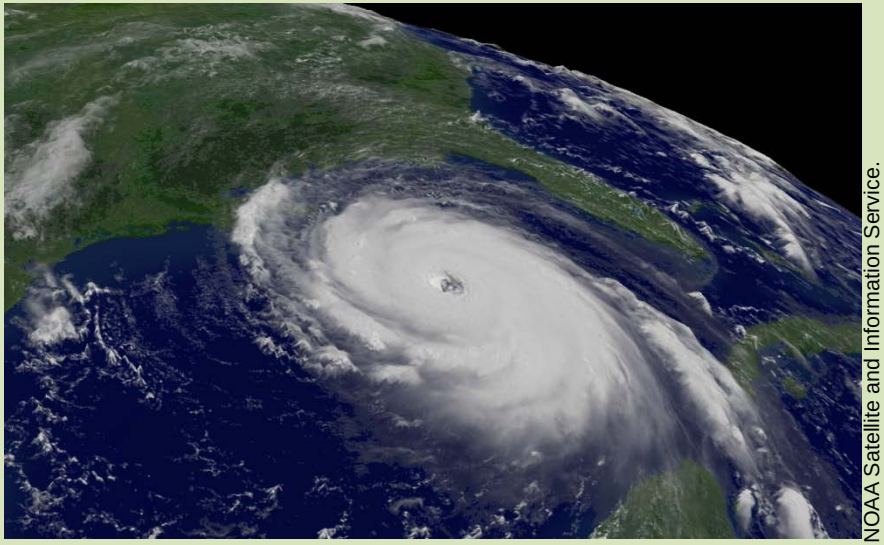
# - Climate Change and Restoration - Building Consensus at the Foundations of the Science

**Mike Hooper**

**USGS Columbia Environmental Research Center**
**Columbia, Missouri**



NOAA Satellite and Information Service.

**U.S. Department of the Interior**
**U.S. Geological Survey**


Metro Center

# Impetus for the Workshop

**Global Climate Change effects are observable now:**

- **Increased rate of polar and glacial melt**
- **Increases in sea temperatures, decreases in pH**
- **Increases in extreme weather events**
- **Shifting ranges and phenology for plants & wildlife**

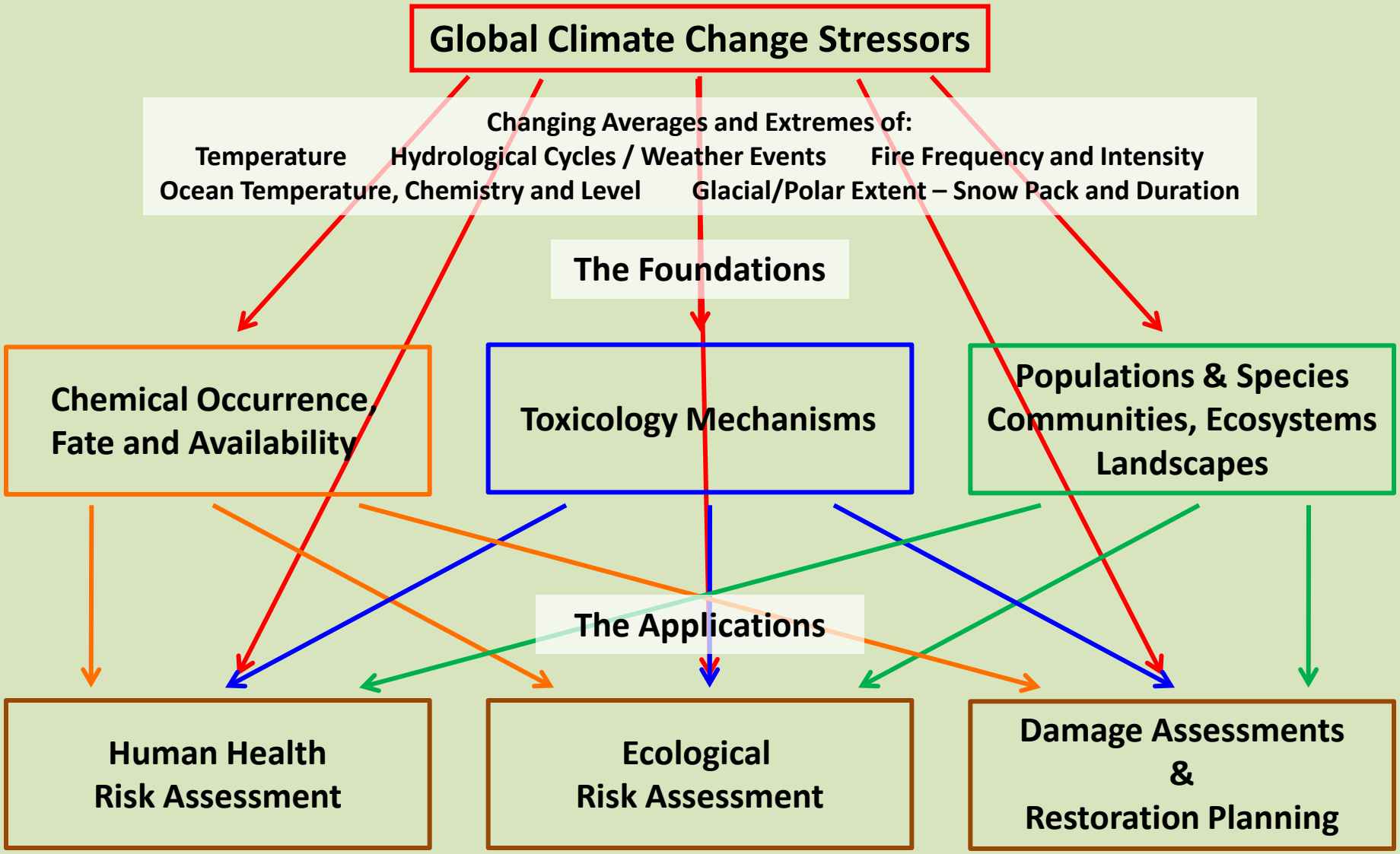
**We sought to answer the question:**

**How will global climate change influence**

**1) the environmental impacts of chemicals and**

**2) the way we assess and manage chemical contamination in the environment?**

USGS
science for a changing world


Global Climate Change Stressors
Changing Averages and Extremes of:
Temperature
Hydrological Cycles / Weather Events
Fire Frequency and Intensity
Ocean Temperature, Chemistry and Level
Glacial/Polar Extent – Snow Pack and Duration
The Foundations
Chemical Occurrence, Fate and Availability
Toxicology Mechanisms
Populations & Species Communities, Ecosystems Landscapes
The Applications
Human Health Risk Assessment
Ecological Risk Assessment
Damage Assessments & Restoration Planning

# Influence of Global Climate Change on the Scientific Foundations and Applications of Environmental Toxicology and Chemistry

## A SETAC International Pellston Workshop

**Workgroups will review and develop research needs for:**

**Chemical Occurrence, Fate and Availability**

**Toxicological Mechanisms**

**Ecological Effects at Scales from Population to Landscape**

**Human Health Risk Assessment**

**Ecological Risk Assessment**

**Damage Assessment and Restoration Ecology**

USGS science for a changing world

**Papers from each workgroup**

# Climate Change and Injury/Damage Assessments

**GCC will: Influence exposure and effects inputs into NRDAs**
**Act as a co-occurring stressor with chemical/oil impacts**

**Challenge: Incorporate both influences on injury and service loss into Natural Resource Damage Assessments**

**Injury is quantified against baseline conditions, considering the pre-injury conditions of the resource, pre-existing anthropogenic modification**

**GCC will complicate development of Baseline Conditions**

**Challenge: Develop temporal and spatial baselines accounting for the progression of GCC effects both historical and in the future, in the absence of contaminant injury.**

USGS
science for a changing world

# Climate Change and Ecological Restoration

## Challenges

**Shifting species ranges and assemblages (including migratory pathways and timing)**

**Invasive species occurrence and prevalence**

**Changing temperatures and precipitation patterns and the resulting changes in surface hydrodynamics**

**Balancing sea level rises and saltwater intrusion with increasing erosion and sediment deposition in shoreline restorations**

## Implications

**Restoring ecosystem structure, function, and services may preclude the ability to completely restore pre-injury species assemblages**

**Forecasting the whereabouts of replacements to be acquired or upgraded may become a challenge.**

USGS
science for a changing world

# Climate Change and Ecological Restoration

***Carefully designed NRDA-associated restorations can provide both Adaptation and Mitigation opportunities***

## Adaptation to Climate Change Effects through Ecological Restoration

**Develop diverse restored ecosystems with functional redundancy to provide resilience necessary to buffer both short- and long-term effects of climate change**

**Provide habitat, refugia, and corridors for species impacted by GCC-induced stressors**

**Seek opportunities to provide habitat for threatened or endangered species previously extirpated from restored areas**

**Strengthen shorelines and offshore barriers with oyster and seagrass beds, mangroves, and other transitional ecosystems to protect on-shore habitats from increasingly intense storm events**

USGS
science for a changing world

# Climate Change and Ecological Restoration

***Adapt to species loss, ice sheet disintegration, increased intensity of floods, storms, droughts and fires? Such talk is disingenuous and futile. For the sake of justice and equity, for our children, grandchildren and nature we have no choice but to focus on mitigation.***

**James Hansen**

## Mitigation Measures in Ecological Restorations

**Revegetation, aforestation, & reforestation to maximize carbon sequestration – both immediate and long term**

**Soil amendment and management practices to increase carbon sequestration in the soil environment**

**Restoration banking with climate change mitigation value**

USGS
science for a changing world

# Steering Committee

## An international Steering Committee comprised of academia, NGOs, government and industry

| | |
|---|---|
| Will Clements | Colorado State University |
| Susan Finger | USGS |
| Alyce Fritz | NOAA |
| Michael Fry | American Bird Conservancy |
| Todd Gouin | Unilever, UK |
| Roger Helm | USFWS |
| Chris Hickey | NIWA, New Zealand |
| Michael Hooper | USGS |
| Wayne Landis | Western Washington University |
| Jannicke Moe | Norwegian Institute for Water Research |
| Wayne Munns | USEPA |
| Ralph Stahl | DuPont |