A Real-Time Water Leasing Market in the Mimbres Basin, NM

David S Brookshire (UNM)
Craig D. Broadbent (IWU)
Don Coursey (U of C)
Vince Tidwell (Sandia)
Introduction

- Over the course of 5 years we engaged with stakeholders to design a real-time marketplace

- A basin specific hydrologic and economic model was created with the goal to:
  - evaluate third party effects
  - price differentials under the doctrine of prior appropriations
Water Law in the West

- **Doctrine of Prior Appropriations** – the first person to use water from a source for beneficial use has the right to continual use with new users allowed to use water for beneficial use as long as they do not impinge on the previous user.
Physical Constraints

Active Water Resource Management Area (AWRM)-enables OSE to actively manage water
Makes up only small portion of basin
Approximately 800 acres of irrigated agriculture
Basin has seen rapid growth in domestic well use

Modeled Local hydrology
Ephemeral tributary contribution
Reservoir
Ditch losses
Crop ET
Groundwater interaction
Methods: Integrated Modeling

- **Hydrology model**
  - Upper Mimbres river,
  - Nine irrigation ditches,
  - Bear Canyon Reservoir,
  - Fluvial and regional groundwater system,
  - Domestic and irrigation demands

- **Water rights**
  - Priority allocations, and
  - Priority call procedures
Mimbres Trading Market Interface

Welcome, **san_lorenzo**. This round is **January 1st, 1980**. Stacking is **permitted**. Time left: **1:51**

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<th>Location</th>
<th>Priority</th>
<th>Call</th>
<th>Yearly Allocation</th>
<th>Crop Use</th>
<th>Bought/Sold This Round</th>
<th>Tradable Left</th>
<th>Stacked Bank Balances</th>
<th>Reserved Bank Balances</th>
<th>You Sell (or Withdraw Your Bid)</th>
<th>You Buy (or Withdraw Your Offer)</th>
<th>Cash</th>
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<th>A.F.</th>
<th>Price/A.F.</th>
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Submit Bid/Offer
Refresh
The Experimental Setup

- Coupled the Hydrologic model to the experimental interface to run 4 treatments

- 13 participants representing the actual users in the basin participated in a 4 week experiment
  - First two sessions informed participants on the legal structure of prior appropriations and how to use the interface
  - Second two sessions participants utilized the software to engage in market transactions
## Mimbres Treatments

<table>
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<tr>
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<th>No Call</th>
<th>Call</th>
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<tr>
<td><strong>No Stacking</strong></td>
<td>Baseline scenario, we generate this scenario</td>
<td>1986 Water Year&lt;br&gt;2 treatments conducted 9/12</td>
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<tr>
<td><strong>Stacking</strong></td>
<td>1968 Water Year&lt;br&gt;2 Treatments conducted 9/12</td>
<td>Our Understanding is this is a legal constraint and we did not conduct these experiments?</td>
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- **Call**- senior water rights can require that junior water rights stop using water so the water will reach the senior users
- **Stack**- two or more water rights of different priorities are used for the same use and in the same place of use
Expected Results

- Price Efficiency
  - Expected Price = Observed Market Price

- Number of transactions by priority date

- Market should alleviate the impacts of a call, that is fewer calls or less users impacted by a call

- Do third party effects exist
Results: Weighted Average Market Price Stacking No Call Scenario

Weighted Average Market Price by Month Stacking No Call Scenarios

- Weighted average price by month- the shaded area of the box represents one standard deviation
Results: No Stacking With A Call Scenario

Weighted Average Market Price by Month With No Stacking Call Scenario

- Weighted average price by month - the shaded area of the box represents one standard deviation
Results: Total Number Of Trades With A Stack No Call Scenario

- Later priority dates trade more from May to August
- Earlier priority dates have a higher number of trades in the fall and early spring
Results: Total Number Of Trades With A No Stack Call Scenario

- Later priority dates have higher total traders in the beginning of the year and in the fall
Results: Effects Of Water Leasing On A Call

- A Call was expected in July and August

- We observed a smaller call, both in number of ditches and length as a result of market transactions
Results: Third Party Effects

- Two types of effects
  - Within ditch effects
    - Trades within a ditch only (i.e. right ditch or left ditch only)
  - Across ditch effects
    - Trades from the right ditch to the left ditch or left to right ditch

![Diagram of third party effects](representation.png)
Take Aways

- Observed prices seem to not differ much from expectations
  - Still analyzing the results to investigate if price differentials exist

- Relatively consistent trading pattern by priority date by month

- The market decreased the number of users impacted by a call

- Data is still being analyzed to understand if third party effects exist