“Hard Times on the Colorado River: Drought, Growth, and the Future of the Compact,” Natural Resources Law Center 26th Annual Conference, June 8-10, 2005

INTERSTATE MARKETING AND SIMILAR ECONOMIC APPROACHES

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or

WHAT IF MARKETS REALLY HAPPEN?

If markets happen:

- Where does the water go?
- What are the net benefits to the buyers and sellers?
- What are the impacts to third parties?

Market scope

- Intrastate
- Interstate but intrabasin
- Interstate and interbasin

The conventional wisdom -

Clear hierarchy of economic value:

1. urban use
2. lower basin agricultural use
3. upper basin agricultural use

Supporting the conventional wisdom:

Pat Tyrrell

- June 8, 2005

"We can't argue dollars with Las Vegas."

Las Vegas \$1/square foot turf removal is

$\$1/ft^2 * 43,560\ ft^2/acre =$

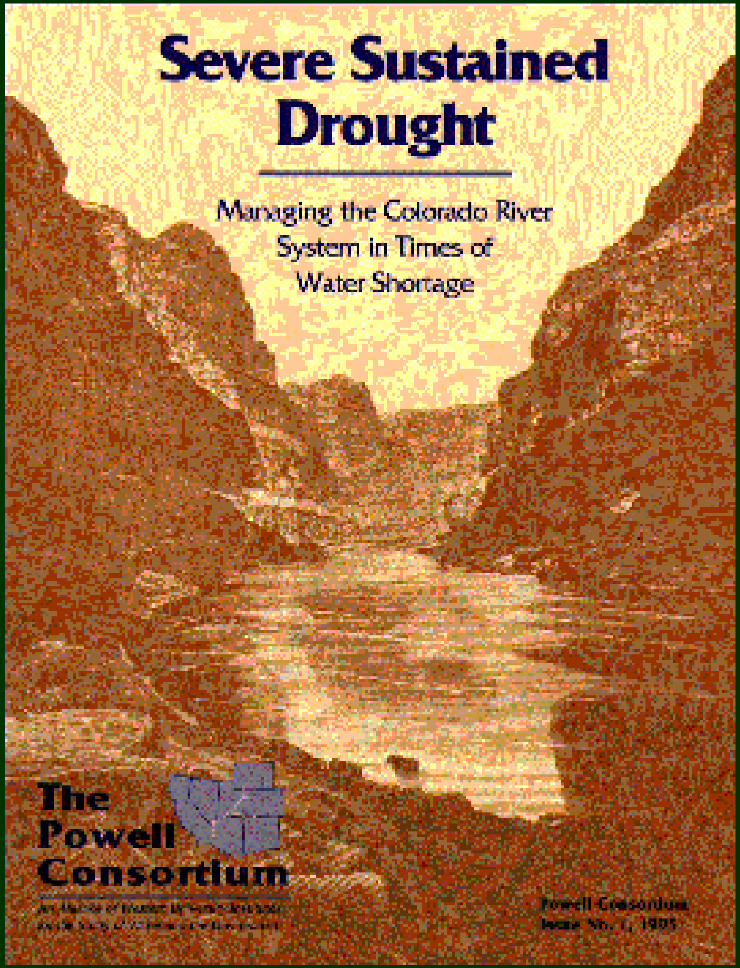
\$43,560 per acre

Compare this to your favorite per acre irrigated land value

Market impacts in the Basin

based on

– *Journal of Environmental Economics and Management*, 1994



containing Booker, "Hydrologic and Economic Impacts…"

and

Contrasting markets in the Basin

<u>Idea:</u> *with and without*

- Water use: how does it change *with vs. without* the market?
- Economic impact: what are the net $ impacts of market transfers (i.e. the difference between *with and without* ?)
- Contrast hydro and other values *with and without* a market.

Contrasting markets in the Basin

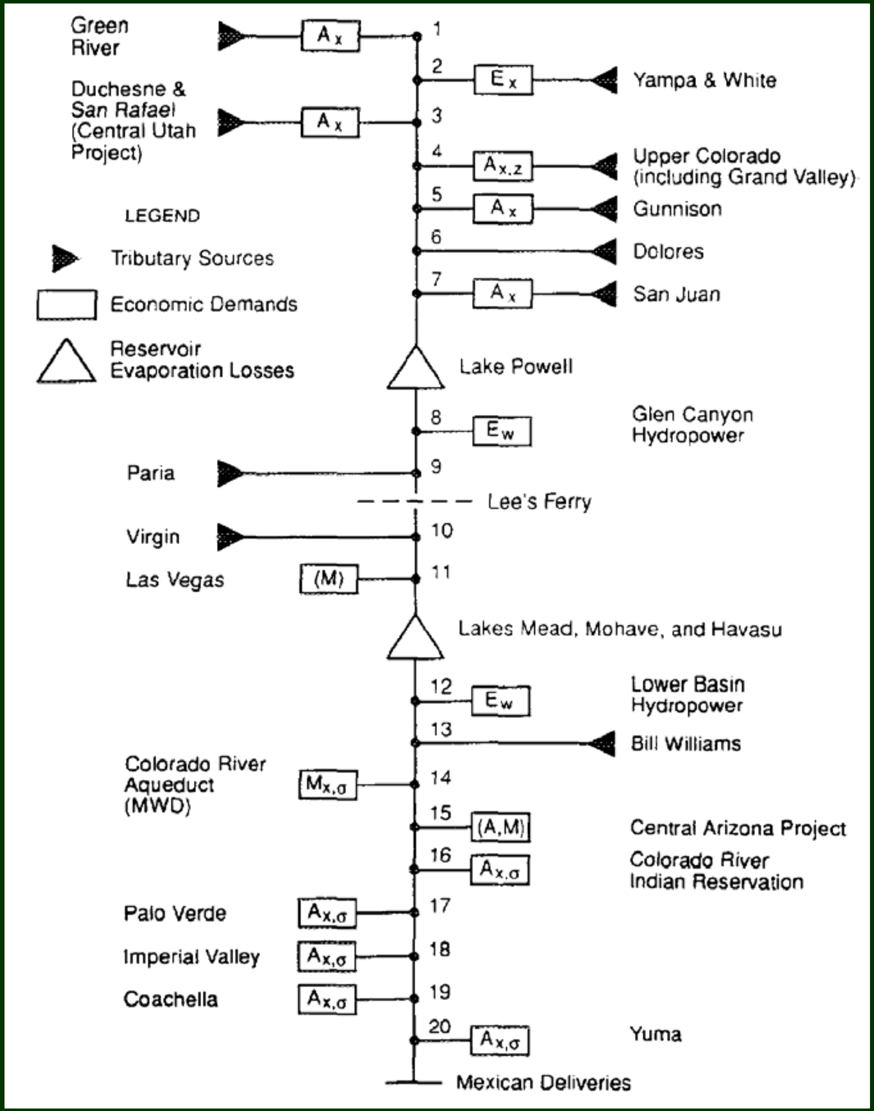
One scenario:

- 10% level of historic 10 year Lee Ferry mean

(almost identical to Stockton and Jacoby median: 13 maf)

- Current (not future) depletion schedule

The Model



Green River
A_x
1
2
E_x
Yampa & White
Duchesne & San Rafael (Central Utah Project)
A_x
3
4
$A_{x,z}$
Upper Colorado (including Grand Valley)
5
A_x
Gunnison
6
Dolores
7
A_x
San Juan
LEGEND
Tributary Sources
Economic Demands
Reservoir Evaporation Losses
Lake Powell
8
E_w
Glen Canyon Hydropower
Paria
9
Lee's Ferry
Virgin
10
Las Vegas
(M)
11
Lakes Mead, Mohave, and Havasu
12
E_w
Lower Basin Hydropower
13
Bill Williams
Colorado River Aqueduct (MWD)
$M_{x,\sigma}$
14
15
(A,M)
Central Arizona Project
16
$A_{x,\sigma}$
Colorado River Indian Reservation
Palo Verde
$A_{x,\sigma}$
17
Imperial Valley
$A_{x,\sigma}$
18
Coachella
$A_{x,\sigma}$
19
20
$A_{x,\sigma}$
Yuma
Mexican Deliveries

Contrasting markets in the Basin

Intrastate

- Ag to urban transfer within states
- $128 million
- hydro benefits unchanged

Interstate

- Ag to urban transfer within state
- $130 million
- hydro benefits unchanged

Preliminary conclusion

Intrastate markets do virtually as well as interstate markets in maximizing the beneficial use of basin water

An unconventional wisdom -

A simpler hierarchy of economic value in basin consumptive uses:

1. urban use
2. agricultural use

What did we leave out?

1. Las Vegas future demands

2. Hydropower, salinity, and other instream values.

Power producers enter market

Intrastate

- Ag to urban transfer within states
- $128 million
- hydro benefits unchanged

Interstate

- Ag transfer to lower basin
- $190 million
- hydro (and salinity) benefits increase

The bottom line - clear hierarchy of economic value:

1. urban use
2. instream use (hydro, water quality, ...)

==>

3. lower basin ag use economically favored over upper basin ag use

More results

Differences from "law of the river" are shown
all data in 1989 million $

	Institution	Use	All	
Current historic	Intra use	93	69	"Old river"
(13.0 maf/yr)	Inter use	94	88	
(JEEM 1994)	Inter all	72	138	
Current tree ring	**Institution**	**Use**	**All**	
(11.7 maf/yr)	Intra use	172	132	
	Inter use	178	93	
	Inter all	161	159	
2010 historic	**Institution**	**Use**	**All**	"New river"
(13.0 maf/yr)	Intra use	656	558	
	Inter use	657	560	
	Inter all	643	634	
2010 tree ring	**Institution**	**Use**	**All**	
(11.7 maf/yr)	Intra use	675	576	
	Inter use	693	515	
	Inter all	662	604	

Elephants in the room

- High cost of new supplies
- Beyond overappropriated: overused
- How much can we use

High cost of new supplies

Neglecting market opportunities leads to:

1. Multibillion dollar schemes like Nevada’s Virgin/Muddy River proposal.

2. Trying to use a desalting plant on agricultural return flows: Yuma.

Cost of new supplies vs. market options

Table B. Summary of annual costs of two alternatives for providing replacement water from a national accounting perspective. Assumes 78,000 acre-feet produced annually, the average of two potential Yuma Desalting Plant yields given in Department of the Interior (2003).

Alternative	National cost estimate (annual)	Risk of substantially greater costs	Implement-ation risk	Flexibility	Secondary economic impacts	Environ-mental impacts
Forbearance agreements	$3 million	*low* – large existing acreage of lower valued crops	*moderate* – institutional procedures not yet in place	*high* – temporary agreements	*moderate* – local loss of related economic activity	*low* – small reduction in flows to Cienaga
Restarting Yuma Desalting Plant	$25 million	*high* – track record of much higher costs; extensive pretreatment requirements; vulnerability to energy cost increases	*high* – updating of complex, older technology required	*low* – costs to maintain plant in ready reserve are greater than costs of forbearance agreements	*moderate* – temporary construction impacts; ecotourism impacts	*high* – loss of Cienaga wetlands

Elephant #2: Beyond overappropriation

"Estimated consumptive uses of the Basin's water between 1996 and 2000 averaged over 19 MAF per year."

- Larry McDonnell, *The Water Report*, Issue #16, June 15, 2005; see also Kenney, Conference Primer, p. 4.

Colorado River System Consumptive Uses and Losses Report 1996-2000

COLORADO RIVER SYSTEM						
Upper Basin	3,759	3,633	3,702	3,538	3,953	3,717
Lower Basin Mainstem	8,028	8,101	7,621	7,977	8,222	7,989
Lower Basin Tributaries	2,827	2,488	2,465	2,368	2,391	2,508
Other	2,024	1,974	1,759	2,154	2,102	2,003
TOTAL	16,638	16,196	15,547	16,037	16,668	16,217
WATER PASSING TO MEXICO						
Treaty	1,500	1,700	1,700	1,700	1,700	1,660
Minutes 218, 241, and 242	112	89	114	79	108	100
Regulatory Waste	5	1,173	3,018	1,194	337	1,146
TOTAL	1,617	2,962	4,832	2,973	2,145	2,906
COLORADO RIVER SYSTEM GRAND TOTAL	18,256	19,158	20,379	19,010	18,813	19,123

U.S. Department of the Interior
Bureau of Reclamation

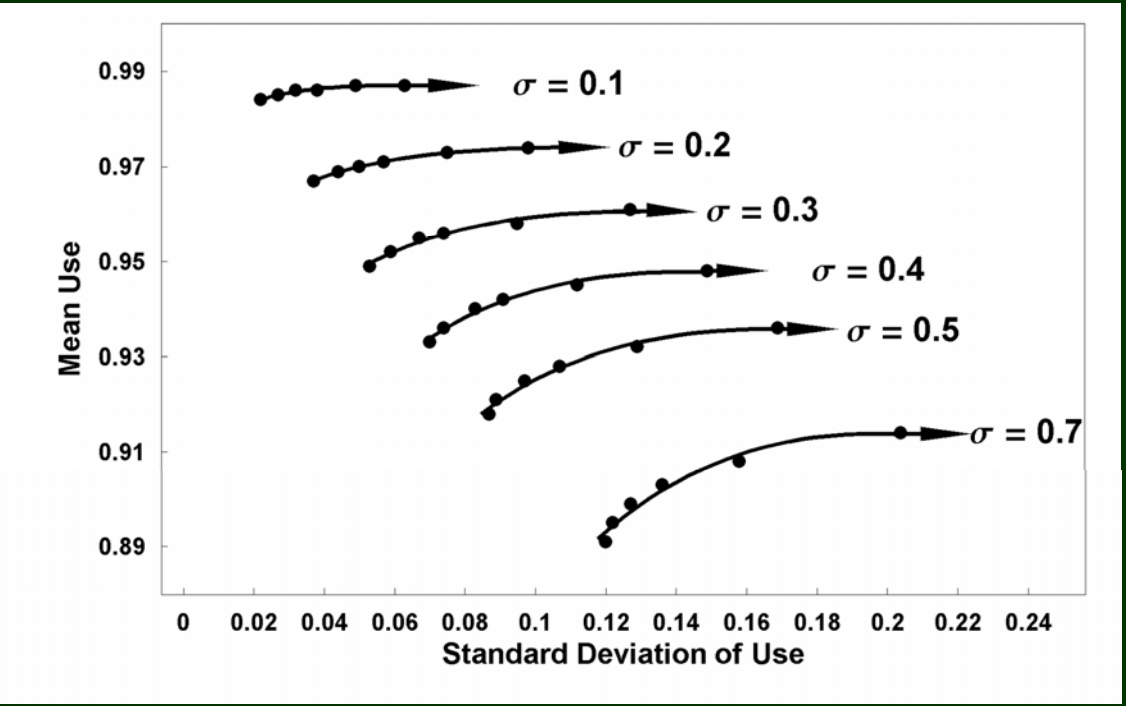
February 2004
Revised December 2004

Elephant #3: How much use is possible?

It depends.

How much variability in use will we accept?

Maximizing use may require *reducing* reservoir evaporation



It depends on storage

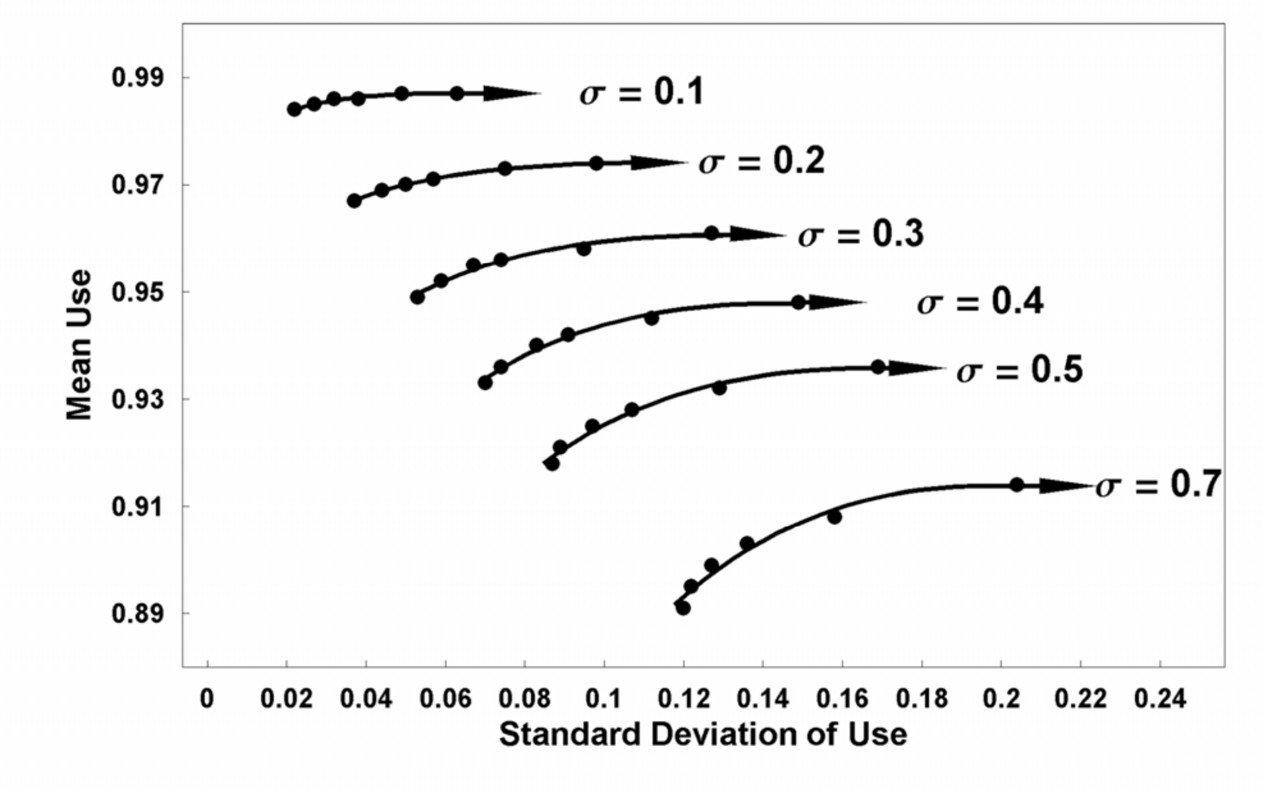
System storage for "basinwide" use

(largely carryover)

Headwaters storage supporting local use

(largely to reshape seasonal flows)

It depends on the willingness to accept shortages

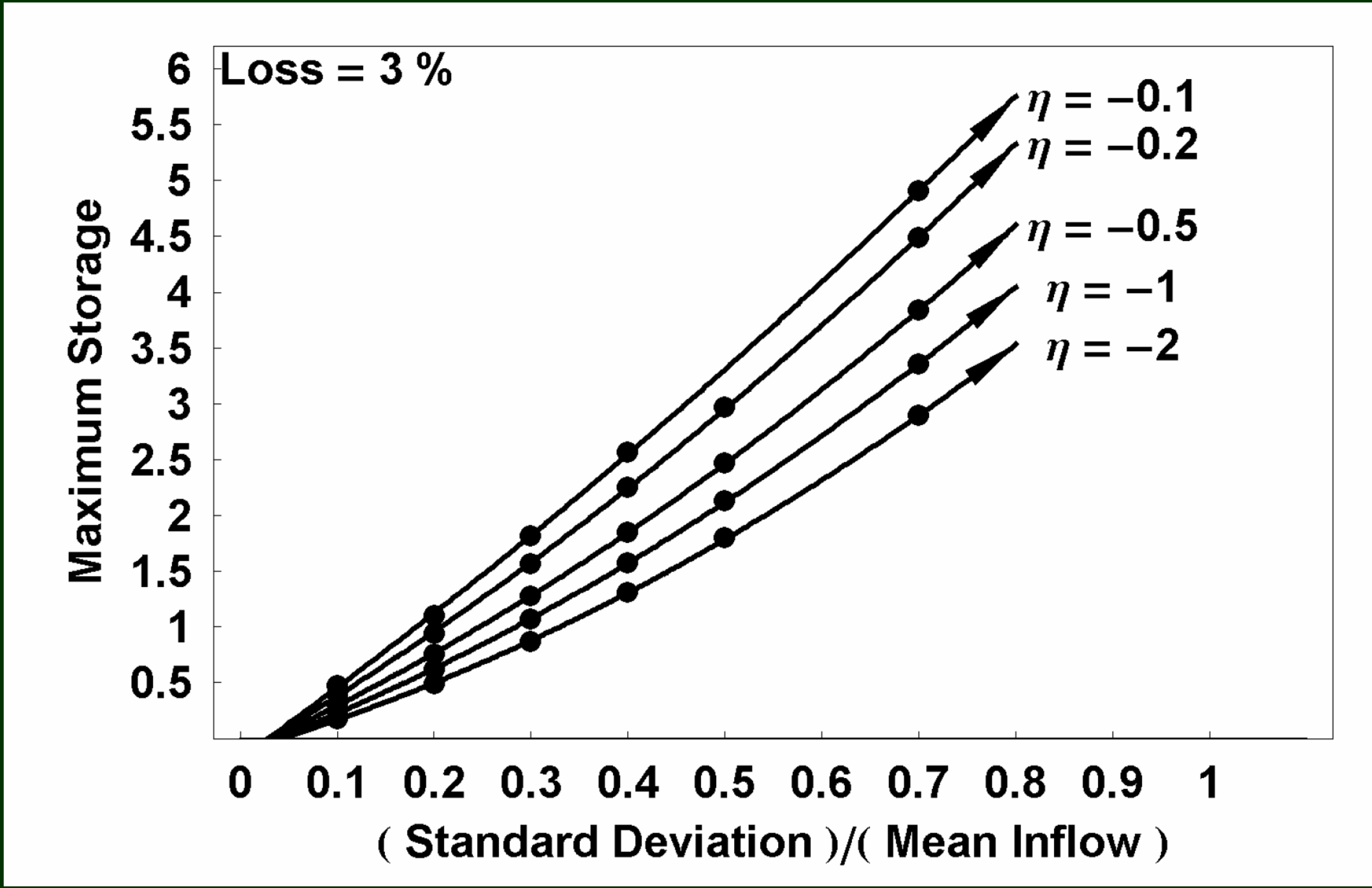


Increasing risk of shortage ==>

Maximizing use may require *reducing* reservoir evaporation -- by *storing less* (Booker, 2005)

What have we learned

- Many new water demands can be met by intrastate markets (but Nevada...)
- Instream uses (e.g. hydro) suggest benefits of an interstate perspective
- New storage has a water cost


Loss = 3 %
$\eta = -0.1$
$\eta = -0.2$
$\eta = -0.5$
$\eta = -1$
$\eta = -2$
Maximum Storage
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
(Standard Deviation)/(Mean Inflow)