A comparative analysis of demographic trends between 1990 and 2000 in Winona County, Minnesota, USA

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Abstract

The demography of any region is constantly changing due to births, deaths, migration of people, etc. Winona County, Minnesota is no exception and is experiencing changes in the characteristics of its population. These include total population change, population density, race, ancestry, age structure, dependency ratio, sex composition, education and human resources, housing units, labor force, occupation, journey time to work, income and poverty. There was an increase in the population in Winona County from 1990 to 2000. There was also an increase in the population density of approximately three people per square mile. The majority of the population are of European ancestry and are White Caucasian. In terms of age, there was an increase in the number of people of employable age. The dependency ratio of the population declined and the population also attained higher education levels. The number of women is slightly greater than men. This paper illustrates some of the basic techniques used to describe and analyze census data using geographic information system (GIS) analysis techniques.

Introduction

Population is described as all people, male or female, child and adult, living in a particular geographic area, while demography is the study of the population. The demography of any region is constantly changing. Winona County in Minnesota, United States is no exception and is experiencing changes in the characteristics of its population in terms of age, sex, education, race, ancestry, labor force, occupation, housing infrastructure, levels of poverty, and migration dynamics. Most problems in development are directly or indirectly linked with the population growth rate. Hence, it is important to understand demographic trends of an area because there are potential consequences of population growth for economic development including growth, poverty and education among others (Todaro, 2000).

History of the Census

The first national census was conducted in 1790 and showed a population of 8.9 million. At that time the framers of the United States Constitution had two major goals when they decided to conduct a decennial census of the population. First, they needed to know how many people were living in all areas of the country so that Congressional districts could be defined with all members of the House of the Representatives elected from districts of the same population size. Differences in population growth in some areas more than others would mean that

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representation would have to be periodically adjusted. Only a periodic census could pinpoint those changes. Second, the founding fathers needed to apportion taxes among the various states, with the total federal taxes to be received from each state proportional to the number of persons of each state. They reasoned that any state wanting to inflate its population figures for more representation would be deterred by the burden of additional taxes. Thus U. S. marshals and their assistants were ordered to canvas the country and ask the heads of households for the number of free white males and females over and under the age of 16, the number of other free persons and the number of slaves.

Since that time, the geographic extent of the census has grown as new states and territories have been added. Not only has the population grown, but in the interest of learning more about the population of this increasingly complex nation, the type of information has also expanded. This additional information is necessary to help understand the changing characteristics of the population.

Winona County

Winona County is located in Southeastern Minnesota, United States (Figure 1). It is geographically bounded by latitude 43.9848 16 and longitude -91.7774907. It has an area of approximately 629 square miles and a population of approximately 50,000. The economy is supported by industrial engineering and education. Unique products made in the area include gummy bears, galvanized metal products, quarried stone products, graphite and fibreglass composite materials and more. Apart from the elementary and high schools, Winona
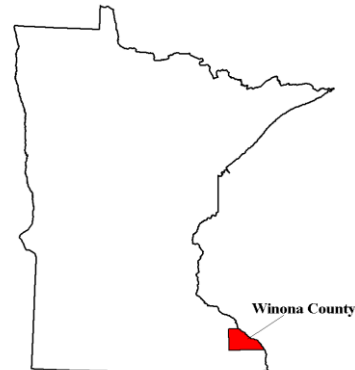

Figure 1. Winona County in Minnesota.

has three colleges and universities. These include Winona State University, Saint Mary's University of Minnesota and Minnesota State College Southeast Technical.

Objective

The objective of this study was to examine the demographic trends of Winona County between 1990 and 2000. Statistics examined include: changes in population, race, age, sex composition, education status, housing infrastructure, labor force, occupation, journey time to work, income and the nature and structure of poverty. Understanding the trends of these demographic variables can assist policy makers in making better policy choices.

Methodology

A census is defined as a complete enumeration, usually of a population, but also of businesses and commercial establishments, farms, governments, etc. Census data for Winona County was analyzed using geographic information systems (GIS). The data was obtained

from the United States Census Bureau and Environmental Systems Research Institute (ESRI) websites. The census data used was decennial meaning it is the census of population and housing taken by the Bureau in years ending in zero, as laid down in Article 1 of the US constitution for the purpose of reapportioning of the U.S House of Representatives (US Census Bureau, 2004). The United States Census data is presented in a hierarchical form (Figure 2). The data is presented in terms of the nation, region, counties, census tracts, block groups and blocks. The focus of this analysis will be at the county and tract levels.
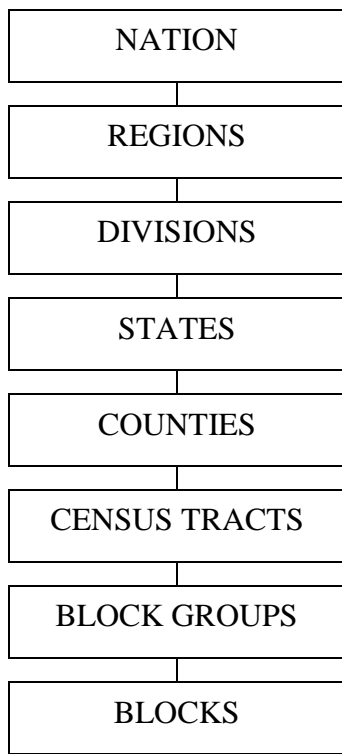

Figure 2. Categorization of census data.

There are 10 census tracts in Winona County (Figure 3). The data from the U. S. Census Bureau (www.census.gov) was acquired in summary files. These files hold statistics for a large number of geographic areas
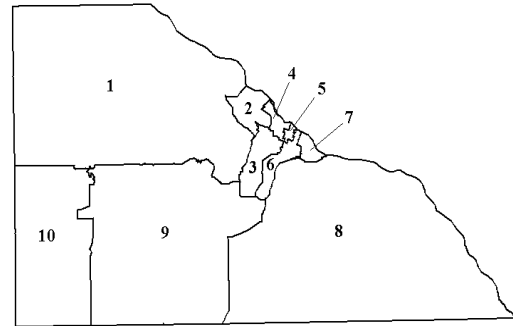

Figure 3. Census Tracts in Winona County.

that are designed to show subject matter detail and are presented in tabular form. The data was obtained from summary files one and three. Summary file one contained 100 percent population and housing figures and 63 race categories. Summary file three contained data on population and housing and included variables such as income and level of education.

Tabular data was downloaded from the Census Bureau website as Microsoft Excel tables. They were classified and merged into appropriate groups and saved as database files. Those downloaded from the ESRI website (www.esri.com) were already in the form of database files. Shapefiles were also downloaded from this site and imported and inspected in ArcCatalog. Definition of projection, datum and units together with re-registering the datasets and analysis were performed in ArcMap (Minami, M 2000). The projection and datum used were Universal Transverse Mercator (UTM), North American Datum of 1983 (NAD83), Zone 15.

Results

In the result tables "Δ" represents change and "%Δ" represents percent change.

Total Population

In 1990, the population of Winona stood at about 47828 persons. By year 2000 it reached 49985 persons or a 5 percent increase. The average population density in 1990 was 76 persons per square mile. By 2000, the population density stood at 79 persons per square mile or an increase of approximately 3 persons per square miles. The possible cause of the increase in population could be population migration into the county. Table 1 provides population figures for the ten census tracts. What is evident is that between 1990 and 2000, seven census tracts exhibited population increase. Tract 8 (rural county southeast) had the largest population increase. In 1990 tract 8 had a population of 6350 persons. By 2000, the population had increased to 7149 persons. This is an increase of 799 persons or 13 percent. Census Tract 10 (rural county southwest) had the second highest population increase. In 1990, the tract had a population of 3724 persons. By 2000, the population reached 4477 persons, an increase of 753 persons, which translates to a population increase of 20 percent. This likely reflects the growth of the St. Charles and surrounding area. Other census tracts that also exhibited an increase in population include census tracts 1, 2, 3, 6 and 9 .Two census tracts including 4 and 7 (urban City of Winona) exhibited population decline.

Census tract 4 (central city) had the largest population decrease. The population declined from 4852 in 1990 to 4708 persons in 2000 a decline of 144 persons or 3 percent. Census tract 7 (east city) had the second largest population decrease with one percent. Census tract 5 experienced a negligible population decline of 17 persons.

Table 1. Population figures for the ten census tracts.

Tract	1990	2000	Δ	%Δ
1	7008	7390	382	5
2	2866	2936	70	2
3	6188	6336	148	2
4	4852	4708	-144	-3
5	5571	5554	-17	0
6	3585	3717	132	4
7	4152	4103	-49	-1
8	6350	7149	799	13
9	3532	3615	83	2
10	3724	4477	753	20

The analysis of block groups within the census tracts was also completed. Given the fact that census tract 4 had the largest population decline and tract 10 had the largest population increase, these two census tracts were examined more thoroughly. Tract 4 (central city) block groups were the same in 1990 and 2000. Tract 10 had 4 block groups in 1990 and 2 block groups in 2000 making it difficult to analyze tract 10. Figure 4 represents tract 4 block groups for both 1990 and 2000. Figure 5 and 6 represent census tract 10 block groups for 1990 and 2000.
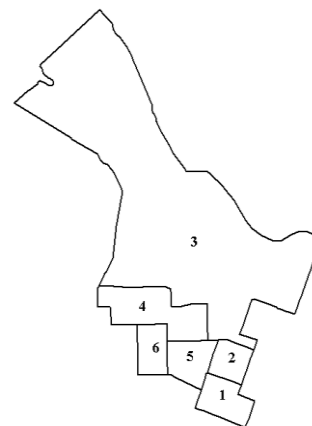

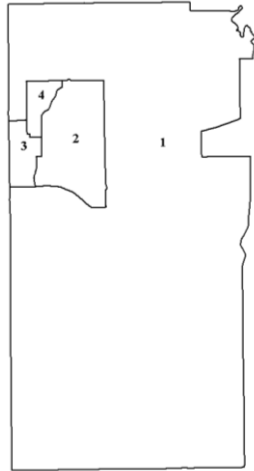Figure 4. Tract 4 Block Groups, 1990 and 2000 (central city).
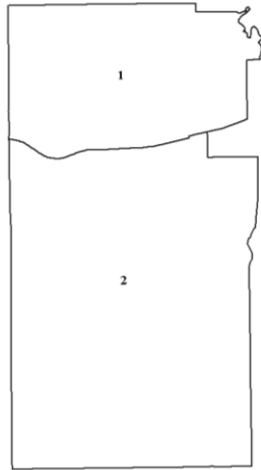
Figure 5. Tract 10 block groups for 1990.

Figure 6. Tract 10 block groups for 2000.

Population Density Per Tract

As noted earlier, population density is the number of inhabitants per unit area of land. Using this definition, population density for each tract was determined. Table 2 represents the population densities for the 10 census tracts for years 1990 and 2000. Tract 8 (rural county southeast) had the largest area with 199 square miles followed by tracts 1 (rural county northwest), 9 (rural county south central), and 10 (rural county south west) with 195, 138 and 71 square miles respectively.

Table 2. Population density for years 1990 and 2000.

Tract	Area	Density 1990	Density 2000
1	195	36	38
2	5	573	587
3	9	688	704
4	2	2426	2354
5	1	5571	5554
6	6	598	620
7	3	1384	1368
8	199	32	36
9	138	26	26
10	71	52	63

Other tracts had areas ranging from 1 to 9 square miles. What is evident from the analysis is that tract 1, 2, 3, 6, 8 and 10 experienced increases in population density. In 1990, tract 5 (central city) was the most densely populated tract with 5571 persons/square mile. However, here the density decreased to 5554 persons/square mile in year 2000. In 1990, the least densely populated tract was tract 9 with 26 persons/square mile. Its density remained the same in the year 2000. This tract is located in the middle southern part of the county where agriculture is dominant. Table 3 represents change in numbers and percent change in population density.

Population density was further analyzed using a classification scheme to visually show population characteristics. Population density values were grouped into classes using the quantile classification method (Figures 7 and 8). This method uses attribute values (from low to high) and sums the number of features as it goes. It divides the total by the number of classes specified to get the

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Table 3. Change and percent change in density per tract.

Tract	Δ (Density)	%Δ (Density)
1	2	6
2	14	2
3	16	2
4	-72	-3
5	-17	0
6	22	4
7	-16	-1
8	4	13
9	0	0
10	11	21

number of features in each class. It then assigns the first features in the order to the lowest class until that class is filled, then moves on to the next class etc (Mitchell, 1999).

As seen in figures 7 and 8 the density patterns are similar for both years. The highest density areas are in the City of Winona and the least are in outlying county areas.
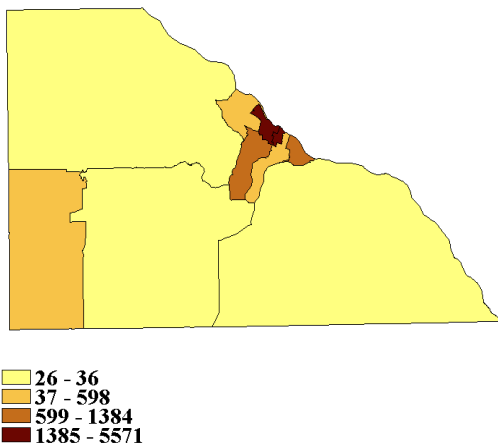

26 - 36
37 - 598
599 - 1384
1385 - 5571

Figure 7. 1990 population tract density data mapped using the quantile classification scheme.

26 - 38
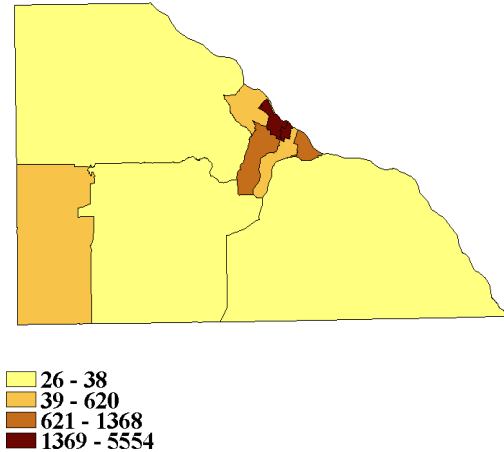39 - 620
621 - 1368
1369 - 5554

Figure 8. 2000 population density data of tracts mapped using the quantile classification scheme.

Race

Race is defined as a group of people having the same culture, history or language. Race in the census is a self-identification data item where respondents indicate the race or races with which they mostly closely identify with (U.S. Census Bureau, 2004). Winona County is predominantly White Caucasian but a growing number of Blacks, Hispanics, Asian and Pacific Islander, American Indians and Multiracial groups are also found in the county (Table 4).

In 1990, the population of Winona in terms of race included 46,892 White Caucasians, 195 Blacks, 113 American Indians, 350 Hispanic, 526 Asian and Pacific Islander and 103 Multiracial. By year 2000, White Caucasian had increased by 2 percent to 47887; Blacks by 97 percent to 384; Hispanic by 96 percent to 686; Asian and Pacific Islander by 80 percent to 947; and Multiracial by 550 percent to 567. Population numbers of the American Indians decreased by 14 percent to 97 persons.

Table 4. Changes in population in terms of race.

RACE	1990	2000	Δ	%Δ
White	46892	47887	995	2
Black	195	384	189	97
American Indian	113	97	-16	-14
Hispanic	350	686	336	96
Asian & Pacific Islander	526	947	421	80
Multirace	103	670	567	550

Ancestry

Ancestry refers to a person's self-identification of heritage, ethnic origin, descent or close identification to an ethnic group (U.S Census Bureau, 2004). The United Nations definition of regions of the world was used to classify the various ancestries. Ancestry for Winona were classified into two categories, G and H. G category grouped all of the ancestral origins in the County into one of six sub-groups including the European, American, Asian and Pacific Islander, Arab, African and other.

The European group, for example would include the Germans, Danish, Dutch, etc. Category H denoted the total number of people in each sub-group. For exposition purposes, if Anc., A, B, C, D, E, F, are used to denote Ancestry, European, American, Asian and Pacific Islander, Arab, African and other group, respectively, then table 5 below can be used to explain the dynamics of ancestry profile for Winona County. The other refers to the people who at the time of the census did not know their ancestry.

Table 5. Ancestral composition 1990 and 2000 of Winona.

Anc.	1990 G	2000 G	1990 H	2000 H
A	28	41	62506	57234
B	3	4	411	95
C	-	1	-	14
D	1	2	93	115
E	1	1	26	90
F	-	-	3127	2751

In the year 1990, there were 33 ancestries reported. This figure increased to 49 in 2000. As evident in table 5, Winona County's population is predominantly of European origin but numbers are fewer in year 2000 than they were in 1990. In 1990 there were 62,506 persons of European ancestry as compared to 57,234 persons in year 2000

Age Structure

Age structure of the population is the composition of a given population. It is one of the variables that is most used when analyzing census data. This is because so much of human behavior, preferences and lifestyles, are linked to age (Todaro 2000, U.S Census Bureau, 2004). Age is derived from date of birth information, and is based on the age of the person in complete years (U.S. Bureau, 2004). Age structure for Winona was analyzed using three age categories: those below 16 years of age; those between 16 and 64; and those over 64 (Table 6).

Between 1990 and 2000, Winona County experienced a decrease in the number of people under 16 years; an increase in people in the 16 to 64 years; and a nearly stable number of people greater than 64 years. The decline in the

Table 6. Change in age categories, 1990 and 2000.

AGE	1990	2000	Δ	%Δ
< 16	10516	9948	-568	-5
16 – 64	30753	33349	2596	8
> 64	6559	6567	8	0

number of people under 16 years likely resulted from decreases in the birth rate while the increase in population between the ages 16 and 64, the working age, likely increased due to increased education and employment opportunities. The number and percent changes in age were determined for the census tracts. Tract 4 (central city) had the greatest decrease in people less than 16 years of age i.e., a decrease of 156 people and tract 10 (rural county southwest) had the highest increase at 143 people. All tracts showed an increase in people between ages16 and 64. For those people greater than 64 years, tract 8 (rural county southeast) showed the greatest increase at 214 people while tract 5 (central city) showed the greatest decrease at 194 people (Table 7).

Table 7.Change in age structure per census tract (T).

T	< 16	16-64	64 >
1	-124	266	116
2	-60	91	60
3	-90	71	169
4	-156	178	-172
5	-100	277	-194
6	-3	242	-123
7	-1	77	-128
8	-80	702	214
9	-97	173	-37
10	143	519	103

Dependency Ratio

The Dependency ratio is the proportion of the total population aged 0 to 16 and above 64 which are considered economically unproductive and therefore not counted in the labor force (Todaro, 2002). Both older adults and children are often referred to as an economic dependency burden in the sense that they are non-productive members of society and therefore must be supported by the country's working labor force. The Dependency ratio (DR) is calculated using the following equation:

$$DR = \frac{(\%under16) + (\%over64)}{\%between\ 16\ and\ 64} \times 100$$

In 1990, the dependency ratio was 56. In 2000, it declined to 49 or by 7% indicating that there were fewer people who were not of working age and more who were working and paying taxes as compared to that in 1990. This is likely a reflection of the reduced number of individuals in the under 16 age group and increases in the 16-64 group noted in the 2000 census.

Sex Composition of the Population

The census report provides population by sex. This is an individual's gender classification, i.e. male or female. Gender classification is an important parameter because there are differences between men and women in all areas of human development such as employment, education, poverty, age and income distribution (U.S Census Bureau, 2004, Todaro, 2000).

In 1990, the population of Winona County was comprised of 23,313 males and 24,515 females (Figure 9). In 2000, this population had increased to 24,372 and to 25613 for males and females respectively. These correspond to a population increase of

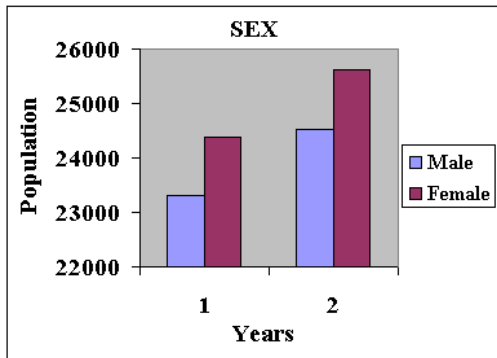five percent for males and four percent for females.

Figure 9. Sex figures for years 1990 (1) and 2000 (2).

Given the number of males and females, we can calculate the sex ratio, which is a measure of the difference in the number of men and women in an area. It is the ratio of males per 100 females, which is obtained by dividing the total number of males by the total number of women and multiplying by 100 (Turner 1998). The overall sex ratio in Winona County for 1990 was the same as for the year 2000 and stood at 95 (95 males per 100 females). It would likely differ if it was calculated across the different age groups (0-16, 16-64 and > 64).

Table 8. The absolute and percent changes in the number of male (M) and female (F) per tract (T).

T	M Δ	F Δ	M %Δ	F %Δ
1	184	198	5	6
2	-20	90	-1	6
3	118	30	4	1
4	-159	15	-7	1
5	49	-66	2	-2
6	-4	136	0	7
7	-18	-31	-1	-1
8	467	332	14	11
9	81	2	5	0
10	361	392	19	21

The differences in number of males and females in the respective tracts was also analyzed (Table 8). Tract 4, 5 (central city) and 10 (rural county southwest) experienced the greatest changes in sex composition. Tract 4 had the biggest percent decrease in the number of males. Tract 10 had the highest percent increase in the number of males and females while tract 5 had the greatest decrease in the number of females.

Education and Human Resources

Education is an important component of human resource. It is the level of intellectual and moral training and instruction attained (Ruse, 1988). Human resources of a nation, not its physical capital or natural resources, ultimately determine the character and pace of its economic and social development. The principal institutional mechanism for developing human skills and knowledge is the formal educational system (Todaro, 2000).

The education data in the county was divided into 4 categories: those lacking high school diploma; high school graduate; some college education and no degree, and may have an associate degree; and those with a bachelor, graduate or a professional degree.

If 1 represents the category lacking high school diploma; 2 represents the high school graduate, 3 represents some college no degree, associate degree; and 4 represents bachelor, graduate and professional degrees, then the education profile for Winona County can be analyzed (Figure 10). Figure 10 represents the total number of educated people in Winona in 1990 and 2000.
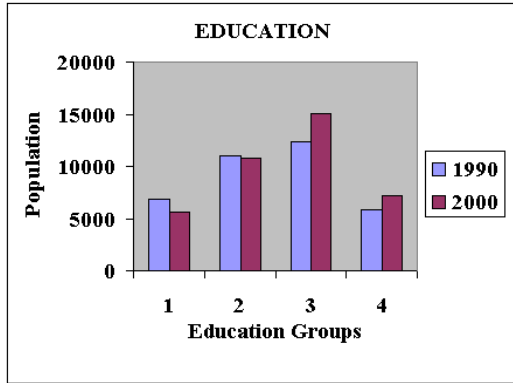
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Figure 10. Education figures for years 1990 and 2000.

In 1990, there were 6872 persons without a high school diploma (category 1). This declined to 5589 in 2000 or by 19 %. In 1990, there were 11,060 high school graduates. By 2000, the number declined to 10,732 or by 3 percent (category 2). Those with some college education (category 3) or with bachelors, graduate or professional degrees (category 4) stood at 12,311 and 5821 in 1990, respectively. Both categories increased to 15100 and 7147 in 2000, respectively, an increase of 23 percent.

Education trends for tracts 4 and 10 were also analyzed (table 9). For tract 4 (central city) in 2000, those without a diploma stood at 434 persons, down from 671 in 1990; high school graduates declined to 1045 down from 1175; and those with a bachelor, graduate, or professional degree declined from 732 to 700. The only category that exhibited an increase were those with some college and no degree, which increased to 1542 up from 1128.

As is evident in table 9 for the case of tract 10 (rural county southwest), in 2000, those without a diploma stood at 548 persons down from 617 in 1990, while those that were high school graduates declined to 895 from 942. Those with some college and no degree, associate degree increased to 1097 in 2000, up from 637 in 1990 and those

with bachelor, graduate and professional degrees increased to 532 in 2000 up from 299 in 1990.

Table 9. Education attained for tracts 4 and 10.

Edu.	Tract 4 1990	Tract 4 2000	Tract 10 1990	Tract 10 2000
1	671	434	617	548
2	1175	1045	942	895
3	1128	1542	637	1097
4	732	700	299	532

Housing Units

A housing unit is defined as a house, an apartment, a mobile home or trailer, a group of rooms, or a single room occupied as a separate living quarters (U.S. Census Bureau, 2000). Housing units are classified as being either in urban or rural areas. They were further classified as inside urbanized areas or inside urban clusters, and whether rural farm or rural non-farm. Figure 11 represents the urban and rural areas in Winona County.

Figure 11. The shaded area represents the urban area in Winona County.

If A represents housing units inside urbanized areas, B housing units inside urban clusters, C units in rural farm areas and D housing units in rural non- farm, then table 10 can be used to analyze housing units in Winona.

Table 10. Changes in housing units between 1990 and 2000.

Units	1990	2000	Δ	%Δ
A	0	0	0	0
B	11816	12857	1041	9
C	1111	886	-225	-20
D	4703	5808	1105	23

There were no housing units inside urbanized areas in both 1990 and 2000. In 1990, there were 11816 housing units inside urban clusters. This increased to 12857 units by 2000, which represented a 9 percent increase. Housing units in rural farms areas declined from 1111 units in 1990 to 886 units in 2000 or a decrease of 20 percent while housing units in rural non-farm increased from 4703 in 1990 to 5808 housing units in 2000 or an increase of 23 percent.

Table 11 represents the number of housing units for tracts 4 (central city) and 10 (rural county southwest) for years 1990 and 2000. The table indicates that there are no housing units in both tract 4 and 10 inside urbanized areas for either 1990 or 2000.

Table 11. Housing units for tracts 4 and 10 for the years 1990 and 2000.

Units	Tract 4 1990	Tract 4 2000	Tract 10 1990	Tract 10 2000
A	0	0	0	0
B	1992	2014	1037	1115
C	0	0	168	128
D	12	0	165	416

In 1990, there were 1992 housing units inside urban clusters, which increased to 2014 units in 2000 for tract 4. Housing units for tract 10 inside urban clusters stood at 1037 units in 1990 and 1115 units in 2000. Tract 10 had 168 rural farm units in 1990 but declined to 128 units in 2000. Finally, in tract 10, there were 165 housing units in 1990, which increased to 416 housing units in 2000, likely a result of growth in outlying Winona County communities.

Labor Force

These are members of the population, who are economically active; i.e. working or looking for work. The labor force status of an individual is normally determined according to a specific reference period. The International Labor Organization suggests two short-term standards for this reference period. Either the previous day or the previous weeks are used as an appropriate period. Individuals who report that they are not employed and want a job and are looking for work are also included in the labor force. But, they must be actively seeking work and the activities must have taken place during the reference period. Labor force in the United States includes all people classified in the civilian labor force (including unemployed workers) plus members of the U.S. Armed Forces (U.S Census Bureau, 2004, Barber and Short, 1987).

The labor data for the county are classified into four categories: private wage and salary workers; government workers; self-employed workers; and unpaid family workers. If A represents private wage and salary workers, B government workers, C self employed workers and D unpaid family workers, then table 12 below can be used to characterize the labor force for the county and present changes in the labor force for 1990 and 2000. In 1990, there

were 18,256 private wage and salary workers; 3031 government workers; 2325 self-employed workers; and 214 unpaid family workers. By the year 2000 these figures stood at 21,211, 3049, 2236 and 192 for private wage and salary, government, self employed, and for unpaid family workers respectively. This translates to an increase of 16 percent for private wage and salary workers, an increase of 1 percent in the government workforce, a decrease of 4 percent in self employed workers and a decrease of 10 percent in unpaid family workers. Winona County's labor force continues to be dominated by private wage and salary workers.

Table 12. Changes in the labor force 1990 and 2000.

Labor	1990	2000	Δ	%Δ
A	18256	21211	2955	16
B	3031	3049	18	1
C	2325	2236	-89	-4
D	214	192	-22	-10

Table 13 provides changes in the labor force for tract 4 and tract 10. In both 1990 and 2000, tract 4 and 10 were also dominated by private wage and salary workers just like the entire county. There were 2079 private wage and salary workers for tract 4 and 1300 private wage and salary workers for tract 10 in 1990 respectively. This category increased to 2224 workers in 2000 for tract 4 to 1756 workers for tract 10. Private wage and salary workers increased for tract 4 while the other three categories: government workers, self-employed workers and unpaid family workers experienced a decline between 1990 and 2000. In tract 10, both private wage and government workers increased while self employed workers and unpaid family worker declined.

Table 13. Changes in the labor force for tracts 4 and 10, 1990 and 2000.

Labor	Tract 4 1990	Tract 4 2000	Tract 10 1990	Tract 10 2000
A	2079	2224	1300	1756
B	239	234	164	250
C	170	135	267	260
D	8	26	29	27

Occupation

Occupation is the activity that uses up one's time. It describes the kind of work a person does on the job. For employed people, the data refer to the person's job during the reference week. For those who worked at two or more jobs, the data refer to the job at which the person worked the greatest number of hours (U. S. Census Bureau, 2004). Occupation is divided into the following groups, as exhibited in table 14: A management professional and related occupation; B sales and office; C service; D farming, fishing and forestry; E construction, extraction and maintenance; and F production, transportation and material moving.

By 2000, management and professional and related occupations had the largest number of people (8014 up from 5151) in 1990. Farming, fishing and forestry continued to have the fewest persons. In fact the number declined from 1589 persons in 1990 down to 433 persons in 2000. Construction, extraction and maintenance also experienced a decline while other occupations exhibited an increasing trend in 2000. Sales and office, which held the highest position in 1990, increased slightly from 6543 to 6633; service from 3555 to 4179; production, transportation and material moving increased from 4375 to 5585. In percentage terms, management,

professional and related occupations increased by 56 percent, sales and office by 1 percent and service by 18 percent. Farming, fishing and forestry decreased by 73 percent, construction, extraction and maintenance decreased by 29 percent; and production, transport and material moving increased by 28 percent (Table 14).

Table 14. Changes in occupation for 1990 and 2000.

Occ.	1990	2000	Δ	%Δ
A	5151	8014	2863	56
B	6543	6633	90	1
C	3555	4179	624	18
D	1589	433	-1156	-73
E	2613	1844	-769	-29
F	4375	5585	1210	28

On analyzing the data for tracts 4 and 10, it was found that, the pattern was similar to that of the whole county (Table 15). For the case of tract 4, sales and office had the highest number in 1990 with 625, followed by management professional and related occupations with 509 persons. However, by 2000, management, professional and related occupation became the most abundant occupation with 747 persons. Major increase in occupation was demonstrated by service, which increased from 427 to 728. Decreases were noted for farming, fishing and forestry (24 to 7 persons); construction, extraction and maintenance from 343 to 173 persons; and production, transportation and material moving from 568 to 549 persons.

For tract 10, the largest increase was that of management, professional and related occupations from 299 in 1990 to 706 in 2000. Other increases were noted in service; construction,

Table 15. Occupation values for tracts 4 and 10 for the years 1990 and 2000.

Occ.	Tract 4 1990	Tract 4 2000	Tract 10 1990	Tract 10 2000
A	509	747	299	706
B	625	415	451	346
C	427	728	292	565
D	24	7	228	54
E	343	173	198	253
F	568	549	292	369

extraction and maintenance, production transportation and material moving occupations. The largest decrease was in farming, fishing and forestry occupations from 228 persons in 1990 to 54 persons in 2000. Sales and office occupation also showed a slight decrease.

Journey Time to Work

Journey time to work describes the amount of time taken by a person to travel from their home to their usual place of work (U. S. Census Bureau, 2004). Table 16 represents the change in journey time to work. The table indicates that the majority of the population do not work far from their homes.

In 1990, 7912 worked about 10 minutes from home while in 2000 the number increased to 8208 persons, an increase of 4 percent. Those who took 10 to 19 minutes and 20 to 29 minutes to work in 1990 were 8603 and 2523, respectively. In 2000 these categories had increased to 9190 and 3029 respectively. Those who took half an hour to an hour to travel to work were 2482 people in 1990. This figure increased to 3387 in the year 2000.Those who took an hour or more to work stood

at about 429 in 1990 and increased to 832 in year 2000.

Table 16. Values, absolute change and percent change in journey time.

Time in minutes	1990	2000	Δ	%Δ
> 10	7912	8208	296	4
10 to 19	8603	9190	587	7
20 to 29	2523	3029	506	20
30 to 34	1303	1778	475	36
35 to 44	601	760	159	26
45 to 59	578	849	271	47
60 to 89	269	418	149	55
90 or more	160	414	254	159

Income

Total income is the sum of the amounts of money reported for wages, salaries, commissions, bonuses, and/or tips; self-employment income from own non-farm or farm businesses, including proprietorships and partnerships; interest, dividends, net rental income, royalty income, or income from estates and trusts; Social Security or Railroad Retirement income; Supplemental Security Income (SSI); any public assistance or welfare payments from the state or local welfare office; retirement, survivor, or disability pensions; and any other sources of income received regularly such as veterans payments, unemployment compensation, child support, or alimony (U. S. Census Bureau, 2004).

Per capita income is the average obtained by dividing aggregate income by total population of an area (U. S. Census Bureau, 2004). Per capita income is used to measure living standards. A country's average material

living standard depends on a person's real income.

In 1990, per capita income for Winona was $11,323. By 2000, it increased to $18,077 (Table 17), which in percentage terms is an increase of 60 percent. This suggests that the living

Table 17. Change in per capita income in Winona .

1990	2000	Δ	%Δ
11323	18077	6754	60

standards of people in Winona improved substantially between 1990 and 2000. Household and family incomes for Winona County were also analyzed. For easier analysis, the data on income for households and families was divided into the following groups:

Inc - Income
A and F - Less than $10000
B and G - $10000 to $24999
C and H - $25000 to $49999
D and I - $50000 to $99999
E and J - $100000 and more

Household Income

A household includes all the people who occupy a housing unit as their usual place of residence (U. S. Census Bureau, 2004).

Table 18 presents changes in household income. In 1990, income groups between $25,000 and $49,999 were the most frequent with 6076 households. This was followed by the income group between $10,000 and $24,999. In the year 2000 the income group between $25000 and $49999 had 6178 households. It was followed by that between $50000 and $99999 indicating a change in trend from 1990.

Table 18. Change in household income.

Inc.	1990	2000	Δ	%Δ
A	2859	1724	-1135	-40
B	5279	4008	-1271	-24
C	6076	6178	102	2
D	2400	5667	3267	136
E	312	1176	864	277

Family Income

A family is a group of two or more people who reside together and who are related by birth, marriage, or adoption (U. S. Census Bureau, 2004).
A similar analysis to that of household income was undertaken for family income. Table 19 indicates those with a family income less than $10,000 declined from 785 to 429 or a 45 percent decrease. This trend was also shown by those families that had income between $10,000 to $24,000 and $25,000 to $49,999. Those with family income from $50,000 to $99,000, and $100,000 or above showed an increase between 1990 and 2000 with the two groups showing an increase of 117 percent and 252 percent, respectively.

Table 19. Values, absolute change and percent change in family income.

Inc.	1990	2000	Δ	%Δ
F	785	429	-356	-45
G	2969	1419	-1550	-52
H	5123	4039	-1084	-21
I	2222	4813	2591	117
J	291	1025	734	252

Poverty

The United States Census Bureau uses a set of money income thresholds that vary by family size and composition to label who is poor. If the total income for a family or unrelated individual falls below the relevant poverty threshold, then the family or unrelated individual is classified as being below the poverty level (U. S. Census Bureau, 2004).

Individual Poverty

An individual is considered as any one human being. Poverty individuals are divided into the following groups. Total number of individuals below poverty level; persons 18 years and over; persons 65 years and over; related children under 18 years; related children 5 to 17 years; and unrelated individuals 15 years and over. If Pov. is poverty, A represents the total number of individuals below poverty level; B persons 18 years and over; C persons 65 years and over; D related children under 18 years; E related children 5 to 17 years; and F unrelated individuals 15 years and over, then the total number of individuals living in poverty in the county can be easily analyzed. Table 20 provides information on individuals living in poverty in the county and indicates an overall decrease in folks defined as living in poverty from 5621 to 5575 or 1 percent.

However, poverty levels for persons 18 years and over increased from 4367 to 4433 or by 2 percent. The same trend was noted for unrelated individuals 15 years and over which increased from 3127 to 3470 or by 11 percent. The number of persons 65 years and over, related individuals under 18 years and related children 5 to 17 years living in poverty decreased. In percentage terms they declined by -17, -11 and -3 percent respectively. The increase in poverty for persons 18 years and over and for unrelated individuals 15 years and over may be because they are probably independent and do not share

resources with family. On the other hand, poverty declines for persons 65 years and over, related children under 18 years, and related children 5 to 17 years are probably living with others and share resources. Often the elderly live in retirement communities and at times, much of their expenses are covered by insurance or life savings.

Table 20. Change in poverty for individuals.

Pov.	1990	2000	Δ	%Δ
A	**5621**	**5575**	**-46**	**-1**
B	4367	4433	66	2
C	673	560	-113	-17
D	1218	1089	-129	-11
E	732	710	-22	-3
F	3127	3470	343	11

Family Poverty

A family is a group of two or more people who reside together and who are related by birth, marriage, or adoption (U. S. Census Bureau, 2004). For ease of analysis, let G represent the total number of families below poverty level; H families with related children under 18 years; I families with related children under 5 years; J families with female households, no husband present; K families with female householder, no husband with related children under 5 and L families with female householder, no husband with related children under 5 then we can analyze changes in poverty for various family categories (Table 21).

The total number of families below poverty level in the county decreased by 104 or by 14 percent. This could be interpreted to mean that people were earning more income or inflation had decreased.

Families with female households,

Table 21. Change in families' poverty.

Pov.	1990	2000	Δ	%Δ
G	**758**	**654**	**-104**	**-14**
H	559	475	-84	-15
I	357	309	-48	-13
J	296	303	7	2
K	284	272	-12	-4
L	169	177	8	5

no husband present and families with female householder no husband with related children under 5 years, poverty level increased but by very small margins. Families with related children under 18 and families with related children under 5 years and families with female householder, no husband with related children under 18 years, the poverty level decreased. Poverty increased for families with female householder, no husband present and for families with female householder, no husband and with related children under 5 years possibly occurs because here the person is single earner. For these folks, their purchasing power is probably low, and they are probably not homeowners and work fewer hours as they have children. Their education level may not be high and this may have a bearing on the type of occupation.

Poverty decreased for the number of families below poverty level, families with related children under 18 years and families with related children under 5 years as their income is probably greater as there are two income earners here. Their purchasing power is higher and they could probably be homeowners. They are also able to work longer hours as they can afford sitters if they have young children. Where the children are over 16 years of age they probably work part time and bring in additional income.

Summary and conclusion

The objective of this study was to examine the demographic trends of Winona County for total population, race, age, sex composition, education status, housing infrastructure, labor force, occupation, journey time to work, income and poverty levels. The analysis was undertaken at the county and tract levels. Census data was used and analyzed using geographic information systems.

The analysis indicated that the total population increased from 47828 persons in 1990 to 49985 persons in 2000. In 1990 Winona's population density was 76 persons and increased to 79 persons in the year 2000. Winona County is predominantly White Caucasian but a growing number of Blacks, Hispanics, Asian, American Indians and Multiracial groups are also found in the county. Winona is dominated by people of European ancestry.

Three categories of age groups were analyzed: the age group below 16 years, people between 16 and 64 years, and people over 64. Between 1990 and 2000, the county experienced a decline in the number of people under 16 years and an increase in people between 16 and 64 years. A relatively stable trend was observed for those over 64 years. In 1990, the dependency ratio was 56. However, it declined to 49 indicating that there were fewer people who were not of working age compared to those who were.

Analysis of sex composition of the population indicated that in 1990 the population of Winona was comprised of 23313 males and 24515 females. In 2000, there were 24372 males and 25613 females. This corresponds to a population increase of 5 and 4 percent for males and females respectively. These figures gave a sex ratio of 95 males per 100 females.

Education data for Winona was divided into four categories. The number of people without a high school diploma and high school graduates decreased by 1611 persons, while those with some college no degree, associate degree; bachelor, graduate and professional degrees increased by 4115 persons. Labor data was also divided into four categories. The number of people who were private wage and salary workers and those that were government workers increased by 2973 persons. Self employed and unpaid family workers decreased by 111 persons.

There was an overall increase in the majority of occupations by 4787 persons except in two categories i.e. farming, fishing and forestry, and construction, extraction and maintenance where there was a decline of 1925 persons.

Per capita income increased by $6,754 or by 60 percent implying that the living standards of people in Winona improved. Households earning less than $24,999 decreased by 2406 while those households earning $25,000 and more increased by 4233. Those families earning less than $49,999 decreased by 2990 while those earning $50,000 and more increased by 3325.

The number of individuals living below poverty decreased by 46 or by 1 percent, while the number of families living below poverty level decreased by 104 or by 14 percent.

Overall, the population of Winona County grew slightly between 1990 and 2000 and generally the economic well being of its citizens improved significantly.

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