Rice fields or... water reservoirs?

Rice fields surround the small towns of Nelson (foreground) and Richvale (middle ground) in the Sacramento Valley, with the Sutter Buttes in the distance (Anthony Dunn)
I. Research Questions

• How do droughts and opportunity to sell water allocations affect farmers’ land use decisions?
  – Participation in water sales by fallowing land
  – Unpack the temporal trends: drought, water bank, price of rice, groundwater export restrictions
  – Effect of district, parcel size, leased vs. owner-farmed

• What can spatial data tell us about farmers’ response to changes in weather and policy?

• Effects of water trades, on habitat contiguity
2. Context

- Water trades are an integral part of coping with droughts.
- ‘Water marketing’ is the temporary, long term, or permanent transfer rights to use water in exchange for compensation.
  - Senior water right holders can sell (lease) in dry years.
  - About 5% all water is now traded in CA.
• Water trades are becoming more decentralized
• The State was a broker for trades during
  – Dry Year Water Purchase Programs of 2001 and 2002
• Now, State is a facilitator: irrigation districts or ‘buyer groups’ are negotiating trades amongst themselves
  – Bilateral trades in 2010, 2012, and 2014
  – Some rules e.g. no more than 20% of county irrigated area can be fallowed for transfers. Cal. Water Code §1745.05(b)
Groundwater: Critical link for surface water trades

• 1992 and 1994 Drought Water Banks were largely based on groundwater substitution

• In November 1996, Butte County voters restricted groundwater exports and groundwater substitution-based surface water sales out of county
  – 22 of 58 CA counties have similar restrictions

• Sustainable Groundwater Management Act passed in Dec. 2014
3. Study Area: Butte County
Project Study Area: Butte County
Private Irrigation Districts

- State Water Project Reservoir System
- Biggs-West Gridley Water District
- Richvale Irrigation District
- Western Canal Water District

Distance Scale: 20 Kilometers
Sample Irrigation Districts’ Share of Water Sales in 2010 Dry Year Transfer Program

Source: SWP Bulletin 132-11, CDWR 2013
4. Data

- GIS database of all publicly available data covering 3 irrigation districts for 1984-2014
  1. CA Department of Water Resources (CDWR) land use survey data: rice field location
  2. August Landsat TM 30m resolution satellite imagery: identify growing rice and fallow rice fields
  3. Tax parcel data from County Assessor: aggregated fields into parcels for each landowner
     - A parcel is a contiguous agricultural area owned by an owner.
- Conversations with ID Managers to ground truth the spatial data
- Compiled drought data, institutional detail of water transfers from CDWR
Rice fields aggregated into tax parcels

- 773 tax parcels
- Observed for each year in 1984-2014
- Fallow status and fraction fallowed observed for each year
1991 designated as ‘Critical’ First Drought Water Bank
2000

designated as

‘Above Normal’

No Drought

Water Bank
2009
 designates as ‘Dry’. Drought
 Water Bank
A major drought year with no formal DWB (DWR has given up on managing DWBs) instead the DWR encouraged the districts to sell water to needy users in the south.

Sold water at **$500** per acre foot

Which then was actioned in the San Joaquin Valley Westlands irrigation district for **$1200-1400** per acre foot.

Fallowed Acreage from imagery:

- Western Canal ID – 9194.7ac
- Richvale ID – 6411.5ac
- Biggs-West Gridley ID – 5738.1ac
<table>
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<th>Year</th>
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16 drought years in SJV when water allocation was cut

No permit needed

Permit needed for gw substitution
• 1984-2014: structural break at 1996
• Since 1996, no groundwater exports or surface water exports based on groundwater substitution without permit from county.
• Therefore, observed fallow in water transfer years is for water sales.
5. Conceptual Model

• Economic model predicts that fallowing will be higher when:
  – Price of rice is lower
  – Price received from water sold is higher (presence of a drought)
  – Previous year is not fallowed
  – Groundwater substitution is not restricted

• Dynamic panel data methods used to test the economic model
6. Key Results

• Fallow area has increased in recent years. Learning-by-doing
  – 20% cap on area fallowed is a binding constraint
• Fallow in alternate years.
  – Perhaps not a source for long droughts.
• Lower participation in transfers when price of rice is higher.
• Smaller parcels before 1996; All parcels fallow now
• So far, no change in irrigation technology, or permanent water sales.
  – No incentive to do so as long as water rights are secure or gains from falling are not taxed or charges for conveyance costs very low
Policy Implications

• 20% rule should apply to irrigators who can fallow and sell only.
  – Cap makes sense at the district-level rather than at county level
  – Cap should be linked to longer term hydro-climatic steady state → more research needed

• More comprehensive regulation of water transfers needed in light of SGMA versus Measure G.
2015 Fallow

- ID’s water delivery cut by 25% each
- Tan = Fallow
- Blue = parcel with well according to DWR
Comparing Data on Fallowed Acres in Biggs-West Gridley WD

- *reported by ID manager*
- *spatial data*