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"Water Issues In US Agriculture and Current Mitigation Measures"

By

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Scope of the Presentation

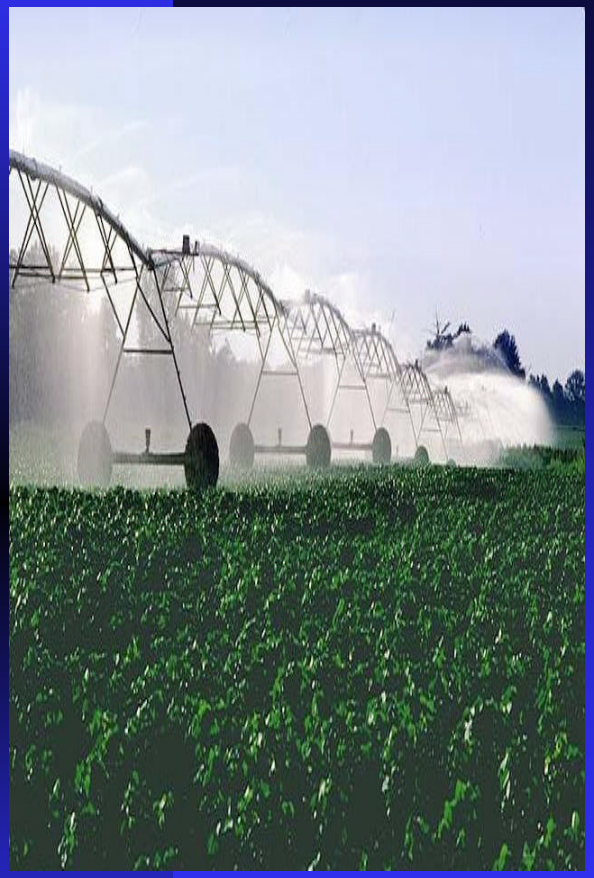
- Purpose of the Research
- Background Information and Issues
- Methodology and the Study Area
- Review of the Regional Case Studies
- Factors Responsible For The Problems
- Mitigation Efforts
- Findings
- Recommendations and Conclusions

Objectives of the Research

- To explore the current water issues in US agriculture
- To update the literature on water management in agriculture
- To design a policy tool for informing decision makers in the domain of agricultural water management
- To identify strategies that can guide policy makers and planners towards efficient water management

Background Information/the Issues

- Agriculture continues to be a major user of water in the United States
- No where is the problem more manifest than in irrigated agriculture
- Irrigated cropland is an important part of US cropland sector (16% of harvests)
- In the West, irrigation accounts for 90% of total consumptive water use
- Compounding the issue is the intensifying competition for water from other uses
- Agriculture facing stiffer competition from Urban and environmental demands
- This has resulted in widespread water competition in the arid West and others
- Considering these issues, there is an urgent need for the design of efficient strategies



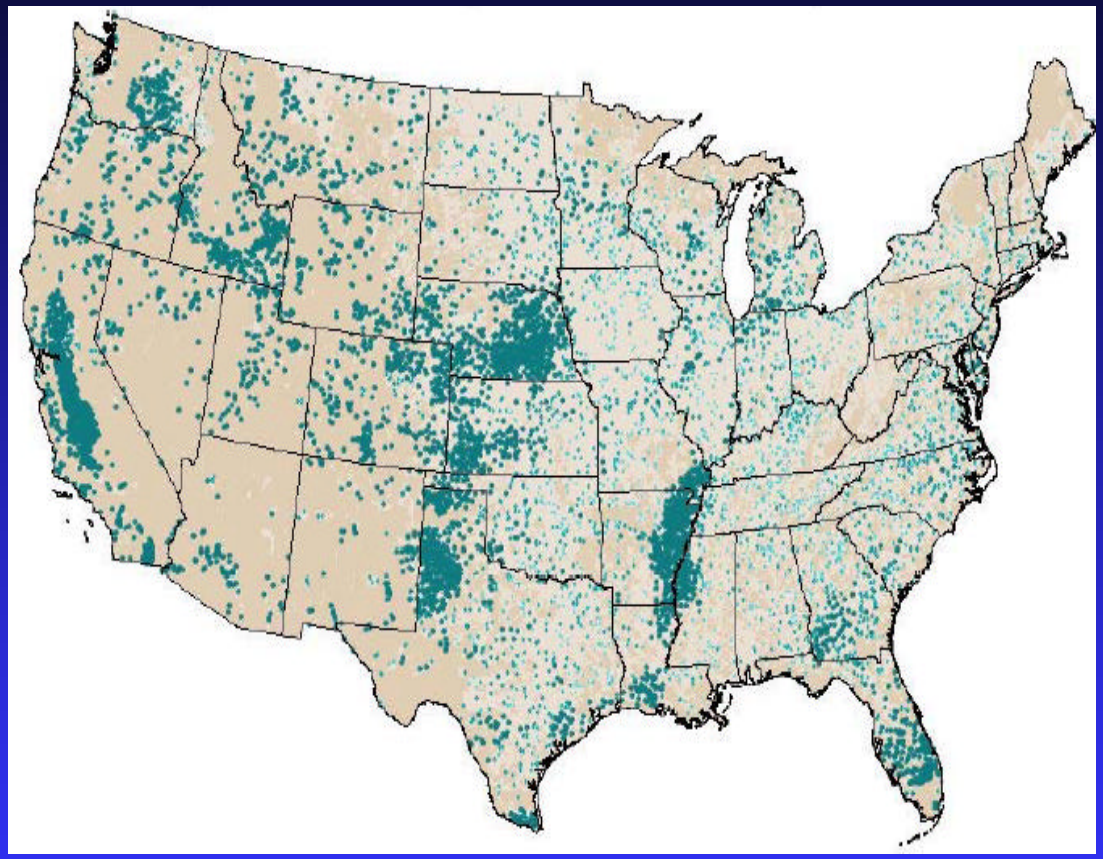


Figure 1.1: Irrigated Land In Farms and Their Locations In 1997

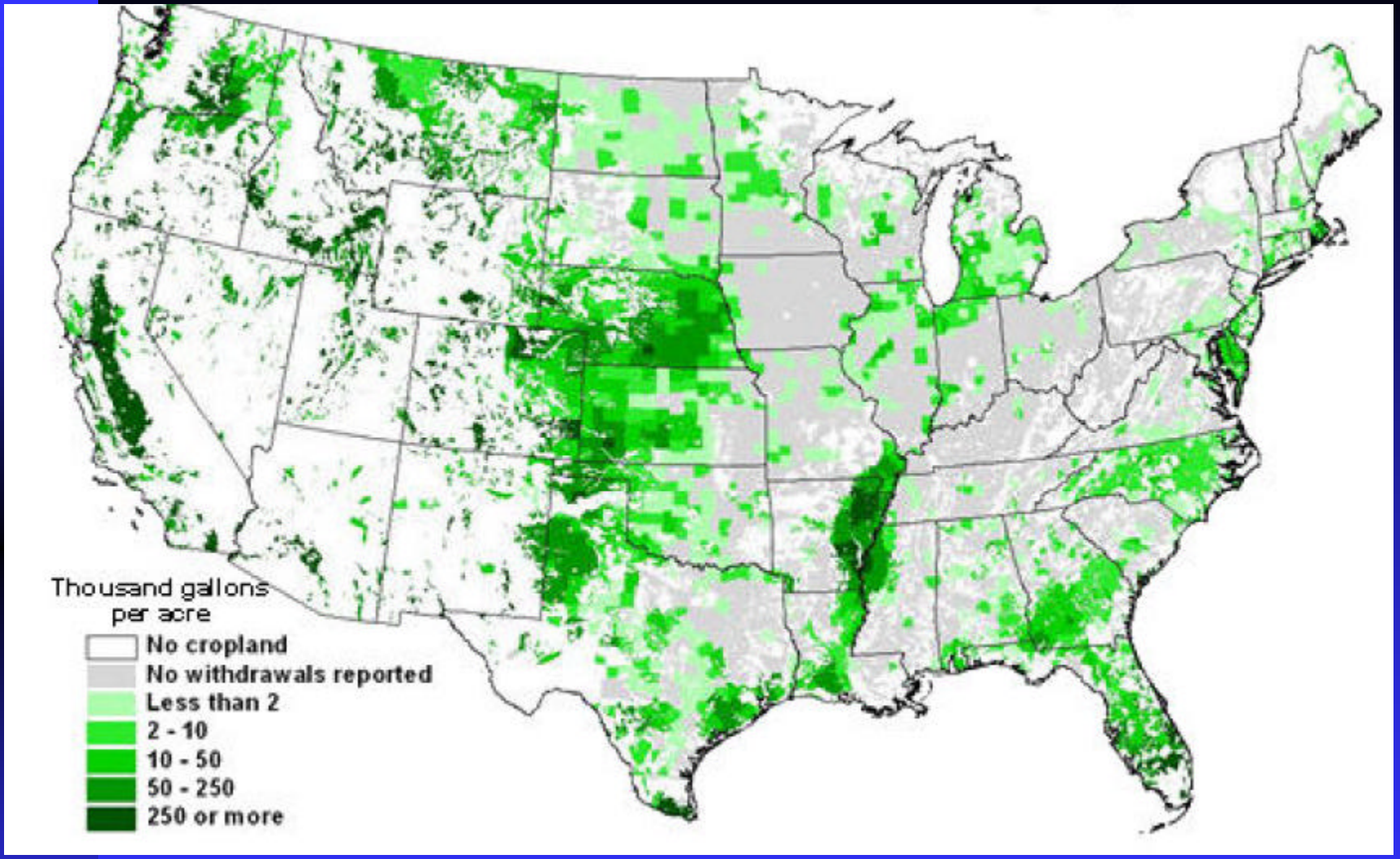


Figure 1.2: Distribution of Freshwater Withdrawals For Irrigation In 1995

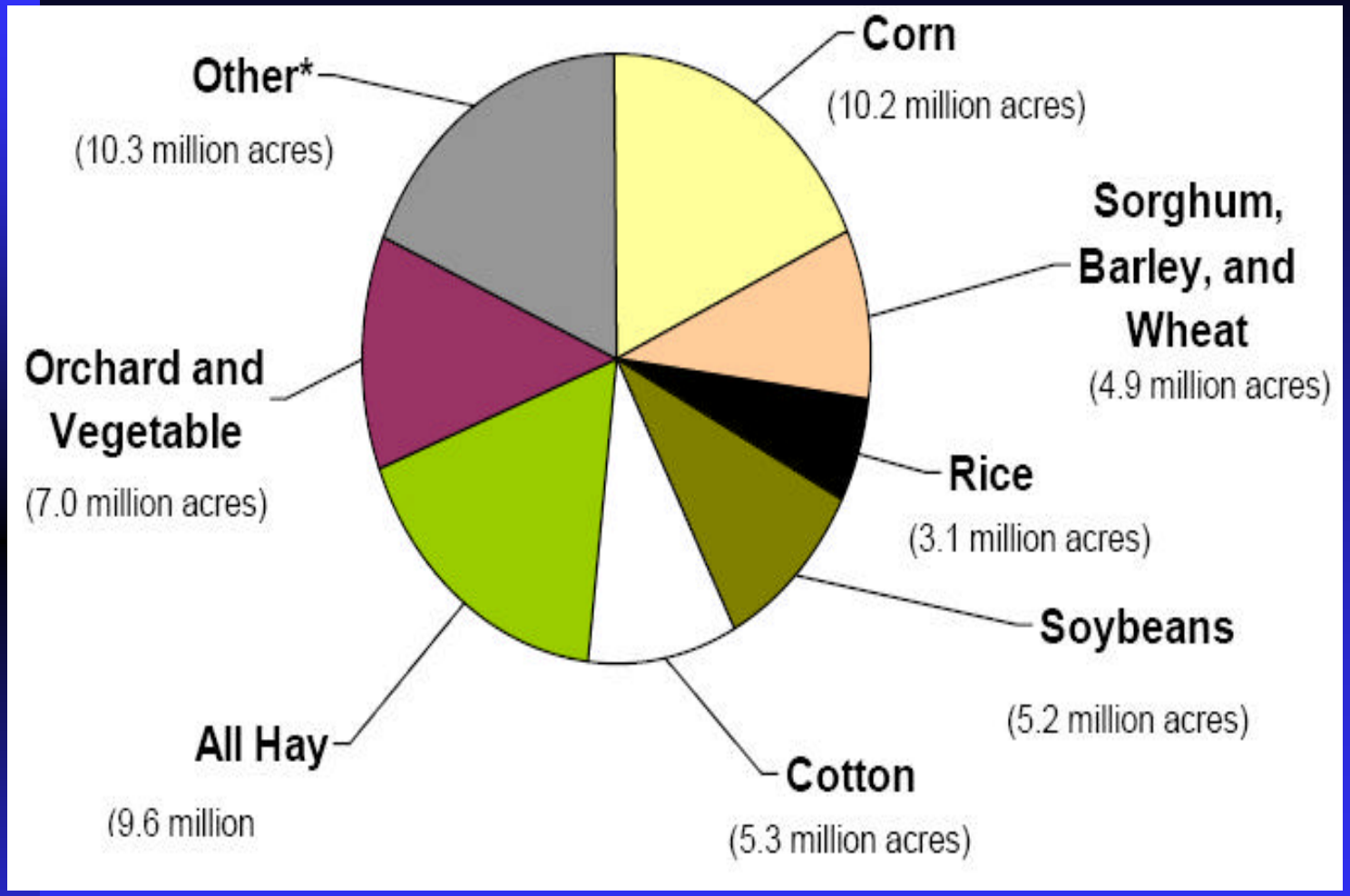


Figure 1.3: Area Irrigated by Crop Across The United States In 2000

Methods and the Study Area

- The study stresses a mix scale approach involving acquisition of field data, secondary data, data design, descriptive analysis, and case studies

- **Stage 1: Identification of Data**

  - Keyword literature search on water issues in agriculture
  - Data procurement from the US Census of Agriculture and State agencies

- **Stage 2: Design of Data Matrices**

  -The design of data matrices covering selected variables
  -The design of spatial data to indicate the locations of water use

- **Stage 3: Data Analysis of The Trends**

  - Measure of descriptive statistics to show the trends
  - Spatial analysis and output (maps-texts-tables) covering the study area

The Study Area and the Justifications

- The study area for the case studies covers California, Arizona , Colorado and the West
- Selecting these states depended largely on location and water issues in farming
- Agricultural sector in the area is productive and supports a number of economic activities
- While the common concern is water stress, agriculture stands as a key water user
- There are also pressures of urbanization, water transfer process and other factors

Figure 2.1: Study Area and The Images of The Colorado River

Western Regional Case Study: Issues In Water Transfer

- **Water Transfers Involves Temporary Transfer From Agriculture**
  - Irrigation remains the major user of water in 11 western states
  - In these areas, agricultural irrigation accounted for 92% of consumptive water in 1995
  - This represents a 2% drop from the 1960 level of 95%

- **Agriculture Major Source of Water Transfers In The Region**
  - Agriculture ranks as the dominant out-stream water user for irrigated production
  - Most transfers involves irrigation because it is low valued water user in many locations
  - Urban/industrial users also seek transfers from agriculture due to stable allocation of supplies

- **Volume of Water Market Transactions Recorded In The West On The Rise**
  - In 1996-1997, 282 transactions worth 2.7 million acre ft were recorded in the Western states
  - Colorado has the most market activity with 194 transfers:184 went(from farms to urban areas)
  - California moved the greatest amount of water with mostly large average-of 57,000 acre ft

- **Water Distribution In 1998 Reflects Rise In Irrigated Acres For Farm Sizes**
  - In some states, pattern of ground water distribution similar to the size of irrigated acres for all farm sizes

Table 1.1 Water Market Transfers In The West

States	Total Contracts in numbers	Contracts in numbers	Water Quantity acre feet	Average Price $
Arizona	10	6	23,212	2,753
California	33	3	38,260	1,947
Colorado	194	189	25,517	4,395
Idaho	7	2	41,500	77
Montana	2	0	0	0
Nevada	2	2	1,928	4,950
New Mexico	7	6	1,621	3,462
Oregon	13	4	18,018	130
Utah	8	6	3,409	1,270
Washington	3	1	40,320	32
Wyoming	3	1	253	0
Total	282	220	194,037	1,360

Table 1. 2 Distribution of Total Ground Water / Irrigated Water (All Farm Sizes) In 1998

States	Total Ground Water Irrigated Acres by All Farm Size and State (Acres)	Total Ground Water Applied (acre feet 1000)
Arizona	243,313	903.0
California	3,071,740	6,987.0
Colorado-	1,331,615	2,090
Idaho	1,226,924	1,975.0
Montana	46,606	79.5
Nevada	223,747	678.3
New Mexico	425,530	938.8
Oregon	304,579	511.7
Utah	139,693	375.7
Washington	445,927	828.0
Wyoming	90,730	157.3
Total	7, 550,404	15524.3

Table1. 3 Distribution of Irrigated Acres and Number Irrigated Farms In 1998

States	Total Irrigated Acres by All Farm Size and State	Total Number of Irrigated Farms
Arizona	873,5 89	2,637
California	8,139,834	40,121
Colorado-	2,942,230	11,846
Idaho	3,188,406	12,346
Montana	1,740,873	6,956
Nevada	694,930	1,764
New Mexico	720,319	6,035
Oregon	1,534,961	10,012
Utah	1,076,346	9,427
Washington	1,554,813	8,742
Wyoming	1,533,468	4,442
Total	23,126,180	114,328

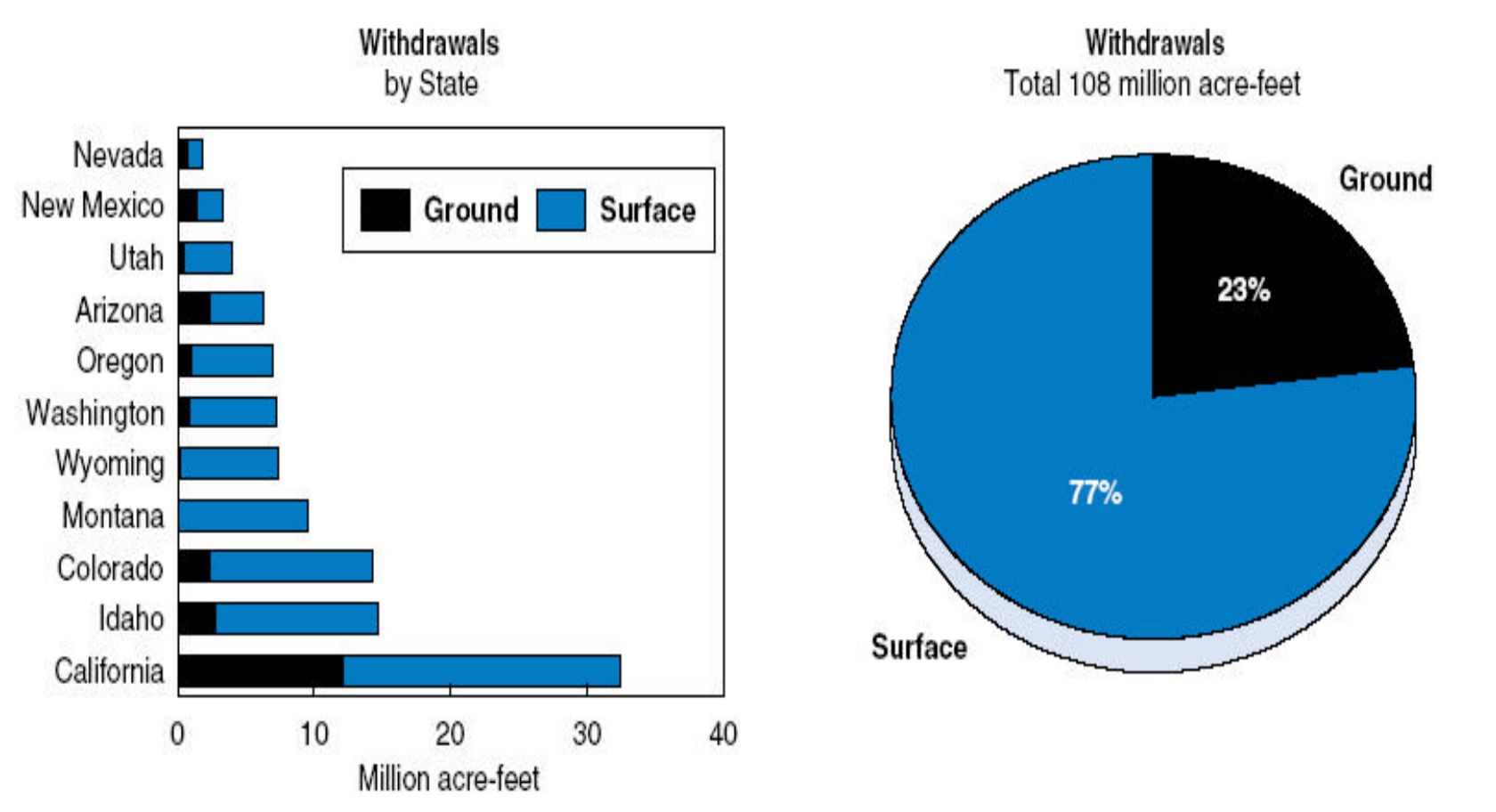


Figure 3.1: Sources of Irrigation Water In The Western States, 1995

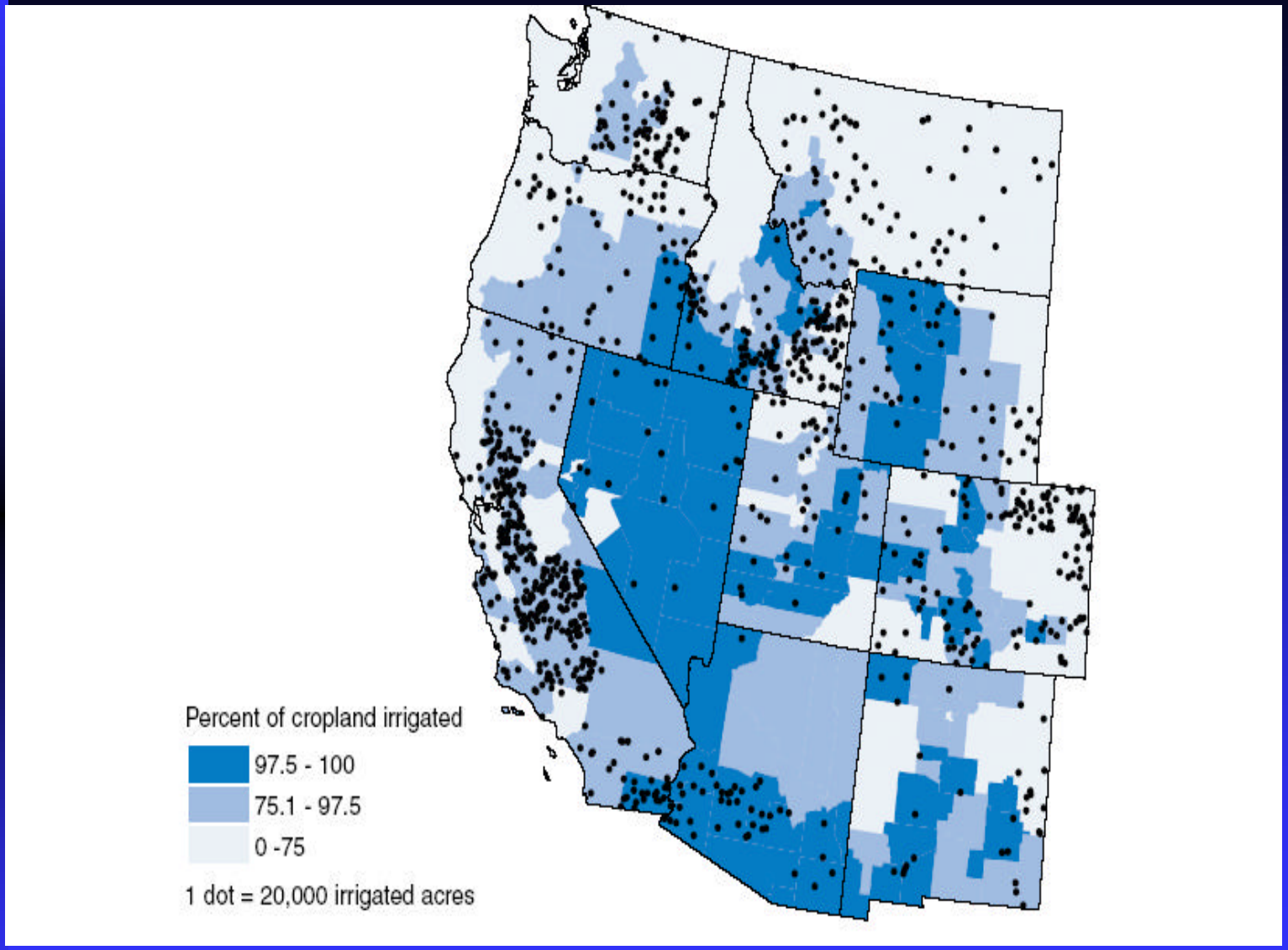


Figure 3.2: Location of Western Irrigated Croplands and Their Dependence On Irrigation, 1992

Arizona Case Study: The Effects of Water Transfers

- **The Impacts of Water Transfers Felt In Many Communities**
  - Several parties such as rural communities are affected by water transfers
  - Transfers of water from irrigated agriculture have impacts beyond the farm gate
  - Most states do not have a formal process to consider the impacts

- **Intense Acquisition Led to Transfers of Water From Arizona Farms**
  - The groundwater act in the 1980s required municipal areas to have 100yr assured water supply
  - This condition prompted series of Arizona transfers with severe impacts
  - Urban areas concentrated their purchases of irrigated land for associated water rights

- **Socio-Economic Effects of Water Farm Transfers In 1980 (Lapaz County)**
  - The water farm purchases totaled 450,000 acres, including 48,000 acres of irrigated land
  - The analysis assumed that 40,000 acres of irrigated land was on the verge of being idled by transfers
  - Drop in number of jobs by 17; loss of personal income of $363,000 for each 1000 acres retired
  - This translates into a total unemployment of 340 jobs and income loss of 14% (Lowe et al)

- **Other Effects**
  - The Lapaz county area lost 5% of its tax revenue from income and jobs lost from the water transfers
  - This led to the loss of the region's character and future development options (Lowe et al)

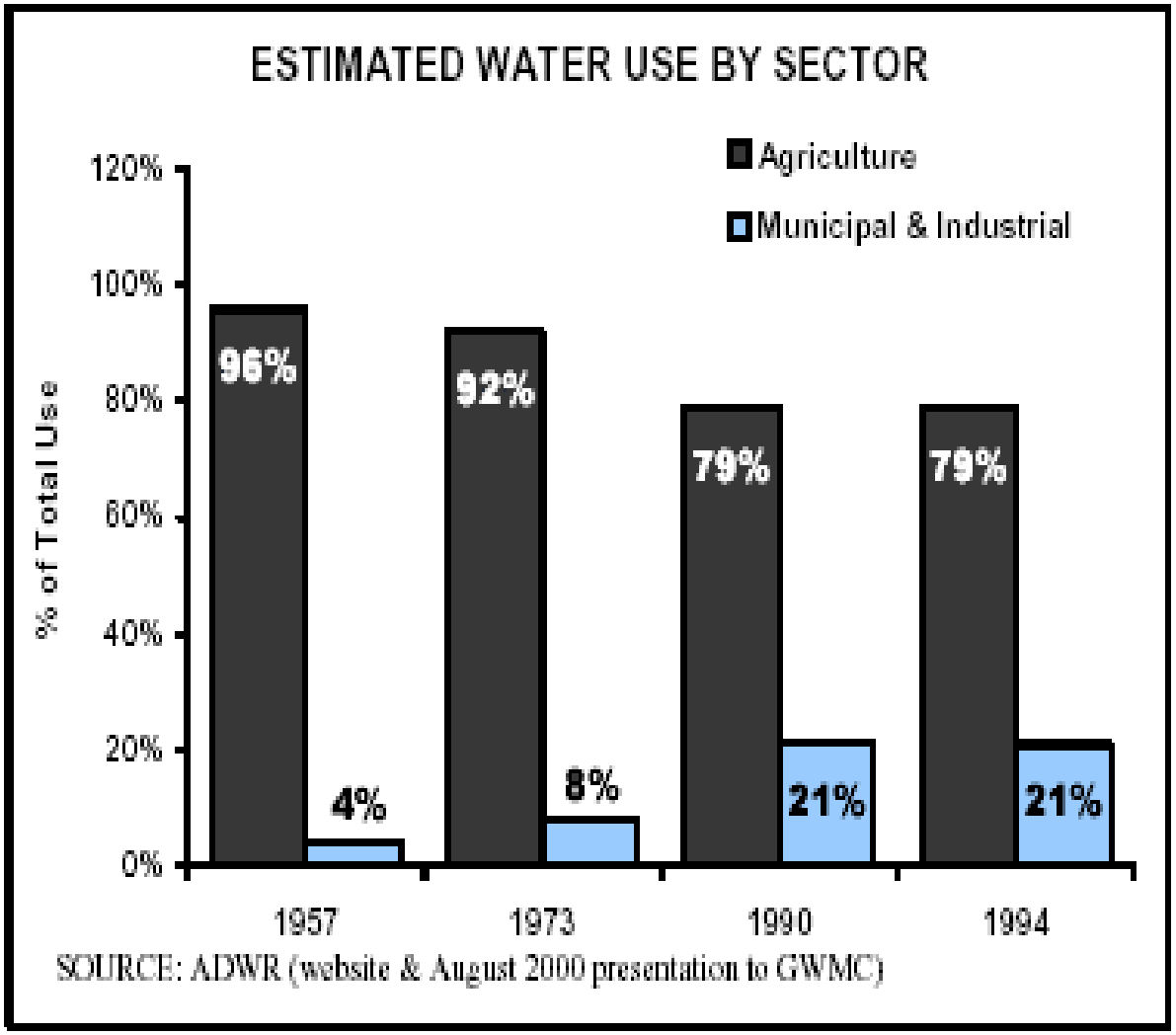


Figure 4.1 Estimated Water Use by Sector In Arizona

Colorado Case Study: Impacts of Water Transfers

- **Water Transfer Stayed On The Rise In 1990s With Idling of Irrigated land**
  - Prior to 1990, surface water transfers from Arkansas Valley to urban areas totaled 100,000 acres ft
  - Much of this came from 48,000 acres of irrigated land
  - This involved also the idling of almost 60 % of irrigated land in the area

- **The Effects of Historic Transfers of The 1990s**
  - In a study, Howe et al assumed that a relatively small acreage of high value crop land would not be affected by the loss of irrigated water
  - The study found that each acre of retired land reduces jobs by 3.2 % and personal income by$100,000

- **Scenarios of The Impacts (Less Extreme)**
  - The scenario estimates 10 % reduction in both farm jobs and value added by agricultural sector by 2010
  - When compared to 1982 levels, regional employment and income stayed at modest 1%

- **Extreme Scenario**
  - 80% decline in feedlots in the area from rise in forage costs due to the reduction in irrigated production
  - This scenario posits a 20% reduction in farm employment by the agricultural sector by 2030
  - When compared to 1982 levels, regional employment and income would decline by 2 to 3 %

Figure 5.1: Surface Water Recharge For Farming In Colorado

California Case Study: Issues In Agricultural Water Supply

- **Not all Water Supplies Destined For Agriculture**
  - Of the 78 million acre feet of water supply developed in the area, 46% used by the environment
  - 43 percent is used on farms while 11 percent is used in homes and businesses

- **Developed Water Supply Not Keeping Pace With Population Growth**
  - Water supplies to farms and other uses are declining or have declined since the 1990s
  - Both state/ Federal surface water deliveries now total 4.8 million acre ft, 14% drop from 1990
  - Compounding the problem is the projected population growth of 54% (29- 46m) from 1990-2020

- **Water Reallocation Process Has Reduced Government Water Supply**
  - In 1990/2000 Fy, 1m acre ft of water was reallocated from farms and others to improve the environment
  - New infrastructure has not replaced the transferred water valued at $250m (enough for 8 million people)

- **Fiscal Spending In The State Impacting On Agricultural Water**
  - The state spends 2.5% of the Gross State Product (GSP) on infrastructure compared to 20% in 1960
  - This means that California can meet new water demands by shifting supplies from other sources such as farmers

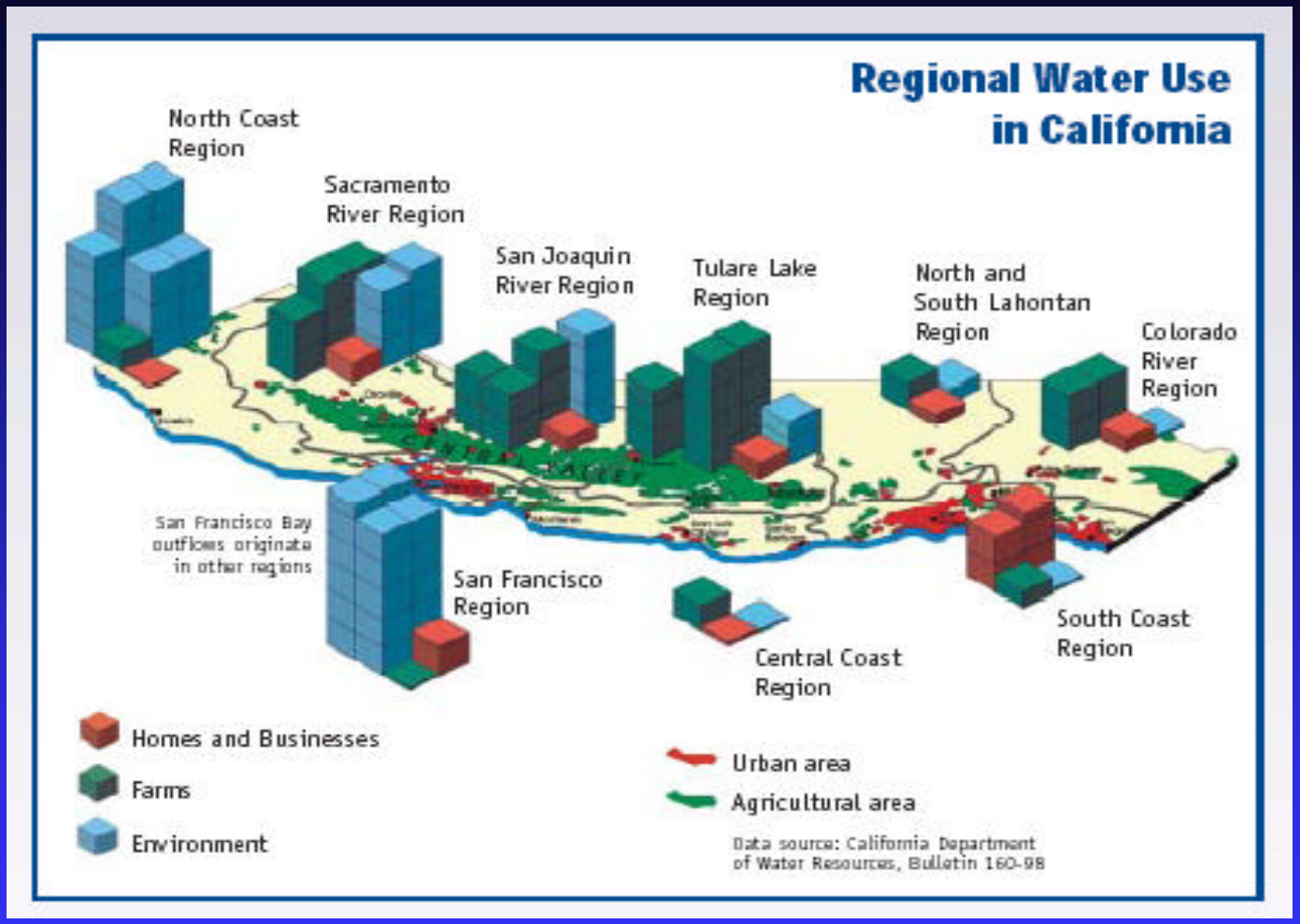
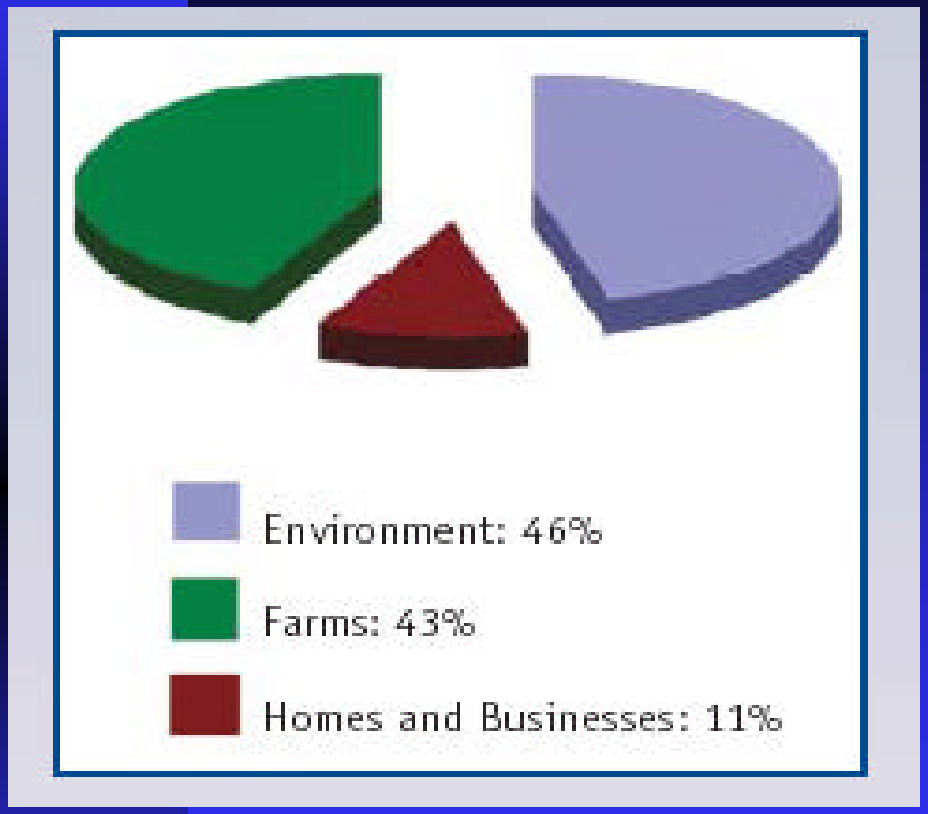


Figure 6.1 Water Use In California



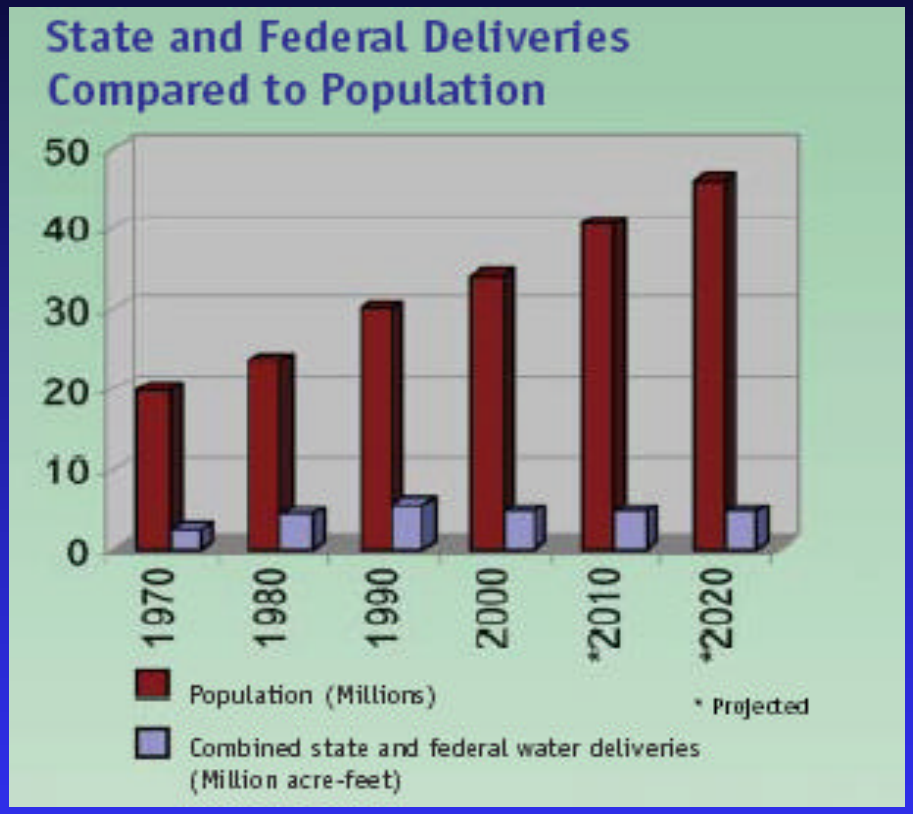


Figure 6.2: Water Distribution In California

Figure 6.3: Population Growth / Water Supply

Table 2.1 Water Uses In California Agriculture Over The Years

Water Trends In California

Year 1	Agricultural Applied water	Crop Acreage 3	Crop Production 4	Total Farm Value 5
1960	28.5 maf	8.4 million	32.7 million tons	$3.2 billion
1967	31.2 maf	8.8 million	35.8 million tons	$3.9 billion
1972	31.7 maf	9.8 million	43.9 million tons	$5.5 billion
1980	35.6 maf	9.9 million	51.3 million tons	$13.7 billion
1985	32.9 maf	9.6 million	52.5 million tons	$13.9 billion
1990	31.1 maf	9.5 million	57.3 million tons	$18.3 billion
1995	30.4 maf	9.5 million	59.7 million tons	$22.1 billion

Table 2.2 Comparison of The Trends Over The Years

Comparison of The Trends On Variables Associated With Water Use				
Comparison Years	Agricultural Applied water	Crop Acreage	Crop Production	Total Farm Value
1960-1995	+7%	+13%	+83%	+590%
1967-1996	-2.5%	+8%	+67%	+467%
1972-1995	-4%	-3%	+36%	+302%
1980-1995	-15%	-4%	+16%	+61%
1985-1995	-7.6%	-1%	+14%	+59%
1990-1995	-2%	0	+4%	+21%

Figure 7.1: Irrigated Farming in The Santa Barbara Area of California , 2006

Figure 7.2: Images of Irrigated Farming In a Local Winery In Santa Barbara, 2006

Figure 7.3: Images of Farms Dependent On Irrigated Water In The Santa Barbara Area of California

Factors Responsible For The Problems

- **Physical -Drought**

  -Drought has affected surface surface water supplies across the region for several years

  -Drought reduces water deliveries for some irrigation districts to less than half the volume

- **Policy**

  - The policies and institutions regulating water transfers evolve slowly unless there is severe shortfall
  - There is also a lack of framework that considers costs and benefits of transfers to all stakeholders

- **Economic Variables**

  - Willing sellers make the decision that they are better off selling water and wont be hurt by the transaction

  -Water markets may disturb a delicately balanced system impacting farm users in a variety of ways
  - Costs of developing new water supplies said to be on the rise

- **Urbanization and Population**

  - Water transfers sometimes motivated by the needs to reallocate water to urban and industrial users

  - Rapid population growth in the West intensifying the level of water stress that is already being felt

  - Western population projected to grow from 1990-2020 by 51% will lead to 5% demand in water

MITIGATION EFFORTS

- **Policy and Programs Promoting Improved Irrigation**

  -Direct public incentive programs used to promote improved water management for irrigated farming

  - This involves cost sharing and technical assistance for conservation practices (EQIP)

  - In 2001, 3,373 irrigated management systems benefited from the EQIP program

- **Water Conservation Plans**

  - Feds require the development of irrigation conservation plans specifying improved irrigation practices

  - Conservation plans must be in place for farms with erodible soils to qualify for program funding

  - Water districts receiving Federal water through Bureau of Land required to develop water plans

- **Research**

  - A recurrent theme has to do with economic and environmental trade offs of policy instruments

  - The research efforts cover series of studies on water markets, water pricing and water transfer issues

- **Institutional Entities/Government Role**

  - The Feds play important role in the development and distribution of agricultural water supplies in the West

  -The Bureau of reclamation serves as a water whole seller for 25 % of West's irrigated acres by storing and conveying water to irrigation districts

Figure 7.4: Technical Assistance On Irrigated Farming In Santa Barbara, California In 2006

Summary of Findings

- **Agriculture a Major User of Water in US Agriculture and The West**
  -The quest for water more evident in irrigated agriculture
  -In the western region, irrigation accounts for 90% of consumptive water use

- **Widespread Competition From Other Users of Water On The Rise**
  - Urban and industrial users (municipalities/hydro) seeking water from agriculture
  - Water for environmental recreation tightening competition for water meant for agriculture

- **Water Transfers Creates Serious Impacts In Some Rural Areas.**
  -The impact of water transfer said to be severe on local agricultural economies
  - Impacts measured at large area seems insignificant while local impacts falls heavily on rural areas

- **Waters Issues compounded By Changes In Socio-Economic/Physical Factors and Policy Lapses**
  - **The** growth in urban population has increased the demand for municipal water from farm sources
  - The ad-hoc nature of policy and the cases of drought remain some of the major factors

- **Institutional Initiatives Already In Place To Address The Problems**
  -Several efforts by such entities as the USDA and BOL were made to deal deal with the problem
  - Conservation and research initiatives have also been put into place

Recommendations

- To address some of the concerns that were identified in the research, four recommendations are presented as part of the remedies

- **Initiate Water Policy Reforms With Respect To Agriculture**

  -The current approach to water policy needs an urgent reform in order to sustain the needs of farming

- **Encourage More Technology and Research To Address Water Related Issues**

  -With increased scarcity, agencies should continue to support improved irrigation technology for farming

- **Promote Conservation and Sustainable Use of Water**

  - Water savings through improved management of irrigation supplies quite essential to farms

- **Strengthen Regional Cooperation / Data Infrastructure On Water Use**

  - The regional nature of scarcity requires states to cooperate regionally so as to monitor impacts on farms

  - Considering the sketchy nature of information, there is a need for a regional data infrastructure on water

Conclusions

- Four vital conclusions can be drawn from this study
- 1)-Water is an integral part of agriculture, case studies point to the benefits of water transfers through irrigation to other users in the western region
- 2) -In Arizona and Colorado, there exists some cases of adverse impacts of water transfers on rural agricultural communities
- 3) Even though state entities have been quite active in crafting mitigation strategies there are potentials for conservation and regional cooperation
- 4)- In light of these findings, the study stands as a viable policy tool for assessing water issues in US agriculture along with mitigation measures

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