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**A COMPARISON OF THE VIEWS OF
FARMERS AND THE NONFARM PUBLIC
REGARDING RESOURCE USE:
THE CASE OF TEXAS GROUNDWATER**

By Don E. Albrecht

ABSTRACT

This paper provides a comparison of the views of farmers and the nonfarm public about the use of a water resource that is critical to both. Specifically, this paper presents the results of surveys of a farm and a nonfarm sample about the uses of water from the Edwards Aquifer in South Central Texas. The paper briefly discusses the Edwards Aquifer and outlining the issues surrounding this critical resource. Hypotheses are then developed, data are analyzed, and conclusions drawn.

INTRODUCTION

In a watershed book on agricultural policy, Paarlberg (1980) noted that demographic and socioeconomic changes in the United States in recent decades have resulted in an extensive loss of power by the agricultural industry, and in agriculture increasingly being brought into the mainstream of American society. Paarlberg maintains that as a result of a rapidly declining farm population (Albrecht and Murdock, 1900), there has been an associated loss of political clout (Leman and Paarlberg, 1988). In addition, technological, financial and other changes in agriculture are combining to make farming more similar to other businesses, and farm life less unique. This loss of uniqueness has resulted in farmers being less likely to be given special treatment, such as exemptions from environmental and labor laws, than in the past (Vogeler, 1981).

Among the consequences of this loss of power and uniqueness in

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agriculture is that farm policy is increasingly being impacted by nonfarm interests (Molnar and Wu, 1989; Thomas and Thigpen, 1993), and to a greater extent than ever before, farmers are being forced to compete with nonfarm entities for resources that are essential to agricultural production. In respect to farm policy, it is apparent from recent farm bills that environmental and other concerns are being imposed on farmers despite their efforts to resist (Reichelderfer, 1990). In addition, there are a growing number of cases where resources that were previously used for agriculture are being moved to nonfarm uses as a result of the greater economic or political power of these users (Luloff and Swanson, 1990). These concerns become heightened as our societies resource demands grows and the frequency and severity of resource shortages increases (Revelle and Revelle, 1988).

The future of agriculture will, no doubt, include increased influence from people outside the farm gate. Consequently, it is important that an understanding of the areas of congruence and incongruence in the views and attitudes of farmers and the nonfarm public be improved. Some recent studies have provided insights into the extent to which the general public understand and appreciate agriculture, their resource needs and the values of agrarianism (Molnar and Wu, 1989; Dalecki and Coughenour, 1992). There is, however, a lack of research about public perceptions of the priority that should be given to the resource needs of agriculture, especially when there is a direct competition for these resources from nonfarm entities. Questions about the extent to which, and under what circumstances, the nonfarm public is willing to reduce its resource use in order to allow the agricultural industry continued access to these resources is unknown. Also, there are very few studies where the views of farmers and nonfarmers on resource issues are directly compared.

The Edwards Aquifer

The Edwards Aquifer is a unique underground water resource located in South Central Texas. The aquifer contains water that enters from the percolation of stream flow and by the direct infiltration of precipitation. Unlike some aquifers where the water is relatively stationary, water entering the Edwards Aquifer flows eastward toward

Albrecht: A Comparison of the Views of Farmers and the Nonfarm Public Regard springs that provide natural discharge points. These springs then form the headwaters of rivers that flow to the Gulf of Mexico. In a typical year, the Edwards Aquifer receives and discharges about 700,000 acre feet of water. During years when precipitation is greater than normal, the amount of water flowing through the Edwards Aquifer will be greater, while during a drought the amount of water in the aquifer decreases.

From the time of early settlement, residents in the area have drilled wells and Edwards Aquifer water has been pumped to the surface where it has been used for household, industrial, commercial and recreational needs. Today, nearly all of the water needs in this area are met by using Edwards Aquifer water. In addition, the Edwards Aquifer has been extensively used in irrigated agriculture, and more than 250,000 acres of crops currently are irrigated in the region. Further, the springs and rivers formed from Edwards Aquifer outflow have also been used extensively for agricultural and recreational purposes.

Obviously, as greater amounts of water are pumped from the aquifer, the amount of water in the aquifer, as well as the amount being discharged at the springs, is reduced. Historically, this has not been a problem because the amount of water flowing through the Edwards Aquifer has been sufficient to meet all demands. While droughts have occurred in this region periodically in the past, there has always been a cushion of water that was not being used. Concern with the potential consequences of drought have increased immensely in recent years, primarily because the population in the Edwards Aquifer region has increased dramatically. Specifically, the city of San Antonio, located in the heart of the Edwards Aquifer region, has become one of the 10 largest cities in the nation; during the 1980s the population of this city grew by about 20 percent.

This large and growing population has greatly increased the pressure on Edwards Aquifer water. With increasing amounts of water being drawn from the aquifer, it is now apparent that when the next serious drought occurs in this region, there will not be enough water to meet all current uses (Texas Water Development Board, 1990). In addition, downstream users are extremely concerned that spring flow levels remain adequate to meet their needs. Consequently, policy makers and residents in the region have been forced to deal

with a number of critical questions about the use of Edwards Aquifer water, and at times this debate has become very heated. Among the questions that have been raised are debates about the degree or extent of the water-related problems associated with the Edwards Aquifer. As of yet, no consensus exists among the public about the severity of the water shortage problems in the Edwards Aquifer area. Other questions include which water uses should have the highest priority and to what extent governmental control will be necessary to preserve and distribute Edwards Aquifer water. A comparison of the views of farmers and the nonfarm public on these issues is the focus of this paper. A more detailed discussion on these issues and the development of hypotheses is provided in the paragraphs that follow.

Water Issues

Perhaps the most basic issue surrounding the Edwards Aquifer is the difference in the perceptions of residents regarding the extent or severity of the water shortage problems in the area. From the discourse in public meetings on the subject, it is apparent that some area residents believe that the potential water shortage problems are not severe and that current conditions will permit continued population and economic growth in the area. Others disagree and believe that the problems emerging with the occurrence of the next drought will be severe. The views that the water problems are not serious in some ways reflect a worldview that has been called the "Dominant Social Paradigm" (Pirages, 1978; Dunlap and Van Liere, 1978). This perspective includes beliefs that resources are abundant, that extensive conservation is unnecessary, and that technology will solve any problems that may emerge. Research has found these views to be more common among farmers than among the public at large (Van Liere and Dunlap, 1980). Consequently, for this study we hypothesize that farmers will be more likely than nonfarm respondents to report that water problems are not severe and are not a constraint to further development.

When faced with a potential drought-induced water shortage, questions about which water uses should have the highest priority become prominent. Of particular concern is the amount of priority that should be given to agricultural water uses as opposed to other

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uses such as household uses, watering lawns, industrial, commercial and recreational uses. The priority given to the agricultural uses of water is the second issue explored in this paper. In the Edwards Aquifer area, as is typical, the amount of water used in agriculture far exceeds the amount used for other needs (Texas Water Development Board, 1990). By irrigating their crops, farmers in this region can greatly increase per acre productivity. The price of farmland, as well as the economy in agriculturally based rural communities in the region, is based on the more productive irrigated agriculture, and reduced production resulting from declines in irrigated agriculture could have extensive implications. Because of the obvious self-interest involved, it is hypothesized that farmers will be more likely than nonfarmers to give high priority to agricultural water uses.

Another critical issue in the area involves the extent to which government involvement is needed to make management decisions regarding Edwards Aquifer water and at which level of government should these decisions be made. Historically, farmers have been champions of the free enterprise system and have expressed opposition to government involvement and control (Hoiberg and Bultena, 1981). This research will provide an understanding of the extent to which this generalization is true in respect to the Edwards Aquifer and the degree to which the views of farmers and the nonfarm public vary. It is hypothesized that farmers will be more likely than nonfarmers to oppose government involvement and control of Edwards Aquifer water.

In sum, this study provides an empirical comparison of the views of farmers and the nonfarm public on three critical Edwards Aquifer water issues. It is hypothesized that farm respondents, compared with nonfarm respondents, will be:

1. less likely to consider water shortage problems to be severe,
2. more likely to give the agricultural uses of water a high priority, and
3. more likely to express opposition to government involvement and control in management decisions regarding the Edwards Aquifer.

Of course, other issues also could be explored. These three, however, are perhaps the most pressing at this particular time in this area, and an examination of these issues should also provide an indication of the extent to which there is agreement or disagreement between these two groups.

METHODS

Data

To test the hypotheses, surveys were conducted with random samples of both farmers and nonfarm residents in the Edwards Aquifer area. The names of all farm and ranch operators in the 13-county Edwards Aquifer region were obtained from a government agency. The names of farmers to be surveyed were randomly selected from these lists. The selection process was conducted so that the number of farmers interviewed in each county was proportional to that county's percentage of total farmers in the study region. Once the names of farmers to be interviewed had been determined, interviews were conducted by telephone during 1990. Completed surveys numbered 448. Of the individuals contacted, 75 percent completed the survey.

The survey of nonfarm residents also was conducted by telephone. A computer-generated list of random telephone numbers from the same 13-county area as the farmer survey was purchased. The number of surveys conducted from each county was proportional to that county's share of the total area population. Thus, a vast majority of the surveys were conducted in San Antonio and surrounding suburbs in Bexar County. The surveys were conducted during the summer of 1991. A total of 501 surveys were completed. Of the total households contacted, 73 percent completed the interview.

Measurement of Variables

Since the major focus of this study is to compare the views of farmers with nonfarm residents, the primary independent variable is farm or nonfarm residence. This is a dichotomous variable, where those interviewed as part of the farm survey were coded 1, while those interviewed as part of the nonfarm survey were coded 0.

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Three dependent variables are used in this study, each of which is the focus of a hypothesis described earlier. The first dependent variable is labeled "extent of problem." During both surveys, respondents were given a list of 17 statements about specific Edwards Aquifer issues and problems. For each statement respondents were asked whether they strongly agreed (score of 1), agreed, disagreed, or strongly disagreed (score of 4). A factor analysis with varimax rotation revealed that six of these variables comprised a factor concerning the respondent's views regarding the extent and severity of water scarcity problems associated with the aquifer. Respondents were given a summated score for these six items, with potential scores ranging from 6 to 24. Based on the wording of the questions, a lower score indicates a feeling that water scarcity problems are less severe.

The second dependent variable concerns the priority given to agricultural water uses. Both farm and nonfarm respondents were given a list of 13 possible water uses and asked if each of these uses were very important, important, unimportant or very unimportant. Among the list of 13 water uses were two related to agriculture: "irrigation of crops" and "watering livestock." Respondents were given one point for each agricultural water use that they said was "very important." Then, because it was possible for respondents to say that many of the water uses were very important, they were further asked to list the three most important water uses. Respondents were then given an additional point for each agricultural water use they listed among the three most important water uses. Thus, possible scores on this variable ranged from zero to four, with higher scores indicating a higher priority given to agricultural water uses.

The third dependent variable in this study measures the extent to which respondents believe federal or state government, rather than individual landowners, should make management decisions concerning the use of the aquifer water. Both farm and nonfarm respondents were asked whether they strongly favored (score of 1), favored, opposed or strongly opposed (score of 4) having each of three entities make management decisions regarding the Edwards Aquifer: federal government, state government or individual landowners. Scoring was reversed for individual landowners. Possible scores could range from 3 to 12, with higher scores indicating great

opposition to government involvement, and lower scores showing evidence that the respondent favors freedom of choice by individuals.

Because potential differences between farm and nonfarm respondents could be a result of differences in sociodemographic characteristics, age, education and income were controlled during the regression analysis. Age was self-reported in years for the respondent. Education was measured by placing both farm and nonfarm respondents into one of eight categories that ranged from (1) never went to school, to (8) completed a graduate or professional degree. Income was measured by asking the respondent their family's total taxable income for the previous year.

Analysis

Regression analysis will be used to test the hypotheses that have been developed. Initially, regression models will be run with only the dichotomous independent variable (farm-nonfarm) being regressed on each of the three dependent variables. These models will determine if the differences between farmers and nonfarmers on each of the dependent variables are significant. In a regression model such as these where the only independent variable is dichotomous, the unstandardized regression coefficient will be the difference between the means of the two groups; if the model is significant it will show that the differences between the two groups are significant. The second set of regression models will include the farm-nonfarm variable as well as the three control variables (age, education, and income) all being used as independent variables with each of the three dependent variables. These models will allow a determination to be made of the extent to which the differences found in the first set of models are a function of differences between the two groups as opposed to being a function of the differences on the control variables.

FINDINGS

Table 1 presents data which show descriptive statistics for all the variables used in the analysis and also provide a comparison of the mean scores for the farm and nonfarm samples. As expected, this table shows that the nonfarm population was more likely than farmers

Table 1. Descriptive Statistics for the Variables Used in the Analysis and a Comparison of the Mean Scores of the Farm and Nonfarm Samples

Variable	Possible Range	Mean Score	
		Farm	Nonfarm
<u>Dependent Variables</u>			
1. Extent of Water Problem	6-24	14.12	16.12
2. Priority of Agriculture	0-4	3.94	2.57
3. Government Control	3-12	7.87	6.96
<u>Control Variables</u>			
1. Age		58.4	41.0
2. Education		5.6	5.9
3. Income		\$32,773	\$42,155

Table 2. Regression Analysis Showing Standardized Regression Coefficients (Beta) and Unstandardized Coefficients (Parenthesis) for Farm-Nonfarm and Control Variables on Each Dependent Variable.

Independent Variables	Dependent Variables					
	Extent of Water Problem		Priority of Agriculture		Government Control	
Model 1^a						
Farm - Nonfarm	-.40*	(-2.00)	.33*	(1.37)	.29*	(.91)
F-Value	176.2*		112.1*		83.7*	
R-Square	.16		.11		.08	
Model 2^b						
Farm - Nonfarm	-.35*	(-1.73)	.36*	(1.52)	.22*	(.71)
Age	-.05	(-.007)	-.00	(-.000)	.13*	(.013)
Education	.11*	(.119)	.01	(.008)	.08*	(.088)
Income	.01	(.000)	.02	(.000)	.02*	(.000)
F-Value	37.0*		26.0*		19.7*	
R-Square	.17		.12		.10	

*Statistically significant at the .05 level.

^aModel 1 includes only the primary independent variable : Farm - Nonfarm.

^bModel 2 includes the primary independent variable as well as the three control variables.

to believe that the water problems associated with the Edwards Aquifer are severe. Also as expected, the farm respondents placed a higher priority on agricultural water uses than did nonfarmers. The farm population was nearly unanimous in giving agricultural water uses the highest score possible. With 4 being the highest score possible, the farm respondents had an average score of 3.94. In addition, Table 1 shows that the farm respondents were more likely than the nonfarm population to oppose government involvement in management decisions regarding the Edwards Aquifer.

While the differences in the views of respondents were as hypothesized, the two groups were also substantially different from one another on the control variables. On average, farm respondents (average 58.4 years) were significantly older than nonfarm respondents (average 41 years). Also, the educational attainment of the nonfarm respondents, on average, was higher than the educational attainment of farm respondents. For our education scale, a score of 5 means the completion of high school, while a score of 6 is "attended some college." Table 1 shows that the average education score for nonfarm respondents was 5.9, while the average score for farm respondents was 5.6. Finally, Table 1 shows that the average family income of nonfarm respondents of \$42,155 was substantially higher than the average income of farm respondents, which was \$32,773.

In Table 2, two sets of regression models are presented. For the first set of models, farm-nonfarm is the only independent variable and this variable is regressed on each of the three dependent variables. This analysis shows that for each dependent variable, the differences between the farm and nonfarm respondents are significant and in the hypothesized direction. Table 2 shows that knowing whether the respondent was a farmer or a nonfarmer allowed us to explain 16 percent of the variation in the extent of water problem variable, 11 percent of the variation in the priority of agriculture variable, and 8 percent of the variation in the government control variable.

While the results presented thus far provide support for the hypotheses of this study, the farm and nonfarm respondents were so different on the control variables that it is possible that the variations found in their views about the Edwards Aquifer are a result of differences in their age, education and income rather than their farm status. Consequently, a second set of regression models were run,

where the three control variables, in addition to the farm-nonfarm variable, were regressed on each of the three dependent variables. The results are shown at the bottom of Table 2. This table provides further support for the hypotheses. For each regression model, the relationship between the farm-nonfarm variable and the dependent variable remained significant after the effects of the control variables were taken into account. For each model 1 regression, the unstandardized regression coefficient is the distance between the mean scores for the farm and the nonfarm populations. The model 2 regressions show that these distances did not greatly diminish when the effects of the control variables were considered. Similarly, the beta coefficients for the farm-nonfarm variables did not greatly diminish when the effects of the control variables was considered. In many cases, the control variables were not significantly related to the dependent variable, and when the relationships were significant, they were consistently weak. Further, the control variables did not add substantially to the amount of variance explained in the dependent variables. On "extent of water problem," the addition of the control variables only caused the R-square to increase from .16 to .17. For "priority of agriculture" the R-square only increased from .11 to .12, while for "government control" it increased from .08 to .10. It can thus be concluded that most of the differences found in the dependent variable can be attributed to the respondents farm status and not differences in their age, education and income.

SUMMARY AND CONCLUSIONS

The water in the Edwards Aquifer is a scarce resource, with much disagreement about the severity of water shortage problems, which water uses should have highest priority, and which groups or individuals should make management decisions. The results of this analysis show extensive differences in the views of farm and nonfarm respondents on these issues. The differences observed were in the direction predicted by the hypothesis and consistent with previous farm-nonfarm comparisons. That is, farmers are less likely than nonfarmers to accept environment problems and resource scarcities as real, farmers more likely than nonfarmers to place a high priority on agriculture, and farmers are more likely than nonfarmers to oppose

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government intervention. The differences between farmers and nonfarmers have major consequences for the farm population, not only for water issues in Texas, but for a wide variety of resource issues throughout the country. No doubt, a comparison of farmers with the nonfarm public on other issues throughout the South, or for that matter throughout the nation, would find similar differences. These differences are important because farmers are always going to be only a small portion of the total population and, as Paarlberg (1980) notes, are going to lack the political clout to get what they want when their views are not in congruence with those of the general population. This problem is becoming more severe because the awareness of and empathy for the needs of farmers is dwindling as this nation becomes increasingly removed from agriculture. In previous generations, many of the nonfarm public had grown up on a farm, or were only one generation removed from the farm. Today, this is becoming increasingly less likely to be the case.

Obviously, the need for the agricultural community to educate the nonfarm public about the needs of agriculture and the consequences if these needs are not met is greater than ever before. The nonfarm public needs constant reminders of how their lives are vitally connected with agriculture. Consequently, determining the effectiveness of various educational programs has become an important research need. In addition, the ability to communicate, compromise and cooperate has become critical. Many questions remain and much additional research is needed as agriculture attempts to find its place in a rapidly changing and increasingly urban society.

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