



***The World's Fresh Water
Resources and the 4C's:
Climate, Conflict, Cooperation,
and Caring***

***Columbia Gorge Community College
Hood River, OR 17 October 2008***

Michael E. Campana

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Watersheds**

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Professor of Geosciences

Founder and President

The Ann Campana Judge Foundation

www.acjfoundation.org

My Background

- Grew up on East coast (NYC metro); left East for good in 1970 (okay – one year in Atlanta in early 1980s)
- Learned my water (hydrology) at U of AZ
- Spent virtually entire adult life - since 1970 – living and working in arid West (AZ, NV, CA, NM)
- International work: Central America, South Caucasus, Central Asia, Egypt, Europe
- 501(c)(3): Ann Campana Judge Foundation (www.acjfoundation.org) – funds and undertakes water and sanitation projects in Central America
- Came to Oregon in May 2006
- Oregon: No water problems, right?





The Oregonian
July 22, 2003

The Oregonian
July 30, 2003

CANBY CONSIDERS FARMERS' RIGHTS FOR WATER

The Oregonian
February 21, 1996

ANOTHER ANOTHER

Fast-growing newcomers to the area are vying for water reserves -- in part to help save the area's water. If the crisis is not ended soon, the state's water supply is endangered. The governor is considering a bill to allow cities in Central Oregon to buy water in the state -- the past decade has seen the Klamath River Basin's most-endangered water supply. A national drought has hit the Klamath River the second time in 20 years. The United States Reclamation released a Klamath Project operation plan that will keep the river and national wildlife refuges drier than usual. Farmers in the Klamath Project will get close to their normal supply of water, although water officials urged them to make the

The Oregonian
June 27, 2002

PORTLAND CLIMATE FORECAST PREDICTS SOARING WATER DEMAND

The Oregonian
February 21, 1996

COUNTY IN SHAMBLES AFTER FLOOD

Chaos reigns while workers try to restore lost services, and officials speculate that the high cost of repair may overtax the ability to pay. By Thursday, Clackamas County workers who had traded in their computers and note pads for brooms and shovels hope to be back to serving the public. But their days will be anything but normal. Count on chaos for a while. The first floor of the county's Transportation and Development Department complex at 902 Abernethy Road was

The Oregonian
June 7, 2003

DEAL WILL MEAN HOOD RIVER DAM REMOVAL

PacifiCorp can operate Powerdale until 2010 with water flow and turbine restrictions. PacifiCorp will remove an aging Hood River dam by 2010, restoring natural river flows for chinook and other fish under an agreement announced Friday in Salem. Powerdale Dam, built in 1923, diverted as much as 80 percent of the river's flow through a man-made channel before returning it near the dam.

The Oregonian
July 27, 2002

PLANNED FOR OWN AQUIFER STORAGE

Klamath River Water District is planning to build a \$100-million aquifer storage and recovery system for the system. The system will be built from the John Tigard area of the area's oldest buildings. The system will stand a small concrete structure, the area's newest buildings, and will be a windowless structure the size of a house. It will sit on powerful pumps and will go 600 feet down to

100-YEAR WAR

The role of the Reclamation Basin and elsewhere likely changed the face of the U.S. Bureau of

The Klamath most-endangered water supply. A national drought has hit the Klamath River the second time in 20 years. The United States Reclamation released a Klamath Project operation plan that will keep the river and national wildlife refuges drier than usual.

multi-triennial need the charter amendment for our own protection.

Why is that? One reason is that the ad hoc future water supply committee is

most productive salmon spawning grounds have been harmed.

The outcome could set a lasting precedent for towns seeking to lock up historic water rights issued decades ago but never developed. They have legal priority

skyscrapers, the largest ever built at the time. They corralled such mighty rivers as the Columbia and Colorado, turned brown deserts into green croplands and generated cheap power for a rapidly growing society.

But as the bureau touched

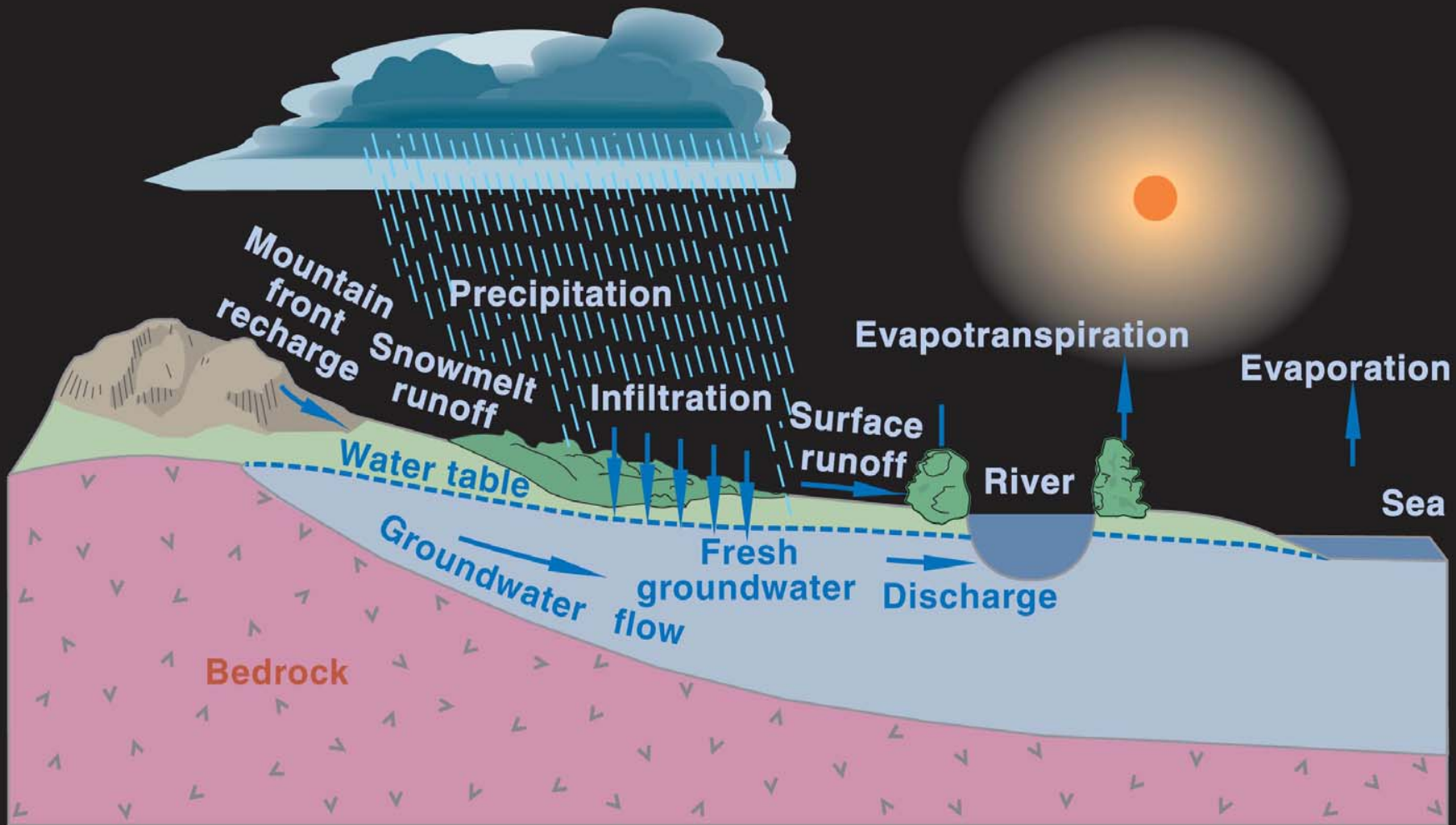
water supply in these rivers stalls, and in some cases traps, migrating salmon and stresses municipal water systems.

Meteorologists, however, expect persistent fall



Talk Organization

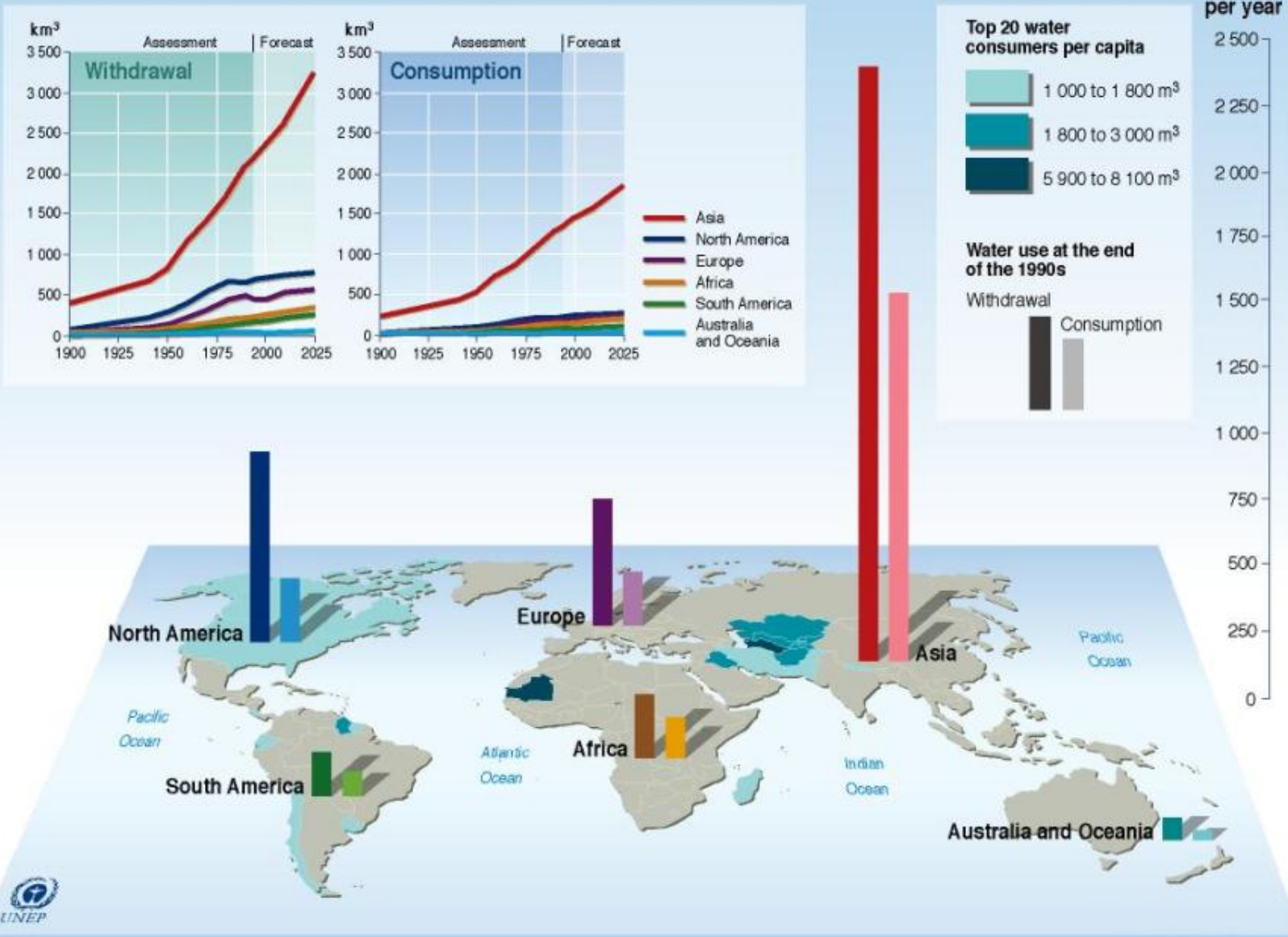
- **Background Information**
- **Global Water Resources**
- **4C's: Climate, Conflict, Cooperation, Caring**
- **Climate: Columbia and Colorado River Basins**
- **Conflict: Western US, Klamath Basin**
- **Conflict & Cooperation: Kura-Araks, Umatilla Basin**
- **Caring: Lack of water, MDGs, HP**
- **Conflation and Conclusion**



The Hydrologic Cycle

(courtesy R. Glennon)

Global Water Withdrawal and Consumption

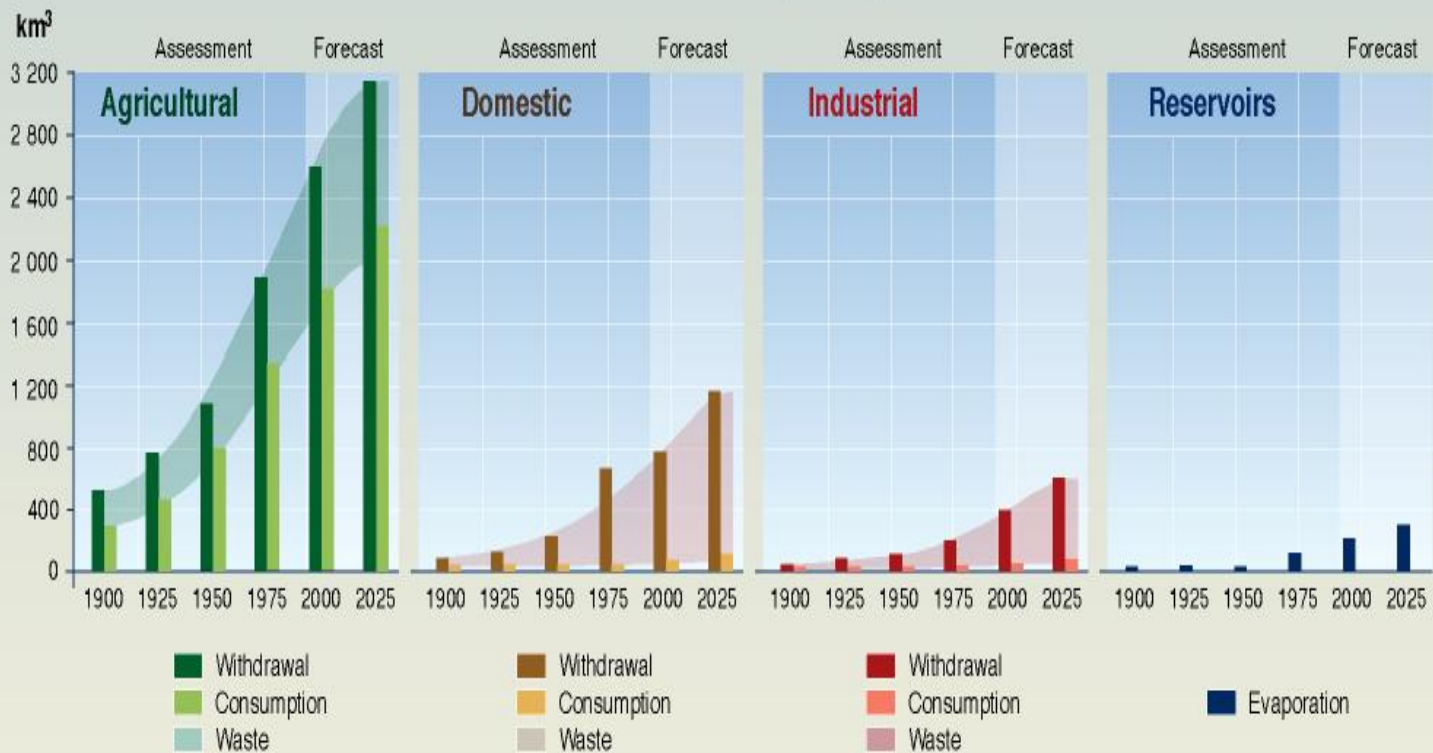


PHILIPPE REKACEWICZ, 11 APRIL 2002

Source: Igor A. Shiklomanov, State Hydrological Institute (SHI, St. Petersburg) and United Nations Educational, Scientific and Cultural Organisation (UNESCO, Paris), 1999; World Resources 2000-2001, *People and Ecosystems: The Fraying Web of Life*, World Resources Institute (WRI), Washington DC, 2000; Paul Harrison and Fred Pearce, *AAAS Atlas of Population 2001*, American Association for the Advancement of Science, University of California Press, Berkeley.



Evolution of Global Water Use Withdrawal and Consumption by Sector



Note: Domestic water consumption in developed countries (500-800 litres per person per day) is about six times greater than in developing countries (60-150 litres per person per day).

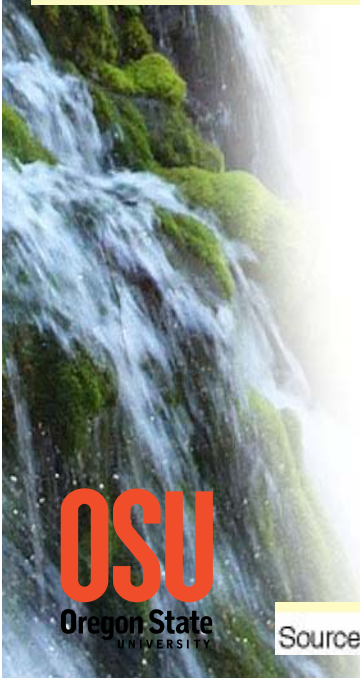
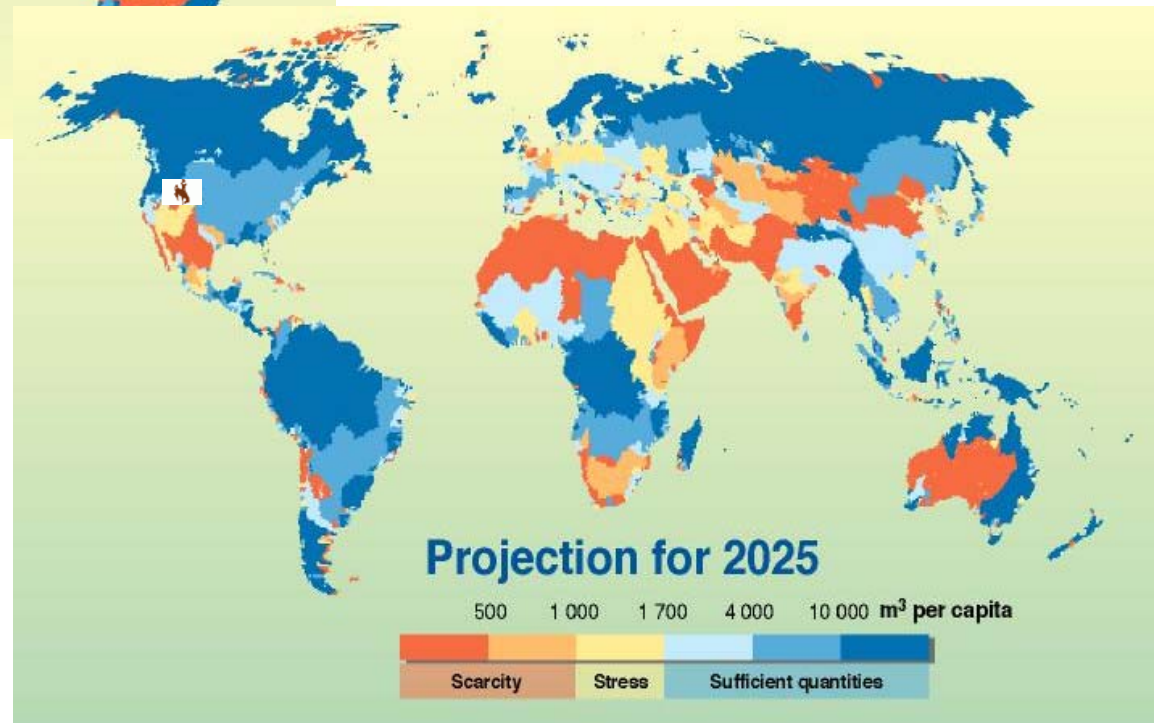
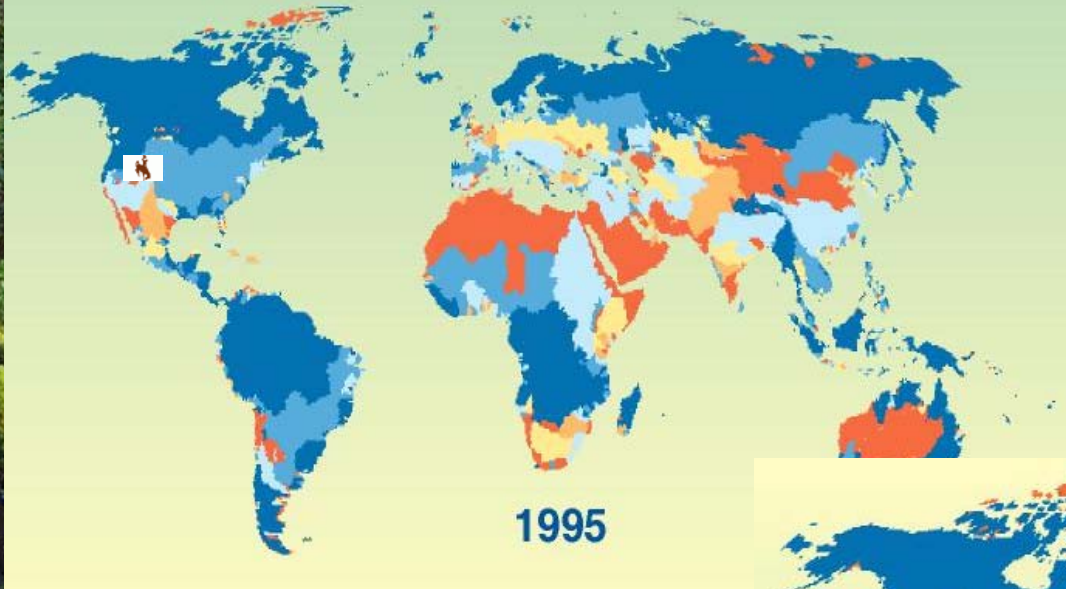
PHILIPPE REKACEWICZ
FEBRUARY 2002

Source: Igor A. Shiklomanov, State Hydrological Institute (SHI, St. Petersburg) and United Nations Educational, Scientific and Cultural Organisation (UNESCO, Paris), 1999.

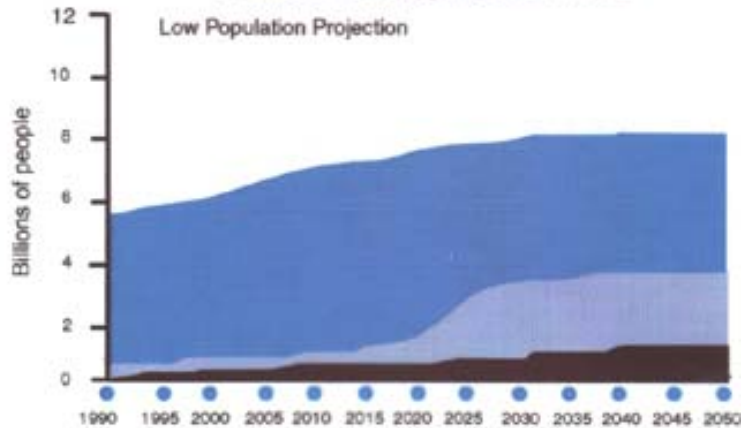


The World's Freshwater Supplies

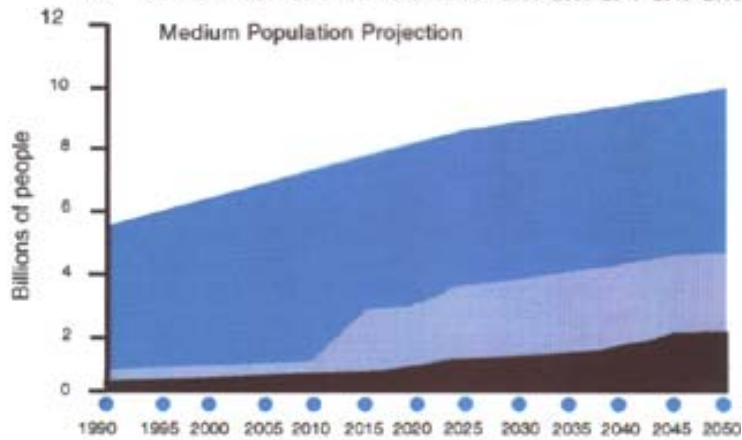
Annual Renewable Supplies per Capita per River Basin



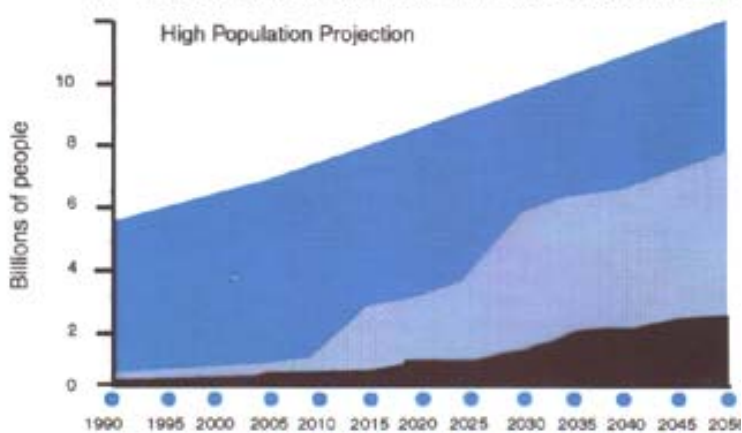
Population Experiencing Fresh Water Scarcity, 1990-2050



Abundance: > 2000 m³/person/year



Stress: 1000-2000 m³/person/year

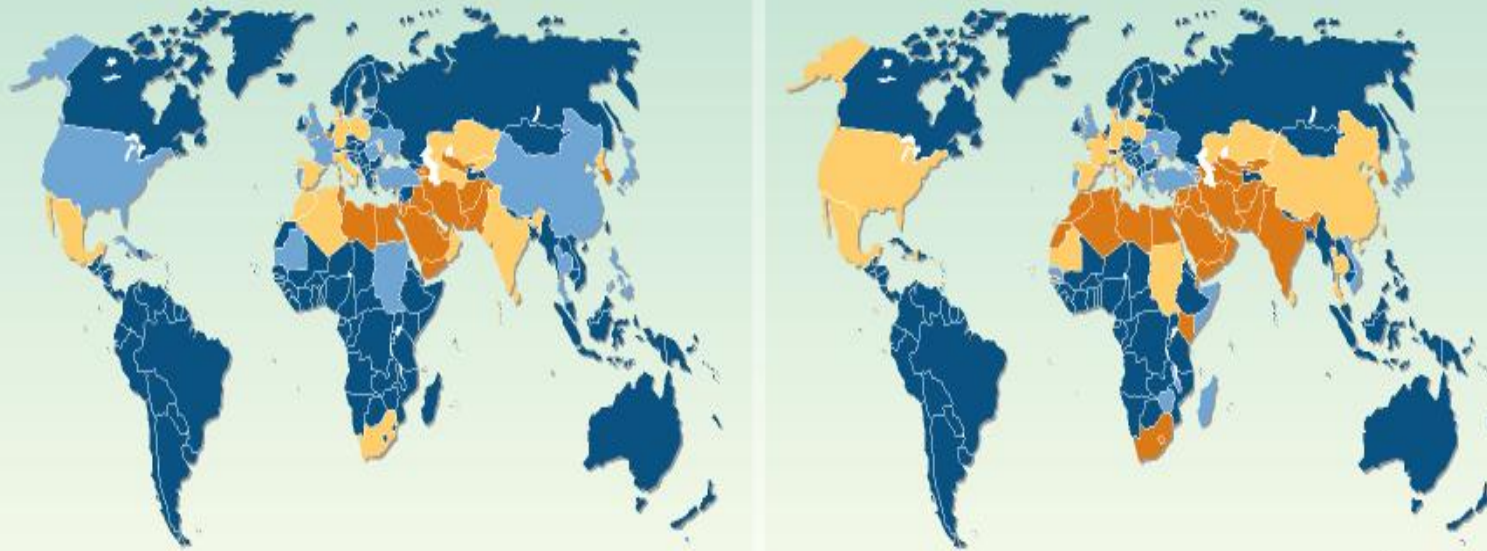


Scarcity: < 1000 m³/person/year

Freshwater Stress

1995

2025

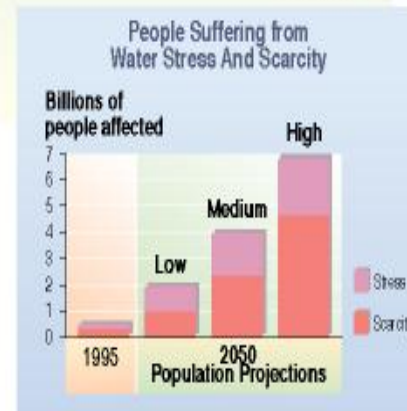


PHILIPPE FIKSACEWICZ
FEBRUARY 2002

Water withdrawal as percentage of total available



Source: World Meteorological Organisation (WMO), Geneva, 1996; Global Environment Outlook 2000 (GEO), UNEP, Earthscan, London, 1999.





Virtual Water

***Amount of water embedded in food
or other products that is needed
for production***

Pair of jeans: 2,900 gallons

Ton of wheat: 300,000 gallons

Cotton shirt: 2,500 gallons

Pound of beef: 1,800 gallons

Car: 105,000 – 250,000 gallons

House: 1,500,000 gallons



The 4C's



CLIMATE

"The climate system is an angry beast, and we are poking at it with sticks."

*-- Wallace Broecker,
Columbia University*



CONFLICT

*“Whisky’s for drinkin’, water’s for
fightin’ over.” – Mark Twain*



COOPERATION

*“One hand washes the other,
and both wash the face.” –
translation of a Spanish proverb
on cooperation*

CARING

"Agua es vida."

"Water is life."

--New Mexico acequia proverb





CLIMATE

“Climate is what you expect, weather is what you get.” – Mark Twain



Science Article (2/20/04) *Global Warming in the West*

News Focus

In a region already prone to water shortages, researchers now forecast that rising temperatures threaten the American West's hidden reservoir: mountain snow

As the West Goes Dry





Columbia River Basin

***“Civilization exists by
geological consent, subject
to change without notice.”***

-- Will Durant

Columbia River Basin

Red dots = Corps of Engineers dams

Yellow dots = Other dams

**Population:
7 million**

**Average
Annual Discharge:
200 MAF/year or
125 million gpm
(at mouth)**

Area: 260 000 mi²



Columbia Basin Water Issues

- Environmental flows
- Other competing uses: irrigation, municipal and industrial (M&I), recreation, power generation, waste dilution, Native American water rights, energy production (biofuels), storage for flood control
- Nonrenewable ground water use
- Water quality
- Transboundary water issues (treaty with Canada, etc.)
- Effects of climate change – loss of snowpack storage
- Hydroelectric energy production – 60% of region's electric power

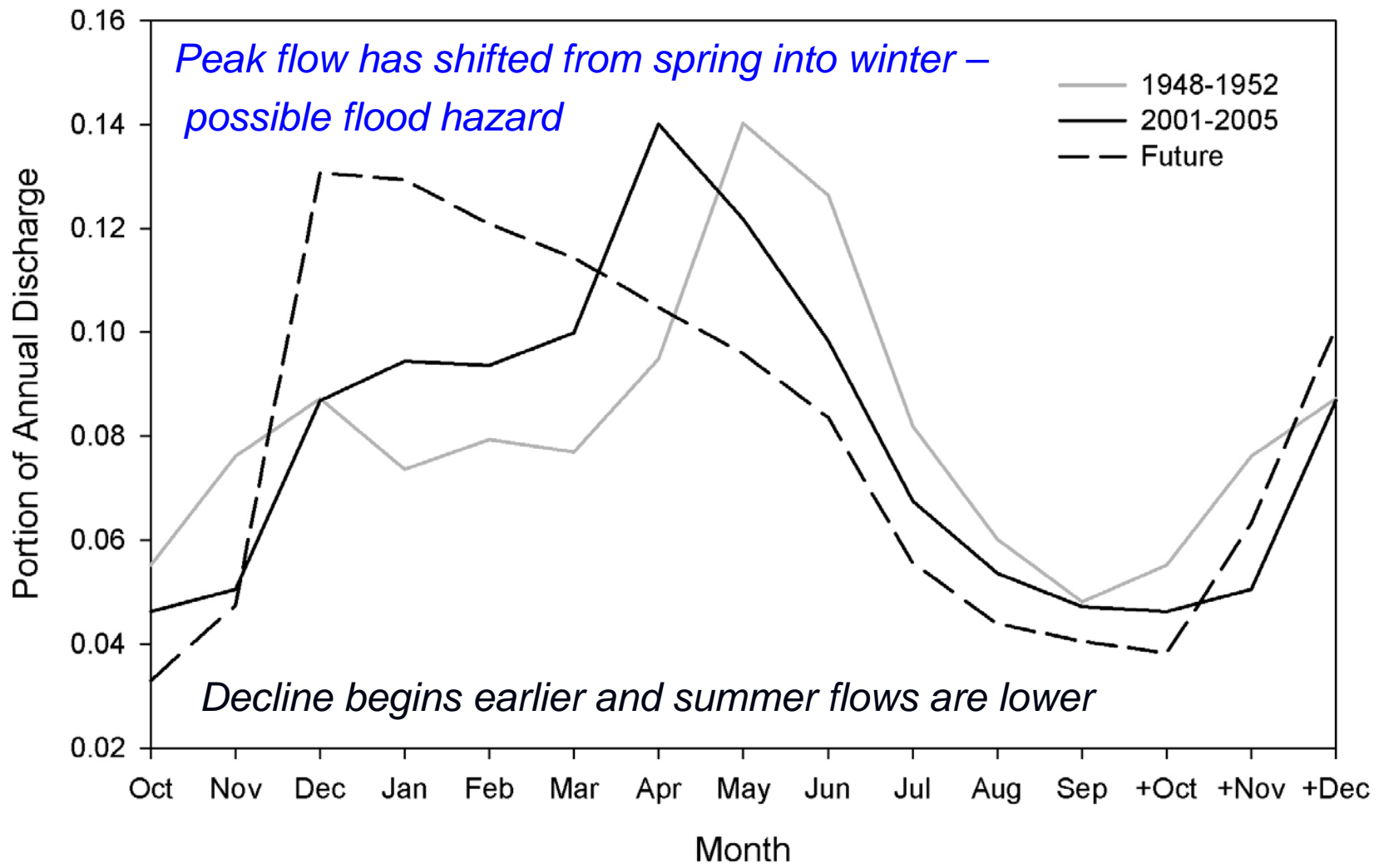




Early Snowmelt – A Problem?

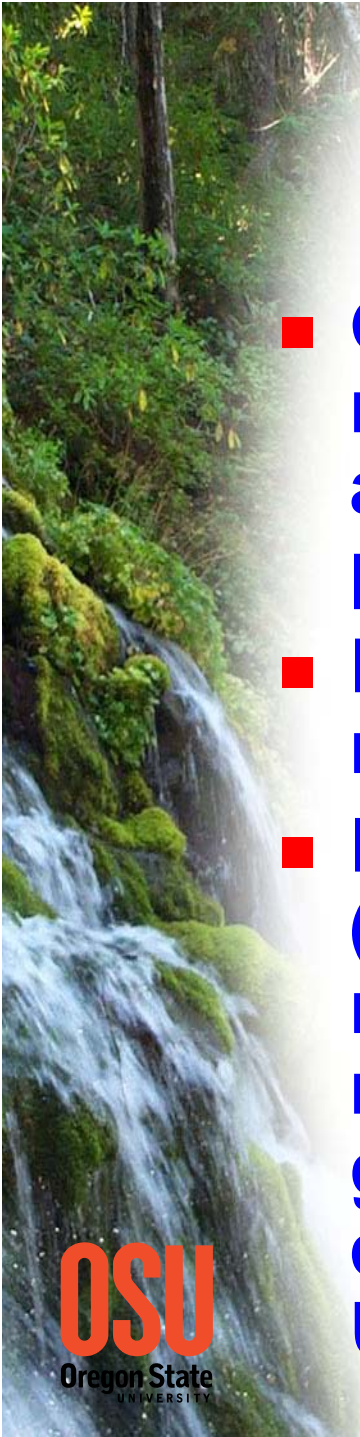
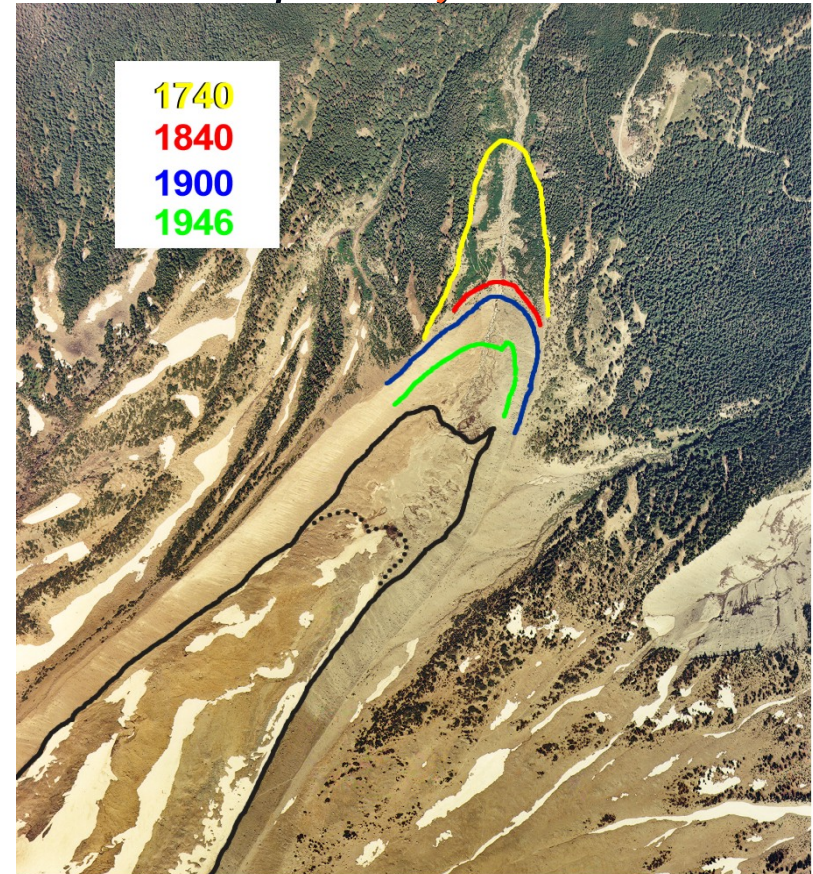
- **More storage may be needed**
- **Impacts water supply and power generation**
- **Will affect ecosystems**
- **Dilution of wastes (water quality considerations)**
- **More intense fire seasons?**
- **Earlier floods, mudslides?**

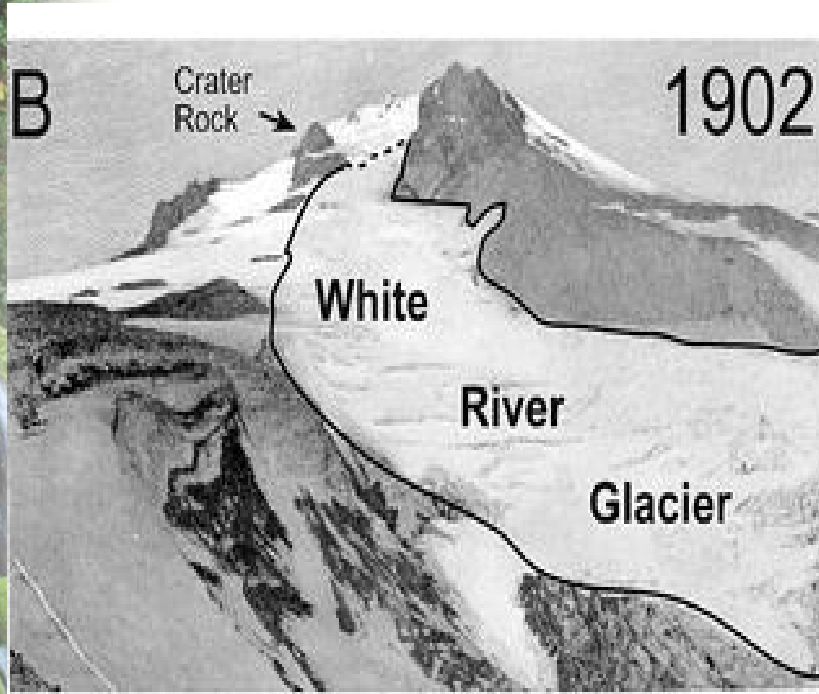
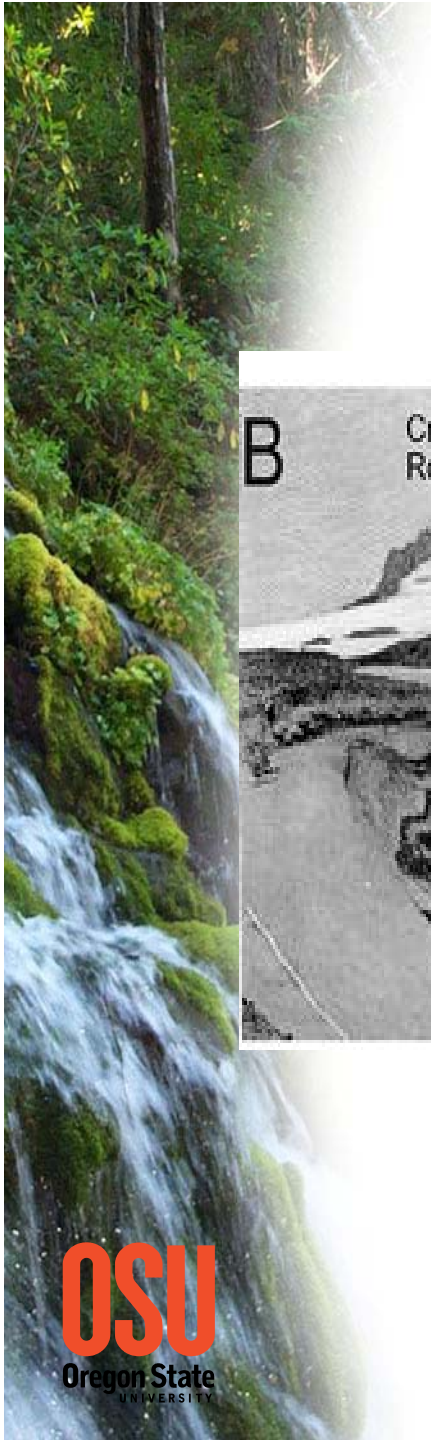
Streamflow – McKenzie River (1948-52, 2001-05, Future)



Mt. Hood Glaciers (courtesy Anne Nolin, OSU)

- Glaciers have retreated as much as **61%** over the past century
- Eliot Glacier retreat, 1740-2000
- Dr. Anne Nolin (OSU) is measuring and modeling the glacier meltwater contributions to Upper Hood river









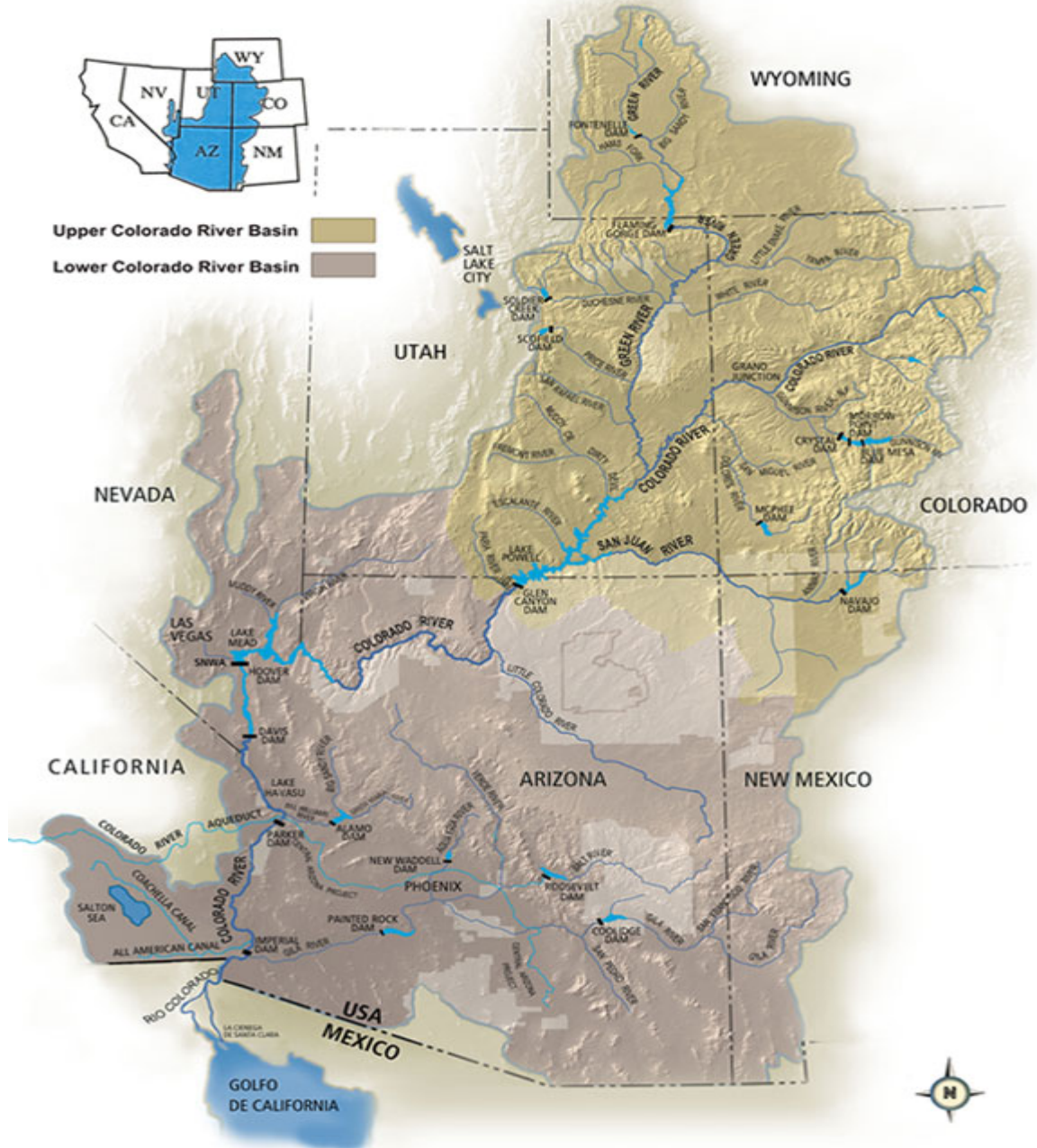
Colorado River Basin

“Westerners call what they have established out here a civilization but it would be more accurate to call it a beachhead.”

-- Marc Reisner, *Cadillac Desert*



Upper Colorado River Basin 
Lower Colorado River Basin 





Colorado River Basin - Facts

- **Area: 245 000 mi²**
- **Mean discharge: 14.5 MAF/year**
- **Main stem: 1 450 mi in length**
- **Long-term (tree-ring data) mean discharge may be 12 MAF/year**
- **Southern part of basin: 7-year drought**



Colorado River Basin

- **Governed by compact among 7 states (1922) and treaty with Mexico (1944)**
- **Compact allocated water using flows that were abnormally high (mean 16 vs. 14.5 MAF/y – based on wet years, 1890-1920)**
- **Long-term mean flow may be only 12 MAF/y**
- **Cannot renegotiate compact unless all parties agree (unlikely)**
- **Drought in southern basin past 7 years**
- **Tree-ring data: evidence of 60-year long “megadroughts” in southern basin**
- **Energy development: water use?**

Western Water Observations

Western water needs will be difficult to meet *even without global warming* - too little water, too many needs.

Environmental flows are a contentious issue and will not “go away”

Land-use planning, water quantity, and water quality are not integrated

States are suspicious of Federal government’s role

Energy development – water requirements?

Pumping more ground water is not a long-term solution

Indian water rights – not entirely quantified

More conflict



Solutions

Water marketing – transfer of water rights from one use to another use. Example: agricultural water rights sold/leased to urban users

Water reuse, conservation, recycling, more efficient agriculture

More subsurface storage

Integrate land-use planning, water quantity, and water quality

Revisit compacts, prior appropriation; increase flexibility

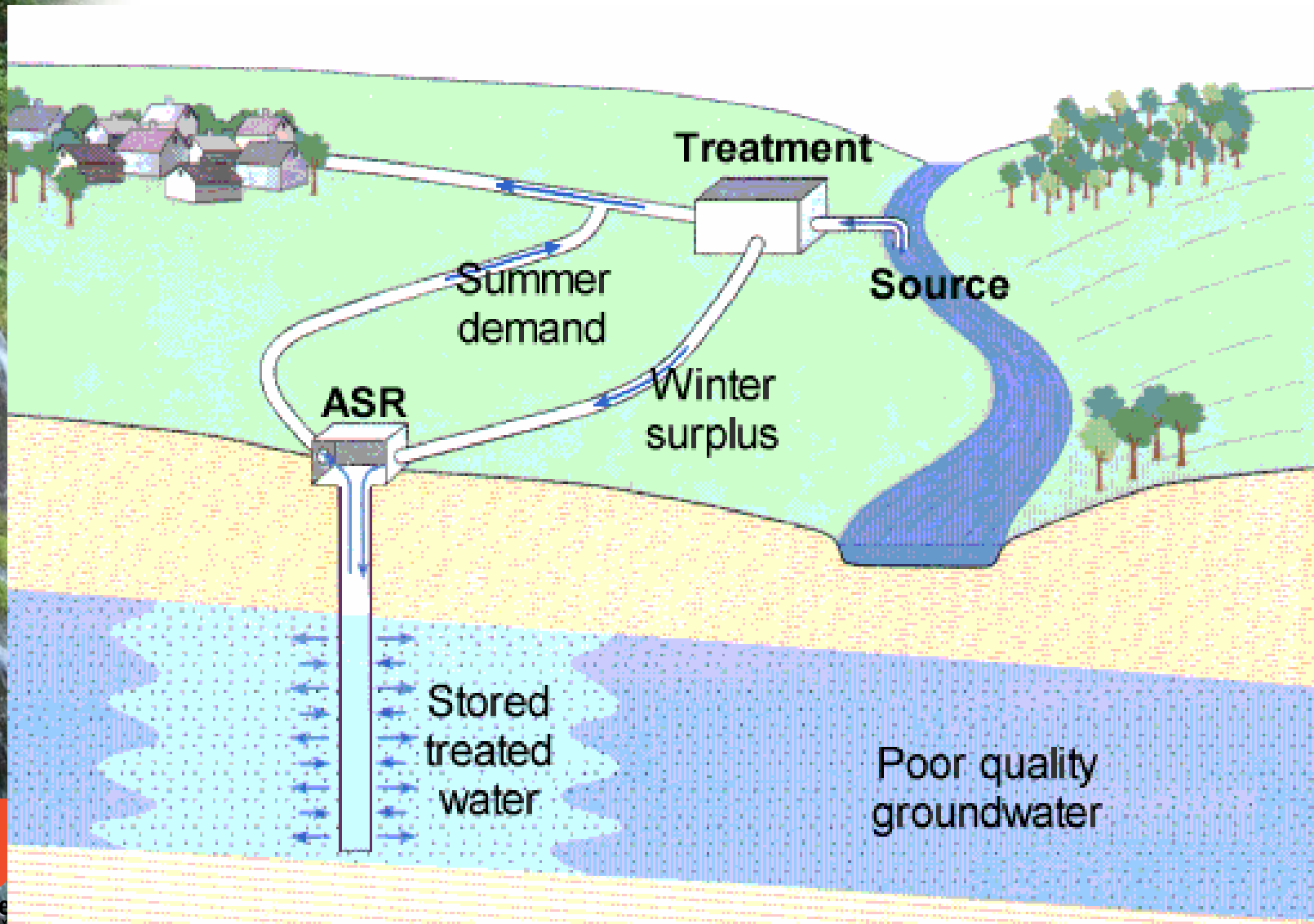
Desalination – sea water, brackish ground water

Regional water authorities – cross traditional jurisdictional boundaries

Education



Aquifer Storage and Recovery



Extreme Solutions

Water rationing – water “debit cards” issued to everyone

Regional water governance – will cut across current political boundaries.

Limit population by law

Federal government preempts state/local control (watermasters, “water czars”)

Large-scale importation schemes: Western Canada, Great Lakes, Alaska

Outmigration to eastern USA (“rust-belt” cities gain population): Detroit, Cleveland, Milwaukee, Toledo, Buffalo, etc. **Maybe to Pacific Northwest!**



PNW Climate Refugees?

Hello,

We live in Northern California in a small town (St. Helena) in the Napa Valley. There has been little planning here for either water use/supplies for the future or global warming. We are looking to move to a place that has and will have water. We also want a local economy that produces food and a place where we can garden and grow our own.

We have been looking at climate maps and water maps endlessly but no one source seems to lead to an answer. We would love to stay in CA but we realize that CA, especially Northern CA has no plan to capture the excess rain water that we will be expecting. We want a walking community so that cars are not a necessity. We are in our 50's and 60's respectively and hopefully can find a place to settle for the long haul. Any suggestions?

Yes – take I-5 north and don't stop till you reach British Columbia.





NARA

The Eastern Route



NARA

The Western Route



CONFLICT

"The optimist learns English. The pessimist learns Chinese. The realist learns Kalashnikov."

-- Dr. A. Saghatelyan, Armenia



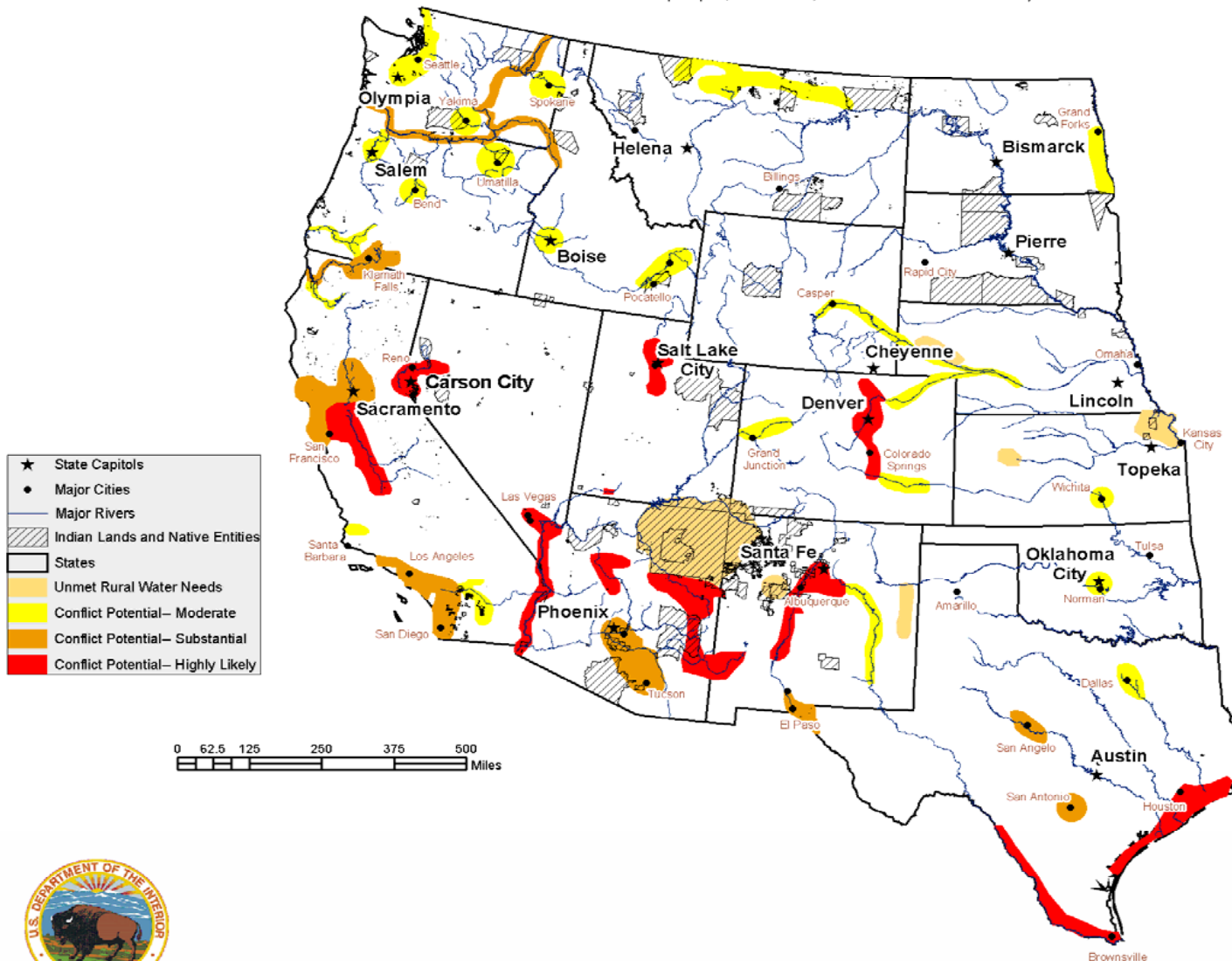
Who Said This and When?

“You are piling up a heritage of conflict and litigation over water rights for there is not sufficient water to supply the land.”

-- John Wesley Powell, 1893

Potential Water Supply Crises by 2025

(Areas where existing supplies are not adequate to meet water demands for people, for farms, and for the environment)

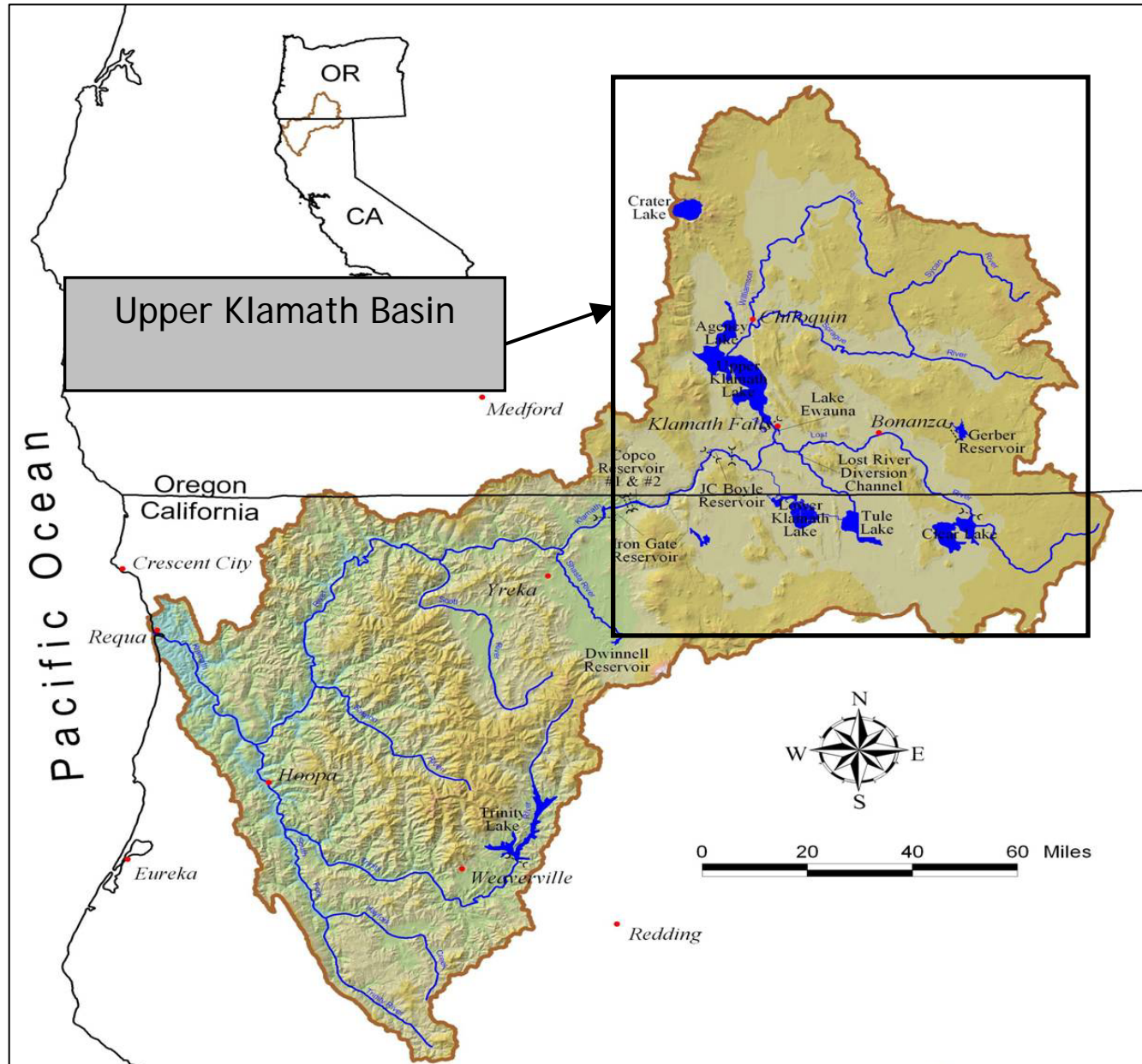


- ★ State Capitols
- Major Cities
- Major Rivers
- ▨ Indian Lands and Native Entities
- ▭ States
- Unmet Rural Water Needs
- Conflict Potential— Moderate
- Conflict Potential— Substantial
- Conflict Potential— Highly Likely

0 62.5 125 250 375 500 Miles



Klamath Basin





Klamath Basin

“Whether the measure used is the size of salmon runs, the state of the Basin’s water quality or the amount of water flowing in Klamath River Basin streams and rivers, the 20-year effort to restore the Klamath River and its fisheries has failed. Salmon runs now are at greater risk of extinction, fishing is more restricted and water quality is more degraded than when ‘restoration’ began in earnest 20 years ago...”

--Klamath Falls *Herald and News*, 9 Nov. 2006

***Water Conflict: "The more things change, the more they remain the same."
(courtesy: duckboy.com)***



Discussing Water Rights, A Western Pastime





The Golden Arches Theory of Conflict Prevention

***“No two countries that have
McDonald’s have gone to
war with each other since
each got its McDonald’s.”***

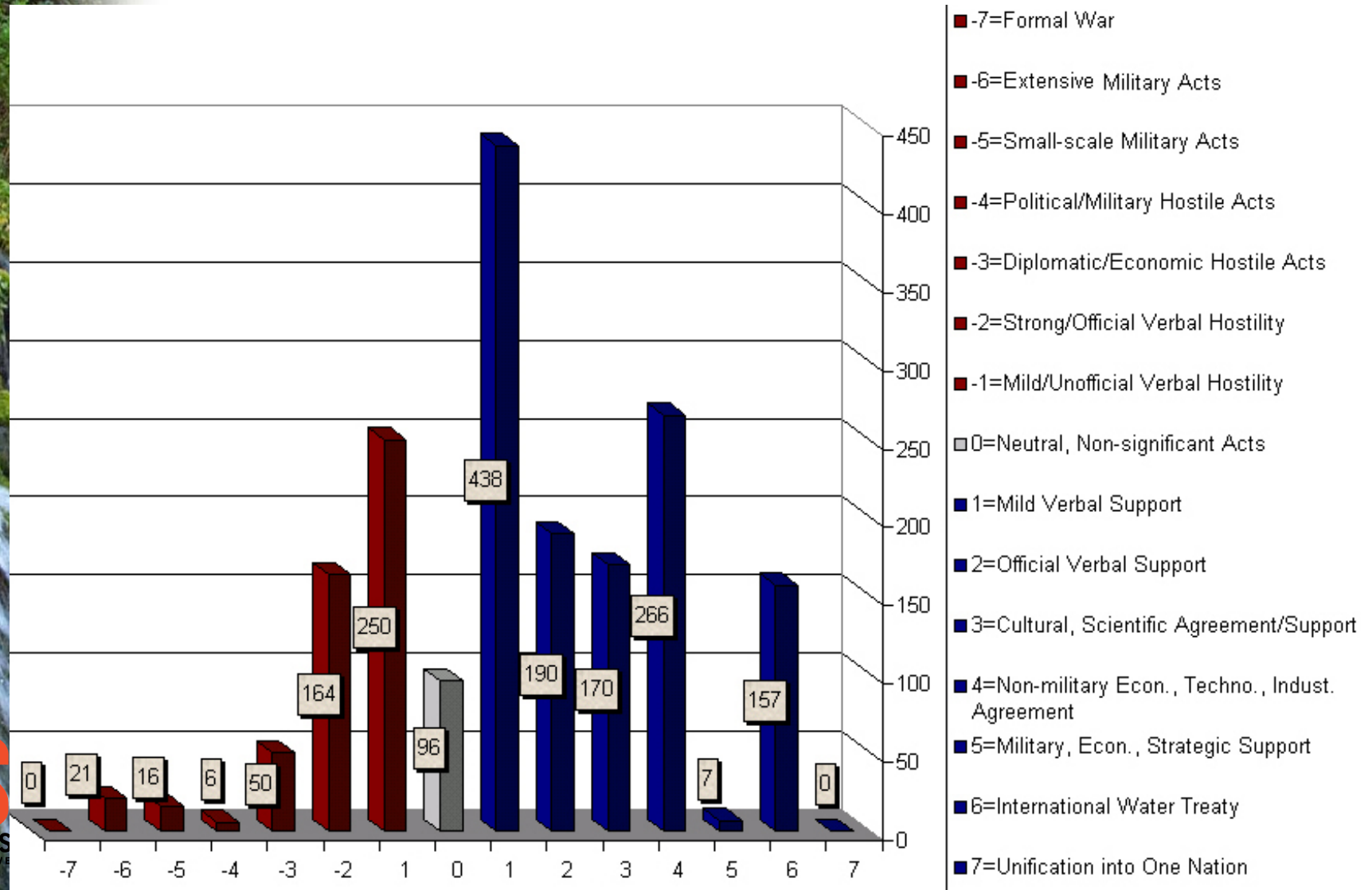
-- Thomas L. Friedman

263 International River Basins



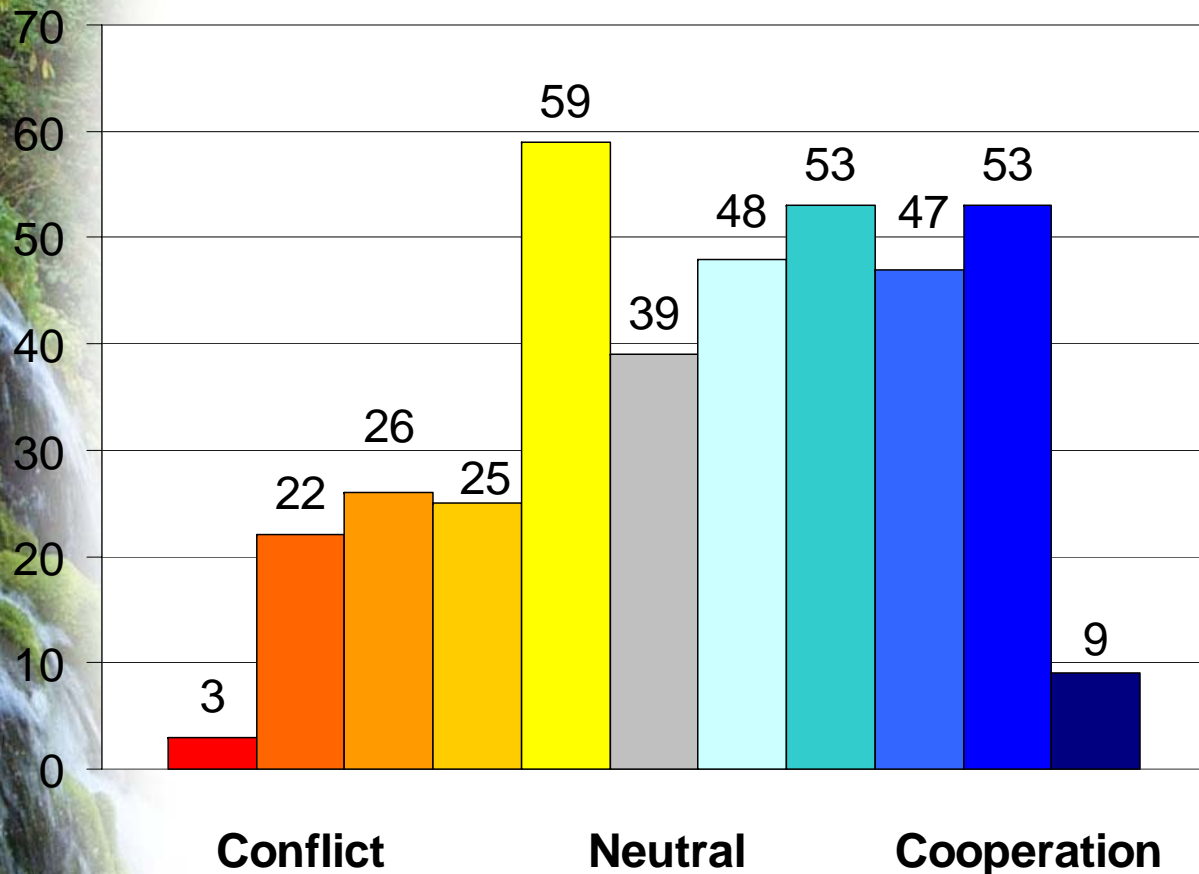
Oregon State University: TFD
Becci Dale, Cartographer

Conflict/Cooperation - International Water Basins (Wolf et al., 2003)



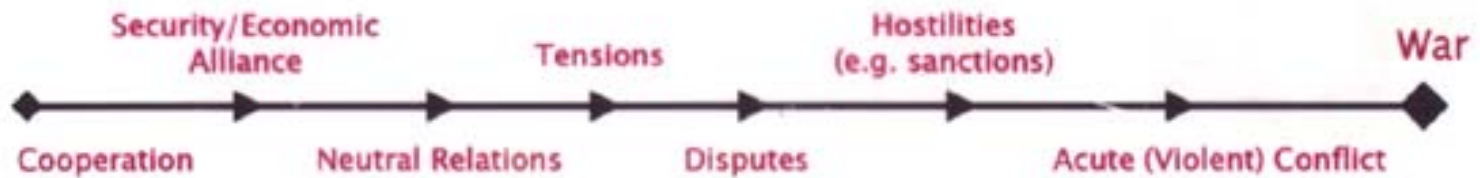
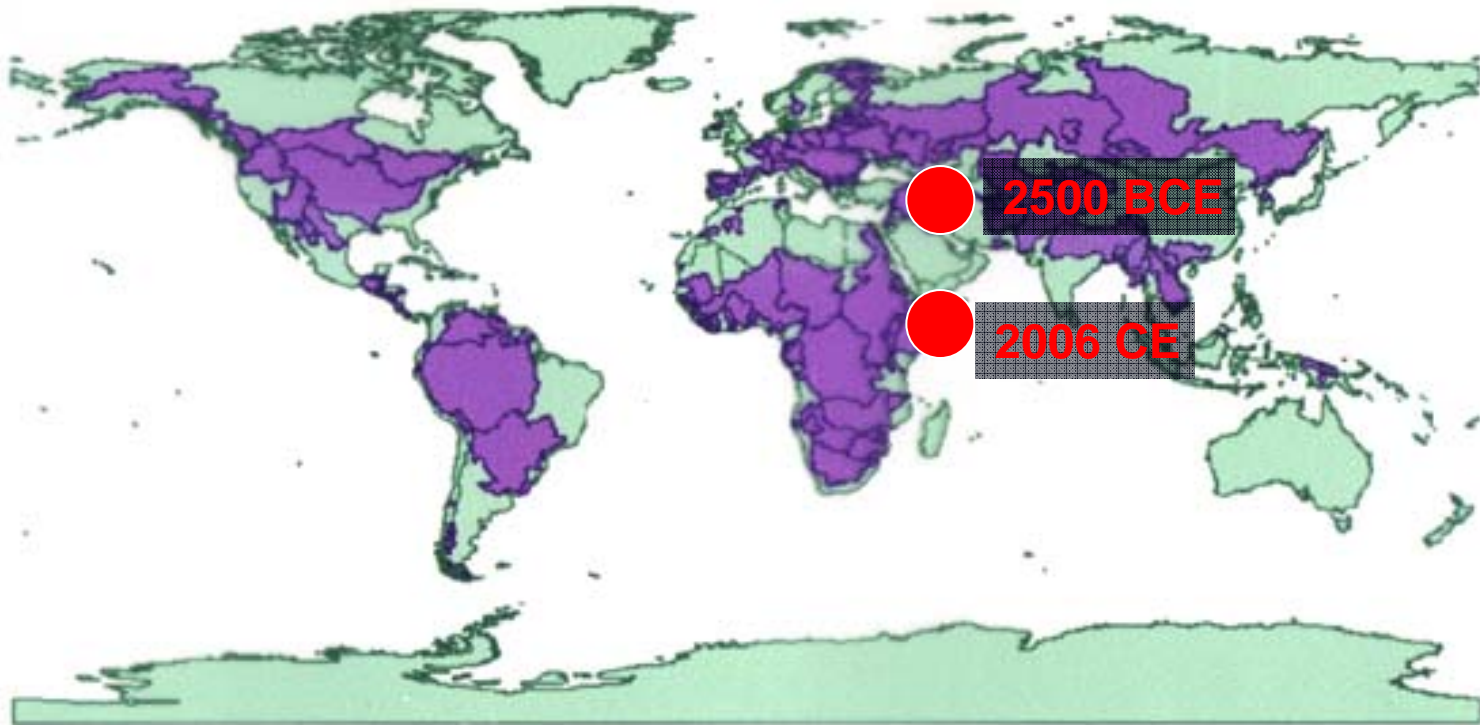
Number of Media Reported Events in Oregon along a Cooperation- Conflict Spectrum from 1990 to 2004

Number of Events (n=384)



- Hostility- Small scale acts of police force, violence or threats
- Litigation- Judicial intervention or management group dissolution
- Dispute- Cooperative group meltdown or regulatory action
- Disagreement- Roadblock or temporary failure of settlement or project progress
- Difference- Voicing opinions of opposition
- Neutral- Action does not increase or decrease conflictive intensity
- Similarity- Voicing opinions of approval
- Agreement- Progress in stakeholder agreements and minor project support
- Assent- Cooperative group progress, preliminary settlement agreement and regulatory compliance
- Alliance- Legally binding cooperative actions like lawsuit settlements and regulation approvals
- Solidarity- State bill passage, compact agreements and management group formation

Scale of Conflict





COOPERATION

"We may have all come on different ships, but we're in the same boat now."

-- Dr. Martin Luther King, Jr.

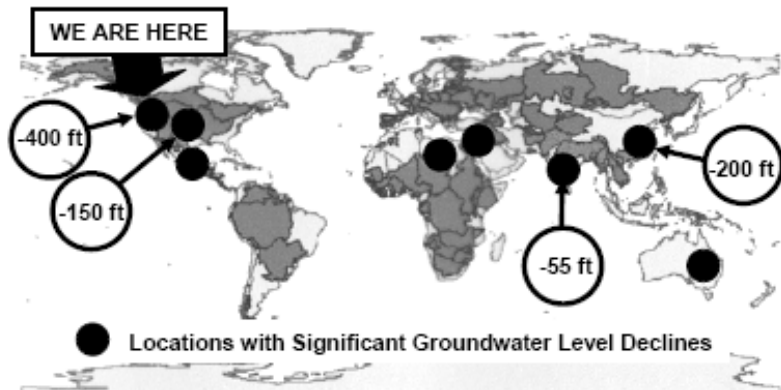
"We are not put on this earth to see through one another, but to see one another through."

-- Unknown



We are not alone:

groundwater declines are a world problem



Groundwater is the world's most used raw material. World-wide withdrawal rates are over 160 trillion gallons annually - over 35 times the amount of water in Crater Lake! Pumping water from underground aquifers causes declines in groundwater levels. Most world areas have groundwater level declines of less than 200 feet. Declines measured in wells drilled into deep basalt aquifers in Umatilla County are about twice those found in other parts of the world and in places exceed 400 feet. How much should this concern citizens of Umatilla County? The Umatilla County Critical Groundwater Taskforce cares about the groundwater situation, and hopes you do, too. Help us find ways to reduce potential future water supply deficits by getting involved.



Tomorrow's
Groundwater,
Today's
Challenge

216 S.E. 4th Street
Pendleton, OR 97801

541.278.6251

<http://www.co.umatilla.or.us/Groundwater.htm>

Funded in part by
a grant from
OWEB.

What are our options?

We must dare to think "unthinkable" thoughts. We must learn to explore all the options and possibilities that confront us in a complex and rapidly changing world.

-J. William Fulbright, former U.S. Senator

So if we have four Critical Groundwater Areas in Umatilla County where groundwaters are being used faster than they are being replaced, what options will increase water supply?

- ◆ We could use surface water from the Columbia River to replace water now being pumped from groundwater in Critical Groundwater Areas.
- ◆ We could fund studies to learn about flow rates and amounts of groundwater beneath us so that we can manage them better.
- ◆ We could implement Phase III of the Umatilla Basin Project, exchanging Columbia River water for McKay Reservoir and Umatilla River water.
- ◆ And, we could do a better job of supervising the process through local oversight, capping new water rights until we know what is available, providing resources to monitor and manage our projects, and prioritizing future needs to protect water supplies to meet these needs.

Got an idea? The Umatilla County Critical Groundwater Taskforce cares about the groundwater situation, and hopes you do, too. Let us hear from you.



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South Caucasus and Central Asia



Why Should We Care?

AGO: Altruism, Gas, & Oil



South Caucasus: Kura-Araks Basin





Kura-Araks: Transboundary River Basin – Water Problems

- **Water resource problems could threaten the stability of the region.**
- **Azerbaijan is especially vulnerable to these problems as it is farthest downstream and relies on the Kura-Araks for over *50%* of its drinking water and about *60%* of its water for agriculture production.**



CARING

*“There is enough water
for human need but not
for human greed.”*

--Gandhi



Some Facts

“Over 1.1 billion people lack access to clean drinking water and almost 2.4 billion people lack access to any kind of improved sanitation services.” - World Health Organization, 2000.

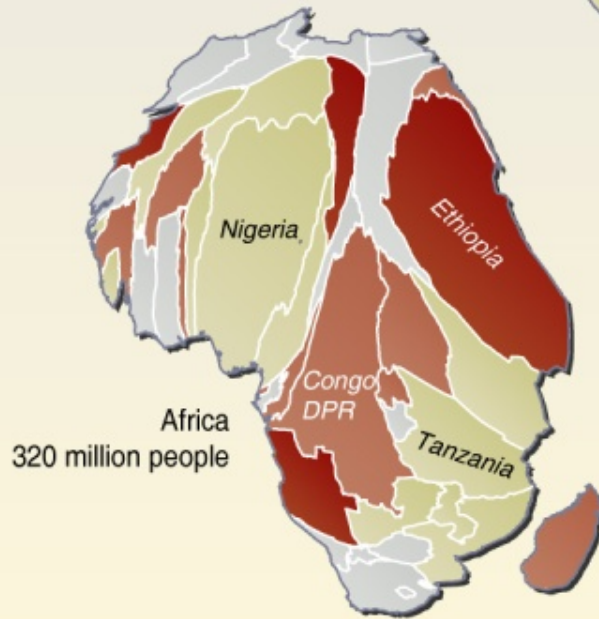
“Every 8 seconds a child dies of a water-related disease.” – WHO, 1996, Fact Sheet 112.

Lack of access to safe water

An improved water source includes wells or public pipes that provide at least 20 litres per day, accessible within a few minutes walk.

Developed countries (Europe, North America, Australia etc.)
0 million people

Latin America and the Caribbean
70 million people without an improved water source



Africa
320 million people



Asia, and the Middle East
1.1 billion people

Share of total population without an improved water source



< 30 %

30 - 45 %

45 - 60 %

> 60 %

Countries are proportional to the number of people without an improved water source



= 1 million

= 10 million

= 26 million

Source: The United Nations Children's Fund (UNICEF) 2001



got water?

Job opening: Water-Carrier.

Requirements: must be able to balance 45 pounds on your head while trekking rocky dirt roads for miles.

Hours: up to 8 hours a day

Wages: \$0

Only women and children need apply!

(courtesy www.nwpdrilling.com)





Millennium Development Goals

- **By 2015, reduce by 50% the number of people who do not have access to safe drinking water or sanitation**
- **Requires that each day until 2015, must provide safe drinking water to about 250,000 people and sanitary facilities to about 500,000 people**
- **Could do this for about \$100B/year**



Hydrophilanthropy

Altruistic concern for the water, sanitation, and related needs of humankind, as manifested by donations of work, money, or resources.

Hydrohumanity

Expression of kindness or benevolence by helping people meet their water, sanitation, and related needs.

Agua de Vida



Bringing the Water of Life to Paraguay



**The Website of Ed & Linda Baker
Missionaries to Paraguay, South America**

**Trust in the Lord with all your heart
and lean not on your own understanding;
in all your ways acknowledge Him
and He will direct your paths. (Proverbs 3:5-6)**

Our Sending Agency:



**The Mission
Society**

Our Primary Sponsoring Church:



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Clean Water for Nicaragua

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El Porvenir supports self-help, community-initiated water, sanitation and reforestation projects.

El Porvenir means "the future". Clean water means a healthier future for Nicaraguan children.

El Porvenir sponsors "Responsible Tourism". Travel with us and contribute in a substantial and positive way to the development of Nicaragua.

Check out our latest newsletter!



THE KASIKI PROJECT

save money... save lives... save the planet.

Kasiki
 save money
 save lives
 save the planet
water jar

www.kasiki.org

Mail donations to:

The Kasiki Project
 c/o Foothills CRDP Walk
 12339 W. Burgundy Ave.
 Littleton, CO 80127

For more information and to donate
 online go to:

www.kasiki.org

When you fill your Kasiki water jar, cross off a
 symbol for each bottled water you did not buy.



You just saved
 the cost of your
 donation!



You've saved money and energy, and prevented
 waste. Now, please send us another donation to
 help save lives through water projects such as
 this one near Masongaleni, Kenya.

Save Money every time you fill your Kasiki
 water jar from the tap, instead of buying bottled
 water or soda.

Save Lives when you contribute money to
 support community water projects that prevent
 water-borne diseases and free women and
 children from carrying water long distances.

Save the Planet through environmentally
 sustainable projects in developing countries
 and by reducing plastic waste and the energy
 used to transport bottled water.

Kasiki is a Kiswahili (East African) word for earthen
 water container, and for a communion cup. When you
 drink from your Kasiki water jar, you connect with
 people in communities around the world. Praise God!

The artwork of the women drawing water is from a
 mural painted on the classroom wall at the Farming
 Systems Kenya office in Nakuru.

Money raised through the Kasiki Project is distributed
 to support community water projects through Water for
 Life, a program of Church World Service, and other
 selected water development organizations. Kasiki is a
 fundraising project created in association with the
 Foothills CRDP Hunger Walk, Littleton, Colorado, USA.
 There are no paid staff -- Kasiki is entirely operated by
 volunteers and all contributions are tax deductible.

For safety, wash your Kasiki water jar often. And, tell
 your friends to donate and get their own Kasiki label.



The Ann Campana Judge Foundation

[purpose](#) [officers](#) [funded projects](#) [contributions](#) [contacts](#) [newsletters](#) [RFPs](#) [links](#)

Guide to Proposal Submission

"Every 8 seconds a child dies from a water-related disease. Each year, over 5.2 million people in developing countries die from water-related diseases".

- World Health Organization, 1996, Fact Sheet 112

"Over 1 billion people lack access to clean drinking water, and almost 2.4 billion people lack access to any kind of improved sanitation services."

- World Health Organization, 2000

NEWS ----

MATCHING GRANT CHALLENGE - An anonymous donor will donate up to \$15,000 as a 1:1 match for all cash/credit card contributions received from January 1, 2007 through December 31, 2007. Please consider [making a donation](#) between now and the end of 2007 if you have not done so already.

PROJECT FUNDING - Beginning with its next proposal solicitation, the Foundation will accept proposals only for projects in Guatemala, El Salvador, Honduras, Nicaragua, and Panama. The Foundation never accepts unsolicited proposals.

Mission Statement

The Ann Campana Judge Foundation exists to promote, undertake, support, and fund philanthropic projects in and relating to developing countries that focus on water, health, sanitation, and student involvement.

Read Jim Belshaw's column on the ACJF

Background

**United Nations 2006 Human Development report:
Beyond scarcity: power, poverty and the global water crisis**

The Ann Campana Judge Foundation (hereinafter referred to as the ACJF) honors **Ann Campana Judge**, former Travel Department Head of *The National Geographic Society*, who was murdered by terrorists on September 11, 2001, just a few months short of her 50th birthday. She was aboard American Airlines Flight 77, which was crashed into the Pentagon. She was a world traveler, mainly to developing countries,



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Other HP Groups

- **Lifewater International** www.lifewater.org
- **Living Water** <http://water.cc>
- **Engineers Without Borders**
www.ewb-usa.org
- **Hydrogeologists Without Borders**
www.hydrogeologistswithoutborders.org
- **Water For People**
www.waterforpeople.org
- **WaterAid** www.wateraid.org/uk
- **Water Advocates (umbrella organization)**
www.wateradvocates.org





Conflation & Conclusion

Conflict over water looms ahead

Climate change can exacerbate those conflicts

What can we do?

Caring can mitigate conflict, promote ***Cooperation***, and help the world deal with climate and other changes

Hydrophilanthropy: we in the developed world have a responsibility to ***make the world a better place***



The Power To Do Good

"I really envy you guys. You have the power to keep people from getting sick. By the time I'm called in, it's invariably too late."

--A medical doctor, talking to some water professionals.



IWW

water.oregonstate.edu

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aquadoc@oregonstate.edu

WaterWired blog:

www.typepad.com/waterwired

The Oregon Water List (TOWL):

lists.oregonstate.edu/mailman/

[listinfo/oregon-water-list](http://lists.oregonstate.edu/mailman/listinfo/oregon-water-list)

***“Be ashamed to die until you have won
some victory for humanity.”***

-- Horace Mann