

Using Climate Information to Predict, Prevent and Reduce Public Health Risk: NOAA Context



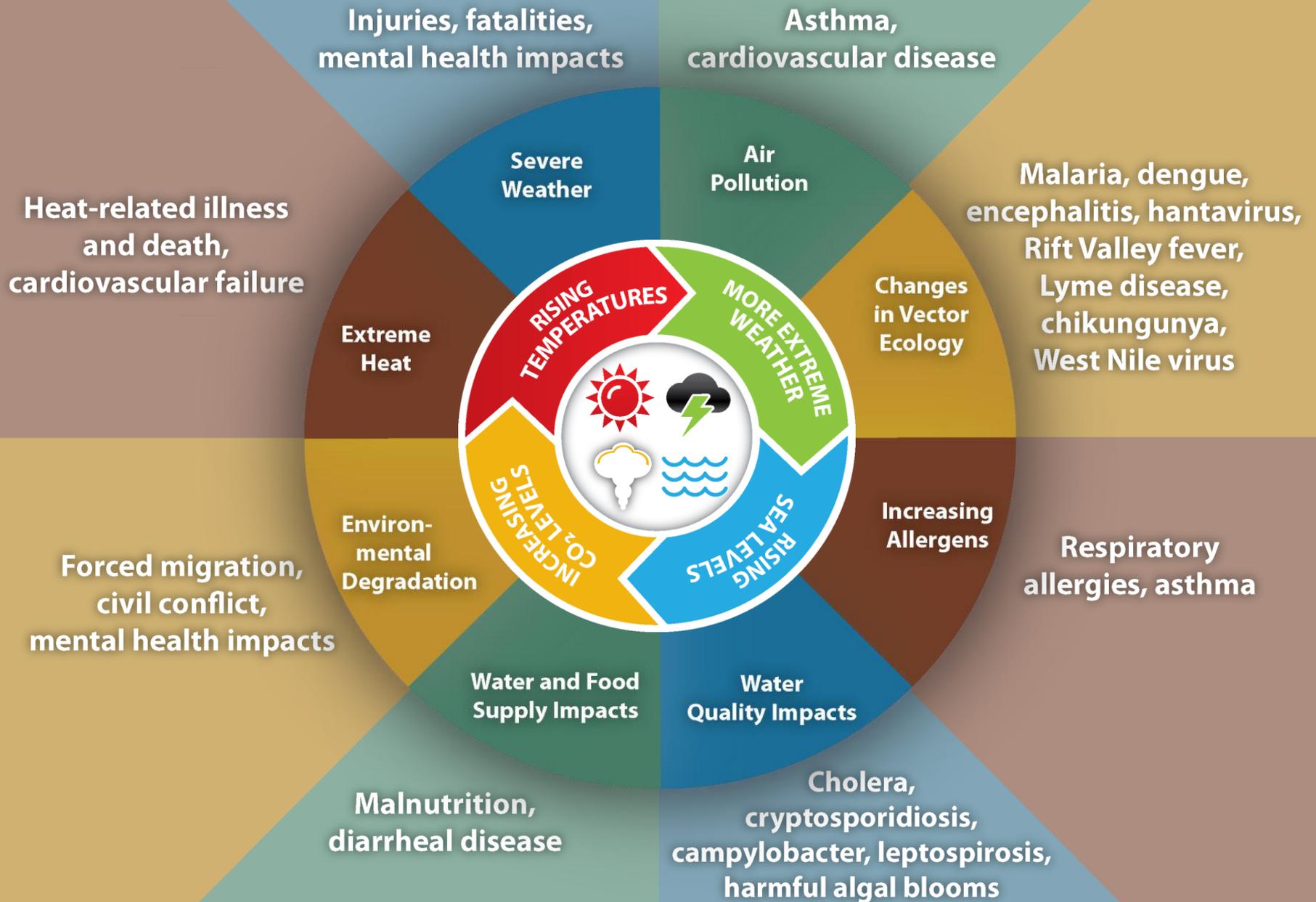
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NOAA context and opportunities

- Extremes, Water, Marine, Ecosystems
 - NOAA/CDC Heat Health Summit
 - International Follow on
- NOAA One Health Group
- Ecological Forecasting Roadmap
- NOAA/CDC MOU
- USGCRP Climate and Health Assessment
- Integrated Modeling
- Global Framework on Climate Services
- Group on Earth Observations
- Cholera Early Warning System—Integrated Environmental Information System for Health, Bangladesh

Impact of Climate Change on Human Health



Projected Temperature Change of Hottest Days

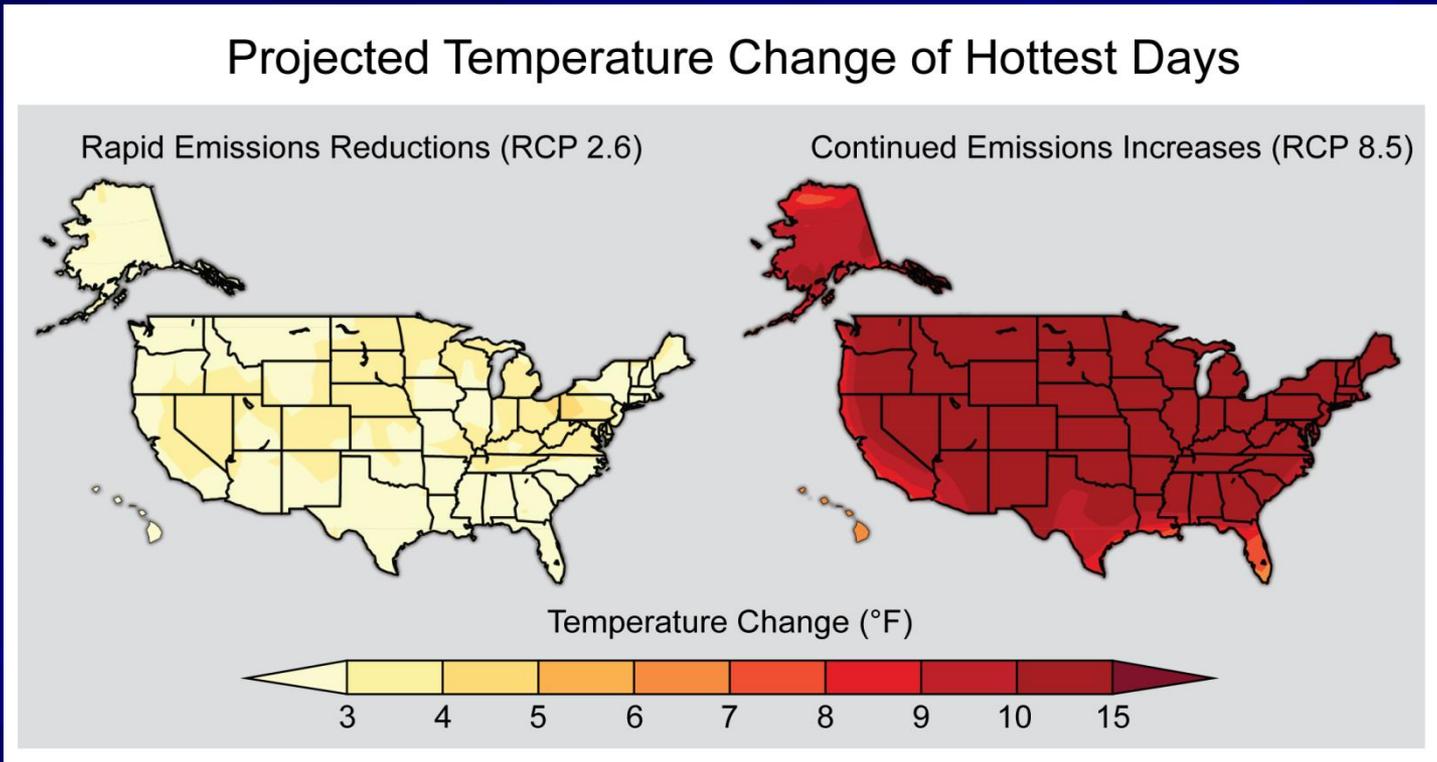


Figure source: NOAA NCDC / CICS-NC





NOAA-CDC Heat Health Summit

Silver Spring, MD – October 28-30, 2014

Weather, climate and health communities benefit from sharing data, tools, and expertise that support our shared interest and missions in protecting life.

■ Participants

- NOAA , CDC, OSHA, EPA, and DOE; state and local health departments; and NOAA funded cooperative science centers, Health Canada, Environment Canada, and the International Association for Urban Climate

■ Discussions

- Understanding decision making contexts – health decisions on preparedness and response, and the Weather Forecast Office decision making process to issue a heat Watch, Warning or Advisory
- Data availability and compatibility – need for better access to health data.
- The need for consistency in—National application, local context
 - Methodologies for issuing heat forecasts
 - Common messaging and outreach efforts
 - Statistical methodology to examine the association of extreme heat and a broad range of health outcomes
 - Reporting of heat-related fatalities across federal, state and local agencies



NOAA-CDC Heat Health Summit



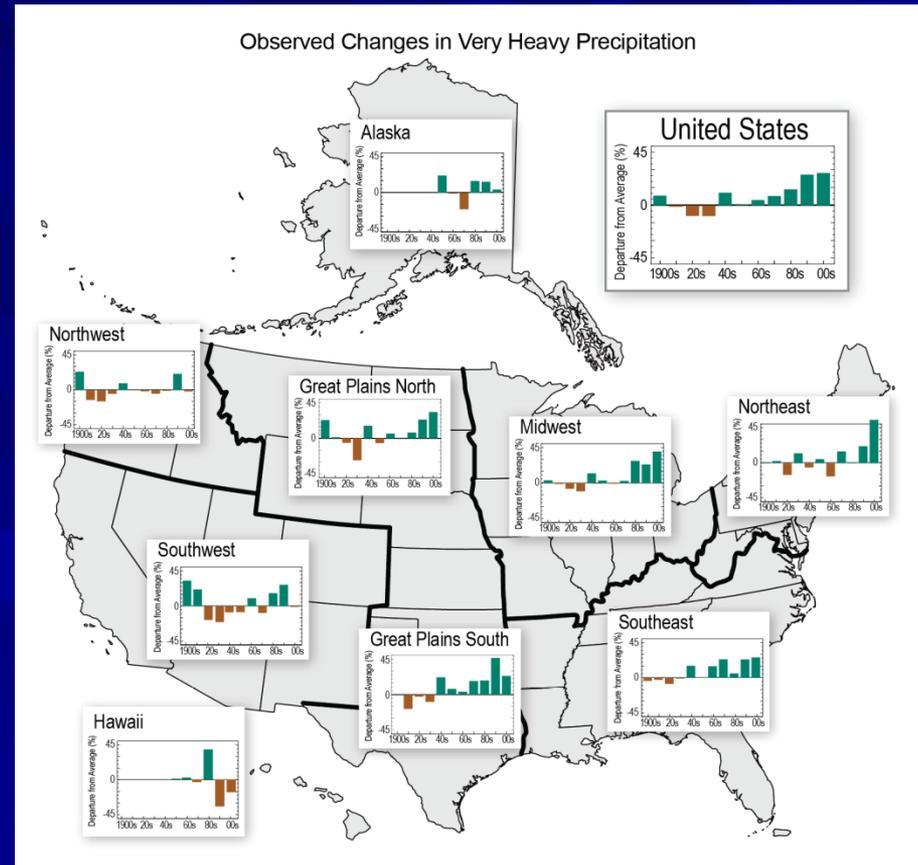
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■ Outcomes & Next Steps

- Commitment to move forward with a focus on collaborations and partnerships between the weather forecast and public health communities.
- Joint outreach and communications plans
- Collaborative research efforts to investigate the utility of extended heat forecasts
- Meeting with international partners to compare methods and lessons learned

Extreme Precipitation Events Impact Human Health: Waterborne Disease

- 67% of waterborne disease outbreaks preceded by precipitation above 80th percentile (across 50 year climate record)
- Heavy precipitation events projected to occur more frequently



Observed Increases in Very Heavy
Precipitation (heaviest 1% of all events)
1901 to 2011

Curriero, Patz, et al, 2001.

Source: Walsh et al. 2013: *Draft NCA Report*, Chapter 2



NOAA One Health Goals

This NOAA-wide Group will advance NOAA's science and services to inform health decisions through:
*improved understanding of the linkages between environmental conditions and health outcomes, and
delivery of useful prediction products, data and tools*



Animal Health



Human Health



Ecosystem Health

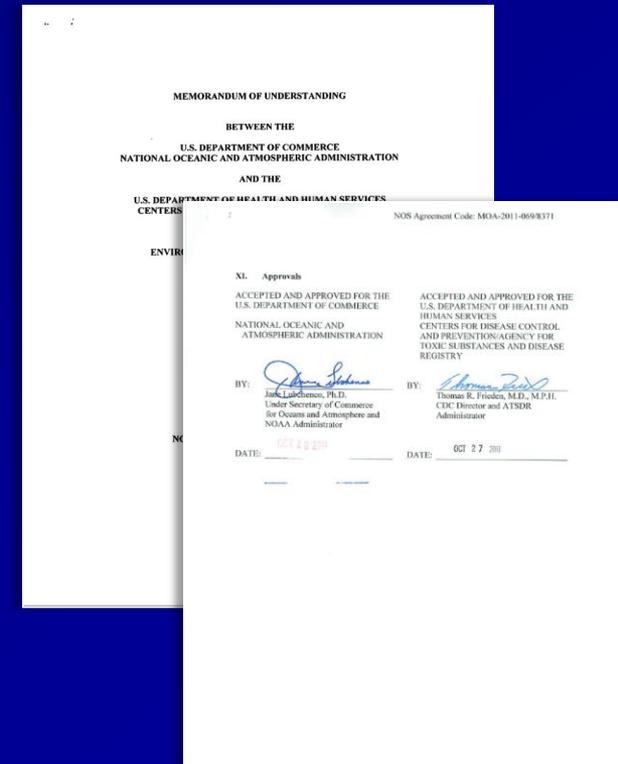
Thematic areas include:

- **Water-borne Illness**
- **Wildlife and Zoonotic Disease**
- **Air Quality**
- **Heat**
- **Drought**
- **Vector-Borne Disease**
- **Natural Products**
- **Safe Food**
- **Arctic**

NOAA and CDC

Memorandum of Understanding

- NOAA has a comprehensive interagency MOU with Centers for Disease Control and Prevention (CDC)
 - Signed October 2011 by Administrators Dr. Lubchenco and Dr. Frieden
 - Cross NOAA and 5 CDC Divisions
- Provides a formal cooperative framework to further collaborative efforts for:
 - preparedness and planning
 - integrated data management
 - surveillance and monitoring
 - prediction and forecasting
 - emergency response and assessment
 - communication and capacity development, including rotational assignments



The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment

- The Interagency Group on Climate Change and Human Health (CCHHG) is driving the development of the USGCRP Climate and Health Assessment

- As part of the ongoing (sustained) efforts of the USGCRP's National Climate Assessment
- As called for under the President's Climate Action Plan
- Because multiple USGCRP agencies identified climate impacts on human health as a high priority topic for an interim assessment (between the 3rd and 4th NCA)
- To leverage ongoing analytical efforts at several agencies focused on climate and health



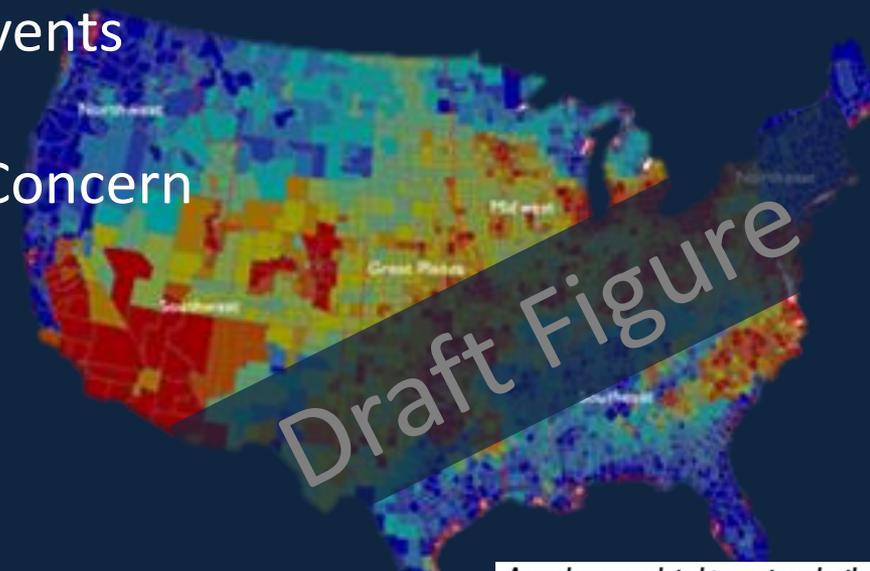
- The purpose of this interagency assessment is to provide a comprehensive, evidence-based, and where possible, quantitative estimation of observed and projected climate change-related health impacts in the United States.



Outline of the USGCRP Climate and Health Assessment

1. Introduction
2. Thermal Extremes
3. Air Quality Impacts
4. Vectorborne and Zoonotic Disease
5. Waterborne and Foodborne Disease
6. Food Safety, Nutrition, and Distribution
7. Extreme Weather and Climate Events
8. Mental Health and Well-Being
9. Risk Factors and Populations of Concern

will highlight additional quantitative analyses



Annual ozone-related premature deaths
GISS/RCP 6.0



Climate, Vibrio Cholera and its Bacterial Cousins



■ *Vibrio parahaemolyticus*

- main cause of seafood poisoning
- under reported, misdiagnosed, increasing

■ *Vibrio vulnificus*

- 95% fatality rate from consumption
- causes wound infections

■ *Vibrio* infection rates have increased 115% over the last decade.

■ *Vibrio Cholera*

- 3–5 million cases, 100,000–120,000 deaths



NOAA's Ecological Forecasting Roadmap: What we will achieve

- Strong science to enable delivery of forecasts
- Delivery of more products and services building on existing NOAA and partner capacity
- Delivery of more consistent, efficient, reliable, and national forecasts (tailored to region-specific needs)
- Adding Climate component

Focus Areas:

HABs, Hypoxia, Pathogens, Habitat/Species Distribution

- Selected based on
 - relative maturity and potential readiness to transition to operations
 - Nation-wide applicability to NOAA's core missions
 - well-identified needs with strong, interested constituencies



Forecasts Under Development

14



Harmful Algal Blooms:

- West Florida Shelf (operational)
- Texas (operational)
- Lake Erie (demo/experimental)
- Gulf of Maine (demo/experimental)
- Puget Sound (demo/experimental)
- Washington Coast (demo/experimental)
- California (future)
- Chesapeake Bay (future)

Hypoxia:

- Gulf of Mexico (demo/experimental)
- Chesapeake Bay (demo/experimental)
- Pacific Northwest (future)

Pathogens:

- Chesapeake Bay (demo/experimental)
- Delaware Bay (demo/experimental)
- Tampa Bay (demo/experimental)
- Gulf of Mexico (future, location may change)

Beach Quality:

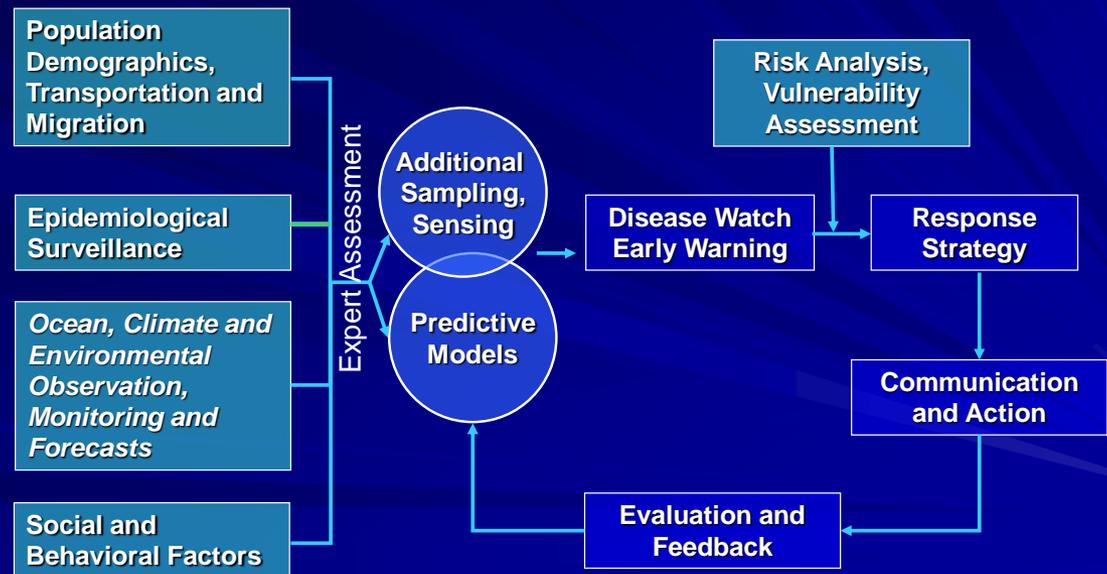
- Great Lakes (demo/experimental)

Building an Integrated Environment and Health Information System: Cholera Early Warning, Bangladesh

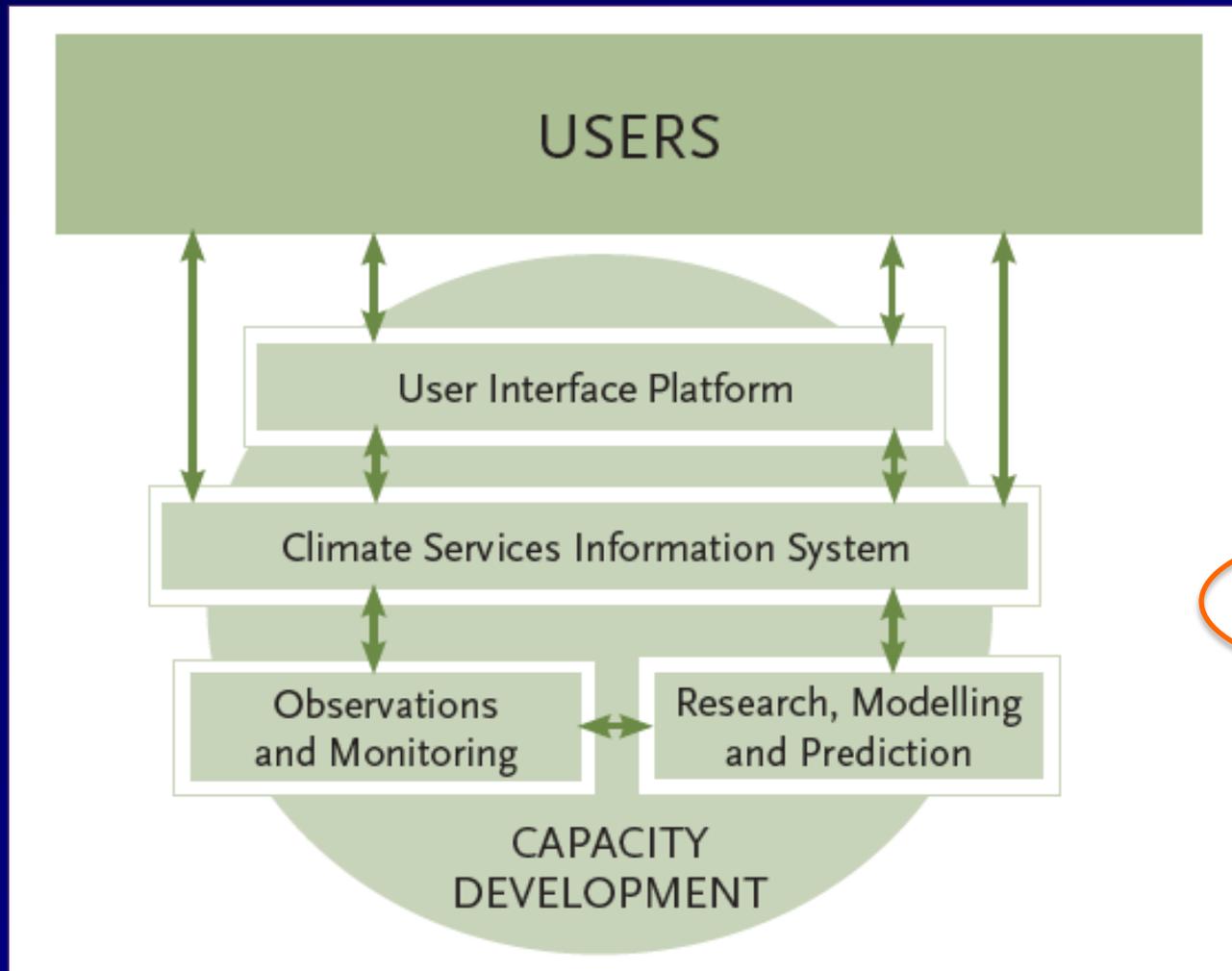
To provide an integrated system of systems

- ❖ Linking water, sanitation, environmental and public health information
- ❖ at seasonal and longer time scale
- ❖ Problem-oriented and place based

Components of a Health Early Warning System



GFCS Approach: Core Pillars and Initial Priority Areas



Water
Resources

Food
Security/Agriculture

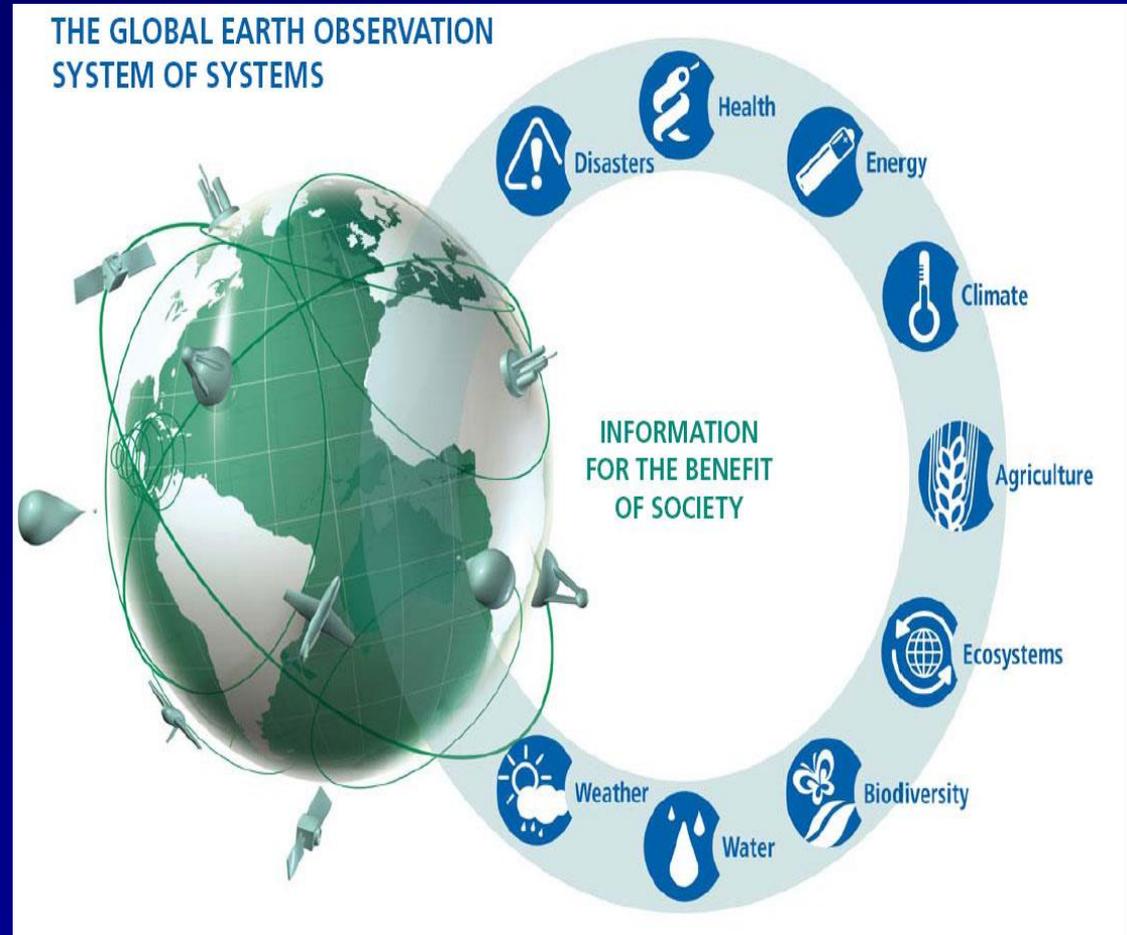
Human Health

Disaster Risk
Reduction



GEOSS: A Global, Coordinated, Comprehensive and Sustained System of Observing Systems

- 90+ countries
- Common Data sharing principles
- In-situ and Satellite obs
- Links to Sustainable Development



So Now What?

- NOAA/CDC—Heat Health Summit 28-30 October 2014—
International follow up
- Thermal Extremes, Precipitation Extremes?
- USGCRP-Climate Change and Human Health Assessment
 - What's in, What's not and Why?
 - What obs and products do we need?
- Ecological Forecasting Roadmap
- OSTP
 - Ebola Task Force, Modeling Group
 - Pandemic Prediction and Forecasting Science and Technology
- NOAA/CDC-BRACE, Personnel Exchange
- International—Cholera/Integrated Health Information System, GFCS,
GEO. Climate and Health Training
- Private Sector
- Communication—to multiple audiences, team effort

Thank you and Questions!



Relationship between Biodiversity, Habitat Loss, Ecosystem Services, and Human Health



Habitat and Biodiversity Loss

Sandifer and Sutton-Grier, Nature and Biodiversity Exposure Impacts on Human Health: Thurs, 2:55-3:15pm, Salon F-G. Weds 10:40 Salon K.

Changes in Ecosystem Services

Decreases in

- Storm surge protection and shoreline stabilization
- Seafood abundance
- Nutrient balance
- Aesthetics, recreation, and education opportunities
- Resilience of the ecosystem to other stressors like nutrient pollution and extreme weather

- Loss of biodiversity

Impacts on Human Health

- Less climate adaptation and storm protection → bigger risk of loss of property and lives
- Less seafood → fewer jobs and food security
- Issues with water quality and clean drinking water → health risks
- Fewer or decreased quality of recreational opportunities
- Impacts to mental health



Examples of Ecosystem Services Provided By Coastal Habitats

Oyster Reef, Coral Reef



Ecosystem Services

- Seafood – commercial and recreational fisheries
- Filtration services – water quality/quantity
- Shoreline protection & stabilization
- Food, medicinal, ornamental, & other products
- Aesthetics, recreation, tourism, cultural and spiritual values
- Shoreline protection/stabilization
- Science & education

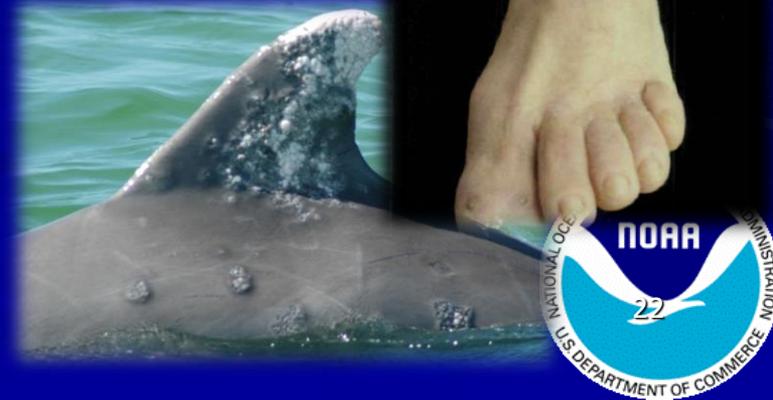


Zoonotics

- Lacaziosis (formerly called Lobomycosis)
 - Previously only in tropics but now in temperate waters of US, Europe and Asia
- *Cryptococcus gattii*
 - Previously found only in tropics outside US
 - Emerged in Pacific Northwest around 1999; first case in US in porpoise, then epidemic in domestic animals and people in Canada, WA, OR
- Not sure if movement of these diseases is due to climate change, but diseases are now showing up in places and species not previously seen



Photo credit: Fonseca, J. 2007.
International Journal of Surgical Pathology



Potential Health Effects of Climate Change

Climate Change:

- Temperature Extremes
- Hydrologic extremes
- Sea level rise
- Ocean currents
- Ocean acidification



HEAT



Heat stress, cardiovascular failure

SEVERE WEATHER



Injuries, fatalities

AIR POLLUTION



Asthma, cardiovascular disease

ALLERGIES



Respiratory allergies, poison ivy

VECTOR-BORNE DISEASES



Malaria, dengue, encephalitis, hantavirus, Rift Valley fever, zoonotics, microbial contamination

WATER-BORNE DISEASES



Cholera, cryptosporidiosis, campylobacter, leptospirosis

WATER AND FOOD SUPPLY



Malnutrition, diarrhea, harmful algal blooms

MENTAL HEALTH



Anxiety, despair, depression, post-traumatic stress

ENVIRONMENTAL REFUGEES



Forced migration, civil conflict

Draft Timeline

Internal Draft	Authors complete chapter drafts and deliver to USGCRP	January, 2015
Peer Review Draft	Public Comment (Federal Register Notice)	March – May, 2015
	NRC Peer Review	March - June, 2015
Internal Final Draft	Internal Agency Reviews and Clearance	Sept – Nov, 2015
Final Release Draft	Authors Revise and Prepare Final Release Draft	Nov 2015 – Feb 2016
	Design and Production complete- Roll Out	March, 2016



Projected Change in Heavy Precipitation Events

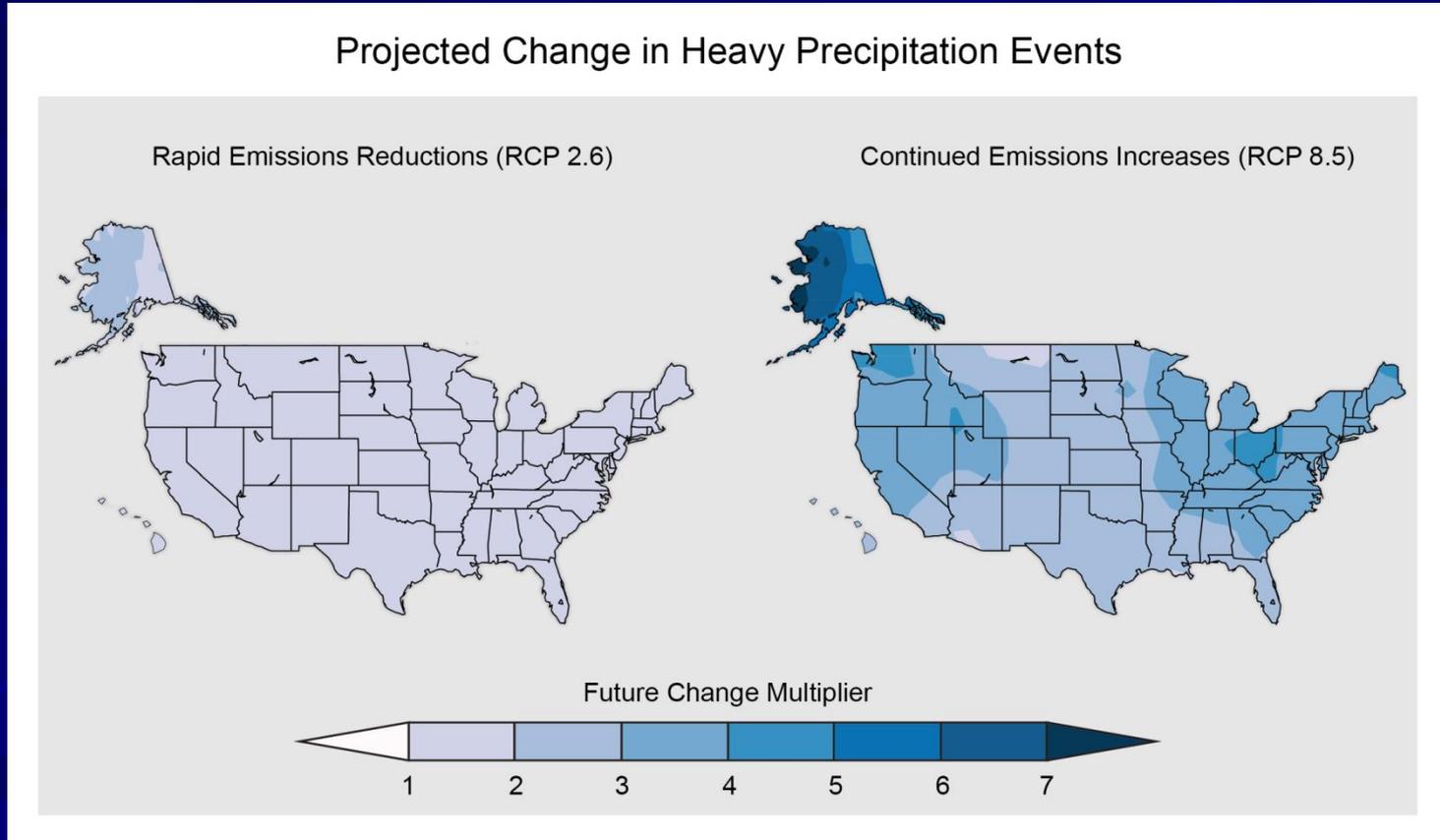


Figure source: NOAA NCDC / CICS-NC



Extreme Precipitation Events Impact Human Health: Waterborne Disease

Waterborne disease are transmitted through drinking water, recreational water or food contaminated with fecal pollution, or other bacteria or viruses

Sources include agricultural runoff and sewage overflows

67% of waterborne disease outbreaks preceded by precipitation above 80th percentile (across 50 year climate record)

Climate change can increase rainfall intensity and increase the amount of pollution entering waterways, infrastructure



Thank you!