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

Atmospheric CO₂
August 1958 - August 2013
August CO₂ | Year Over Year | Mauna Loa Observatory
Data: U.S. National Oceanic and Atmospheric Administration (NOAA)

CO₂Now.org Featuring NOAA-ESRL dataset of Sept. 9, 2013
March 2013

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

13.28°C
March 2013
+0.58°C above the
March average
1901-2000

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

NOAA 2010
Water stress indicator: withdrawal to availability ratio

- No stress
- Low stress
- Mid stress
- High stress
- Very high stress

Water withdrawal: water used for irrigation, livestock, domestic and industrial purposes (2000)

Water availability: average annual water availability based on the 30-year period 1961-90

IPCC, 2008
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

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- “Past performance is not indicative of future results”
Climate Change

- In the Western U.S.
- Less water (drought), higher heat, more wildfires
Drought Vulnerability in the US, 2000-2009:
Average Number of Extreme Low Flow Days, by Watershed

Days Per Year of Extreme Low Flow
- < 15
- 15 - 33
- > 33
- Insufficient flow data

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

Coastline if present ice sheets melt

Coastline 18,000 years ago

E-Zine 2010
Sea Level Rise
Sea Level Rise

Coastline if present ice sheets melt

Coastline 18,000 years ago

E-Zine 2010
Snow Water Equivalent Change

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

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

![Graph showing natural Columbia River flow at the Dalles, OR with 30-50% less water in the summer compared to present flow.](image)

Population Growth

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

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

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

Areas of physical and economic water scarcity

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

feet above MSL (mean sea level)

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

![Diagram showing water use vs rights in acre-feet per year](image)
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)

2007
2,321
490,106
134,489
54,227
27,946

2008
19,348
568,538
169,235
51,248
103,419

2009
74,985
686,148
159,460
473,118
49,432

2010
140,362
540,365
151,613
91,472
412,901

2011
147,374
585,186
166,125
97,904
527,456

SOURCE: USDA-FAS & LIVESTOCK MARKETING INFORMATION CENTER

Agweb
Potatoes
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.
One-third go to french fry market
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

Hells Canyon Complex

Grand Coulee
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