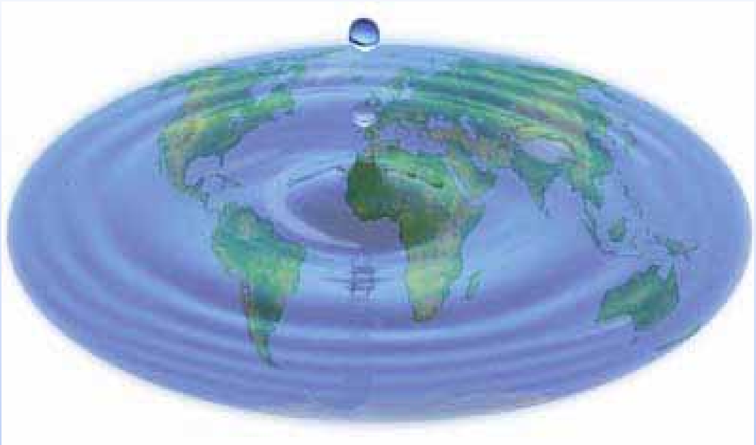
Water Shortage Sharing Agreements: An Application for Climate Prediction



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Water Supply Variability Risks

- Reduced water deliveries to customers
- Reduced hydropower generation
- Difficulty complying with environ. regs
  - surface water quality standards
  - flows for habitat, fish recovery, etc.

Costs of Water Supply Variability

- Acquiring dry year supplies
- Higher electric power costs
- Increased water treatment costs
- Conflict, regional coordination efforts

Dry year supply reliability a challenge *throughout* the West!

Hot spots: **recent efforts to acquire water**

Advantages of Temporary Dry-Year Transfers

- Voluntary, negotiated compensation
- Price negotiations can reflect market and climactic conditions
- Compared to permanent acquisitions:
  - lower transaction costs
  - reduced third-party impacts (econ., env.)
  - can’t be shifted to supply new growth

Different Ways to Structure Temporary Water Transfers

- Regional Water Banks
- Spot Markets
- Long term Dry-Year Option contracts

Dry-Year Options Contracts

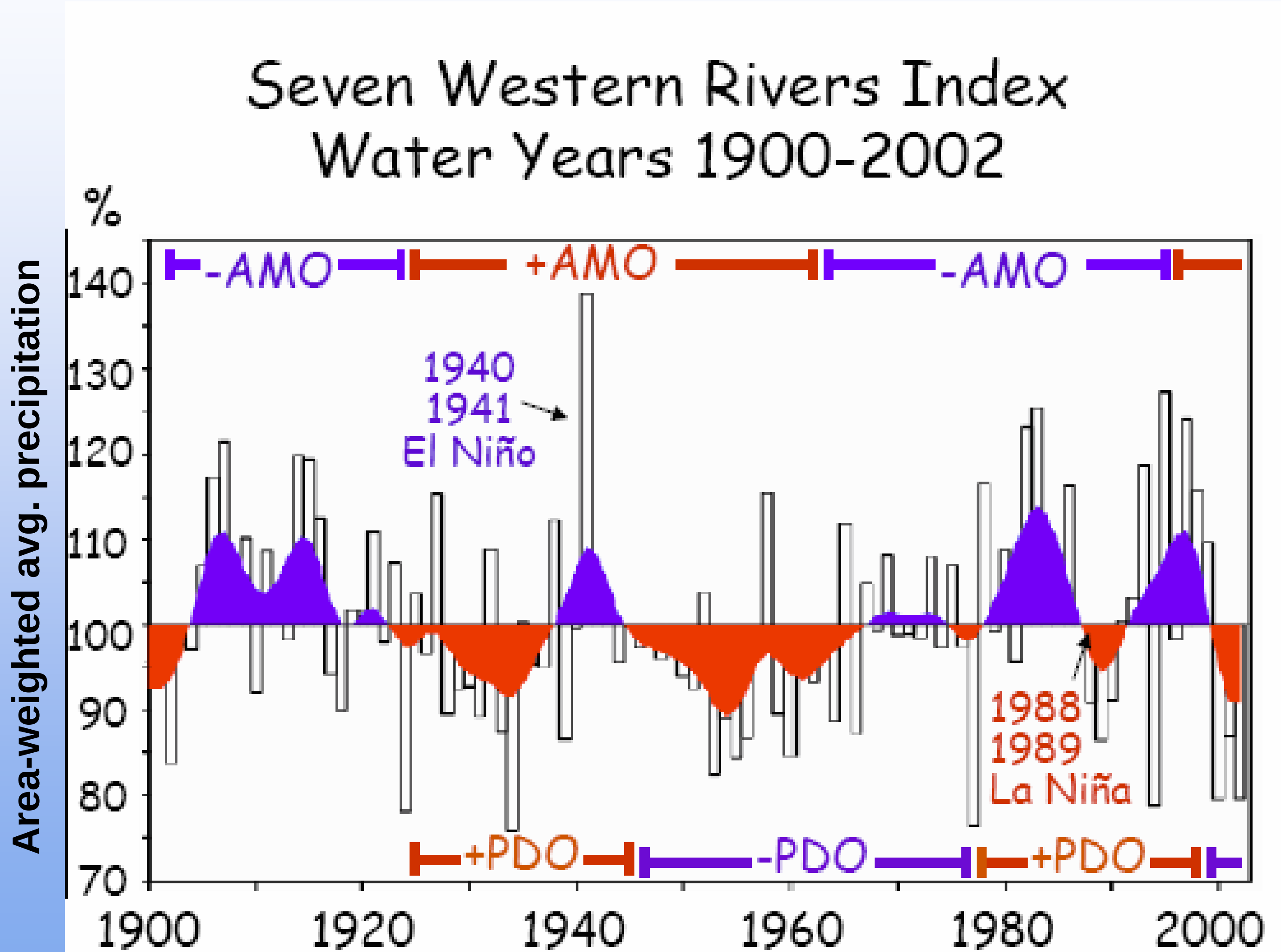
- Voluntary, temporary drought-triggered transfers
- Ownership of water right unchanged
- Can maintain ag base while meeting M&I and environmental drought needs
- Compensation for net crop income foregone

PLUS…

Dry-Year Options Contracts

- Requires sound working relations between district and irrigators
- Cost needs to be justified by increased reliability provided
- But dry-year options cost ***much*** more (per af/year) than outright purchases

Climate Cycles and Water Supply



Graphic courtesy of Henry Diaz, NOAA

Using Climate Science To Improve Dry-Year Agreements

- Improve water use planning & adaptation
  - Crop rotations, labor contracts, technology
  - Financing water acquisition costs
- Tailor option prices & 3rd party compensation based on:
  - Lead time to fallow land
  - Volume of shortage, acres fallowed
  - Duration of shortage, fallowing

California Emergency Drought Water Leasing

- 1991, offered farmers $125 per acre-foot
- Acquired 820,000 acre-feet
- Only wanted 655,000 acre feet
- BUT rapidly acquired water for drought needs
- 1992, offered $50 per acre foot
- Acquired 154,000 acre feet

Klamath Basin: Dry Year Fallowing

- Paid **$300/acre,** 2002
- Paid **$188/acre**, 2003
- Paid **$65/af**, 2004, bid solicitation process
- Bids accepted based on lowest cost per acre-foot of water “saved”
- Savings estimated with crop & soil data

3rd Party Impacts Example: Imperial-San Diego Transfer

In 2005:

- **30,000** AF transferred
- SDCWA paid IID **$276/AF**
- Third-party impacts **$132/AF** (after-tax third-party income and local tax receipts)

Summary of Western Water Leases, 1986 - 2005			
STATE	**Number of Leases**	**Avg. Volume (AF)**	**Avg. Price/AF ($2005)**
AZ	48	93439	100.57
CA	204	31570	122.31
CO	72	3104	141.74
ID	53	55541	32.94
MT	10	2900	20.17
NM	51	9398	53.94
NV	4	18600	66.94
OR	46	16441	68.83
TX	143	8271	165.47
UT	17	7704	32.50
WA	27	3938	85.88
WY	30	2826	54.86
AVG	**59**	**21144**	**78.85**

Modeling Lease Prices With Climate Variables

Climate Variables:

- Palmer Hydrologic Drought Index
- SPI
- SOI
- Other useful climate variables?

Modeling Lease Prices With Climate Variables

Preliminary Results:

- Arizona
  - PHDI insignificant
  - Reflects constrained AZ water markets
- Colorado
  - PHDI significant and negative
  - Statistical relationship between dry conditions and higher price of leased water

Summary

- Dry-year temp. transfers effective way to address supply variability
- Shortage sharing agreements can be improved through Climate Science
  - Planning and adaptation
  - Cost-effectiveness
- Ongoing work:
  - Climate impact on cost of temp. transactions