



# INTREXON<sup>®</sup>

Lieutenant General (Ret) Thomas Bostick  
Chief Operating Officer, Intrexon

## Climatters 2018

*The Global Security Implications of Natural Resource (Water) Scarcity*

24 May 2018

# Forward-Looking Statements

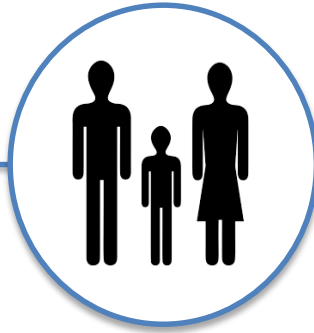
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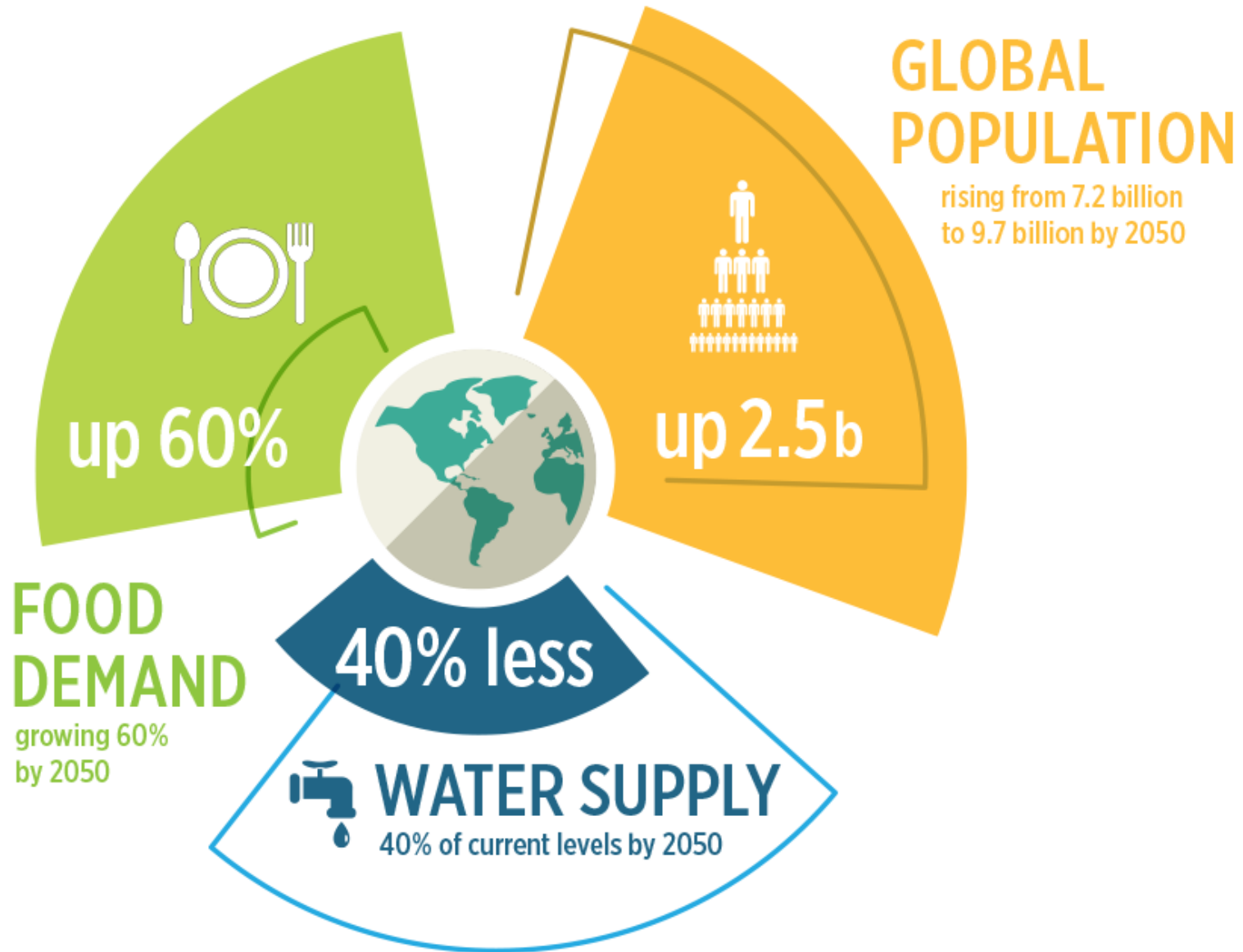
# Humans Impact the Environment



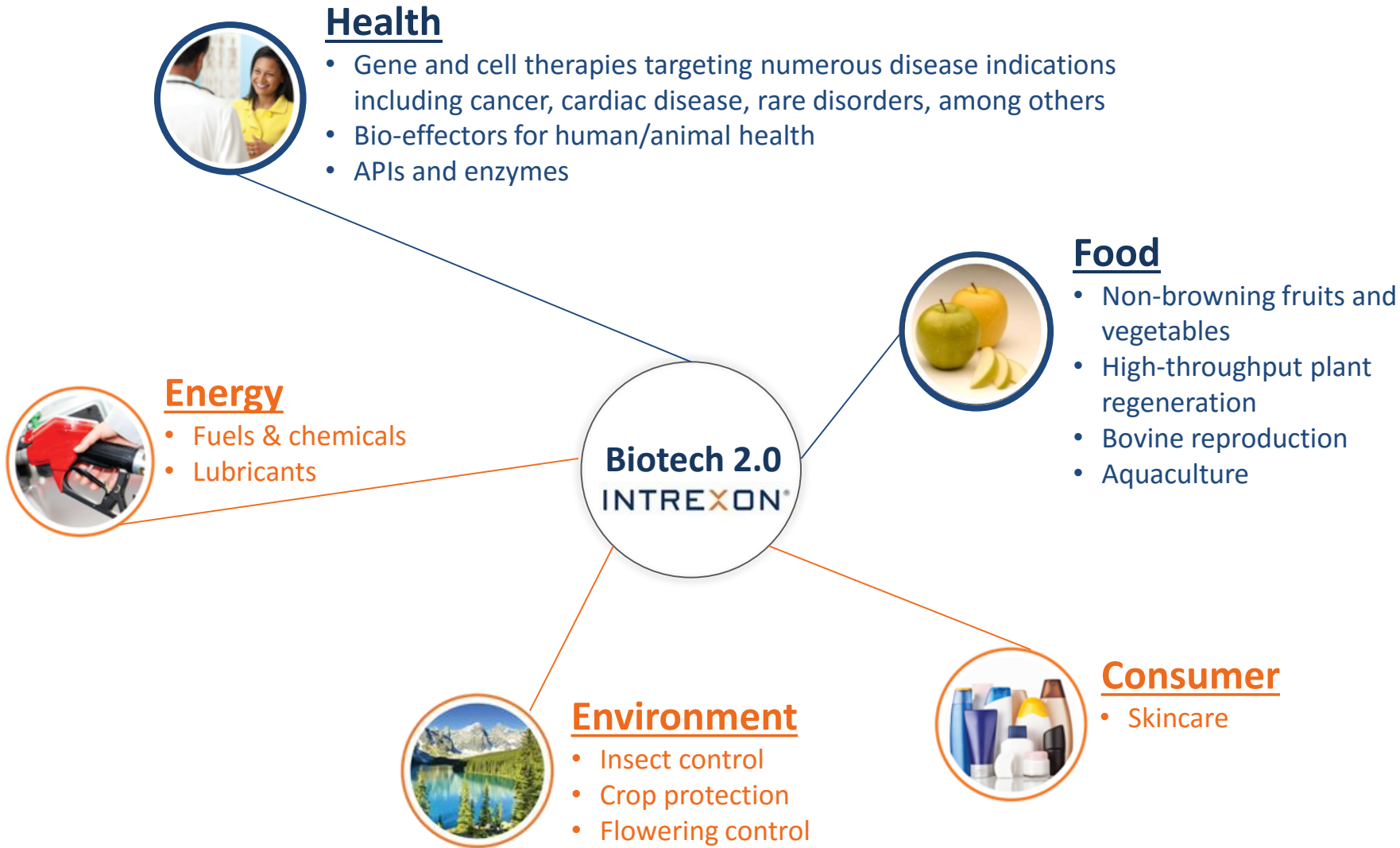
- 1. Overpopulation**
- 2. Pollution**
- 3. Global Warming**
- 4. Climate Change**
- 5. Genetic Modification**

- 6. Ocean Acidification**
- 7. Water Pollution**
- 8. Deforestation**
- 9. Acid Rain**
- 10. Ozone Depletion**

# Population Growth Increases Requirements



# Expanding Biotechnology's Reach and Impact



# Broad Application of Innovative Arctic® Solution

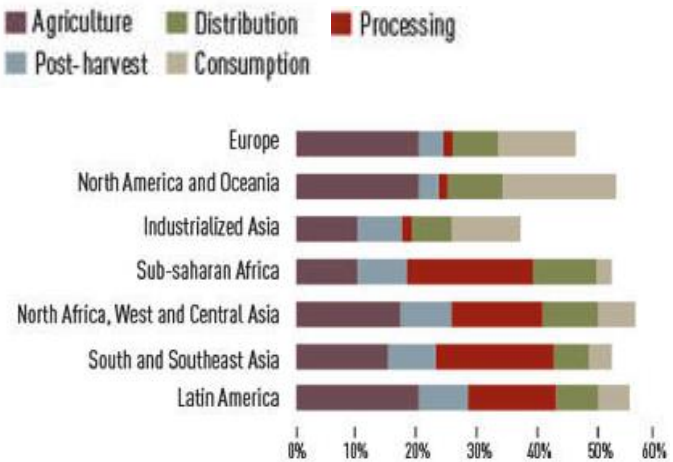
**45%**  
**FRUIT & VEGETABLES**  
**FOOD LOSSES**

Along with roots and tubers, fruit and vegetables have the highest wastage rates of any food products; almost half of all the fruit and vegetables produced are wasted.

- Unique Arctic Advantage™ solution creates benefits for commercial tree fruit varieties & vegetables across the entire supply chain – from growers to consumers – reducing food waste
- First target is apples, 40% of which are wasted – much from superficial bruising & browning



**3.7 Trillion Apples**



# Biosustainable Aquaculture

Lead Product: AquAdvantage® Salmon represents the first biotechnology solution to enter \$150 billion aquaculture market

*Atlantic salmon grown in land-based facilities in **half the time** with **one-quarter less feed** and **no vaccines/antibiotics** results in **more sustainable production** with **no impact to marine ecosystems***



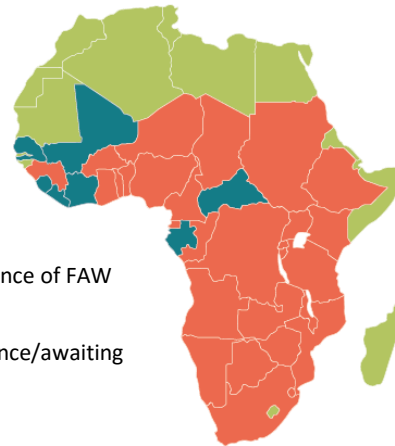
Credit: AquaBounty Technologies



# ICP: Targeted Biological Control of Ag Pests

*Intrexon Crop Protection Achieves Milestone in Development of Pioneering Self-Limiting Fall Armyworm Solution*  
**October 2017**

**Destructive march of fall armyworm across Africa since arrival in 2016**



- Confirmed presence of FAW
- Suspected presence/awaiting confirmation

**28**  
COUNTRIES

Confirmed presence

**\$14**  
BILLION

Estimated loss of maize, sorghum, rice, and sugarcane as of Apr 2017

UP TO  
**67%**  
CROP LOSS

Due to fall armyworm in Ghana alone

*Oxitec's Innovative Solution to Tackle Growing Diamondback Moth Pest Issue Begins Field Trials*  
**September 2017**



Animal and Plant Health Inspection Service  
**Finding of No Significant Impact**



DBM is highly invasive pest resistant to many insecticides and *Bt* crops. DBM costs farmers over \$4 billion annually.



Diamondback moth damage on cauliflower in India



Diamondback moth damage on cabbage in NY State

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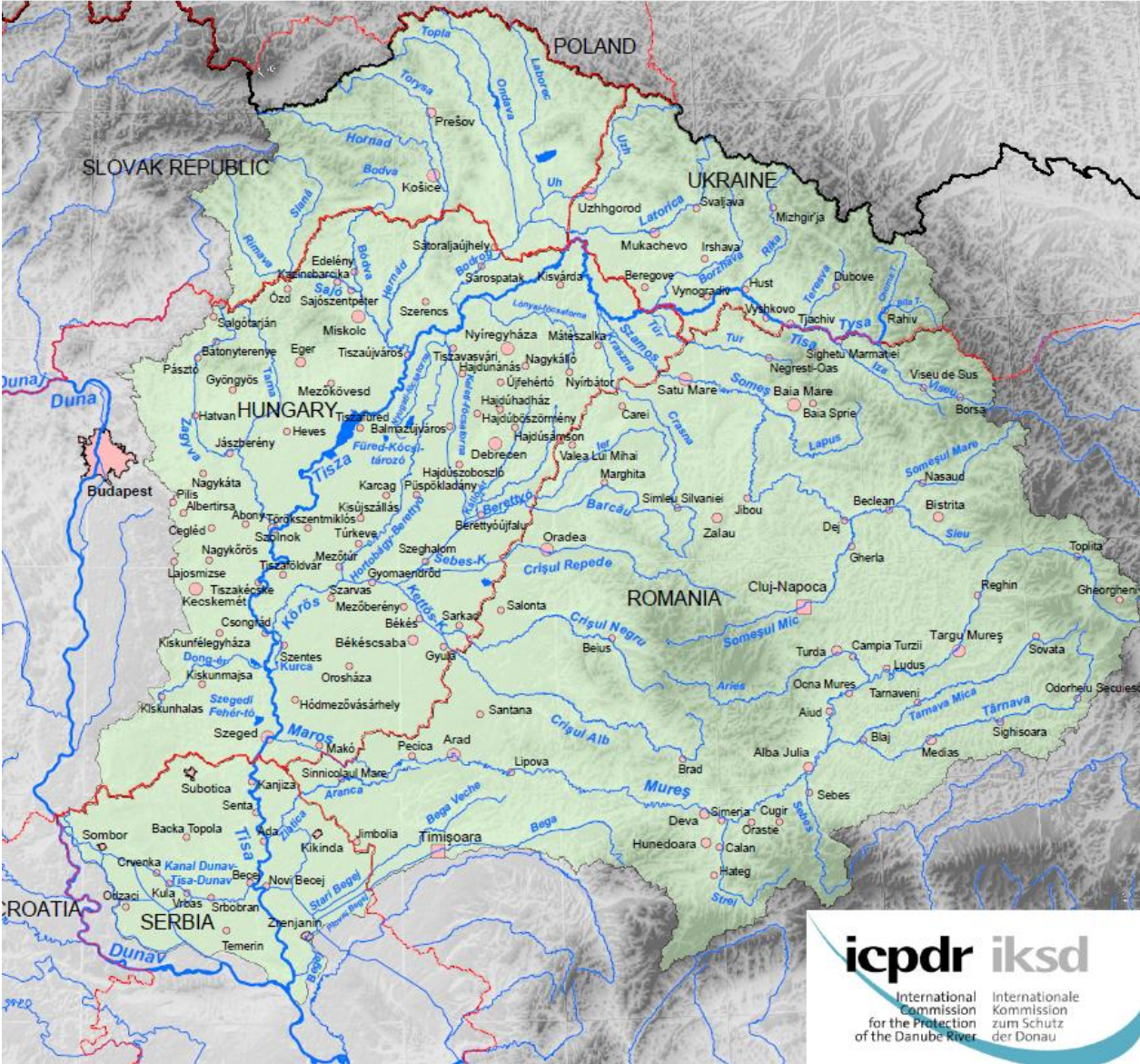
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**Chief of Engineers of the  
United States Army and  
Commanding General of the  
U.S. Army Corps of Engineers**

**INTREXON<sup>®</sup>**



# Shared Vision Planning Project in Tisza River Basin



Water is not just “*nice*” ...  
it’s *essential*.



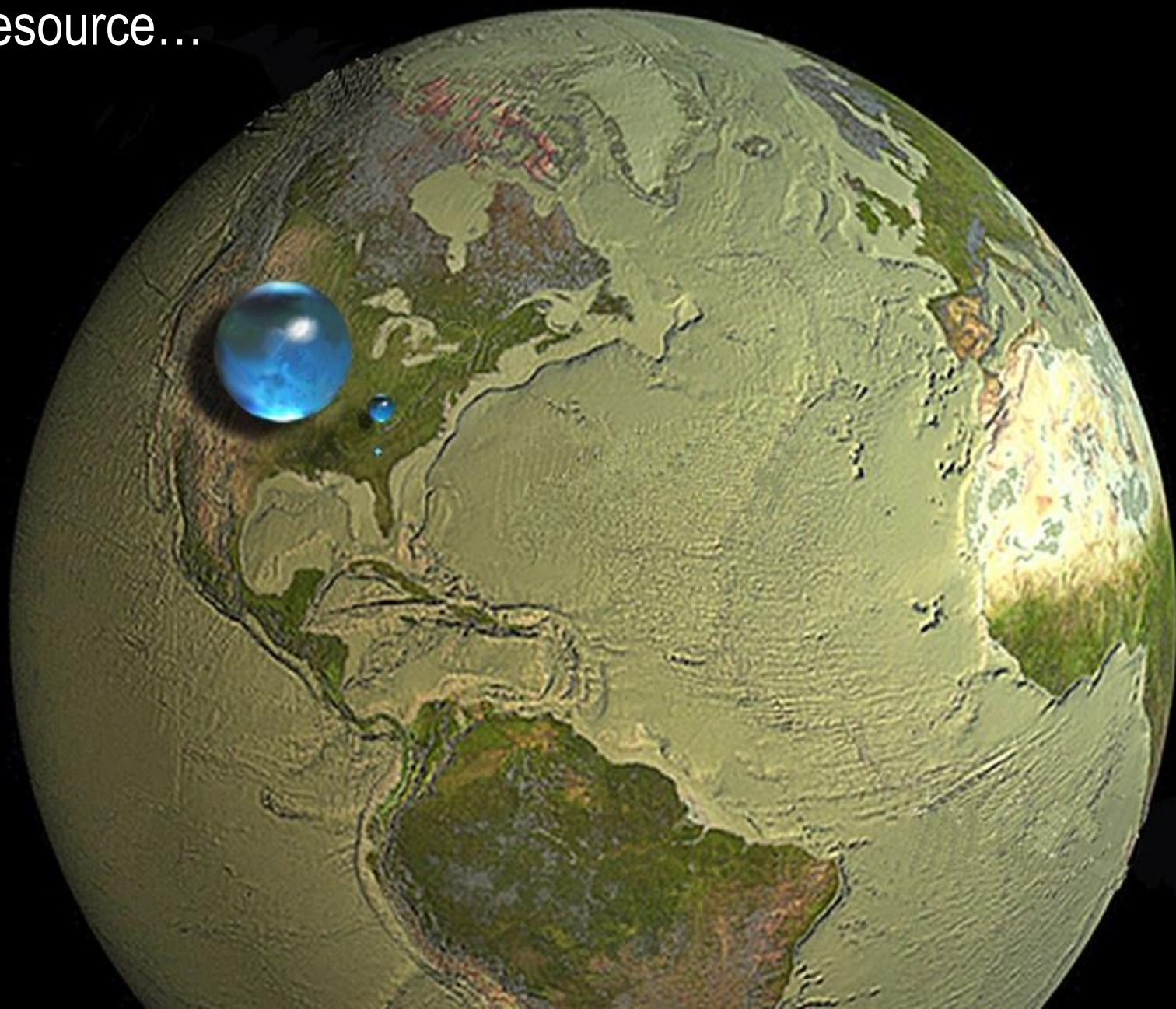
# Why Water?

**Water is a vital resource.** It drives our economy, our society, our culture, and is critical for our very survival. **Water is an important in all parts of the world and, unlike other natural resources, water has no substitute**

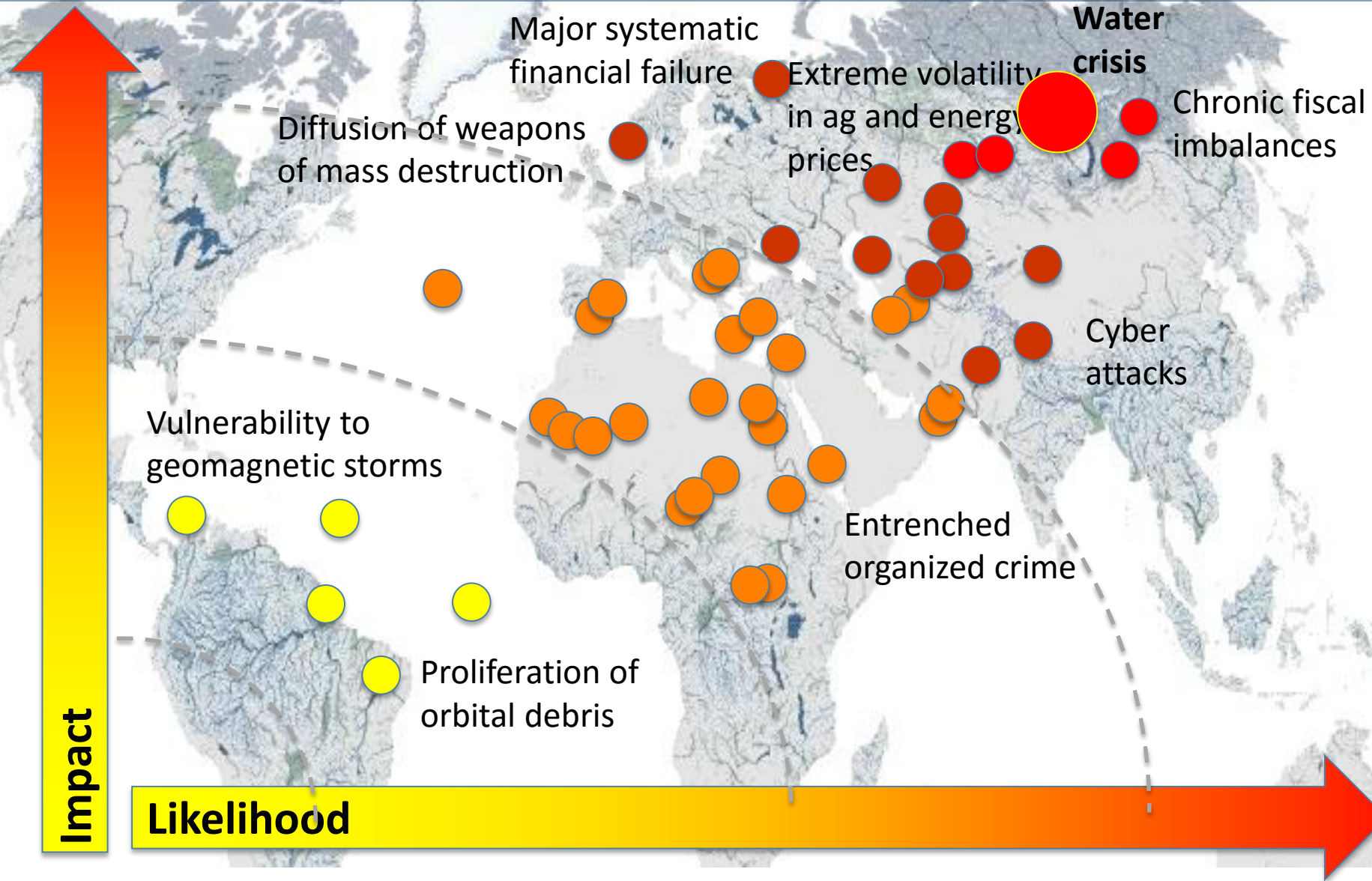
# Water Security

The **capacity of a population to safeguard sustainable access to adequate quantities of and acceptable quality water** for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability. (UN Water)

A scarce resource...



# The highest global risk...





# WATER SCARCITY



WATER USE HAS BEEN GROWING AT MORE THAN TWICE THE RATE OF POPULATION INCREASE IN THE LAST CENTURY

INCREASE IN WATER WITHDRAWALS BY 2025

50%

DEVELOPING COUNTRIES

18%

DEVELOPED COUNTRIES

By 2025, 1.8 billion people will be living in countries or regions with absolute water scarcity, and two-thirds of the world population could be under stress conditions

## People

- 663 million people are still without access to clean drinking water
- 8 out of 10 people without access to clean water live in rural areas.
- 159 million people use untreated water from lakes and rivers, the most unsafe water source there is.



# Bloomberg

**Disaster Declared in 26 States as Drought  
Sears U.S.**



Worst drought in decades  
could affect U.S. energy  
markets



**REUTERS**

**Worst drought in decades hits  
Brazil's Northeast**

**CNNMoney**  
A Service of CNN, Fortune & Money

**2030: China's coming water  
crisis**

December 14, 2012: 10:43 AM ET

**U.S. NEWS** on **NBCNEWS.com**

**'Wake-up call': Chicago set to break 73-  
year-old snowless record**

THE EXPRESS  
**TRIBUNE**  
WITH THE International Herald Tribune

**'Water scarcity could cost Pakistan its future'**

By Our Correspondent Published: January 2, 2013

**theguardian**

Drought pushes  
Mississippi river water  
levels to historic low

**KMEG14** **FOX44** **SIUXLAND  
NEWS.COM**

**Drought Burns  
Livestock Industry**

**The Des Moines Register**

Iowa crop losses soar past \$1 billion

**Bloomberg**

**U.S. Drought Persisting Seen  
as Threat to Corn, Soybeans**

**U.S. NEWS** on **NBCNEWS.com**

**Drought still grips Corn Belt – dry winter  
adds to farmers' fears**

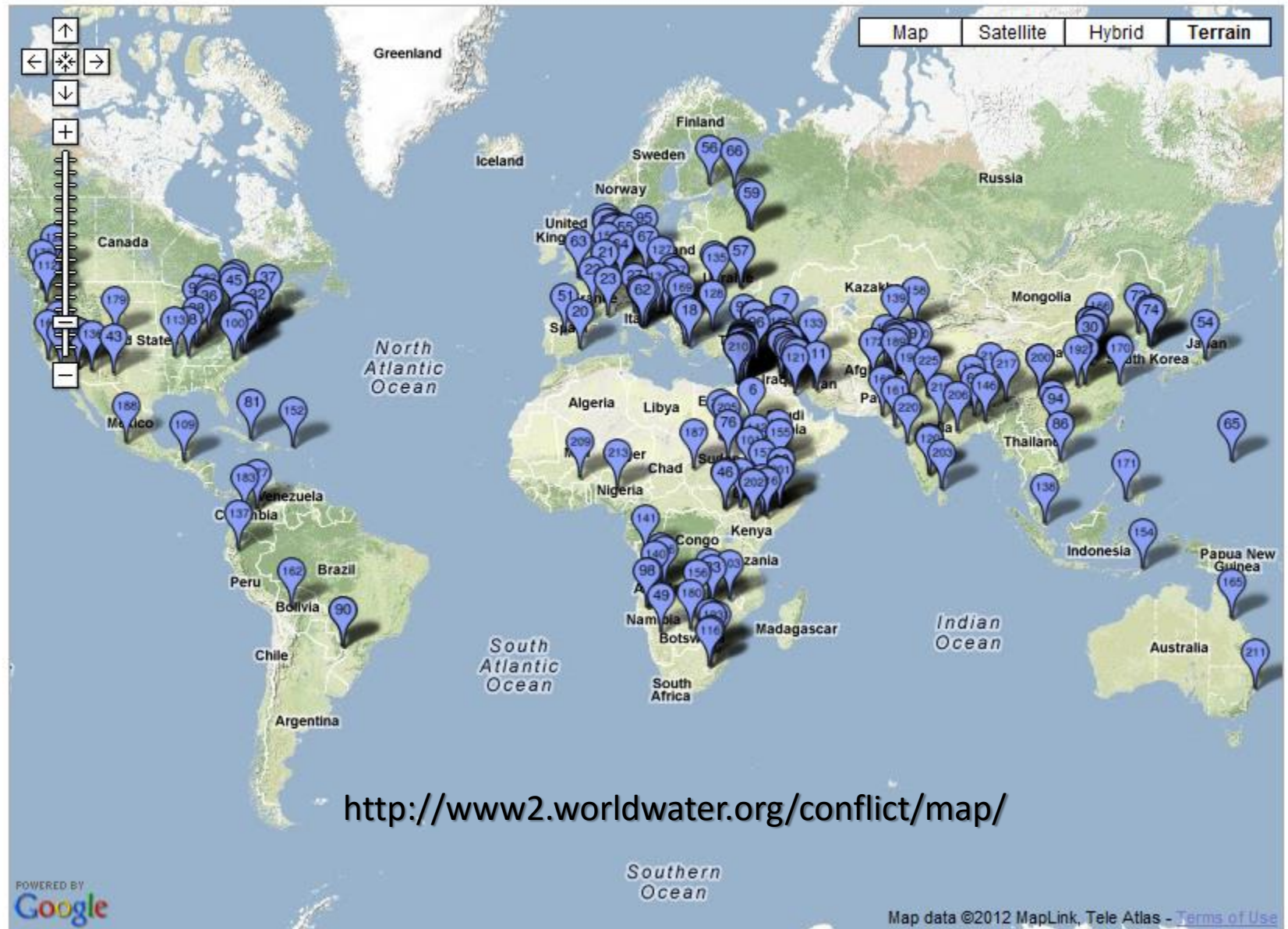
# Newsweek

**THE WORLD WILL SOON BE AT  
WAR OVER WATER**

James Fergusson 4/24/15

# Water Conflict Chronology Map

Region  Conflict Type  Date Range  Search



Yemen's civil war leaves millions without access to drinking water

In Somalia, dozens killed in local land and water dispute

Islamic State shuts off water flow below Ramadi Dam

Ukrainian town loses water supply

Revolutionary forces in Colombia blow up a water treatment facility

Terrorists bomb main water pipe into Aleppo, Syria

Syrian rebel groups cut off water supply to Damascus

Saudi Arabia destroys a water bottling plant in Yemen; kills dozens

Small Peruvian town protests company's groundwater pumping

Russian Federation forces bomb water treatment facility in Aleppo, Syria

Iranian border guards open fire on Afghan villagers accessing river water

Threats to cut off supply of water in northwestern Tunisia

Scarce water supplies in drought regions of India spark violence

Rioting and looting over energy and water cuts in Venezuela

Protests against the building of dams on the Brahmaputra River in India

Riots over water in Bangalore, India

Severe drought sparked "water riots" in Northern KwaZuluNatal

18 killed and 200 injured after reopening of the Munak canal, India

Armed guards clash with farmers over drought struck region of Bundelkhand

Islamic State fighters destroy pipeline that provides water for eastern Mosul, Iraq



Pacific  
Institute



Global Water Security  
INTELLIGENCE COMMUNITY ASSESSMENT  
ICA 2012-08, 2 February 2012  
This is an IC-coordinated paper.

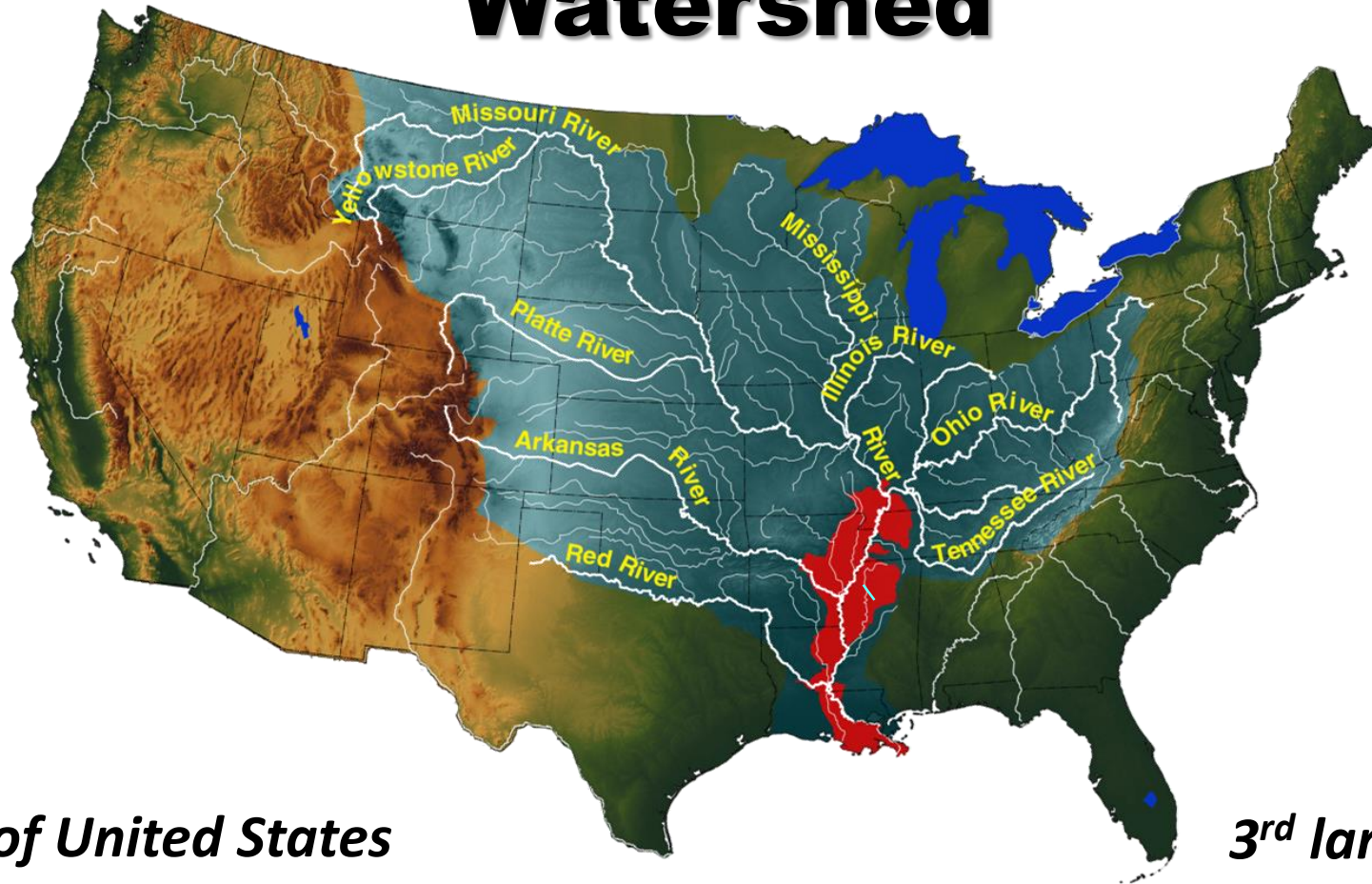
Many countries important to the United States will experience water problems—shortages, poor water quality, or floods—that will risk instability and state failure, increase regional tensions, and distract them from working with the United States on important US policy objectives.

Between now and 2040, fresh water availability will not keep up with demand

Water problems will hinder the ability of key countries to produce food and generate energy, posing a risk to global food markets and hobbling economic growth.

As a result of demographic and economic development pressures, North Africa, the Middle East, and South Asia will face major challenges coping with water problems.

# World's Largest “Naturally” Navigable Watershed



*41% of United States  
drainage flows through  
the heartland of the nation*

*3<sup>rd</sup> largest  
watershed  
in the world*

# Mississippi River Flood 1927



**Result: ~500 dead; 700,000 displaced; 137,000 buildings destroyed; \$347M in damages; 27,000 sq. miles (70,000 km<sup>2</sup>) flooded**

**Mississippi River Commission abandons “levees only” policy, creates “room for the river”**



# resilience

/rə'zilyəns/

**noun**

1. the capacity to recover quickly from difficulties; toughness.
2. the ability of a substance or object to spring back into shape; elasticity.



# Mississippi River & Tributaries Project

## Levees & floodwalls



## Floodways

- Atchafalaya
- Bonnet Carré
- Birds Point-New Madrid
- Morganza



## Channel Improvement & Stabilization



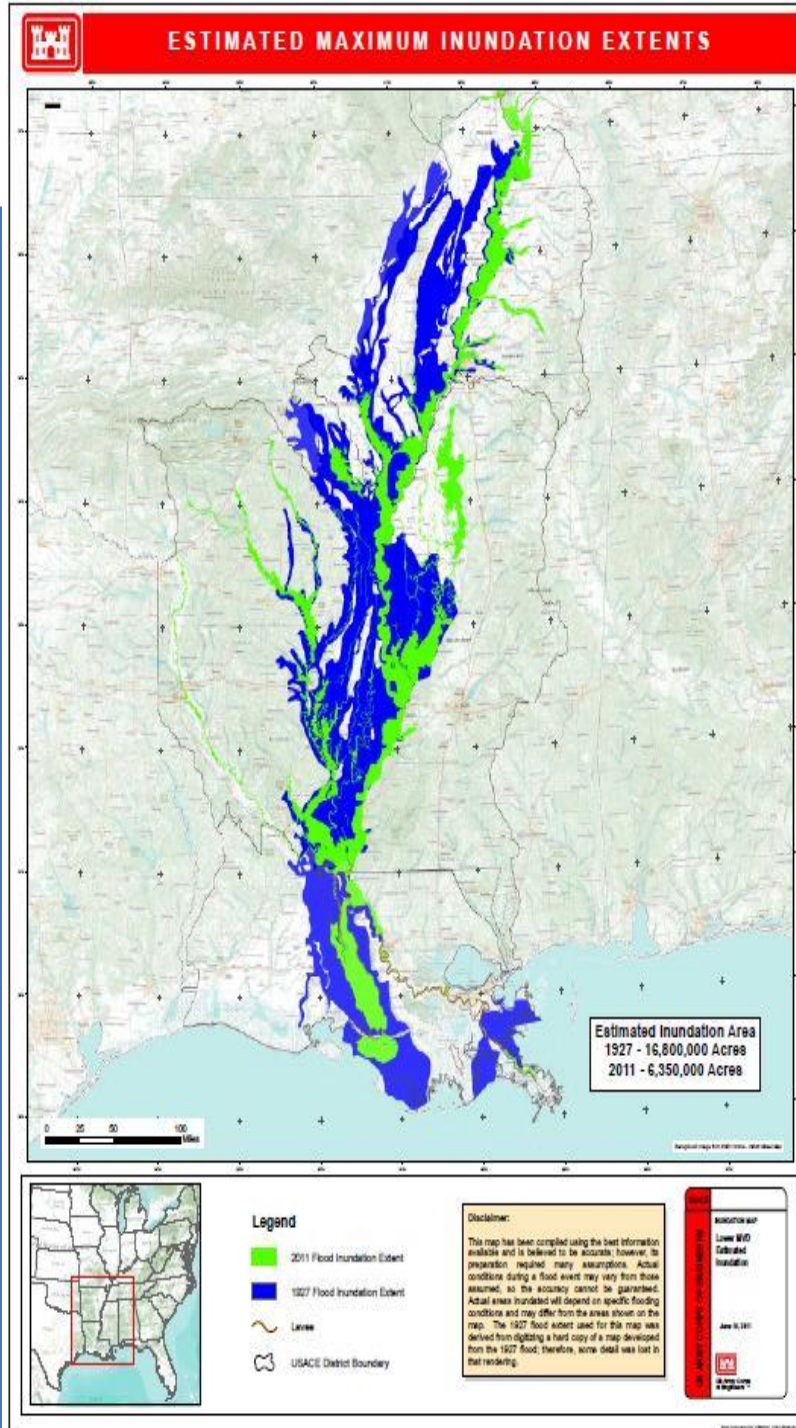
## Tributary Basin Improvements



# Flooded Areas

## 1927 Flood vs 2011 Flood

- 1927: 26,000 square miles flooded
- 2011: 9,900 square miles flooded, per system design
- Over 16,000 square miles not flooded in 2011 because of system
- 1927: 700,000 people evacuated
- 2011: 9,900 people evacuated
- 1927: Over 500 people killed
- 2011: About 20 people killed
- New stages and flood records set in 2011 over much of lower Mississippi River basin





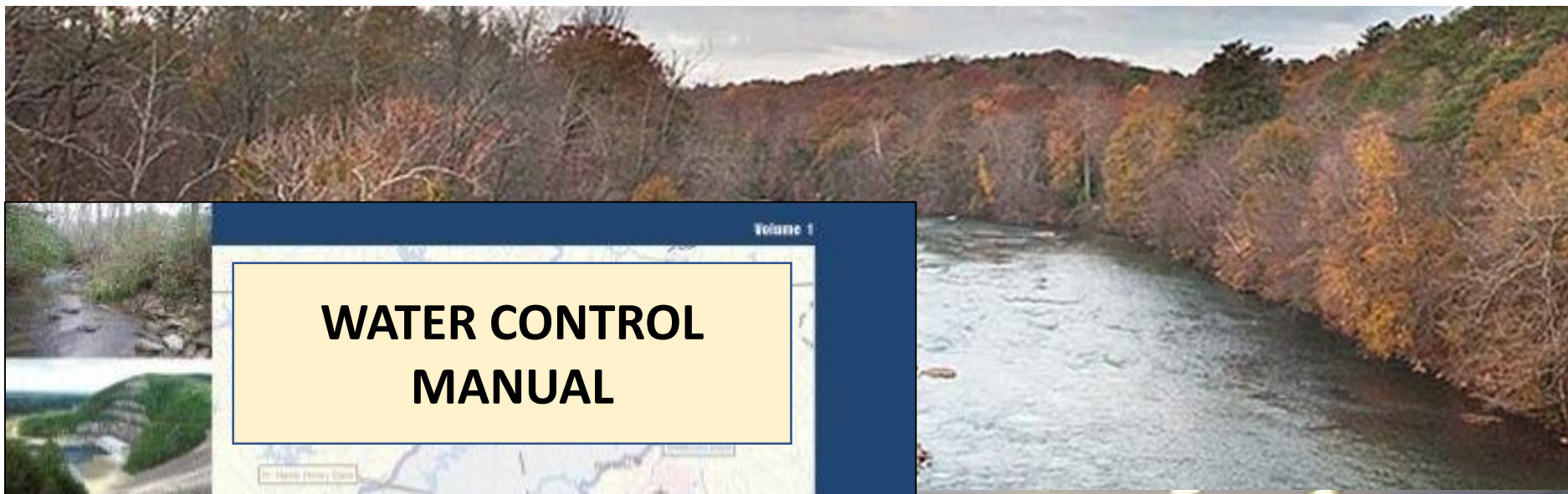
**Mississippi River Record Low Water  
2012**

# Atlanta, Georgia



Alabama sides with Florida against Georgia in water wars





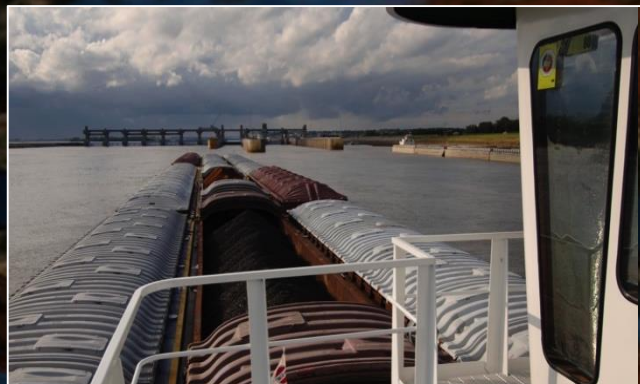
Volume 1

# WATER CONTROL MANUAL





# *Interagency and International Governance at Watershed and Systems*



# The Good News

**It is now widely acknowledged that there is enough water on Earth for all, even in areas where temporary shortages may exist. Clearly, the current water “crisis” is not a crisis of scarcity but a crisis of mismanagement...**



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