

## URBANIZATION ISSUES IN THE MIDDLE RIO GRANDE CONSERVANCY DISTRICT

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### ABSTRACT

Numerous rapidly growing urban areas in the western United States are located in irrigated river valleys. Agricultural irrigation in these communities is being affected by urbanization, and the characteristics and objectives of the irrigator population are also changing. New Mexico's Middle Rio Grande Conservancy District (MRGCD) encompasses the rapidly growing Albuquerque metropolitan area. The South Valley is one of the state's oldest traditional agricultural communities, and is located on the southern fringe of Albuquerque within the MRGCD. South Valley irrigated agriculture is in a state of transition, and many lands that were previously used to produce a diverse mix of fruits, vegetables, grains and forages have been converted into commercial and residential development. A few relatively large farms continue to operate in the area; however, hundreds of small or micro-scale irrigated properties are located in the South Valley. These small rural-residential properties predominately apply MRGCD irrigation water to hay and pasture. Little is known about agronomic, irrigation, or marketing practices on South Valley micro-farms, as well as the economic outcomes or impacts of irrigation water use. A team of New Mexico State University researchers is currently surveying MRGCD irrigators, measuring alfalfa consumptive use, and attempting to quantify the economic impact of South Valley irrigated agriculture.

### INTRODUCTION

Population and economic growth throughout the United States have accelerated the conversion of agricultural land to non-agricultural uses over the last several decades, with approximately 20% of all U.S. cropland now subject to some degree of development pressure (Heimlich and Barnard 2003). Many rapidly growing urban areas in the western United States are located in irrigated river valleys, with the future of agricultural land closely linked to the future of water resources (and vice versa). Advocates of traditional irrigated agricultural communities thus struggle to justify economic, historic, cultural, and lifestyle-based claims on combined land and water resources in the face of growing competition for both assets from non-agricultural users. The changing character of the

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agricultural irrigator population also challenges conventional notions of successful agricultural irrigation and beneficial use of water resources.

This situation is particularly acute in the Albuquerque, New Mexico metropolitan area, located in the arid southwest where both arable land and water are scarce. One of New Mexico's oldest, traditional agricultural communities is known as the South Valley. This unincorporated community is located on the southern fringe of the Albuquerque metro area, has been home to irrigated agriculture for many centuries, and is in the process of dramatic transformation. South Valley agricultural lands, agricultural irrigation water, agrarian values and traditions are being supplanted by suburban and urban land and water uses, with values and traditions also shifting from rural to urban. Lands that were once home to small, medium and large farms producing a diverse mix of fruits, vegetables, grains, forages, irrigated pasture, and small-scale mixed livestock species have been converted into commercial and residential development. A few large farms continue to operate in the area, although the majority of farms in the South Valley are small to very small, and while their numbers are large, these farms contribute marginally to the value of total agricultural output and economic activity in the state. The majority of large-lot rural residences that continue to use irrigation water do so primarily for lifestyle and landscape purposes, often for the production of pasture or relatively low-valued hay.

#### **THE MIDDLE RIO GRANDE CONSERVANCY DISTRICT**

The South Valley is located within the Middle Rio Grande Conservancy District (MRGCD) in Bernalillo County, New Mexico. The MRGCD was officially founded in the 1920s, but may be the oldest operating irrigation system in North America (Gensler, Oad and Kinzli 2009). The MRGCD delivers irrigation water to approximately 22,300 ha, and is important for flood protection and soil drainage in the region along the Rio Grande from Cochiti Dam in the north to the Bosque del Apache Wildlife Refuge in the south. The MRGCD covers numerous jurisdictions including federal, city, county, and tribal (Figure 1).

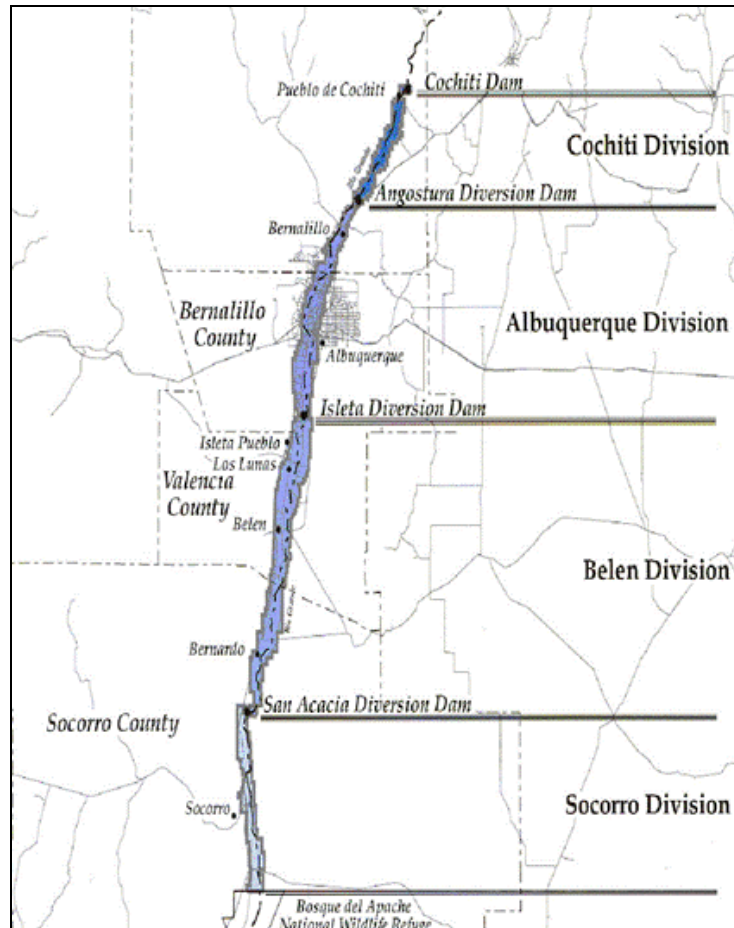


Figure 1. Central New Mexico's Middle Rio Grande Conservancy District<sup>2</sup>.

### RURAL-TO-URBAN LAND USE TRANSITION

Land use and land cover changes in Albuquerque's South Valley (bordered on the north by Rio Grande Boulevard, and on the south by Interstate-25) from 1985 to 2009 are illustrated in Table 1 and Figure 2.<sup>3</sup> During the past 25 years, the region experienced a 33% increase in urban land use along with a 20% decrease in agricultural land use and an

<sup>2</sup> Source of map: Middle Rio Grande Conservancy District.

<sup>3</sup> The land classification map in Figure 2 was created using remote sensing analysis of Landsat 5 Thematic Mapper satellite images. The Landsat 5 images were acquired for 13 September 13 1985 and 1 October 1 2009 to illustrate change in land cover types over a 24-year period. Both images were taken during vegetation leaf-on periods and have homogeneous reflectance values. A maximum likelihood land classification technique within EVNI 4.7 software was used to classify five land cover types: Agriculture, urban, water, desert and barren. Desert and barren land covers were combined for ease of processing the two images. The 1985 image has an overall classification accuracy of 87% and the 2009 image has an accuracy of 85%. The accuracy was assessed by creating regions of interest (ROI) that depict the actual land cover type of the image (e.g., ground truthing). Classification data within the ROIs are collected for actual sites, with the area in those sites compared to the output classification image for the entire image.

8% decrease in desert or barren area.<sup>4</sup> The increase in urbanization in the South Valley is a result of both commercial and residential development, as well as increases in surface area devoted to new roads and the driveways which access or are part of subdivisions and fragmented rural-residential home sites.

Table 1. Percentage and area changes of land cover types, 1985-2009, South Valley

Land Cover Type	% Change 1985-2009	Area Change in Km <sup>2</sup> 1985-2009
Urban	33.715	123.21
Agriculture	-20.954	-22.32
Water	-48.507	-4.58
Desert/Barren	-8.970	-96.32

Albuquerque, NM Study Area

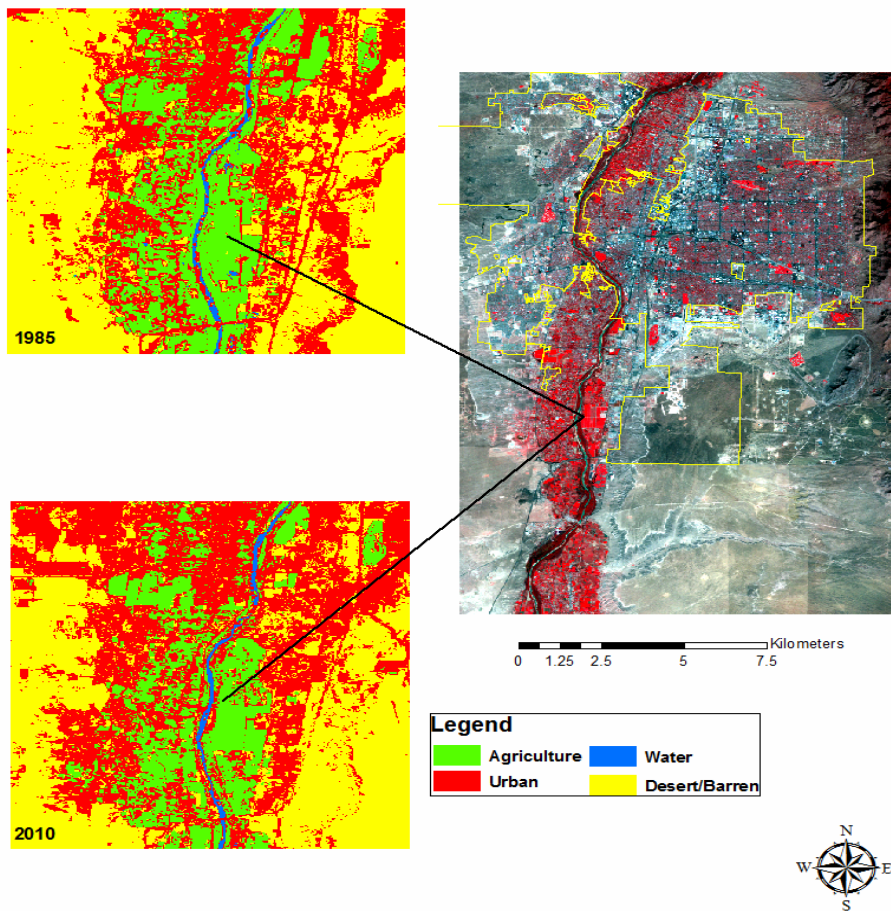


Figure 2. Land use and land cover change in the southern Albuquerque, NM metropolitan area (South Valley community).

<sup>4</sup> The region’s small amount of land surface covered by water decreased during the period 1985-2009; however, the region’s small water surface area fluctuates annually due to variable river flows in the Middle Rio Grande Basin and decreased water area is not related to urbanization trends.

## AGRICULTURE IN THE SOUTH VALLEY

Land cover change data for the South Valley illustrate the shift in land use in the southern Albuquerque metro area, with the urbanized landscape increasing at the expense of agricultural and desert land area over the last few decades. Historically, many South Valley producers grew high-value crops such as apples, grapes, chile peppers, and other orchard and vegetable crops for human consumption. Today, most South Valley farms produce lower-valued and less management intensive pasture grass, grass hay, and alfalfa. The majority of the community's households are dependent on off-farm income, both earned and unearned, and there is relatively little local food production.

A previous study which examined attitudes held by residents of the South Valley found they believe agriculture and the ecosystem are inextricably linked, that small-scale agricultural producers are an integral part of the ecosystem and serve as producers of ecosystem goods and services that range from the provisioning of food, fiber, and fresh water to the regulation of processes that affect air quality, climate, erosion control and human diseases (Wang 2007). Moreover, many South Valley citizens strongly recognize the landscape, open space, cultural, and social contributions of their small-scale farms and want to keep local agriculture sustainable in their community (Wang 2007). These people believe that small-scale irrigated agriculture is an essential component of their culture and heritage, is the foundation of their identity as land-based people, and is something to which they are deeply connected (Wang 2007).

Relative to other irrigated areas in New Mexico and the western United States, research and data for South Valley crop water use, farm management practices, irrigation efficiency, and the hydrologic impacts of agriculture are limited. Little information is available regarding the economic and environmental impacts of small-scale agricultural production and agricultural water use in this region. No data have been developed for the South Valley on relationships between crops, water application, water management practices, and surface and ground water interactions. Furthermore, no research has examined the South Valley's agricultural structure, agricultural incomes, agricultural households and their attitudes, motivations and objectives, and these households' use of and relationship to natural resources (e.g., land and water).

This paper briefly describes a current research project which is developing baseline information and data about irrigated agriculture in New Mexico's South Valley. The project is funded by a three-year grant from the United States Department of Agriculture.<sup>5</sup> Project personnel include agricultural economists, water resource engineers, and strategic planning specialist from New Mexico State University. The project's study area includes that portion of the MRGCD located between Rio Grande Boulevard in the north and Interstate-25 in the south, is located in the southern part of the Albuquerque Division of the MRGCD (as illustrated in Figure 1), and does not include any tribal lands. The project began in 2009 and since that time, the research team has

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<sup>5</sup> USDA-CSREES Small and Medium Size Farm Prosperity Agreement No. 2009-55618-05096, "Improving Economic Returns & Long-Run Sustainability in a Rapidly Growing Peri-Urban, Multicultural, Traditional Farming Community".

been documenting hydrologic, agronomic, environmental, and economic variables in South Valley irrigated agriculture. One of the objectives of the project is to generate better information about the small-scale irrigator population and their agricultural activities. A telephone survey of these irrigators began in 2010 and is providing new insight into the nature of local irrigated agriculture as well as the impacts of urbanization on local agriculture. Specifically, the research team is learning about the characteristics of the small-farm irrigator population's agricultural activities and their perceived obstacles to and opportunities for increased agricultural production in the South Valley. As noted above, there is currently little intensive agricultural production in the region and most irrigation water is used in forage production. Some community residents and local activists strongly believe that local food production has the potential to contribute significantly to the region's economic development and quality of life (including landscape, environmental, and human health improvements) (Wang 2007). However, very few data are available which can be used to evaluate the potential for local food production in the South Valley.

In order to assess a region's agricultural output or potential for output, the U.S. Census of Agriculture is usually the first place to look for data on producers and production as it provides a county-level snapshot every five years. Since the 1970s, a "farm" has been 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.<sup>6</sup> Thus, small irrigated residential/lifestyle farms selling very small amounts of agricultural products or producing only for home consumption or barter are not enumerated in the Census of Agriculture and very little is known about the nature and character of these farms. As of early 2011, the current research project has telephone interviewed ~50 small-scale irrigated agricultural producers in the South Valley in an effort to develop a better understanding of this population. Surveying continues in early 2011, and statistical analysis of the results will be conducted when a larger number of responses have been obtained. Preliminary results of the survey are discussed below.

### **SURVEY OF SOUTH VALLEY IRRIGATORS**

A list of approximately 1,200 South Valley irrigators was obtained from the MRGCD. A random sample of irrigators was drawn from this list, and telephone numbers for these people were located using telephone listing services for the region. Telephone surveying has been conducted from the NMSU campus in Las Cruces, and was preceded by a mailed letter to the irrigator. The letter explained the objectives of the survey, and indicated that the recipient would soon be receiving a phone call from NMSU researchers. The letter also provided information about NMSU administration contacts and contact information for the research team. The letter noted that participation in the survey was entirely voluntary, and that the survey was part of a larger research project

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<sup>6</sup> United States Department of Agriculture National Agricultural Statistics Service, 2007 Census of Agriculture United States Summary and State Data, Volume 1, Geographic Area Series, Part 51 (February 2009), available at [http://www.agcensus.usda.gov/Publications/2007/Full\\_Report/usv1.pdf](http://www.agcensus.usda.gov/Publications/2007/Full_Report/usv1.pdf).

seeking to develop baseline data and information about South Valley agriculture and agricultural irrigation.

Of the approximately 40 small-scale farmers interviewed thus far, the majority indicated that they use their water to irrigate grass pasture or to produce alfalfa or grass hay. A small number of respondents reported irrigating a few fruit trees (peach, pear, and apples) and one respondent reported an irrigated garden. The irrigated acreages reported ranged from 0.5 to 25, although the majority of respondents reported less than four acres. Hay yields were reported in numbers of small bales per acre, although bale weights were not reported. The respondents did not report yield estimates for their pasture, grass or alfalfa hay that harvested through grazing.

The most frequent response for irrigation frequency among the respondents is once every week, and flood irrigation is the only technology reported. No respondents indicated that they use any technology for deciding when and how much to irrigate their fields, while seven respondents reported laser-leveled their fields. Two respondents reported active insect pest management using insecticides, three reported active weed management through cultivation, herbicides, or burning. Fertilization also was reported by two respondents, and two individuals reported having their soil tested or receiving technical soil fertility advice. Advice on seeding rates for alfalfa or grass or herbicide usage was reportedly obtained from local merchants.

The presence of livestock (horses, goats, chickens, cows, sheep, and pigs) was reported by a majority of respondents. When asked why they keep livestock, respondents indicated it was for personal use and consumption, a hobby, to sell eggs, for weed and grass control, rodeo, and to earn a little cash. Then asked why they are engaged in agricultural production, only one respondent said that it was a primary source of household income. Several people reported that agriculture is a secondary source of household income, while a few noted that it is a hobby, a retirement activity, a way to produce feed for their horses, or a fun pastime. When asked where they sell their agricultural products, the most frequent response was to neighbors, usually in return for cash payment. Only three respondents reported hiring any employees to help with their agricultural production or marketing activities.

The survey included a question which asked respondents to assess the importance of different objectives for their farming operations. The list of objectives they were given to choose from was: minimize production cost, maximize income from sales of agricultural products, ensure farm survival, hold on to land until it can be developed, increase farm size, increase crop quality and reputation, increase leisure time, decrease financial risk, and preserve agricultural lifestyle. For the ~40 respondents who have been surveyed at the time of this writing, "preserve agricultural lifestyle" received the highest rankings.

As part of the survey, respondents were asked their opinion of local agriculture and its future. The comments received from the respondents covered a range of reasons or topics which have been condensed into three broad categories. Several respondents noted that many irrigators in the region lack knowledge about their soils and the relationships

between weather and crop production, and also have little understanding of good irrigation and agronomic practices. Some respondents stated that there is a widespread lack of capital to invest in new agricultural (including irrigation) technologies on small-scale farms in the region, and a few stated that local culture, traditions, and attitudes were obstacles to increasing agricultural production. The term “apathy” was used by some respondents, who indicated that many South Valley residents of small-scale farms are too old to significantly change their agricultural practices, and that agriculture is more of a lifestyle or a hobby, or a garden – rather than an income generating enterprise. Some respondents stated that it was difficult to make a profit from their small farms, that farmers in the region were unorganized, lacked information, were not willing to take risks, and that crime in the region was an impediment to agricultural growth and development.

### **SOUTH VALLEY IRRIGATION AND ECONOMIC IMPACT RESEARCH**

The preliminary survey results for small-scale irrigators in the South Valley tend to confirm our hypotheses that much agricultural production in the region can be characterized as low-input, low-management intensity, and low-output. Irrigator surveying continues, and it remains to be seen how, or if, future responses are different from the responses reported above. The engineering component of this project is measuring crop water use by alfalfa in the South Valley in order to assess the hydrologic balance within the region. A flux tower has been installed on one ~10 ha parcel of alfalfa, and two weather stations have been installed at two other locations. Point measurements of crop water use will be combined with remotely sensed data to develop region-wide estimates of agricultural evapotranspiration (ET). Existing yield-ET models for alfalfa will be used to generate estimates of the region’s hay production, although the small size of many of the fields will be a challenge to the use of the remotely sensed data. Installing weather stations in the study area has also been challenged by the need to place the stations on larger fields.

Estimates of crop yields derived from the yield-ET models will provide an additional dimension to the project’s attempts to estimate the economic value and economic impact of South Valley agriculture (and by extension, impute a value to the use of water in small-scale agricultural irrigation in the region). An existing input-output model (IMPLAN, Impact Analysis for Planning<sup>TM</sup>) is being used to analyze the economic impact of local agriculture in MRGCD counties using data reported by county in the U.S. Census of Agriculture. Our survey of small-scale South Valley irrigators and our estimates of crop evapotranspiration and yields are providing previously unavailable insight into the household objectives, crop production and irrigation practices, consumptive use outcomes and economic impacts of small-scale agricultural production.



## SUMMARY

Irrigated agriculture in the South Valley has been impacted dramatically by urbanization in the last few decades. The number of Bernalillo County farms enumerated by the Census of Agriculture<sup>7</sup> has increased, the numbers of very small irrigated properties has increased dramatically, the amount of irrigated land has decreased, there is little local food production, and smallholder irrigation is strongly motivated by lifestyle rather than income objectives. The majority of irrigated small farms in Bernalillo County and in the South Valley are so small that they are not enumerated by the Census of Agriculture, thus their numbers are not reflected in the urbanization trends reported within Census data.

As a result of urbanization, widespread on-farm irrigation investments, improvements, and increased water use efficiencies are unlikely to occur in the South Valley. Preliminary results from our survey of small-scale irrigators indicate that the majority of them are not motivated to increase the intensity of their agronomic practices, marketing, or irrigation management. Management intensive production of alfalfa hay continues to take place on the few large irrigated parcels that remain in the area. Management intensive or commercially-oriented production of higher-valued crops for direct human consumption (e.g., fruits, vegetables) in the region is unlikely to increase significantly in the future. Improvements in irrigation practices and increased management intensity in grass and alfalfa hay production are possible and would contribute to increased water use efficiency in the region; however, many small-scale irrigators in the South Valley are unlikely to be motivated to change their practices.

## ACKNOWLEDGEMENTS

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<sup>7</sup> United States Census of Agriculture data for New Mexico counties are available at: [http://aces.nmsu.edu/academics/aeab/trends-in-new-mexico-agr.html#anchor\\_73028](http://aces.nmsu.edu/academics/aeab/trends-in-new-mexico-agr.html#anchor_73028).

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