October 1997

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Great Plains Research 7 (Fall 1997): 225-50

DEPOPULATION OF THE RURAL GREAT PLAINS COUNTIES OF TEXAS

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Abstract. *The counties of the Texas Great Plains have been part of a depopulation of the rural "heartland" of the United States. This paper traces the loss of population in these counties since 1910 and tries to account for the reasons underlying the trend. Four major groups of variables are analyzed through stepwise regression to determine their relative conceptual importance: demographic factors (age-structure and percent Hispanic), environmental factors (annual rainfall, percent irrigated land, and amount of oil production), geographic factors (distance to an urban central place and population size of a county's central place) and socioeconomic factors (lack of diversification of local economy, per capita income and percent of population with a high school diploma). The percent of the population greater than 65 years was most closely associated, both as a cause and effect, with depopulation. Probing beyond this somewhat inherently linked demographic variable, the next most important factor underlying depopulation was the distance of a county to a major metropolitan area. Also associated with depopulation were the lack of economic diversification, insufficient water supply and lower levels of income.*

One of the more intriguing demographic trends of the 20th century has been the out-migration of people from rural America. Since the turn of the century, while the metropolitan population increased from 25 million to 187 million, rural population numbers have remained relatively stable (U.S. Census 1995). In addition, the distribution of the rural population has changed dramatically. In the American Great Plains, many counties have consistently lost population since the early decades of this century. Despite the unexpected "nonmetropolitan turnaround" during the 1970s, rural depopulation continues today. In the 1980s, 54% of the 2,304 nonmetropolitan counties in the U.S. lost population (O'Malley 1994). Between 1990 and 1994, although only 27% of the nonmetropolitan counties lost population, counties in the Midwest continued to depopulate (Johnson and Beale 1995).

In spite of a short-lived nationwide concern over depopulation during the early 1980s (Mathis 1988), rural Great Plains demographic problems have continued relatively unnoticed. Sustained population losses have altered the demographic and economic foundations of many counties. With shrinking tax bases, fewer jobs, and aging populations, many rural areas are becoming pockets of poverty, with fewer services such as police and fire protection, health facilities and schools (Davidson 1990). Such losses likely have been exacerbated by the extreme drought of the mid-1990s, which is in some ways comparable to the dust bowl of the early 1930s and the droughts of the 1950s and 1970s. Indeed, this scenario has lead some scholars to suggest the possible return of parts of the American Great Plains to a buffalo commons (Matthews 1992).

This research examines the underlying dynamics of this demographic change by studying the Great Plains counties of Texas from 1910 to 1990 (Figure 1). This region, in many ways a reflection of the American Great Plains, appears to illuminate the effects of twentieth century demographic and agricultural change on the larger region (Popper 1995). The county was chosen as the unit of analysis for the study because data is readily available at this scale and because the Texas Great Plains counties are relatively homogenous internally, thus allowing them to be good descriptors of the varying characteristics of the whole region. The 67 counties of the region can be subdivided into four agricultural regions: the Northern High Plains, the Southern High Plains, the Northern Low Plains, and the Southern Low Plains (Texas Comptroller's Office 1986). These regional distinctions are recognized by scholars and locals alike.

The study aims to uncover the most important causes and correlates of depopulation in the Texas Great Plains. To this end, we suggest four sets of conceptual factors underlying this trend: demographic, geographic, environmental and socio-economic. Ten specific variables are tested with regression analysis to assess the relative importance of these factors in four twenty-year periods between 1910 and 1990. We examine the extent to which economic diversification and irrigation are important in explaining population growth in Texas Great Plains counties. In addition, we hypothesize that nonmetropolitan counties with older populations, small central cities and the greatest distance from metropolitan counties will experience population decline. Because one variable—the older population—is so closely related to depopulation (the dependent variable), the analyses are conducted both with and without this variable.

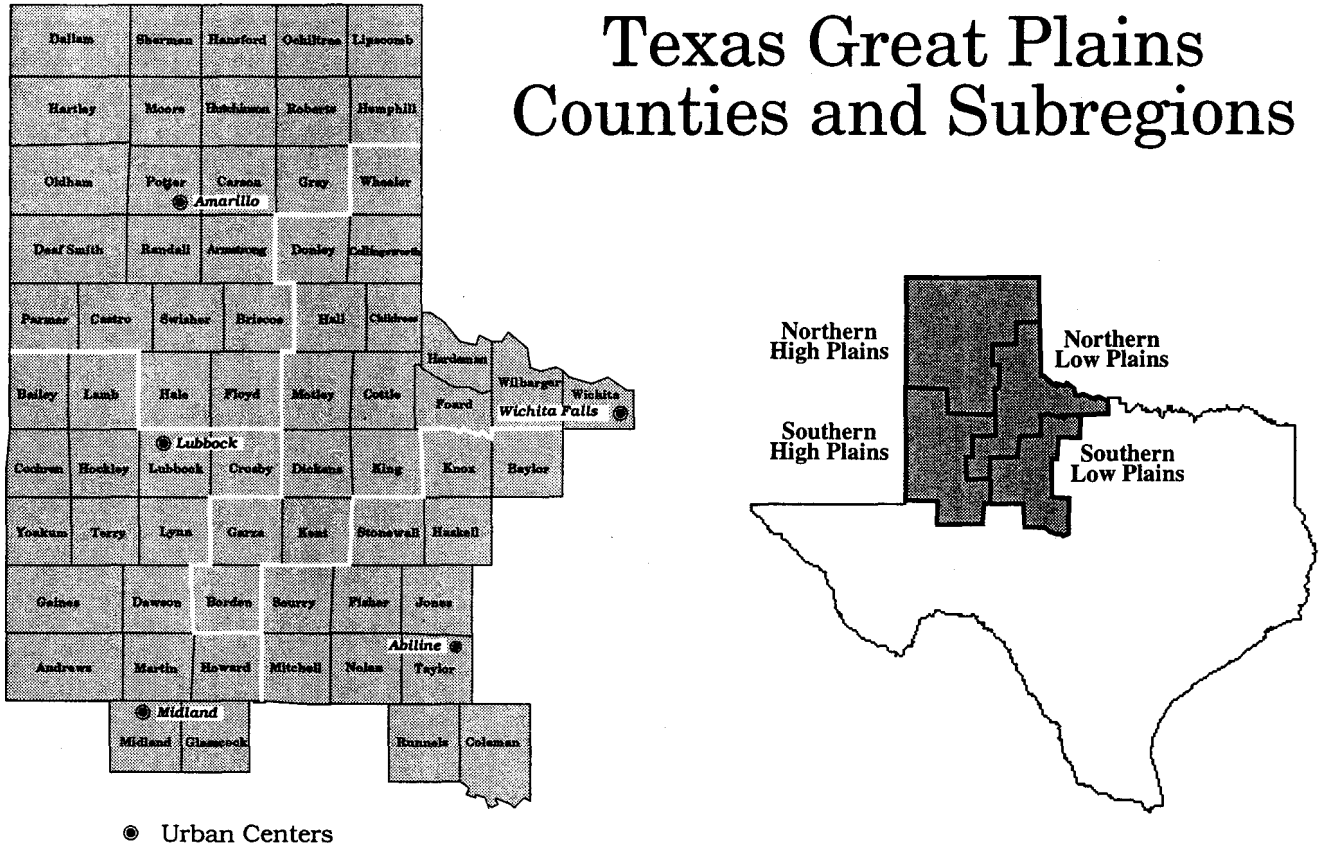

Figure 1. The study area: The counties and subregions of the Texas Great Plains.

This study proceeds as follows. We first provide a background by documenting 20th century population trends in the Great Plains region of the U.S. and the Great Plains counties of Texas. Second, we review each conceptual factor underlying depopulation in the context of previous research, particularly studies related to the Great Plains counties of Texas. We then discuss the results of the stepwise regression analyses in detail, while attempting to explain which factors have most significantly affected the depopulation of the Texas Great Plains.

Great Plains Population Trends in the 20th Century

The Great Plains region of the U.S. consists of portions of states west of the 98th meridian and east of the Rocky Mountains, including parts of North and South Dakota, Nebraska, Kansas, Oklahoma and Texas, and also of Montana, Wyoming, Colorado and New Mexico. This shortgrass prairie region lacks sufficient rainfall, surface water and timber and suffers extreme heat, cold and wind, which made it inhospitable for settlement in the late 19th century (Webb 1931; Kraenzel 1955; Albrecht and Murdock 1985). This led many westward-bound settlers to refer to the Great Plains as the Great American Desert (Albrecht and Murdock 1985, 1986a). The region was considered uninhabitable; therefore few people dared to settle and population growth was slow (Albrecht and Murdock 1986a).

Advancement in technology in the late 1880s and early 1900s transformed the Great Plains from a shortgrass prairie to one of the most agriculturally productive regions in the U.S. (Albrecht and Murdock 1985). Initially, more people were able to settle in this area than had been thought possible. However, as irrigation technology improved in the 1930s, many non-irrigated, agriculturally dependent counties began to depopulate.

Despite notable population growth in most of the U.S. after the Second World War, rural areas in the Great Plains continued to depopulate rapidly. Since 1950, forty-five of the 58 plains counties in Kansas have lost population (Socolosky as cited by Popper 1992), although some urban counties in western Kansas have maintained or slightly increased their population (White 1994). During the 1970s South Dakota lost population in 42 of its 66 plains counties and during the 1980s North Dakota lost population in all but three of its 41 plains counties (Popper 1992). During the 1980s the population dropped in all but two of the 52 plains counties of Nebraska, while Oklahoma lost population in 22 of its 23 plains counties (Popper 1992).

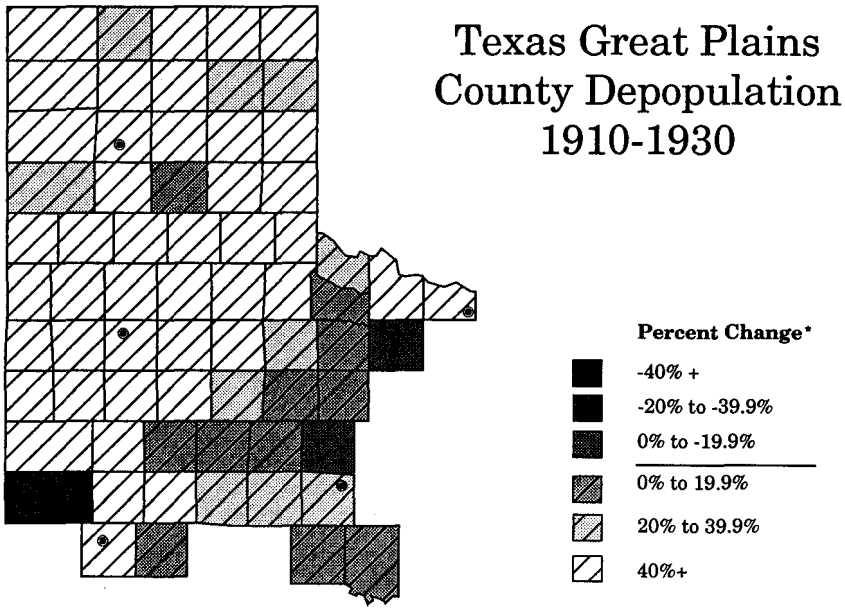

Figure 2. Population change in the Texas Great Plains, by county: 1910-1930.

Texas Great Plains Population Growth and Decline

With the arrival of the railroad in the 1880s, a British land and cattle company imported livestock and began ranching operations in the Texas Panhandle (Kirby 1987). In general, the development of West Texas was "affected by four principal influences: the spread of range cattle; railroad building; the advance of farming; and industrialization" (Texas Rural Development Commission 1973:14). Population increased in many Great Plains counties, boosted by the spread of cotton farming and the discovery of oil and natural gas. From 1900 to 1920, the number of farms increased more than five-fold (Nall 1990). This was a prosperous time in the Texas Great Plains—a time of increasing land values and large bank deposits—and the population grew in all but three Plains counties from 1910 to 1930 (Figure 2). By 1930, however, many counties had reached their peak population, and

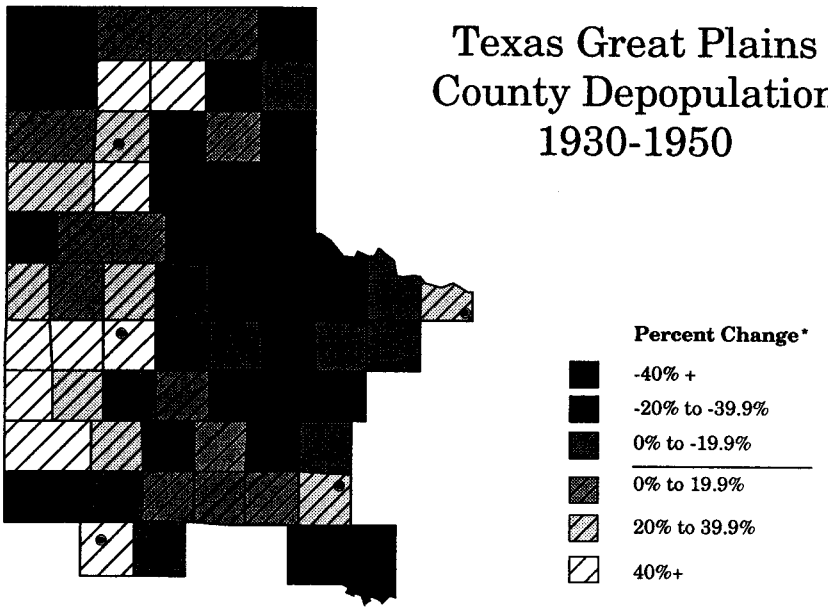

Figure 3. Depopulation of the Texas Great Plains counties: 1930-1950.

slower growth in the Southern Low Plains foreshadowed the rapid population decline in the southeastern part of the Texas Great Plains which was to follow.

Depopulation of the rural counties of the Texas Great Plains did not begin until the 1930s when the Depression and the Dust Bowl slowed growth in this area (Kraenzel 1955). This decline, which has continued almost unabated to the present in many of these counties, is quite evident in the eastern portions of the High Plains, but is most pronounced in the Low Plains (Figures 3-5). The upswing in the American economy in the Second World War enticed impoverished farmers to head to cities for employment. In addition, the rise of mechanization and the use of irrigation during the 1940s significantly changed Texas Great Plains agriculture. By the 1970s over one-half of the cultivated land in this area was irrigated and many farmers were using fertilizers, herbicides and improved plant varieties. These developments increased yields of cotton, wheat, and grain sorghum. Irrigation also

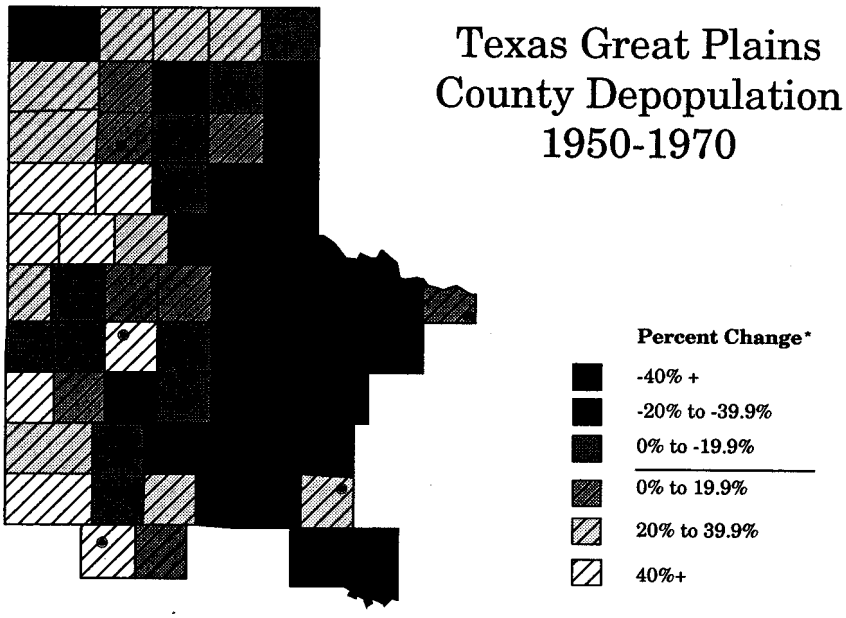

Figure 4. Depopulation of the Texas Great Plains counties: 1950-1970.

enabled farmers to commercially produce grapes, sunflowers, soybeans and many types of vegetables (Nall 1990). By 1984 farmers in the Texas High Plains led the state of Texas in the production of corn, cotton, alfalfa, sorghum, wheat, potatoes, sugar beets, sunflowers, and feed cattle (Nall 1990). Farm consolidation continued and many rural plains counties in the region experienced widespread population losses, especially those in which irrigation was uncommon.

During the 1970s when the U.S. underwent a rural-urban turnaround, Texas Great Plains counties with predominately agricultural labor forces still suffered population losses (Albrecht 1986; Johnson 1989). Outside the Great Plains region, the non-metropolitan rebound was primarily precipitated by rural nonfarm in-migration. Therefore, depopulation continued for most Texas Great Plains counties, which were not attractive to people moving to rural nonfarm areas.

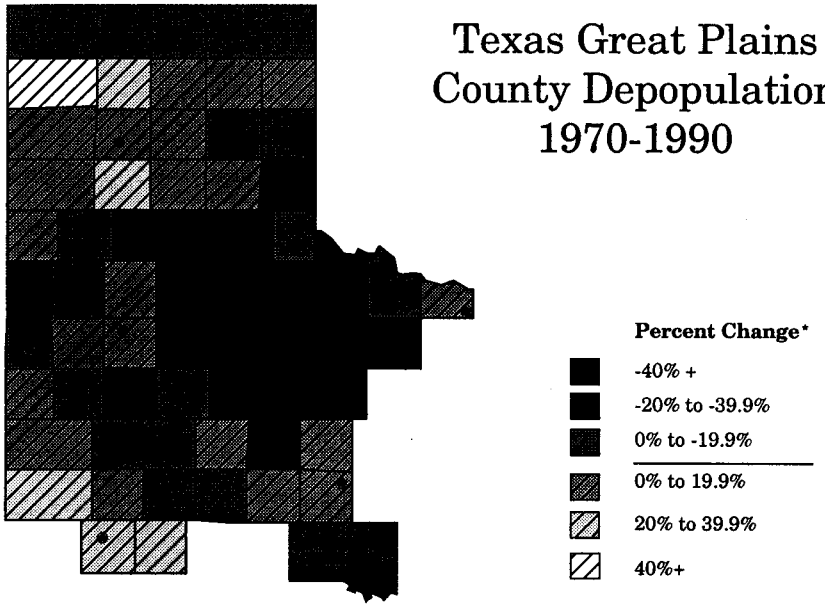

Figure 5. Depopulation of the Texas Great Plains counties: 1970-1990.

While Texas' population increased by 18.2% in the 1980s, the population of the Texas Great Plains region increased only one percent, with growth primarily in or near metropolitan areas. From 1970 to 1990 the rural population of Texas rose; however, most of this increase came in rural counties in the central, northeast, and southeast regions of the state. Fifty-four of the 67 Great Plains counties of Texas lost population in the 1980s (Texas Almanac 1990), a trend that has persisted in the 1990s.

Factors Underlying Depopulation of the Texas Great Plains: A Review of the Literature

Four conceptual factors—1) demographic, 2) geographic, 3) environmental and 4) socio-economic—may help explain the dynamics of depopulation in the Texas Great Plains (Table 1). In this section we discuss specific

TABLE 1
DEPOPULATION OF THE TEXAS GREAT PLAINS COUNTIES, 1910-1990: CONCEPTUAL FACTORS AND OPERATIONAL VARIABLES

Dependent variable:

Percent change in county population, 1910-1930, 1930-1950, 1950-1970, 1970-1990

Independent variables:

Conceptual factors	Operational variables	Hypothesized Association with depopulation
1. Demographic		
Older Population	Percent population 65 and older	+
Hispanic Population	Percent Hispanic	-
2. Geographic		
Distance	Proximity of central place in county to metropolitan central place, in miles	-
Central Place	Population of central place in county	-
3. Environmental		
Precipitation	Annual rainfall	-
Irrigation	Percent irrigated land in county	-
Oil	Oil production	-
4. Socio-economic		
Lack of diversification	Percent employed in agriculture	+
Income	Per capita income	-
Education	Percent of population over 25 with a high school diploma	-

variables corresponding to the four conceptual factors in the context of the extant literature, and hypothesize the effect of each on depopulation in the Great Plains counties of Texas.

Demographics

Older Populations. Census data indicate that people 65 and older are more concentrated in the South and the Midwest, mostly in agricultural and retirement areas (Siegel 1993). More than one million persons over the age of 65 reside in Texas. These older residents comprise 20% or more of the population in fifty counties (Siegel 1993). Beale noted that during the rural-to-urban turnaround of the 1970s, some rural regions of the U.S. experienced a 15-30% increase in in-migration of individuals over 60 years of age (Coward and Lee 1985). Between 1975 and 1980, more than 50,000 persons 65 and older moved to Texas (Siegel 1993). Although many affluent and better educated retirees have migrated to certain counties in South Texas and the German Hill Country, thereby contributing to rapid population growth, such has not been the case in the Texas Great Plains. Great Plains counties have little appeal for retirees and the older population tends to consist of rural farmers "aging in place" (Rogers and Woodward 1988).

In Texas Great Plains counties the out-migration of many younger people, particularly those in their late teens and twenties, has left counties with an aging populace. This population of mainly middle-aged and older residents leads to population size stagnation, renders the community less attractive to younger people, and results in higher overall death rates. As counties depopulate, many have become incapable of supporting full-time physicians, druggists or hospitals, which further compromises the health of the older rural population (Bunce 1982). We anticipate that counties with higher percentages of their population 65 and older will be correlated with greater population losses.

Hispanic Population. From the 1940s to the 1980s, there were unparalleled levels of documented and undocumented immigration from Mexico. More than four million people entered the U.S. under the "Braceros Program" (1942-1964), primarily as temporary agricultural workers. Despite brief periods of curtailed Mexican immigration, the flow of Mexican immigrants continued into the U.S., meeting the demands for cheap labor. Since the 1980s Texas has been second only to California in the numerical increase of its Hispanic population. This has led to major changes in the ethnic and

cultural composition of many areas statewide, including some counties in the Texas Great Plains.

Before 1960 few Hispanics lived permanently in the Great Plains region of Texas (Fuguitt et al. 1989). Yet for many years Hispanics traveled throughout the Great Plains harvesting crops. Although 87% of Texas Hispanics live in urban areas (U.S. Census 1990), for some, the rural Great Plains—especially the northern High Plains—has become a place to settle and raise families. In the 1980s Hispanics in the Great Plains counties had higher birth rates, higher levels of education, and higher median incomes than Hispanics in the Rio Grande River counties (Fuguitt et al. 1989). This younger Great Plains Hispanic population, although in turn poorer and having less formal education than their Anglo neighbors (Kanellos 1993), appears to be attracted by lower-wage work opportunities and cheap homes, and could revitalize Texas Great Plains counties while reversing depopulation trends. From this evidence, we anticipate that counties which have a higher proportion of Hispanic residents have experienced less population decline.

Geographic Factors: Distance and Centrality

Proximity to a major metropolitan area. With each passing year the distance to a major metropolitan area has become more and more important to people in the Texas Great Plains. Increased distance from urban areas reduces access to employment opportunities and essential services, as well as to cultural and social activities (Fuguitt 1977). The major metropolitan areas in the Texas Great Plains are Abilene, Lubbock, Amarillo, Wichita Falls and Midland (Figure 1). We anticipate that those counties most distant from these cities will experience the greatest population losses. Furthermore we suspect that counties contiguous to major metropolitan areas will tend to have stable or positive population growth.

Central place. In the late 1800s Great Plains towns were built along wagon trails and railroad lines by banker-promoters, businesspersons and merchants. Farmers encouraged overbuilding of towns because they preferred to have convenient trade centers. Many towns contained elevators for grain, gins and warehouses for cotton, as well as lumberyards, banks, restaurants and hotels (Hudson 1979). As late as the 1960s, towns which had a cotton gin, a church—or both—were the ones most likely to retain or attract population (Abbe 1987).

The variable, "population of the central place of the county," helps analyze whether these usually small central towns tend to stabilize a county's population. Small towns need to maintain an adequate population threshold to retain various businesses. Migration streams, however, tend to be related to higher ranking places in the urban hierarchy (Lee 1966), with migrants often moving from rural area to village to county center and then to regional city (Cadwallader 1992). With the improvement of vehicles and road networks, rural communities declined as farm population migrated to central places in the county. This was especially true during the 1950s and early 1960s. As the hinterlands emptied, small county centers gained population, despite overall county population decline.

In Texas, however, from the late 1960s to late 1980s, chain migration to metropolitan areas such as Lubbock, Abilene and Amarillo contributed to the decline of many nonmetropolitan county centers (Fuguitt 1977). As county centers dropped below critical threshold populations, the profitability of many businesses was undermined, and these smaller towns became caught in a downward spiral of declining population. People's desires for better shopping and housing, as well as for more social and intellectual opportunities encouraged rural to urban migration (Clout 1972). In addition, the consolidation of a county's school system clearly signaled depopulation. With fewer children to educate, many smaller towns in the Texas Plains lost their independent school districts. Local schools then could no longer serve as a focal point of the entire community through sports, concerts and other activities (Bunce 1982; Davidson 1990). In our analysis, we anticipate that the smaller the population size of a county's central place, the greater its population decline.

Environmental Factors

Precipitation. The distribution of water resources has always played an important role in the development and population growth of the Texas Great Plains. In spite of rich soils, sufficient growing season and flat terrain, it was the lack of rainfall that made this area one of the last to be settled (Albrecht 1988). Since the beginning of cultivation in the Great Plains, access to water has, for the most part, determined not only the type of agriculture but also the size of the community needed to produce that commodity.

Annual rainfall patterns in this part of the state do not vary greatly. Similar to most of the American Great Plains, there is a fairly uniform spatial pattern of precipitation change. In the Texas Great Plains this varies from

annual rates of 26 inches per year in the east to 15 inches per year in the west. Because there is only an 11-inch range in annual precipitation within the region's counties and there is more rainfall in the lower plains area where there is less irrigation, perhaps this variable will suggest less about population loss than the variable which documents irrigation. More rainfall most likely will not be related to population gains.

Irrigation. With only a few streams to depend upon in the early years, the Great Plains counties of Texas were primarily ranching and dryland farming areas. Without irrigation, rainfall was too unpredictable for commercial farming (Ember et al. 1986). When pumps were developed during the 1930s, farmers began irrigating from the Ogallala Aquifer. By the 1950s, with improved technology, the farmer's reliance on the Ogallala increased, resulting in the creation of one of the most productive agricultural areas in the United States (Ember et al. 1986). Throughout the Great Plains, however, the Ogallala Aquifer differs not only in thickness and depth but in location, thus requiring different farming methods (Albrecht and Murdock 1986a; 1986b). With irrigation, yields are more predictable and can be increased to two to six times that of dryland farming but require "increased [inputs and] a larger labor force and thus a larger population" (Albrecht and Murdock 1986a:384).

From 1974 to 1984 one million irrigated acres in the Great Plains were returned to dryland farming, in part due to declining water levels and increased energy costs (Albrecht and Murdock 1985; Nall 1990). Some farmers in Texas' Great Plains region replaced cotton, a high water usage crop, with other crops; others stopped farming completely. While the Ogallala Aquifer provides over 90% of the water used in the Great Plains, it is recharged from the surface at only about one-twentieth of an inch a year (Holden 1970). It has been estimated that the Ogallala Aquifer is now one-half depleted in some areas and that by the year 2020 two-thirds of the water in the aquifer will have been used (Corbett 1986).

Between 1940 and 1970 many agriculturally dependent rural areas lost up to one half of their population (Beale, 1978). Communities with sufficient water to justify investment in irrigation have been more economically productive, and have retained more of their population (Albrecht and Murdock 1985; 1986b). Between 1940 and 1980 Great Plains nonmetropolitan counties with irrigation had higher yields per acre and higher gross farm sales. Even though all counties suffered losses in the number of farms during that time, low irrigation counties lost 54% of their farms whereas high irrigation counties lost 41% Albrecht and Murdock (1985,

1986a). We anticipate that those counties with fewer irrigated acres will suffer the greater population losses.

Oil. Another important mainstay of the Texas Great Plains economy is oil. The oil boom of the 1920s stimulated growth in Texas Great Plains counties and kept many areas alive during the1930s (Britten 1993). Several counties with oil and natural gas have been able to maintain their population. Although much of the oil field workforce is transitory, a portion of the money accruing from the oil business and supporting services remains in the area and provides some stability to the local community. Many counties also have facilities to process oil and gas, further strengthening their economic base. Overall, oil has played a positive role in the economic development of many Texas Great Plains counties. We anticipate that counties with greater oil production will experience slower population decline and sometimes growth.

Socioeconomic Factors

Lack of Diversification (Percent of Labor force in Agriculture). Ninety-five percent of the Texas Great Plains land area consists of farms and ranches (Mathis 1989). The most rapidly depopulating Texas Great Plains counties have depended on agriculture as their main economic support base and have diversified very little (Saenz and Colberg 1988; Johnson 1989; Albrecht 1986, 1993). On the other hand, the nonmetropolitan counties that have specialized in a diversity of commodities that are internationally, nationally and regionally competitive have been less likely to depopulate (Murdock et al. 1993).

In some areas heavily dependent on agriculture, large numbers of farmers have been forced out of farming by fluctuating interest rates, devalued land, and low commodity prices. Many of them were at their most productive ages, earning their income primarily from farming (Leistritz and Murdock 1988; Murdock et al. 1986). In 1984, 32% of the Texas Great Plains full-time farmers had debt-to-asset ratios that were above 40%; this suggests many of these farmers were unable to repay their debts (Texas Comptroller of Public Accounts 1986). Although much of Texas farmland has increased in worth over the years, land values have continued to decline in all areas of the Great Plains (Texas Comptroller of Public Accounts 1986). We anticipate that counties with higher employment in agriculture will suffer greater population losses.

Income. The agricultural sector in the U.S. recently has experienced three periods of "rising relative prices and improved returns to resources" (Leistritz and Murdock 1988:21). These periods were the 1910s, 1940s and 1970s. During the 1970s, U.S. agricultural exports grew rapidly due to the declining value of the dollar and worldwide economic growth, especially in developing countries. Fueled by low interest rates, farmers invested in machinery and land. By the 1980s a worldwide recession and the rising value of the American dollar led to reductions in exports. In addition, some developing countries had increased their own food production and were no longer importing agricultural commodities and in some cases were now exporting (Leistritz and Murdock 1988). With high debt and decreased cash flow, many farmers and agriculturally based businesses filed for bankruptcy.

Rural counties in the Texas Great Plains both tend to have lower incomes and to suffer greater population losses. "Relative to metropolitan areas, the labor force in nonmetropolitan Texas is older, poorer, and less educated, has less gainful employment, and supports a larger dependent population" (Marshall et al. 1974:6). Even though income levels are lower for rural residents, it usually costs more to obtain goods and services when time and money are both taken into consideration (Dillman and Hobbs 1982). Rural areas contain few jobs not related to agriculture, and most of the jobs are low-paying and low-skilled (Davidson 1990). Furthermore, commuters and in-migrants are usually hired for the higher-paid skilled positions such as bankofficers and city management personnel positions (Lyson 1986). Most likely poorer counties will be found to be depopulating.

Education. Educated persons have more social and spatial mobility and are therefore more likely to move to obtain a better job. After several decades of decline, rural Great Plains counties have lost the larger part of their young, educated and innovative population (Murdock et al. 1989). Given the greater likelihood of educated persons, as well as of their more educated offspring, to move, we anticipate that lower levels of education will be found in counties with continuing population losses.

Regression Analyses of Population Change, 1910-1990

In order to understand which factors are most crucially intertwined with depopulation, eight stepwise multiple regression analyses were undertaken. For four time periods, from 1910 to 1990, we report several interpretive statistics including the cumulative R^2 and the order in which the variables

TABLE 2
SUMMARY OF SIGNIFICANT VARIABLES RELATED TO POPULATION CHANGE IN THE TEXAS GREAT PLAINS BY TIME PERIODS 1910-1990

	Cumulative R^2	Beta Coefficients
1910-1930		
Percent population 65 and older	.22	-.50
Percent literate	**.45**	.48
1910-1930 (w/o 65 and older variable)		
Percent literate	.20	.40
Annual rainfall	.28	-.36
Population of central place in county	**.35**	.27
1930-1950		
Percent population 65 and older	.74	-.71
Percent employed in agriculture	.80	-.22
Proximity to metropolitan city, in miles	**.83**	-.18
1930-1950 (w/o 65 and older variable)		
Per capita income	.47	.49
Percent employed in agriculture	.62	-.39
Percent irrigated land in county	.69	.20
Proximity to metropolitan city, in miles	**.72**	-.18
1950-1970		
Percent population 65 and older	.66	-.32
Percent of population 25 years & over with a high school diploma	.72	.55
Proximity to metropolitan city, in miles	.77	-.20
Percent Hispanic	**.80**	.26
1950-1970 (w/o 65 and older variable)		
Percent of population 25 years & over with a high school diploma	.50	.80
Percent Hispanic	.73	.44
Proximity to metropolitan city, in miles	**.77**	-.21
1970-1990		
Percent population 65 and older	.38	-.47
Percent employed in agriculture	.61	-.45
Per capita income	**.68**	.31
1970-1990 (w/o 65 and older variable)		
Per capita income	.31	.51
Percent employed in agriculture	.50	-.33
Annual rainfall	.59	removed
Proximity to metropolitan city, in miles	.64	-.25
Oil production	.69	.30
Percent irrigated land in county	**.71**	.21

Note: Variables are placed in order of entrance into the equation. The bold numbers indicate the final R-squared value for each regression analysis

entered the regression equation at the .05 level of significance. Beta values suggest the relative strength and direction of the relationship of each included variable with population growth (Table 2).

Because of the dominant statistical effect of the variable representing the older population and because the "percent population 65 and older" could be considered both as a cause and as a consequence of population decline, we repeated the regression analyses without the older population variable. This allowed other, perhaps more independent "causative" variables, to enter the equations and aid in explaining depopulation patterns.

Data sources for this study included the Census of Population (U.S. Bureau of the Census, various dates) for 1930, 1950, 1970 and 1990 for: total population (1910-1990), percent of population 65 and over, percent Mexican (1930 data only), percent Hispanic, percent high school graduates 25 and older, percent literate (1930 data only), percent of the labor force employed in agriculture, and per capita income. Per capita income data were not available for 1930 and percent Hispanic population were not available for 1950. Therefore both variables were excluded from those time periods. The data for the "percent of land irrigated" were obtained from the Census of Agriculture (U.S. Bureau of the Census various dates) for 1930, 1950, 1974, and 1987. The size of central place, annual rainfall and oil production data were obtained from the *Texas Almanac* (1933, 1953, 1973, 1993). Distance from the central city of a county to the nearest metropolitan city was calculated using the *Rand McNally Road Atlas* (Rand McNally 1990).

1910-1930 Population Growth

In the first time period, 1910-1930, the "older population" and "education" variables were most importantly related to population growth (Table 2). Those counties with fewer elderly peoples tended to be growing, while those with higher rates of literacy were likely to experience population increase. Precipitation and a county's distance to a central place had less, but still notable importance. The positive relationship between central place and population change indicates that those counties with larger central places had experienced population growth. The negative relationship between rainfall and population change appears to be spurious. The Texas Great Plains counties that receive the most rainfall are, for the most part, the counties that are not located over the Ogallala aquifer. However, these counties do not receive enough rainfall to make up for the lack of underground water. This

analysis of 1910 to 1930 reflects the last growth period for the Texas Great Plains as only three counties—Andrews, Baylor, and Jones—recorded population losses.

While our analyses in general were able to explain much of the variation in county population change, our results for the 1910-1930 time period were less convincing. Given that the major aim of this study was to identify factors underlying depopulation, it appears logical that our variables would be less telling for this earlier period, which was indeed the last time of true population growth in the region. During this period when much of the region was still being settled, population growth was slower in counties with older populations; however, there were relatively fewer older people at the time. In a sense, the predominant younger age group settled the area and would later "age in place." With selective out-migration of younger cohorts in the ensuing decades, the population of the region later aged notably.

1930-1950 Population Change

During the second time period, 1930-1950, the negative associations of the older population, percent employed in agriculture, and distance to a metropolitan county with population change suggest a strong rural-to-urban migration stream. In particular, the older population had a very strong simple correlation (-.86) with population change, accounting for 74% of the variance. During this time, young people migrated to the urban areas, leaving the older population in counties that were predominantly agricultural, stagnating, less economically diversified and far away from metropolitan areas such as Abilene, Lubbock, Midland, Wichita Falls and Amarillo. The lack of economic diversification appears to have caused these predominately agricultural counties to continue to lose population. The irrigation variable suggests that counties with more irrigated land were less likely to experience depopulation in the 1930s and 1940s. This period reflects the onset of population decline for the Texas Plains counties, as 35 of the 67 counties recorded population losses (Figure 3).

1950-1970 Population Change

The two analyses for the third time period, 1950-1970, were quite similar. As in earlier time periods, counties with sizable older populations were depopulating. However, the strong independent strengths of the variables accounting for education, Hispanic concentrations and distance to a

metropolitan area clearly demonstrate the interrelated importance of social, demographic and geographic dynamics in the region. Counties with a larger Hispanic or more educated population were less likely to lose residents, while counties located at greater distances from metropolitan areas were depopulating. From 1950 to 1970, rural-to-urban migration continued and rural counties that had experienced previous out-migration of younger workers now declined even more because of their generally older populations. In the 1950s and 1960s there were notable population gains in the High Plains and major declines in the Low Plains, except for the urban counties containing Wichita Falls and Abilene (Figure 4). Overall, 41 of the counties in the whole region (61%) reported population losses from 1950 to 1970.

1970-1990 Population Change

During the last time period (1970 to 1990), the "percent population 65 and older" variable was not as strongly related to depopulation as it was earlier (from 1930 to 1970), although, as before, it entered the regression analysis first (Table 2). In the most recent decades the older generation came to comprise a smaller proportional share of the county populations, so that other factors became more influential to explain the increasingly complex dynamics of declining county populations. During the 1970s and 1980s depopulation continued in the same number of counties (41) as in the previous twenty-year period. Those counties that had an older population and were more agriculturally dependent continued to decline, whereas those with higher per capita incomes continued to grow. Here we can see the paramount importance of economic considerations: a lack of economic diversification and lower income per capita are both contributing to population decline as well as being a consequence of it. Distance to a metropolitan area, as in the previous four decades, continued to be negatively related to population change, showing the persistence of population loss in remote counties.

After removing the older population variable from the analysis, those counties with more oil production and irrigation were found to be less likely to depopulate. In addition, education did not enter the analysis because of its intercorrelation with income (.72); however, there is some evidence that, with time and the passing of the older generation, this education variable may no longer play an important role in depopulation, since more people of the Texas Great Plains have graduated from high school. Perhaps a more

telling variable would be the percentage of the adult population with a college degree.

Summary and Conclusions

This research examined the population trends of the Great Plains counties of Texas from 1910 to 1990 using four conceptual factors to explain depopulation: demographic, geographic, environmental and socio-economic. For all time periods analyzed, our results are generally consistent with the original hypotheses (Table 1).

Depopulation has continued steadily since the 1930s, with only slight indications that the decline may be slowing. Especially hard hit have been the counties located in the Low Plains (Figures 3-5). Counties with continuous depopulation are the most distant from metropolitan areas, with a labor force predominantly employed in agriculture and with fewer irrigated acres of farmland (Figure 6). They are in several respects the "worst case scenarios" in our analysis; they are indeed most susceptible to continuing depopulation. Conversely, all five metropolitan counties never experienced a period of depopulation.

In this study of 67 Texas Great Plains counties, there is strong evidence that the counties with greater percentages of older populations experience heavier depopulation; however, it is sometimes unclear when a symptom of population change becomes a cause of population change (Clout 1972). Therefore, when the "65 and older variable" was removed from the analysis, other variables such as distance to a metropolitan central place, population size of the central place, irrigated acres, and percentage employed in agriculture showed their significance. Because of this we included analyses of population change both with and without the 65 and older population variable.

Consistent with Christaller's (1966) central place theory, for all time periods studied either distance to the nearest metropolitan area or the population of a county's central city were related to depopulation. It appears that the small-population places in the urban hierarchy of the Texas Great Plains are falling below the crucial threshold populations needed to sustain their businesses and their roles in the central place hierarchy (Bunce 1982; Clout 1972). Up to about 1930, small towns grew with the booming growth of the region; later, however, towns farther from large metropolitan areas became less competitive with metropolitan areas. This resulted in the closing of downtown stores, and fewer attractions for the younger generations (Ballard

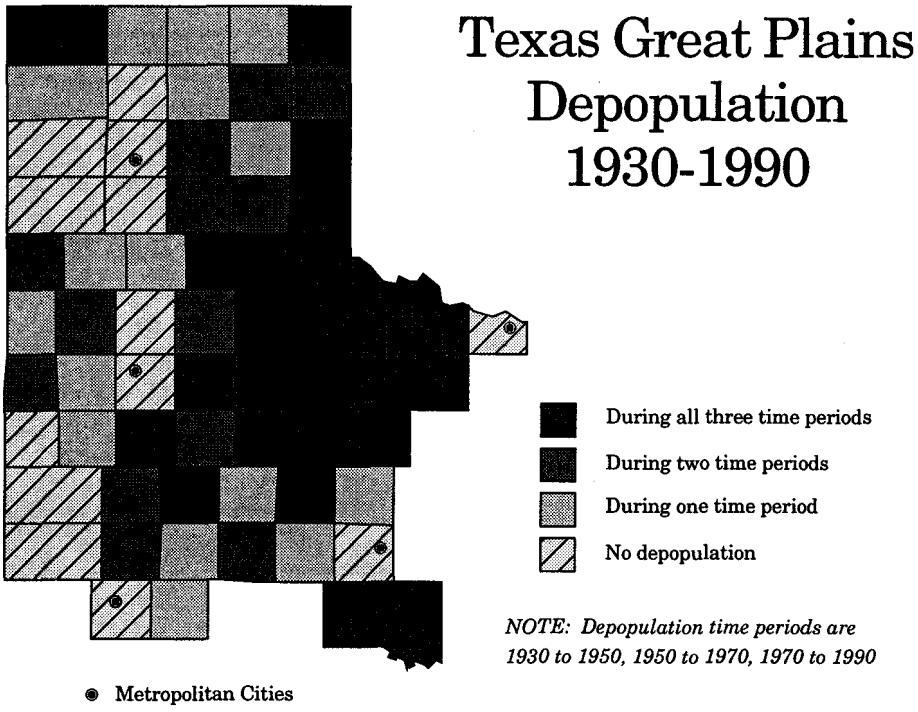

Figure 6. Number of time periods that depopulation occurred in Texas Great Plains counties, 1930-1990.

and Fuguitt 1985). As losses in population and economic base persisted, small towns continued to lose once-profitable businesses. This in turn led to the loss of other local businesses as former shopkeepers moved out and more locals went elsewhere to shop (Davidson 1990). In the Texas Great Plains today, major long-distance shopping trips to the nearest big city have become the norm, and may be taken several times a year (Hodge 1991).

Rainfall and irrigation, although significant in two analyses, were only marginally important in accounting for population change overall. The association of more irrigated land with population growth was not particularly strong as suggested by Albrecht and Murdock (1985, 1986a). Perhaps better specified "water" variables would yield more significant insights. Further research might examine measuring how frequently (during a given time period) a county's rainfall fell below 15 inches. One might also consider the actual amount of groundwater used, most likely a better measure of the intensity of irrigation (White 1994).

The results of the analyses have several implications for rural public policy. Depending on the strengths and weaknesses of each county, the solutions for problems of depopulation will vary. What will not vary is the trend of depopulation of the Great Plains counties of Texas if policies are not implemented to slow the decline. This research has pointed out factors, such as distance to a major city and the lack of economic diversification, that have influenced patterns of population decline. The research suggests some of the population losses can be offset by Hispanic in-migrants. For many of the Texas Great Plains counties to retain viable communities into the twenty-first century, they will need to reassess their strengths and build new and stronger foundations. The population of the Texas Great Plains will probably never equal the peak numbers of the early 1900s; yet with adequate planning and follow-through, stabilization of the present population and perhaps some growth in the future may be possible.

Acknowledgments

The authors would like to thank Fred Shelley, John Tiefenbacher and the anonymous reviewers for their comments on earlier versions of this paper. We also would like to extend our appreciation to Joe Karbarz for his help with the cartography, Anu Day for her careful editing, and Dr. Dennis Fitzsimmons for his insights on the cartographic design.

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