



Water Markets: Myth or Reality?

Objective:

- To determine whether or not water markets lead to efficient water use in the agriculture sector using California as a case study
- To determine what hinders or helps the development of a water market.

Water Markets or Water Transfers

- Water markets place a value on water so that through its sale both the buyer and seller benefit. A financial transaction is involved. (Newlin 2000) In addition, multiple players must be involved.
- Water transfers are a voluntary, permanent, or temporary change in existing purpose of water under an established legal right or entitlement. (Newlin 2000)

Why water markets in California?

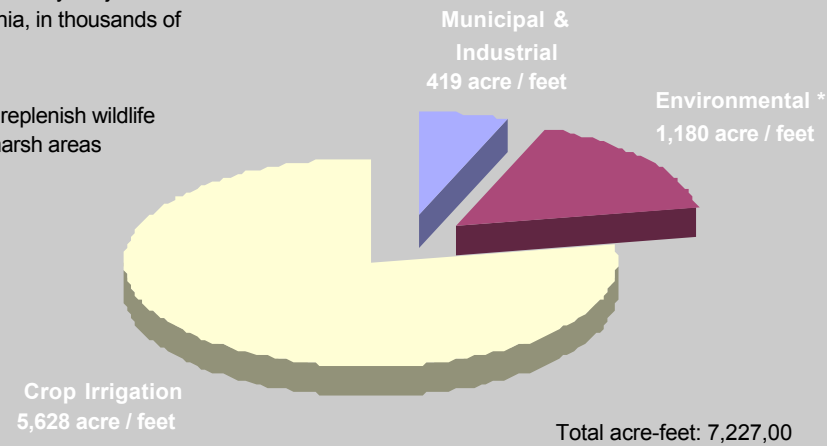
- To meet the demands of the urban sector by transferring water out of the agriculture sector.
- Move water to a higher value.
- Water markets can provide incentives to farmers to conserve water by adopting best practices such as the installation of efficient irrigation technology and improved cropping patterns.

Water Use of Central Valley Project in California

Making a Desert Bloom

Uses of Central Valley Project water in California, in thousands of acre-feet

* water used to replenish wildlife refuges and marsh areas



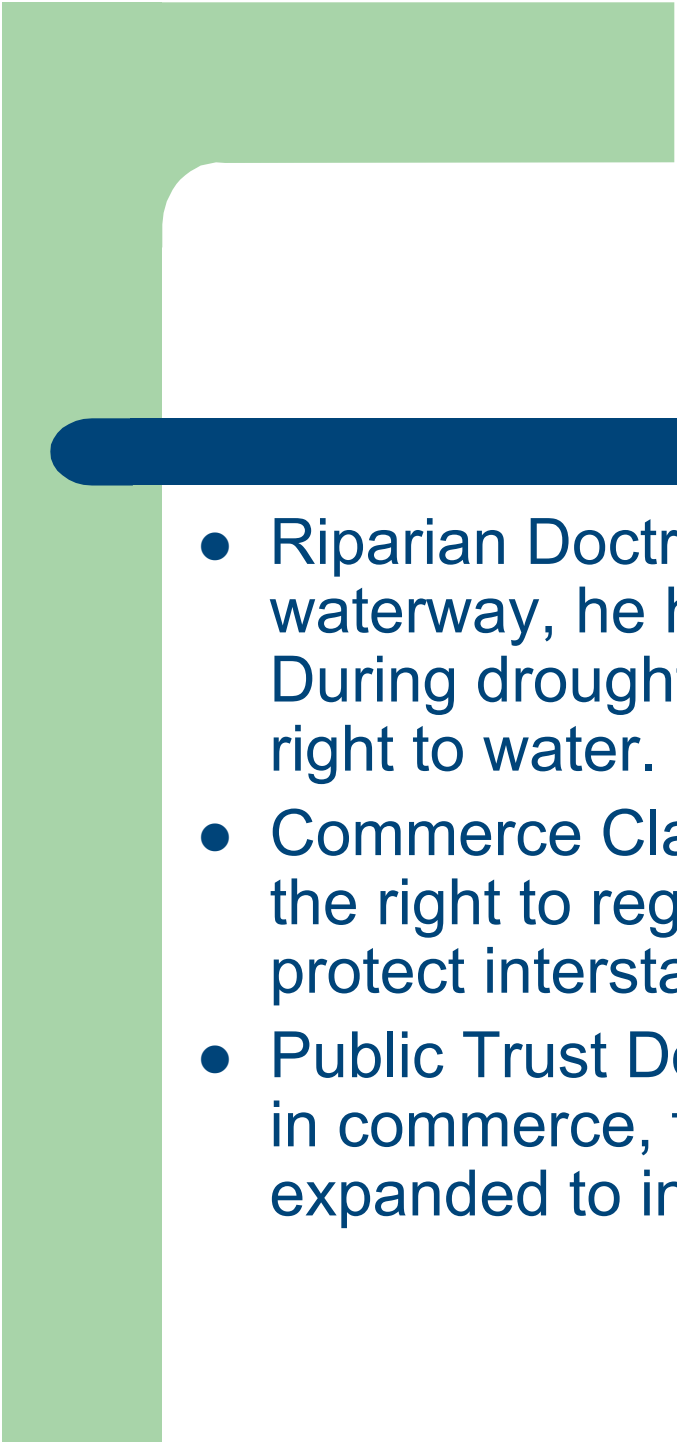

Source: Wall Street Journal citing from the U.S. Bureau of Reclamation

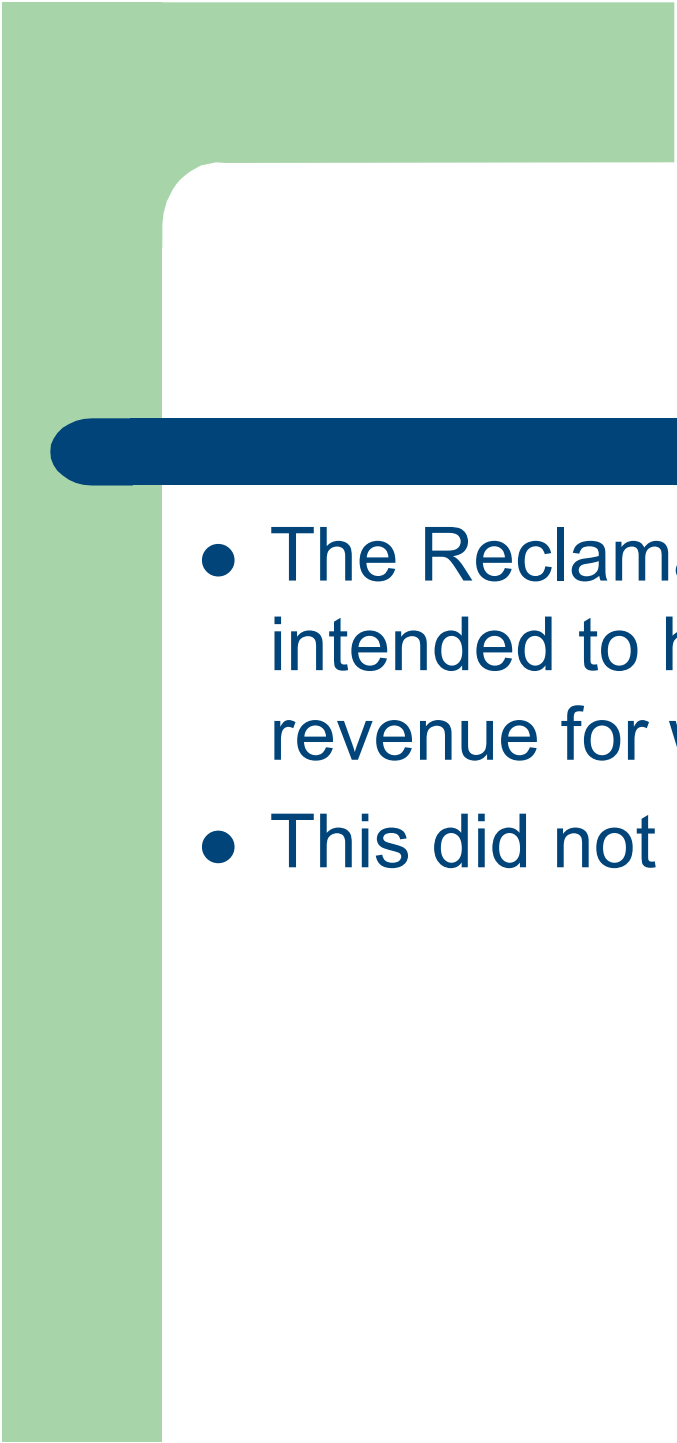

History of water law, and the development of water markets

- Prior Appropriation Doctrine – “first in time – first in right”
- Water rights divided into senior and junior users.
- The west started to develop an effective system of water rights through provisions for defining and enforcing water rights. These provisions were necessary for the development of water markets

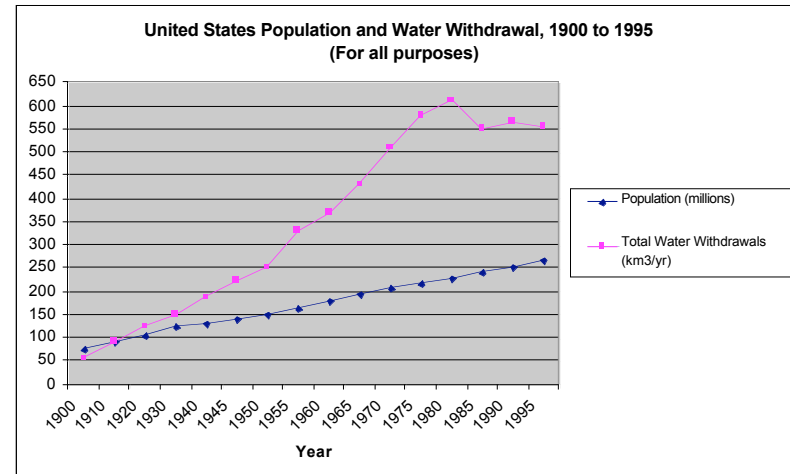
A turning point in the wrong direction

- Courts placed restrictions on the prior appropriation doctrine.
- State laws started to move toward public ownership.

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- Riparian Doctrine - If a landowner lived along a waterway, he had a right to draw water from it. During droughts, the urban sector was given the first right to water.
 - Commerce Clause – Gave the federal government the right to regulate navigable waters to regulate and protect interstate commerce.
 - Public Trust Doctrine – Protects the public's interest in commerce, fishing, and navigation, and overtime expanded to include environmental protection.

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- The Reclamation Act, passed in 1902, was intended to help farmers and generate revenue for western states.
 - This did not happen.

- Since the early 1900s the demand for water has increased; however, water management continues to follow these clauses, doctrines, and acts created in the late 1800s and early 1900s.



(Gleick 2002 citing USGS, US Census)

Concerns about water markets

Revenue Generation

- Should farmers have the right to sell water that they do not pay for?

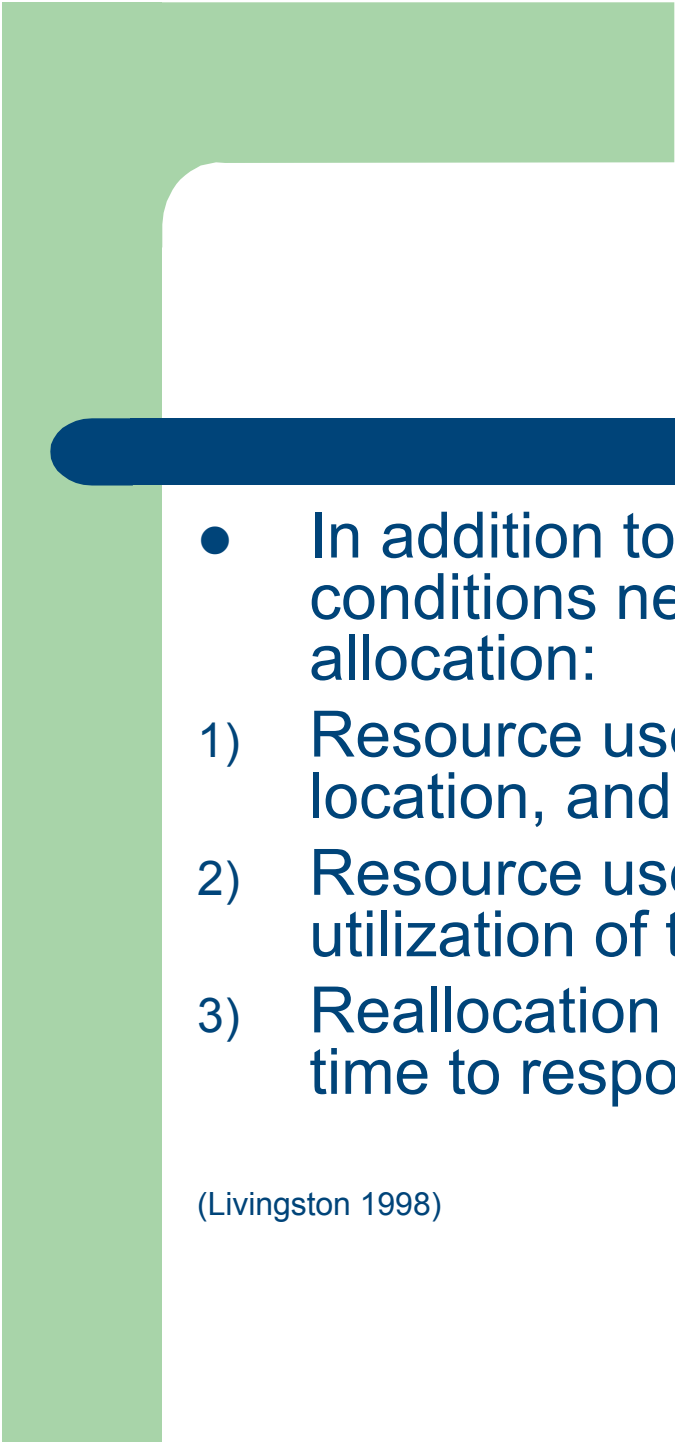

Rent Seeking

- When farmers were not able to meet their obligation for repayment of the purchased project land, they would seek rents.
- Rents can be obtained by changing cropping patterns.
- Example: the diversion of one acre-foot of water to irrigate wheat produces a \$20 return and for grapes a \$50 return. Therefore, farmers would reallocate water from wheat to grapes to capture a rent of \$30.



Water – an economic and social good

- Water is a necessity for human life
- When defined as an economic good, conflicts arise because there are no set ways to measure or capture the costs and benefits of water use
- There is a concern that under a water market poor people or small businesses will be priced out of the market.
- Consensus among the literature that says when water is managed as an economic and social good, property rights associated with it need to be clearly defined in laws, regulations, and informal rules.

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- In addition to clearly defining property rights, three conditions necessary for efficient resource allocation:
 - 1) Resource user must know the quantity, quality, location, and timing of resource availability.
 - 2) Resource use must not affect or be affected by the utilization of the resource by another party.
 - 3) Reallocation of the resource must be possible over time to respond to changing conditions.

(Livingston 1998)

Types of Water Markets

- True water market:
 - 1) Buyers and sellers have complete knowledge about the transaction, and both parties benefit from the exchange
 - 2) Well defined property rights
 - 3) Must be buyers and sellers
 - 4) Transferability of resources
 - 5) Availability of accurate information on trades

(Newlin 2000)

Formal Water Markets

- The user has some form of water right or use that they can buy or sell.
- In California, public utilities control the majority of their water supply. As a result, there are not multiple players to determine the actual cost of water.
- Public utilities do not want to give up water rights because they fear that they will lose control over the allocation of the resource.

Informal Water Markets

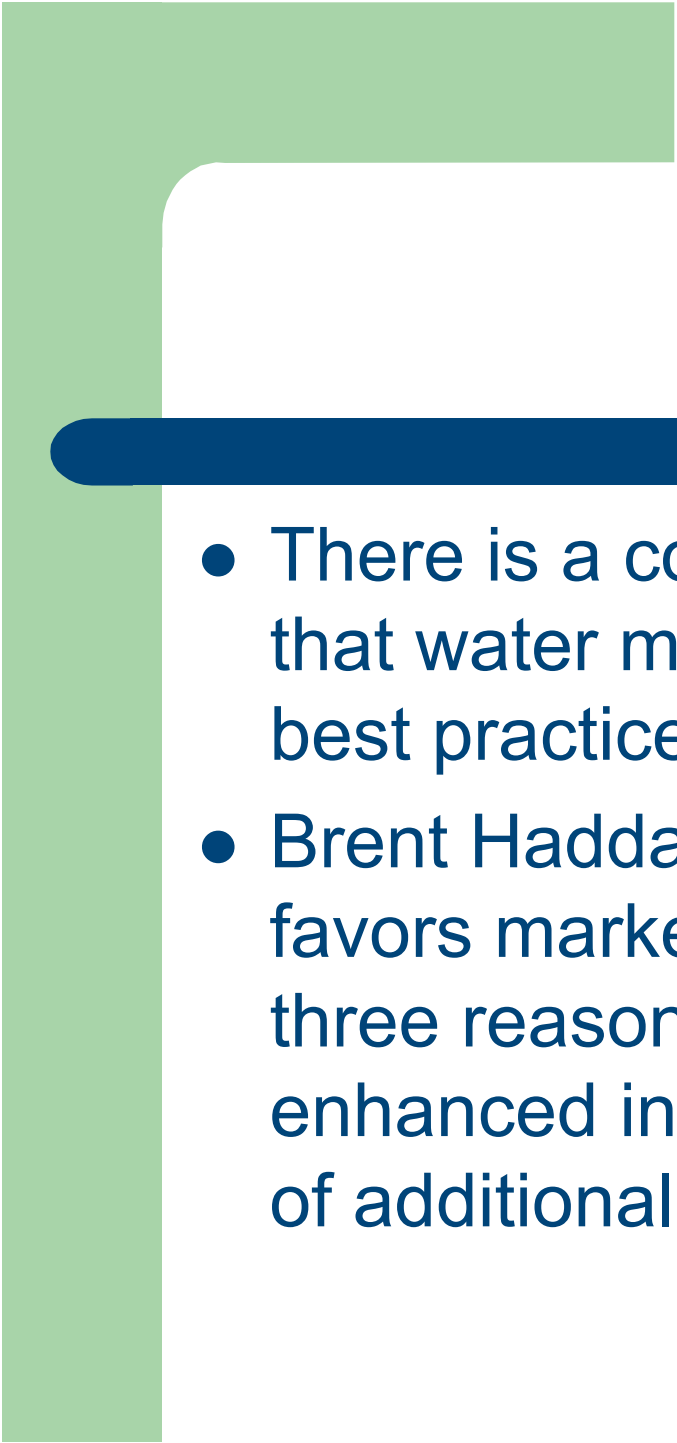

- Less government involvement
- Occur when the government does not respond quickly
- May occur when a farmer sells his surplus of ground or surface water supplies to a neighboring farmer or community.

Informal markets: spot and option water markets

- Spot markets are used in times of water scarcity.
- Option markets consist of long-term water transfer contracts.

- In California, spot and option markets are used more than formal markets because
 - 1) Surface water rights are dominated by appropriative rights.
 - 2) Formal water rights over appropriate water rights leading to “paper water” vs. “wet water.”
 - 3) Environmental impacts and third-party economic effects must be internalized before trades occur.
 - 4) Effective internalization of these externalities requires that consumptive use is defined and monitored which leads to higher transaction costs

Howitt 1998

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- There is a consensus among the literature that water markets will lead to the adoption of best practices to sell more water.
 - Brent Haddad, author of *Rivers of Gold*, favors market based water reallocation for three reasons: economic efficiency, enhanced individual freedom, and availability of additional policy options.

Water Pricing

- In California, growing disparities between the growing metropolitan areas and agriculture areas.
- How do you price irrigation water when the value of land includes the price of water rights?
- How do you account for return flows

Water Policy

- Policy-induced transaction costs such as attorney fees, court costs, state fees, or hydrologic and engineering studies lead to efficient water allocation.
- Policy makers struggle with the flexibility of water transfers because of positive and negative externalities
- Positive externalities occur for the region in which water is being transferred. An example, increased economic activity
- Negative externalities occur for the region from which water is begin transferred. Examples include: reduced water supplies and lower economic activity

(Colby 1990)

Taken from Colby 1990

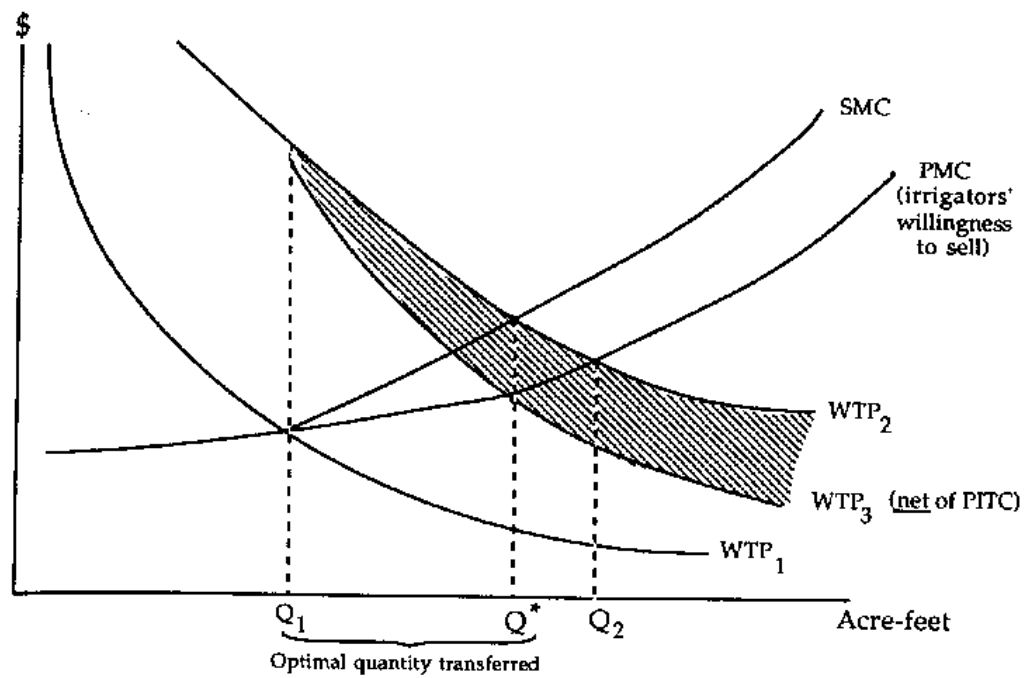
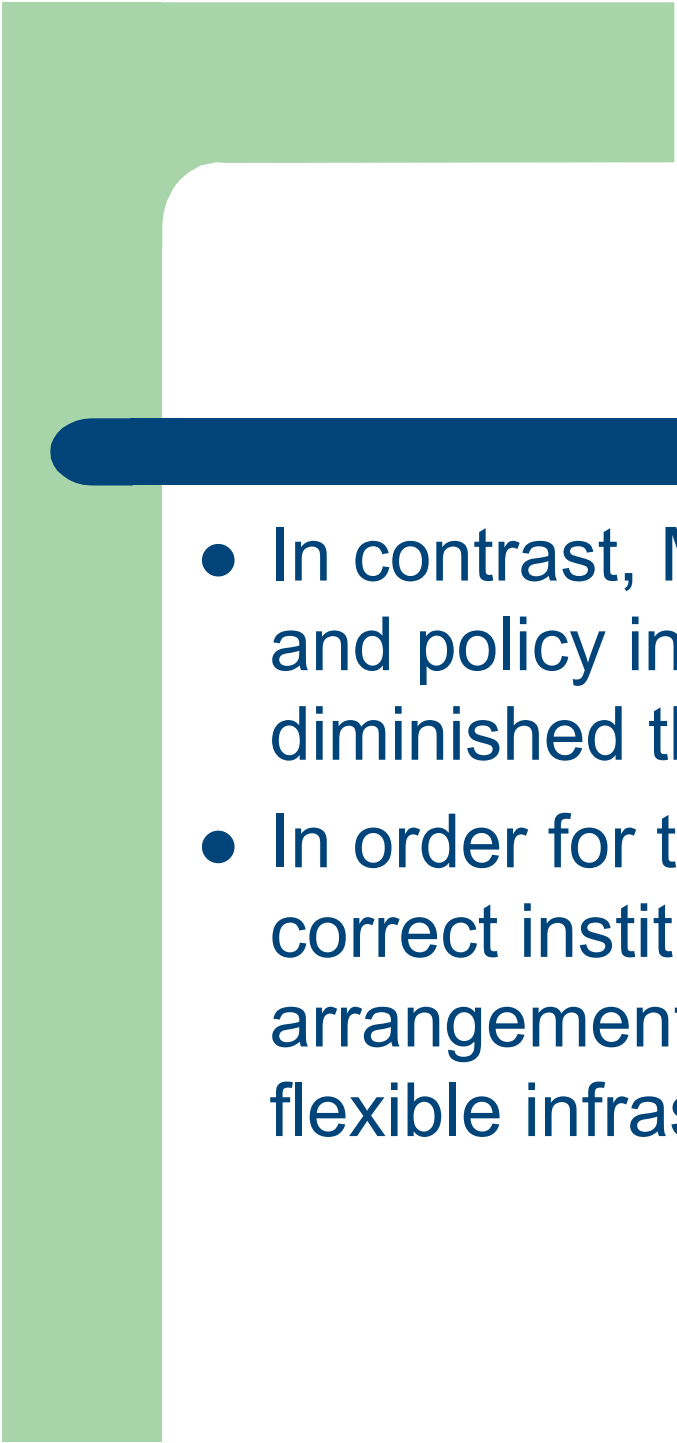

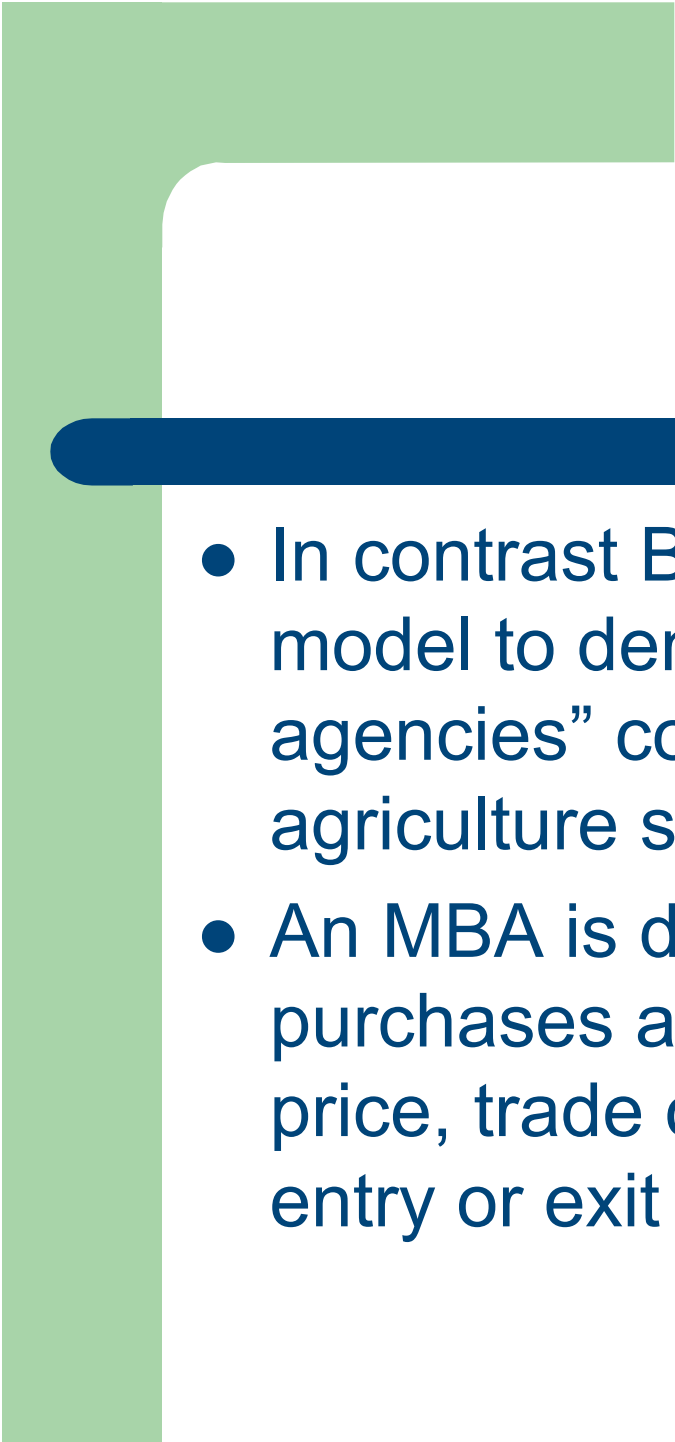



Figure 1a. Optimal PITC

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- In contrast, McKay found that administrative and policy induced transaction costs diminished the gains from water trade.
 - In order for transaction costs to be low, the correct institutional and organizational arrangements need to be in place plus flexible infrastructure and management

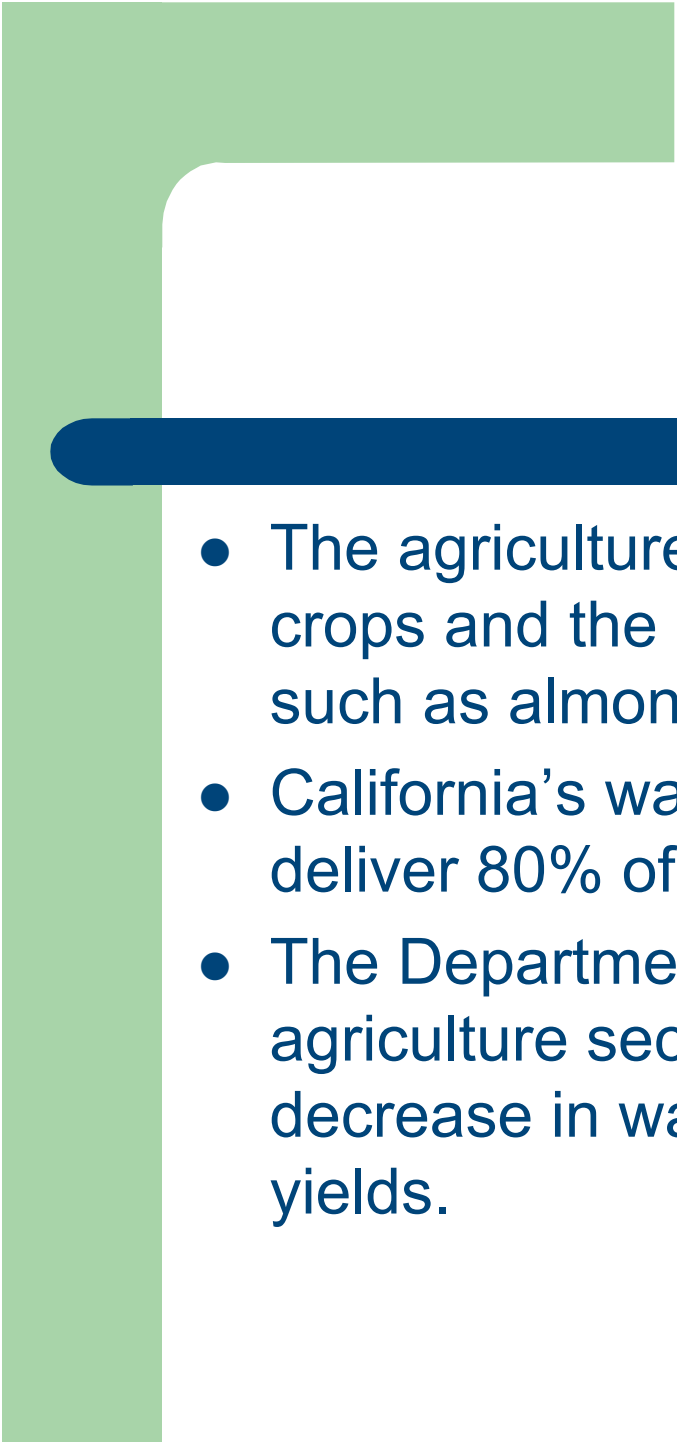

Rural to urban water markets and transfers

- Carey et al., found that water markets do not necessarily prompt farmers to purchase efficient technologies.
- Farmers will invest in modern technologies when the expected present value of investment exceeds the cost of investment

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- In contrast Ballestro et al., developed a model to demonstrate that “markets by agencies” could lead to efficiencies in the agriculture sector.
 - An MBA is defined as an agency which purchases and transfers water at the market price, trade of one good occurs, and no free entry or exit into or out of the MBA.

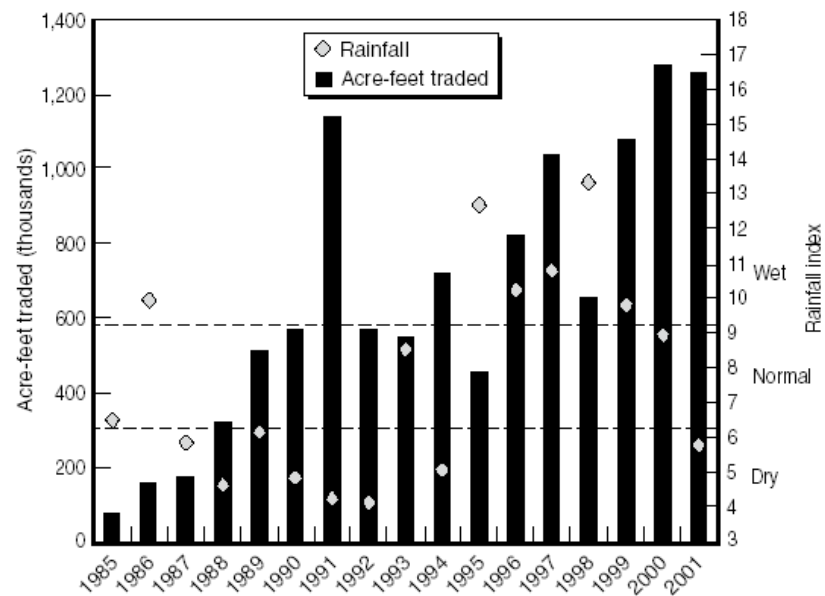
California as a Case Study

- On the one hand, some authors state that water markets are in place, and on the other hand, some authors state that California has not developed water markets but water transfers, which have only been implemented during drought periods.

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- The agriculture sector produces approximately 250 crops and the sole U.S. producer of commodities such as almonds, artichokes, figs, and olives.
 - California's water infrastructure was designed to deliver 80% of water supply to agriculture land.
 - The Department of Water Resources says that the agriculture sector uses water efficiently and any decrease in water for irrigation would decrease crop yields.

California Water Markets?


- Rising demand is the catalyst in the development of markets.
- Urban population growth
- Water markets in the form of temporary, long-term, and permanent transfers have occurred in California (Hanak 2003)



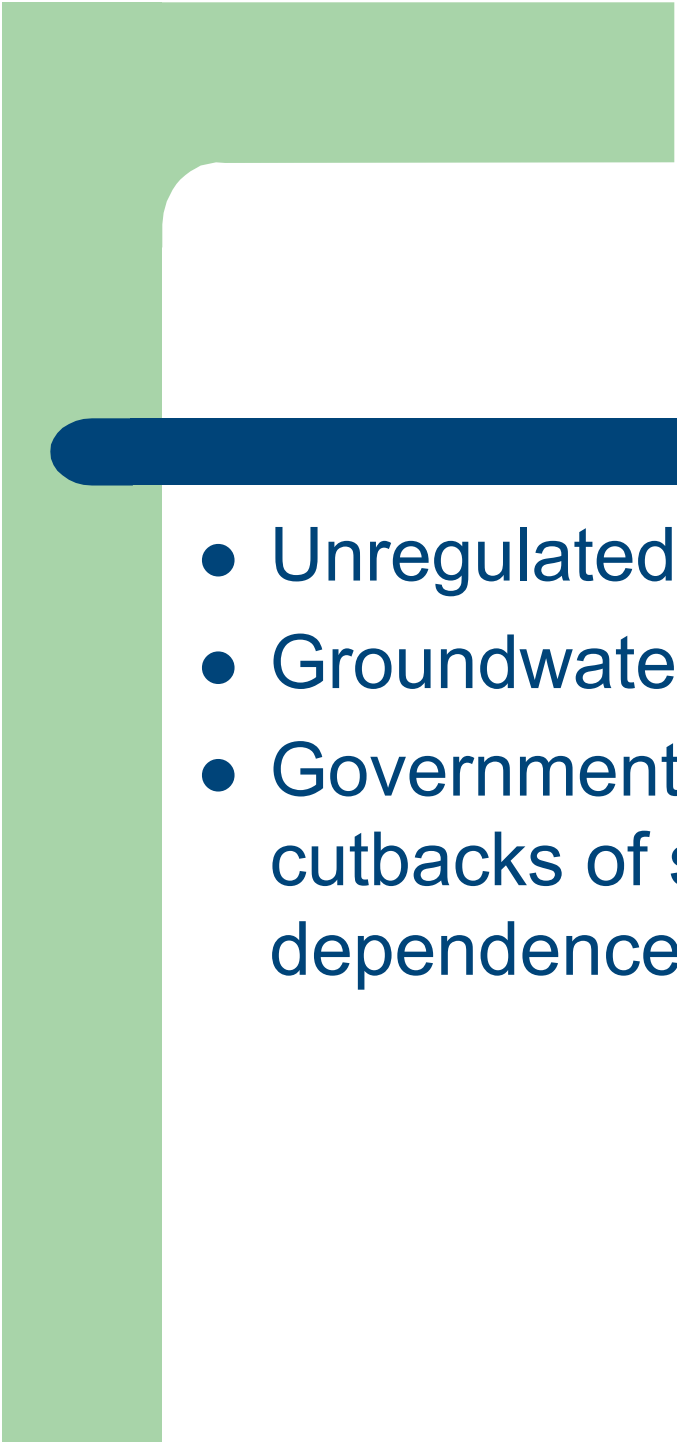

NOTES: For details, see Table A.1. Rainfall is measured by the Sacramento Valley 40-30-30 index, an indicator of water supply conditions for the state's primary river system (see Appendix D).

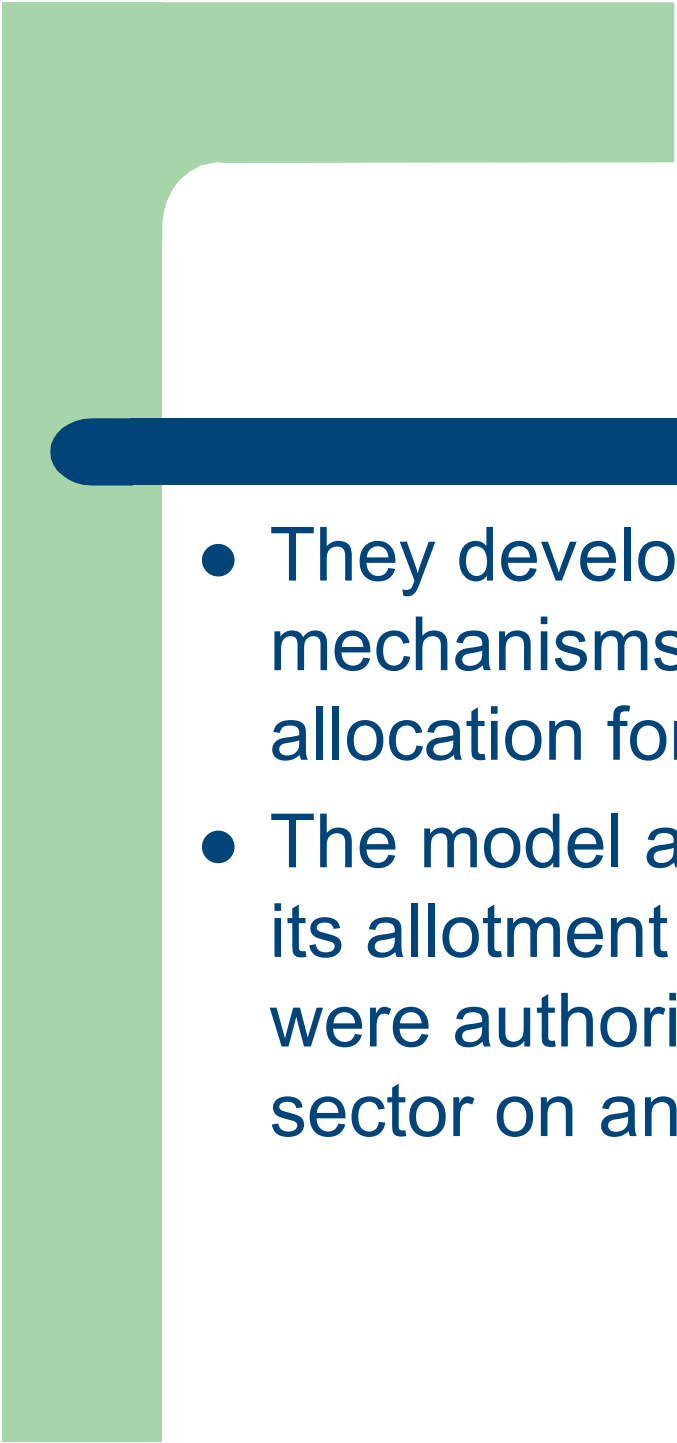

Figure 2.1—Short- and Long-Term Water Transfers in California Since 1985



(Hanak 2003)

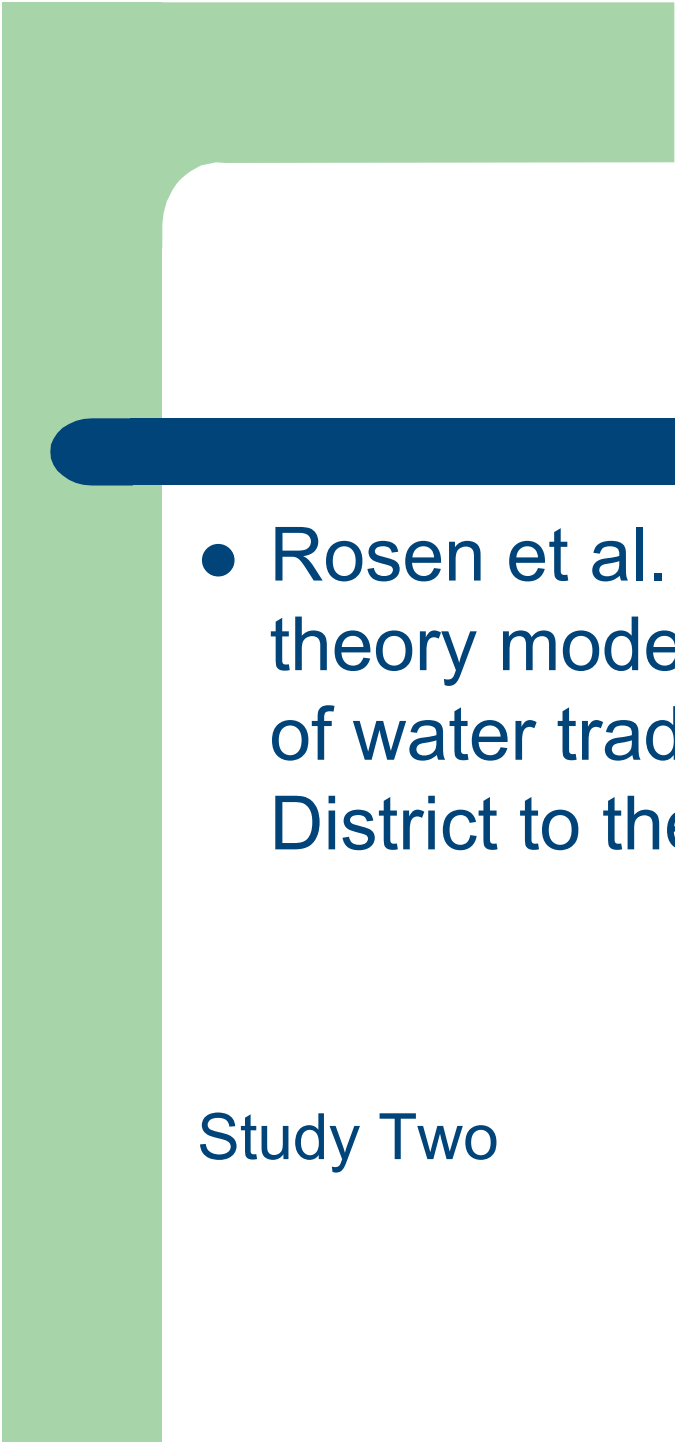

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- Knapp et al., discussed two state inter-basin water transfers associated with water markets that exist in Kern County.
 - They looked at the effect of surface water transfers on agriculture production, groundwater management, and water pricing.

Study One

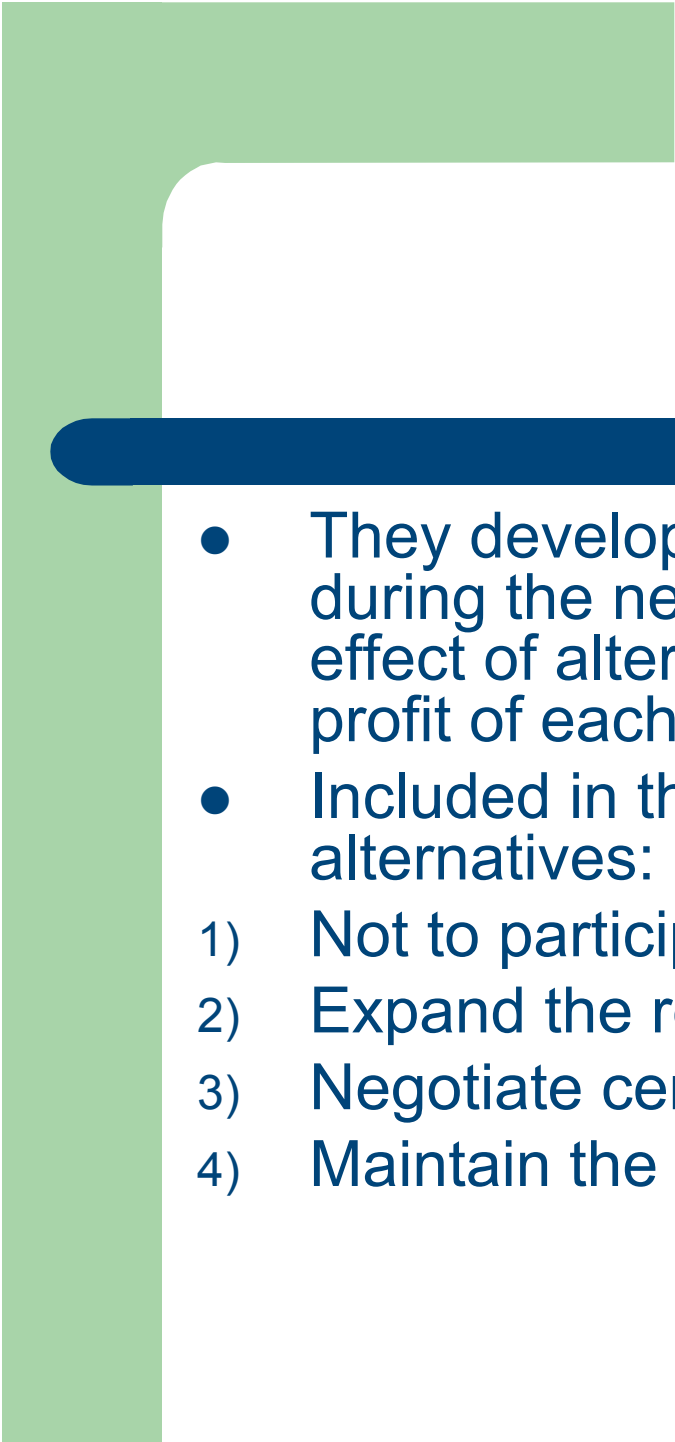

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- Unregulated groundwater resources
 - Groundwater common property
 - Government enforcement of involuntary cutbacks of surface water leads to greater dependence on groundwater supplies

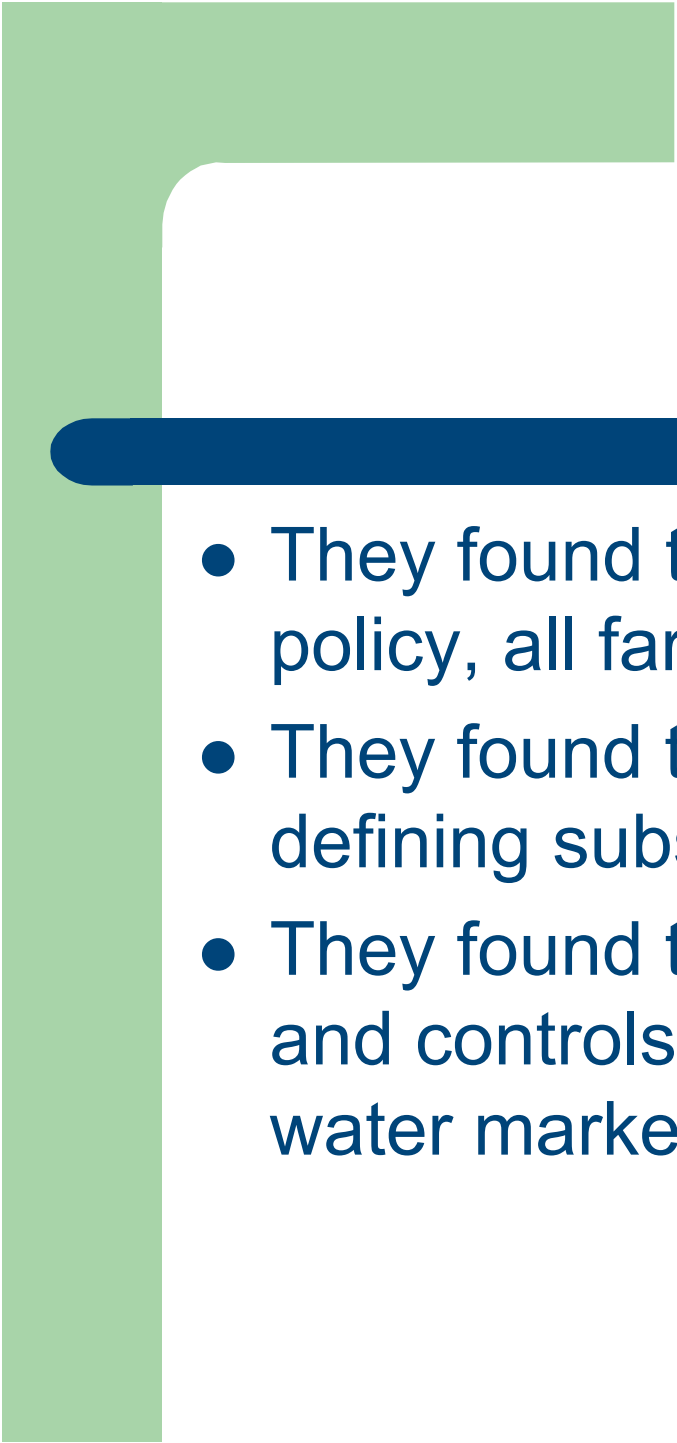

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- They developed a model for water mechanisms of inter-sectoral transfers and allocation for an unregulated aquifer.
 - The model assumed that the basin received its allotment of surface water and farmers were authorized to sell water to the urban sector on an individual basis.

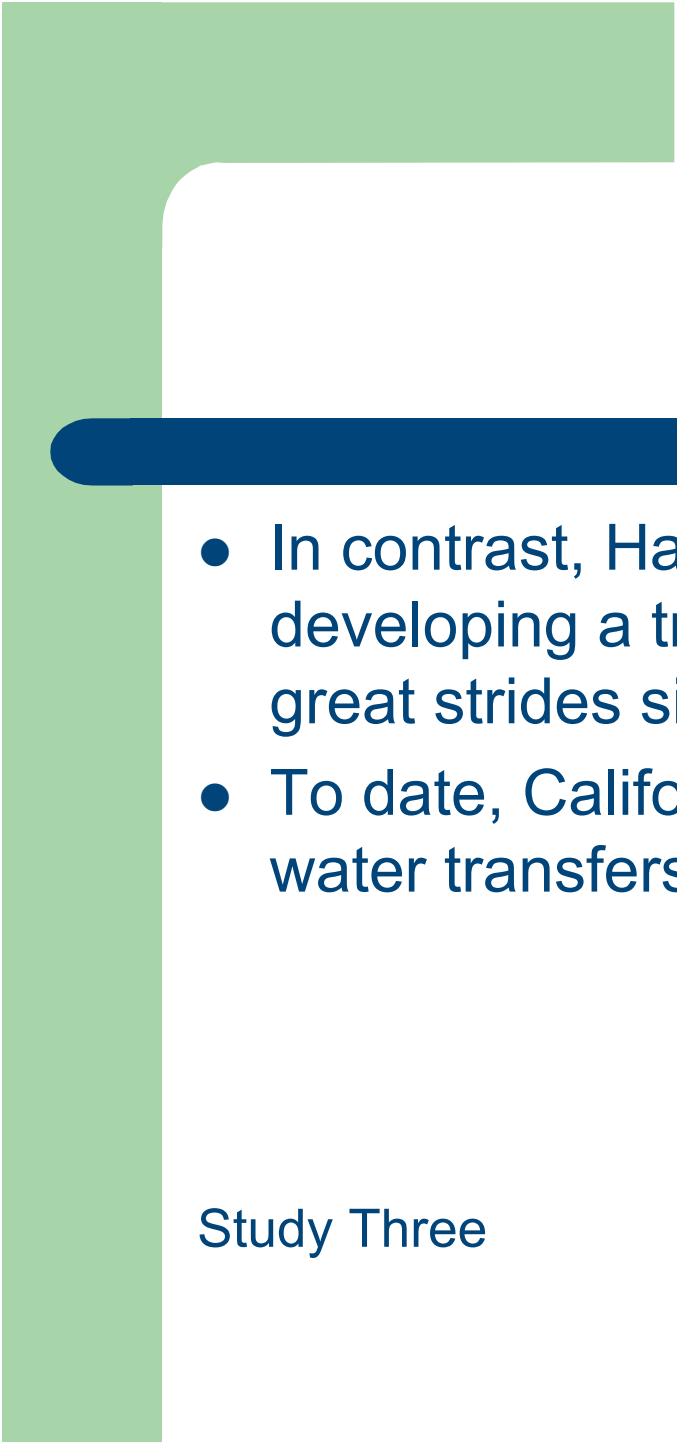

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- The model found that social net benefits increase when moving from a non-market to market conditions.
 - They expect that in California water transfers will range from 5 to 15% from the agriculture to urban sector over the next 10 to 20 years.
 - They conclude that regions in California require a groundwater management plan before pumping and transfers occur.

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- Rosen et al., conducted a voting and game theory model to determine the effectiveness of water trades from the Imperial Irrigation District to the Metropolitan Water District

Study Two

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- They developed models for each farm surveyed during the negotiation period to determine the effect of alternative water trade scenarios on the profit of each farm.
 - Included in the evaluation were four policy alternatives:
 - 1) Not to participate in trade
 - 2) Expand the resource
 - 3) Negotiate certificates
 - 4) Maintain the resource

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- They found that under the maintain resource policy, all farmers were expected to benefit
 - They found that the models could assist in defining subsidy-free allocations
 - They found that if well-defined property rights and controls of those rights are not defined, a water market will not be successful.

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- In contrast, Haddad finds that despite California not developing a true water market, they have made great strides since the 1980s.
 - To date, California has only developed six long term water transfers.

Study Three

Steps toward a water market

- California Water Code
- From 1987 to 1991, water market reforms addressed short-term water needs
- Central Valley Project Improvement Act
- Multi-year agreement to improve water quality in the San Francisco Bay and the Sacramento-San Joaquin Delta
- Monterey Agreement
- Environmental Protection
- CALFED Bay-Delta Program

The Future of Water Markets

- Water markets encourage both buyers and sellers to conserve water.
- Water markets reduce rent-seeking
- Trades can be either temporary or permanent.
- William Easter, Mark Rosegrant, and Ariel Dinar developed a table which outlines strategies for mitigating problems and constraints when developing water markets. The table can be found in my paper.

Conclusion

- The state of California's water resources are in flux
- To date, only water transfers have occurred
- If water markets are properly designed, they can lead to efficiencies in the agricultural sector
- States do not focus on long-term
- It is difficult to obtain data on water transfers, water transfers that have occurred under an informal market have not been recorded
- The terminology used for defining water markets needs to be clearly defined. The research alludes to water markets being in place; however, in actuality, few if any exist