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# Land Use and Planning Report

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## A DESCRIPTION OF WATER TRANSFERS IN THE COLORADO RIVER BASIN [1]

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The Colorado River Basin (Figure 1) is one of the most critical sources of water in the West spanning seven US states and two states in Mexico. This river's remarkable reach includes providing water to more than 30 million people, irrigating nearly four million acres of agricultural land. The river's energy powers more than 4,200 MW of electrical capacity to households and industry. However, the river is at risk because increasing water demands and climate change are jeopardizing water security.

This report represents the second of a two part study on the Colorado River Basin (CRB). The objective of the report is to summarize water transfers within the upper and lower Colorado River Basins. For a summary on agriculture production in the CRB, refer to "A Description of Agriculture Production in the Colorado River Basin" (Appleby & Pritchett, 2011). For the unabridged report, refer to the Colorado Water Institute at http://cwi.colostate.edu.

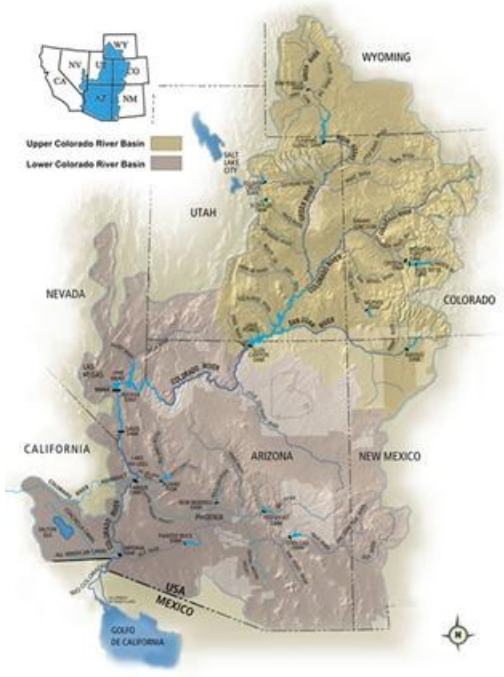


**Figure 1.** Colorado River Basin. http://www.gcdamp.gov/aboutamp/crb.html

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When obtaining data on water use in the CRB, two sources are of particular importance. The first is the Watersheds Report, which is a specific aggregation of responses to the US Census of Agriculture into watershed and hydrologic unit codes defined by the US Geological Survey. These water resource regions (WRR) are subdivided into subregions (4-digit Hydrologic Unit Code [HUC] level) based on water flow patterns from the major rivers within the region. The subregions are further divided into basins (6-digit HUC level). The second source is the Farm and Ranch Irrigation Survey (FRIS), which is statistical sampling performed at five year intervals by NASS to supplement the US Census of Agriculture.

Water is a scarce resource in the Colorado River Basin and the rights to its use are nearly fully allocated. Water rights transactions may be temporary or permanent and may take the form of a lease exchange or outright purchase. The number of historical yearly CRB water transactions in a year is represented by the red line in Figure 2. A general upward trend in the number of transactions is accomplished with particular downturns corresponding to declining economic activity. The column bars represent the number of acre feet transacted within a particular year. Combining the two data series, it is clear that the number of transactions is increasing each year, but the number of acre feet transacted isn't nearly at the level as was traded in the late 1980s and early 1990s. It appears then that the transactions are becoming more frequent but also smaller.

As an alternative, the Bren database categorizes transactions into three types: sales, leases and exchanges. Examination of transactions over time suggest that sales are occurring less frequently than before, and leases and exchanges are relied upon more frequently. Figure 3 illustrates water rights sales. The red line represents the number of sales in a year. The blue columns represent the number of acre feet sold within a year. With some exceptions, there is a correlation between the two. As the number sales increase within a year, in general, the acre feet sold within a year also increases.

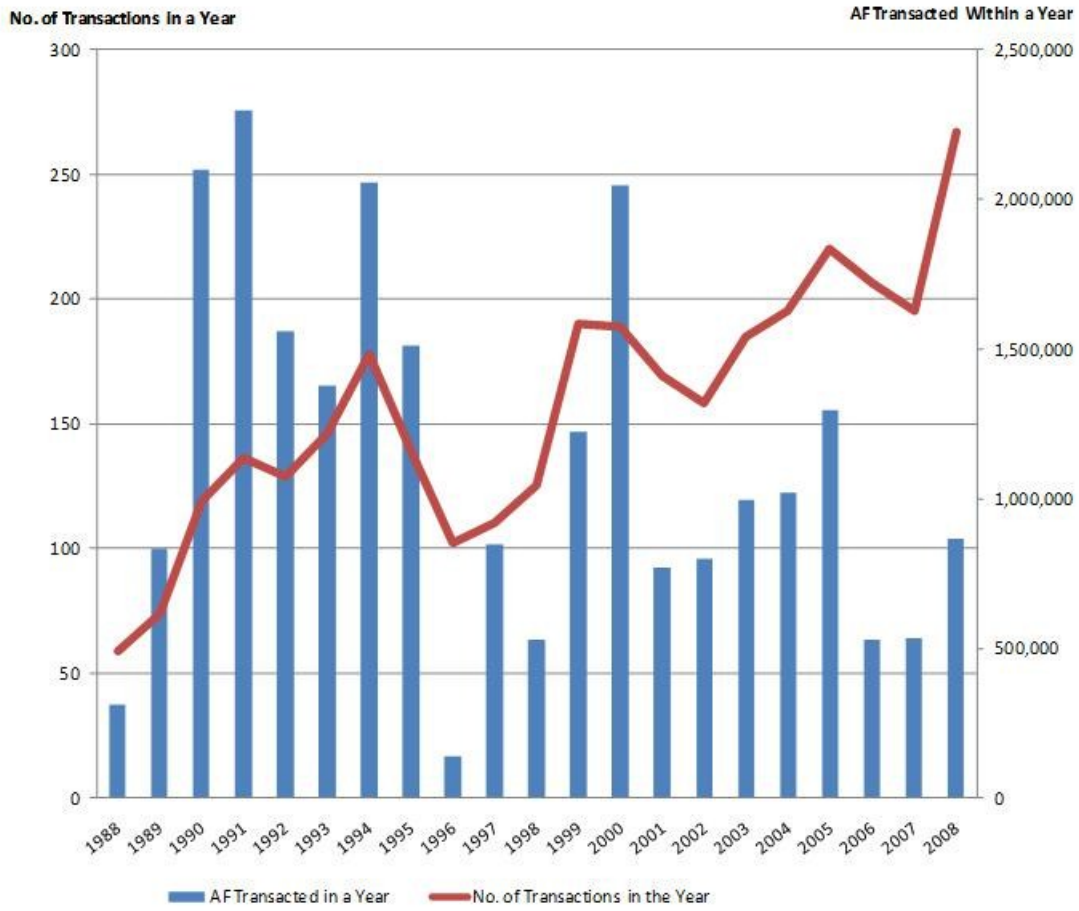


**Figure 2.** Yearly Volume and Number of Transactions in the CRB (1988 – 2008)

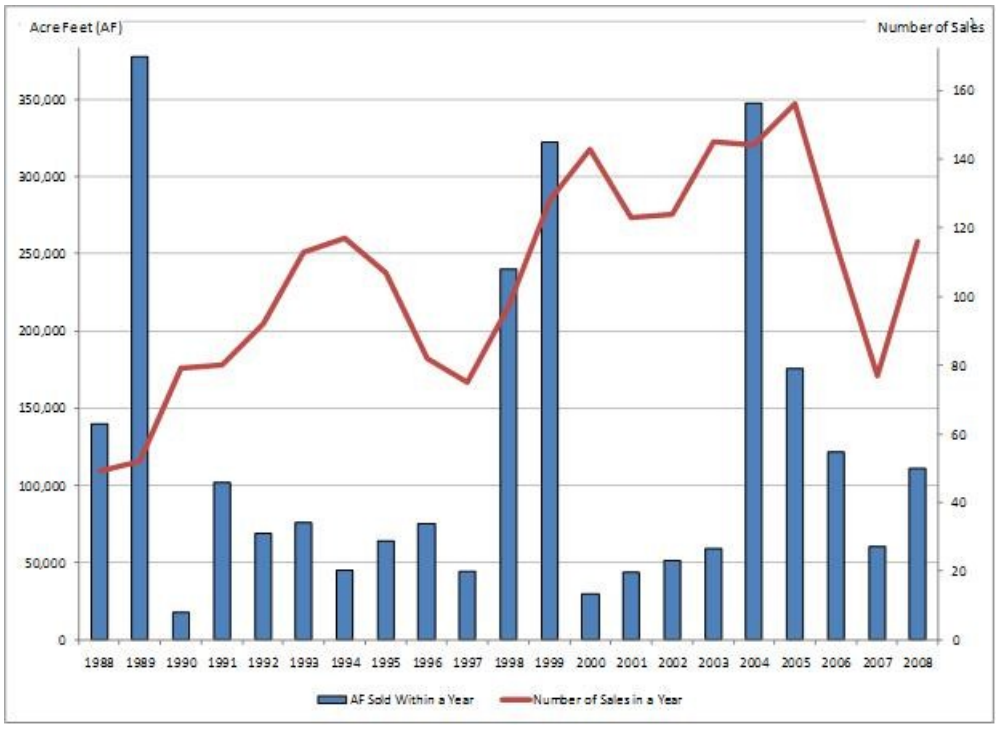


**Figure 3.** Sales of Water Rights and Acre Feet Transacted (1988 – 2008)

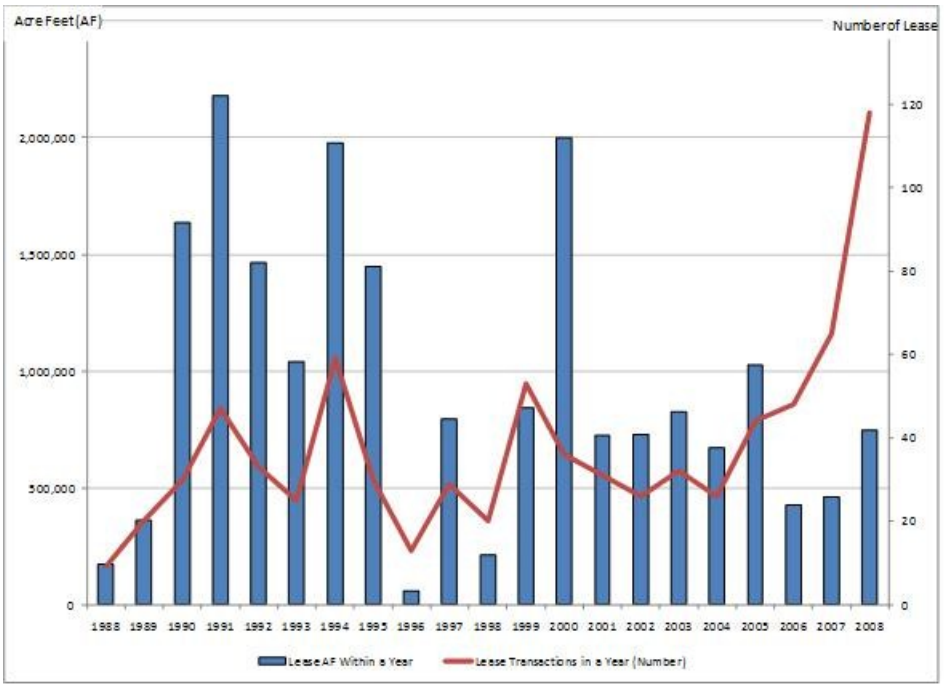


**Figure 4.** Number of Leases and Acre Feet Leased

Figure 4 illustrates the correlation between the number of leases and the total acre feet leased. The red line again represents the number of transactions, whereas the blue columns are the acre feet leased annually. Lease transactions are increasing in number, especially after 2004, but the amount of water transacted has decreased substantially since the mid-1990s except for 2000. The increasing number of leases may be explained, in part, by a trend for municipal governments to seek less permanent water rights.

***Comparing Transactions in Different States***

The size of a transaction will depend importantly on expectations of future water demand, the perceived scarcity of local water resources, the costs to collect, convey, store and treat water, as well as the transactions costs related to water right adjudication or change of use. It's no surprise that the size of transactions (e.g., sales, leases and exchanges) might be different between states (see Table 1) that have different rates of urbanization, different climates, disparate concentrations of water rights among holders, and distinct legal institutions.

***Water Transactions in which Agriculture is the Supplier***

Agriculture continues to divert and use the vast majority of water in the West and the Colorado River Basin. With supplies fully appropriated, reallocation among users is one method of meeting increasing demands among agriculture, environmental and municipal interests. Agriculture was the source of at least 82% of the transactions recorded in the Bren database between 1988 and 2008, and agriculture supplied 68% of the acre feet of water that was transacted.

Figure 5 indicates the pattern of transactions through time in which agriculture provided water to other parties, including agriculture interests. The number of transactions is generally increasing, but the acre feet transacted in a year is remaining somewhat steady, with the exception of 1997.

Of particular interest are sales of water rights from agriculture to municipal use. These voluntary transactions may be the result of increasing urbanization in the West and are linked to the reduced acreage in irrigated cropping illustrated earlier in the report. As

**Table 1.** Percentage of Transactions and Percentage of Acre Feet Transacted in Each State (1988-2008)

| | Arizona | California | Colorado | Nevada | Utah | Wyoming |
|---|---|---|---|---|---|---|
| Number of Transactions (1988-2008) | 218 | 644 | 2,113 | 177 | 77 | 61 |
| Percentage of Total Transactions (1988-2008) | 7% | 20% | 64% | 5% | 2% | 2% |
| Percentage of Acre Feet Transacted (1988-2008) | 36% | 53% | 6% | 1% | 2% | 2% |

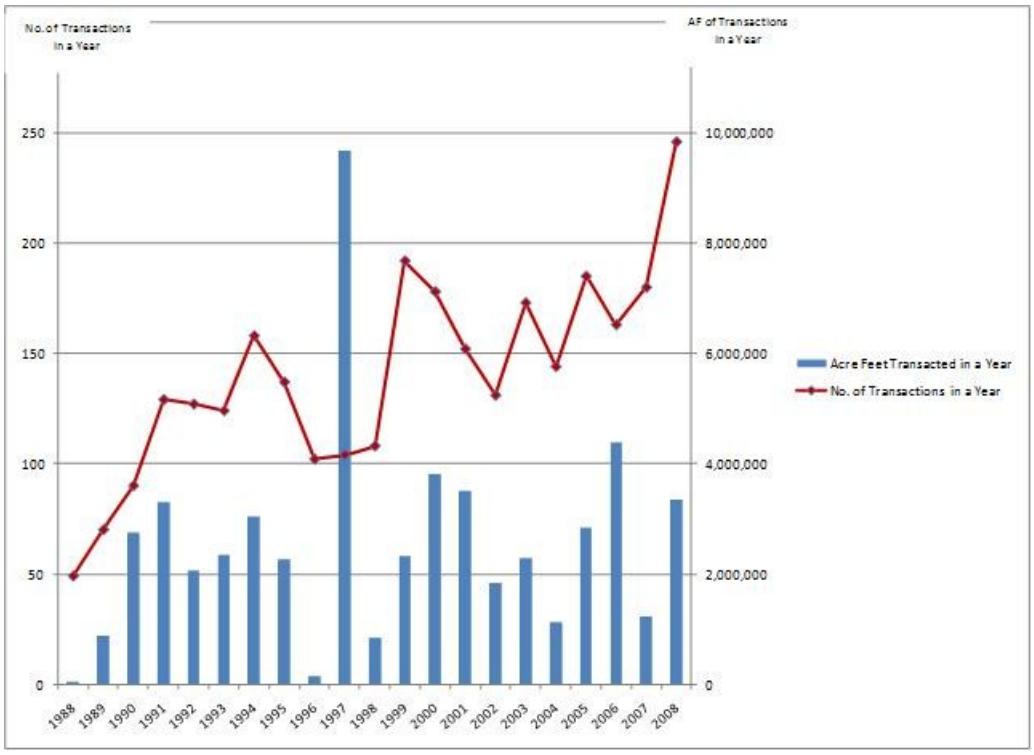


**Figure 5.** Number and Acre Feet of Transactions in which Agriculture is the Supplier

indicated in Figure 6, the number of agriculture to urban sales follows an increasing trend from 1998 to 2008, but the acre feet per transaction is declining. Perhaps municipal suppliers are beginning to seek less permanent transactions for meeting increasing demands as the cost to transfer water becomes more expensive.

## Conclusions

The Colorado River Basin is a vital resource of water for agricultural, environmental and municipal interests. Increasing demands among users and climate variability are driving a reallocation of use that will persist for some time. Summary points include:

- Water transactions are increasing in the CRB, but the average size of transactions is declining. The number and volume of water transacted varies according to state, in part due to differential rates of urbanization and institutional structures.
- Sales are the most frequently used transfer mechanism, but a greater volume of water is transferred using leases. The trend is toward increased leasing and decreasing use of sales as a transfer mechanism.
- Agriculture is the predominant water right holder in the CRB, and agriculture water right holders are most often the supplier in a transaction. Agricultural users are the most frequent receivers of water in transactions, but municipal to agricultural transactions are increasing.
- The water transactions data are limited to the states of AZ, CA, CO, NV, UT and WY, but the recorded transactions need not fall in the hydrologic range of the CRB. This is an opportunity for future research.
- This study makes use of secondary data compiled by the Bren School of Environmental Science and Management at the University of California, Santa Barbara. Inference drawn from this data is limited by its scope and the manner in which it is summarized.

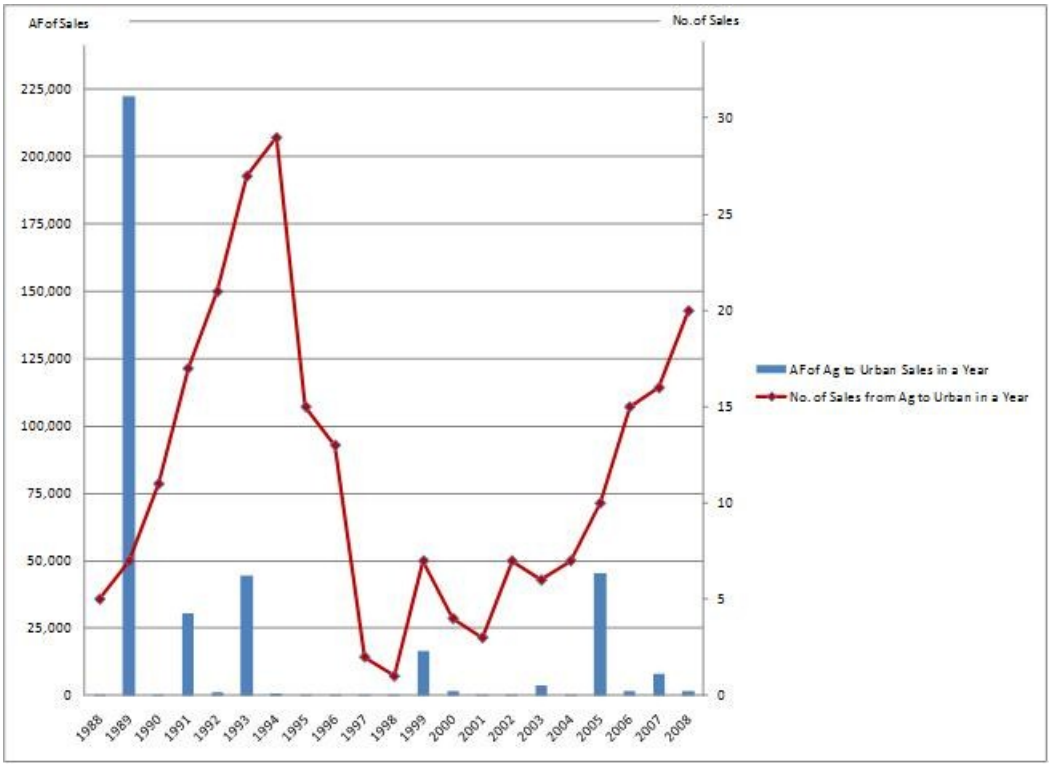


**Figure 6.** Volume and Number of Transactions from Agriculture to Municipal Water Right Holders

**Sources**


1. University of California, Santa Barbara, Donald Bren School of Environmental Science and Management, Water Transfer Database. http://www.bren.ucsb.edu/news/water_transfers.htm Note that transactions were updated through February 2009.
2. US Census of Agriculture, Farm and Ranch Irrigation Survey (various issues). US Department of Agriculture, National Agriculture Statistics Service. http://www.agcensus.usda.gov/Publications/2007/Farm_and_Ranch_Irrigation_Survey/index.asp
3. US Census of Agriculture, Watersheds Report. US Department of Agriculture, National Agriculture Statistics Service. http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/Watersheds/index.asp