

US EPA ARCHIVE DOCUMENT

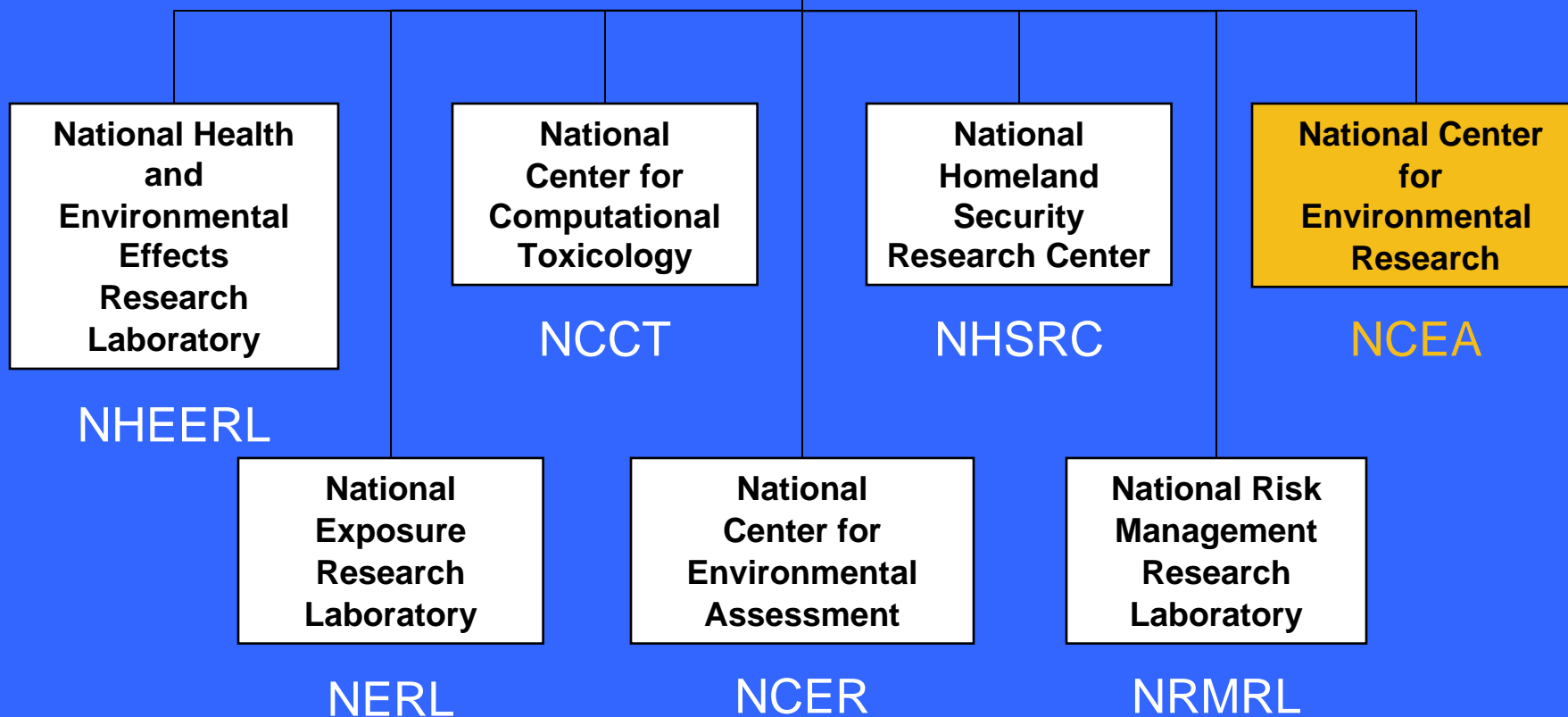
Global Change Research Program:
*invasive species, biocriteria, land use
change, climate-sensitive decisions*

Britta Bierwagen

Global Change Research Program
National Center for Environmental Assessment
Office of Research & Development
U.S. Environmental Protection Agency

The views expressed in this presentation do not necessarily reflect policies of the US
Environmental Protection Agency

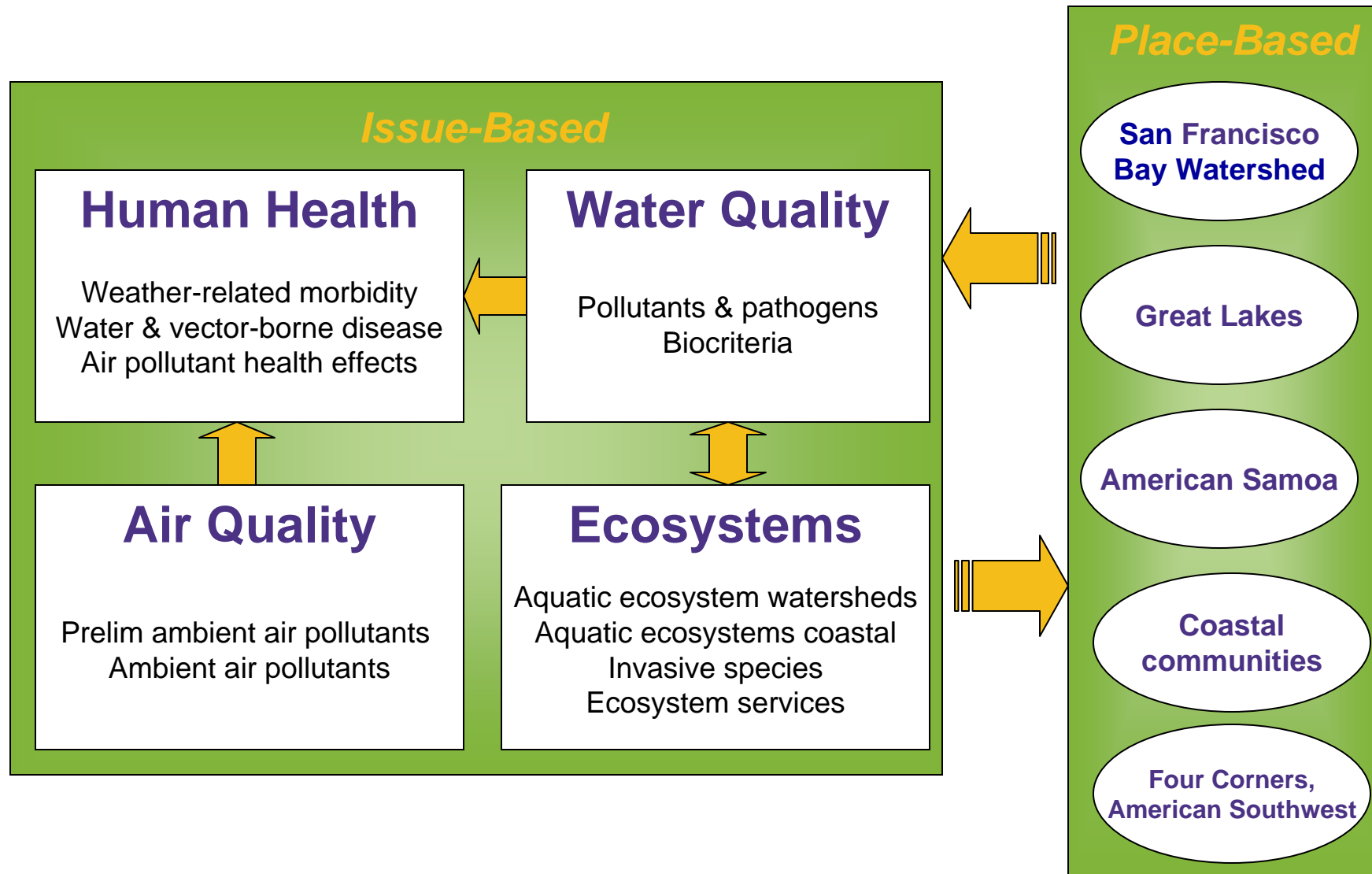
Office of Research & Development



RESEARCH & DEVELOPMENT

Building a scientific foundation for sound environmental decisions

Integrated Issue & Place-Based Research



RESEARCH & DEVELOPMENT

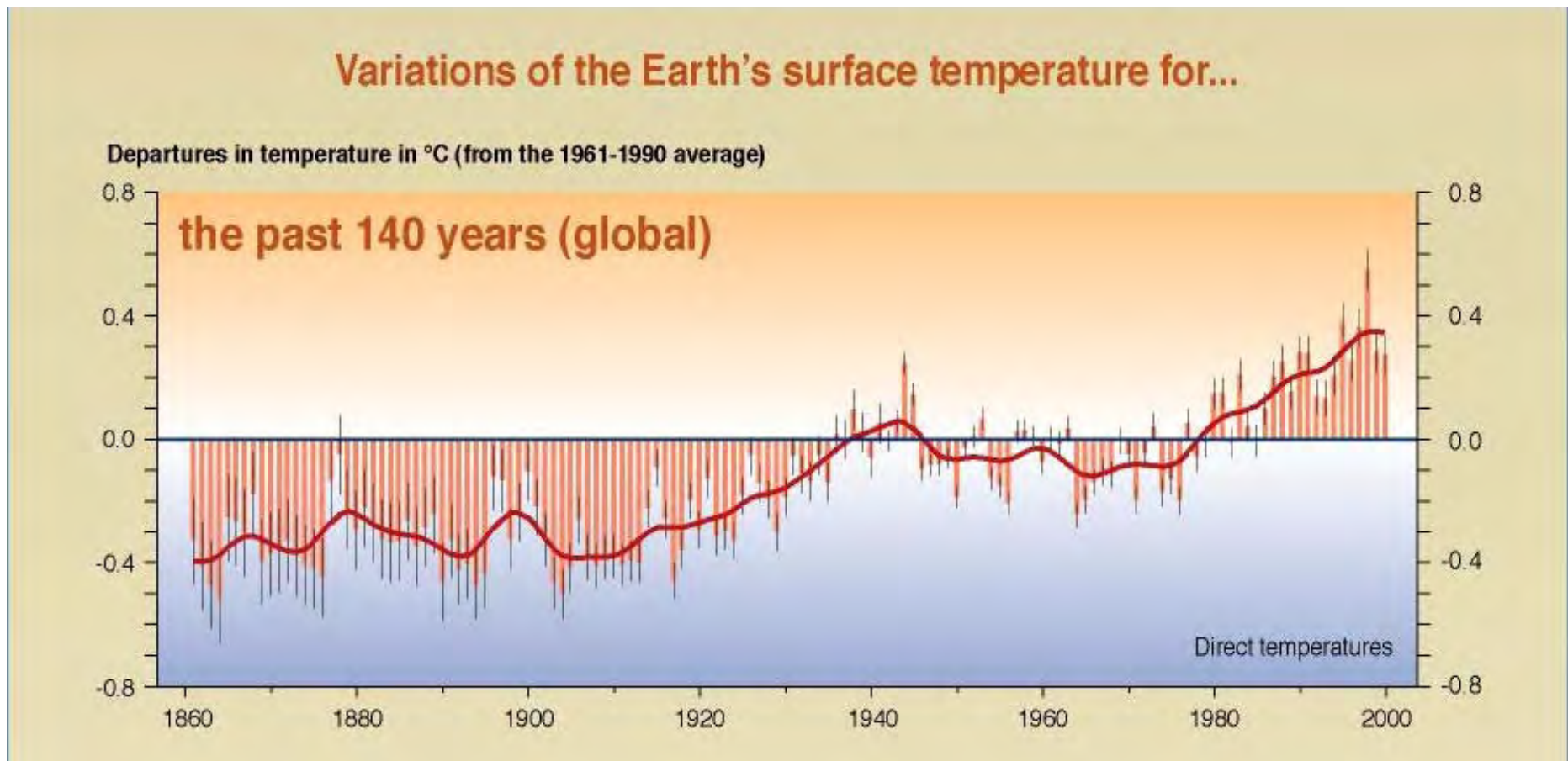
Building a scientific foundation for sound environmental decisions

Four brief examples

GCRP is currently working on:

- Invasive species
- Biocriteria
- Land use change
- Water quality BMPs

Observed climate changes - temperature

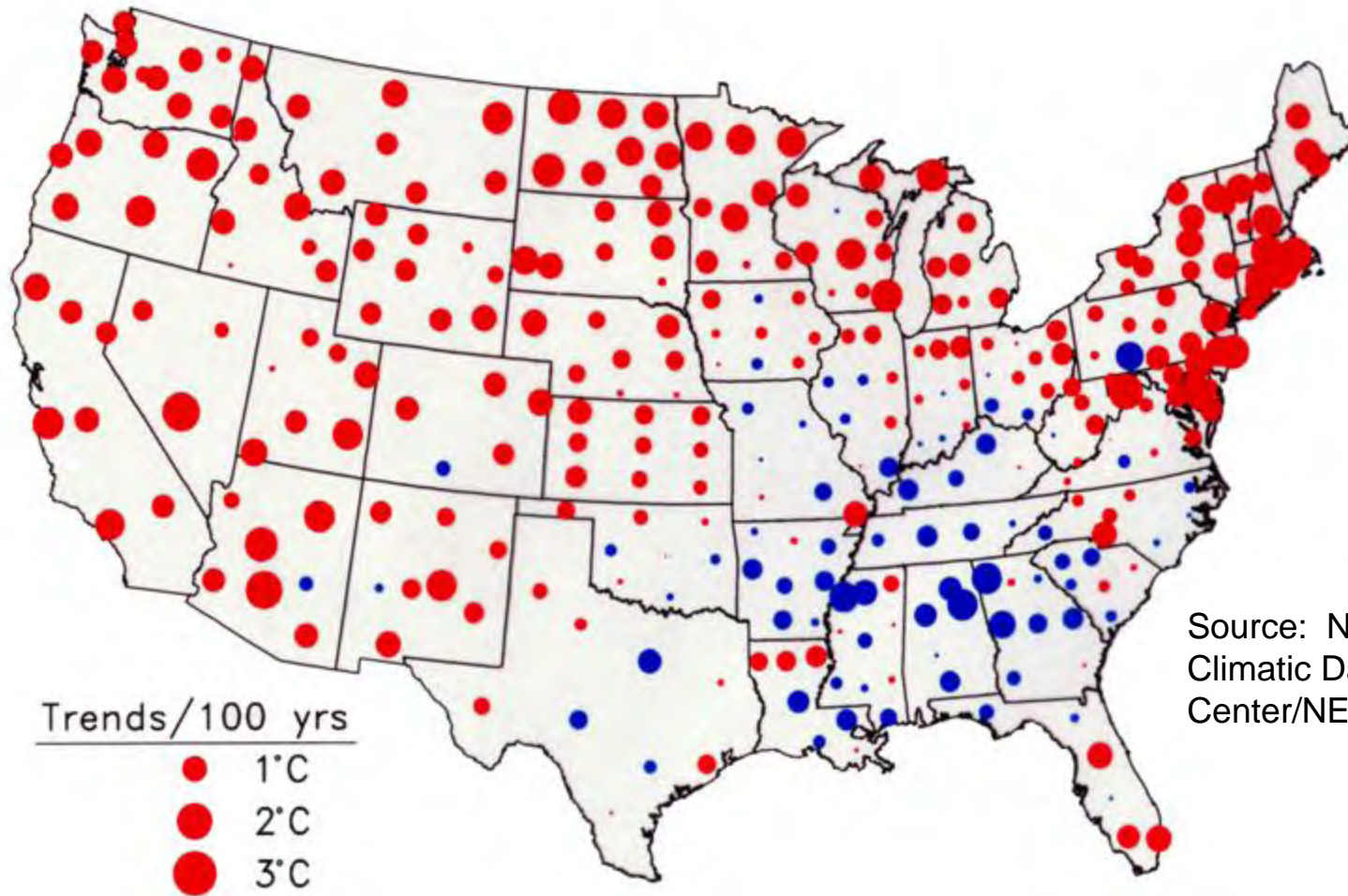


Source: IPCC 2001

RESEARCH & DEVELOPMENT

Building a scientific foundation for sound environmental decisions

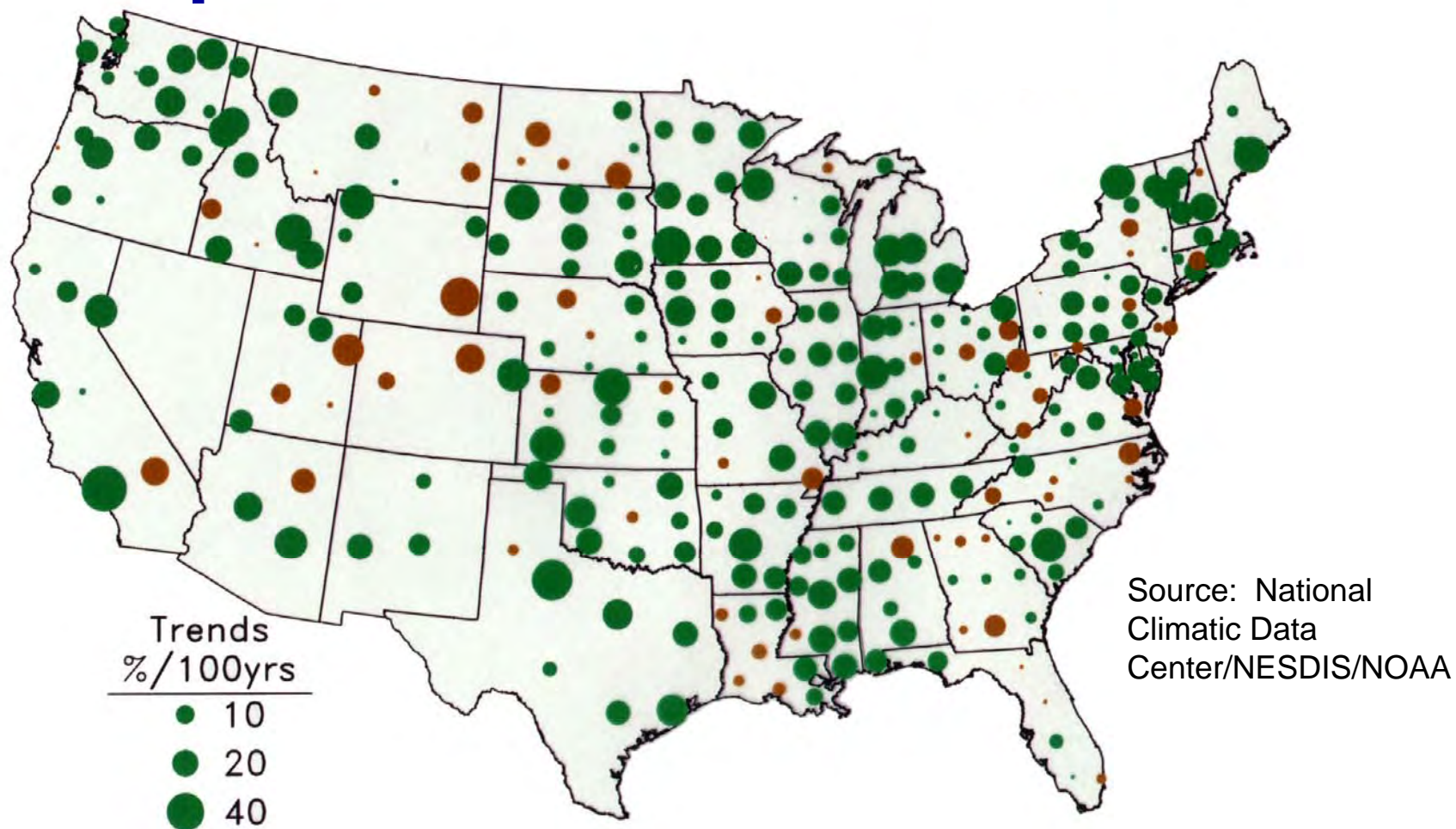
Temperature trends: 1901 to 1998



Source: National Climatic Data Center/NESDIS/NOAA

Red circles reflect warming;
 Blue circles reflect cooling.
 All stations/trends displayed regardless of statistical significance.

Precipitation trends: 1901 to 1998



**Green circles reflect increasing precipitation;
Brown circles reflect decreasing precipitation.
All stations/trends displayed regardless of statistical significance.**

RESEARCH & DEVELOPMENT

Building a scientific foundation for sound environmental decisions

Invasive species & climate change

Methods

Contract with Environmental Law

Institute to:

- Review implications of climate change for aquatic invasive species
- Review management activities in each state
- Identify adaptive opportunities and research gaps



Climate change and other stressors may lead to selection regime modification that favors invasions (Byers 2002):

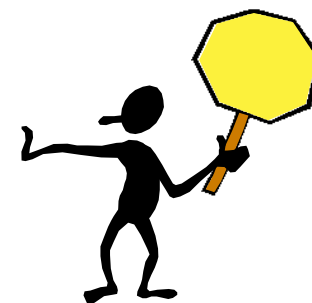
- Advantages of native species decline or disappear
- Success of invasive species' propagules increases
- New niches or microhabitats available



Management under a changing climate

Climate change will create challenges for the management of invasive species:

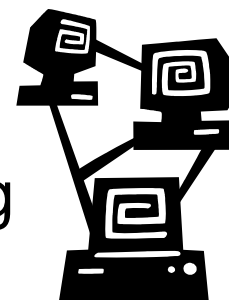
- Prevention activities will be challenged as species move outside current ranges
 - Integrated Vector Management (J. Carlton)
 - Precautionary principle for new species



Management under a changing climate

Climate change will create challenges for the management of invasive species:

- Monitoring networks will need to detect new species in new places
 - Regional coordination
 - Landscape-scale monitoring
 - Alteration of timing and frequency of monitoring
 - Modeling to determine when non-natives become invasive



Management under a changing climate

Climate change will create challenges for the management of invasive species:

- Control and eradication activities will face new species and changing circumstances
 - Rapid response teams
 - Targeted research



Invasive species infrastructure

- Management activities are based on a growing **infrastructure** of personnel, practices, experience, and resources
- Climate change **challenges assumptions** about the breadth of infrastructure
- Design, implementation, and maintenance of invasive species infrastructure requires **targeted research** to better understand and anticipate the effects of climate change



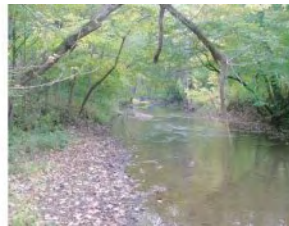
RESEARCH & DEVELOPMENT

Building a scientific foundation for sound environmental decisions

Biocriteria

Climate Change & Biocriteria

- Additional stressor on ecosystem
- Affects both reference & non-reference sites
- Current indicators may be confounded by climate change effects on ecosystems
- Biocriteria Management goals
 - Difficult to establish goal if baseline is changing
 - Or goals may be impossible to meet



Climate Change Effects on Metrics

Rivers & Streams

- Range shifts (thermal tolerance)
 - Warmwater fish range expansions
 - Coldwater fish range contractions
- Spawning (flow, temperature, turbidity)



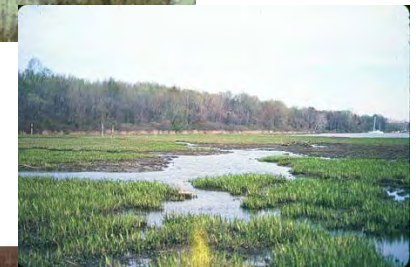
RESEARCH & DEVELOPMENT

Building a scientific foundation for sound environmental decisions

Climate Change Effects on Metrics

Coastal wetlands

- Species composition shifts (salinity tolerance)
 - Salt tolerant plant and invertebrate species expansion
- Community shifts (sea level rise)
 - Water depth changes affecting SAV



<i>Sensitive to Climate Change</i>	<i>Insensitive to Climate Change</i>	<i>Sensitive to Climate Change and Other Stressors</i>
River and Stream Biocriteria		
Fish species comparison	Warmwater fish Selected inverts Periphyton – general	Coldwater fish Ratio of drought sensitive to insensitive mussel spp. Periphyton – sediment algae
Wetland Biocriteria		
Vegetation (freshwater, coastal) Shellfish, fish, inverts (coastal)	Timing of amphibian breeding (freshwater)	Amphibian populations, invertebrates, bird populations, mammals, fish (freshwater)

Adaptive Management Options

- Use information on impacts to understand how metrics respond
- Monitor reference and non-reference sites for similar changes
 - Landscape-level assessments
- Adjust assessment plans based on threats

Integrated Climate and Land Use Change Scenarios (ICLUS)

Land use scenarios

Demographic and economic conditions based on:

1. IPCC* scenarios:

Socioeconomic conditions consistent with IPCC storylines

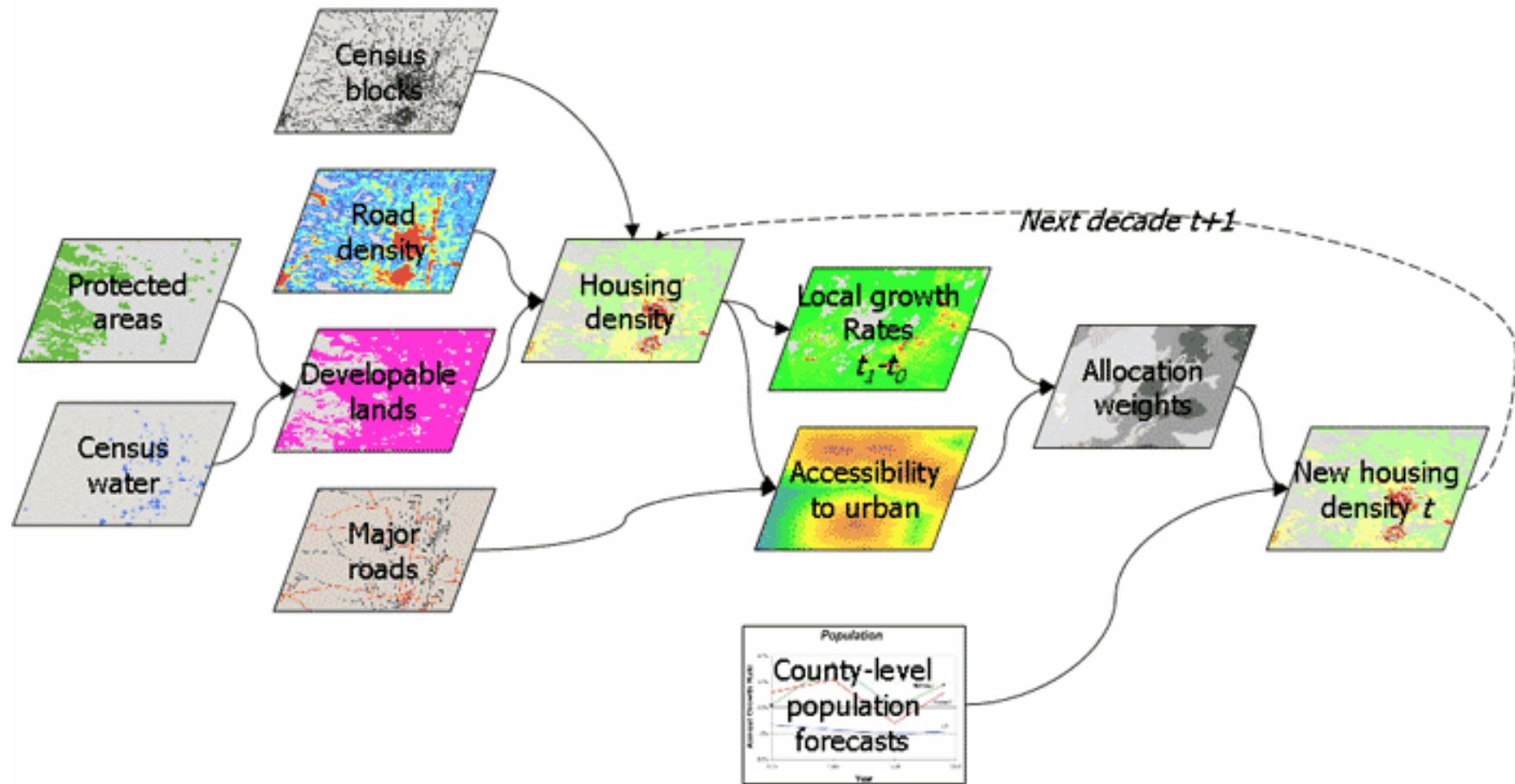
2. Decision-focused

scenarios: Socioeconomic conditions specified by stakeholder groups

* Intergovernmental Panel on Climate Change



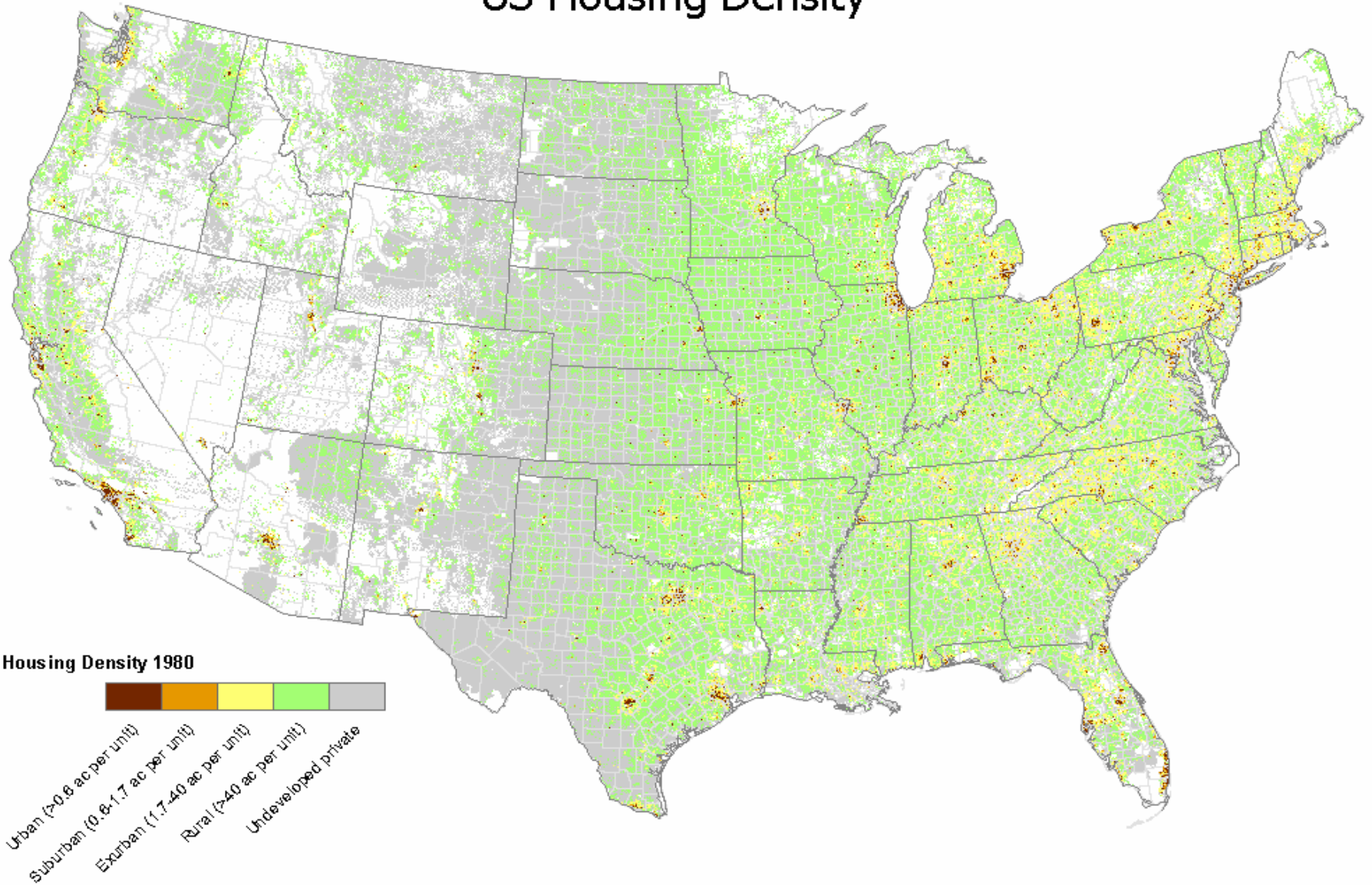
SERGoM v1



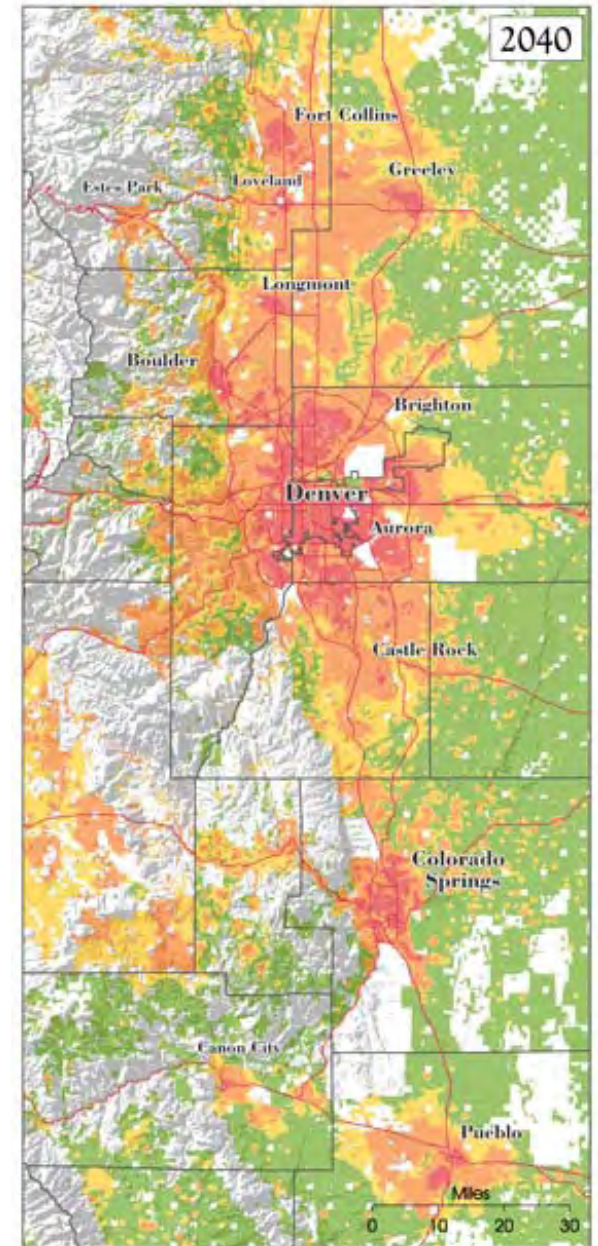
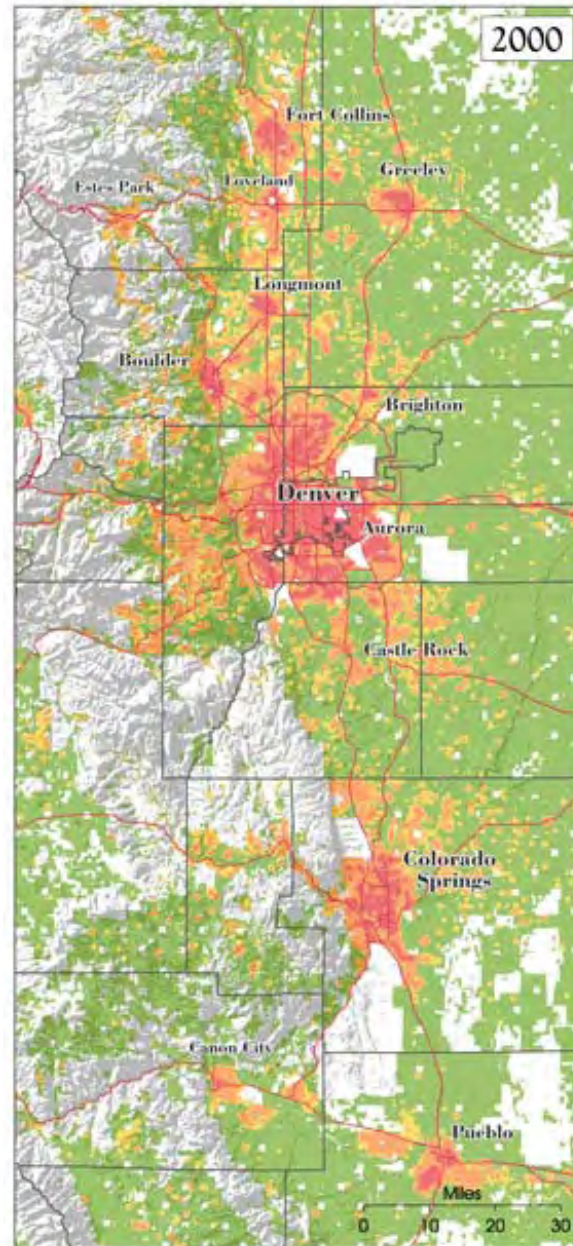
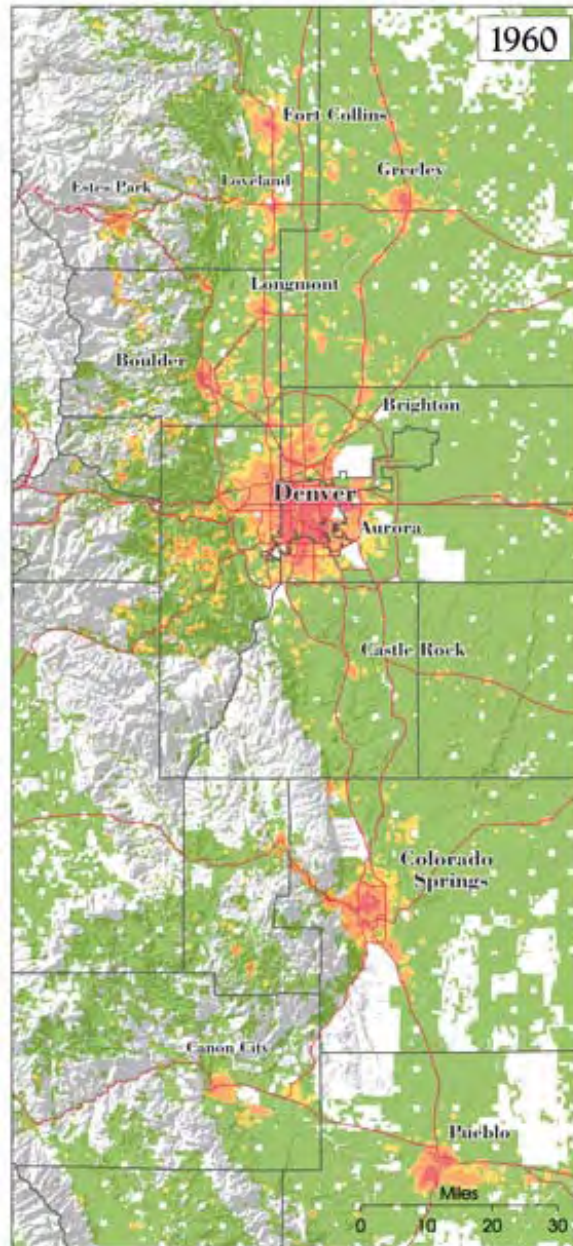
RESEARCH & DEVELOPMENT

Building a scientific foundation for sound environmental decisions

US Housing Density



Data source: US Census Bureau 2000 block-groups and blocks.
Created by David Theobald, Colorado State University, 21 June 2004.



Decision assessment

Evolution of decision support

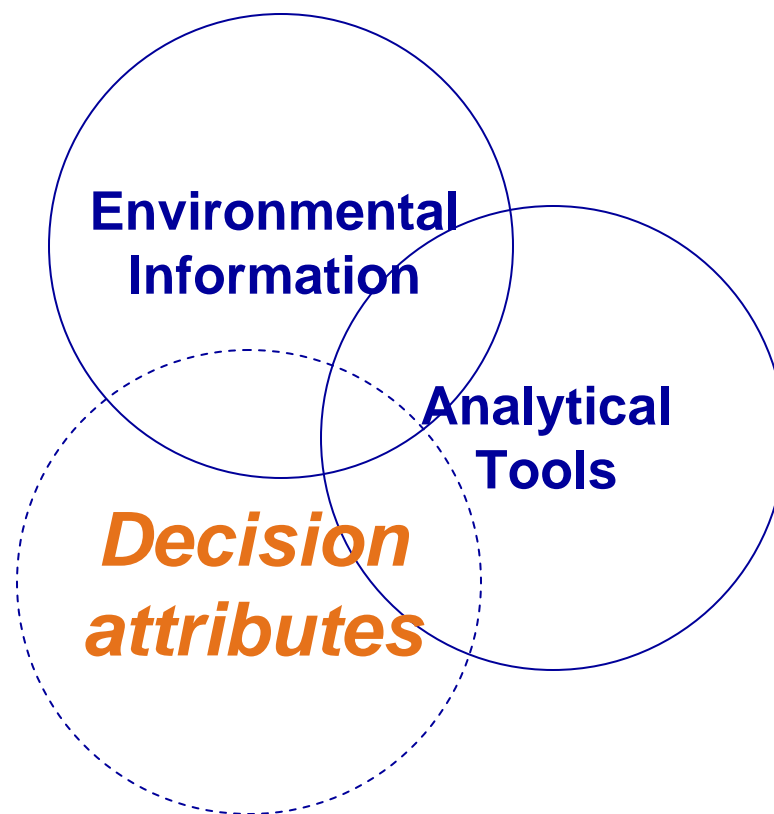
Our goal is to support adaptation to climate change:

- Identify important, climate-sensitive management decisions
- Target climate-sensitive decisions likely to benefit from research and development activities
- Conduct research that helps achieve environmental management goals under changing climatic conditions

Decision assessment

A systematic inventory and analysis of climate-sensitive decisions:

- Understand the characteristics of decisions
- Identify climate-related decisions relevant to adaptation
- Prioritize decision support resources



Decision inventory products

- Inventory of **emissions sources**
- Foundation for **mitigation policy**
- Inventory of **adaptation decisions**
- Foundation for **adaptation policy**

Emissions
Inventory



Decision
Inventory



RESEARCH & DEVELOPMENT

Building a scientific foundation for sound environmental decisions

Chesapeake Bay BMPs

State tributary strategies including:

- Urban tree planting
- Erosion and sediment control
- Riparian forest buffers
- Stormwater management – retention ponds
- Stormwater management – wet ponds & wetlands
- Conservation tillage
- ...

Preliminary highlights

Screening of water quality BMPs:

- ~ 72% of BMPs may be sensitive to lower low flows, higher high flows, or higher temperatures
- ~ 33% of BMPs have expected performance periods over 25 years



For more information:

Britta Bierwagen

bierwagen.britta@epa.gov

202-564-3388



RESEARCH & DEVELOPMENT

Building a scientific foundation for sound environmental decisions