Introduction

This analysis provides an estimate of the economic impact on agricultural production in the Walker River Basin under a water banking scenario. The analysis is a simple accounting process involving banked water, water deliveries for irrigation, cropland irrigated, water diverted for alfalfa production, and the per acre gross value of alfalfa production.

The scenario is as follows:
Under moderate flow conditions of calendar year 1993, farmers on the East, West, and Main Walker Rivers are willing to bank 15% of their monthly irrigation diversions, reduce irrigated cropland acres, and make water available for other uses. In return, the farmers receive a lump sum payment and, as a condition, cannot substitute groundwater pumping.

The scenario uses 1993 flow conditions because 1993 is considered a "moderate" flow year. Therefore, adjustments are not required to accommodate wet conditions in which the amount of water available exceeds the amount consumed, or dry conditions, in which the amount of water available is less than what is consumed and underground pumping is used to compensate for differences.
The selection to bank 15% of the water is strategic since for 1993, following a drought year (1992), there was sufficient capacity to store the 15% of water banked. If storage capacity is not available, banked water would be released downstream. Other percentages may be substituted easily to explore the impact under varying levels of farmer willingness to bank water.

Calculating the Economic Impact

The economic impact on agricultural production under a hypothetical water bank scenario is expressed in terms of decline in alfalfa production. Calculating the impact involves 4 steps. These are:

step #1: Calculate
\[
\left(\frac{\text{water diverted for irrigation}}{\text{cropland under irrigation}}\right) \times \text{water delivery adjustment factor for alfalfa production} = \text{crop irrigation diversion rate}^1 (\text{using 1995 wet flow conditions and water righted land data}^2)
\]

step #2:
1993 water diverted x percentage of water willingly banked = banked water

step #3:
banked water / crop irrigation diversion rate = acres taken out of production

step #4:
acres taken out of production X per acre gross value of alfalfa production = value of alfalfa production decline

Special Considerations

Reasons for using irrigation diversions and irrigated land acres for wet conditions instead of moderate conditions in step #1 is twofold. First, using wet conditions to calculate the diversion rate minimizes the ground-water pumping effect on irrigation diversions. Second, since no information exists on effects of drought on irrigated land acreage, it is assumed that all water-righted land was irrigated in 1995.

The diversion rate calculated in step #1 is based on surface flow only and does not include groundwater pumping. Currently, groundwater pumping information does not exist nor does hydrologic-geologic data for the basin. This lack of data limits severely both hydrologic modeling of water banking as well as economic impact assessments incorporating effects of ground water pumping for irrigation.

In Step #3 acres taken out of production is directly proportional to the assumption that 15% of water is banked. Nevada water law allocates water to specific land use duties so that when water is banked, a fixed amount of acreage must be retired proportionately.

The value of decline in alfalfa production calculated in step #4 is the value of production foregone by the sale and transfer of water from agricultural to other uses. This value represents a direct economic impact on the agricultural sector. Gross value, rather than net value, of production per acre is used to calculate impact because the study focused on payments to inputs that will affect the regional (basin) economy.

Alfalfa hay is chosen instead of other crops because basin farmers grow alfalfa hay on the largest portion of irrigated cropland. Although irrigated pastureland acreage in the basin is significant, using pastureland acreage may not reflect economic impact as accurately. That is, taking pastureland acreage out of production affects livestock grazing practices which may result in a significant indirect economic impact expressed as reductions in animal herds and eventually, sales. Additionally, alfalfa hay requires more water, on average, than irrigated pastureland. Alfalfa is a perennial crop and if not irrigated adequately, requires reestablishment.
To calculate the impact on agriculture production for **East Walker River**, for example, the crop diversion rate is first calculated.

**step #1:**
\[
\frac{\text{water diverted for irrigation / cropland under irrigation}}{\times \text{water consumptive use factor for alfalfa production}} = \text{crop irrigation diversion rate (using 1995 wet flow conditions and water righted land data)}
\]

Thus, for East Walker River:
\[
\frac{84,480}{24,384} \times 1.015 = 3.51...
\]

The amount of water banked based on a 15% transaction is calculated as follows:
**step #2:**
\[
\text{1993 water diverted x percentage of water willingly banked} = \text{banked water}
\]
or
\[
75,484 \times .15 = 11,323 \text{ acre-feet.}
\]

To determine acreage that must be taken out of production:
**step #3**
\[
\frac{\text{banked water}}{\text{crop irrigation diversion rate}} = \text{acres taken out of production}
\]
or,
\[
11,323 / 3.51... = 3,223 \text{ acres taken out of production.}
\]

Finally, to determine the value of alfalfa production decline attributed to acreage taken out of production:
**step #4:**
\[
\text{acres taken out of production x per acre gross value of alfalfa production} = \text{value of alfalfa production decline}
\]
or
\[
3,223 \times 497.25 = 1,602,836
\]
or $1.6 million decline in production. Table 1 illustrates these calculations for each of the three segments of river within the basin.

<table>
<thead>
<tr>
<th>Location</th>
<th>‘95 irrigation diversion/ acres irrigated (adjustment factor) = diversion rate</th>
<th>.15 x diversion ‘93 = banked water</th>
<th>banked water/diversion rate = acres out of production</th>
<th>acres out x gross value/acre = economic impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Walker</td>
<td>84,480 / 24,384 (1.015)</td>
<td>3.51 ac ft</td>
<td>11,323 ac ft</td>
<td>3,223 ac x 497.25 = $1,602,836</td>
</tr>
<tr>
<td>West Walker</td>
<td>198,100 / 42,624 (1.012)</td>
<td>4.7 ac ft</td>
<td>23,204 ac ft</td>
<td>4,939 ac x 497.25 = $2,455,960</td>
</tr>
<tr>
<td>Main Walker</td>
<td>95,006 / 29,107 (1.015)</td>
<td>3.31 ac ft</td>
<td>13,470 ac ft</td>
<td>4,070 ac x 497.25 = $2,023,934</td>
</tr>
</tbody>
</table>

**Conclusions**

An analysis of the economic impact on agriculture in the Walker River Basin under a water banking scenario revealed significant declines in alfalfa production. The Bridgeport and Topaz Lake Reservoirs on the East and West Walker Rivers, respectively, realize higher water levels in both summer and early fall. This water management effect, due to water banking, may positively impact recreation in the basin as water recreators are attracted to higher rather than lower lake levels--particularly during peak recreational months. Still, consideration should be given to the argument that banking water will result in more efficient use of water.
This analysis represents an initial impact assessment. Further work is needed to refine the analysis and assess impact on the Walker River Irrigation District specifically. Additional work is scheduled to study farmer willingness to participate in water banking. Surveys will be designed to assess willingness, assign values and approximate prices for banked water. In addition to estimating values for water, the survey will be used to analyze production options farmers would expect to utilize in exchange for voluntarily banking a portion of water. Additionally, ditch companies within the district will be surveyed to assess what technical changes would be needed to accommodate voluntary water banking.

References