

# WHAT WILL WASHINGTON'S WATERS LOOK LIKE IN THE YEAR 2040?

---

Rachael Paschal Osborn  
WA-AWRA Annual Meeting  
September 26, 2013

# Outline

## Baseline

Population Growth

Climate Change Impacts on Water

Historic Water Mis-Management

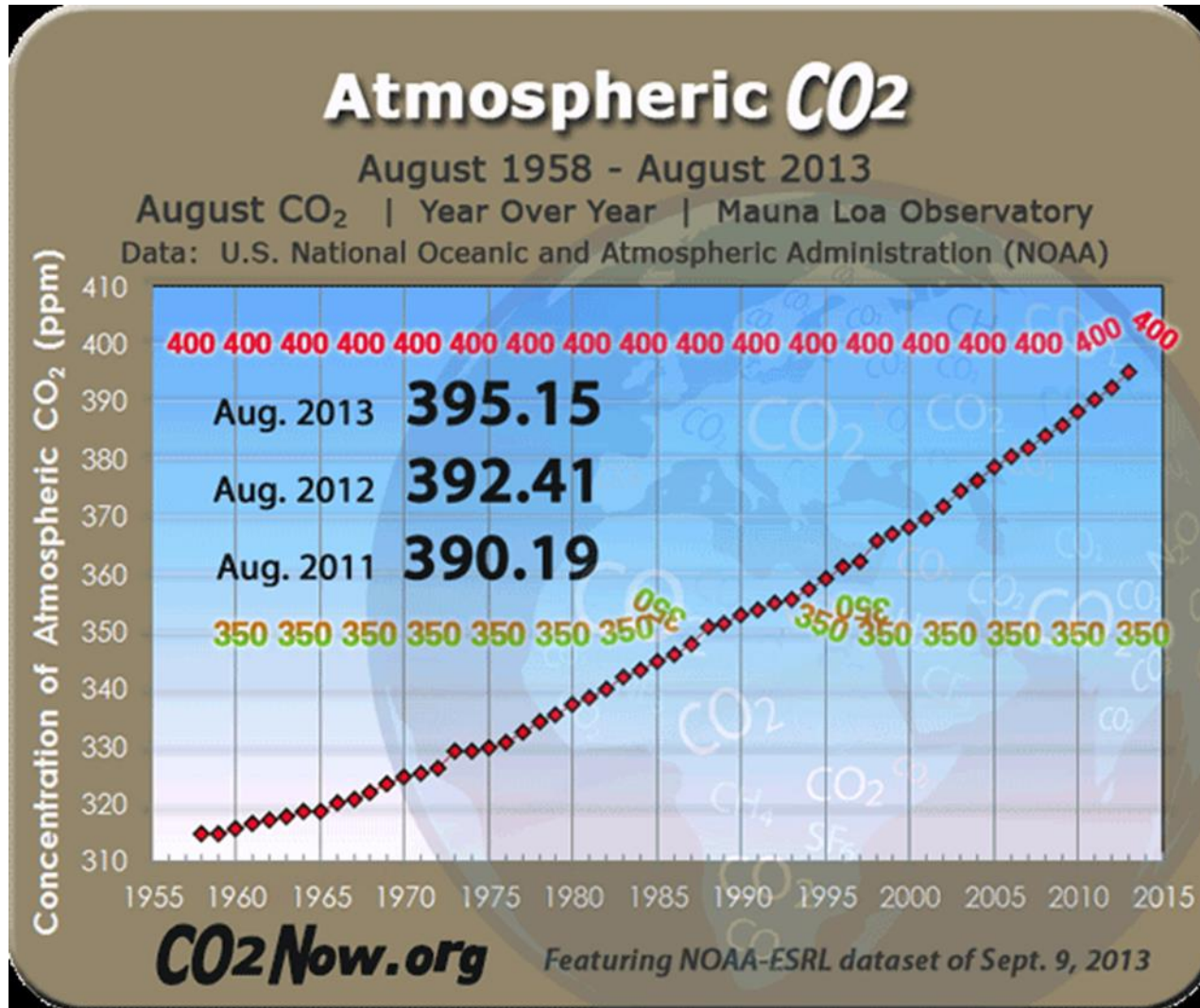
## Trending

The Columbia River Treaty

The Stevens Treaties

Water Law Reform

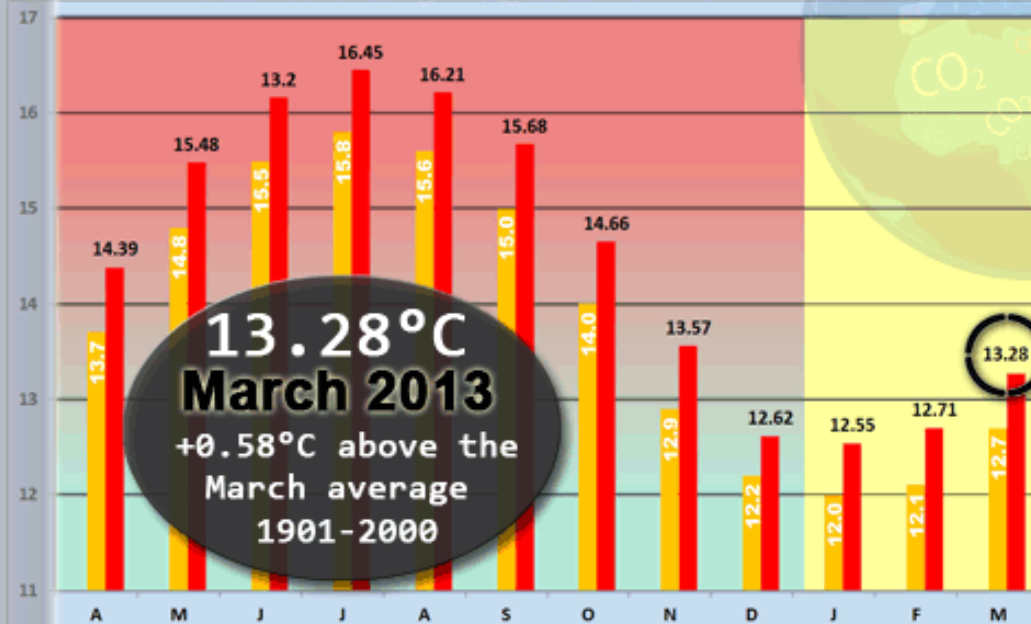
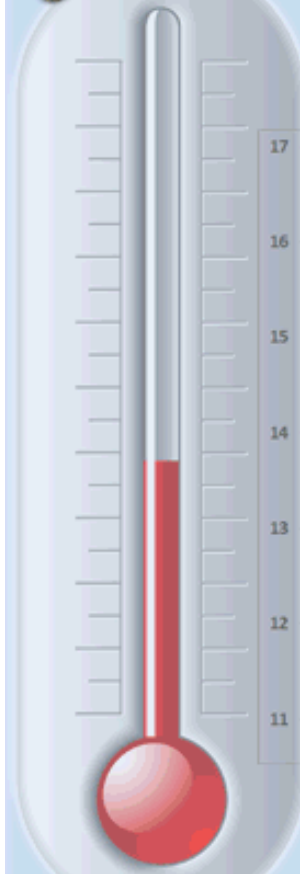
# Climate Change



CO2Now.org

# March 2013 Global Temperature

Earth's average surface temperature (land and sea)  
Data retrieved April 22, 2013 from NOAA - NCDC

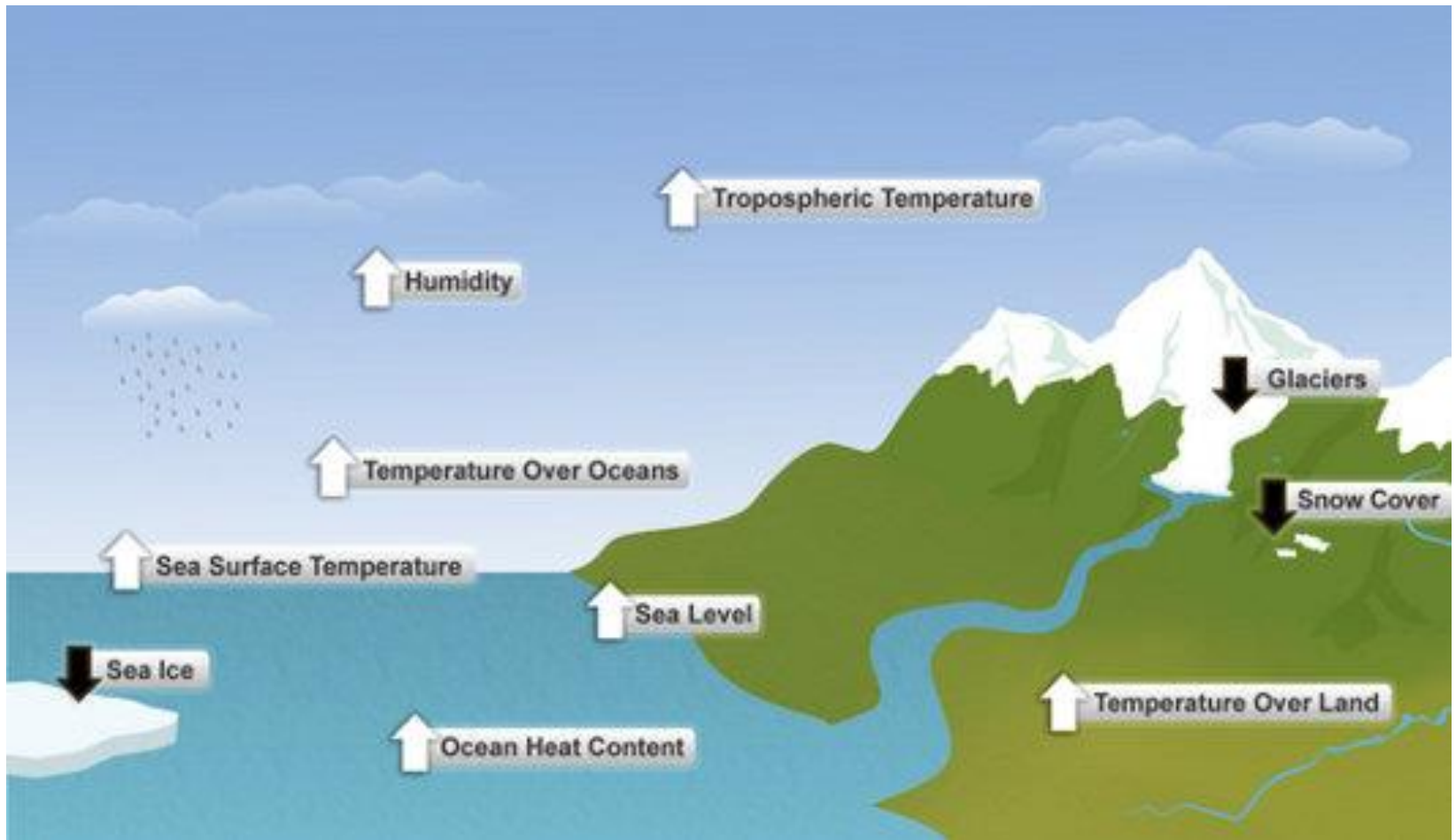


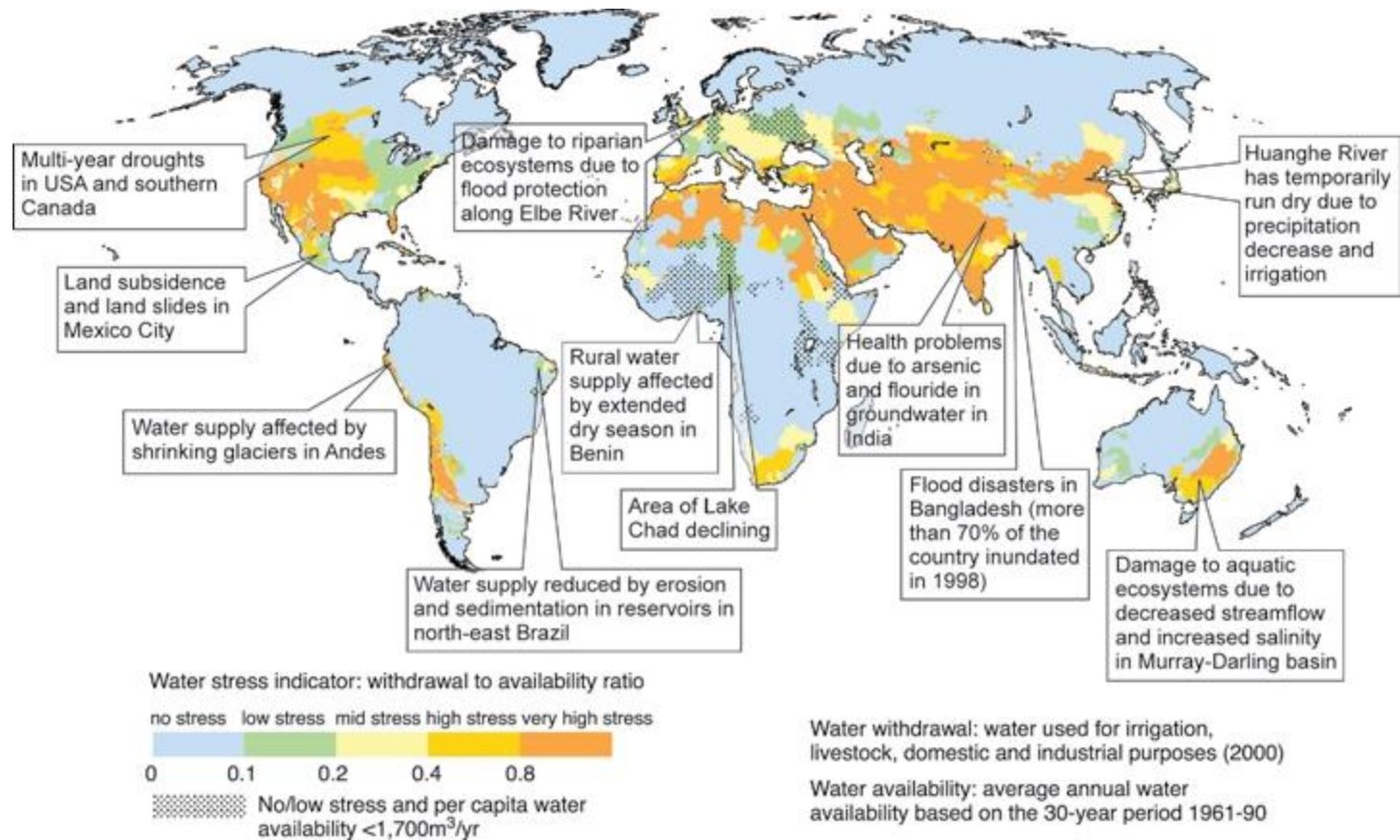
**April 2012 - March 2013 (red bars)**

**1901 - 2000 monthly average (yellow bars)**

March 2013 & 2006 are tied as the 10th warmest March since 1880

# 10 Indicators for a Warming World





# Non-Stationarity

- The outer boundaries of climate extremes are changing; we can no longer rely on past climate events (e.g., 10-, 50- and 100-year floods) to predict future events

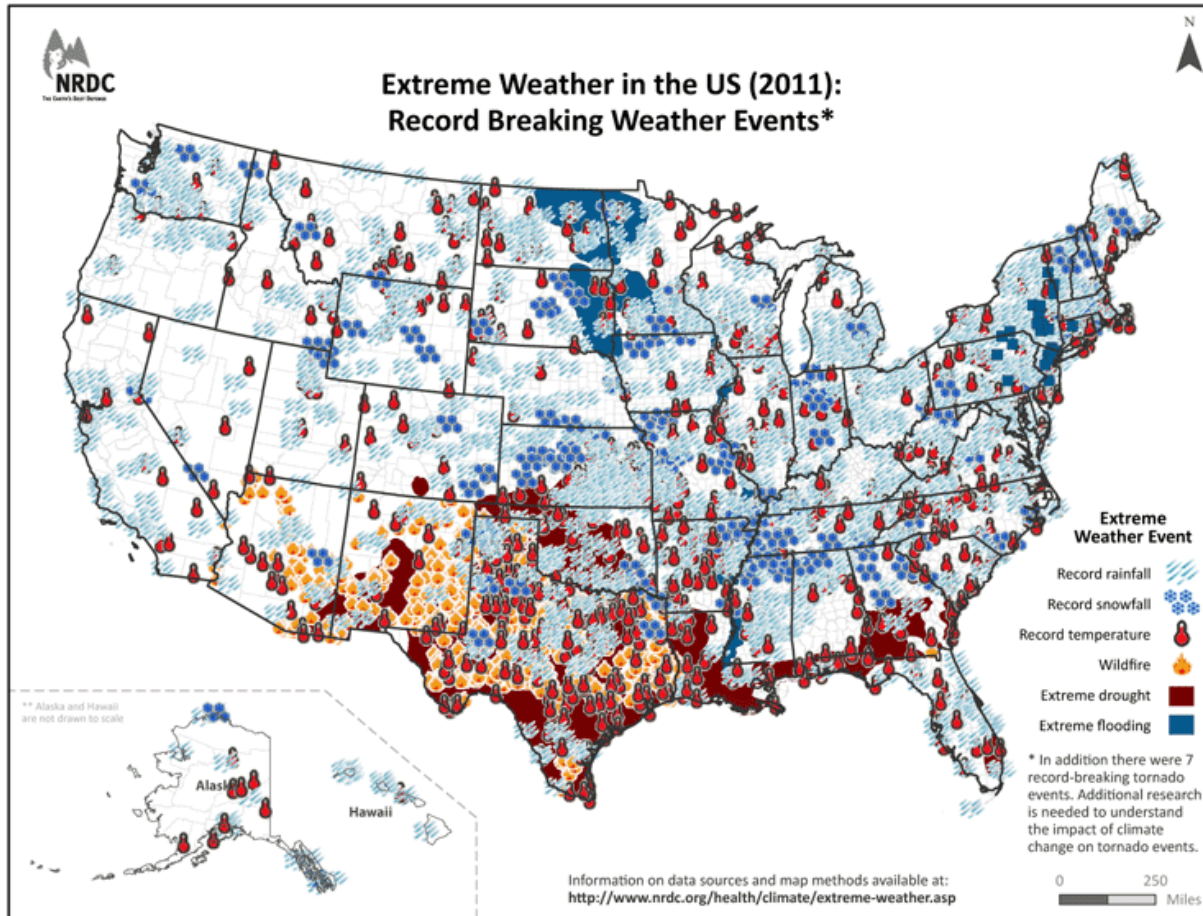
# Non-Stationarity

- The outer boundaries of climate extremes are changing; we can no longer rely on past climate events (e.g., 10-, 50- and 100-year floods) to predict future events.
- “Past performance is not indicative of future results”



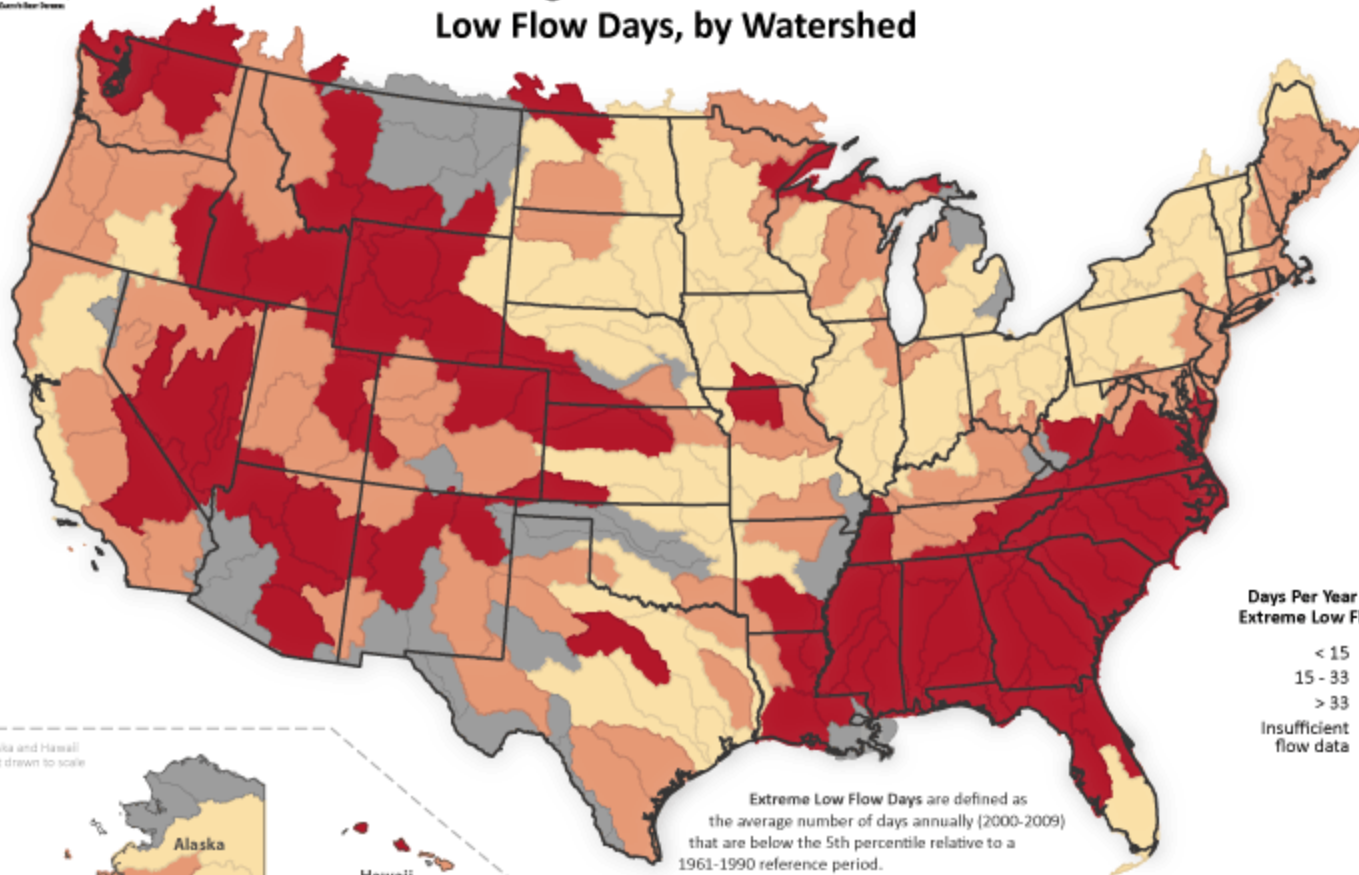
# Climate Change

- In the
- Less v





# Drought Vulnerability in the US, 2000-2009: Average Number of Extreme Low Flow Days, by Watershed



**Days Per Year of  
Extreme Low Flow**

< 15	Light Yellow
15 - 33	Orange
> 33	Dark Red
Insufficient flow data	Gray



Extreme Low Flow Days are defined as  
the average number of days annually (2000-2009)  
that are below the 5th percentile relative to a  
1961-1990 reference period.

- USGS monitoring stations were excluded if:
- 1) Greater than 75% of the reference period data was missing or;
  - 2) Greater than 75% of the 2000-2009 analysis period was missing or;
  - 3) Greater than 8 (out of 10) analysis period years were missing.



# Sea Level Rise





# Sea Level Rise



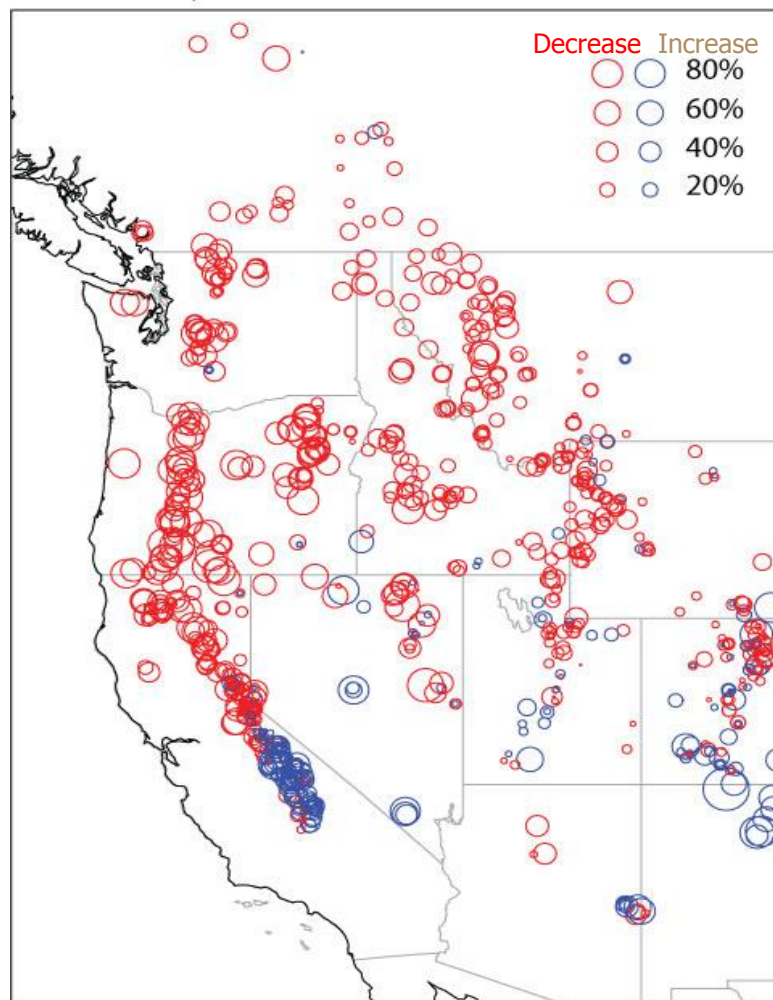
# Sea Level Rise



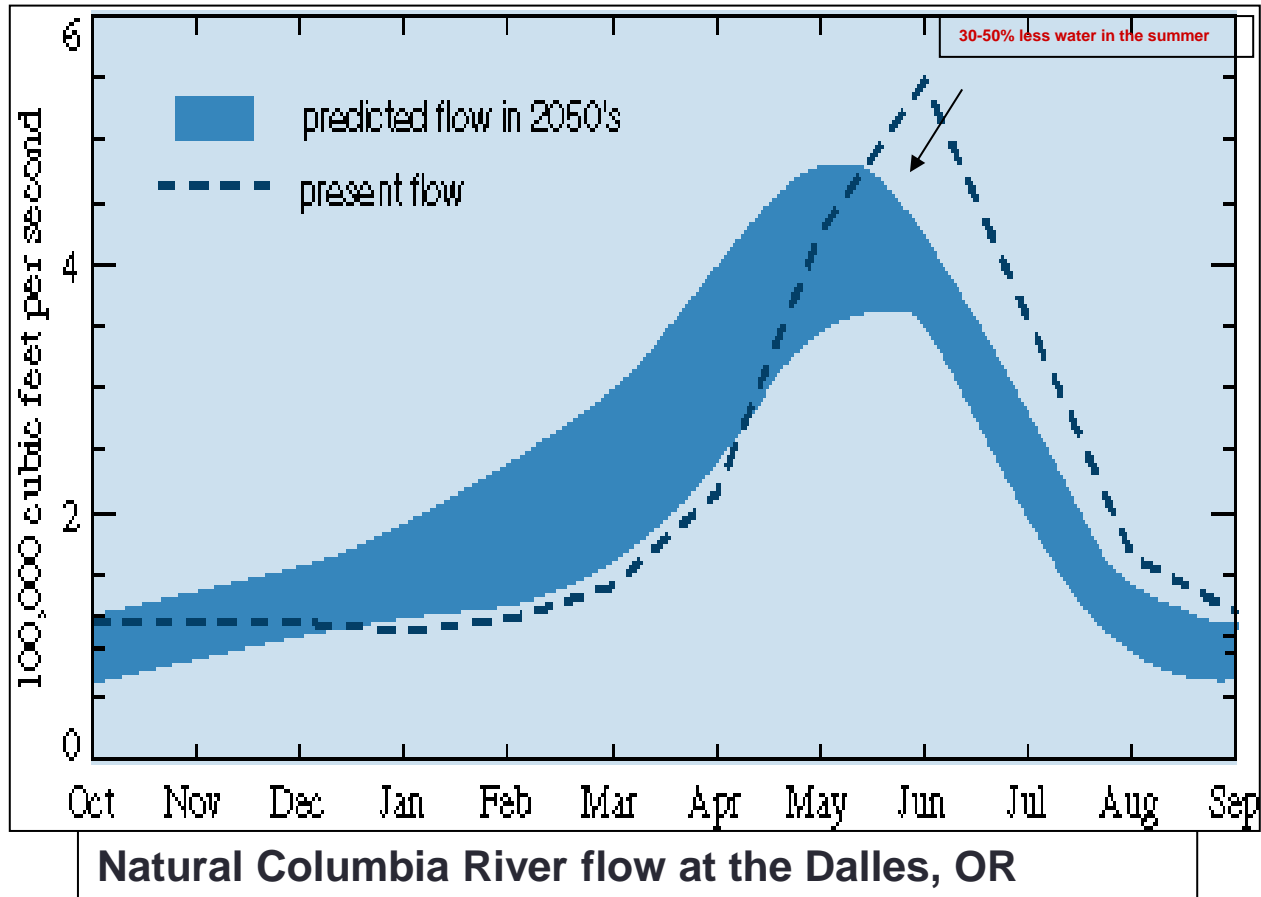
# Snow Water Equivalent Change

- ▶ Snow water equivalent: most PNW stations showing a decline in April 1 SWE

a. April 1 SWE Observations 1950-1997



Less snow, earlier melt means larger spring floods and lower flows during summer months.



National Assessment Synthesis Team, US  
Global Change Research Program (2000)

# Population Growth

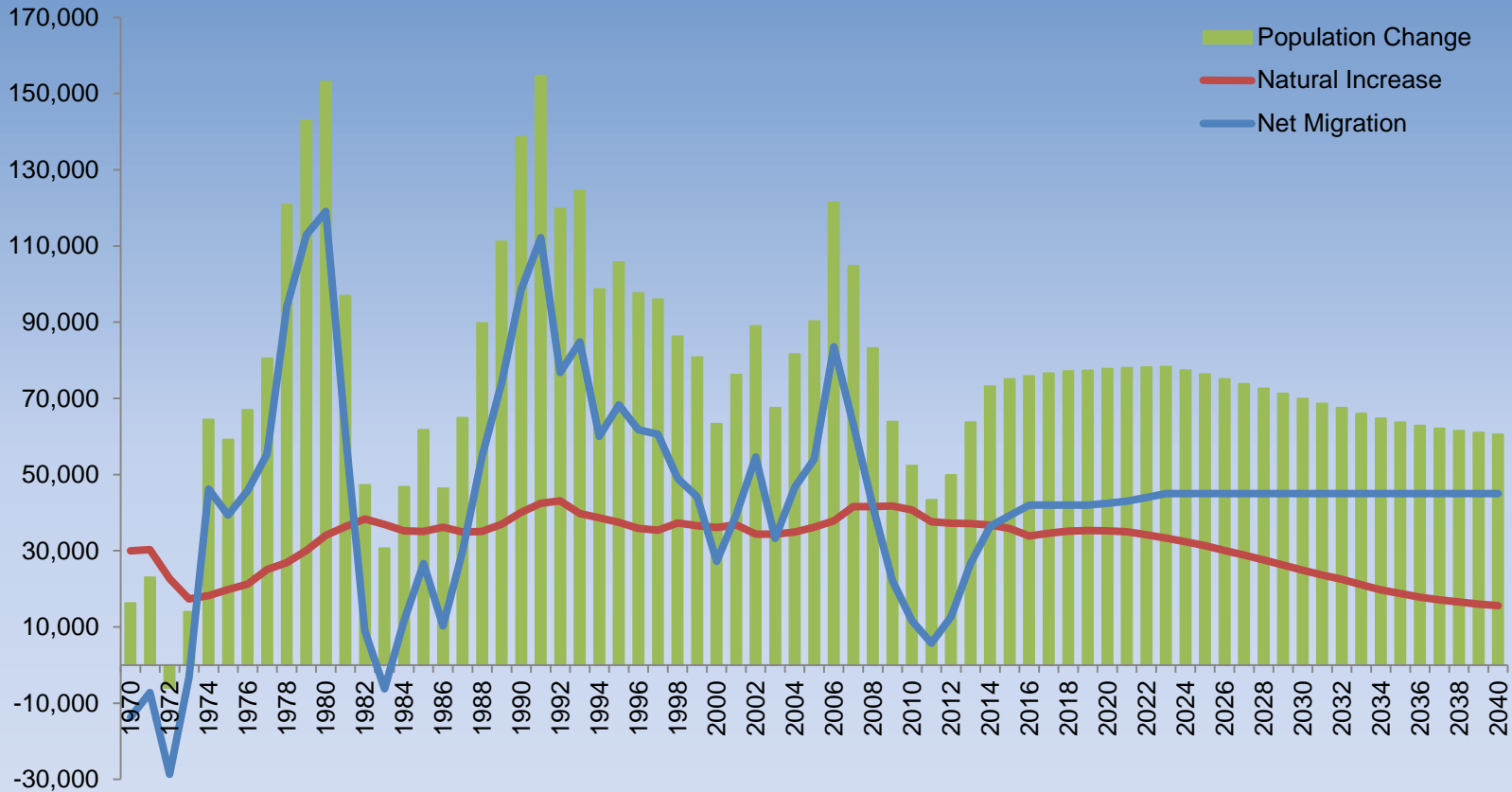
- OFM predicts an increase, from 2010 to 2040, of 2.1 million people.

Decade	Population		Births	Deaths	Natural Increase	Net Migration
2010	6,724,540		840,630	460,369	380,261	450,136
2020	7,414,437		898,840	540,039	358,801	331,096
2030	8,165,376		976,369	672,430	303,939	447,000
2040	8,804,150		1,035,618	846,844	188,774	450,000

WA OFM 2013



# Components of Population Change

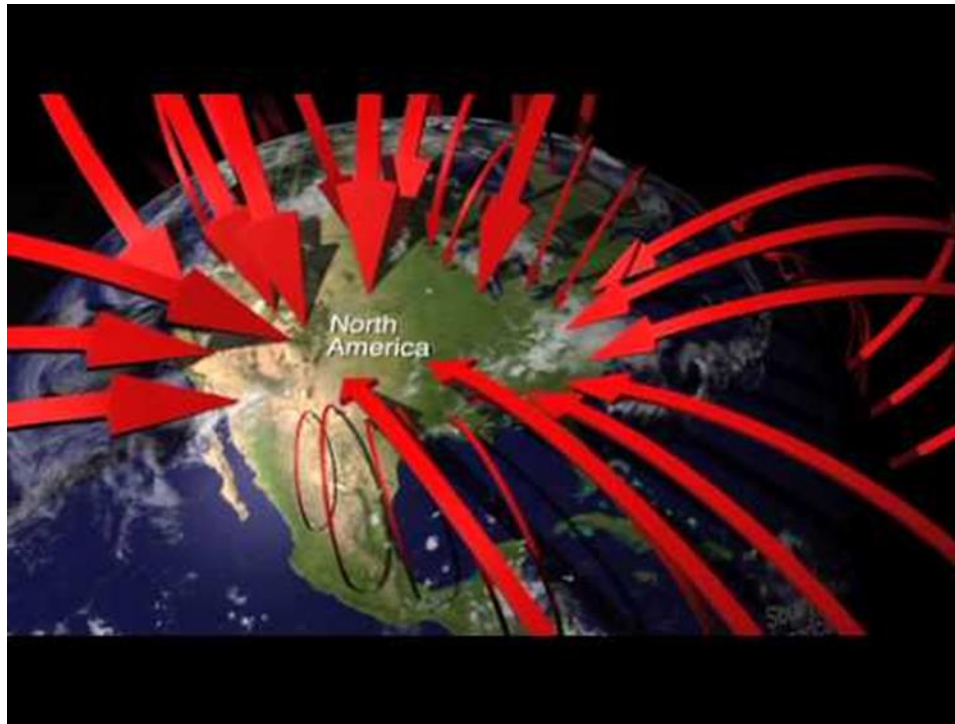


Natural increase is expected to decline from a level of 40,700 in 2010 to 15,600 by 2040. Migration will remain the main contributor to state population growth into the foreseeable future.



# Population Growth

- Climate refugees moving north



# New York (2012)





# New Orleans 2005

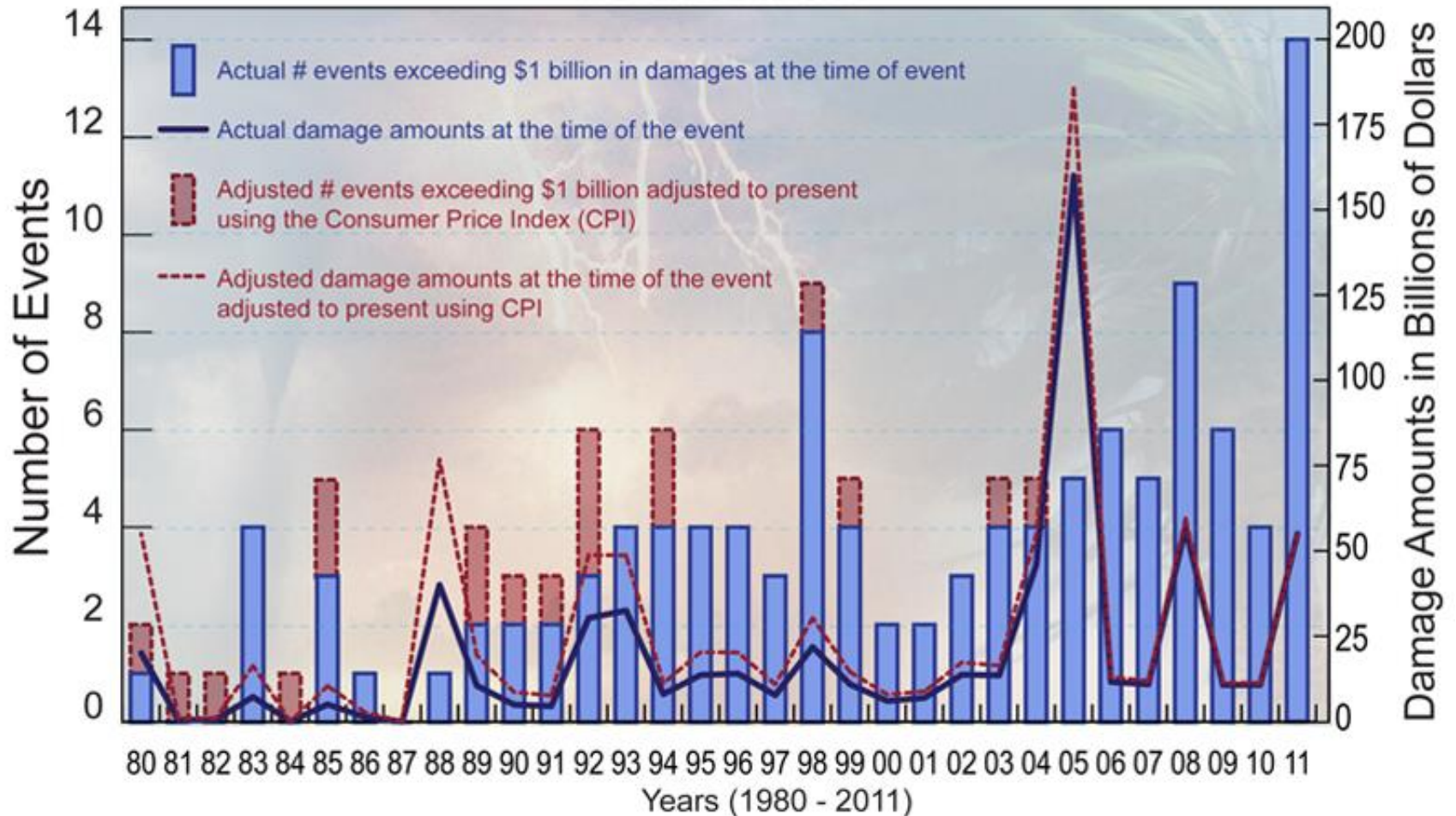




# Billion Dollar Weather/Climate Disasters

1980 - 2011

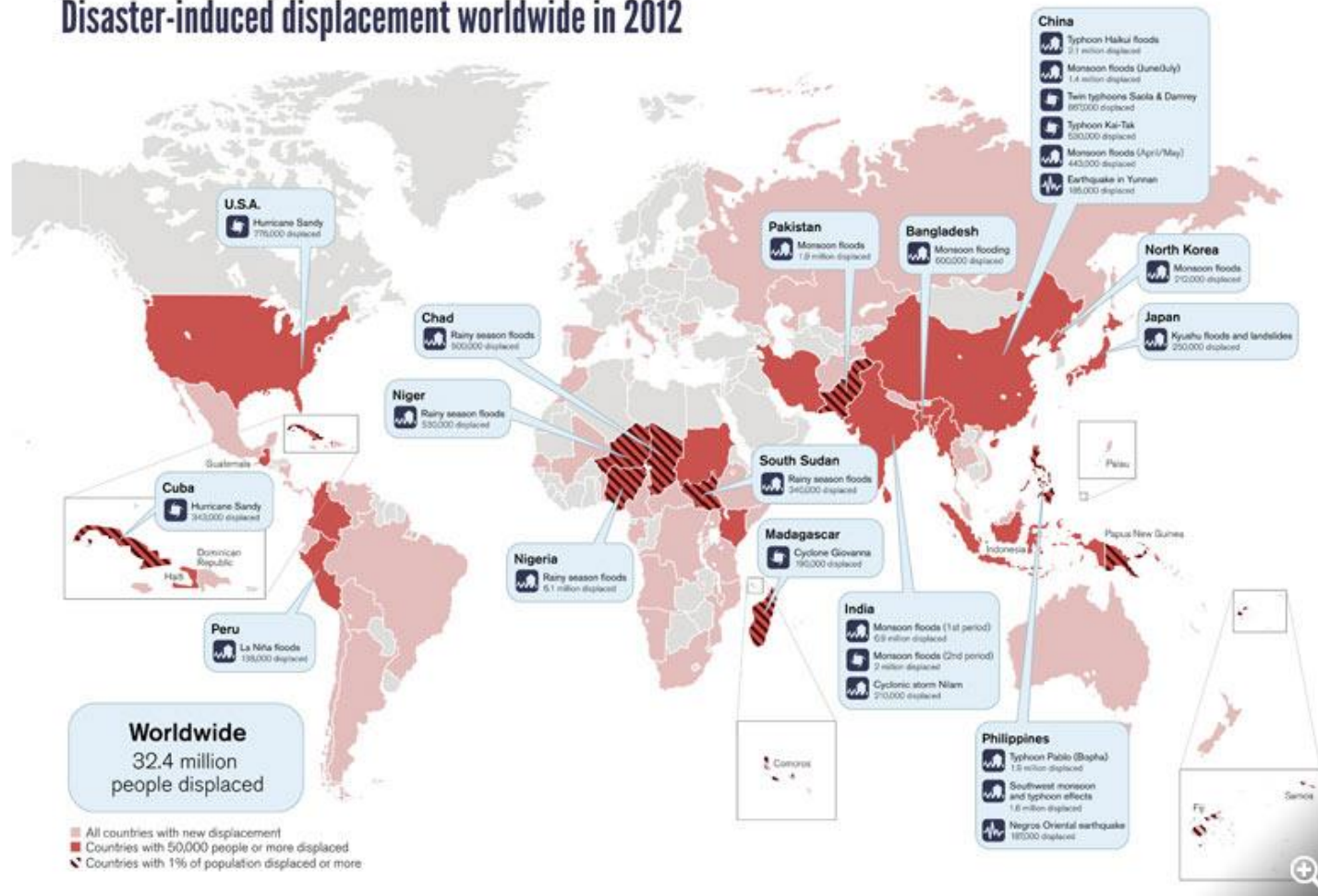
NOAA/NESDIS/NCDC





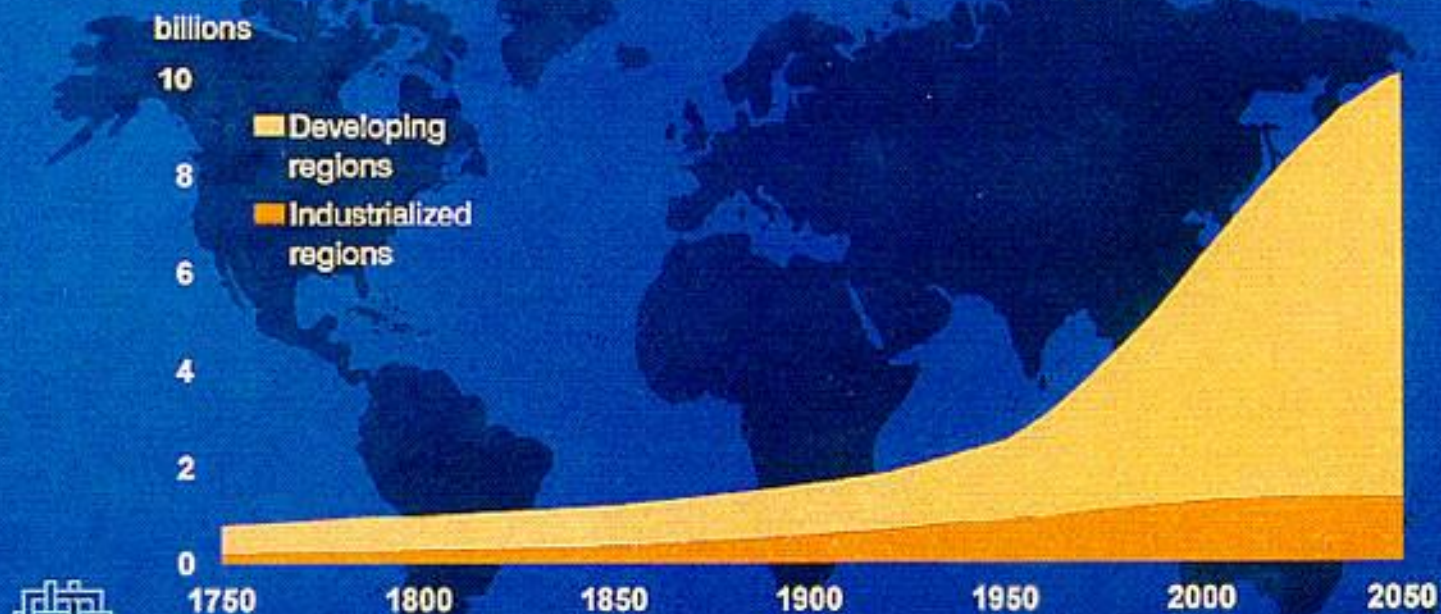
In 2012, 32 million people were displaced by environmental disasters.

## Disaster-induced displacement worldwide in 2012



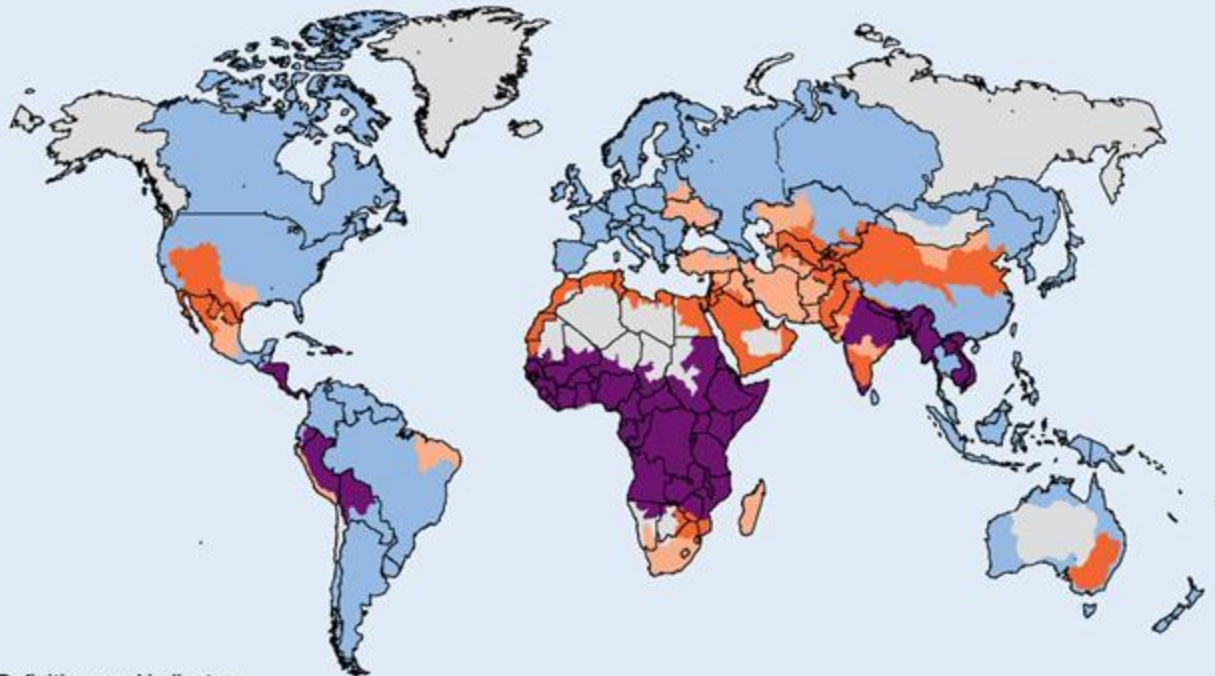
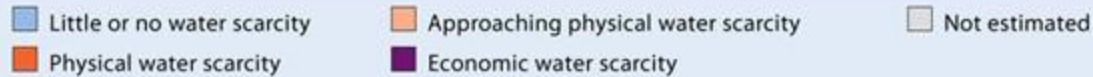
Disaster-induced displacement worldwide in 2012 from the International Displacement Monitoring Centre and Norwegian Refugee Council

# World Population Growth



World  
Resources  
Institute

Sources: United Nations Population Division and Population Reference Bureau, 1993.



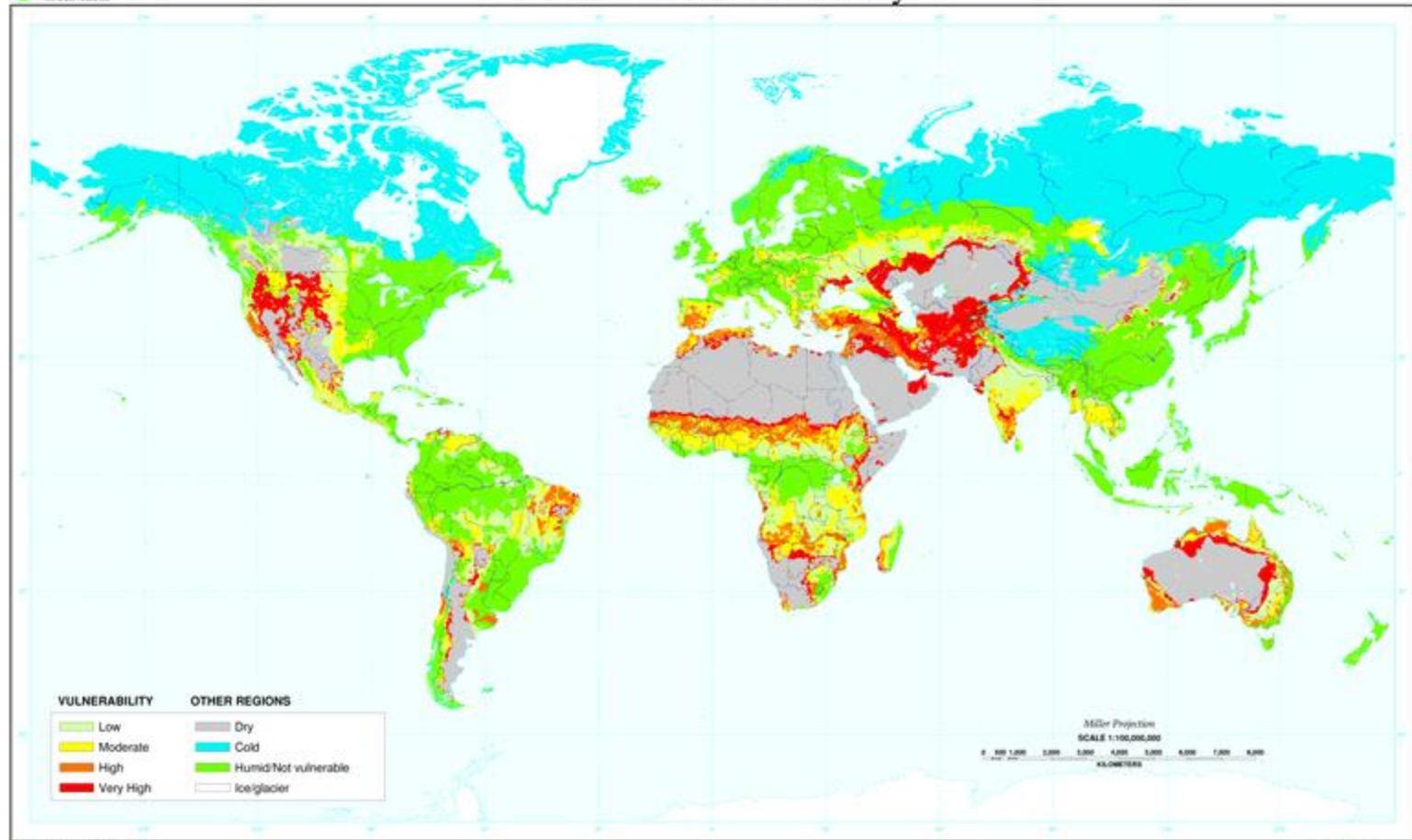
#### Definitions and indicators

- *Little or no water scarcity.* Abundant water resources relative to use, with less than 25% of water from rivers withdrawn for human purposes.
- *Physical water scarcity (water resources development is approaching or has exceeded sustainable limits).* More than 75% of river flows are withdrawn for agriculture, industry, and domestic purposes (accounting for recycling of return flows). This definition—relating water availability to water demand—implies that dry areas are not necessarily water scarce.
- *Approaching physical water scarcity.* More than 60% of river flows are withdrawn. These basins will experience physical water scarcity in the near future.
- *Economic water scarcity (human, institutional, and financial capital limit access to water even though water in nature is available locally to meet human demands).* Water resources are abundant relative to water use, with less than 25% of water from rivers withdrawn for human purposes, but malnutrition exists.

Source: International Water Management Institute analysis done for the Comprehensive Assessment of Water Management in Agriculture using the Watersim model; chapter 2.



## Desertification Vulnerability



# Historic Water Mis-Management

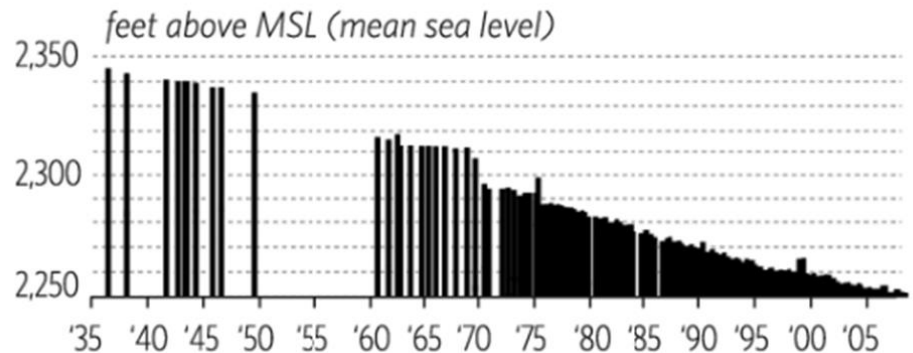
- **Prior Appropriation – “First in time, first in right”**
  - Inequitable
  - Junior users demand “bail-outs”

# Historic Water Mis-Management

- Unsustainable
- Leads to Over-Allocation
  - Inadequate instream flows
  - Aquifer mining

## Water level elevation 1935-2007

### WSU test well water level elevation

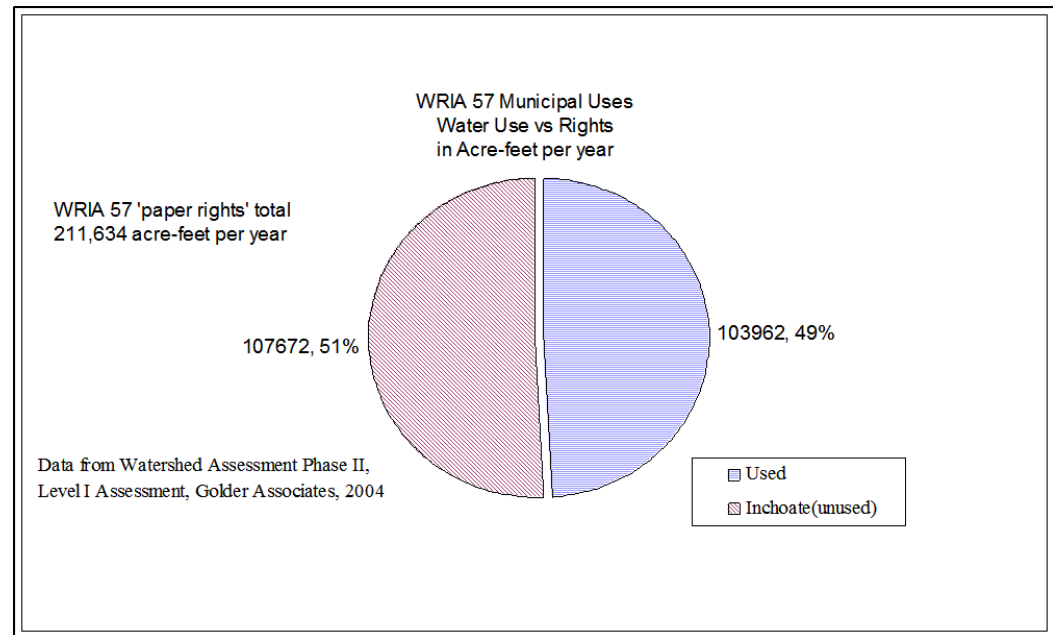


SOURCE: Washington State University

Graphic courtesy of The Spokesman-Review

# Historic Water Mis-Management

- Promotes Water Hoarding
- The “inchoate” problem
  - Claims
  - Municipals
  - Dams never built



# Historic Water Mis-Management

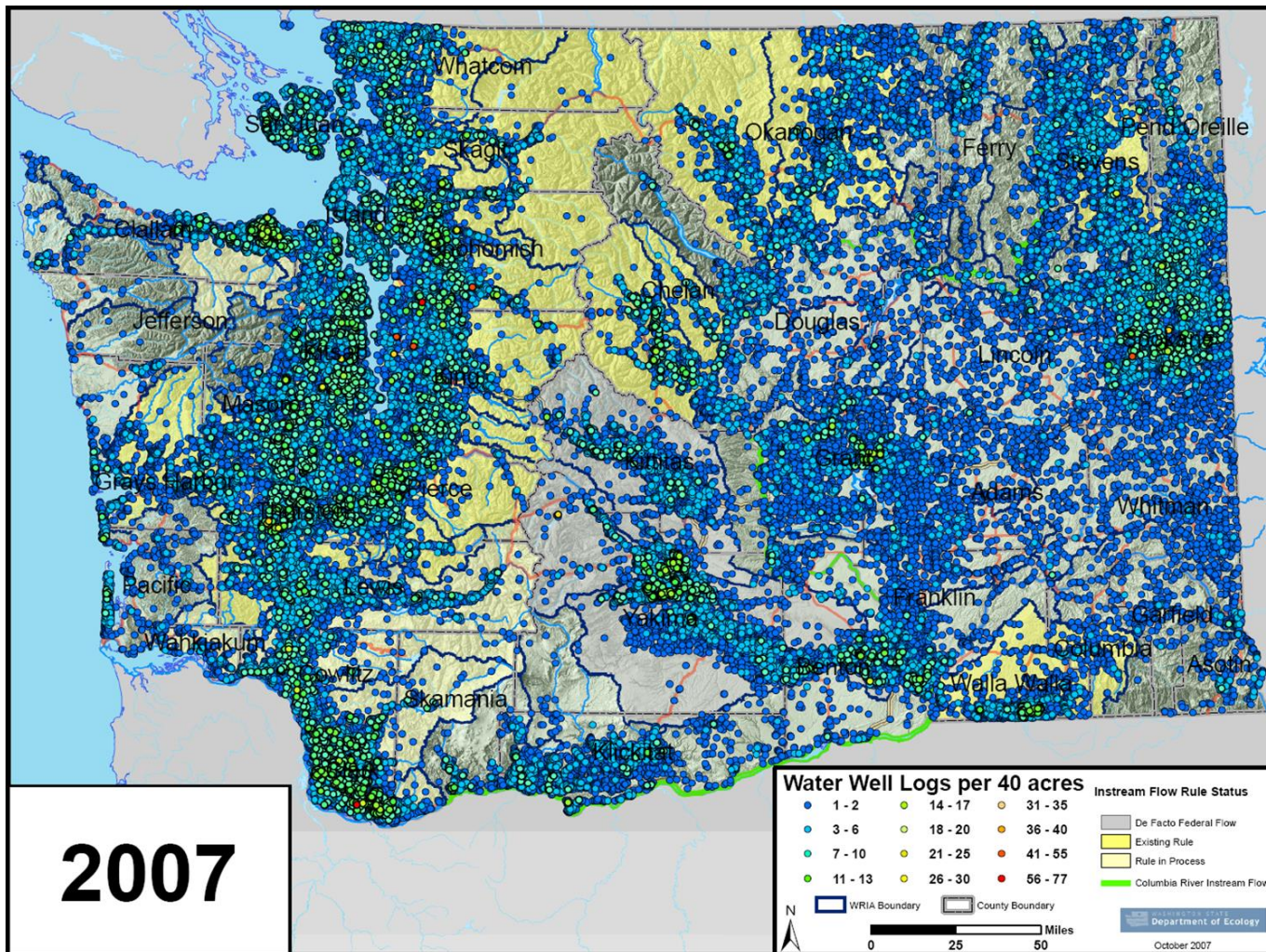
- The exempt well problem
  - No longer de-minimus:
    - Rural sprawl
    - Stockwater loophole
    - Failure of enforcement



Photo: Mike Siegel, Seattle Times



# Washington water wells



# Unlimited stockwater





# Historic Water Mis-Management

- Beneficial Use = Purpose and Efficiency





# Timothy Hay . . .

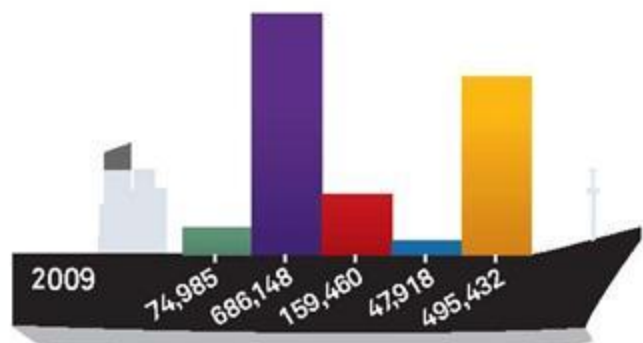
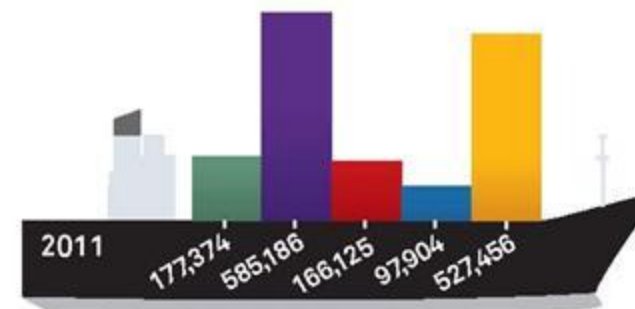
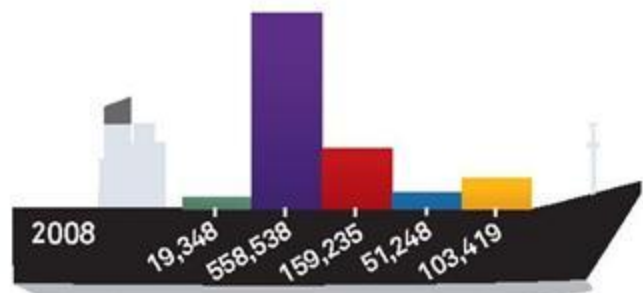
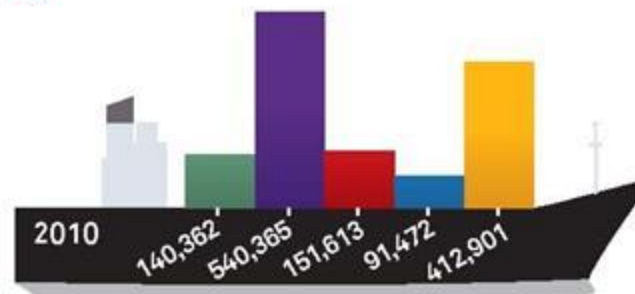
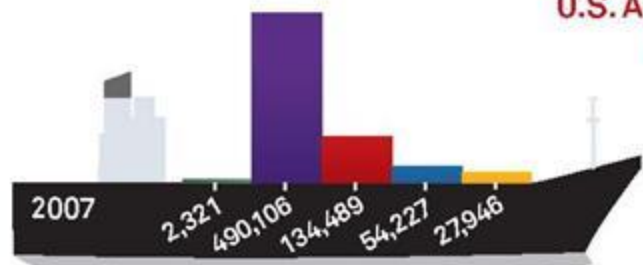


Western Farm Press 2013

# For Japanese racehorses



### U.S. ALFALFA HAY EXPORTS (in metric tons)



SOURCE: USDA-FAS & LIVESTOCK MARKETING INFORMATION CENTER

# Potatoes . . .



wiseGEEK



# For french fries



you say potato. we say profit.

Maximize your margins with Nemco innovation that takes all the labor out of your signature fried potatoes.



**Spiral Fry**  
Model #5553AN



**Chip Twister Fry**  
Model #5553AN-CT



**Wavy Chip Twister Fry**  
Model #5553AN-WCT



**Ribbon Fry**  
Model #5553AN-RF



**Wavy Ribbon Fry**  
Model #5553AN-WRF

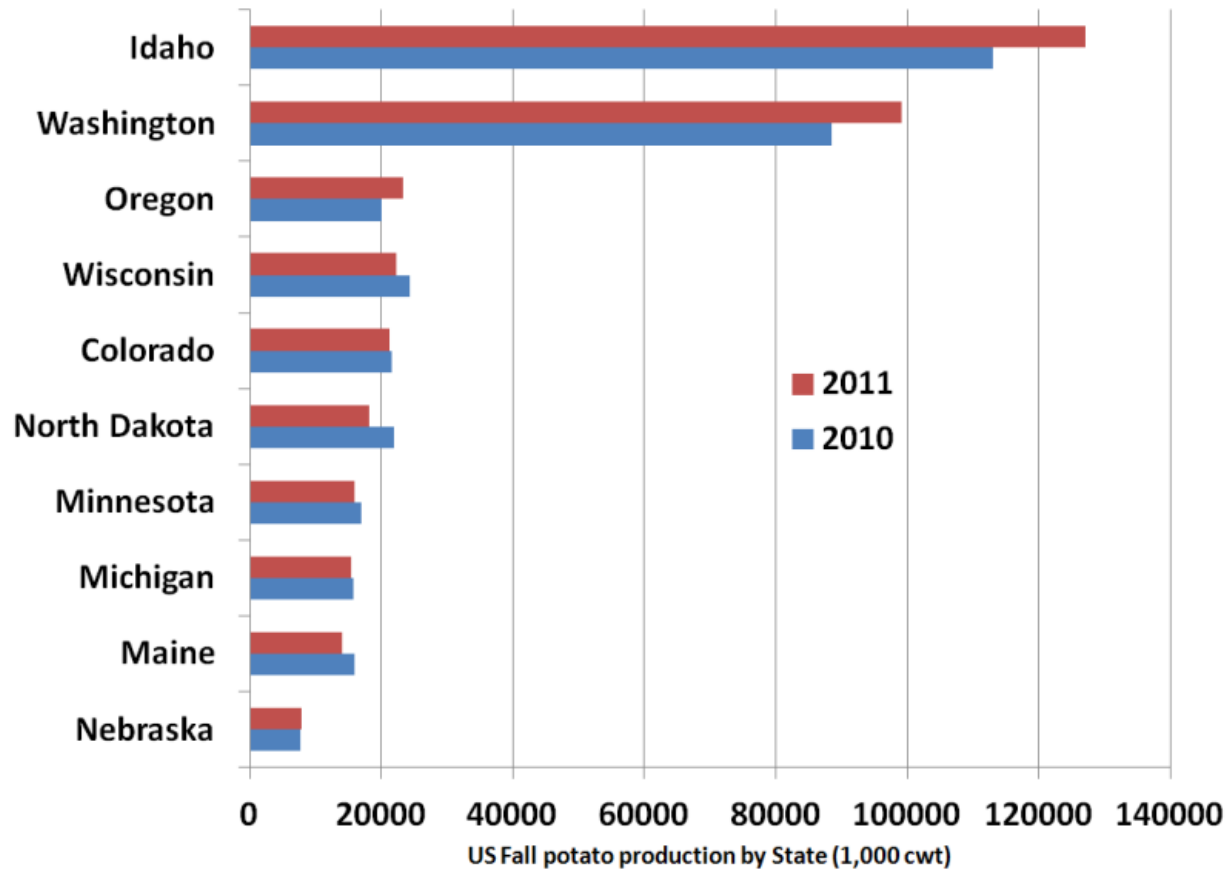


**French Fry**  
Model #55152



**Steak Fry**  
Model #50452

# One-third go to french fry market





Columbia Basin Herald 2011

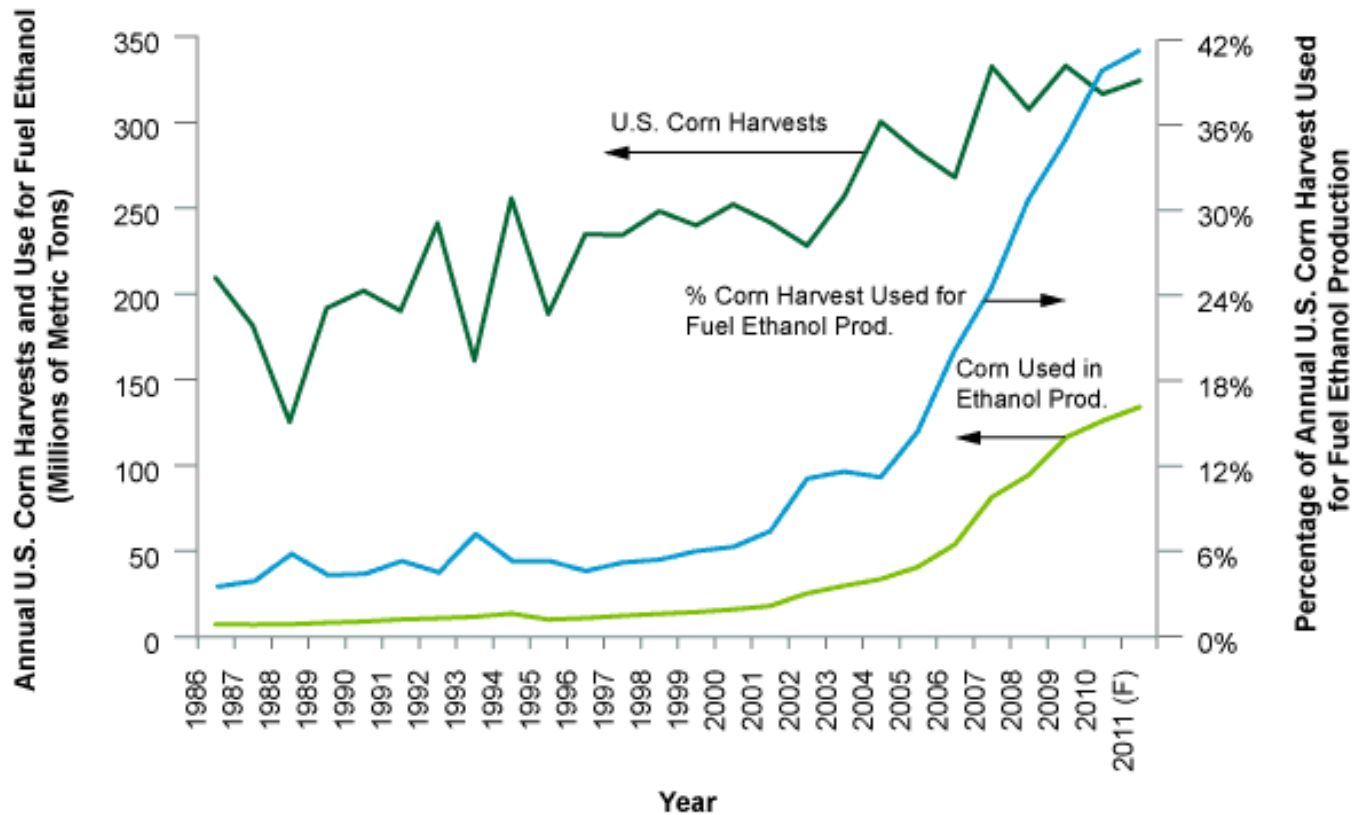
# Corn for ethanol





## Annual U.S. Corn Harvests Used for Fuel Ethanol Production Have Grown to Over 40% in the Last 25 Years.

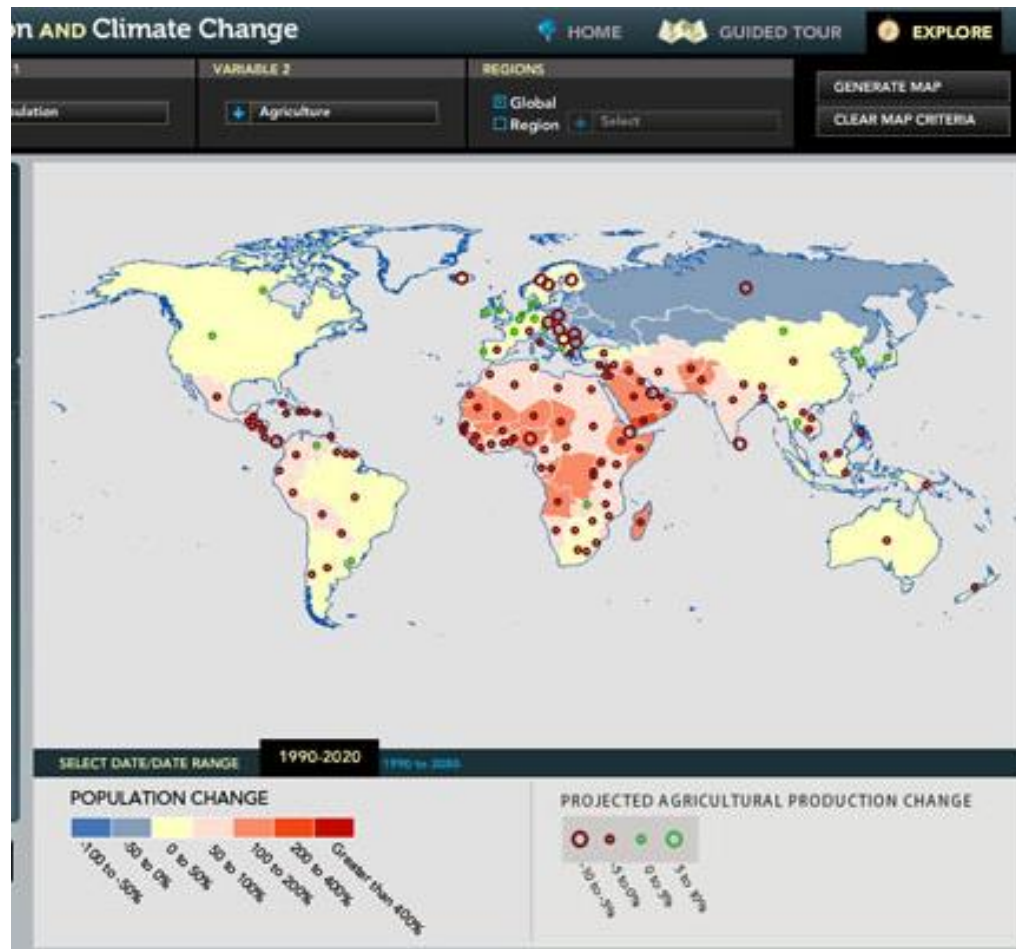
Annual U.S. corn production, use in fuel ethanol and percentage of total production used in fuel ethanol: 1986 to 2011 (F)



Sources: Corn Production: USDA National Agricultural Statistics Service.  
 Corn Used for Ethanol: USDA Economic Research Service - Feed Grains Database

# Food Security

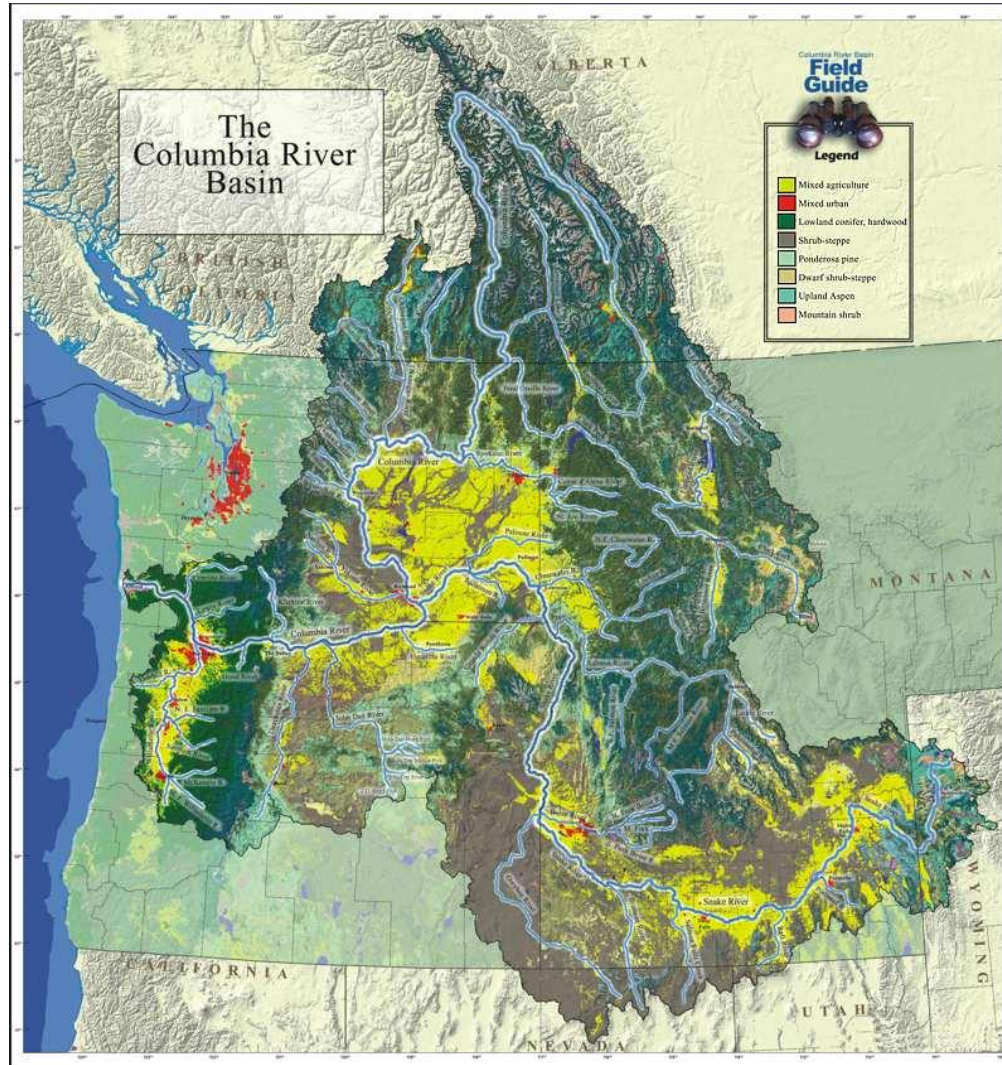
- Lester R. Brown, Plan B 4.0 and Full Planet, Empty Plates



# Ideas Trending into Action



# Columbia River Treaty





# CRT Background

- 1964 agreement – U.S. & Canada
- Two purposes: flood control & hydropower generation
- 3 new dams in Canada (and 1 in the U.S.)
- Shared benefits – we ship to BC Hydro one-half of the electricity generated as a result of the Canadian dams
- This is known as the “Canadian Entitlement”

# Columbia-Snake River Hydroelectric Development – Impacts on Salmon

Grand Coulee

Hells Canyon Complex



Columbia River Basin

# CRT – Change En Route

- 2024 change in flood control operations
- Ten years notice to terminate = 2014
- Treaty review underway in both countries

# CRT – U.S. Draft Proposals (09-20-13)

- New Third Purpose of Treaty: Ecosystem Function
- Fish Passage at mainstem dams
- Integrate Clean Energy
- Get Smart about Flood Control –
  - Reconnect floodplains
  - Flexible flood trigger for dry years



# The Stevens Treaties



# The Right Reserved by Tribes

- To fish in common with the people of the territory at usual and accustomed fishing stations . . .

# The Right Reserved by Tribes

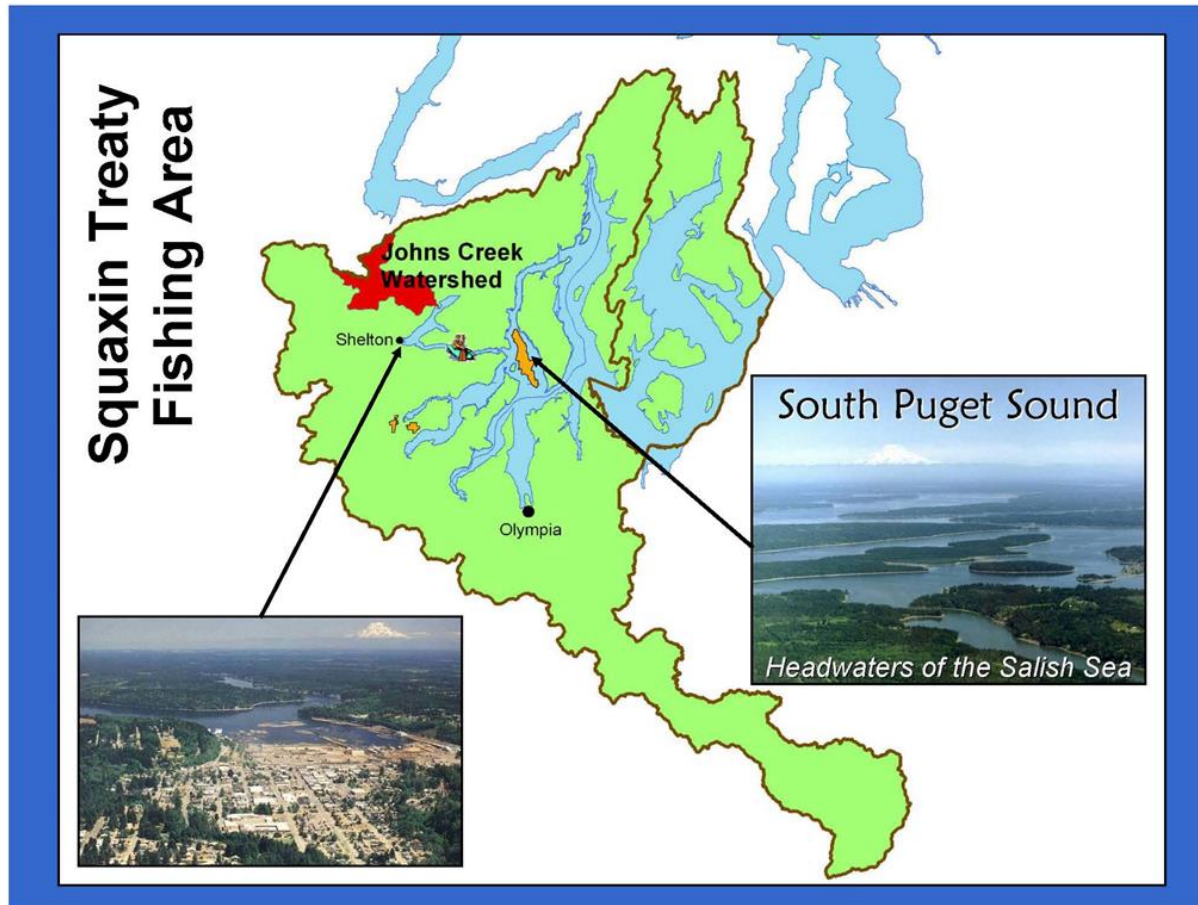
- To fish in common with the people of the territory at usual and accustomed fishing stations . . .
- Not just a fishing right . . .

# The Right Reserved by Tribes

- To fish in common with the people of the territory at usual and accustomed fishing stations . . . .
- Not just a fishing right . . . .
- A habitat right, throughout the watershed.



# Example: Squaxin Island Tribe



# The Culvert Case

- March 2013, U.S. District Judge Martinez:
- Culverts that block anadromous fish habitat violate the Stevens Treaty fishing/habitat right.
- Approximately 1,500 state-owned culverts (WSDOT, DNR, DFW) must be fixed by 2016

# Stevens Treaty & water rights?

- Yakama Nation – Acquavella
- Muckleshoot Indian Tribe – Cedar River instream flow agreements

# Deliberative Change in Water Law

- Reform
  - Clean up the books
  - Monitor quantity, use, trends
  - Adopt sustainability policies
  - Re-define beneficial use
- New Programs
  - Climate Adaptation
  - Water Sustainability Agency