Climate Change, Water, and Health

CAT Public Health Work Group
September, 2009

"And I called for a drought upon the land, and upon the mountains, and upon the corn, and upon the new wine, and upon the oil, and upon that which the ground bringeth forth, and upon men, and upon cattle, and upon all the labor of the hands."

Haggai 1-11

Drought

- Diminishing Sierra Nevada snowpack State's largest water "reservoir"
  - challenges ability to ensure availability of drinking water and other water
  - increases flooding, with attendant risks to water systems
- Drinking water quality
  - increasing salinity, dissolved solids, algal and bacterial growth, chemical contaminant concentrations
  - pushes water management agencies to seek new water supply sources
    - recycling, desalination use of groundwater of lower quality.
- Increased groundwater pumping
  - dropping water tables (impacts well users)
  - land subsidence
  - changes in water quality
- Increased disputes over water rights
  - Increased stress levels

- Salinity increases
  - reduced volume surface water & reduced snow melt
  - larger percentage of flow from treated wastewater discharge
  - groundwater pump-in to secure water resources for southern CA
- Dissolved solids
  - Increased demand on groundwater (w/higher dissolved solids) due to reduced surface water availability
  - negative impact on consumer acceptance
  - increased costs associated with mineral deposits in water heaters, plumbing
  - elimination of blending as a solution for many public water systems that rely on the low salinity Delta water to enable use of local water supplies with high solids
- Algal and bacterial growth
  - Decreased reservoir water levels and warmer water temperatures
  - Increased algal growth
  - Warmer water supports different bacteria

Drought

- Chemical contaminants
  - Higher concentrations inorganics (nitrates, arsenic) in groundwater
    - Requires balancing reservoirs to reduce contamination
- Recycled water
  - Risk for exposures with improper treatment or systems
- Rising sea level & salinity
  - Extends fresh water/salt water transition zone
  - Increases salinity of coastal water sources (e.g. SF Bay, Delta)
  - Intrusion of salt water into surface water and wells
    - Requires treatment or salt water intrusion barriers
  - Bromide in salt water may cause problems with disinfection byproducts (bromate)

Drought

- Diminished snowpack and increased rainfall and flood flows
  - Challenge raw water infrastructure (reservoirs, conveyance structures, Delta levees)
  - Insufficient capacity to capture flood flows – water discharged to Bay unavailable for meeting summer/fall drinking water demands
- Flood water turbidity
  - May exceed capacity of surface water treatment facilities
  - Requires improvement to meet drinking water standards in winter/spring rain periods
- Pathogen loading
  - storm flows may cause overflows of raw or partially treated wastewater
  - Requires increased disinfection
    - Disinfection byproduct compliance issues
- Insufficient recharge of hard rock wells (mountain communities)

Recreational waters

- Flooding - increased runoff from urban and agricultural watershed with increased pathogens fresh & marine bodies of water
  - Sanitary sewer overflows from wastewater treatment systems & disposal systems
  - Flooding and runoff from cattle grazing areas, animal feed lots
- Recreational water illnesses
  - Most common pathogens: Cryptosporidium, Giardia, Shigella, norovirus and E. Coli 0157:H7.
    - Symptoms: GI - diarrhea, skin, ear, respiratory, eye, neurological and wound infections
    - High risk: children, pregnant. compromised immune systems
  - Naturally occurring pathogens (warmer water, decreased salinity)
    - Vibrio vulnificus and other
- Blue Green Algae
  - Increased BGA blooms in rivers and lakes
    - Toxins (neuro-, hepato-)
    - Allergic response
  - Warmer and nutrient rich (Nitrogen, phosphorous) water (related to ag/urban runoff)
  - Recent Klamath River blooms with local health advisories
  - Economic as well as health impacts
- Loss of aquatic recreation areas

Other issues

- Nuclear power
  - Southeast US & France reduced electric power when nuclear facilities shut down due to low flow in rivers used for cooling – during heat waves
- Mental health issues
  - E.g. Australia

Health equity issues

- Adequacy of drinking water supplies may increase cost of drinking and household water
  - Disproportionate impact on low income communities
- Diminished access to public recreational areas
  - Disproportionate impact on low income families