

Managing Drought Risks Through Water Banks: Who Pays and Who Benefits?

Bonnie Colby, University of Arizona

Bonnie Colby is a professor in the University of Arizona's College of Agriculture, where she has been a faculty member since 1983 in the Departments of Agricultural and Resource Economics and Hydrology and Water Resources. Bonnie's work focuses on voluntary, incentive-based arrangements to improve water supply reliability and reduce regional economic losses during drought. Over the past 35 years, Bonnie has served on multiple design, implementation and evaluation teams for the leading drought impact mitigation and water banking programs across the western U.S.



Bonnie has provided invited testimony to state legislatures, the Western Governors Association and the U.S. Congress. She has taught water resource economics at Harvard University's Executive Training Programs and has provided water economics trainings for the coalition of federal and state water judges and water masters, as well as for many professional associations. She works with private firms, water districts, NGOs and public agencies to develop and implement new strategies to improve regional resilience to drought and to resolve conflicts over water.

Dr. Colby has authored over one hundred journal articles and eight books, including Risk And Resilience: The Economics Of Climate, Water and Energy In The Arid Southwest, Water Markets in Theory and Practice, and Braving the Currents: Resolving Conflicts Over the Waters of the American West.

Managing Drought Risks Through Water Banks: Who Pays and Who Benefits?

Professor Bonnie Colby
Agricultural & Resource Economics, University of Arizona

New Mexico Water Resources Research Institute Conference
Silver City, New Mexico, October 2016

The organizations indicated below provided support for work summarized in this presentation.

Figure 1. Introduction.

Why water banks?

Trading capital, water & risk improves regional economic resilience

Regional economy needs thriving farm & non-farm sectors

Local control – reduce impetus for fed & state mandates

Regional “pressure relief valve” in face of water scarcity – an alternative to litigating

NM has several water banks, considering more




Photo: Todd Sargent, 1988, San Luis Valley, Colorado

Figure 2. Importance of water banks.

What is a water bank?

- a generic term, every bank unique, custom-crafted
- legally authorized to facilitate temporary & intermittent transfers, streamlined procedures
- alternative to farm land “buy and dry”
- range in geographic scale from small watersheds to broad regions that cross state lines

Figure 3. Defining a water bank.

- NM has several water banks, considering more – MRG, Pecos, LRG proposed
- Regional problem-solving capacity
- Specific goals – every bank is unique
 - compact compliance
 - water for highest value crops
 - M&I supply reliability
 - habitat restoration

Figure 4. Water bank objectives.

- Farmers’ risks:
 - fluctuating farm income
 - selling their water “too low”
 - who are the next generation of farmers?
- Urban & Environ. Supply Managers’ risks:
 - paying “too much”
 - false alarms – water acquired then not needed
 - water NOT acquired, significant shortfall occurs

Figure 5. Water banks are all about managing risk.

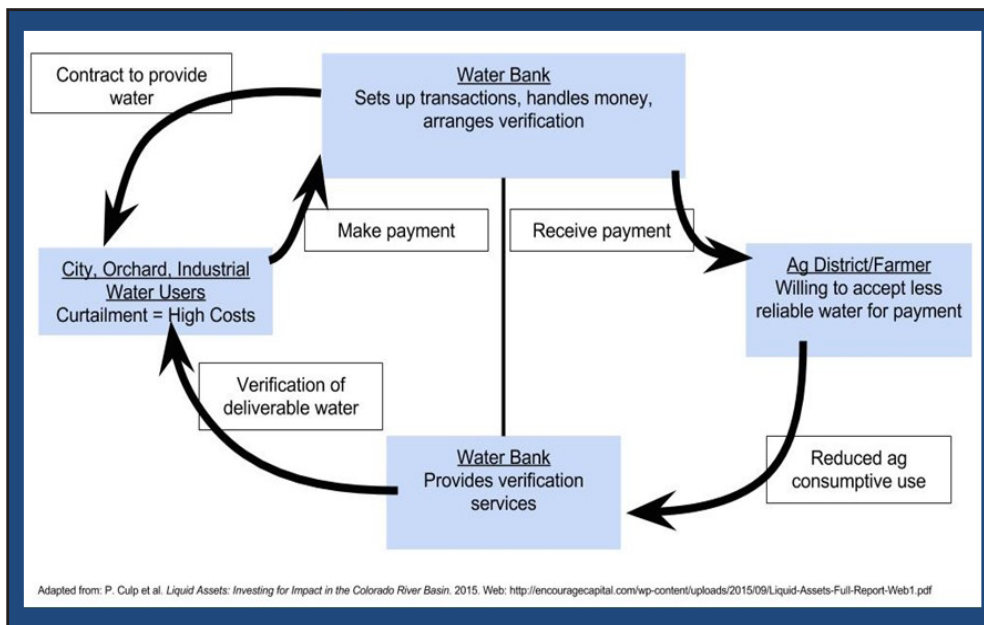


Figure 6. Simple water bank.

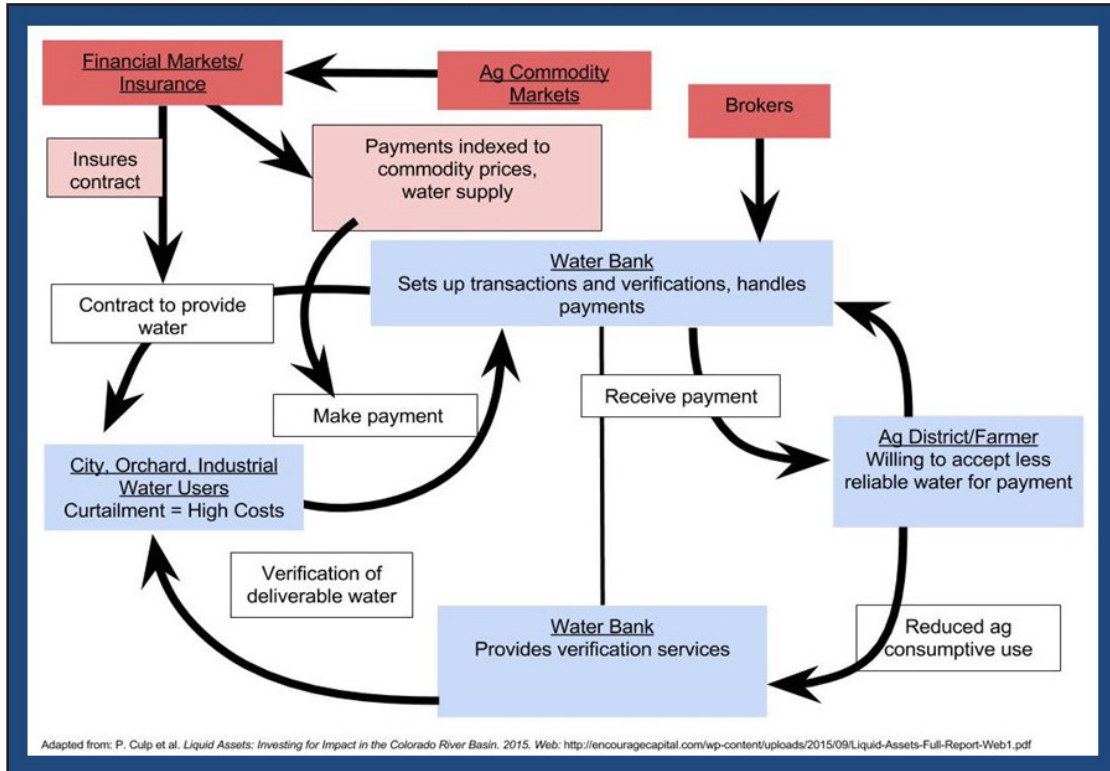


Figure 7. More parties enter water bank.

- “friction” in the system, “grit in the gears”
- finding trading partners, determining price, obtaining approval, implementing
- high TC erode impetus for trading, especially seasonal & temporary trades

Figure 8. Transaction costs.

- serve diversity of water uses with varying WTP to reduce risk of curtailment
 - cost-effectively provide seasonal, temporary trades
 - provide timely response to curtailment of juniors
 - maintain hydrological integrity in water accounting
- (WTP = willingness to pay)

Figure 9. Qualities for water banks to succeed.

Water bank prices should:

- reflect changes in water supply conditions
- reflect changes in farm profitability
- be high enough to attract farmers to enroll
- avoid being too high, dampening regional economy, discouraging new businesses

Figure 10. Pricing water banks.

Ways to establish water bank prices

- trades “matched” online
- fixed offer price, set administratively
- case-by-case negotiations
- can offer bonuses to enroll lands at ends of ditches, close to river, other spatial distinctions

Figure 11. Establishing water bank prices.

Water bank design challenges

- Pay for reduced consumptive use – NOT per acre
- Defining baseline to measure reduced ag CU
- Track crop yield and profitability changes, not only changes in irrigation acreage

Figure 12. Challenges in designing water banks.

Methods for reducing ag CU

- full season cropland fallowing - easiest to monitor, most consistent with water rights admin
- partial season irrigation suspension
- change in crop mix to alter crop CU
- change in irrigation technology & practices
- intentional deficit irrigation – sacrifice some crop yield in return for payment

Figure 13. Methods for reducing agricultural consumptive use (CU).

Neighboring States Colorado

- actively working to develop statewide bank AND Upper Colo R Basin bank (WY, CO, UT)
- ongoing irrigation field trials to test reduced CU
- guiding principles, new Anne Castle & Larry MacDonnell report

Figure 14. Water banks between neighboring states.

Nebraska Platte Basin NRDs

- NRDs must meet streamflow targets – compacts, ESA.
- Face regulatory cutbacks if trading ineffective
- Farmers paid per unit of effect on surface flow (GW-SW models)
- Online trading platforms calculate transferrable quantities and match buyers and sellers

Figure 15. Nebraska Platte Basin NRDs.

Water Bank “Maturing Process”

- Edwards Aquifer bank, mid-1990s: unmarked vehicles, high attorney fees, costly process
- As banks mature: transaction costs fall, price info & trading protocols get better
- Today: dozens of water banks in western US, regular online transactions, managing GW-SW connectivity

Figure 16. Water bank “Maturing Process.”

Examples: water bank economic benefits

- Pecan grower & row crop farmer
Pecans ~ \$260/afcu net farm income
cotton/alfalfa ~ \$135/afcu (NMSU 2012)
- Irrigation district and municipal water provider
- voluntary agreements, juniors pay, seniors receive payment

Figure 17. Economic benefits of water banks.

Lets try it out for ourselves

- HAY & CORN FARMERS
 - senior rights with specific on-farm values
 - provide water to juniors
 - white handout
- CITY, GAME & FISH, VINEYARDS
 - junior rights
 - seek to lease from seniors, budget cap
 - colored handouts

Figure 18. Water trading exercise for conference participants.

Trading and scoring

- 10 minutes to make a deal, agree on price
- Both parties need to register trade
- If junior: want to obtain 100 units at as LOW a cost as possible. Money you do not spend adds to your score.
- If senior: want as HIGH a price as possible. Lease earnings in excess of your on-farm profit add to your score.

Figure 19. Water trading exercise: trading and scoring.

trading money, risk & water = resilient regional economies



*farmer in training,
western U.S* gpb.org

Thank you

bcolby@email.arizona.edu

Figure 20. Trading money, risk, and water = resilient regional economies.

Guidebooks: Innovative Water Trading

- **Prioritizing Water Acquisitions for Cost-Effectiveness, 2013**
- **Measurement, Monitoring and Enforcement of Irrigation Forbearance Agreements, 2012**
- **Entendiendo el Valor del Agua en la Agricultura: Herramientas para Negociar Intercambios de Agua, 2012**
- **Understanding the Value of Water in Agriculture, 2011**
- **Water Banks: A Tool for Enhancing Water Supply Reliability, 2010**
- **Dry-Year Water Supply Reliability Contracts: A Tool for Water Managers, 2009**

Mo O'Donnell (now at UNM), Bonnie Colby and various co-authors, University of Arizona, Department of Agricultural and Resource Economics.

Google: Colby water guidebooks

Figure 21. Guidebooks to innovative water trading.

References

- Basta, E and B Colby, "Water Market Trends: Transactions, Quantities, and Prices," *The Appraisal Journal*, Winter 2010, volume 78, number 1, p 50-66.
- Castle, A. J. & MacDonnell, L. J. (March 2016). "An Enhanced Water Bank for Colorado". *Getches-Wilkinson Center for Natural Resources, Energy and the Environment*.
- Colby, Bonnie G. "Developing System Conservation Programs: A Guide For The Bureau Of Reclamation And Partner Organizations", *January, 2016*
- Colby, Bonnie. "Lower Rio Grande Groundwater Banking White Paper", Report to New Mexico Interstate Stream Commission, November, 2015
- Jones, Lana and Bonnie Colby. "Weather, Climate, and Environmental Water Transactions". *Weather, Climate, and Society*, American Meteorological Society, Volume 2, Issue 3: 210 –223, 2010a
- Jones L & BG Colby. Farmer Participation in Temporary Irrigation Forbearance: Portfolio Risk Management. *Rural Connections*: 43-48, 2010b.
- Lindenmayer, Hansen, Brummer, and Pritchett, *Deficit Irrigation of Alfalfa for Water-Savings in the Great Plains and Intermountain West: A Review and Analysis of the Literature*, *Agron. J.* 103:45–50 (2010) doi:, Colorado State Univ., Fort Collins, CO
- Macarena, Dagnino and Frank A. Ward. "Economics of Agricultural Water Conservation: Empirical Analysis and Policy Implications." *International Journal of Water Resources Development*. 28.4(2012): 577-600, DOI: 10.1080/07900627.2012.665801.
- New Mexico State University, College of Agricultural , Consumer and Environmentla Sciences, Cost and Return Estimates for Farms and Ranches 2013 <http://aces.nmsu.edu/cropcosts/>
- Ward, Frank A. and Manuel Pulido-Velasquez. "Economic Costs of Sustaining Water Supplies: Findings from the Rio Grande." *Water Resource Management* (2012): n.p. PDF File.

Figure 22. References.