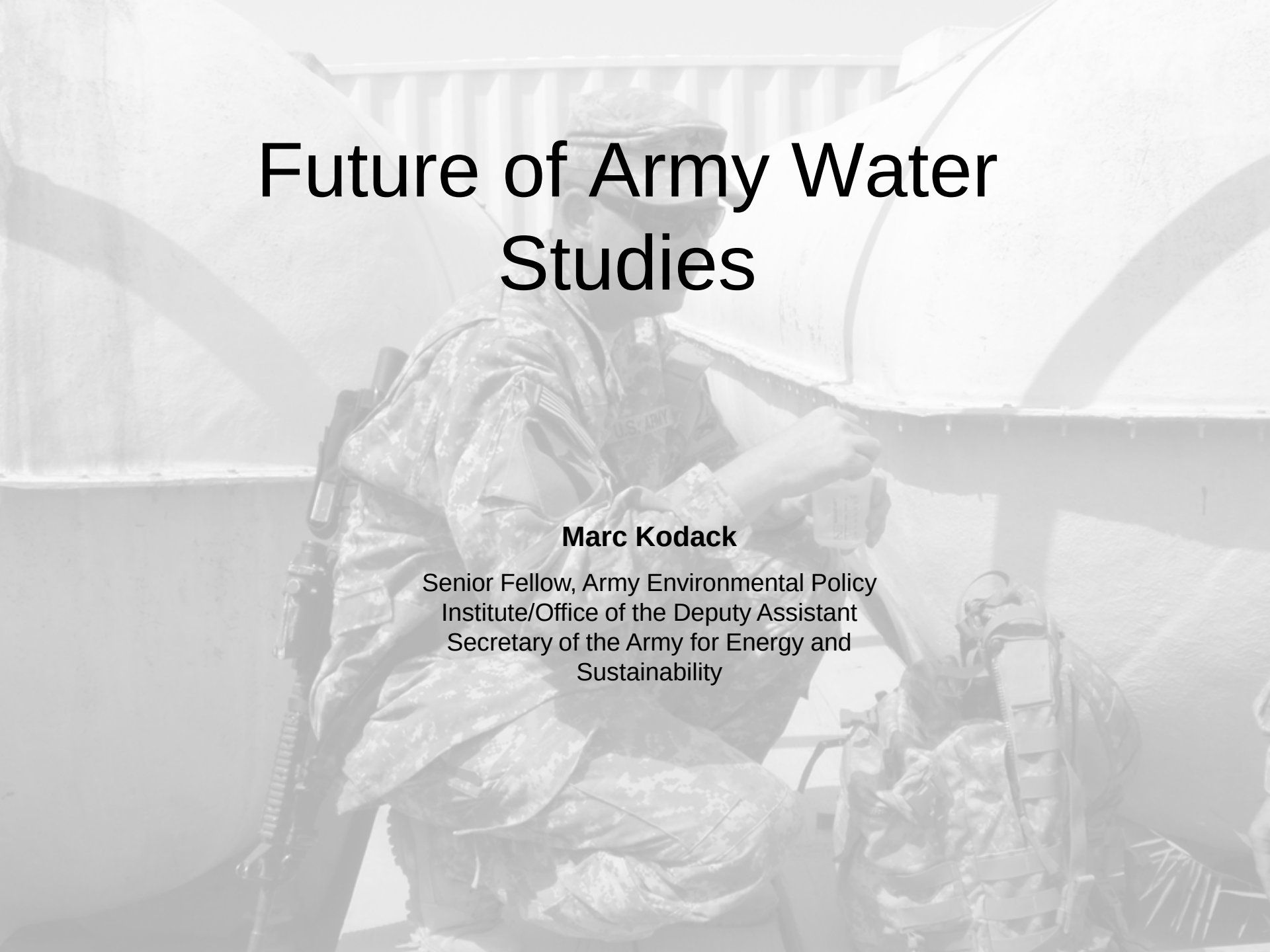
Future of Army Water Studies



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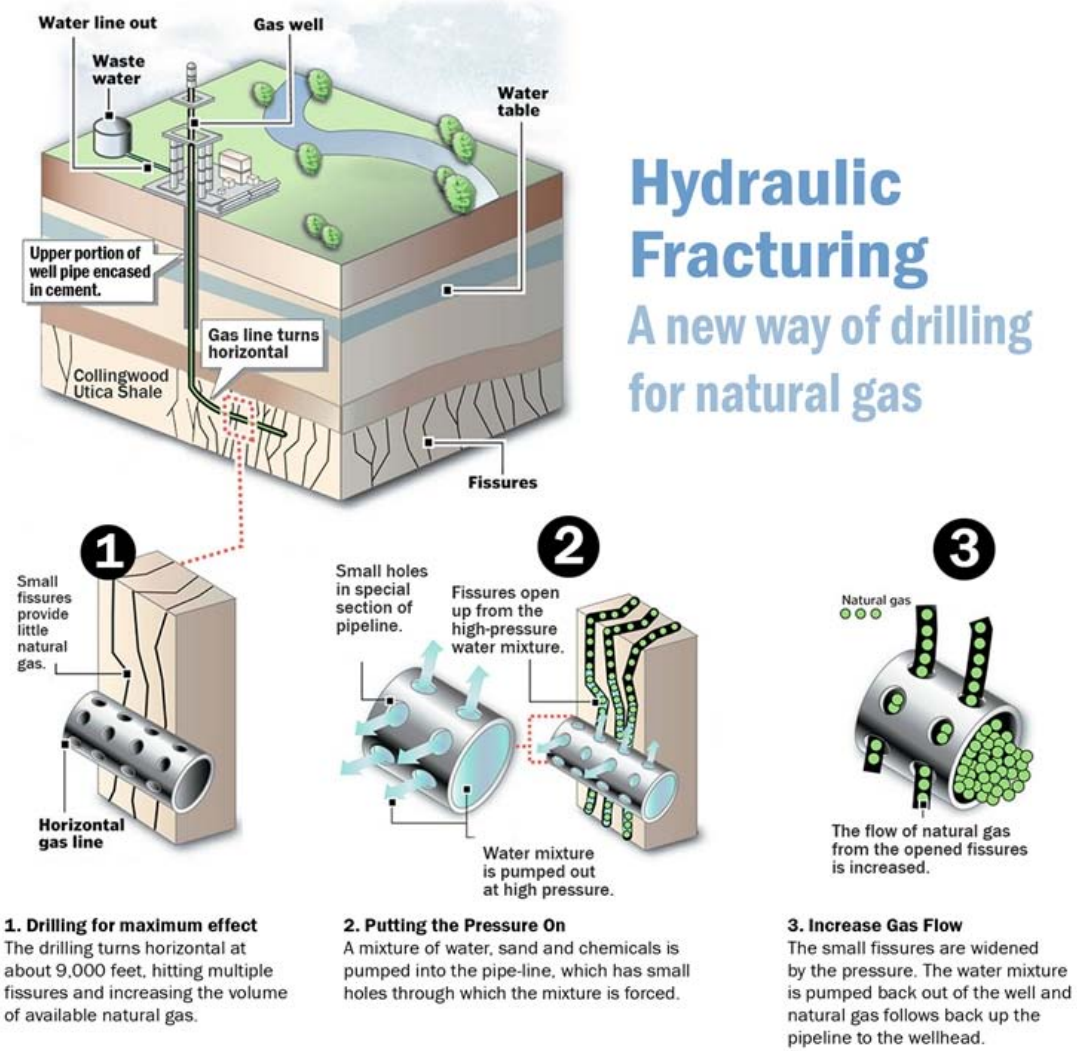
Water Challenges

- Energy/water nexus
- Balancing supply with demand
- Aging infrastructure
- Complex water rights issues
- Cost vs. price imbalance
- Quality degradation

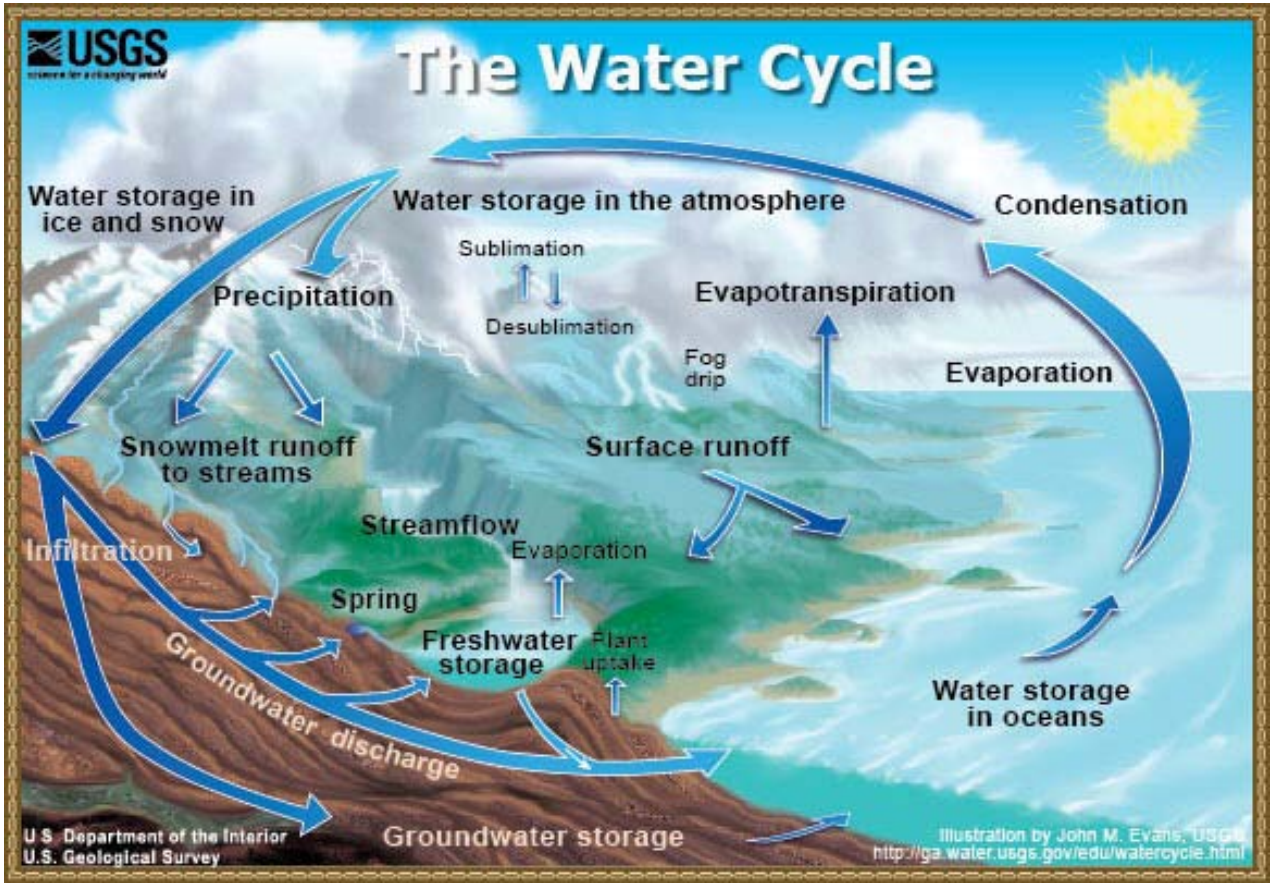
Energy/Water Nexus

- Thermoelectric power
- Geothermal
- Biofuels
- Solar-hot water
- Hydropower
- Carbon Capture
- “Fracking”



Regional Water Balance?

- Supply
  - Rivers
  - Aquifers
- Demand
  - Installation
  - Public Supply
  - Domestic
  - Industrial
  - Agriculture



Supply

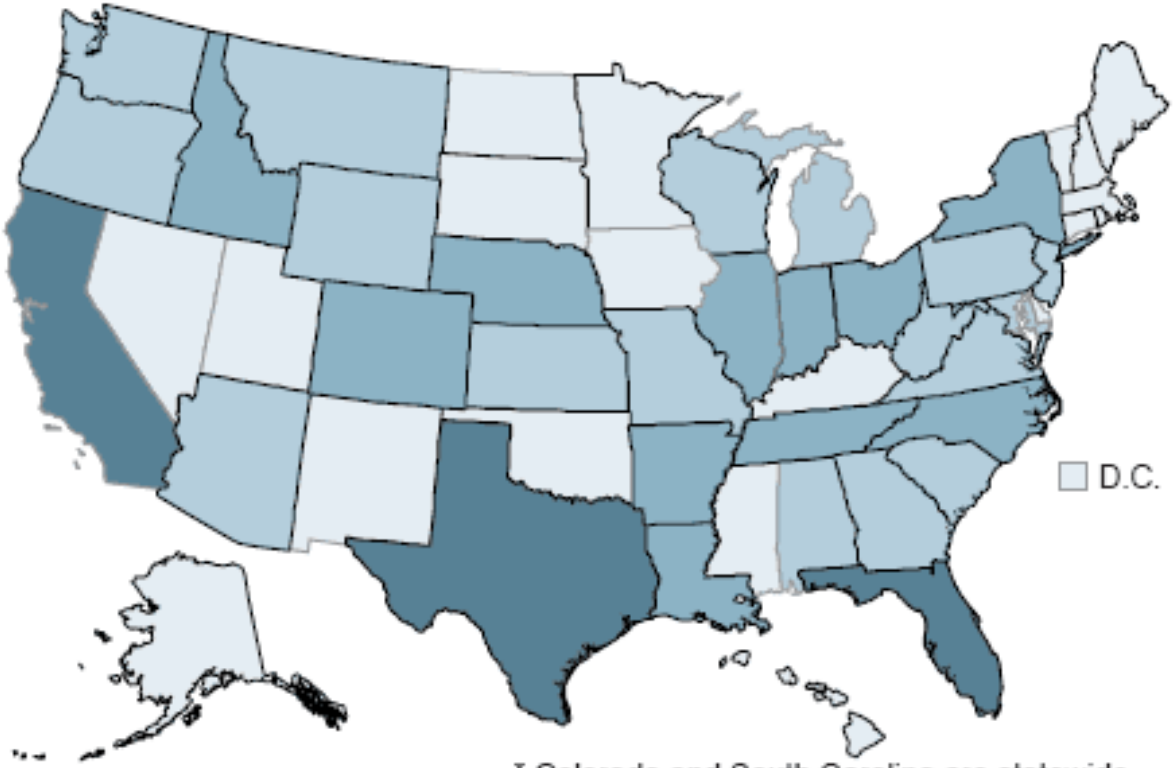
Three states use a quarter of U.S. water

Florida, California and Texas lead the country in water usage. The government projects that at least 36 states will face water shortages within five years.

Estimated water withdrawals, in million gallons per day in 2000

0 to 5,000 | 5,001 to 10,000 | 10,001 to 20,000 | 20,001 to 52,000

Likely to experience water shortage before 2013*



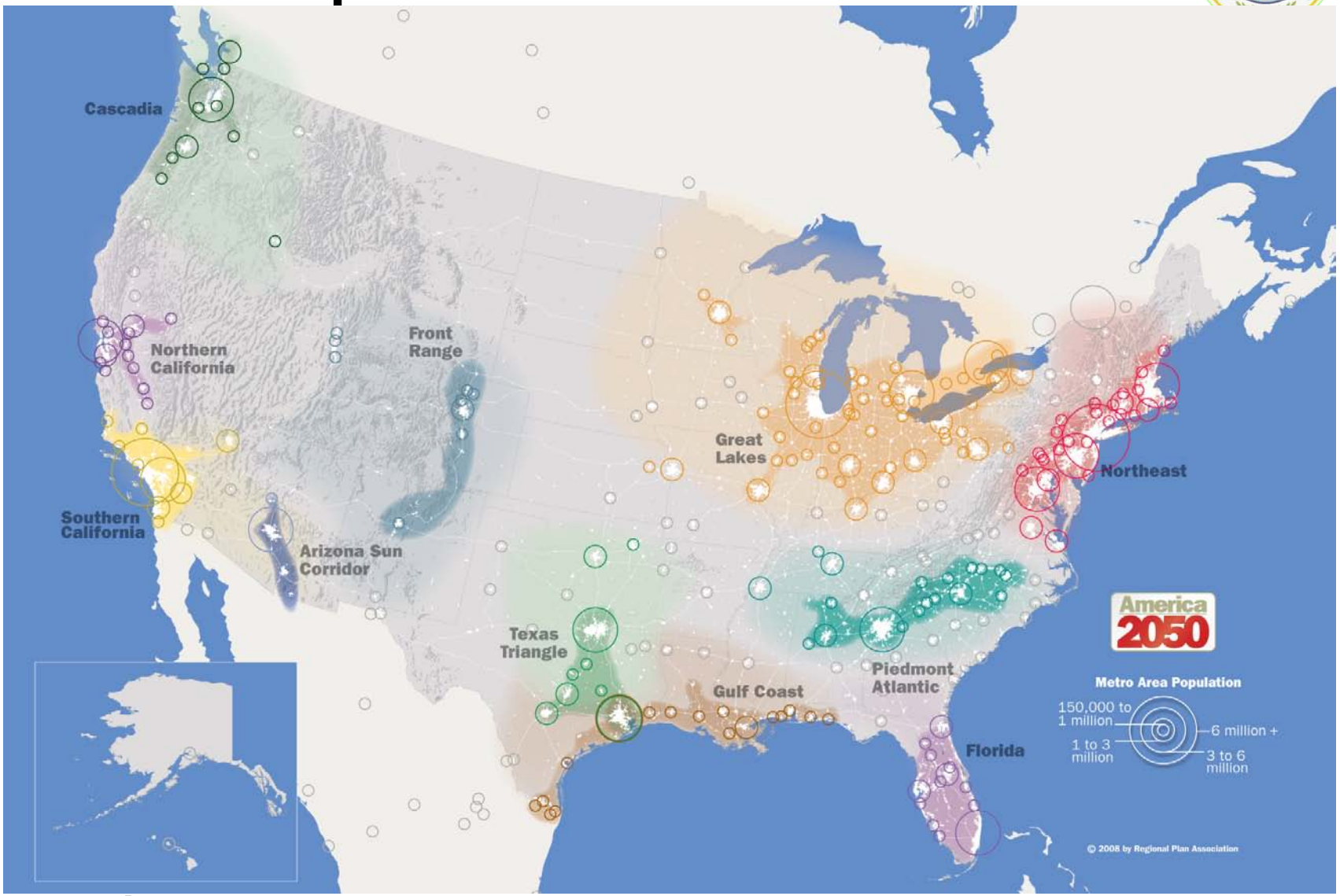
* Colorado and South Carolina are statewide. All other states are regional or local.

SOURCE(S): U.S. Geological Survey; Government Accountability Office AP

Lake Meade, AZ and NV

Supply

Population Growth



Demand

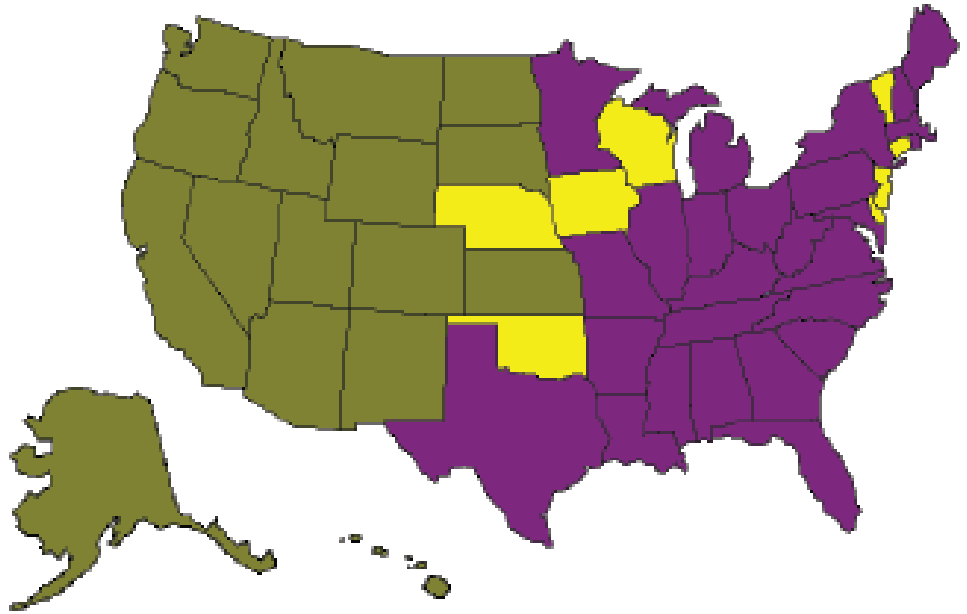
Aging Infrastructure

- 240,000 water main breaks/year
- 1.7 trillion gal/year lost costing $2.6 B
- American Water Works Association targets 15% for unaccounted water
- Infrastructure report card: D-
- Gap analysis: $263B shortfall by 2020

Complex Water Rights

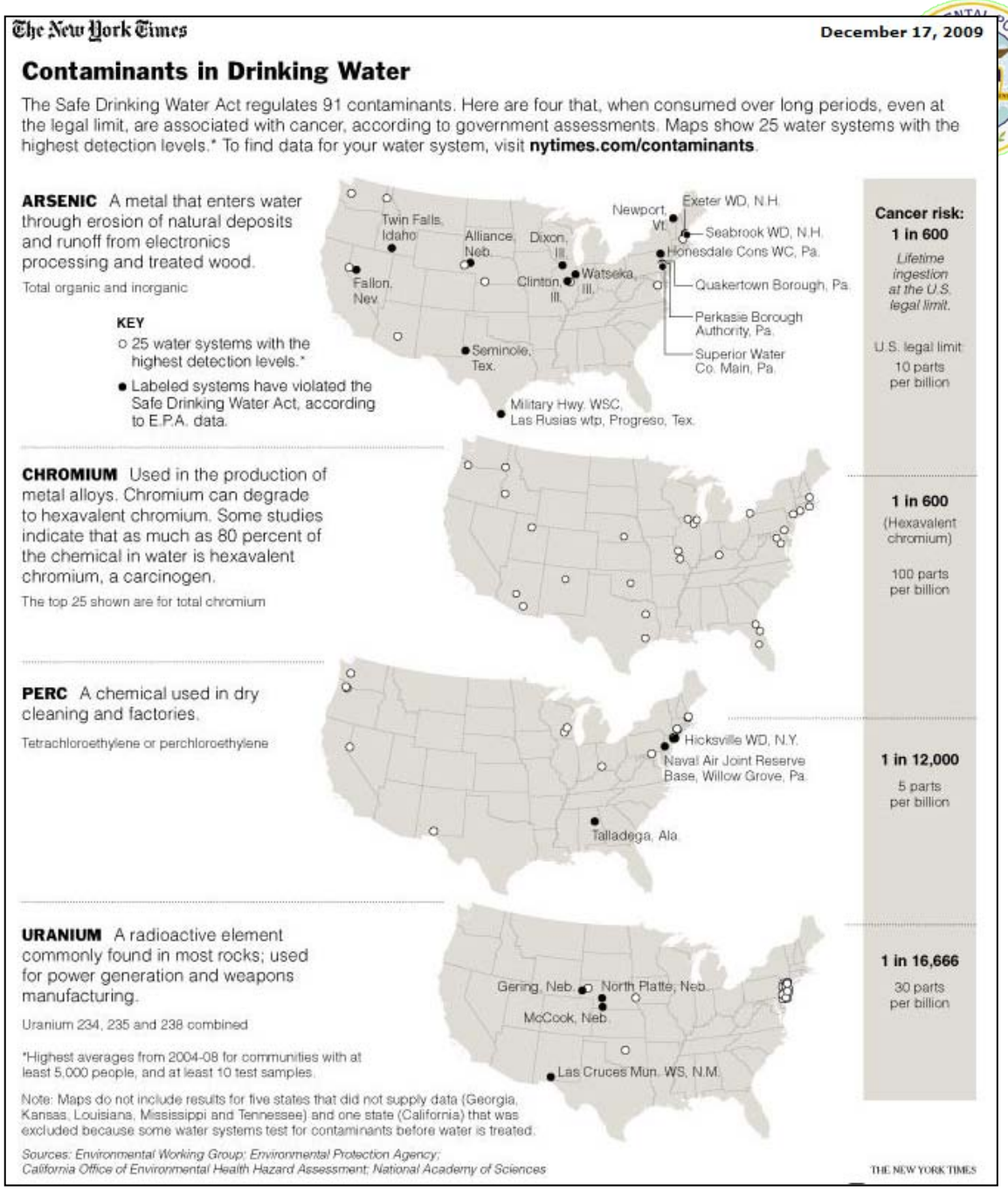
- Regulated Riparian
- Prior Appropriation

Legal Allocation of Water: 48% (shown in purple) of the 50 states allocate water by riparian rights of landowners and 38% (shown in green) by prior appropriation doctrine (the right to use the water). The other states (shown in yellow) have a mix of laws or some other type of authority.



Quality Degradation

Degraded water cannot be considered a viable source



The New York Times — December 17, 2009

Contaminants in Drinking Water

The Safe Drinking Water Act regulates 91 contaminants. Here are four that, when consumed over long periods, even at the legal limit, are associated with cancer, according to government assessments. Maps show 25 water systems with the highest detection levels.* To find data for your water system, visit **nytimes.com/contaminants**.

ARSENIC A metal that enters water through erosion of natural deposits and runoff from electronics processing and treated wood.

Total organic and inorganic

KEY
- ○ 25 water systems with the highest detection levels.*
- ● Labeled systems have violated the Safe Drinking Water Act, according to E.P.A. data.

Twin Falls, Idaho; Alliance, Neb.; Dixon, Ill.; Fallon, Nev.; Clinton, Ill.; Watseka, Ill.; Newport, Vt.; Exeter WD, N.H.; Seabrook WD, N.H.; Honesdale Cons WC, Pa.; Quakertown Borough, Pa.; Perkasie Borough Authority, Pa.; Superior Water Co. Main, Pa.; Seminole, Tex.; Military Hwy. WSC, Las Rusias wtp, Progreso, Tex.

Cancer risk: 1 in 600
Lifetime ingestion at the U.S. legal limit.
U.S. legal limit: 10 parts per billion

CHROMIUM Used in the production of metal alloys. Chromium can degrade to hexavalent chromium. Some studies indicate that as much as 80 percent of the chemical in water is hexavalent chromium, a carcinogen.

The top 25 shown are for total chromium

1 in 600
(Hexavalent chromium)
100 parts per billion

PERC A chemical used in dry cleaning and factories.

Tetrachloroethylene or perchloroethylene

Hicksville WD, N.Y.; Naval Air Joint Reserve Base, Willow Grove, Pa.; Talladega, Ala.

1 in 12,000
5 parts per billion

URANIUM A radioactive element commonly found in most rocks; used for power generation and weapons manufacturing.

Uranium 234, 235 and 238 combined

Gering, Neb.; North Platte, Neb.; McCook, Neb.; Las Cruces Mun. WS, N.M.

1 in 16,666
30 parts per billion

*Highest averages from 2004-08 for communities with at least 5,000 people, and at least 10 test samples.

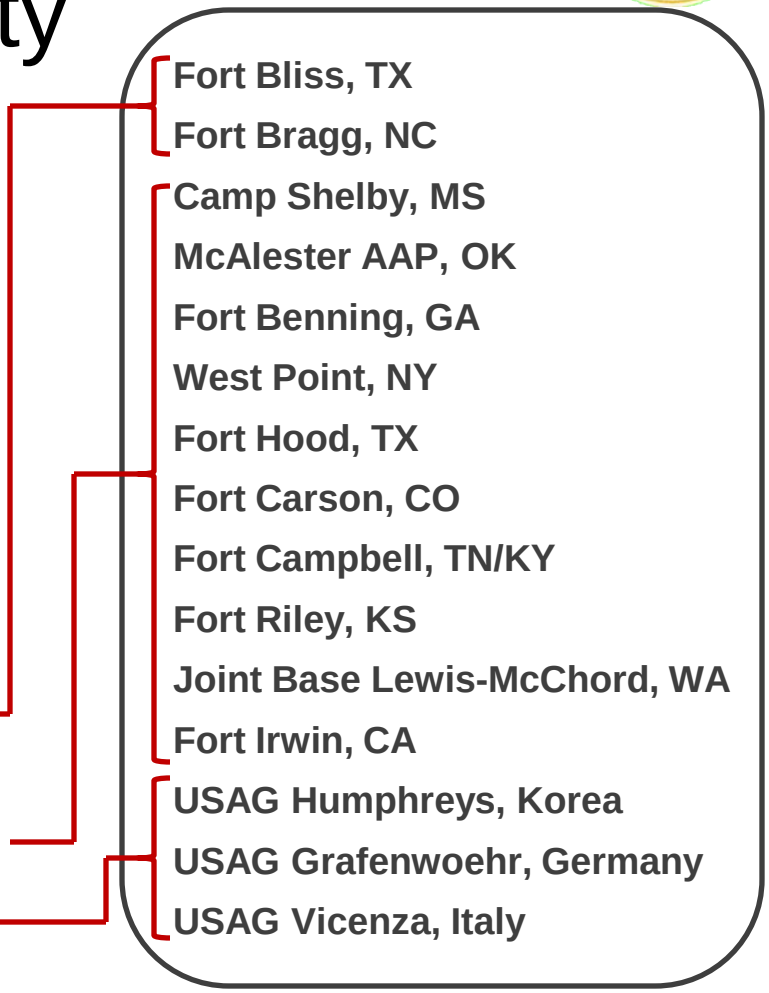
Note: Maps do not include results for five states that did not supply data (Georgia, Kansas, Louisiana, Mississippi and Tennessee) and one state (California) that was excluded because some water systems test for contaminants before water is treated.

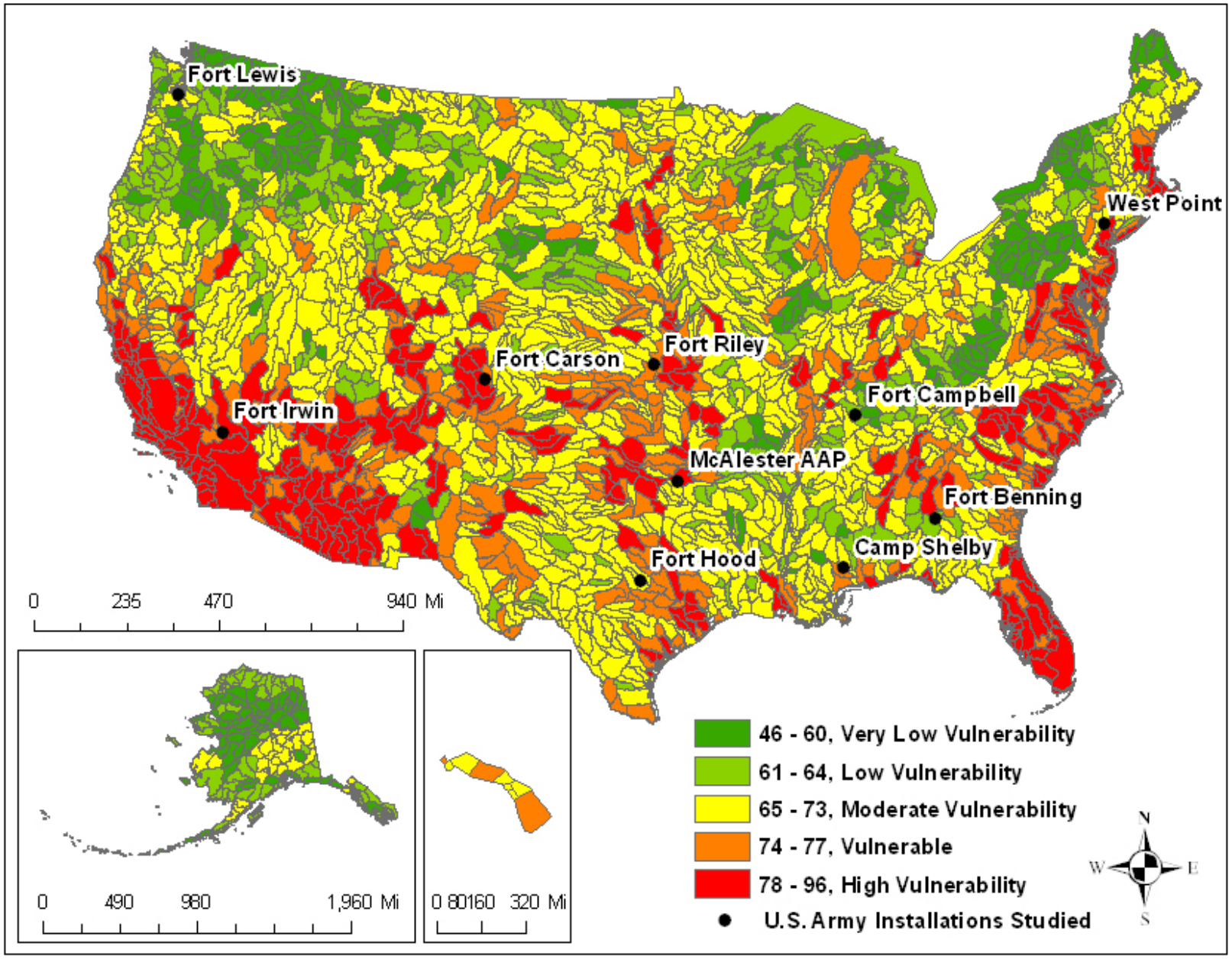
Sources: Environmental Working Group; Environmental Protection Agency; California Office of Environmental Health Hazard Assessment; National Academy of Sciences

THE NEW YORK TIMES

Long-term Regional Studies with Broad Applicability

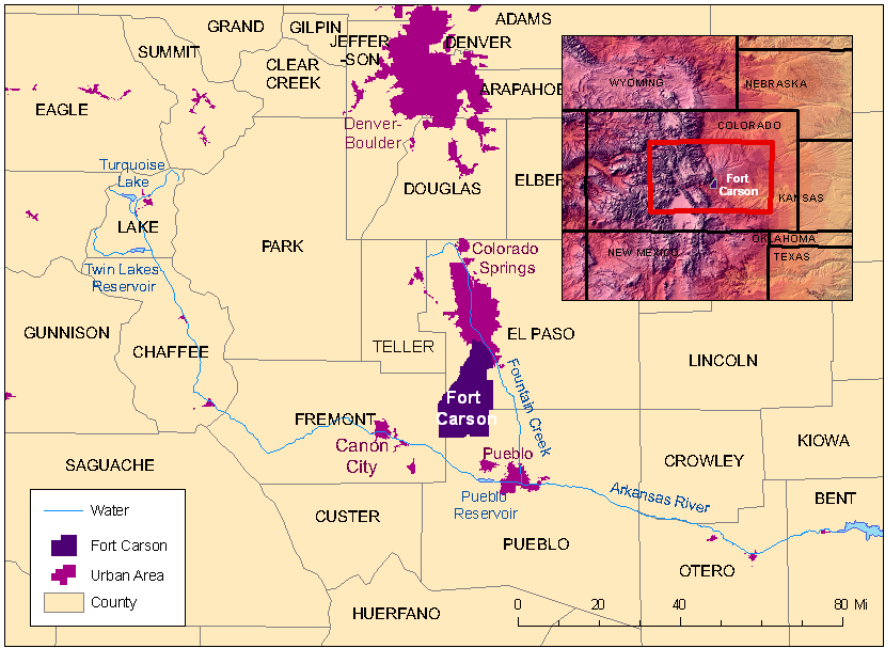
- Assess 30-year water supply and demand for sample of Army installations
  - Method developed in 2009 at two pilot studies
  - Applied to 10 domestic and 3 overseas installations




Fort Lewis
West Point
Fort Carson
Fort Riley
Fort Irwin
Fort Campbell
McAlester AAP
Fort Benning
Fort Hood
Camp Shelby
0 235 470 940 Mi
0 490 980 1,960 Mi
0 80160 320 Mi
46 - 60, Very Low Vulnerability
61 - 64, Low Vulnerability
65 - 73, Moderate Vulnerability
74 - 77, Vulnerable
78 - 96, High Vulnerability
U.S. Army Installations Studied
N
W
E
S

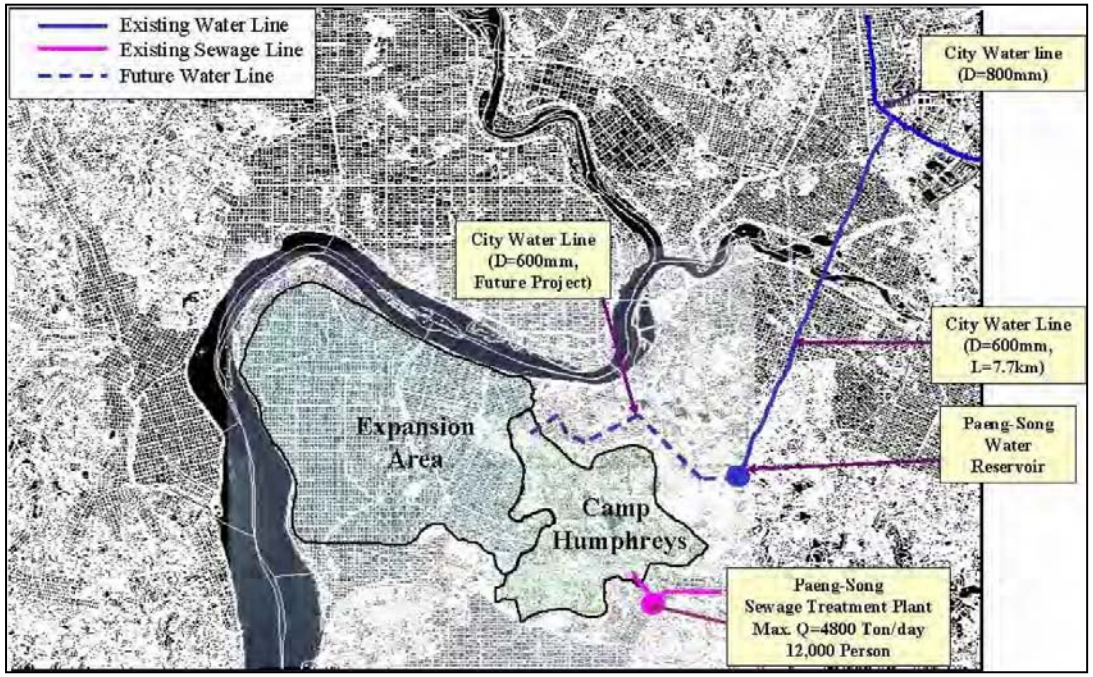
Fort Carson, CO

- Award winning water conservation program
  - ➢ Alternative sources, recycling, and reclamation
- Regional over appropriation of water resources
- Climate change may lead to declines in runoff, higher temperatures, and earlier snowmelt
- Increasing infrastructure costs



USAG Humphreys, South Korea

- Increasing demand
- Fluctuating supply
- Lack of access to relatively abundant water resources
  - Natural patterns of seasonal and regional water distribution
  - Condition of distribution systems
  - Topography



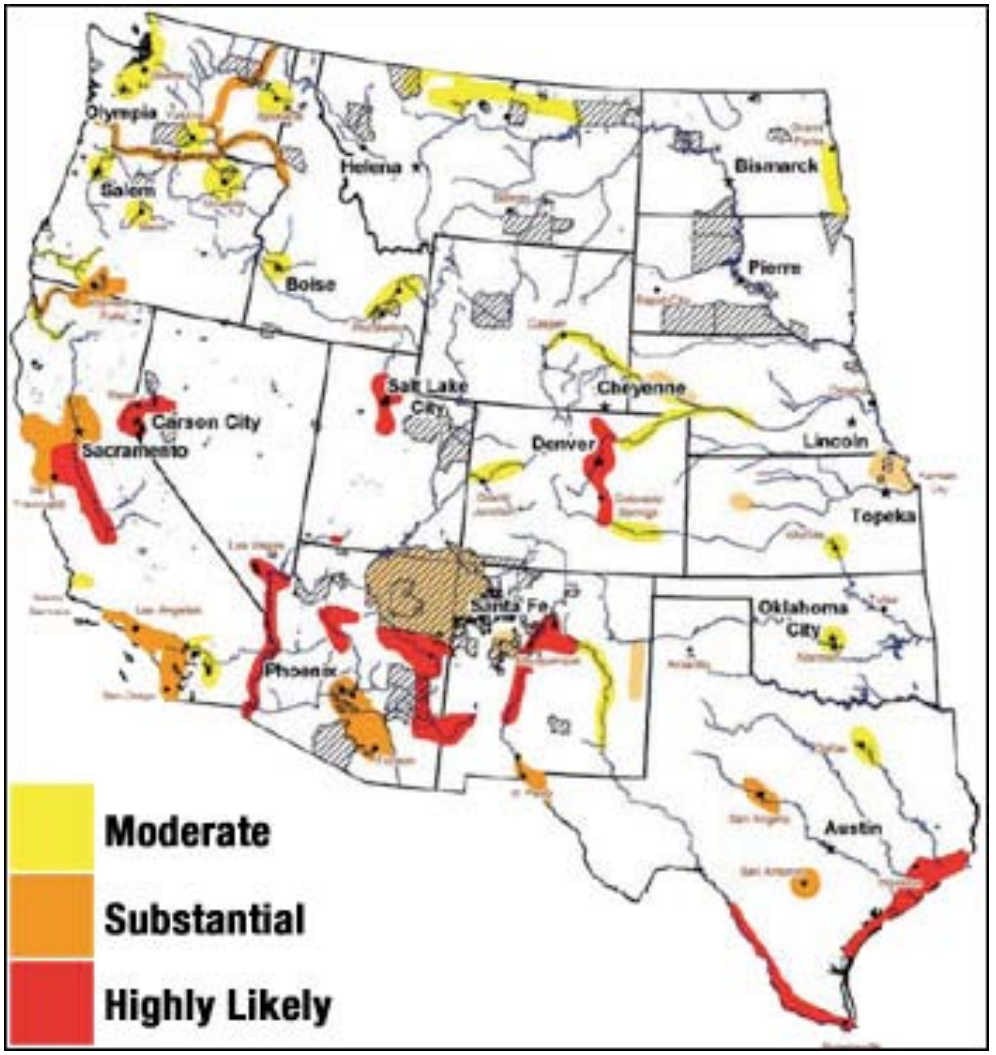
- Water quality
  - Non-point source pollution
  - Wastewater treatment
- Climate change: temperature rise, increased variability of precipitation

General Observations

- Need installation of more water meters
- Water rights may be limiting factors for some installations
- Climate change
  - Exacerbate scarcity in arid regions
  - Effect availability in historically wet regions
- Need aggressive leak detection program
- Regional solutions

Future of Water

- Conflict
- Water security
- Embedded water in the supply chain
- Identification of critical suppliers
  - Components
  - Physical location and water supply/demand



Abrams Tank

Abrams Major Suppliers

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Report will be posted on http://www.aepi.army.mil