# Overview of CDC Water Resources Adaptation to Climate Change Activities


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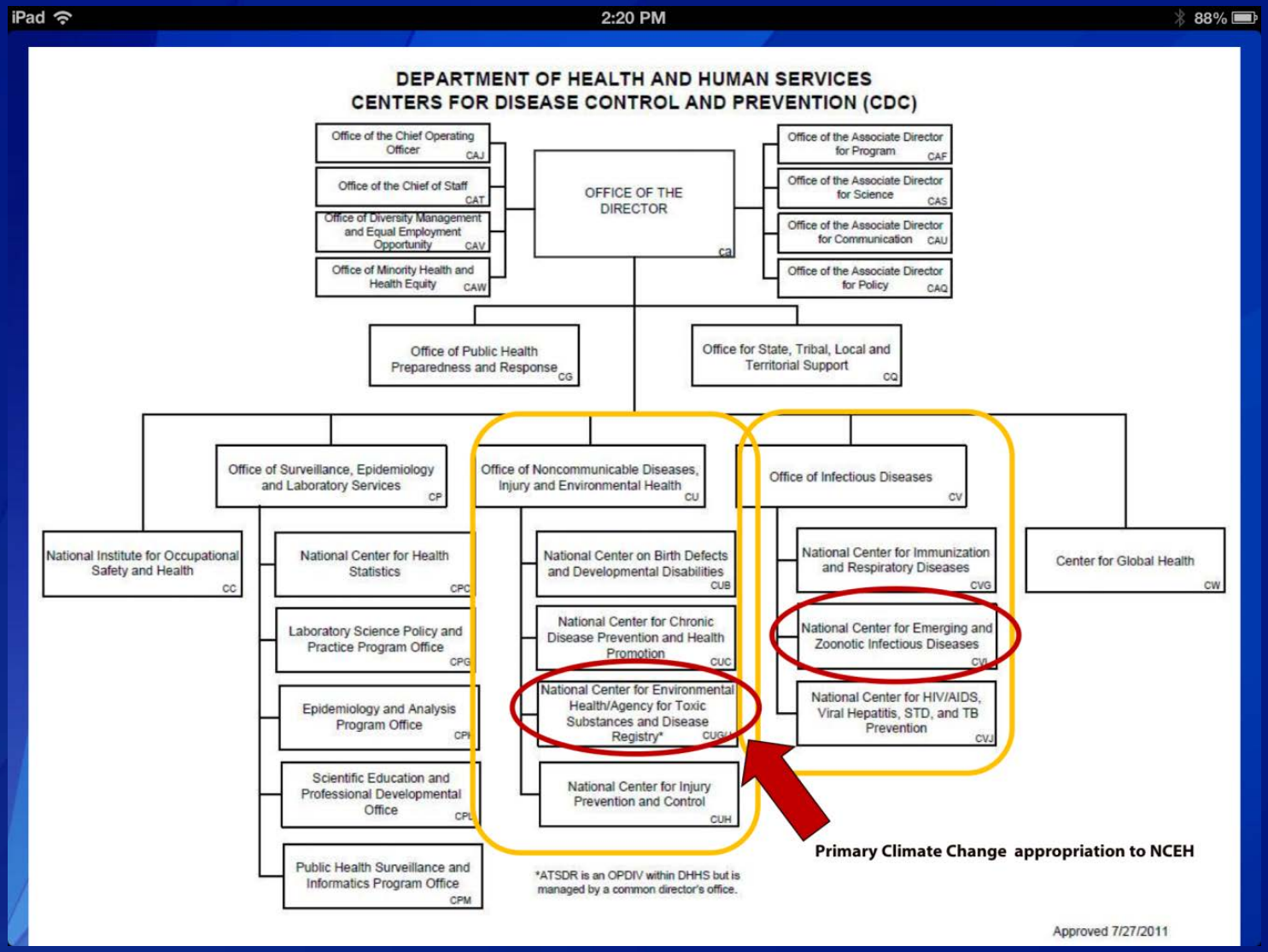
**Centers for Disease Control and Prevention**


**ACWI Meeting, February 19, 2014**


National Center for Emerging and Zoonotic Infectious Diseases

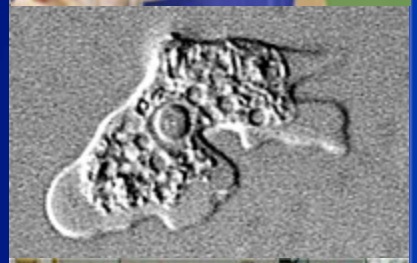
Division of Foodborne, Waterborne, and Environmental Diseases

# CDC Organizational Chart



# Waterborne Disease Prevention Branch

- Vision
  - A world where everyone has access to safe water, adequate sanitation, and basic hygiene practices
- Mission
  - To maximize the health, productivity, and well-being of people in the United States and around the globe through improved and sustained access to safe water for drinking, recreation, and other uses, adequate sanitation, and basic hygiene practices



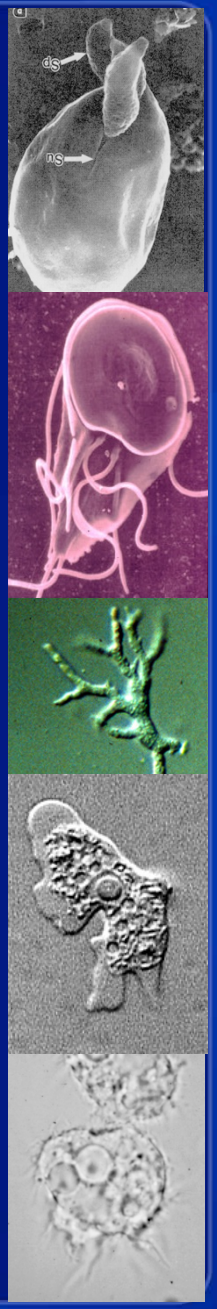
# Activities and Responsibilities

- Surveillance
  - Track waterborne disease nationally
  - Provide technical assistance to Ministries of Health
- Outbreak Investigation
  - Investigate causes & sources of waterborne disease outbreaks
  - Identify risk factors for infection
- Laboratory Science
  - Develop improved pathogen detection & water sampling methods
  - Develop new ways to remove or inactivate pathogens
- Prevention and Technical Assistance
  - Assess new interventions and prevention ideas
  - Improve communication and education on waterborne disease
  - Develop WASH-related guidance and policy

# Pathogen and Disease Responsibilities

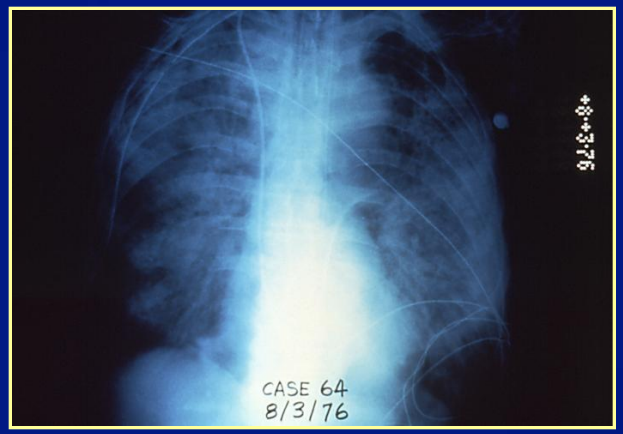
- International
  - Cholera
  - Typhoid fever
  - Dracunculiasis (Guinea worm)

- Domestic/International
  - *Giardia*
  - *Cryptosporidium*
  - Amebiasis (*E. histolytica*)
  - Free-living amebae
    - *Naegleria fowleri*
    - *Acanthamoeba*
    - *Balamuthia mandrillaris*
    - *Sappinia*



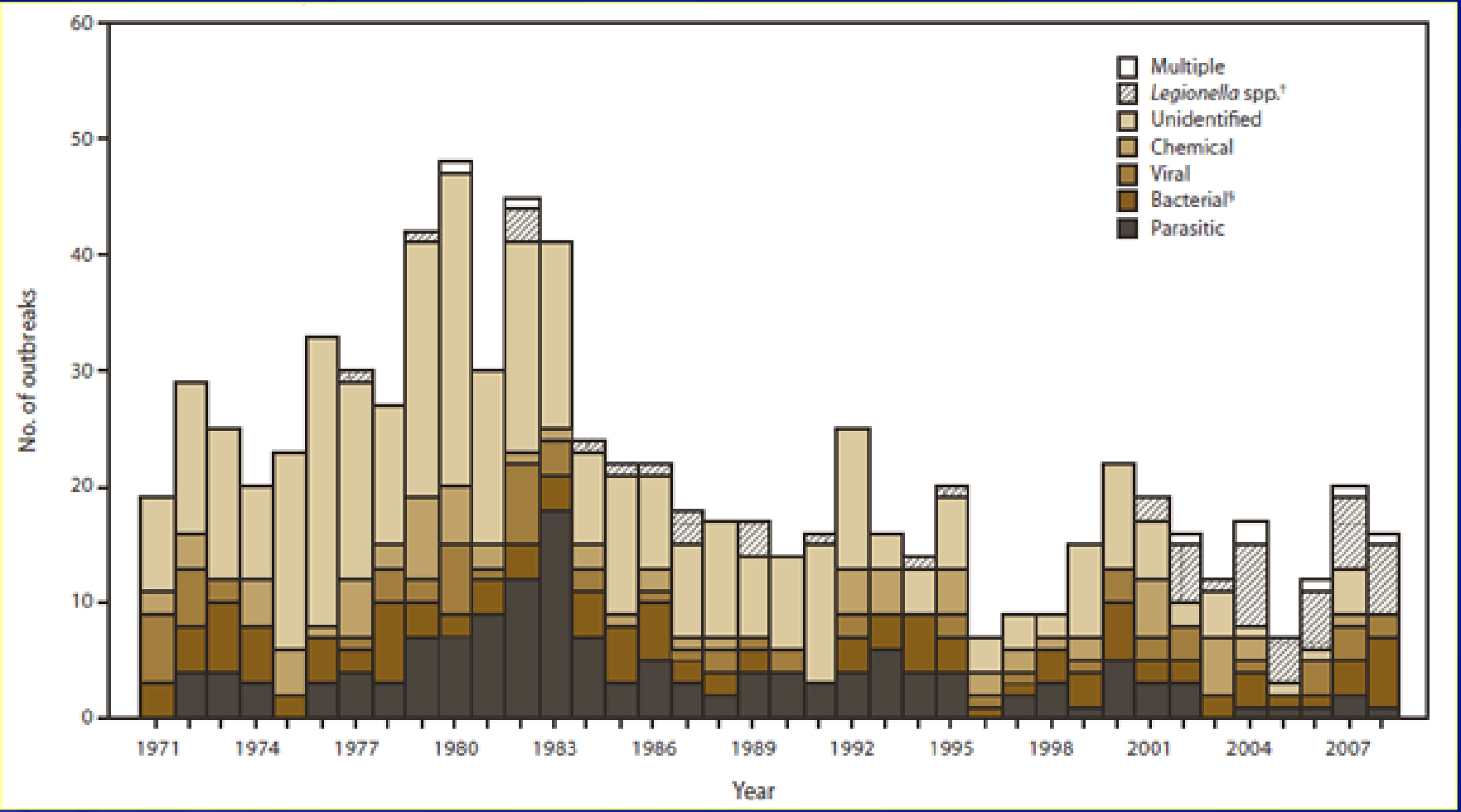
# Spectrum of Waterborne Disease

- Acute gastroenteritis
  - *Cryptosporidium*, toxigenic *E. coli*, *Giardia*, *Shigella*, Norovirus, chemicals
- Skin infections
  - *Pseudomonas* dermatitis/folliculitis, fungal infections
- Ear infections – *Pseudomonas*
- Eye infections and irritation
  - *Acanthamoeba keratitis*, Adenoviruses
- Respiratory infections
  - *Legionella, Mycobacterium,* chemicals
- Neurologic infections – Echovirus, *Naegleria fowleri*
- Wound infections – *Vibrios*
- Hepatitis – HAV
- Urinary tract infections – *Pseudomonas*



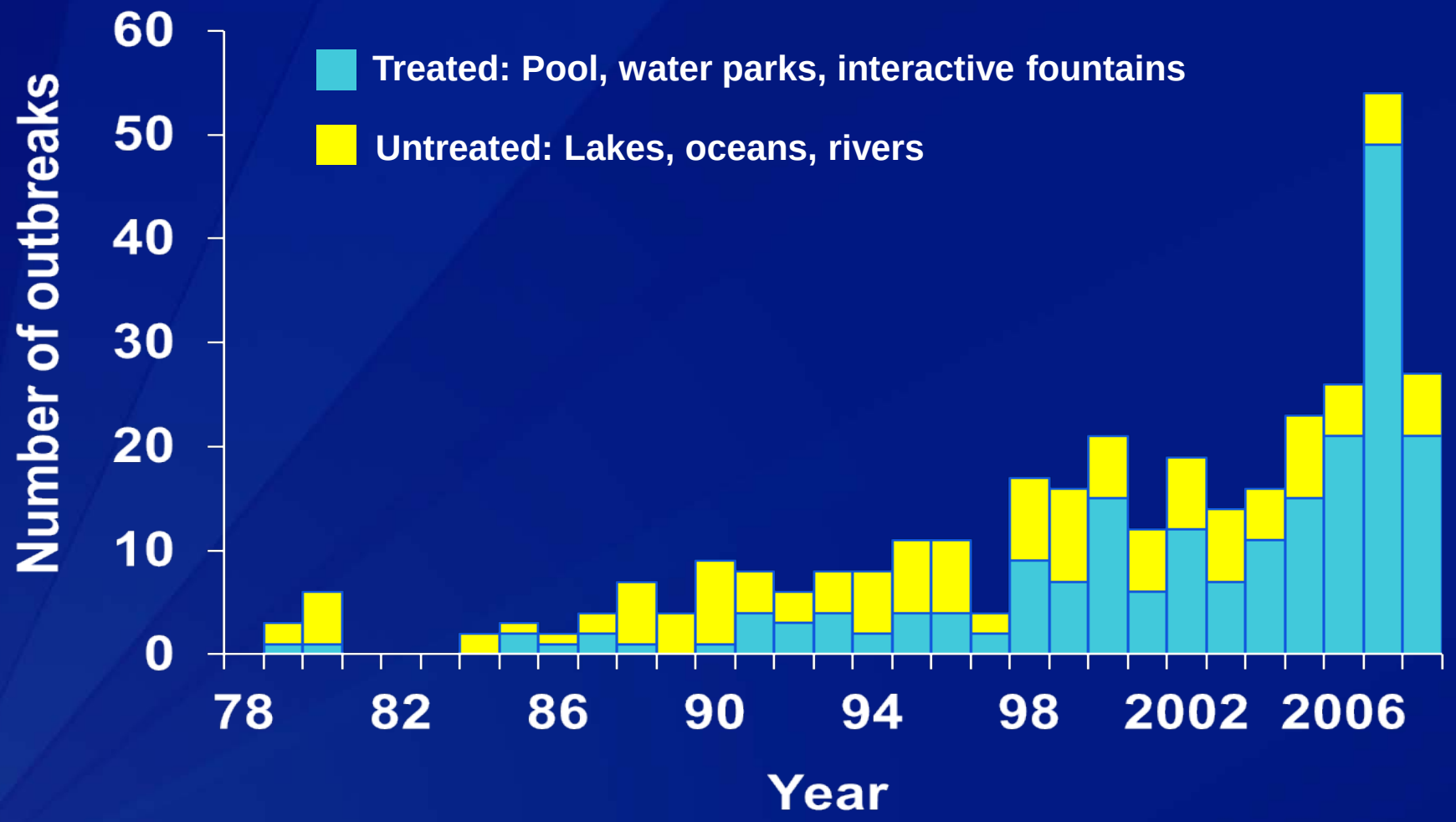

X-ray of bilateral pulmonary infiltrates in patient with Legionnaires' disease
Source: CDC PHIL

# Drinking Water Outbreaks,* United States 1971-2008 (N=818)




*Reported to Waterborne Disease Outbreak Surveillance System
Source: Brunkard *et al.* 2011, MMWR Surveillance Summary

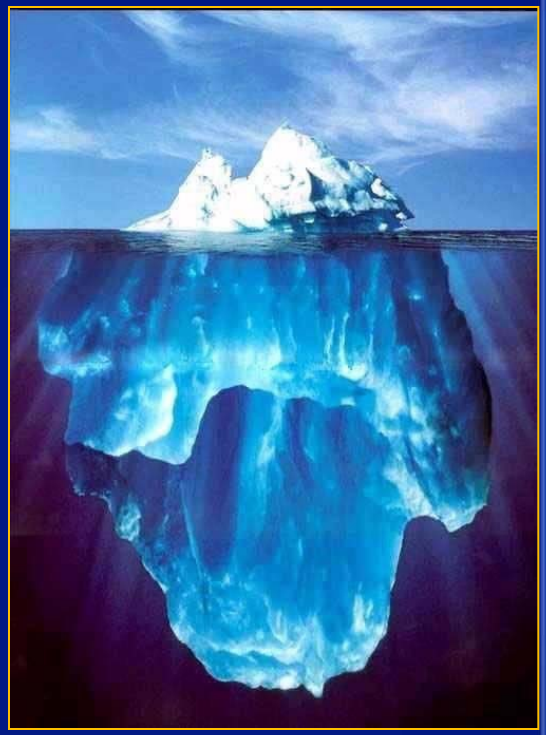
# RWI Outbreaks of Gastroenteritis, United States,1978–2008 (n=341)




Source: Hlavsa MC *et al*. 2011. MMWR 60(SS-12):1–39.

# Limitations of Outbreak Surveillance Data

- Passive surveillance
- Not all outbreaks detected, investigated, reported
- Inconsistent or incomplete data
- No reliable estimates of the number of undetected outbreaks
- Data does not include cases of endemic waterborne disease
- Not an indicator of magnitude of disease



# 2013 Highlights: *Recommendation 2, Action 5*

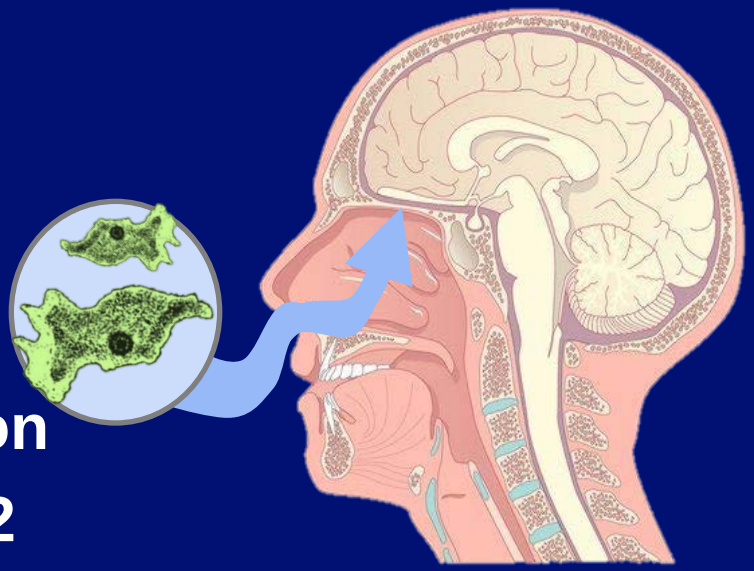
## Implement an active, reliable surveillance system for tracking waterborne disease and public health threats relevant to climate change

- **First Waterborne Disease Capacity Grants**
  - Continued support of waterborne disease capacity in 7 states
- **Enhanced Waterborne Disease Outbreak Reporting**
  - Transition to electronic data reporting for states
- **Grants to Great Lakes States for epidemiologic capacity**
  - Great Lakes Restoration Initiative funding for CSTE fellows
- **Tracking Harmful Algal Blooms**

# 2014 WORKPLAN

- Continue waterborne disease capacity grant funding in Arizona, Florida, Ohio, South Carolina, Washington, New Hampshire, Louisiana, and Maine
- Support waterborne disease surveillance capacity in the Great Lakes states with Epidemiology and Laboratory Capacity funding to focus on waterborne disease surveillance and prevention issues focused on ambient water quality
- Collaborate with state and federal partners to integrate surveillance of public health data on harmful algal blooms into the National Outbreak Reporting System (NORS), CDC's largest electronic outbreak reporting system

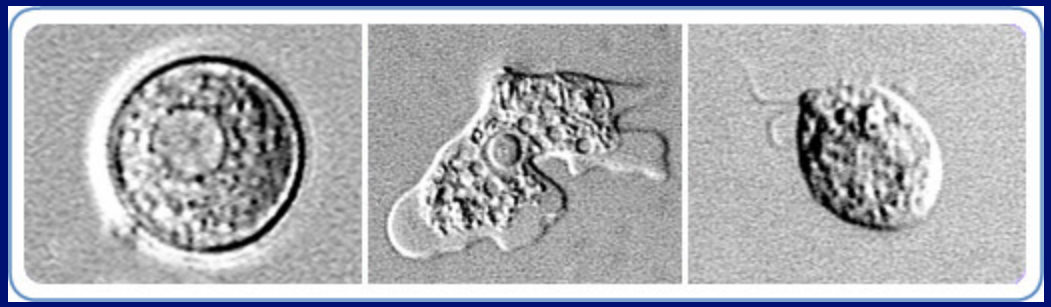
# Primary Amebic Meningoencephalitis (PAM)



- Rare and serious brain infection
  - 132 cases in U.S. since 1962
    - Most diagnostics come through CDC
  - Fatal: only 3 known US survivors
  - Acute disease: exposure to death in ~10 days
- Caused by free-living ameba, *Naegleria fowleri*
- Most infections associated with swimming in lakes, rivers
  - Water containing *Naegleria* goes up nose to brain
- All infections in southern tier states in US until 2010

# Organism: *Naegleria fowleri*

- Distributed globally
- Potential for being a climate-sensitive pathogen as water temperatures rise globally
  - Thermophilic free-living ameba
  - Lives in temperatures up to 115ºF (46ºC)
- CDC has been tracking infections since 1962



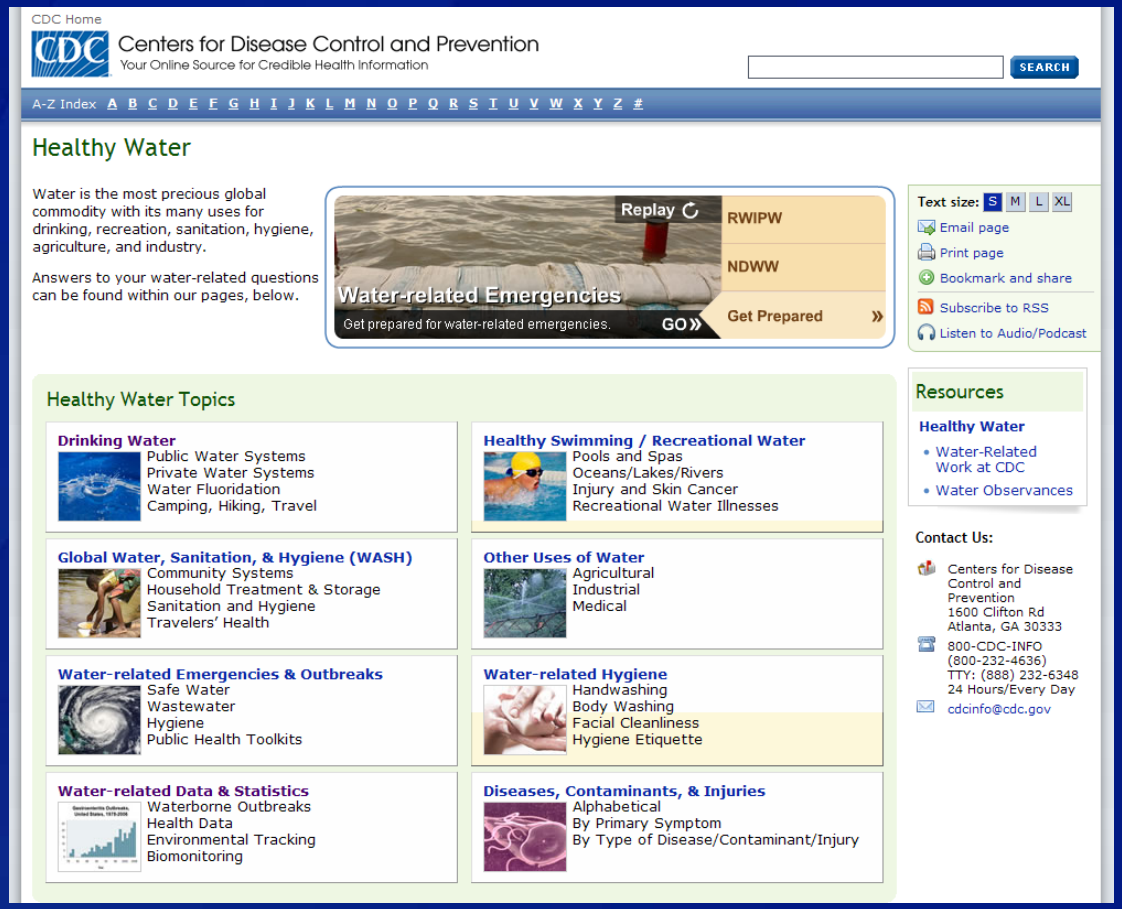
# *Naegleria fowleri :* Changes In the Water Since 2010

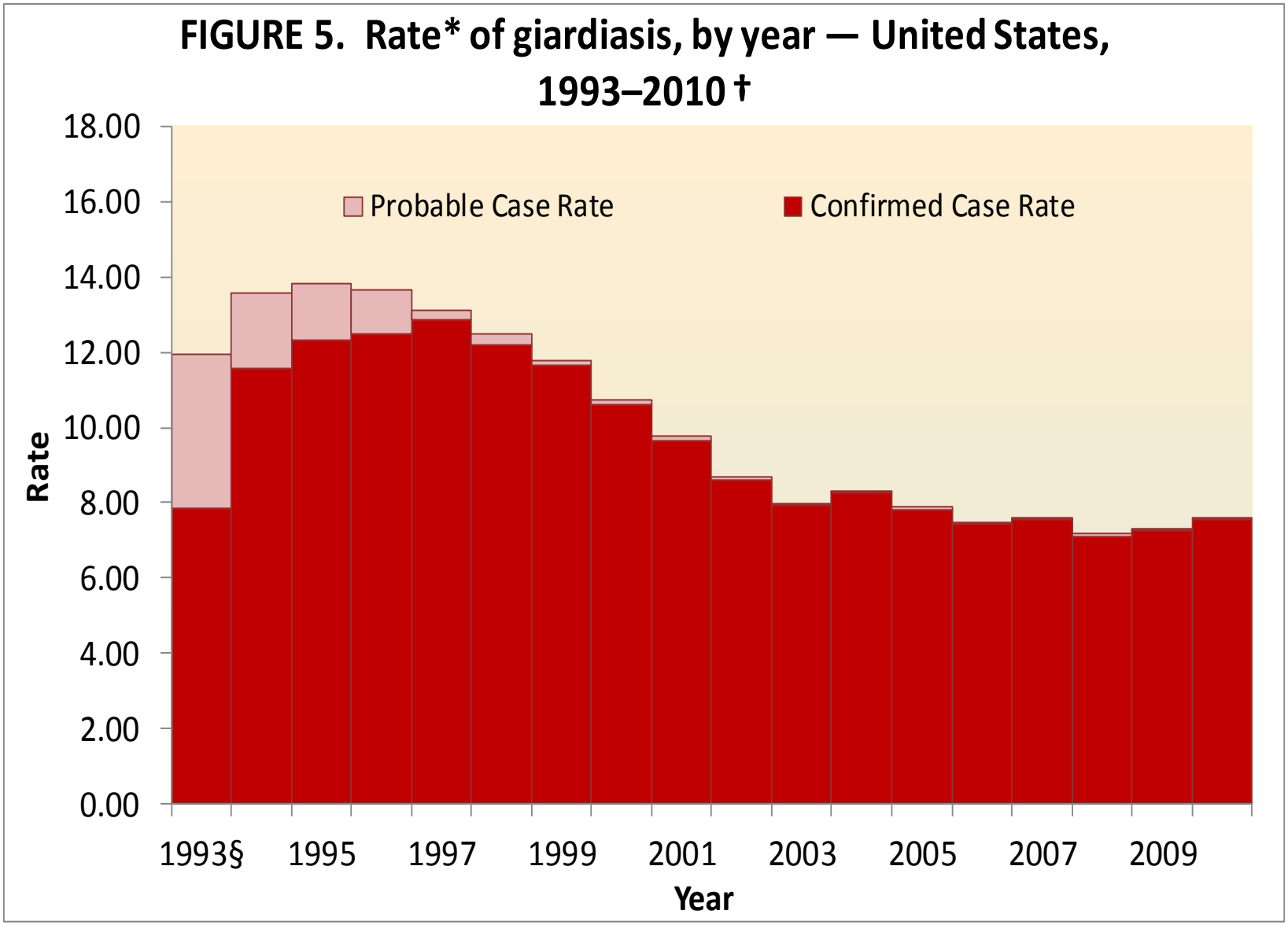
- First documented infections in MN, KS, IN
  - 600 miles farther north than ever before
- First documented infections associated with nasal irrigation
  - Neti pots (Louisiana, 2011)
  - Ritual ablutions (U.S. Virgin Islands, 2012)
- First death associated with colonization of a treated drinking water supply and colonization of the public water system (Louisiana, 2013)
- First survivor in U.S. since 1978 partially due to first release of investigational drug miltefosine from CDC Drug Service(Arkansas, 2013)

# Data and Information Needs

- Ensuring continuity of surveillance and detection of waterborne diseases – producing reliable, representative, long-term data and observations
- Documenting, predicting, and adapting to changing transmission routes and ranges of waterborne pathogens
  - Naegleria, Vibrios, HABs
- Collecting public health data on the health benefits/deficits of water reuse and developing best practices that include public health perspective
- Working with other USG agencies and partners to develop guidance for utilities, communities and practitioners regarding water-related events associated with extreme weather events
  - Chemical/pathogen intrusion, flooding of wells/septic tanks, water system remediation

# Questions?
# More Information: Healthy Water Website
# www.cdc.gov/healthywater



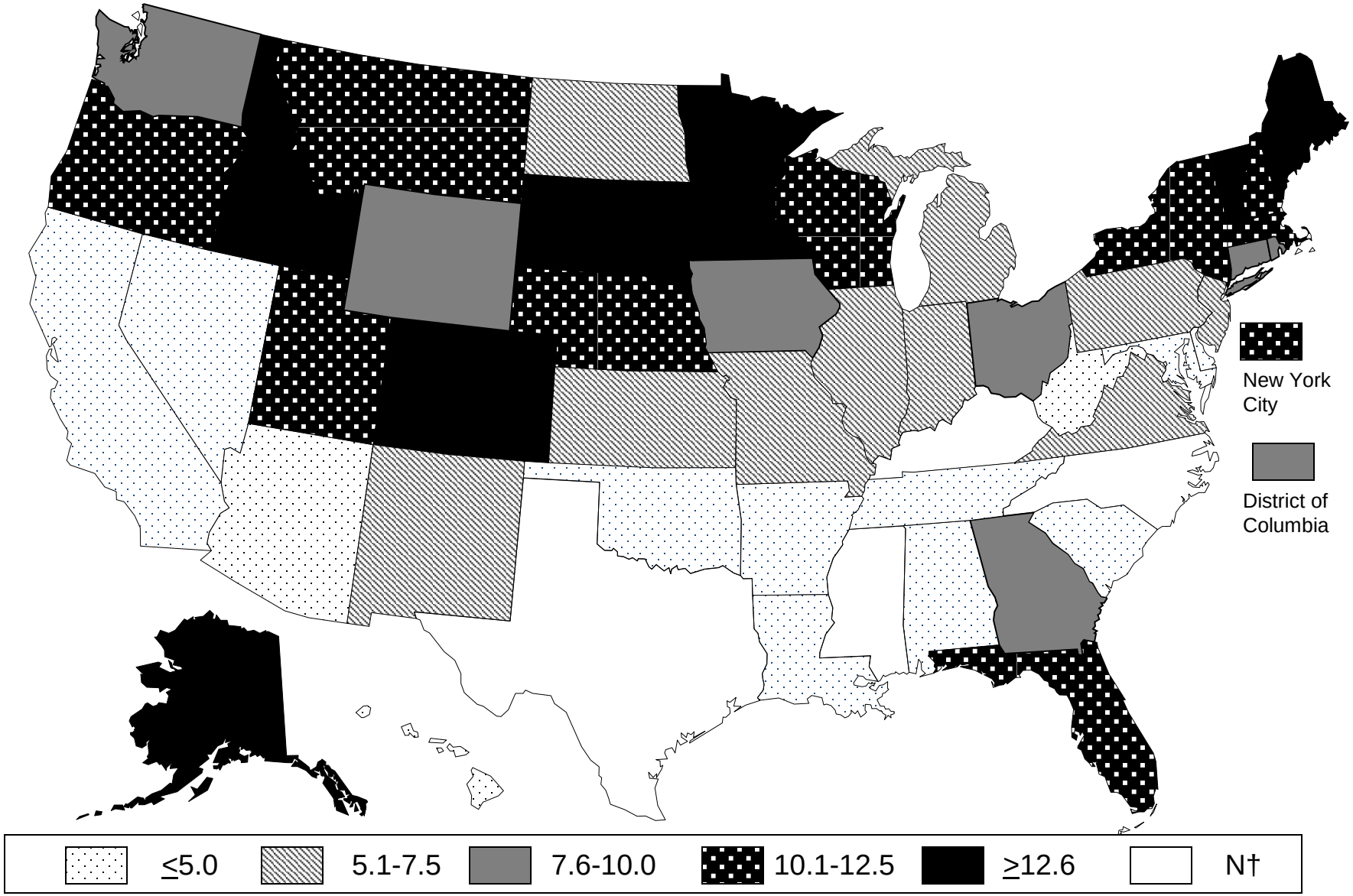



*Per 100,000 population. Population estimates are from the Population Division, US Census Bureau. Available at http://www.census.gov/popest/states Accessed July 28 2011.

†N = 391,492.

§ First year with assigned reporting number.

# FIGURE1. Rate* of giardiasis, by state/area — United States, 2010




*** Per 100,000 population.** Population estimates are from the U.S. Census Bureau. Table 1. Intercensal Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2000 to July 1, 2010. Data in this table were accessed on January 9, 2012 at www.census.gov/popest/data/index.html. Estimates of the New York City population: Intercensal Estimates of the Resident Population for Counties: April 1, 2000 to July 1, 2010 (summing populations of Bronx, Kings, New York, Richmond, and Queens counties). Data in this table were accessed on January 9, 2012 at www.census.gov/popest/data/intercensal/county/county2010.html.

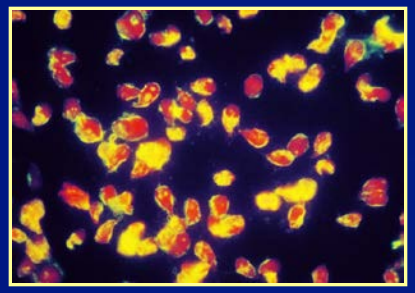
**†Not a reportable disease in these states.**

# WDPB Climate and Water Activities

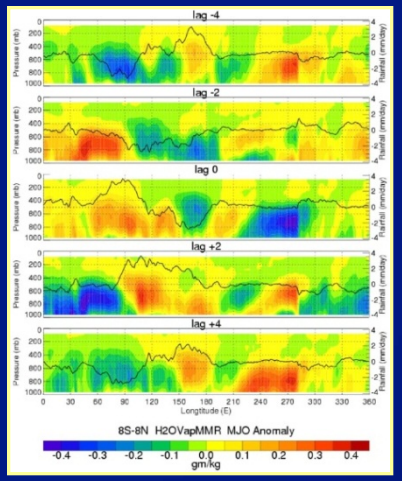
- **Federal advisory committee representation on water and climate issues**
  - White House Council on Environmental Quality Water Resources Climate Adaptation Working Group
  - OSTP Subcommittee on Water Availability and Quality (SWAQ)
- **Engagement with water utility sector and EPA on climate adaptation issues in the water sector**
  - CDC-funded project on adaptation strategies with 21 water utilities in the U.S. and Australia
  - EPA Climate Ready Water Utilities work group participation
- **Intra-agency and external consultation and engagement with partners**

# Research Questions and Needs

- How will warming temperature and changing precipitation patterns impact waterborne disease?
  - Increased pathogen occurrence in current range?
  - New colonization / range expansion and infections?
  - Interaction with other public health infrastructure stressors and demographic trends
- How can public health practitioners prepare?
  - Better understanding of climate-sensitivity patterns of waterborne diseases
  - Improved analytic and modeling approaches
    - Data (primarily epidemiologic)
    - Appropriate methods, models, and time scales
  - Development of predictive models and early warning systems

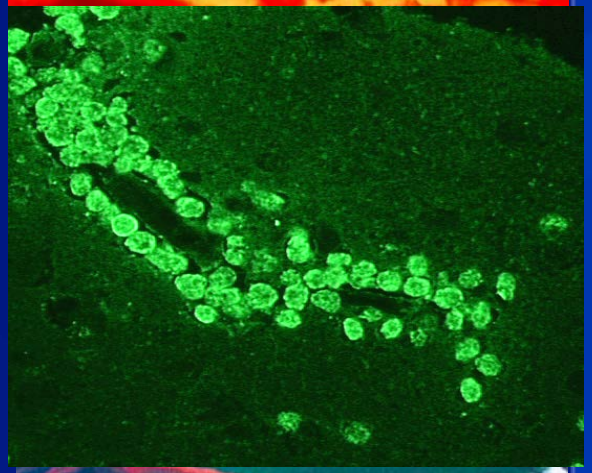


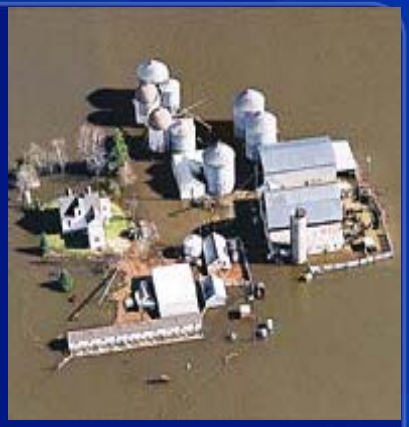
*Giardia lamblia*
Source: CDC PHIL



# Higher Temperatures

- Increasing water temperatures
  - Movement of pathogens to more northern regions
    - *Vibrio parahaemolyticus* in Alaska
    - *Naegleria fowleri* infections in northern states
  - Enhanced growth of pathogens
    - *Naegleria*, *Vibrio*, harmful algal blooms, *Pseudomonas*
    - Increased recreational water use, exposure and possible increased infections, health effects



# Floods

- Mortality associated with flooding
- Outbreaks of leptospirosis, *Vibrio spp*., other waterborne pathogens
- Potential infrastructure failures of drinking / wastewater treatment
- Sewer overflows (combined and sanitary)
  - >1 trillion gal of sewage & storm water discharged annually during CSO's
- Agricultural and livestock areas rinsed into surface water → lower water quality
- Surface & ground water contamination with pathogens, chemicals