THE CHANGING FACE OF WESTERN IRRIGATED AGRICULTURE: STRUCTURE, WATER MANAGEMENT, AND POLICY IMPLICATIONS

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ABSTRACT

The structure of U.S. agriculture is dualistic and likely to become more so in the future. A small percentage of farms produce the majority of output, and almost three-fourths of U.S. farms sell less than $50,000 worth of goods annually. Farms in the lower sales categories tend to have chronic negative net farm incomes, and many have no intention of earning a living from agriculture. Much of this residential, lifestyle, or retirement agriculture occurs on the urban fringe and in rural areas just beyond the urban fringe. In the arid western U.S., much of it is located in irrigated river valleys, which are also centers of population and economic activity.

New Mexico's Elephant Butte Irrigation District (EBID) is located in one of the fastest growing counties in the United States. The region is experiencing water rights adjudication, rapid population growth, economic diversification, and increased competition for water resources. Recent research in the District found large differences in irrigation practices, efficiencies, and on-farm infrastructure relative to farm size. The small, residential, lifestyle, or retirement farms are notably different from the larger, commercially oriented farms. Many small producers view irrigation as a recreational, social, or lifestyle activity, rather than an income generating pursuit. The small farms have limited on-farm infrastructure, low irrigation efficiencies, and little interest in making irrigation improvements. Large, commercially oriented farms have high levels of on-farm irrigation efficiency due to deficit irrigation practices and investments in infrastructure.

The Elephant Butte research led to questions about changes in agricultural structure, water management, and water resource policy implications in other western U.S. irrigated districts. We hypothesized that the trends in agricultural structure found in the EBID would appear in other irrigated areas in the West. Analysis of limited U.S. Census of Agriculture data for a sample of western counties supports this hypothesis for some regions. The water policy implications of the findings are discussed.

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INTRODUCTION

The Structure of U.S. Agriculture

The U.S. current dual structure agriculture is one where approximately 7% of farms (with annual sales over $250,000) produce more than 76% of the total value of output, while 93% of farms are responsible for the remaining 24% of output (U.S. Dept. of Agriculture, 2004). A "farm" is defined by the U.S. Census of Agriculture as any place from which $1,000 or more of agricultural products were produced and sold, or normally would have been sold, in a given year. In 2002, the United States had 2.1 million farms comprising an extremely diverse farm sector. Fifty-nine percent of farms had less than $10,000 in annual sales of farm products. Approximately 43% of all U.S. farm operators do not consider farming to be their principal occupation and 55% of farms report some off-farm work (U.S. Dept. of Agriculture, 2004). Fifty-four percent of all U.S. farms are retirement or residential/lifestyle operations, which account for 7.8% of the value of U.S. agricultural production (Hoppe, 2001).

Almost 80% of all U.S. farms sell less than $50,000 worth of goods yearly (U.S. Dept. of Agriculture, 2004). The 1.6 million farms in the lower sales categories tend to have chronic negative net farm incomes. For these people, crop or livestock production is a consumption activity which is subsidized with non-farm earnings.

Much of the residential/lifestyle and retirement agricultural activity occurs on the urban fringe and in rural areas just beyond the urban fringe.[3] In the arid western United States, retirement and residential/lifestyle farming is often located in irrigated river valleys, which also tend to be rapidly growing in population and increasing in economic diversity. Agricultural irrigation accounted for 92% of total consumptive water use in the eleven western states in 1995, and market transfers of water from agriculture are viewed as the most likely way to accommodate growing municipal and industrial demands for water supplies (Gollehon, 1999). It is often assumed that improving low irrigation efficiencies will release water from agriculture to other uses, while at the same time allowing agricultural production to continue. The economic, lifestyle, environmental, open space, and preservation values of urban fringe agriculture could thus be maintained.

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[3]"Urban fringe" is defined as the rural parts of metropolitan counties not settled densely enough to be called urban, while "beyond the urban fringe" refers to the rural countryside beyond the edge of existing urban areas in metro counties and often in adjacent nonmetro counties (Heimlich and Anderson, 2001).

Increased irrigation efficiency implies a change in technology (e.g., adoption of drip irrigation, canal lining), management practices (e.g., irrigation scheduling), or both. It is usually assumed that incentives to increase irrigation efficiency will work because agricultural water users have traditional business-like objectives (e.g., increased revenues and profits, and reduced costs). However, a significant percentage of farm operators throughout the United States and in the West are not strongly motivated by business or commercial objectives.

New Mexico's Elephant Butte Irrigation District

New Mexico's Lower Rio Grande Valley is experiencing rapid population growth, development of the rural countryside, and decreasing municipal groundwater supplies. Plans are underway to transfer some of the surface water from agriculture to municipal and industrial use in Doña Ana County, where most of the Elephant Butte Irrigation District (EBID) is located. Lifestyle agriculture is widespread in the county, where the number of irrigated farms increased by 70% between 1974 and 1997 (U.S. Dept. of Commerce, 1981; U.S. Dept. of Agriculture, 1999). Irrigated acreage in the Elephant Butte Irrigation District has been stable over that period of time (approximately 75,000 acres), while numbers of farms in the smallest acreage categories grew dramatically as a result of land splits. For instance, there were 150 farms between one and nine acres in 1974 and 691 of these farms in 1997 (U.S. Dept. of Commerce, 1981; U.S. Dept. of Agriculture, 1999). Farms between one and nine acres were 54% of all Doña Ana County farms in 1997.

Irrigation practices, irrigation efficiencies, crop yields, and crop quality vary dramatically between farms of different sizes. Skaggs and Samani (2005a) analyzed data provided by the EBID and conducted extensive fieldwork in the region in 2002 and 2003. These authors found striking differences in amounts of water applied, irrigation duration, irrigation timing (relative to crop water needs) and on-farm water delivery infrastructure on farms producing pecans, alfalfa, and cotton. The research found that applied water per acre was inversely related to farm size. Pecans, alfalfa, and cotton account for ~75% of the District's irrigated acreage. The research is summarized in Skaggs and Samani (2005b).

Agricultural Structure in Other Western U.S. Irrigated Areas

The structure of agriculture refers to the number and size of farms, ownership and control of resources, and the managerial, technological, and capital organization of farming (Knutson et al., 1995). The EBID research led the authors to question whether or not agricultural structure in other western U.S. irrigation districts has changed in ways similar to those found in New Mexico. There are limited county or district level data available to analyze these changes, however, the U.S. Census of Agriculture provides some insight into the questions. Thus, Census of Agriculture county-level data for a sample of western U.S. irrigation districts were collected for the years 1982, 1987, 1992, and 1997[4]. Data for 94 counties in Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, New Mexico, Oregon, Utah, Washington, and Wyoming were analyzed. Irrigation districts in these counties had previously been surveyed by McGuckin (2003). Census data for the counties were analyzed using Excel™. Results for selected variables are discussed below.

Change in Irrigated Farm Numbers and Irrigated Acreage. As discussed above, irrigated farm numbers in New Mexico's EBID increased dramatically through the 1980s and 1990s. Census data show a 43% increase from 1982 to 1997. All Arizona, California, Idaho, Nebraska, Nevada, and Washington counties in the sample showed net decreases or no change in irrigated farm numbers from 1982-1997. Counties which showed the largest increases in irrigated farm numbers were in Colorado, New Mexico, and Oregon. Results for counties in other states were mixed. Total irrigated acreage increased notably in some states over the period analyzed. There was limited consistency for the counties when comparing the 1982-1997 changes in total irrigated farm numbers and changes in total irrigated acreage. In several Colorado counties irrigated farm numbers increased while total irrigated acreage decreased between 1982 and 1997.

Farm Operators Working Off-Farm. As indicated above, more than half of all U.S. farms report off-farm work. Four-fifths of all U.S. farms have gross annual sales of agricultural products of less than $50,000 (and 59% of farms have less than $10,000 in annual sales). Using a rule of thumb that $1.00 in gross sales results in approximately 20-25¢ of net farm income, then the majority of "farm" households are dependent on non-farm income. County data for the EBID region show a 23% increase in farm operators reporting 200+ days/year of off-farm work over the period 1982-1997. Large decreases in the percentage of farm operators working 200+ days off-farm were reported for all the Arizona and California counties, and for many of those in Washington and Utah. Large increases were noted for most of the selected counties in Colorado, Montana, Nebraska, and Oregon. Results for the New Mexico counties were mixed. These results may reflect a movement of full-time farm operators to off-farm work due to unsatisfactory farm financial conditions. However, it is interesting to note that Colorado and Oregon county data both show growing numbers of farms and farm operators working 200+ days off-farm. Unfortunately, Census data cannot be used to identify farm operators who are retired to farming from some other occupation, and who thus may not report off-farm work.

Farm Enterprise Choices. Some research has been conducted into the relationships between off-farm employment and on-farm production decisions;

[4]These Census years were chosen because of the consistency of data reporting across all years.

however, attention has been limited (Phimister and Roberts, 2002). Anosike and Coughenour (1990) found that farm diversification was negatively and significantly associated with off-farm work. Carlin and Ghelfi (1979) concluded that part-time farmers must adjust their farm enterprises to off-farm labor requirements and do so by adopting less labor intensive farm enterprises. These authors indicated that operators of animal specialty farms, livestock enterprises, fruit and tree nut farms, and meadow production all have higher levels of off-farm employment and that these enterprises are all better suited to part-time farming than other crops or enterprises. Census data do not provide much ability to test these hypotheses. However, the Census of Agriculture does contain information for numbers of farms with orchards and numbers of farms producing hay crops. Review of these data for 1982-1997 for the selected counties revealed decreased numbers of farms with orchards in the Arizona, California, Colorado, and Oregon counties, while orchard numbers increased in several Washington counties. There was a greater than 100% increase in orchard numbers in the county where EBID is primarily located, although other New Mexico counties saw decreases in farms with land in orchards over the period analyzed.

Numbers of farms producing hay in the selected counties was also examined. These farm numbers tended to show consistent decreases from 1982-1997 in the Arizona, California, Idaho, and Washington counties. Results for New Mexico, Oregon, and Utah were mixed with no obvious tendencies over time, while the majority of the Colorado counties examined had increases in the numbers of farms producing hay between 1982 and 1997.

<u>Summary of Census of Agriculture Comparisons.</u> This review of Census data for the period 1982-1997 leads the authors to conclude that the structural changes in the irrigated agricultural sector the authors have found in New Mexico's Rio Grande Basin may be more unusual than hypothesized. As noted above, the data obtained through the Census of Agriculture point toward similar structural changes in Colorado and Oregon, although additional research is needed to confirm or reject this observation. If primary data could be obtained from irrigation districts in those states, as well as other western states, additional insight into changes in the structure of agriculture would be available.

IRRIGATION SYSTEM IMPLICATIONS OF CHANGING AGRICULTURAL STRUCTURE

Irrigation in New Mexico has a very long history, which predates European settlement. Irrigation customs are part of the social, cultural, and historic fabric of Rio Grande corridor communities. A wide range of social values related to water are held by Anglos, Hispanics, and Native Americans alike. Water plays an important role in defining the landscape for both long-term residents and newcomers. New Mexico may represent an extreme case of increasing numbers of people entering into agricultural lifestyles as a result of unique socio-cultural factors; however, our limited review of Census data leads us to believe that some other regions in the West are experiencing similar phenomena.

The visible presence of water in a landscape has been found to have beneficial psychological and physiological effects (Burmil et al.,1999). These beneficial effects of water (perceived or actual) and the aesthetic desirability of the oasis-type landscape are especially important in arid areas. The sight, movement, and sound of water all have value to humans, and surface irrigation activities allow people to directly experience these values. Large lot housing development gives homeowners the opportunity to have an irrigated agricultural lifestyle on the urban fringe.

The economic value of water is typically defined around consumptive use. Consumptive uses are usually classified as agricultural, industry, and household (primarily culinary and residential landscaping) applications of water. Water is also valued economically as a public good (i.e., in recreational uses, wildlife habitat, in-stream flows for environmental purposes, scenic values, etcetera). The value of water used in agricultural irrigation is a measure of the net economic contribution of water to the value of agricultural production (Young, 1996). According to economic theory, the value of an input or factor of production is the upper bound of a firm's ability to pay for the input. Profit maximizers will use inputs to the point where the price of the input is equal to the marginal value product of the output. Marginal value product is defined as the input's marginal product multiplied by the price of the output. Demand for an input (water, in this case) is based on these concepts and valuations of irrigation water estimated with them are used in economic feasibility tests for new irrigation projects as well as investments in rehabilitation of existing systems. Discussions of water reallocations between competing sectors generally incorporate valuations that have been derived using some version of the "residual" method described above. When markets for outputs such as environmental improvements do not exist, shadow values or prices for the water are estimated.

In agricultural policy debates unrelated to water resource use, the question is often raised as to whether or not agriculture is a "way of life" or a business (Blank, 2002). The "way of life" claim is used to support agricultural policies which directly or indirectly subsidize the farm sector. Farmers have historically been afforded a relatively high degree of protection from environmental regulations and been rewarded with a variety of cost reducing and/or income enhancing subsidies. Agriculture's status as a special industry in need of government support and protection is a well established tradition (and is maintained through a very complex policy structure).

The dictionary defines a "business" as a "commercial or industrial establishment" and notes that a "business" connotes a "profit motive." A "hobby" is defined as "something one likes to do in one's spare time; a favorite pastime or avocation."

As noted by Blank (2002), a hobby is a leisure activity that people do in order to increase their personal happiness, or utility. Hobbies come in all types, and with a range of costs that a hobbyist must pay to in order to have or increase happiness. The term “hobby farm” carries with it certain negative connotations (i.e., the belief that hobby farm operators aren’t *real* farmers), and is being replaced by the terms “lifestyle,” “retirement,” and “rural residential” farms. The United States is now at the point where more than half of all farms fall into these pastime or avocation categories.

Valuation of irrigation water continues to be based on the profit maximizer model, yet, many water users in the district intensively studied by the authors are clearly not profit maximizers. Skaggs and Samani (2005) hypothesize that many smaller water users seek to minimize the costs or risks of operating their small farms (regardless of the impacts on irrigation water productivity, yields, or total agricultural output). Smaller water users also appear to have maximizing their utility or satisfaction from the small farm generally (and irrigation activities in particular) as a key objective. These objective functions are not compatible with the notion that water users are interested in increasing irrigation efficiency through changes in technology, increases in management intensity, and responding to financial incentives to release surface water from agriculture for other competing uses.

A key water policy question is how water used in a “hobby” should be valued for the purposes of resource reallocation, irrigation infrastructure investments, and other policy questions. Traditional residual estimates of the value of water used in irrigation are likely to provide biased estimates of “lifestyle” irrigators’ true willingness to pay for water. Lifestyle irrigators may be willing to pay higher prices for the water resource than commercial farm operations, where levels of input use are driven by profit maximizing criteria. In this scenario, lifestyle irrigation water could be priced in a manner similar to other hobbies (golf, for example). Some lifestyle irrigators would be unwilling to “pay to play” and thus be priced out of the activity. However, it could take a relatively high price (or offer) to encourage some lifestyle irrigators to reduce their use of irrigation water. The price at which many small farm operators would be inclined to change their irrigation practices may be very high, because for them, irrigation is a revered recreational, social, or lifestyle activity.

Also, should investments in irrigation system rehabilitation be subsidized for lifestyle irrigators? Extensive public money is (and will be) dedicated to improving existing U.S. irrigation systems. Does it make good sense for taxpayers to subsidize building new irrigation structures to serve increasing numbers of lifestyle irrigators? If parcels in an irrigated area become so fractioned as to make irrigation technically very difficult, how should lifestyle irrigators be “bought out”? Should a commercial farm value or a hobby value be used? How should irrigation system technical inefficiencies be dealt with when they are a result of large-lot housing development and accompanying common property and easement disputes? Should remedies for these technical problems treat (and request payment from) the irrigators as commercial farmers or lifestyle irrigators? How do regulations governing the subdivision of farm land affect irrigation systems?

Agricultural structure in the United States will continue to evolve with urbanization, population growth, and economic development. As a result, compatibility between irrigation infrastructure, water policies, and agricultural structure does not currently exist. Furthermore, such compatibility is not a static target, given the dynamic nature of urban fringe agriculture. Irrigation system investments and public policies are currently designed for the commercial, profit maximizing model of farmer/irrigator behavior. Changes in agricultural structure and the diversity of irrigator motivations are not being incorporated in water valuation studies, infrastructure investment decisions, or water resource policy formulation. This situation needs to change!

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