Methods and Data for Developing Coordinated Population Forecasts

Prepared by

Population Research Center

College of Urban and Public Affairs

Portland State University

June 2021

Population Research Center
PORTLAND STATE UNIVERSITY

Table of Contents

Introduction

This document is to accompany the coordinated population forecasts and their corresponding reports prepared by the Population Research Center (PRC).

Developing long-term coordinated population projections for a county and its sub-areas (urban growth boundary areas – called UGBs – and areas outside UGBs are referred to sub-areas in this document), requires these main stages: 1) compiling and evaluating historic and recent data to ascertain demographic characteristics and trends in the study area and to obtain a population base from which the forecasts may be launched; 2) making assumptions about the future and adjusting the data or rates in the forecasting models to incorporate anticipated rates or trends; and 3) reconciling, or modifying the forecasts so the sum of the sub-area forecasts is consistent with the forecast for the county total.

We first develop population projections and then we adjust these projections in order to produce population forecasts. We develop population projections by extending historic and current demographic and housing trends into the future. Forecasting population require assumptions about future population change and adjustments to projection models to account for circumstances that perhaps skew past trends or may affect future change. Such circumstances in the past could be a building moratorium or the opening of a new group quarters facility. Events affecting future change would be, for example, planned future housing development that is higher than usual, a foreseen change in an area's physical ability to accommodate growth (buildable land available is approaching capacity or improvements to infrastructure are underway), anticipated changes in the economy (the location of a new employer or the upswing or downturn of the economy in general), or an expected change in the local population and household composition (age, ethnicity, and average household size).

Modified Methodology

The Population Research Center actively works to improve the population forecast by consulting different stakeholders and exploring appropriate data sources. The population forecast team has undergone multiple internal discussions, as well as meetings with the DLCD and county/region/city representatives in producing the most recent forecast in 2021. The general approach and methodology applied to the forecast remains the same as the 2020 forecast methodology documentation[1]. Several modifications were made in the 2021 forecast, which are described in this section.

Annual Average Growth Rate (AAGR)

The AAGR for years 26-50 was calculated the same way as described in the 2020 methodology documentation. For years 26-50, PRC projects the county population using the annual growth rate from the 24th-25th year. For example, if we were to forecast a county to grow 0.4% between the 24th and 25th year of the forecast, we would project the county population thereafter using a 0.4% average annual growth rate (AAGR). For sub-area forecasts after 2045, the annual average growth rate between the 24th

[1] Methods and Data for Developing Coordinated Population Forecasts 2020. https://www.pdx.edu/population-research/population-forecasts.

and 25th year of the forecast is applied to each sub-area and are extrapolated to calculate the county share of each sub-area.

Fertility and Mortality

Births and deaths were projected based on the historical birth data of up to 2019. Mortality rates were projected using the methodology described in Clark and Sharrow 2011[2]. Mortality rates for the 85+ age group were further divided into 5-year age groups up to 100+. Potential changes in life expectancy were considered when applying the number of deaths in the model. Certain constraints were applied to the calculation to ensure the annual number of deaths remains at a reasonable level as the aging population is expected to increase in the future. The assumption is that life expectancy will increase due to factors such as medical advancement and healthier lifestyles among the elderly population. Fertility rates were projected up to 2030 and the 2030 rates were kept constant for 2031-2045.

Net Migration

Net migration rates were based on the data published by the University of Wisconsin-Madison for 2000-2010[3]. Minor adjustments made using this data when applying to the current forecast. It was assumed that in/out migration gradually approaches zero for populations aged 65 and over, assuming there is minimal moving for people as they approach the age of 85+. In/out migration among college students were considered based on enrollment data when applicable.

Sub-Area Forecast Models

In the past, sub-areas with fewer than 8,000 people used the housing unit method while sub-areas with more than 8,000 people used the cohort component model. In the most recent 2021 forecast, the housing unit method was applied to all population forecasts at the sub-area level, regardless of the size of the sub-area. Doing so helps keep the forecast of different sub-areas consistent and provides a better picture when looking at the county share of each sub-area. To improve consistency, PRC's 2020 population estimates for the cities are taken into account to produce the base population for the sub-area forecasts. The 2020 populations outside the city limits but within the UGBs are calculated based on the Census Bureau's Local Update of the Census Addresses Operation (LUCA). The UGB population outside of the city limits are combined with the 2020 PRC city population estimates to generate the base population used for the sub area forecasts.

COVID-19 Impacts

The COVID-19 pandemic has posted great impacts on population behavior and demographic trends. For instance, net migration may drop significantly due to travel restrictions and nation-wide campus shutdowns. However, further research and more supporting data are required to account for the COVID-19 impacts in the forecast. For example, the effect of the pandemic on fertility rates is uncertain due to the lack of the 2020 and 2021 age-specific fertility data. The current forecast model assumes that impacts

[2] Contemporary Model Life Tables for Developed Countries: An Application of Model-based Clustering. https://csss.uw.edu/research/working-papers/contemporary-model-life-tables-developed-countries-application-model-based.

[3] Net Migration Patterns for US Counties. https://netmigration.wisc.edu/data-details.

associated with the COVID-19 pandemic is short-term and therefore does not implement these impacts in the current results.

Although impacts associated with COVID-19 were not applied in the 2021 county and sub-area forecasts, certain figures in the final reports reflect these impacts to provide a realistic picture of demographic changes under the pandemic. Fore example, net migration for most counties dropped dramatically in 2020 and is expected to remain at a relatively lower rate in 2021. For many counties, births have dropped while deaths increased in 2020. It is important to note that the 2020 and 2021 births/deaths data used to illustrate the possible impacts related to the pandemic was preliminary and is yet to be finalized by the data providers.

Climate Change Impacts

Models rely on trends and relationships observed in the past. The models used in these population projections rely on measurements subject to non-sampling error. The results assume no radical change in the economic, policy, or natural environments. The proposed projections assume economic stability throughout the forecast period, and that resource constraints such as water, housing, and transportation capacity grow at a sufficient pace. Changes in migration, education, housing or transportation policy would have significant effects and are not considered here; likewise, there is a risk of unforeseen changes in technology (especially reproductive technology and healthcare) and productivity. The model is subject to several sources of bias including non-sampling error in the decennial census, sampling and non-sampling error in the American Community Survey (ACS), and propagation of errors in datasets used to measure births, deaths, and housing unit and group quarters changes.

Climate change is a global challenge that will impact population trends at all geographic levels; it may increase the frequency of natural disasters (e.g., wildfires, floods, and erosion, etc.), degrading our social and natural environments as a consequence. These risks have not been incorporated into the population projections, except to the extent that they are reflected in population dynamics evident in the data used in model fit. Sequelae of climate change are currently not included in our forecasts due to uncertainty regarding the effect, extent, and timing of such changes here in Oregon.

Models for Population Forecasts

Two methods were used in the forecast: The cohort-component method and the housing unit method. The forecasting models are described in more detail below.

Cohort-Component Method

We develop separate cohort-component models for each county. PRC's 2010-2020 certified population estimates and other recent trends from the most recent data lay out the foundation for the forecast. The 2020 certified population estimates were used as the base population in the county-level forecasts.

The cohort-component model forecasts future populations as outcomes of the life events that occur over time. These events are comprised of births, deaths, and migrations. Thus, an area's population grows when births outnumber deaths or when more people move into the area than leave it; or when some combination of these events occurs. The occurrences of these events are more frequent in certain age groups, or cohorts, than in others. For example, people tend to move around the most when they are in their 20s, or the elderly have lower chances than people in their 40s to survive over the next five years. Applying appropriate age- and sex-specific rates of birth, death and migration to the existing population cohorts of an area produces its future population projection. The cohort-component model produces forecasts in 1-year intervals, but the results were presented in 5-year time intervals[4] in the reports for simplicity.

$$Pop_{t2} = Pop_{t2} + Births_{(t1\ through\ t2)} - Deaths_{(t1\ through\ t2)} + NetMig_{(t1\ through\ t2)}$$
$Pop: Population$
$NetMig: Net\ Migration$
$t1: Starting\ year$
$t2: Ending\ year$

The cohort-component method relies on the availability of accurate data on the age and sex composition of an area's population. The most precise information about population age structure in our study areas is decennial data from the U.S. Census Bureau. We derive age-specific rates of life events from data provided the Oregon Center for Health Statistics. These rates are then applied to known population cohorts from one census, which moves them forward through time (aging the population) to meet the next cohort in the following census. We modify baseline demographic rates to account for the most recent trends as well as for ones assumed to occur in the future. Examples of such trends that may affect the future population of an area include the recent tendency among women of childbearing ages to delay having their first child, or a predisposition of young men (ages 20 to 29) to be more mobile than women in the same age cohort. We develop a set of assumptions to address likely changes in the baseline

[4] To obtain population projections for single-year time intervals, we prepared an interpolation worksheet. The worksheet and instructions about how to calculate a single year population forecast based on the forecasts for 5- year time intervals are located on our website at this link: https://www.pdx.edu/prc/current-documents-andpresentations.

rates of life events and require judgment about how the trends might evolve in the study area. The existing population structure mostly determines the future population composition of the area, but it may change some depending on age- specific migration rates predicted for the future. Trends detected from historic and recent data, such as housing; land use; employment; income tax returns and exemptions; driver license issuances; and school enrollment data, help determine these future migration rates.

The population and housing data comes from the 2000 and 2010 Censuses of Population and Housing, the Census Bureau's Population Estimates Program (PEP), and PRC's Population Estimates Program. The forecast project team obtain additional housing information and land use data from local governments, at both the county and UGB levels of geography; the Oregon Center for Health Statistics provided information on births and deaths; and some administrative data from Oregon state agencies.

The PEP's population data by single-year age group and sex were used to calculate the distribution of age and sex in each county. The proportions of each single-age year group (0-100+) and sex were adjusted to a controlled total county population from the most recent PRC's certified population estimates. The result was used as the base population for the forecast.

The number of live births occurring to women of childbearing ages (15-44) are calculated based on the historical vital data from the Oregon Health Authority (OHA). Age-specific fertility rates are projected to 2030 based on this historical data. Fertility rates from 2030 forward remains constant at the 2030 level. The age-specific fertility rates are applied to the numbers of women in childbearing cohorts. Age-specific fertility rates indicate how many children women in a given age group are likely to give birth to during each five-year period. Once born, children become subject to survival rates and are "moved through the system", or aged over time, like all the other cohorts. Future trends in fertility rates after the starting point are jointly influenced by historic changes in age-specific fertility rates and the county total fertility rate (TFR).

Age-specific survival rates are calculated based on historical deaths data and the method described in Clark and Sharrow 2011. Historical deaths data is used to format a life table to produce the required parameters for feeding into the mortality model described in Clark and Sharrow 2011 to project the future mortality rates. Specifically, input parameters include historical life expectancies by sex and mortality rates for certain ages (e.g., infant mortality rate, child mortality rate, and adult mortality rate). For instant, adult mortality rate is often indicated as 45q15, meaning the chance of a person aged 15 not surviving to age 60. The mortality rates up to 2030 are produced for males and females aged 0 to 100+ in 5-year intervals. The mortality rates are applied to each age group in the cohort-component model. The mortality rates for each 5-year age group are evenly distributed in each age within that age group. For example, the mortality rate for females aged 15-19 is applied to females aged 15, 16, 17, 18, and 19 in the forecast model.

The most difficult part in forecasting population is estimating the in- and out-migration of an area. Due to a scarcity of reliable data available to study in- and out-migration, it is best to use net migration rates. Net migration is the balance between in- and out-migration. Net migration can be calculated as a residual if the population is known at the beginning and the end of a time period, along with the number of births and deaths that occurred during that same time period. Net migration is positive (in-migration) when more people move into the area than leave it; it is negative (out-migration) if the opposite is true. Net migration rates we use in the cohort-component model can be interpreted as the number of people per 1,000 who are added to (or subtracted from) a given cohort due to migration over a given period.

Net migration and net migration rates applied to the cohort-component model are derived from the data published by the University of Wisconsin-Madison's Applied Population Lab. This data includes county-level net migration data between 2000 and 2010 by sex and 5-year age groups. The data applies the forward cohort residual method. This method counts the number of people added in each cohort over a time period, for example, 5 years, in addition to natural increase/decrease to determine the number of net migration in that age group. Adjustments to the data are made for each county based on recent knowledge and appropriate assumptions.

Demographic trends identified in post-2010 data from PRC's annual population estimates and the U.S. Census Bureau's ACS data had some bearing on the adjustments made to the model in the initial forecast period. Additionally, migration patterns are greatly influenced by the local economy and by housing growth in the area, both current and assumed. When making the final adjustments to the net migration rates, we consider planned future development, as well as knowledge from local planners and citizens about accommodations or limitations to population growth in the area. We use unique sets of demographic data for each of the counties and their sub-area; we considered trends specific to each of them when adjusting their cohort component models.

Housing Unit Method

The housing unit method is applied to the forecasts for all sub-area. This method requires that we compile a current housing inventory for each area and historic rates of change of residential development. Other housing and population data are also needed for the components of the housing unit model, and they are: occupancy rates, the average number of persons per household (PPH), and group quarter's population. In this method, the number of housing units in an area is first projected. Next, assumptions about future housing occupancy and average household size are made to forecast household population. We calculate an area's total population in the housing unit method by multiplying the projected number of housing units by the occupancy rate and PPH and adding that product to the group quarters population. This process is carried out for five-year intervals throughout the forecast period[5]. The housing unit method is presented as the following:

$$Population = HU \times Occ \times PPH + GQ$$

HU: $Housing\ unit\ stock$
Occ: $Occupancy\ rate$
PPH: $Persons\ per\ household$ GQ: $Group\ quarters\ population$

Data used in the housing unit models are from the 2000 and 2010 Censuses of Population and Housing, and the most recent address list updates collected by the Census Bureau from the Local Updates of Census Addresses Operation (LUCA). Additional data related to housing development plans and land capacity for local jurisdictions are obtained from survey responses (we send a housing and population questionnaire to Oregon's cities and counties and request that they complete and return the form to us each year).

The 1990, 2000, and 2010 decennial population and housing data are obtained by census blocks. The data contained in each census block are then allocated to each of the UGBs according to the 2020 jurisdiction boundaries (the UGBs used were as they existed in the forecast launch year) using Geographic Information Systems (GIS). The same process is conducted to extract the LUCA data. The results are used to compile a historical housing and population inventory for each sub-area, within and outside of the UGB. The 2020 population within and outside of each UGB is estimated using the 2019 LUCA data as the baseline. The 2010-2019 housing unit growth rates are applied to estimate the 2020 housing units for each sub-area. Other parameters, including persons per household (PPH), occupancy rates, and group quarter population, are obtained from the 2010 decennial census. The 2020 housing unit estimates serve as the baseline for the 2020-2030 forecast. The projected 2030 forecast results are used as the baseline for the 2030-2045 forecast. To allocate the projected county population to its sub-areas, the county population share of each sub-area is applied to the total county population.

Future housing unit growth trends are projected from the historical decennial census data, LUCA, and responses from the general and housing surveys distributed by PRC. In general, the model accounts for known planned future housing and possible future trends. PRC calculates housing growth rates using the housing inventories and the magnitude of annual or periodic change they experienced. Housing unit growth trends are applied to a starting year's housing inventory to arrive at the numbers of housing units in the future. To reduce the possibility of over or under estimation in the long term, a weighted average from annual or periodic growth rates is calculated, giving more bearing to the years believed to have more influence on what

[5] To obtain population projections for single-year time intervals, we prepared an interpolation worksheet. The worksheet and instructions about how to use the worksheet to calculate a single year population forecast based on the forecasts for 5-year time intervals is located on our website at this link: https://www.pdx.edu/prc/currentdocuments-and-presentations.

likely will occur in the future. For example, the next 5 years of housing unit development trends are based on the general survey (if housing development information is provided) and the most recent housing trend (i.e., 2010-2019). After 2030, a weighted average housing unit growth rate over the past three decades is applied. When applicable, the most recent data provided by local officials is considered. Additionally, the forecast team adjusts the models to accelerate or curb growth based on current conditions compared to the past or plans for future change.

The 2010 Census data is used to calculate housing occupancy rates and the PPH. We base forecasts housing occupancy and PPH on recent historic rates and trends. Occupancy rates vary more than PPH and are more dependent on local economic conditions, which can fluctuate. Demand for housing, and thus occupancy rates depend on population growth. We are conservative when forecasting occupancy rates to avoid forecasting extreme rates in a wrong direction. After studying the past forecasts produced by the PRC, PPH and occupancy rates do not vary much throughout the forecast period. At this point, the forecast team decides to use the PPH, occupancy rates, and group quarter population data provided in the 2010 decennial census for all sub-area forecast to minimize future uncertainties related to these parameters.

Reconciliation of the Forecasts

We develop separate population forecasts for each county in the forecast region and for each county's subareas. For consistency, the sum of the parts must equal the whole, which means that the sum of the individual forecasts of each county's sub-areas should be equal to the corresponding county-level forecast. In the 2021 forecast, the method in which the county-wide forecasts serve as the control total (called a "top down" approach) is applied. To maintain consistency across all counties and sub-areas, the "bottom up" technique, where the sum of sub-areas serves as the control total, is not used. In the top-down approach, we proportionally allocate the total county population to each sub-area based on the shares calculated using the housing unit method.

Supporting Data and Projections Produced from Other Demographic Models

In addition to evaluating demographic trends detected from the primary source data we used in our forecasting models, we review other data and information to obtain a better understanding of the dynamics of population change specific to our study areas. This supporting information helps us to make better, or more realistic, assumptions about future population growth and helps us to use better judgment when adjusting our demographic models. Most of the supporting data and information are available either at the county level of geography, or for other large geographic areas. The sources include labor force data and economic profiles from the Oregon Employment Department, school enrollment data for school districts from the Oregon Department of Education, and demographic and socioeconomic data from the U.S. Census Bureau's American Community Survey (ACS), and various administrative data sets from state or national agencies. Also, population forecasts from the Oregon Office of Economic

Analysis (OEA), and employment projections from the Oregon Employment Department are used to gauge our county-wide results and for comparison.

To help make our forecasts more accurate, additional sets of population projections are produced from demographic models other than the primary models employed in this study. We produce secondary sets of projections to serve as an evaluation tool to verify that the numbers forecast from the primary models are reasonable. The current forecasts are also compared against PRC's forecasts from previous years to detect discrepancies and possible causes that led to the differences. Population trends depend on many factors, including local socioeconomic development, regional planning, demographic structure, migration behavior, and environmental changes, etc. Changes of data sources and calculation methods also post changes to the results. It is possible that the current population forecasts are different from the previous version as the forecast team at PRC actively works to update the data in producing the most up-to-date forecasts.

Data Sources and Description

We compile equivalent types of datasets for most of the geographic parts in the forecast region. Some data, such as the one-year estimates from the American Community Survey (ACS), are only available for geographic areas whose population is a minimum of 65,000. However, the ACS 5-year multi-year estimates are available for all geographic areas in the study. Most administrative datasets we use, such as data for Medicare enrollees, DMV driver license issuances, voter registration, and state and federal tax exemptions, are available for counties only.

We base our population forecasts on data obtained from several sources. PRC staff aggregate much of the data to the county and sub-area level. The data sources include:

- The U.S. Census Bureau's Decennial Census. The decennial Census is the only source of data with 100 percent coverage that are collected for small areas across the nation. The 2000 and 2010 Census block data are used to obtain the population, by age and sex, residing in each county and its sub-areas. Housing unit data is derived from the 2000 and 2010 decennial census to use in the sub-area forecasts. Data for population by race/ethnicity, and housing were obtained from the two Censuses to help inform the population forecasts.
- Population Estimates Program (PEP). The population estimates are produced annually by the Census Bureau. Population estimates are grouped by characteristics such as age, sex, and race/ethnicity at different geographic levels. The data is used to determine the proportion of each single-year age group within a county to estimate the base year population in the county-level forecasts.
- The American Community Survey. These U.S. Census Bureau survey data are available for one and five- year periods. The American Community Survey asks the same or similar questions as the 2000 Census. Although the data are from a survey of a sample of the

population and thereby are prone to large margins of error, especially for areas with small population sizes, the data are representations of time periods after the last decennial Census.

- Local Updates of Census Addresses Operation (LUCA). The Census Bureau uses LUCA to collect the latest address updates from states, county, and local governments for inclusion in the 2020 census. LUCA updates provide a more up-to-date housing data compared to the 2010 census. The most recent LUCA closed out in June 2020. Address data collected through LUCA is used to estimate the 2020 housing units in the sub-area forecasts.
- Birth and Death Data. We obtain births and deaths data from the Oregon Health Authority (OHA). The data are used for two primary purposes: 1) to calculate overall fertility and mortality rates for each county; 2) to determine and examine birth and death trends and to make correspondences with population change.
- Net Migration Data. County-level net migration data is produced by the Applied Population Lab at the University of Wisconsin-Madison. The data uses a residual method to count the balance of in and out migration over a ten-year period and the process has been carried out every 10 years for over 60 years. The 2000-2010 net migration patterns are used as a baseline in the forecast to estimate the net migration rates for different age groups in each county.
- Annual Population Estimates. Annual population estimates for cities and counties of Oregon are prepared by the Population Research Center at Portland State University as part of its Population Estimates Program. Data utilized to develop the population estimates include building permits for new housing and demolitions, group quarters population counts, state and federal income tax returns and exemptions, vital statistics, Medicare enrollees, school enrollments, voter registration, and driver license issuances.
- UGB Boundary Files. Local governments and the Oregon Geospatial Enterprise Office provide the boundary files for the UGBs within the forecast region, and we request that local government staff verify these boundaries. The boundaries are current to the launch year of the forecast period. These files are used for mapping and for aggregating demographic and other data unique to each geographic part in the forecast region.
- Local Employment Dynamics Data. These annual data provide background information about commuting patterns of workers. An area's availability of employment or draw of workers, influences population and housing changes. We evaluate these data to identify commuting patterns and changes over time. Additionally, we incorporate the data into a secondary population projections model used for reasonableness checking.
- Local Area Unemployment Statistics and Employment Projections. We evaluate data from the Oregon Employment Department on the numbers of employed and unemployed persons by county to determine trends and their relation to population change. The employment 10-year projections, also from the Employment Department, are available for economic regions that represent groups of counties across Oregon.
- Regional Economic Profiles and Reports. We obtain background and current economic information for the economic regions and counties within the forecast region from the

Oregon Employment Department. The information provides us with an understanding of historic and recent economic trends and the general economic climate in our study area.

- Other Background Information. We examine county and city comprehensive plans, amendments to those comprehensive plans, other population forecasts prepared for counties or cities, and other planning reports and documents to obtain background information. We collect additional information that county and city officials and staff think might have bearing on the population forecasts from jurisdictions (see forecast reports for survey documents).
- National Population Projections. The U. S. Census Bureau publishes national long-term population projections (most recently for the 2020-2060 time period). These projections are available by age, sex, and race/Hispanic origin detail.

General Comments about Population Forecasts

The longer the timespan of the forecast, the more likely it is that conditions change, and thus the uncertainty in rates and assumptions will increase. It is crucial to have recent data that allows us to test and calibrate our assumptions used in the forecasting models. We use the study area's historic population to calibrate and adjust original migration and growth rates in the forecast models, so we achieve a better fit between actual and predicted population. In the long run, however, the local economy and conditions affecting populations are likely to change in ways not currently anticipated.

All population forecasts are based on a combination of a beginning population; various known, estimated, and predicted rates; and the forecaster's judgment about future trends. The forecasts may err through imprecise data or unexpected shifts in demographic trends. Generally, a forecast for a larger population size, such as a populous county, is more reliable than a forecast for a small area, such as a small city with fewer than 1,000 persons. Population forecasts serve as a guide to population growth over the next several years. However, unexpected changes in the local areas will surely affect populations in some cities and actual populations will deviate from those forecasted. The differences between the forecast and actual populations will vary in magnitude and perhaps direction.

A Note of Caution about the Population Forecasts

Given that we develop these forecasts for long-term trends, they are conservative. This means that they do not assume drastic changes to the population trends, such as seen during a recession.

Policy makers should view population forecasts as one of several available sources of information about likely future conditions. We base our forecasts on assumptions developed from analysis of historic trends and expectations for the future. While the past gives some indication of what is likely to happen in the future, there is always the possibility of the occurrence of unforeseen events that could have a significant impact on population change.

Thus, users of these forecasts should be aware that unexpected changes could happen and that it is wise to evaluate forecasts periodically in future years. Given the uncertainty of the timing, occurrence, and magnitude of future events, several points should be kept in mind when interpreting the population forecasts in this report.

First, the population forecasts represent a medium-growth, or most-likely, scenario derived from assumptions representing our best judgment as to the possibilities for future conditions. It is not possible to judge ahead of time which of the assumptions, or combinations of assumptions, may best forecast future populations. The initial few years of the forecast period will better reveal whether the modeled demographic trends are likely to occur. If different conditions arise, then it would be appropriate to revise the population forecasts, taking into account new assumptions.

Second, variations in forecasts become larger in the long run. As years go by, the population forecasts depend increasingly on assumptions about who and how many persons will move into and out of the study area, and on the number of births that will occur annually to parents who reside in the study area. The population forecasts become less certain over longer periods of time.

Third, the smaller the population the harder it is to develop an accurate forecast. Slight unpredicted variations in demographic trends can cause larger fluctuations in these population forecasts than those for larger populations. Forecasts for large cities and counties tend to be more precise than forecasts for small cities or towns.

Finally, when interpreting a forecast, there is a temptation to ask: "How accurate is it?”. The question implies that there is a need to bank on exact numbers in a current forecast and then base future plans on only the one forecast. The more appropriate use of a forecast is to consider that there is likely to be some variation around the numbers and that we will want to update them as conditions evolve. Instead of deciding what exact outcome will occur over the forecast horizon, we urge government officials and the public to "monitor and manage" the changing conditions that will affect future populations. The most- likely forecast can best serve as a guideline in this process of monitoring and managing.