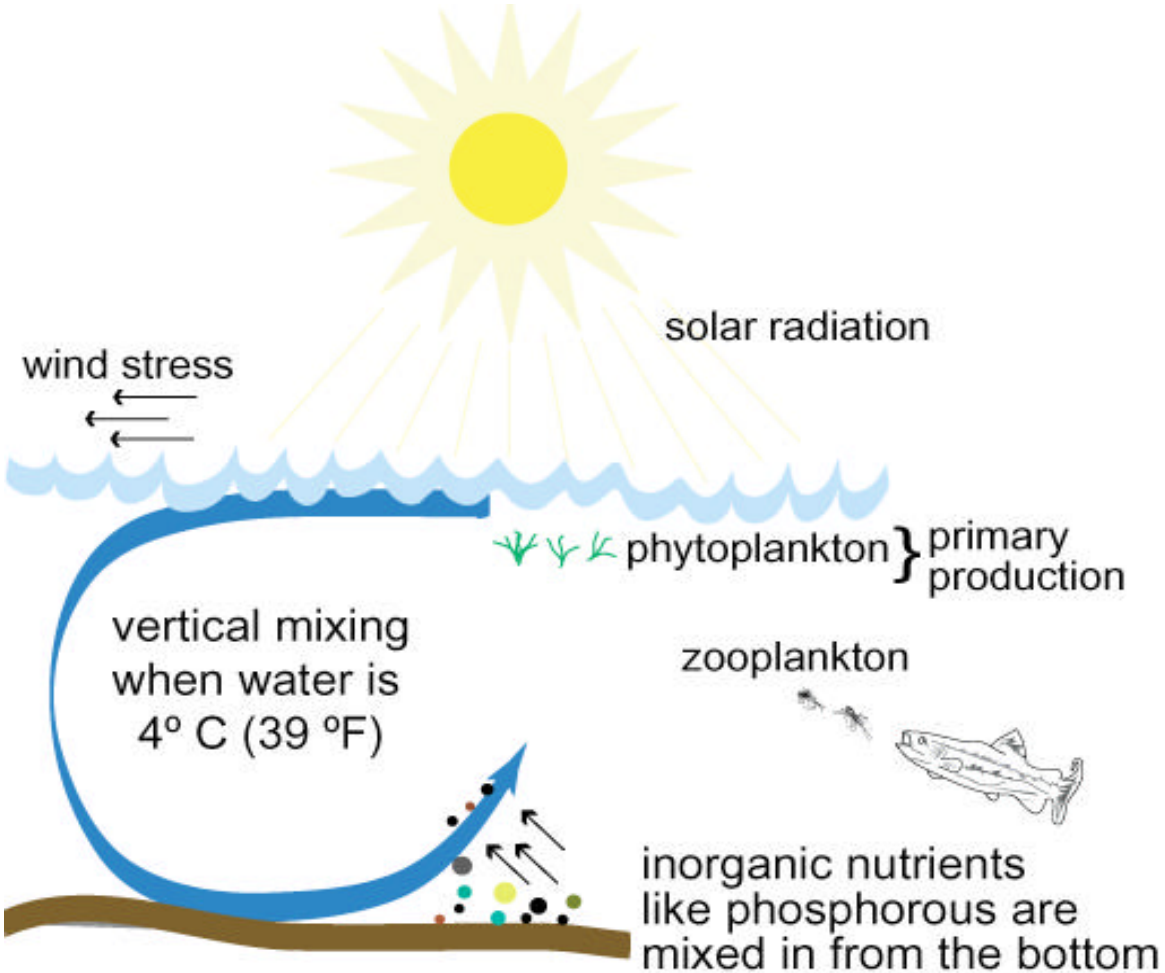


- For each inch of draft lost, 1,000 foot ships must offload 270 tons of freight
- Options proposed at Chicago Lake Levels Workshop:
  - Lengthen shipping season
  - Dredging
  - Shallower-draft ships
  - Shift to land transport

Research Needs:

- *Does dredging exacerbate or ameliorate contaminated sediments?*
- *What non-dredge options are there?*
- *What are the consequences of each?*

Stakeholder Concerns: Climate and Large-Lake Dynamics

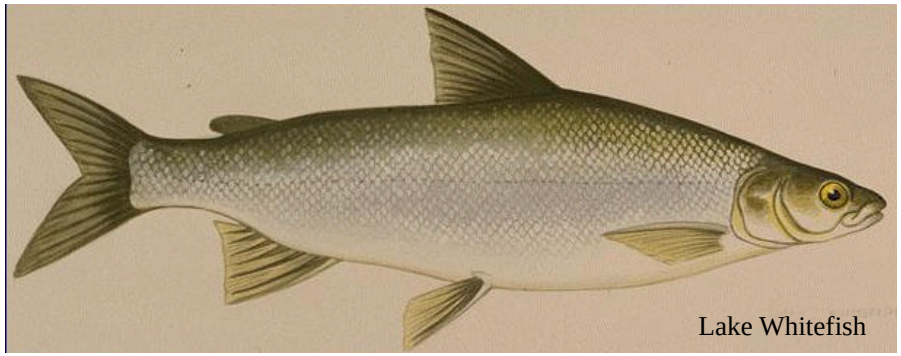


Aquatic life in the Great Lakes depends critically on how surface nutrients and oxygen are mixed through-out the depth of the lakes. The mixing in turn depends on the seasonal cycles of lake and air temperatures, sunshine, and winds.

We need a better knowledge of how future precipitation and wind patterns will change over the Great Lakes drainage basin, how land-use practices will change, and how the links in the food web operate between the primary producers and the top, economically important fish.

Stakeholder Concerns: The Lakes and Fishing

- Invasive Species are displacing native, high-value fish
- Invasives are changing water quality
- Recovering species are competing with fishermen


Lake Whitefish

<u>Research Needs:</u>

- *What is the impact of invasive species on ecosystems?*
  - *On water quality?*
  - *On commercial fishing?*
  - *On fish consumption warnings?*
- *How will temperature changes affect mixing and productivity?*
- *How may changes in water quality affect human behavior?*

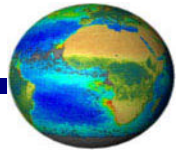
Information Needs Identified at Stakeholder Workshops

- Shipping community:
  - Information on lake levels, shipping channels, remediation options
- Agriculture sector:
  - Long term planting decision support, derivatives, other opportunities (e.g., wind farms)
- Timber industry:
  - Operational decision support, lobbying decision support

Great Lakes Assessment Activities: Synopsis

The Great Lakes Regional Assessment:

- Published sound, widely reviewed reports and articles
- Engaged stakeholders throughout the region
- Produced decision-relevant information
- Produced insights on how to engage stakeholders
- Developed new research and assessment questions
- Engaged other agencies and EPA Regions

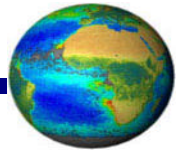


Success Story: Weather Derivatives (Weather is a Business Risk)

The U.S. Department of Commerce estimates that up to **$1 trillion** of the $7 trillion U.S. economy is subject to weather risk.

Recent Weather Related News Items:

- *…"Bullish hopes that a recent bout of hot and dry weather would hurt the quality of the 2001 crops were thrown aside following reports of a rainy, cool weekend in key corn and wheat growing regions…." WSJ, May 22, 2001*
- *…"Hot, dry weather in August damaged the nation's corn crop, dropping the estimated harvest to the lowest in four years…." St. Louis Dispatch, September 15, 2001*
- *"Weather Problems Result in Bad Year for Michigan Wine Grape Growers"…."even before the growing season began, more than half of the buds of damage-prone wine grape varieties were killed by harsh winter temperatures in December….." Knight Ridder, October 20, 2001*

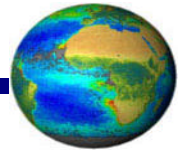


Success Story: Weather Derivatives (cont.)

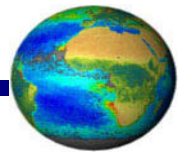
Weather is a Business Risk That Can be Covered

- The market for weather risk management products was established in late 1997 to help energy companies hedge volumetric risk and smooth revenue streams. It is quickly migrating to new industries as participants become familiar with the applications and benefits of these products.
- Volume of transactions since market inception is roughly $10 billion.
- Weather risk management tools are used by companies for protection against "adverse" weather conditions.
- Companies no longer have to bet on "good" weather.

Great Lakes Region Stakeholder: Cargill Risk Management



Stakeholder Feedback

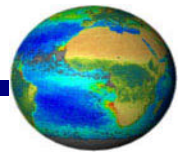


EPA Region 5

Letter from David Ullrich (Deputy RA, Region 5) to Henry Longest, February 11, 2002:

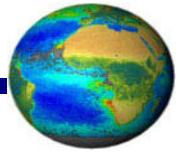
"Last week during a meeting of the Great Lakes Water Quality Board, which I co-chair with John Mills of Environment Canada, we devoted a significant portion of the agenda to climate change and its potential effects on the Great Lakes. It is the top priority the International Joint Commission has asked us to deal with over the next two years."

"I want to express my strong support for the continuation of the Regional Assessments, especially the Great Lakes Regional Assessment, for obvious reasons. I think this is one of the best examples I have seen in my almost 29 years at EPA of ORD and the Regional needs really being in synch with one another."



Great Lakes National Program Office

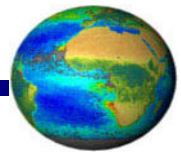
- Support expressed by:
  - Gary Gulezian (Director)
  - David C. Cowgill
- Interest expressed by:
  - National Association of Conservation Districts' (NACD) Great Lakes Committee



New England Science Center Collaborative (Region 1 Partner)

Letter from Mary Lou Krambeer (Coordinator) to Henry Longest and Paul Gilman, February 11, 2002:

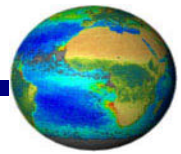
"I am writing to endorse the continued support of the Regional Assessment activities conducted under the US Global Change Research Program. The work … is critical to engaging the public in the tremendous body of knowledge and extensive research being conducted on climate change. The Regional Assessments include many stakeholders in their work and as a result have produced accessible, well-documented and non-partisan information in a user-friendly format."



State of New Hampshire, Department of Environmental Services

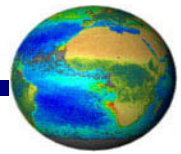
Letter from Kenneth A. Colburn (Director, Air Resources Division) to Henry Longest and Paul Gilman, February 15, 2002:

"Since large sectors of New Hampshire's economy … are critically dependent on the State's natural environment, it is imperative that the scientific efforts led by the U.S. Environmental Protection Agency (EPA) which produced these findings continue."



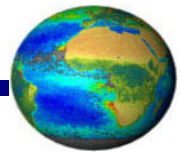
EPA Global Program Supports CCRI/USGCRP Integrated Program Goals

- Socioeconomic and human impacts
- Atmospheric composition
- Climate-ecosystem interactions
- Land use/land cover
- Water cycle
- Observation and monitoring systems



Consistency of Program with Critical Elements of New USGCRP Strategic Vision

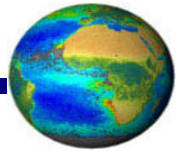
- Develop regional-scale predictions of interactions of natural and human-induced changes
- Diagnose vulnerability and evaluate options for enhancing resilience of natural resources
- Provide useful knowledge for decision making by governments, communities and the private sector



Climate Change Research Initiative (CCRI)

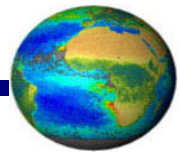
- Consistent with Secretary Evans' guidance:
  - New investments must provide answers that would better inform difficult decisions facing our country and the world
  - New science must produce products **that aid in making decisions**

- Focus on:
  - Atmospheric processes
  - Carbon cycle
  - Climate observations
  - Operational modeling
  - **Regional impacts**



Opportunities for EPA and the Administration

- Opportunity for public release of *Research Strategy* for EPA/ORD's Global Change Research Program at Administration public "event"
- Opportunity for public release of TEAM decision-support tool for water resource managers
- Opportunity for public announcements of new competitively-awarded cooperative agreements:
  - to continue Great Lakes, Gulf Coast, and Mid- to Upper-Atlantic Regional Assessment activities
  - to produce decision-support systems



Atmospheric Programs (OAR)

- **Reducing Emissions Through Voluntary Programs**
  - **~ ENERGY STAR**
  - **~ Climate Leaders**
  - **~ Methane and Other Non-CO2 Gases**
- **Assessment of Market-Based Approaches to Reducing Emissions**
- **Technical Expertise for Climate Negotiations and Other International Fora**
- **Development of Annual U.S. Greenhouse Gas Inventory**
- **State and Local Capacity Building**
- **Working with Developing Countries to Help Shift Development to Climate-Friendly Paths**

Transportation & Air Quality (OAR)

- **Improve Vehicle Fuel Economy**
  - ~ **Advanced Automotive Technology Program**
  - ~ **Green Vehicle Guide Website**
  - ~ **Fuel Economy Trends Report**

- **Reduce Fuel Life Cycle Emissions**

- **Reduce Vehicle Miles Traveled**
  - ~ **Commuter Choice Initiative**