

EVALUATING DECLINE

AN ASSESSMENT OF VARIABLES CORRELATED WITH SHRINKING, RURAL COMMUNITIES



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Bioregional Planning

EVALUATING DECLINE: AN ASSESSMENT OF VARIABLES CORRELATED WITH
SHRINKING, RURAL COMMUNITIES

by

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Resident Drew Parkin describes the challenges faced by Escalante, U.T.

EXECUTIVE SUMMARY

Researchers have long sought to understand the relationship between rural population decline and the factors causing variations from time to time and from place to place (Albrecht, 2010). However, few studies have made comparisons at the local level or developed appropriate regional or place-based metrics. The purpose of this project was to determine which local-level factors and variables correlate with rural population decline and to provide recommendations based on those findings.

This project analyzed the relationships between 2000-2010 population trends and a variety of demographic, economic, and biophysical factors specific to rural communities throughout the state of Utah. A community-level natural amenity index was developed in order to investigate the relationship between population change and the presence or absence of place-specific natural amenities. Findings suggest that planning for rural population decline should be comprehensive and systematic, recognize the joint influence of factors and variables, understand that factors are time dependent, promote physical and social geographic linkages, and acknowledge the leading role of economics.



Escalante, U.T.

INTRODUCTION



In June of 2015 Utah's Garfield County declared a state of emergency (Miller, 2015). The emergency wasn't the result of violence, natural disaster, or famine and drought; it was the result of population decline. In the last 18 years, school enrollment has dropped from 150 children to 50 (McKellar, 2015). Many people blame the 1996 designation of the Grand Staircase National Monument as the reason for the significant drop in numbers. According to Petrzelka and Marquart-Pyatt (2012), economic activity was heavily rooted in timber, agriculture, and livestock grazing on public lands at the time of the designation.

While these activities remain important components of the local economy, they have declined substantially in recent decades as tourism and recreation based services have become increasingly important to the economy. In fact, Garfield County depends on tourism for employment more than any other county in Utah (Petrzelka and Marquart-Pyatt, 2012).

The real crux of it all, according to Commissioner Leland F. Pollock, is that today there is a lack of strong, year-round work options for community members (Miller, 2015). By declaring a state of emergency, Garfield County hopes to call attention to the correlation between a lack of students and a lack of good employment options (Miller, 2015).

Challenges related to population decline are not unique to Garfield County nor are they solely the result of federal land designations. Small towns have entered a new era, the implications of which will be immense for the rural west (Albrecht, 2014). The new competitive pressures from an increasingly volatile global market will continue to change the rural economy and have significant impacts on rural demographics and quality of life (Kandel and Brown, 2006).

“... You lose a school, you lose the heart and soul of that community.”

*-Commissioner David Tebbs,
June 2015*

Communities that cleave to the notion of “business as usual” will likely struggle. Adaptation will be key for rural places as outside forces and changing cultural values bring new challenges (Albrecht, 2014). Today's small town can either deal directly with those changes and have some control over the outcomes, or allow outside forces to determine their fates (Albrecht, 2014).

Today's local and regional leaders are relied upon to respond to demographic, economic, social, political, cultural, and environmental change (Sullivan et. al., 2014). The exploration of the factors, variables, and trends related to rural population decline will be essential as global changes, economic restructuring, and technological advances continue to affect the characteristics of small towns with shrinking populations (Albrecht, 2010).

LITERATURE REVIEW

Small Town in a Global Society

In his book, *Rethinking Rural*, Don Albrecht states, “No community is an island. Communities have always been affected by events occurring outside their boundaries” (Albrecht, 2014, pg. 3). Change has and will continue to affect rural communities in both positive and negative ways.

Rural America has entered a new era which sociologists have labeled “Small Town in a Global Society” (Albrecht, 2014). Traditional primary sources of employment continue to decline while employment in the service sector has increased (Albrecht, 2010). Once prosperous communities are now facing demographic and economic decline while communities that have long struggled are now attempting to cope with explosive growth and development (Albrecht, 2014).

Garfield County’s story exemplifies the challenges and concerns that can come with change. Today, two of the biggest concerns facing Utah’s Intermountain West are economic decline contrasted against rapid growth and development (Kurtzman et al., 2002). While rapid growth also creates significant challenges for rural towns, the focus of this project is rural population decline (Kurtzman et al., 2002).

Global changes will continue to affect demographic patterns and alter the characteristics of rural towns susceptible to decline (Albrecht, 2010). Learning how to adapt and plan for an uncertain future while preserving local character and quality of life are central goals for many rural communities facing change. The ability to understand, plan for, and adapt to the dynamic variables associated with population decline will aid communities in achieving their goals.

“No community is an island. Communities have always been affected by events occurring outside their boundaries.”

-Don E. Albrecht, 2014: pg. 3



The Factors Related to Rural Population Decline

The factors associated with rural population decline can be categorized in a variety of ways. This document organizes them into three broad realms: population factors, economic factors, and amenity-related factors. Since these factors and variables are extensive and complex, a holistic examination of population change and the driving factors is essential for planners and decision makers (Chi and Ventura, 2011).

A holistic, integrated perspective recognizes the complex interactions between human factors (such as demographic composition and economics) with biophysical factors (such as natural amenities). This type of integrated framework produces more comprehensive information that can aid local planners and decision makers to plan for an uncertain future (Chi and Ventura, 2011).

The factors and variables described in this report are not meant to be exhaustive, but to provide a holistic view of both human and natural factors that are specific to rural areas.

Population Factors

Population change is comprised of three main components: births, deaths and migration (Rogers and Boresella, 2016). The change in population from births and deaths is referred to as natural change. Migration is a measurement of people moving from one place to another and is most often expressed as net migration (Rogers and Boresella, 2016). Total population change is a combination of natural change and net migration.

Put simply, a population will shrink when people are lost faster than they can be replaced. While natural change and net migration are the essential components for calculating population change, other factors (such as economics) act as drivers and will influence population growth or decline (Chi and Ventura, 2011).

Population change can be understood in relative and absolute terms. Relative population growth is the rate of growth compared to national and state averages. Absolute growth is the actual rate of growth or decline unrelated to outside trends. Between 2010 and 2015 Utah grew by 8.4% while the U.S. as a whole grew by less than half that rate at 4.1% (U.S. Census Bureau, 2010 and 2015). Utah communities which were growing at a rate of 4.1% between 2010 and 2015 matched national growth trends but were well below average state growth rates.

Compared to national averages, Utah's population growth rate is high, but county and community-level analysis reveals that it is also highly variable, with localized growth in communities along the Wasatch Front. Davis, Salt Lake, Weber, and Utah counties have significantly higher populations and population densities than the rest of the state. Salt Lake County alone accounted for almost 25% of the state's total population growth between 2000-2010 (U.S. Census, 2000 and 2010).

As a component of population change, birth rate is normally expressed as the number of births per 1,000 women (U.S. Census Bureau, 2010). Utah has long held the highest number of average births in the nation likely due to a population base strongly rooted in the Mormon culture which encourages large families. However, national and state trends have seen a significant decline in birth rates since 2008 (McCombs, 2015).

Between 2008-2015, Utah birth rates dropped by 18%. In general, people are putting off marriage and having children, and more are remaining at home with parents for longer periods of time (McCombs, 2015). In rural places where natural increase once had a significant impact on growth, declining birth rates mean that the aging population is not being replaced. In places such as Garfield County, a low birth rate translates to declining school enrollments and other associated challenges.

Along with birth rate, net migration is an important driver of population change. Nationally in 2010, net outmigration outpaced natural population change in most rural counties. In fact, 346,000 more people moved out of rural counties in 2010 than moved in (USDA, 2015).

In addition to employment driven out-migration, rural population loss has long been associated with the out-migration of rural college-age youth. The out-migration of youth is common to both urban and rural places but what distinguishes declining rural areas are low levels of in-migration (Reichert and Arthun, 2014). However, return migrants do make up a significant number of the in-migrants to these areas of low population growth. Those who return are attracted by family, community, and adequate employment opportunities (Reichert and Arthun, 2014).

Retirees (60+) make up a significant percentage of rural in-migrants. Retirees, often referred to as amenity migrants, are attracted to recreation opportunities, pleasant climates, and adequate health care and lodging (USDA, 2015). In contrast, young adults make up the bulk of out-migrants as they leave for college or better employment opportunities (USDA, 2015). For this project, migration data was not available at the community level or in a form that could be easily analyzed. Instead of migration data, different age trends were analyzed as part of the population-related factors.

Different age groups affect and contribute to rural population decline in different ways. For this reason, age composition is an important consideration when analyzing population trends (Johnson, 2006). Today, many rural areas have increasingly older populations due to outmigration of youth and declining birth rates (McGranahan and Beale, 2002). Children (0-19) are important for replacing the older generation and the labor force age group (20-59) is essential to local economic activity. In Addition, a robust labor force can attract businesses and contribute to economic stability (Johnson, 2006). A balance between the number of children, working adults, and retirees is one of the contributing factors to community stability (McGranahan and Beale 2002).



Springville, U.T.

Economic Factors

To understand the economic factors related to rural population decline, it is necessary to first understand economic restructuring. Traditionally, rural economies were heavily dependent on agriculture, ranching, and other extractive or natural resource-based industries. Today, many rural economies are dependent on service sector employment such as tourism, hospitality services, and retail trade (Kandel and Brown, 2006).

Economic restructuring has had a huge impact on rural demographics as farms shrink or disappear and manufacturing jobs decrease in demand and availability. (Kandel and Brown, 2006). Additionally, the shift from goods-producing industries towards service sector employment is significant because the service sector has different wage structures, educational requirements, gender proportions, and relationships between owners and workers (Albrecht and Albrecht, 2009).

Income levels and poverty rates play an important role in predicting population patterns. Historically, rural places have had higher poverty rates than their urban counterparts. These trends continued as poverty rates increased between 2000 and 2010 throughout the United States with the greatest increase in nonmetropolitan counties (Farrigan and Parker, 2012). In 2014, average U.S. poverty levels were estimated to be 15.5% while rural poverty levels were estimated to be 18.1% (USDA, 2015).

Directly related to the challenges of low income and high poverty rate is employment opportunity. In many rural towns, service-sector jobs (in particular tourism and recreation) dominate the local economy and, as with any form of economic development activity, have associative opportunities and threats (Krannich and Petrzelka, 2003). Tourism and recreation-oriented employment are categorized by seasonal part-time jobs with low wages, few benefits, and low economic impact.

Krannich and Petrzelka (2003) found that while tourism can generate millions of dollars in income, create new jobs, and stimulate population growth, often the economic consequences compete with the benefits. The lower wages and part time work associated with tourism jobs often do not provide an income sufficient for supporting a family and can lead to limited and unattractive employment opportunities (Krannich and Petrzelka, 2003).

However, not all service sector employment is associated with low income and seasonal employment. In fact, compared to manufacturing and other goods-producing industries, the service-sector industry offers a variety of employment opportunities (Albrecht and Albrecht, 2009). Jobs in fields such as information, finance, medicine, and education are examples of high-quality, skill-based jobs that fall within service sector employment. Unfortunately, many rural areas struggle to attract these specific jobs because communities are often remote, lack capacity, and are without sufficient demand for those kinds of services.

Tourism can also create challenges for the local housing market and economy. Outside business interests will often buy up land for commercial and residential developments, pushing out local farmers, ranchers, and business owners (Pumphrey, 2010). When a tourism destination becomes more popular, more people will want to live there, raising land value and housing costs. At this point, local residents as well as seasonal workers may no longer be able to afford the cost of living and are forced to relocate (Pumphrey, 2010).

Unfortunately, as the tourism industry grows, more rural communities will have to deal with these difficult issues (Pumphrey, 2010). Planners and decision makers must consider how to best incorporate tourism into their economy without marginalizing local quality of life. While the costs and benefits must be considered, protecting local cost of living can improve social equity, increase spending and employment for local economies, and increase funding for local governments (Wardrip et. al., 2011).





Escalante High School Escalante, U.T.

Education is another important economic factor since labor market outcomes are closely linked to educational attainment (Kusmin, 2016). Those who are more highly educated are more likely to receive higher earnings and are less likely to be unemployed or live in poverty. The high school completion rate gap between metropolitan and nonmetropolitan areas is closing, but the college completion gap is growing. Median earnings for college graduates in rural areas is 54% above the median for high school graduates. In urban areas, the earnings for college graduates is 83% above the median for high school graduates (Kusmin, 2016).

In addition to educational attainment, the presence of quality educational opportunities within and the near rural communities can contribute to quality of life as well as act as economic drivers. Quality education attracts and retains students and families as well as provides jobs. Unfortunately, low education budgets, lack of affordable housing, remoteness, low capacity, and low incomes can all act as obstacles to rural educational attainment as well as educational opportunities (COED, 2016).

Unemployment rate often correlates with educational attainment. Those with more educational attainment most often experience lower rates of unemployment. In 2010 the unemployment rate for adults 25 and older without a high school diploma was 15% (USDA, 2015). Those with a bachelor's degree only experienced a 4% unemployment rate and those with graduate degrees only a 3% rate. Rural unemployment rates since then have continued to decline, but remain in favor of those with more educational attainment (USDA, 2015).

Just as educational attainment contributes to improved employment opportunities and wages, economic diversity contributes to greater economic stability and diversity. One way to measure economic diversity is the Hachman Index (Moore, 2001). The Hachman Index, developed by Frank Hachman, measures how closely the employment distribution of a region (in this case a community) reflects the reference region's (statewide) employment mix. The higher the Hachman Index score, the more diverse the economy (Moore, 2001). If a community's industries closely reflect those of their county or state's employment distribution, it will have a relatively high Hachman Index value.

A study done with the Bureau of Economic Research at the University of Utah, looked at 36 counties in Oregon to measure the extent of economic diversity (Moore, 2001). A simple regression test showed that the Hachman value assigned to each county was negatively correlated with the variation in job growth rates. These results indicate that less diverse economies tend to be less stable while more diverse economies tend to be more stable. This knowledge supports the idea that economic diversification efforts may enhance economic growth and job opportunities, attract high-wage firms and jobs, and provide more economic stability through diversification efforts over time (Moore, 2001). Additionally, during times of economic downturn, communities with multiple industries are much more likely to stay strong and have a solid rebound (COED, 2016)

Natural Amenities

Mountains, lakes, forests, scenic vistas, and open spaces have long attracted population growth, tourism, recreation, and economic development to rural areas (Krannich and Petrzelka, 2003). Communities near desirable natural amenities often experience more growth and development than communities with less desirable amenities.

Early settlement patterns reflect this attraction to traditional natural resources such as minerals, timbers, coal, oil, and especially water and soil (Albrecht, 2010). Today people are attracted to high amenity places more for recreation and residence (McGranahan, 1999).

A study done by Don Albrecht in 2010 identified natural amenities as the best predictor for rural population change. Unfortunately, the presence or absence of natural amenities is not something a community can control. In this way, amenity-based development is not realistic for many rural areas since the natural features needed to attract tourism and other amenity-based activities are not always present (Krannich and Petrzelka, 2003). However, for communities that do have the potential, amenity-based growth is the result of purposeful local actions and planning efforts (Krannich and Petrzelka, 2003).

For many of Utah's rural communities, conflict over natural resources has become a real issue. Traditional uses such as farming and ranching are now in conflict with tourism, recreation, wildlife habitat, military operations, and other public purposes. Planning for the future is difficult because of the increased user competition and diverse opinions about public resource issues (Kurtzman et al., 2002).

The Federal and State designations of new parks or monuments, the construction of reservoirs or other resource-based attractions, and other non-local development interests such as resort facilities are examples of outside forces that can stimulate economic change and population growth or decline in rural localities (Krannich and Petrzelka, 2003). For many rural towns, the viability and sustainability of their community depends upon their ability to harmonize traditional land uses with new economic opportunities (Kurtzman et al., 2002).



The Natural Amenity Index

McGranahan (1999) defines natural amenities as the physical attributes that enhance a location as a place to live. In order to measure the presence or absence of amenity resources, a natural amenity index was developed by McGranahan and researchers at the Economic Research Service (ERS) of USDA. The variables and measurements were selected based on the environmental qualities preferred by most people. Taken at the county level, measurements include climate-related variables as well as physical characteristics.

The first two variables included in the McGranahan scale are related to climate. Average January temperature and average number of January days of sunshine are included under the assumption that most people prefer warm winters and sunny skies.

The third and fourth variables are temperate summers and low average July humidity. Since places that are warm in the winter also tend to be hot in the summer, a temperate summer is seen as most desirable. Humidity adds to discomfort, most notably in the summer and low levels of humidity are considered most desirable (McGranahan, 1999).

The final two variables included by McGranahan are related to desirable physical characteristics within the landscape. For many people, topographic variation creates an appealing setting in which to live and recreate. The ERS scale measures topographic variation by using different landform categories such as plains, hills or mountains. Counties with more than one type of landform score greater topographic variation.

Lastly, water area was included since areas with more surface water are considered more pleasant than areas lacking surface water (McGranahan, 1999). Water area was calculated as the proportion of surface water area to total county area.

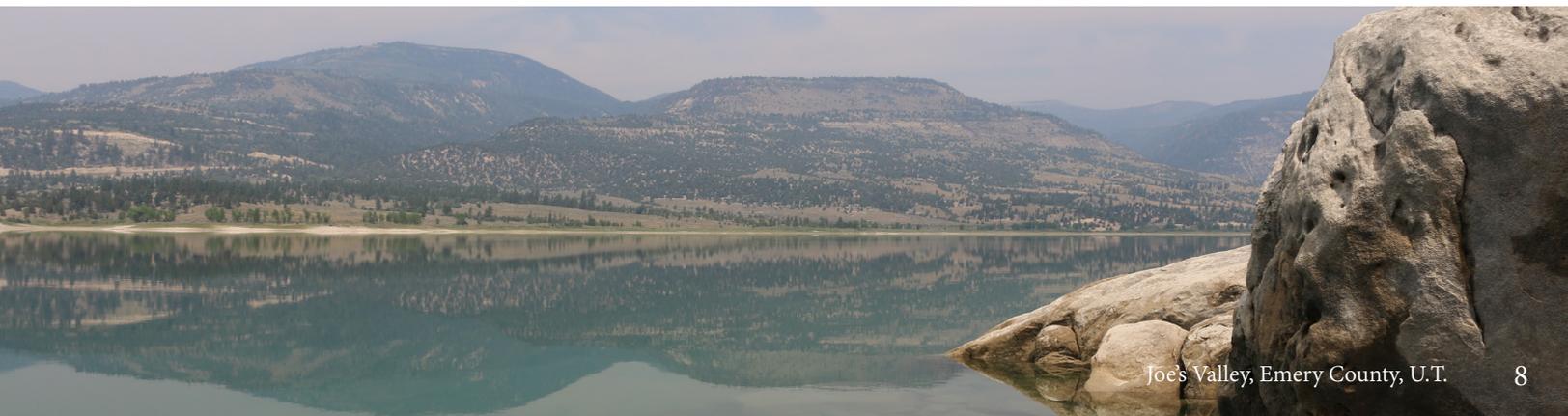
Place-Specific Variables

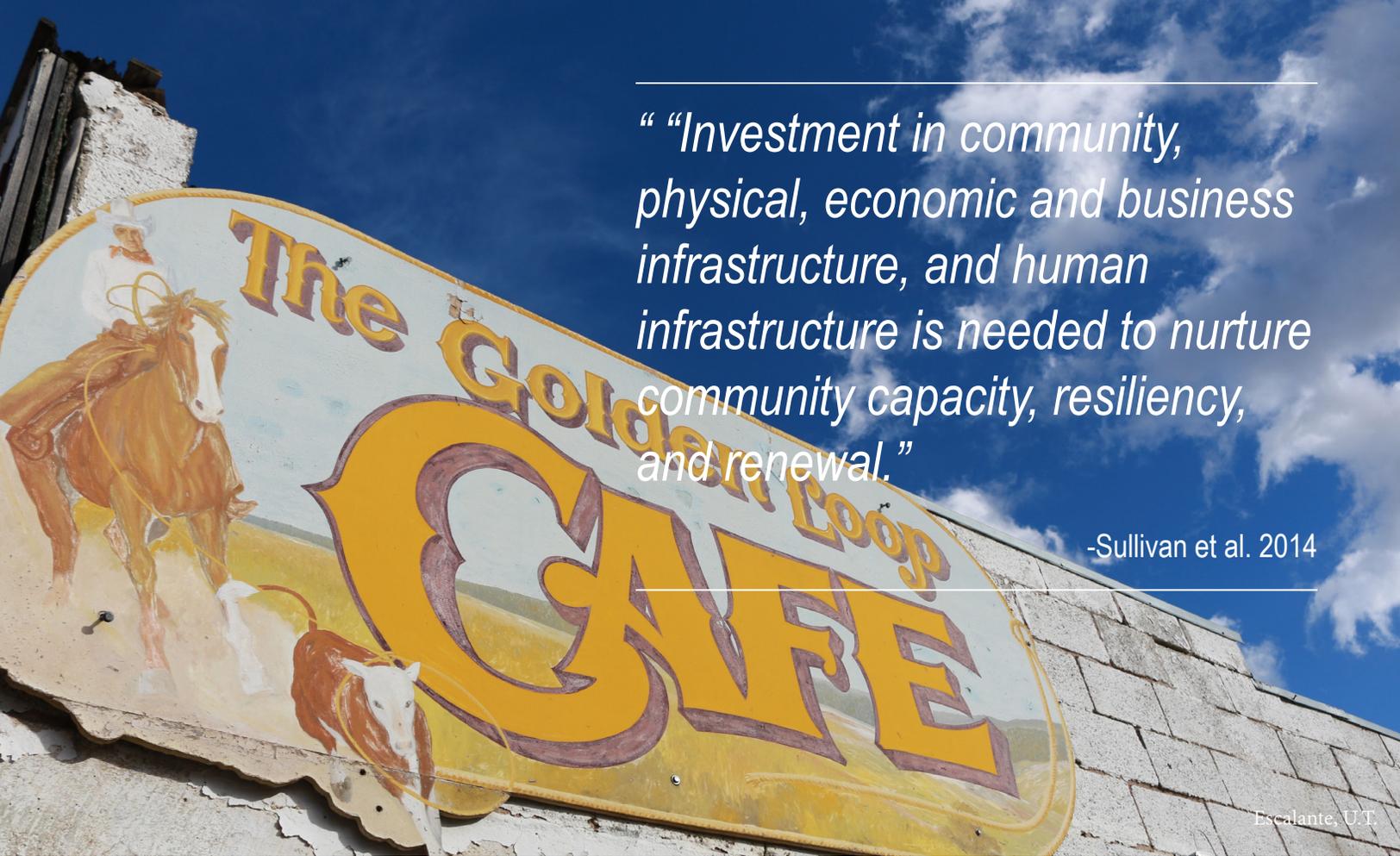
One aspect of the McGranahan scale is that it cannot differentiate communities across a common amenity-oriented landscape (Ganning and Flint, 2010). As a whole, the mountainous West scores very high and Utah counties range between high and very high scores with little variation throughout the state (McGranahan and Beale, 2002). In order to understand Utah's unique landscape and climate variations, a place-specific natural amenity index was created for this project.

While conducting forest-related research in Colorado, Ganning and Flint (2010) developed a list of variables that could be applied to place-specific research. The Colorado communities, similar to rural Utah, ranged from luxury resort towns to communities combining extractive industries with second-home development and outdoor recreation (Ganning and Flint, 2010). The place-specific variables developed by Ganning and Flint (2010) are well suited to Utah's landscape and improve local natural amenity calculations.

Along with the variables developed by McGranahan, two additional variables were adopted by this study from Ganning and Flint's research. Those variables include: (1) area owned by the U.S. Forest Service within a 10-mile radius; (2) total number of recreation locations within a 10-mile radius (defined in this study as the number of ski resorts, golf courses, trail-heads, local parks, boat launches, and campsites). Additionally, similar to the ERS scale, area in open water was included but calculated as open water within a 1-mile radius (Ganning and Flint, 2010).

Methods for quantifying natural amenities continue to progress and the ability to distinguish natural amenities at a variety of geographic scales will be important for future place-based population research.





“Investment in community, physical, economic and business infrastructure, and human infrastructure is needed to nurture community capacity, resiliency, and renewal.”

-Sullivan et al. 2014

Escalante, U.T.

Community Amenities (Local Services)

Sullivan et. al. (2014) states that local services are essential to small towns because they provide for both public and individual needs, enhance quality of life, and assist in attracting and retaining residents and economic activity. Furthermore, services can build and increase community capacity by promoting interaction between residents. “Investment in community, physical, economic and business infrastructure, and human infrastructure is needed to nurture community capacity, resiliency, and renewal” (Sullivan et. al., 2014).

Local services include healthcare, financial, educational, food, arts and entertainment, and other important services and activities. In this document, community amenities will be referred to as the constructed mediums through which services are provided such as hospitals, banks, schools, and restaurants.

Ready access to doctors, schools, and stores, enhances rural quality of life. Unfortunately, easy access to these services is a big challenge in rural places and “people often shop in one town, work in another, and live in neither” (McGranahan and Beale, 2002). Remoteness and small population density combined with insufficient infrastructure all contribute to the challenge of rural service provision.

Healthcare is a major industry within rural communities, not only providing needed medical care but employment for skilled workers (COED, 2016). The construction of local hospitals is largely the result of local collaboration, donations, and support. Towns that recognize how services, such as healthcare, support both social and economic renewal can evaluate the supports and services needed to improve stability in their own communities (Sullivan et al., 2014). Retaining and/or expanding these types of services, stores, and jobs within local economies will be an important tool for economic development since they represent assets already in place (Kandel and Brown, 2006).

METHODOLOGY

Research Framework

(An overview of the methodology process can be found on page 13).

A study done by Don Albrecht (2010) was used to determine a framework for analyzing rural population trends and variables. His methodology was adapted in order to fit the goals and objectives of this project.

Albrecht analyzed rural population trends and variables related to population growth using 2000-2008 population estimates and county-level data. A central component of Albrecht's study was to examine variables related to rural population growth and determine which variables had the strongest relationship to growth. He determined that counties with more extensive amenity resources were much more likely to experience growth than counties with low amenity resources (Albrecht, 2010, Abstract).

Overall, Albrecht found that "the presence or absence of natural amenities has become the best predictor of nonmetropolitan population change in recent decades" (Albrecht, 2010). He also concluded that during times of economic growth and prosperity, natural amenity driven growth is more likely to occur since more families can afford to live and work in rural areas. During times of economic decline, other variables (such as economics) become more important predictors of rural population trends (Albrecht, 2010).

This project focuses on the variables related to rural population change at the community level. Using a methodology similar to Don Albrecht, current (2010) census data was used to examine the relationship between population change and variables derived from Albrecht's study, additional literature, and input from the Rural Planning Group (RPG).

Because community specific data was gathered, some adaptations were made when specific data points were either unavailable or not in an accessible format. GIS was used to analyze and collect geographic data as well as to produce preliminary maps. Indices were created and regression analysis were performed using Microsoft Excel. Escalante, Utah was used as a case study in order to make place-specific recommendations.

While similar analyses of variable influenced population change have been performed, this study provides a place-specific analysis approach and compares population trends to a more extensive list of related variables. Composites of variable groups (indices) as well as individual variables were analyzed.

Research Questions & Objectives

Two main research questions were explored:

1. Which kinds of demographic, economic, and biophysical variables are most strongly correlated with rural population decline?
2. What recommendations should be made to a community with a declining population based on the results?

The following objectives were determined:

- a. Compile a list of measurable variables related to rural population change based on population, economic, and amenity-related categories.
- b. Gather population, economic, and amenity-related variable data for each of Utah's rural communities.
- c. Create a population, economic, natural amenity, and community amenity index for each variable in order to compare the variable categories.
- d. Develop a community-level natural amenity index tailored to Utah's unique climate and landscape.
- e. Determine whether the existing national-scale, natural amenity index is sufficient for measuring amenities at the local/regional-level.
- f. Analyze the relationship between each individual variable and population change through data visualization methods as well as linear regression models.
- g. Determine which variables have the strongest relationship to population change based on the results of the analysis.
- h. Based on analysis results, provide recommendations to a community that has a declining population.



Castle Dale, U.T.

Important Terms

- **Community amenities** refer to local services such as medical care, educational institutions, arts and entertainment, and other built elements that enhance a community as a place to live.
- **Dependent variable** refers to a variable whose value depends on another variable. The dependent variable used throughout this report is percent population change between 2000-2010.
- **Independent variable** refers to a variable whose variation does not depend on another variable.
- **Hot spot analysis (Getis-Ord Gi)** is a geospatial tool used to identify statistically significant clusters of high and low values.
- **Index** refers to an indicator or metric that is a combination of individual variables such as the natural amenity index.
- **Natural amenities** refer to variables such as climate, water, or access to recreation that are used to measure the physical characteristics of an area that naturally enhance the location as a place to live.
- **Regression model analysis** is a statistical process used for estimating the relationships between variables.
- **Trend** refers to a change or development in a general direction. Trends are measured as percent change in this report.
- **Variables** are factors that are related to, affect, and are affected by population change.

Study Communities

Building upon Albrecht’s (2010) methodology, this study analyzed variable-influenced population decline systematically using both qualitative and quantitative methods (see *Process Diagram on pg. 13*). The first important step was to define the study communities.

Taken from USDA definitions, a “rural” community was defined as (1) any community outside of Weber, Davis, Salt Lake, and Utah Counties and (2) any community less than or equal to 10,000 people. Approximately 160 communities met this criteria (see *figure 1*). Forty-three of these communities were eliminated in order to account for urban influenced growth.

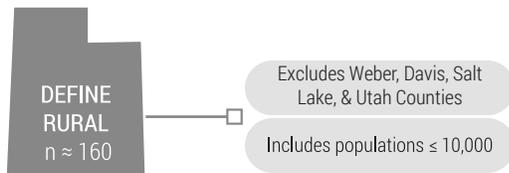


Figure 1. Definition of rural communities.

Data

Data for this analysis was obtained from a variety of sources (see *table 1, pg. 16*). The community was the unit of analysis and all incorporated rural Utah communities with available data on all determined variables were included in the sample of data analysis (n=160). Later the sample size was narrowed to improve statistical analysis and account for urban-influence-based population growth (n = 117).

Variables

When constructing the regression models, percent population change (2000–2010) was the **dependent variable**. Population estimates between 2000-2014 were also analyzed but proved to be less accurate, and ultimately counts from the 2000–2010 Census were found to be most reliable and appropriate for this study.

As discussed in the literature review, a number of **independent variables** were used in this analysis. Independent variables were classified into three basic categories: population variables, economic variables, and amenity variables.

Indices

A composite or **index** for each category (population, economic, and amenity-related variables) was created in order to compare data of various units and magnitudes (see *figure 2*). Individual variables were analyzed later.

Z-score was calculated by subtracting the mean from each examined data point and dividing that figure by the standard deviation. An Index was created by combining the Z-scores in Excel based on the variables within each index category.

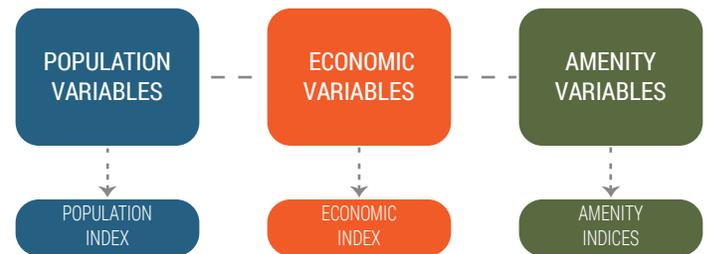


Figure 2. Variables within each category were combined to create a population, economic, natural amenity, and community amenity index. Source: RPG

Population Variables

(A summary of all variables can be found on page 16).

The population classified variables included **birth rates**, based on American Community Survey (ACS) 2009 actual rates, and **age division demographics** operationalized as the percent of the population classified as children (0–19 yrs.), labor force (20–59 yrs.), and retirees (60 yrs.+) (see *figure 3*).

The population index included each of these variables as well as 10 year percent population change (2000–2010) and 14 year percent population change estimates (2000-2014) for each community.

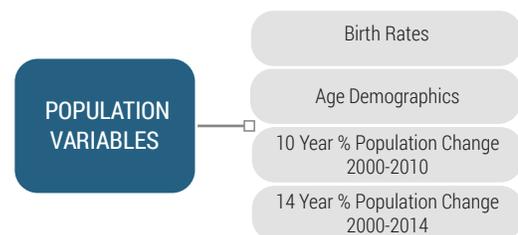


Figure 3. Population variables.

Methodology Diagram

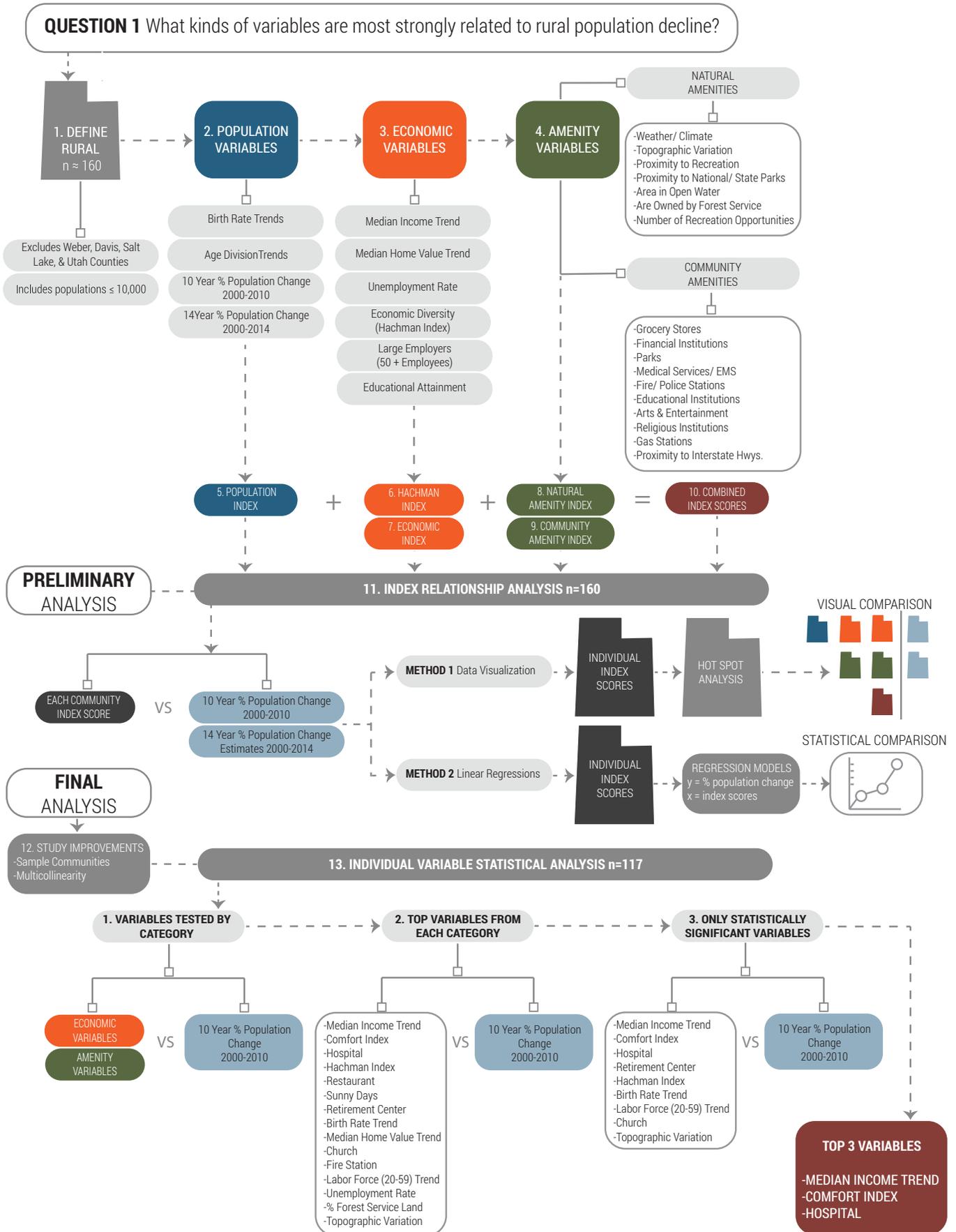


Figure 4. Overview of the methodology process.

Economic Variables

Economic classified variables included trends (percent increase or decrease) in **median income**, **median home value**, **unemployment rate**, and **poverty rate** (based on census definitions). Additionally, **economic diversity** was analyzed using a community-level Hachman Index (see figure 5).

In creating a community level Hachman Index, each community was used as the subject region and Utah was used as the reference region against which employment distribution was compared. Confining the geographic scale to Utah made sense relative to the make-up of local economies (RPG, 2016). The Hachman Index was used as both a variable component of the economic index, as well as a separate index (see table 1 on pg. 16).

Number of large employers (50+ employees) was used as a separate variable to test whether large employers have an impact on population growth. Finally, **educational attainment**, measured as the percent of the population with a bachelor's degree or higher, was included.

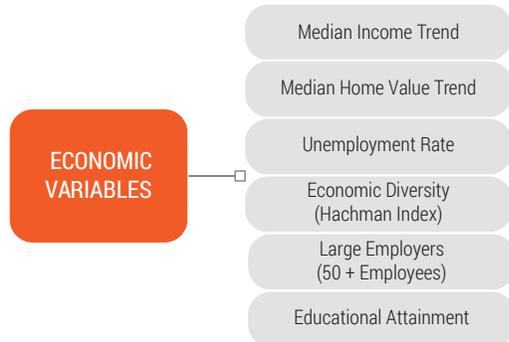


Figure 5. Economic variables.

Natural Amenity Variables

The development of a community-level natural amenity scale was an important component of this project since the existing scale developed by McGranahan (1999) is a national scale based on county-level data. County-level data is more complete, more accurate, and more easily accessible than community-level data; however, it is less specific to local places, less flexible, and does not differentiate communities across a common amenity-oriented landscape (Ganning and Flint, 2010).

The community-level natural amenity scale was developed to be more relevant to Utah's unique environment and local amenities (see figure 6). Natural amenity-related variables were included based on data availability, relevance, and recommendations found in the literature (McGranahan, 1999, Albrecht, 2010 and Ganning and Flint, 2010). The AGRC and GIS analysis were the main resources for geospatial data collection.

Natural amenity-based variables included:

1. **Climate-related variables** including average January low and average July high temperatures, annual snowfall in inches, number of sunny days per year, and comfort index rating (based on afternoon temperature and humidity). The comfort index was used in place of humidity since community-specific humidity data was inaccessible.
2. **Topographic variation** measured as the difference in elevation within a 10 mile radius.
3. **Area in open water** within a 1-mile radius.
4. **Area owned by the U.S. Forest Service** within a 10 mile radius.
5. **Recreation potential** based on proximity to a National park, State Park, and/or National Monument.
6. **Recreational opportunities** within a 10 mile radius including total number of ski resorts, golf courses, trailheads, parks, boat launches, and campsites.

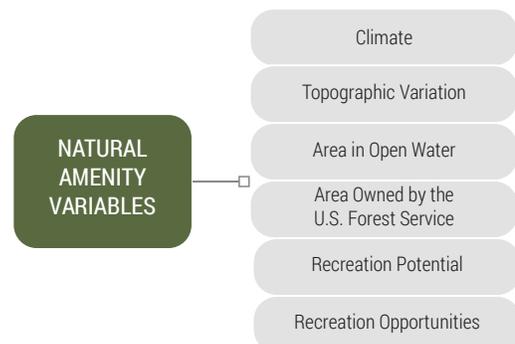


Figure 6. Classifications of community-specific natural amenity variables.

Community Amenity Variables

In addition to natural-amenity related variables, data was collected for a variety of non-natural amenities classified as community-amenities or local services. Community-amenities were included based on the hypothesis that proximity to and availability of services is positively correlated with population growth because it increases the “livability” of a place.

The variables were postulated and compiled by members of the Rural Planning Group (*see figure 7*). Buffer distances (mile radius) for both natural and community-amenity variables were based off of recommendations by Ganning and Flint (2010), emergency response times, and commute distance. Data accuracy and availability were important considerations and adaptations were made to fit the scale of this project.

Community amenity variables included:

1. **Health Care Services** including medical centers (within a 10 mile radius) and hospitals (within a 30 mile radius).
2. **Cultural Services** as the number of libraries, museums, movie theaters, and places of worship within city limits.
3. **Educational Services** as the number of schools (K-12) and higher education facilities within a 10 mile radius.
4. **Civic Services** as the number of fire and police stations, Emergency Medical Services (EMS), and community centers within city limits.
5. **Food services** as the number of grocery stores and restaurants.
6. **Financial Services** as the number of banks within city limits.
7. **Gas Stations** within city limits.
8. **Proximity to a Highway** determined whether a state highway was within 10 miles from city limits.

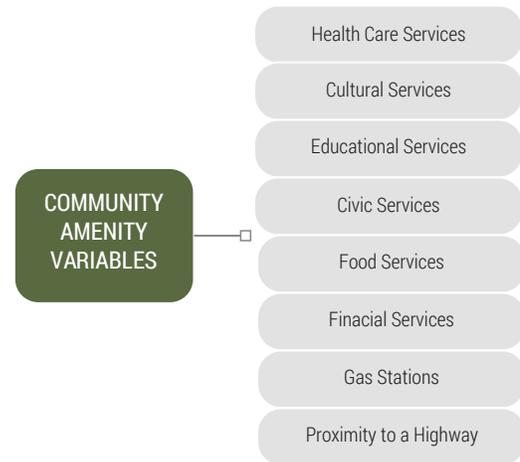


Figure 7. Classifications of community amenity variables.

Preliminary Analysis of Indices

Once all variables were gathered and indices had been determined, a preliminary analysis was performed using two methods: (1) data visualization and (2) linear regressions.



Figure 8. Summary of all determined indices. The total index is a composite of the population, economic, Hachman, natural amenity, and community amenity indices.

Method 1: Data Visualization

Analysis was performed on the population, economic, Hachman, natural amenity, community amenity, and the “total” indices (*see figure 8*). Initially, a visual comparison was made between each index and percent population change after determining growth and decline hotspots using the **Getis Ord-Gi hotspot tool** (*see figure 9*). Hotspot analysis was performed on (1) community percent population change and (2) each index dataset in order to identify spatially significant relationships between each index and 2000-2010 population trends.

Variable & Data Summary

Table 1. Summary of all variables, measurements, and data sources based on variable categories.

Variable	Measurement	Data Source
POPULATION		
2000- 2010 Population Trend	Percent	U.S. Census
Birth Rates 2009	Rate per 1000	ACS
Birth Rates 2014	Rate per 1000	ACS
Birth Rate Trend 2009-2014	Percent	ACS
Percent of Population Children (0-19) 2000	Percent	U.S. Census
Percent of Population Children (0-19) 2005 Estimate	Percent	U.S. Census
Percent of Population Children (0-19) 2010	Percent	U.S. Census
Percent of Population Children (0-19) 2000-2010 Trend	Percent	U.S. Census
Percent of Population Labor Force (20-59) 2000	Percent	U.S. Census
Percent of Population Labor Force (20-59) 2005 Estimate	Percent	U.S. Census
Percent of Population Labor Force (20-59) 2010	Percent	U.S. Census
Percent of Population Labor Force (20-59) 2000-2010 Trend	Percent	U.S. Census
Percent of Population Retirees (60+) 2000	Percent	U.S. Census
Percent of Population Retirees (60+) 2005 Estimate	Percent	U.S. Census
Percent of Population Retirees (60+) 2010	Percent	U.S. Census
Percent of Population Retirees (60+) 2000-2010 Trend	Percent	U.S. Census
ECONOMIC		
Median Income Trend 2000-2010	Percent	U.S. Census
Unemployment Rate Trend 2000-2010	Percent	U.S. Census
Percent with a Bachelor's or Higher 2000-2010	Percent	U.S. Census
Median Home Value Trend 2000-2010	Percent	U.S. Census
Poverty Rate 2000-2010	Percent	U.S. Census
Hachman Index	Index Rating	RPG Calculation
Number of Large Employers (Over 50 Employees)	Number	NAICS
NATURAL AMENITIES		
Average Low January Temperature	Temperature	city-stats.org
Average High July Temperature	Temperature	city-stats.org
Comfort Index (Humidity and Afternoon Summer Temperature)	Index Rating	city-stats.org
Average Snowfall	Inches	city-stats.org
Average Days of Sunshine per Year	Number	city-stats.org
Topographic Variation	Difference in Elevation within a 10 mile radius	Utah AGRC
Proximity to a National Park, State Park, or National Monument	Number within a 10 mile radius	Utah AGRC
Area in Open Water	Percent within a 1 mile radius	Utah AGRC
Area Owned by U.S. Forest Service	Percent within a 10 mile radius	Utah AGRC
Access to Recreational Opportunities	Number of Ski Resorts, Trailheads, Local Parks, Boat Launches, and Campsites	Utah AGRC
COMMUNITY AMENITIES		
Grocery Stores	Number within City Limits	NAICS
Financial Institutions	Number within City Limits	NAICS
Hospitals	Number within a 30 mile radius	Utah AGRC
Emergency Medical Centers	Number within City Limits	Utah AGRC
Specialty Health Care	Number within a 10 mile radius	Utah AGRC
Medical Centers	Number within a 10 mile radius	Utah AGRC
Shopping Opportunities	Number within a 10 mile radius	NAICS
Higher Education Campus	Number within a 10 mile radius	Utah AGRC
Schools (K-12)	Number within a 10 mile radius	Utah AGRC
Retirement Centers	Number within a 10 mile radius	Utah AGRC
Libraries	Number within City Limits	Utah AGRC
Museums	Number within City Limits	Utah Dept. or Heritage and Arts
Community Centers	Number within City Limits	NAICS
Movie Theatres	Number within City Limits	NAICS
Gas Stations	Number within City Limits	NAICS
Restaurants	Number within City Limits	NAICS
Places of Worship	Number within City Limits	Utah AGRC
Police Services	Number within City Limits	Utah AGRC
Fire Protection Services	Number within City Limits	Utah AGRC
Interstate Access	Binary Access within 10 miles	Utah AGRC
Count of all Community Amenities	Total Number of Amenities	Varied

Getis Ord-Gi Hotspot Analysis

The Getis Ord-Gi hotspot tool was used to determine statistically significant clusters of positive and negative scores (see figure 9). First, a hotspot analysis was performed on percent population change between 2000-2010 and then population estimates between 2000-2014. This method determined where population decline “hotspots” had occurred between 2000-2010 and 2000-2014 estimates based on percent population change.

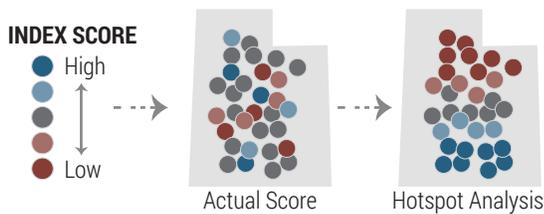


Figure 9. Data visualization through hotspot analysis.

These preliminary population change hotspot maps were then compared against a hotspot analysis of each index. This method was used to provide a quick assessment of the visual relationships between the variables (indices) and percent population change and to determine clusters of high and low scores (see figure 10).

(For a full description of hotspot methodology see Appendix A, pg. 46).

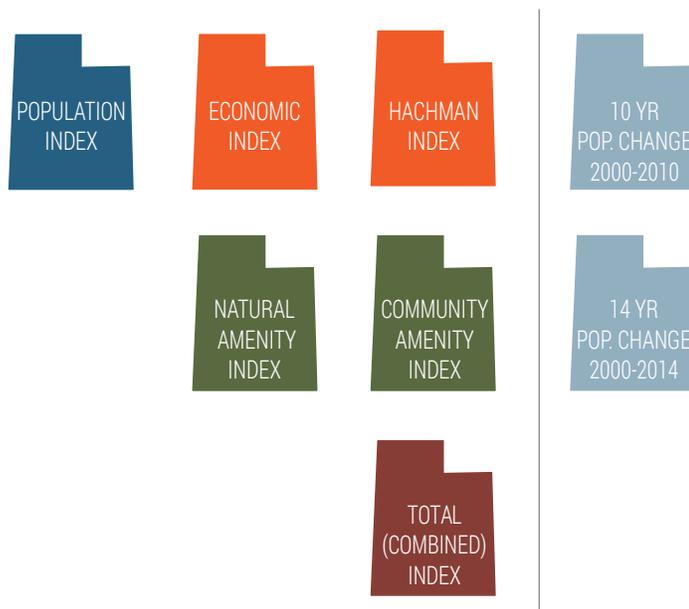


Figure 10. Each index hotspot map was visually compared to the 2000-2010 and 2000-2014 population change hotspot maps to determine if there were similar hotspot clusters.

Method 2: Linear Regressions

After the initial hotspot analysis, linear regression modeling was used to determine the significance of the relationship between population change and each index (see figure 11). Additionally, the population, economic, and amenity indices were combined into a “total” index which was also tested. Modeling was done using Microsoft Excel where each index was tested against percent population change (2000-2010 and 2000-2014). Significance was determined from R-score, F Significance, and a P-score values less than .05 or within the 95th percentile (Rumsey, 2010).

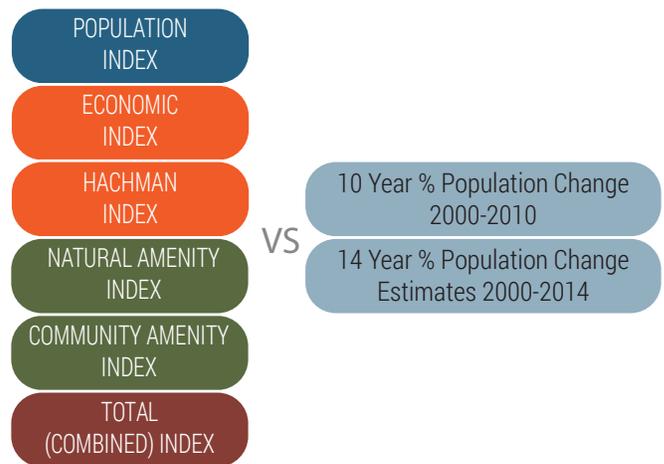


Figure 11. Preliminary linear regression models were between indices and population change.

Study Improvements & Adjustments

After the initial analysis, the following adjustments were made to the analysis in order to improve the viability of the study and results. The final regression tests focused on individual variables rather than indices.

- Improving the sample size
- Accounting for multicollinearity
- Testing individual variables by category
- Testing the top 3 variables from each category based on lowest P-scores
- Testing only statistically significant variables (P-score less than .05)

Sample Improvements

Within this study, the original sample of 160 communities contained towns that were likely experiencing population growth because of their proximity to larger cities such as Logan and St. George. Ganning et al. (2013), found that non-metropolitan places are influenced by approximation to other cities and urban commuting.

In order to determine which communities were possibly skewing the data, CBSA (core based statistical areas) were obtained from the Census. Forty-three communities were eliminated based on available CBSA data for the state of Utah. Urban influence was calculated in GIS by creating a 20 mile buffer (based on commute time) around each CBSA designated city. Communities within the 20 mile buffer were eliminated leaving a sample size of 117.

Multicollinearity

In addition to adjusting the sample size, several variables were adjusted or eliminated in order to account for multicollinearity. **Multicollinearity** refers to the case when two or more variables are inherently correlated and are essentially measuring the same thing. For example, the population variables were all highly correlated since birth rates and age groups are already components of population change. When additional regression models were run, population variables were tested in a series of separate models (see Appendix B, pg. 53). Multicollinearity could also be found in amenity related variables. For example, July high temperatures were tested separately from the comfort index since the comfort index is a composite of July high temperatures and humidity.

Final Analysis of Variables

Final variable tests were done in three phases, maintaining 2000-2010 percent population change as the dependent variable (see figure 12).

1. Separate, category-based regression models
2. Top 3 variables from each category (based on lowest P-scores)
3. Only statistically significant variables

For reasons outlined, it did not make sense to determine which variables were most significant within the population category since each variable already shared a correlation. The labor force (20-59) age division was determined to improve overall statistical significance after regressions were performed on age divisions separately (see Appendix B, pg. 53). For this reason the labor force age division was included as an independent variable in the final models.

The top three variables from each category were tested followed by a final model that tested only statistically significant variables. Out of the category based test, top three variable test, and statistically significant variable tests the following two variables were determined to be statistically significant:

1. Median Income Trend
2. Hospital Proximity

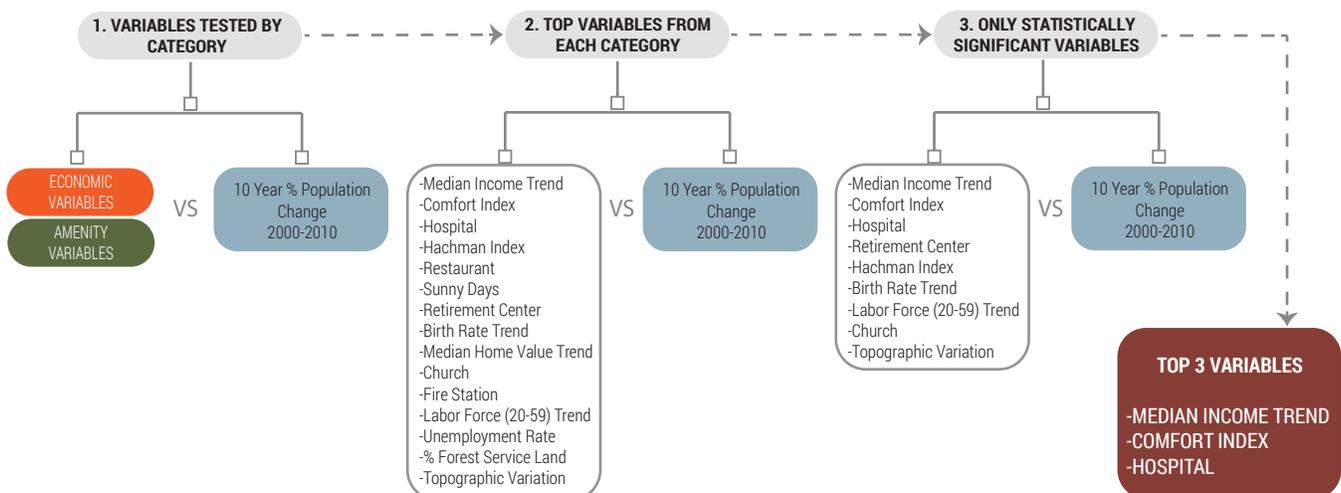


Figure 12. The 3 phases of the final statistical analysis between variables.

Methodology of Case Study

Case studies are a basic method of scientific understanding which allows for the practical application of research findings (Ruddin, 2006). Ruddin (2006) quotes “We do not infer things ‘from’ a case study; we impose a construction, a pattern of meaning “onto” the case” (Ruddin, 2006). For this project Escalante, Utah was used as a case study onto which research findings were imposed in order to generate real-world, practical applications.

Escalante, UT

Escalante has experienced significant population loss and economic restructuring since the closing of the Paul Steed Sawmill in 1991 and the designation of the Grand Staircase National Monument in 1996. These two events reflect the double-edged sword of natural resource dependency; despite wealth creation and high-paying jobs, these economies are especially susceptible to cycles of expansion and decline (Krannich and Luloff, 1991). Today, the tourism and recreation industries have become central components to the local economy (Petrzelka and Marquart-Pyatt, 2012).

The transition of Escalante’s economy from a resource-based economy to a tourism economy has brought both challenges and opportunities. Tourism economies are most often associated with volatile, seasonal low-wage jobs with few benefits. These challenges resonate in frustrations from local leaders. Escalante mayor Jerry Taylor said in 2010, “Yeah, the monument has brought some government jobs here and it’s helped the tourism - it’s the other jobs we need here.” (Miller, 2015).

Between 2000 and 2010, Escalante experienced a 3% population decline from 818 to 797. While a decline of 3% may not seem drastic, the impact was felt heavily by the schools (see figure 13). In 1996 there were 140 children enrolled in seventh through 12th grade and by 2015 that number had dropped to 50 (Miller, 2015).



Figure 13. Drop in school enrollment 1996-2015.

“Yeah, the monument has brought some government jobs here and it’s helped the tourism - it’s the other jobs we need here.”

-Escalante Mayor Jerry Taylor



Community Concerns

The city invited the Rural Planning Group to perform a community analysis in July 2016 in order to assist with planning recommendations and develop strategies for their future. Many of the same issues and concerns were brought up by residents and town officials in 2016.

- Lack of long-term employment options
- Not enough jobs to support young families
- Concern for the schools and students
- Limited affordable housing options
- Distrust and frustration with the state and federal governments
- Lack of dependable seasonal employees
- Concern for losing cultural heritage and sense of place

Community Vision & Goals

The first step to effective community development begins at home and involves defining assets and establishing local goals. Escalante residents expressed a variety of differing opinions and concerns, however they shared many of the same goals. By reaching out to local leadership and community members, three common overall goals were established:

1. Economic development
2. Stable community demographics
3. Economic diversification

With these goals in mind, the RPG reviewed the data on Escalante's population, economic, and amenity-based variables. This data, in addition to the goals provided by the community, provided a baseline and overall direction for the on-site visit. Before a two-day on-site assessment, additional preparations were made to canvas the town through on-site evaluations and door-to-door surveys.

On-site evaluations included an assessment of building conditions, road conditions, inventory of community amenities, and main street assessment. Additionally a door to door community survey, business survey, and local leadership survey were given in order to confirm community goals and perceptions.

As one of the 117 study communities, Escalante's scores for each population, economic, and amenity-related variable were compiled, focusing on the variables that were determined to be most significant from each category test and final regression test. From there it was evaluated which variables Escalante could control and plan for and which best fit the town's goals and vision. Based on data collection, assessment, goals, on-site evaluation, and research results, recommendations were made.

FINDINGS

General 2000-2010 Population Trends

Utah's population grew 23.8% between 2000-2010 with Utah and Washington County showing the most growth (see figure 14). The Provo-Orem area as well as St. George were among the fastest growing Metropolitan Statistical Areas (MSA) in the nation (U.S. Census Bureau, 2010). While the contrast between Utah's rural and urban growth rates during those 10 years is striking, it is not surprising after reviewing the existing literature and census reports.

Of the 117 study communities, 28 (24%) of the communities experienced decline while 5 (4%) were stagnant. Stagnation was defined as a population change (either positively or negatively) that was less than or equal to .005%. Thirty-four (29%) of the study communities grew by less than 1%. Growth rates ranged from 0.1 to 8.2% with an average rate of 1.3% (see figure 15).

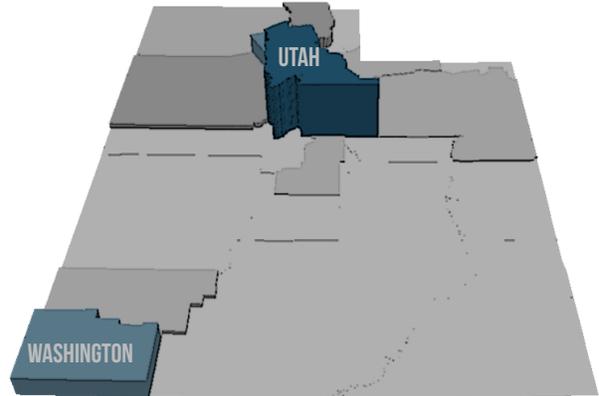


Figure 14. Extruded 2000-2010 population change by county. Blue represents counties that grew the most.

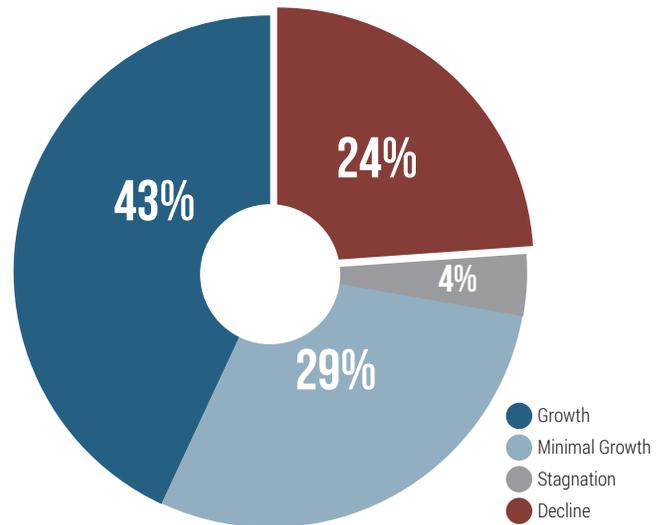
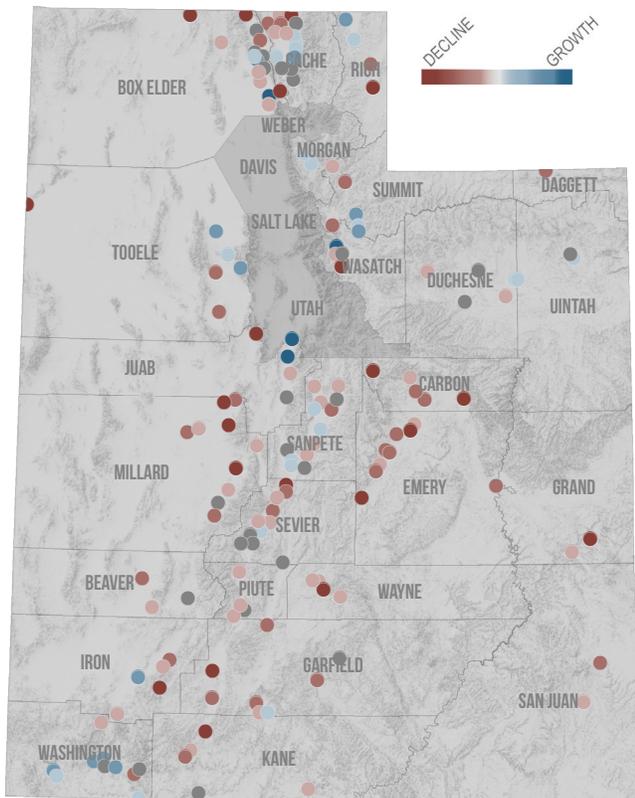
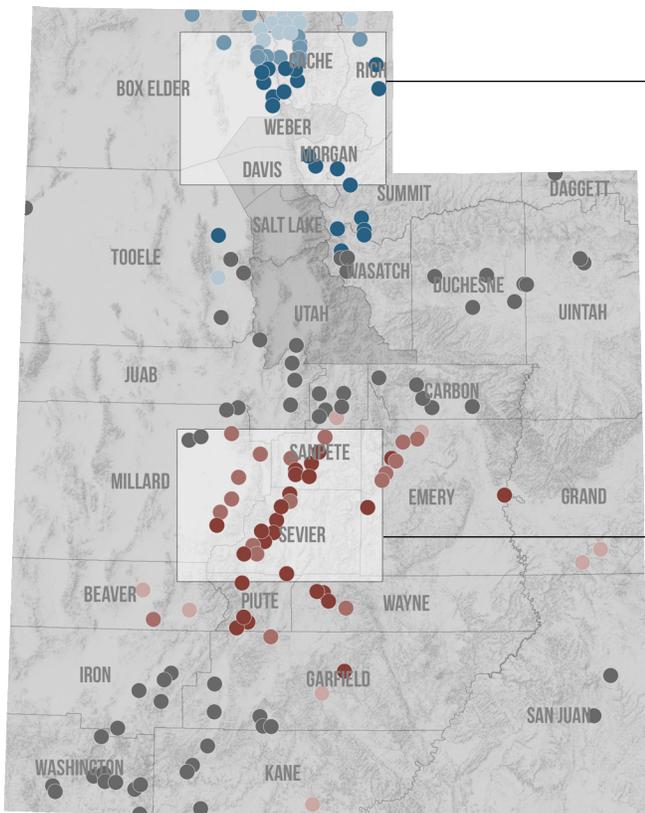


Figure 15. Percent of the 117 communities which experienced decline, stagnation, or minimal growth (less than 1%) between 2000-2010.



% POPULATION CHANGE ACTUALS 2000-2010



% POPULATION CHANGE HOTSPOT ANALYSIS 2000-2010

Results of Index Hotspot Analysis

Population grew the most between 2000-2010 in communities in and near Cache County as well as communities bordering the Wasatch Front. Communities in the central and southern parts of the state show clusters of low or declining populations. Note that county level population measurements (see figure 14) include the Wasatch Front while the hotspot analysis (see figure 16) excludes the Wasatch Front and measures population change at the community level.

Results reflect the geographic influence of population trends and related variables. While economic structure and amenities are important factors, a community's growth or decline is also a function of the distance to and growth of the nearest city. Factors such as income, population growth rates, nearest city or set of cities, and demographic and economic structures influence regional population trends (Ganning et al., 2013).

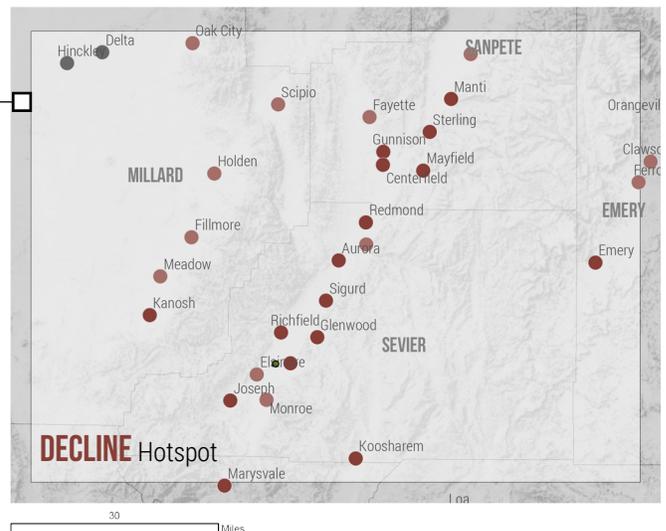
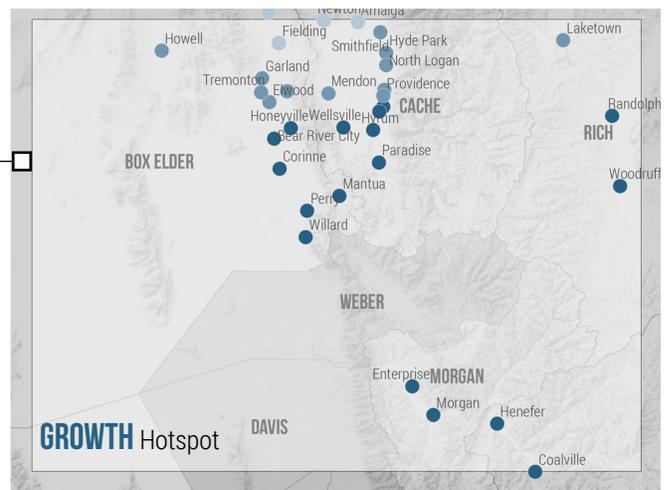


Figure 16. 2000-2010 population change actuals and hotspot analysis for the original 160 communities. Growth and decline hotspots are magnified.

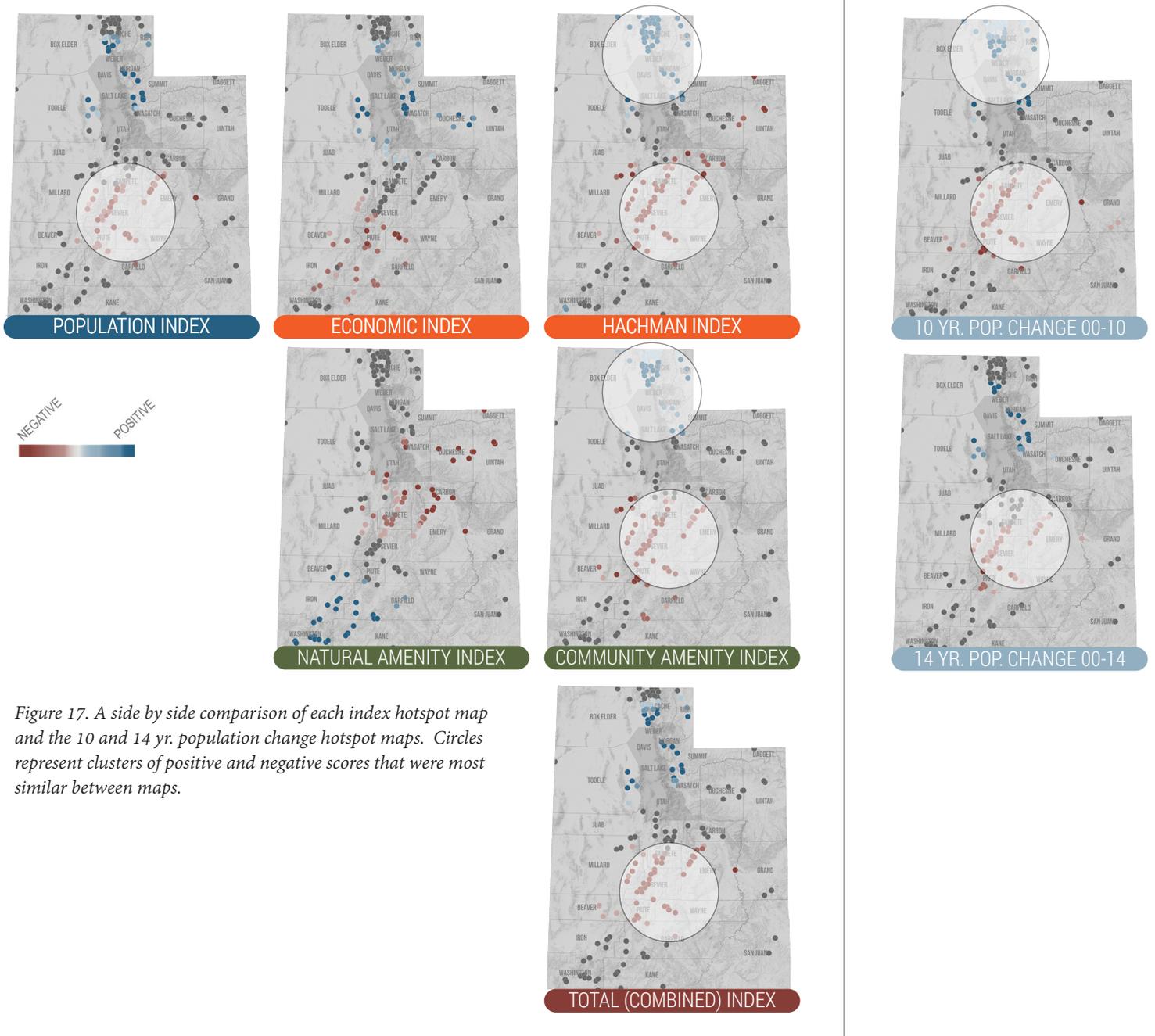


Figure 17. A side by side comparison of each index hotspot map and the 10 and 14 yr. population change hotspot maps. Circles represent clusters of positive and negative scores that were most similar between maps.

While there were similar patterns between each of the index and population change hotspot maps, the strongest visual correlations were between the **10 yr. population change** hotspot map, and the **Hachman** and **community amenity** index hotspot maps (see figure 17). Both the Hachman and community amenity maps showed similar clusters of positive scores (blue) to the north, and clusters of negative scores (red) in the south-central part of the state. This suggests that regions with collectively diverse economies as well as a variety of local services showed similar growth and decline patterns.

Other index hotspot maps that showed strong visual correlations with negative clusters (red) were the **population**, and **total (combined)** index maps. Both the population and total index maps contain the 2000-2010 population trend dataset and similarities were expected. The maps with weaker visual correlations were the **economic** and **natural amenity** index maps. The weak correlation between economic and natural amenity hotspot clusters and population change was unexpected since the literature suggests there is a strong correlation. While hotspot analysis is a valuable method for showing spacial trends and the influence of neighboring communities, it cannot prove or disprove correlation between variables (see Appendix A, pg. 47-48 for large scale maps).

Results of Index Regression Models

Table 2 provides the results of the initial regression between 2000-2010 percent population change and each index. Relationships were considered significant if probability (P-value) was less than .005. Overall results were highly significant (R Square = 78%) with the strongest correlations between the **Hachman Index** (a positive correlation) and the **economic index** (a negative correlation).

Table 3 provides the results of the same regression as Table 2 but with 2000-2014 percent population change estimates as the dependent variable. In this case the strongest correlations were between the **population index** (a positive correlation) and the **Hachman Index** (a negative correlation). Results showed an extremely high correlation (R Square = 89%).

Notably, the results of the hotspot and the regression model analyses were very different. However, the results do show that trends follow regional patterns and that multicollinearity is an important consideration when regression models are being developed.

Both preliminary regression tests showed high significance and strong correlations with multicollinearity likely explaining these results. For example, the Economic Index includes a composite of the Hachman Index meaning that the two are essentially measuring the same thing. Similarly, the Population Index is a composite of both 10 and 14 year population trends.

For the purpose of this project it was essential that variables be tested separately and not as composites. Additionally the community sample size was improved and the following results reflect the adjusted number of communities n=117 (see methodology section for further descriptions). 2000-2010 percent population was used consistently as the dependent variable from this point forward.

Table 2. Regression results for 2000-2010 percent population change and indices.

Index	Coefficient	Std. Error	t-Statistic	Prob.
Hachman	0.178	0.054	3.307	0.001
Economic	-0.156	0.075	-2.083	0.039
Total	0.428	0.235	1.820	0.071
Natural Amentiy	-0.045	0.036	-1.251	0.213
Population	0.045	0.117	0.382	0.703
Community Amenity	0.007	0.020	0.338	0.736

Dependent Variable	2000-2010 Percent Population Change
R Square	0.784
Adjusted R Square	0.776
Significance F	2.068E-48
Observations	160

Table 3. Regression results for 2000-2014 percent population change estimates and indices.

Index	Coefficient	Std. Error	t-Statistic	Prob.
Population	0.830	0.150	5.543	0.000
Hachman	-0.164	0.069	-2.364	0.019
Total	-0.587	0.302	-1.946	0.054
Economic	0.160	1.663	1.663	0.098
Natural Amentiy	0.059	0.046	1.275	0.204
Community Amenity	0.010	0.026	0.401	0.689

Dependent Variable	2000-2014 Percent Population Change Estimates
R Square	0.892
Adjusted R Square	0.888
Significance F	2.668E-71
Observations	160

Results of Individual Variable Regression Models

1. Variables by Category

Economic Variables

Table 4 provides the results of the economic variable regression model. Results indicate that the highest correlations were between the **Hachman Index** and **median income trend**, both positive correlations. Significance was relatively high (R Square =23%).

Natural Amenity Variables

Table 5 shows results of the natural amenity variable analysis. **Topographic variation** showed a positive correlation with a P-score of .03 . Approximately 14% of response variable variation could be explained by a linear model.

Community Amenity Variables

Table 6 provides the results of the community amenity variable regression tests. Final results showed that **hospitals** had a positive correlation with population change with a P-score of .003. Approximately 16% of response variable variation could be explained by a linear model.

Table 4. Regression results for economic variables.

Index	Coefficient	Std. Error	t-Statistic	Prob.
Hachman Index	0.371	0.095	3.892	0.000
Median Income Trend	0.245	0.067	3.671	0.000
Median Home Value	0.099	0.055	1.804	0.074
Unemployment Rate	0.009	0.007	1.359	0.177
Poverty Rate	0.018	0.014	1.305	0.195
Bachelor's Degree or Higher	0.022	0.017	1.270	0.207
Number of Large Employers	0.002	0.002	0.632	0.529

Dependent Variable	2000-2010 Percent Population Change
R Square	0.225
Adjusted R Square	0.175
Significance F	0.0002
Observations	117

Table 5. Regression results for natural amenity variables.

Index	Coefficient	Std. Error	t-Statistic	Prob.
Topographic Variation	0.000	0.000	2.195	0.030
Number of Sunny Days	-0.002	0.001	-1.644	0.103
Proximity to NP ST NM	0.135	0.120	1.124	0.263
Area of Open Water	0.238	0.220	1.083	0.281
July High Temp.	0.005	0.006	0.894	0.373
Annual Snowfall	-0.001	0.001	-0.797	0.427
Recreation Opportunities	0.001	0.002	0.433	0.666
January Low Temp.	-0.001	0.005	-0.263	0.793

Dependent Variable	2000-2010 Percent Population Change
R Square	0.136
Adjusted R Square	0.072
Significance F	0.0388
Observations	117

Table 6. Regression results for community amenity variables.

Index	Coefficient	Std. Error	t-Statistic	Prob.
Hospital	0.020	0.007	3.027	0.003
Retirement Center	0.011	0.010	1.114	0.268
Medical Center	0.013	0.021	0.637	0.526
Community Center	0.034	0.058	0.585	0.560
Restaurant	0.000	0.003	0.131	0.896

Dependent Variable	2000-2010 Percent Population Change
R Square	0.155
Adjusted R Square	0.117
Significance F	0.0019
Observations	117

2. Top Three Variables From Each Category

After it was determined which variables had the strongest relationship to population change within each category, a regression model was performed which included the top three variables from each category with the lowest P-score, not necessarily statistically significant variables.

Table 7 shows the results of the top three variables from each category. Correlations were found between **median income trend** (percent change in median income between 2000-2010), **hospitals** (within a 30 mile radius), and **medium home value trend** (all of which showed a positive correlation). Significance was relatively high (R Square = 32%).

Table 7. Regression results for top three variables.

Index	Coefficient	Std. Error	t-Statistic	Prob.
Median Income Trend	0.187	0.066	2.838	0.005
Hospital	0.016	0.007	2.297	0.024
Median Home Value Trend	0.125	0.054	2.293	0.024
Birth Rate 2009	0.000	0.000	1.901	0.060
Hachman Index	0.174	0.103	1.691	0.094
Proximity to NP ST NM	0.168	0.104	1.617	0.109
Retirement Center	0.012	0.010	1.209	0.229
Labor Force (20-59) 2000	-0.405	0.347	-1.168	0.245
Topographic Variation	0.000	0.000	1.030	0.306
Number of Sunny Days	-0.001	0.001	-0.947	0.346
Medical Center	0.007	0.020	0.329	0.743

Dependent Variable	2000-2010 Percent Population Change
R Square	0.323
Adjusted R Square	0.252
Significance F	1.228E-05
Observations	117

3. Only Statistically Significant Variables

When only statistically significant variables were tested (see table 8), results indicated that the variables with the strongest correlation with rural population change were:

1. **Median income trend (a positive correlation)**
2. **Hospital proximity (a positive correlation)**

Table 8. Regression results for only statistically significant variables.

Index	Coefficient	Std. Error	t-Statistic	Prob.
Median Income Trend	0.196	0.068	2.895	0.005
Hospital	0.018	0.007	2.662	0.009
Hachman Index	0.203	0.104	1.955	0.053
Birth Rate 2009	0.000	0.000	1.845	0.068
Topographic Variation	0.000	0.000	1.132	0.260
Labor Force (20-59) 2000	-0.223	0.342	-0.654	0.515

Dependent Variable	2000-2010 Percent Population Change
R Square	0.241
Adjusted R Square	0.199
Significance F	2.773E-05
Observations	117

Final Regression Model Results

Median income trend had the lowest P-score in both models and showed a positive correlation. This indicates that communities in which the population grew the most between 2000-2010, also likely experienced a rise in median income.

Hospital proximity (within 30 miles) showed a positive correlation with population growth. Communities with a hospital within 30 miles were most likely to experience population growth between 2000-2010.

For correlation matrices, preliminary regression models, demographic age group regressions, and scatter plots of regression model residuals, see Appendix B, pg. 49.

Escalante Case Study Results

Population Characteristics

As stated, Escalante’s population decreased by 3% between 2000-2010. Available data on birth rates showed zero births in 2009 with low future projections. Most notable, the change in age structure showed a significant decline in children (-26%), limited growth in the labor force (2%) and a significant increase in retirees (28%) (see figure 18).

The community’s goal of demographic diversity is highly appropriate since the aging population is increasing and not being replaced by younger generations. Additionally, the small gain in the labor force reflects the lack of attractive, long-term job opportunities.

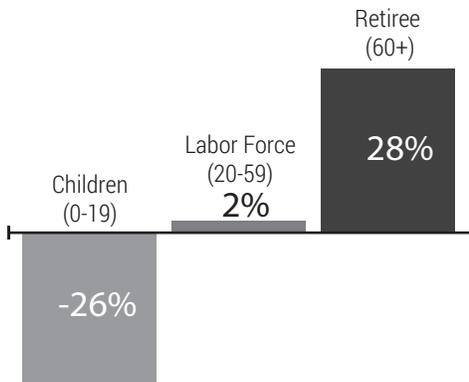


Figure 18. Change in age structure 2000-2010.



Figure 19. Change in median income adjusted and unadjusted.



Figure 20. Rise in home value.

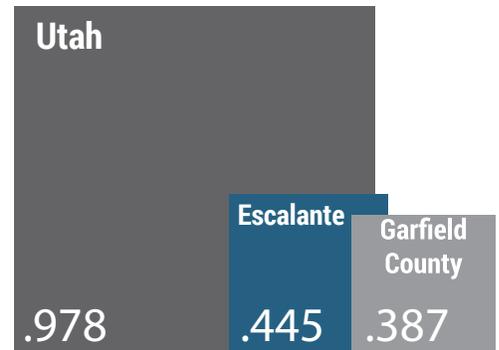


Figure 21. Hachman Index comparisons. Escalante has better economic diversity than the county.

Economic Characteristics

Data shows that Escalante’s median income increased by 3.4%. This seems like good news but when inflation is considered, the median income actually decreased by 18% (see figure 19). In order to test whether median income was still statistically correlated with inflation, an additional regression model was performed using 2000 actual income numbers. Results showed that median income remained the most significant variable (P-value=.035). Future studies should account for inflation when determining variable relationships.

While adjusted income trends show an ongoing decline, home values grew by 5% (see figure 20). While home value was not a significant correlation, the fact that income is going down and housing costs are going up is concerning. Housing affordability is already a significant challenge and trends show home values growing over time.

Escalante’s Hachman Index score was .445 which is greater than Garfield County’s overall score of .387 (see figure 21). Additionally there are more employers per capita and large employers in town than most of rural Utah. This suggests that the economic situation can improve and potentially improve the more negative socioeconomic and demographic trends.



Natural Amenity Characteristics in Escalante

Despite Escalante’s size, the community has many excellent assets and amenities. Known as “the gateway to Hole in the Rock,” Escalante is part of a majestic region known for the plethora of unique outdoor attractions available.

Escalante ranked 54 out of 117 on the community-level natural amenity-index, scoring .14 (see figure 22). The highest scoring community was Willard at 4.34 and the lowest scoring community was Woodruff at -2.28 (the range was 6.62). While it is difficult to compare the national and local-level scales, these results illustrate the uniqueness of each community and the difficulty in capturing the “amenityness” of each place (Ganning and Flint 2010).

Individual natural amenity variables showed a wide range of scores. Escalante’s comfort index score (humidity and afternoon temperature) was 61 while the average was 65 (see figure 23). Topographic variation showed an average of 1,406 ft. with Escalante at 1,212 ft of variation within a 10-mile radius (see figure 24).

Surprisingly, the community only scored 6 recreation opportunities when the average was 14.94 (see figure 25). This is likely due to data quality, distance (10-mile radius), and the type of recreation opportunities included in the analysis. As will be discussed, future studies are needed to improve the measurement of recreation. Since federal land ownership has been a challenge to Escalante’s growth, it was not surprising that 66% of the land within a 10-mile radius was National Monument land (NPSPNM). The average was 8% (see figure 26). While the percent of NPSPNM land was not found to be statistically significant in regressions, it does limit the possibility of future expansion and affects the local economy in both positive and negative ways.

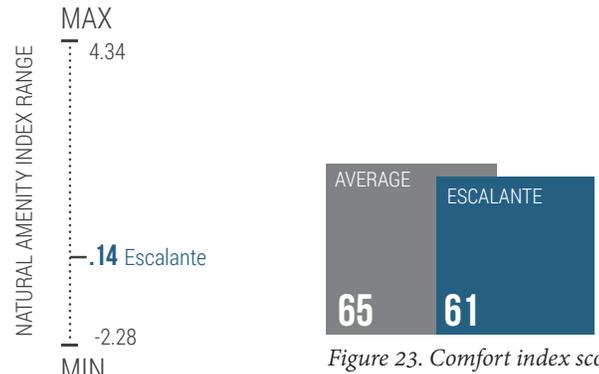


Figure 22. Escalante scored .14 on the community-level natural amenity index.

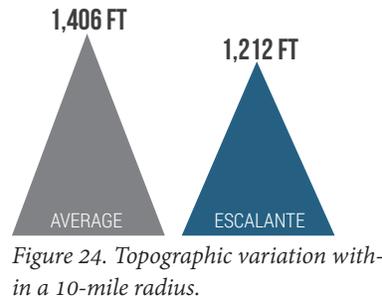


Figure 24. Topographic variation within a 10-mile radius.



Figure 25. Recreation opportunities within a 10-mile radius.

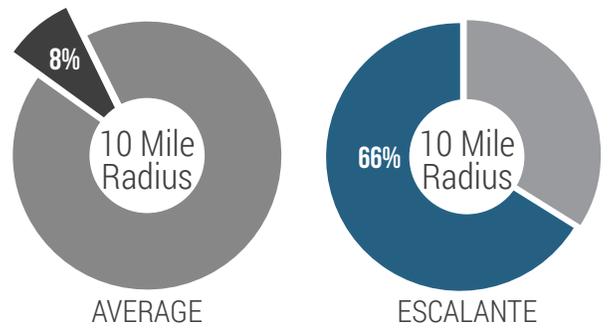


Figure 26. Average percent of NPSPNM land within a 10-mile radius was 8%. 66% of the land surrounding Escalante National Monument.





Figure 27. Escalante’s downtown has a variety of amenities (represented by different colors). The number and type of amenities and services a community provides can have a profound impact on the retention of businesses as well as residents.

Community Amenity Characteristics

Escalante is equipped with a number of desirable community amenities including a federal interagency visitors center, a new state of the art medical clinic, a local grocery store, and the Escalante Heritage Center. These amenities and services can have a profound impact on the retention of businesses and residents (see figure 27).

In addition to the data gathered during the course of this study, the RPG did an on-site inventory of all Escalante’s community amenities in addition to reviewing the data that had been gathered. Between the gathered data and the on-site inventory, one discrepancy was found. Escalante has a recently restored movie show-house which was not reported, otherwise the data matched the on-site inventory.

While data was gathered for a large variety of community amenities, it may be valuable for future studies to include additional amenities such as lodging and hospitality services. Escalante has a large number of hotels and other lodging services which were not included in the initial dataset. Recreation services such as tour guides and ATV rentals are important components of the local economy and including them may improve future analysis.

Analysis results indicated that having a hospital (within 30 miles) had a significant impact on growth. Escalante does not have a hospital within 30 miles; however, the community does have a new medical clinic. Clinics are classified differently from hospitals by size and capacity even though they provide similar services.

Even though medical clinics were not statistically significant, the fact that Escalante is able to provide medical services and jobs is important. If future growth does occur, the medical center could expand in order to provide healthcare for future residents. Escalante’s future plans can build off of the infrastructure and programs that are already in place.



Ephraim, U.T.

Overall Findings Summary

As expected, population hotspots showed regional patterns where population decline was concentrated in the more rural parts of the state with Index hotspots following similar patterns. The Hachman, community, population, and “total” index hotspot maps showed the strongest visual correlations.

Although multicollinearity must be taken into consideration, preliminary index regression models for both time-frames (2000-2010 and 2000-2014) showed that the Hachman Index (economic diversity) was statistically significant. These preliminary results suggested that communities with less diverse economies were more likely to experience decline than communities with more diverse economies.

When individual variables were analyzed, the Hachman Index as well as median income trend were the strongest economic indicators for population change. Within the natural amenity variable category, topographic variation had the strongest relationship to population change and within the community amenity variable category, hospital proximity was found to have a significant relationship to population change. Overall, two variables were found to be statistically significant - median income trend and proximity to a hospital (30 miles). This means that communities with low average median incomes and communities further than 30 miles from a hospital were most likely to experience population decline between 2000-2010.

While Albrecht’s (2010) results suggest that natural amenities are the most significant indicators for growth or decline, when variables were tested at the community level, economic variables were found to have a stronger impact on population change. Community specific findings for Escalante showed both expected results (age trends) as well as unexpected results (number of recreation opportunities). The next section will discuss findings in greater detail.

DISCUSSION

Which Kinds of Demographic, Economic, and Biophysical Variables are Most Strongly Correlated with Rural Population Decline?

1. Joint Influence

(For a full review of research questions and objectives see page 10).

First, population change is the result of many different factors and variables. These factors interact with and often depend on each other to jointly influence population change (Chi and Ventura, 2011) (see figure 28). No single factor or variable individually determines the direction or magnitude of population change (Chi and Ventura, 2011).

Planners and researchers should recognize that the variables correlated with population change do not exist independently from each other. While this report identified the significance of individual variables, results suggest that decision makers should have the flexibility to adapt to different circumstances and not to adhere to a single set of factors or variables in all cases (Chi and Ventura, 2011).

However, results also support the evidence that economically advantaged communities with higher median incomes are more likely to grow than their less advantaged counterparts. Notwithstanding, the role of median income must be coupled with an understanding of the joint influence of other economic, demographic, and biophysical variables. For example, a high median income is tied to adequate housing and employment, economic diversity, low poverty rates, attractive physical amenities and local services, livability, ect.

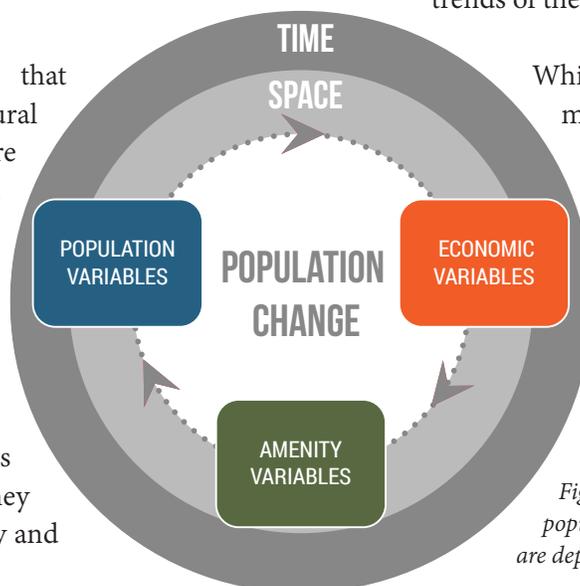
Additionally, results suggest that communities with desirable natural and community amenities are better able to attract growth and development than communities with less desirable features. Findings indicate that topographic variation is a desirable natural amenity; however, topography by itself does not equal growth. Similarly, community amenities such as hospitals exist because they are supported by the local economy and adequate infrastructure.

2. Time

Second, the factors that influence population change have different strengths of impact depending on temporal factors. A specific variable could be highly influential in one time period but ineffective in another. Similarly, a variable could have a positive effect on population growth in one time period and a negative effect in another (Chi and Ventura, 2011).

The findings of this project inherently reflect the trends of the 2000-2010 time period and in particular, the 2008 recession. For example, the weak relationship between natural amenities and population change in this study seems contrary to the results of the Albrecht (2010) study. As stated, his regional study found the presence or absence of natural amenities to be the strongest indicator for rural population change; however, Albrecht also states that during times of economic “sluggishness” other more traditional variables (such as economics) become more important predictors (Albrecht, 2010).

Between 2000-2010, families who would have otherwise moved to high amenity locations, may have been constrained financially and remained in place. Jobs in high amenity locations may not have provided sufficient income during the recession where otherwise they would have been sufficient. Consequently, relationships between variables and population change are dependent on the economic trends of the time frame being analyzed.



While research on the impact of macroeconomic events on local rural population shifts is needed, planners and decision makers should plan for a dynamic future and acknowledge that the factors which influence population change are dependent on both temporal and spacial factors (Chi and Ventura, 2011).

Figure 28. The factors that influence population change have a joint influence and are dependent on both time and space.

3. Space

Third, population trends interact with, and influence population trends in neighboring areas. Mapping the population trends and index scores showed a wide distribution of scores across the state, but after hotspot analysis demonstrated statistically significant clusters of data, regional trends were highly visible. This suggests that while each community is unique, they are still linked spatially within a region

Ganning et. al. (2013) suggests that in order for nonmetropolitan places to have effective growth policies, they need to understand the geographic reach of their economic linkages. Connectivity can be enhanced by both physical interactions (such as improved transportation networks), and social interactions (such as mayors from neighboring communities coordinating planning efforts). In this way, geographic linkages between places can greatly influence economic growth and development between communities. Policies should allow for flexible planning that allows communities to pursue goals with different cities according to the markets, characteristics, goals and strengths of each community (Ganning et. al., 2013).

4. Economics

Fourth, the preliminary regression models of the population, economic, and natural and community amenity indices indicated that the Hachman and economic indices were highly correlated with population change. While no single factor can determine population change, findings suggest that economic variables are the best predictors for local population trends (when measured as a composite of economic variables) rather than the natural amenity index.

If an economic index or combination of economic variables is the best predictor of local population trends, it suggests that communities do have more control over the variables that influence growth and decline. While the presence or absence of natural amenities is outside of a community's control, many economic factors can be improved through careful planning efforts, programs, and education (Albrecht, 2014.)



Findings also suggest that when variable categories are combined, such as an economic index, their combined influence is greater than if the variables are considered individually. Similar to the spokes of a wheel, individual variables are connected and influence one another. For declining communities, this suggests that focusing on a single variable will not likely have a large impact on population decline. Understanding how each variable or “spoke” fits together and planning for each of those factors will have a greater impact.

Future research is needed to determine the best approach for creating and comparing variable indices as well as to determine the value of an economic index as the best indicator for local population trends. It should also be determined whether or not individual variables should be weighted differently. A hospital, for example, is not the same as a restaurant and may need to be weighted more heavily. A methodology is needed for determining the magnitude of individual variables.

5. Median Income & Hospitals

Fifth, there was some variation as to which independent variables had the most significant relationship to population decline but two variables were consistently significant: **median income** and **proximity to a hospital**.

Both an economic and community amenity variable were significant in the final model. This supports the conclusion that a combination of variables, not just a single variable or variable category, needs to be considered in order to understand and address growth-related challenges. It does not mean that pursuing these two variables should be the focus for every declining community. As discussed, each community is uniquely situated and depends on both spatial and temporal factors.

6. Economic Diversity

Sixth, additional variables that showed significance within the category (population, economic, and amenities) models should also be acknowledged. Surprisingly, in the economic variable analysis, economic diversity had a strong correlation with population growth while the number of large employers did not.

Attracting big businesses or manufacturers has long been and continues to be a strategy for declining rural communities; however, if economic diversity is more significant than the number of large employers to population growth, then the focus of declining communities should be reevaluated. Green (2001) suggests that the focus should not only be on the number of jobs, but on the quality of jobs created and local economic diversification.

7. Age Trends

Seventh, although specific age groups were not found to be significant indicators of population decline, they did influence the significance of other economic and amenity-related variables within the models.

As discussed, demographic variables were evaluated once the significant economic, natural, and community amenity variables were determined by category. Age trends were included as an independent variable next to the significant variables as well as the dependent variable in additional regression models (*see Appendix B, pg. 53*). The labor force age division improved overall model significance (when included with birth rates) and was ultimately used in the final modeling process; however, the age trend specific regression models showed a variety of interesting results.

Models in which the age groups were included as independent variables showed similar results, but with slightly different P-scores between significant variables (*see Appendix B, pg. 53*). For example, hospital proximity was significant in each model, but hospital P-score was most significant in the model containing percent labor force as an independent variable (P= .014). Similarly, the model containing percent children as an independent variable showed median income trend with the highest P-score (P=.001).

The percent children, labor force, and retiree age trends were also tested as dependent variables (*see Appendix B, pg. 53*). This was done in order to determine the influence of different age groups on population change as well as the statistically significant variables. Results showed that the children and labor force age trends were both correlated with median income trend and the Hachman Index. The retiree age group showed no significant correlations. These findings support evidence that community age trends and characteristics influence and are influenced by population trends and variables in different ways.

8. Community-Level Natural Amenity Scale

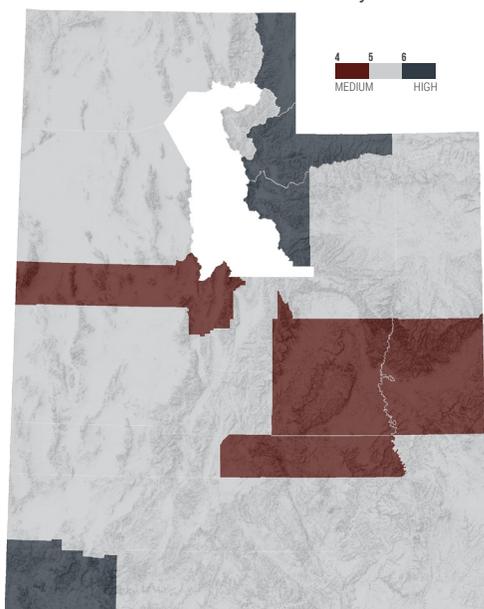
Eighth, national scales may not always be appropriate at the local or regional level. According to the McGranahan Scale, most of Utah ranks “medium to very high” in natural amenities (see figure 29) In reality, amenities vary greatly across places and geographic scales.

As stated, it is difficult to compare the national scale with the local-level scale developed for this project; however, when community-level natural amenity data was mapped, the results showed variation across county lines (see Appendix A for map methodology). While natural amenities were not found to be significant in final models, their presence or absence does impact population trends as stated by Albrecht (2010). Findings indicate that amenities do vary by community and an exploration of local and regional scales is important for future analysis of amenity-related growth and decline.

Furthermore, it is important to recognize that the presence or absence of natural amenities does not equal population change by itself. Other factors must be in place for natural amenity variables to make a difference. If, for example, a community has a highly favorable recreation destination but has no infrastructure to support visitors or capacity to provide employment or affordable housing for migrants, the presence of natural amenities is unlikely to act as a catalyst for growth. Natural amenities should be considered jointly along with economic and demographic variables in relation to population decline.

The local-scale natural amenity index map is a raster surface projection of the natural amenity index point data (see Appendix A for further descriptions).

NATIONAL SCALE Natural Amenity Index Rank



LOCAL SCALE Natural Amenity Index Rank

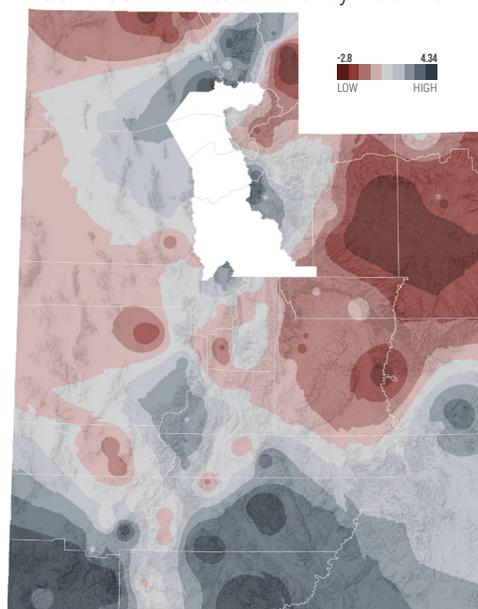


Figure 29. The National amenity index scale (left) shows only three county-level variations across Utah’s amenity rich landscape. The local amenity index scale (right) was developed to show the variation in natural amenities measured at the community-level.

9. Recreation

Ninth, it was surprising that proximity to national parks, national monuments, and state parks (NPSPNM) did not show a stronger correlation with population decline. Many communities, such as Escalante, have experienced population challenges related to state park and national monument designations. The reason for the weak correlation may be in the way in which recreation potential was measured. Potential was measured as the percent of land within a 10-mile radius of the community that was designated as a NPSPNM. A larger radius may better capture the impact. Also, recreation potential may be less about area of land devoted to recreation and more about the attractiveness of the NPSPNM and the land ownership.

Future research is needed to improve metrics as well as determine whether there is a different “draw” or attractiveness between Utah’s various national parks, national monuments, and state parks. Do towns located near more popular NPSPNM destinations grow more than less popular destinations? Do national parks have more influence on growth than state parks? These questions could be the focus of future research projects and analysis.

It was also surprising that having a higher number of recreational opportunities was not correlated with population growth. Research suggests that a community with more recreation opportunities will attract greater growth than a community with fewer opportunities. The quantity and quality of nearby recreation opportunities has the power to attract new residents, new businesses, tourism, and other growth stimulating factors (Pumphrey, 2010). In this report, recreation opportunities were measured as a count of ski resorts, golf courses, trailheads, parks, boat launches, and campsites with the assumption that more opportunities would contribute to population growth.

Similar to recreation potential, recreation opportunities may be more about the quality or type of recreation. Seasonal variations may also need to be considered between summer and winter recreation activities. The accuracy of available geographic data (such as the location of campgrounds or parks) should be considered. Future research can determine what kinds of recreation opportunities are most desirable and if seasonal variations make a difference.



Research Challenges

Data Limitations

Community specific data, especially for small rural areas, is not readily available nor accessible. Adaptations were necessary when data was not available or not in a format that could be easily analyzed. For example, the comfort index was used as a substitute for humidity data because humidity data was not readily available at the local level.

Other adaptations included variables such as birth rate trends which were limited to the years 2009-2014 since 2000-2010 trend data was not available. Geographic data also presented limitations since many of the data points were precise locations within a small radius. The accuracy and precision of data points, such as campgrounds or local parks, were affected by the availability of high resolution elevation data.

It was also difficult to establish appropriate metrics for some of the geographic variables. Measuring topographic variation as the difference between the highest and lowest elevation points within a 10 mile radius may not capture the value of topographic variation as a natural amenity. Future research is needed to establish a methodology for determining appropriate place-based metrics.

Sample Communities & Population Size

As stated, adaptations were made to the sample communities in order to control for urban-influenced population growth. Accounting for urban influence from the very beginning of the study would have saved time as well as improved the accuracy of preliminary index comparison results. Also, whether or not 117 communities is a sufficient sample size is undetermined.

Variation in population size is another factor that may need to be considered in future studies. For example, it is hard to explain why the number of churches within a community would be negatively correlated with population change until you look at the population size of the communities. A population decline of 1% for a town of 10,000 people would be a more significant population loss than for a town of 100. The town of 10,000 would likely have more churches already built than the town of 100. In this way, negative population change in larger communities would show seemingly odd correlations between certain variables such as churches. Future analysis should account for variations in population size in order to better understand the relationship between certain variables.

Variable Challenges

Some variables were found to be unreliable indicators. For example, proximity to higher education showed a negative correlation when evidence suggests that the opposite should be true. Upon reviewing the data, it was found that only three large colleges fall within the study area and that technology schools and extension offices make up the rest of the higher education sample. It is likely that tech schools and extension offices do not have the same effect as larger colleges and universities on population growth, possibly reflected by the negative correlation.

As previously discussed, multicollinearity was a significant challenge since several variables were components of other variables or indices (such as the Hachman Index as a component of the economic index). Careful considerations had to be made when testing individual variables and deductive reasoning was often necessary to interpret the results.

Escalante Case Study Recommendations

What Recommendations Should be Made to a Community with a Declining Population Based on Findings?

With Escalante’s goals in mind, the specific data was reviewed for Escalante’s population, economic, and amenity-related variables, focusing on variables that were determined to be significant as well as variables that were within the community’s control. This data was used to determine a baseline or “snapshot” of Escalante from which appropriate recommendations were made.

A set of detailed, measurable, time-specific recommendations are not the goal of this project, those specific details must be determined by the community. The intent of this document is to provide a shrinking community (Escalante) with general recommendations based on research findings that can then inform specific actions and future plans.

1. Joint Influence: Plan Comprehensively

As discussed, population change is jointly influenced by a variety of factors and variables. A city such as Escalante cannot combat population decline if their focus is singular. Future plans and policies will be most effective if they comprehensively consider population dynamics, housing, economic development, transportation, existing local services, natural and cultural resources, land use planning, and other elements (Chi and Ventura, 2011).

2. Space: Promote Regional Collaboration

Communities which are linked geographically are likely to experience similar population trends. These spacial linkages can have a huge impact on economic growth and development (Chi and Ventura, 2011). Escalante has the opportunity to improve both the physical and social connections it has between neighboring communities. Escalante and neighboring communities can work together and pool resources to build capacity and achieve common goals (COED, 2016).

Highway 12, which also serves as Escalante’s Main Street, provides the physical connection between Escalante and neighboring communities. Improving Main Street’s functionality for businesses, residents, and visitors, is already a long term goal shared by community members. Working closely with UDOT and the other communities along Highway 12 will help Escalante improve their physical connectivity.

To enhance social connectivity, Escalante leadership should meet consistently with leadership from other communities to discuss what is going on at home, share goals, and coordinate planning efforts. Regional collaboration can expand the efforts of individual communities, improve awareness of outside ideas, goals and actions, and lead to more effective policies (Ganning et. al., 2013).

Ganning et. al. (2013) found that from a policy perspective, geographic linkages imply that rural places should have flexibility in their planning efforts. As discussed, communities should be able to strategically pursue goals with different cities according to the markets, characteristics, goals, and strengths of each city. By recognizing the geographic reach of their economic linkages, Escalante can create more effective growth policies and plans while including neighboring communities in those efforts.



3. Economics: Strengthen Weak Economic and Demographic Factors

Of all tested variables, low median income and economic diversity showed the strongest correlation with population decline. This fact is supported by Escalante's concern for lack of long-term, high-wage, benefited jobs. These concerns are also evident in demographic trends which indicate an increasing number of retirees, decreasing number of children, and stagnant growth in the labor force.

While jobs are the top concern for residents, findings suggest that planning efforts will be most effective if economic and demographic variables are considered jointly. The town's goal to have a more stable, balanced demographic makeup is directly tied to their goals of economic development and diversification.

Improving economic diversity and stability relies in part on growing existing businesses and attracting new businesses to the community (COED, 2016). Unfortunately, certain factors limit Escalante as an attractive location to outside businesses. One of the factors preventing businesses growth is a lack of affordable housing for employees and their families.

One course of action would be to create an affordable housing plan so that workers and young families who want to move to the area can afford to do so. Affordable housing plans determine the current supply of moderate income housing and then estimate the 5-year need (Wardrip et al., 2011). Escalante is already working towards adopting a plan which will make affordable housing available to tourism and industry workers as well as young families who want to live and work in the area. In addition to providing affordable housing options, Escalante can improve conditions for low-wage workers by implementing low cost transportation and child care programs (Green, 2001)

Molotch (1976) stated, "All that a locality can do is to attempt to guarantee that a certain proportion of newly created jobs will be in the locality in question." Because economic development and diversification are central to Escalante's goals, the community must be proactive to insure that new jobs will be created locally. Escalante has already taken those first steps through a community development program called the ASAP process (WRDC, 2016).

The Area Sector Analysis process (ASAP) program matches communities with appropriate business sectors and then provides tools to compare different community development options (WRDC, 2016). The results of the ASAP process can guide a community to (1) strengthen existing desirable and compatible business sectors, (2) recruit new desirable and compatible businesses, and (3) to invest in infrastructure that is needed to attract businesses. The ASAP program may not be feasible or available to every town, but the process and underlying principles can guide a shrinking community on how to improve economic stability and diversity.

Escalante can start by strengthening desirable local businesses that are already in place, identifying businesses that are desirable and compatible and recruiting them, and investing in the necessary infrastructure (such as roads, water, and power) to make the community attractive to businesses (WRDC, 2016). In addition to attractive and compatible businesses, Escalante should seek and maintain businesses that increase and contribute to economic diversity rather than solely recruiting large employers.



4. Natural and Community Amenities: Invest in Natural and Community Amenities

Escalante can identify and invest in natural and community amenities in order to create a place where people want to live, work, and recreate. Natural amenity-related tourism has both associative opportunities and constraints but forward-looking investments coupled with efforts to improve economic diversification could lead to growth and improved economic stability (COED, 2016). Escalante can provide affordable housing options for tourism workers, establish policies that preserve view-sheds to natural rock formations, and market the area through improved branding and regional collaboration.

Efforts devoted to building, improving, and maintaining community amenities can attract more people and businesses to the region as well as improve community vitality. Escalante's medical center is among the town's valuable community amenities and could lead to job growth in the future. Future expansion of health services could lead to Escalante becoming a regional health hub capable of providing excellent service to retirees and other community members.

Although school enrollment has seen drastic decline, efforts to provide the best possible education and opportunities for students should continue. Education opportunities are linked to retaining and attracting families. Without continued investment in education, Escalante will continue to lose young families. Capitalizing on and investing in local amenities and assets will help to attract and retain important demographic groups and improve the local economy.

The challenges associated with population decline, declining school enrollment, lack of jobs, and other difficult issues will continue to increase if efforts are not made to alter the trajectory. Escalante's proactive planning efforts and understanding of the relationship between the variables discussed throughout this report will aid them in making positive choices, taking preventative measures, and ensuring collective action to prepare for their future (RPG, 2016).



CONCLUSION

The results of this study support the findings of Ganning et. al (2013) that a collaborative, regional approach to nonmetropolitan development will result in more effective plans and policies. An understanding of a community's geographic reach and regional economic linkages will contribute to more effective growth policies.

The primary focus of this project was to identify which specific population, economic, and amenity-related variables have the greatest influence on population change. The results indicate that median income as well as proximity to a hospital had the strongest relationship to population change between 2000-2010 in the rural communities studied. Communities with low median incomes or that were more than 30 miles from a hospital were most likely to experience population decline during this time period.

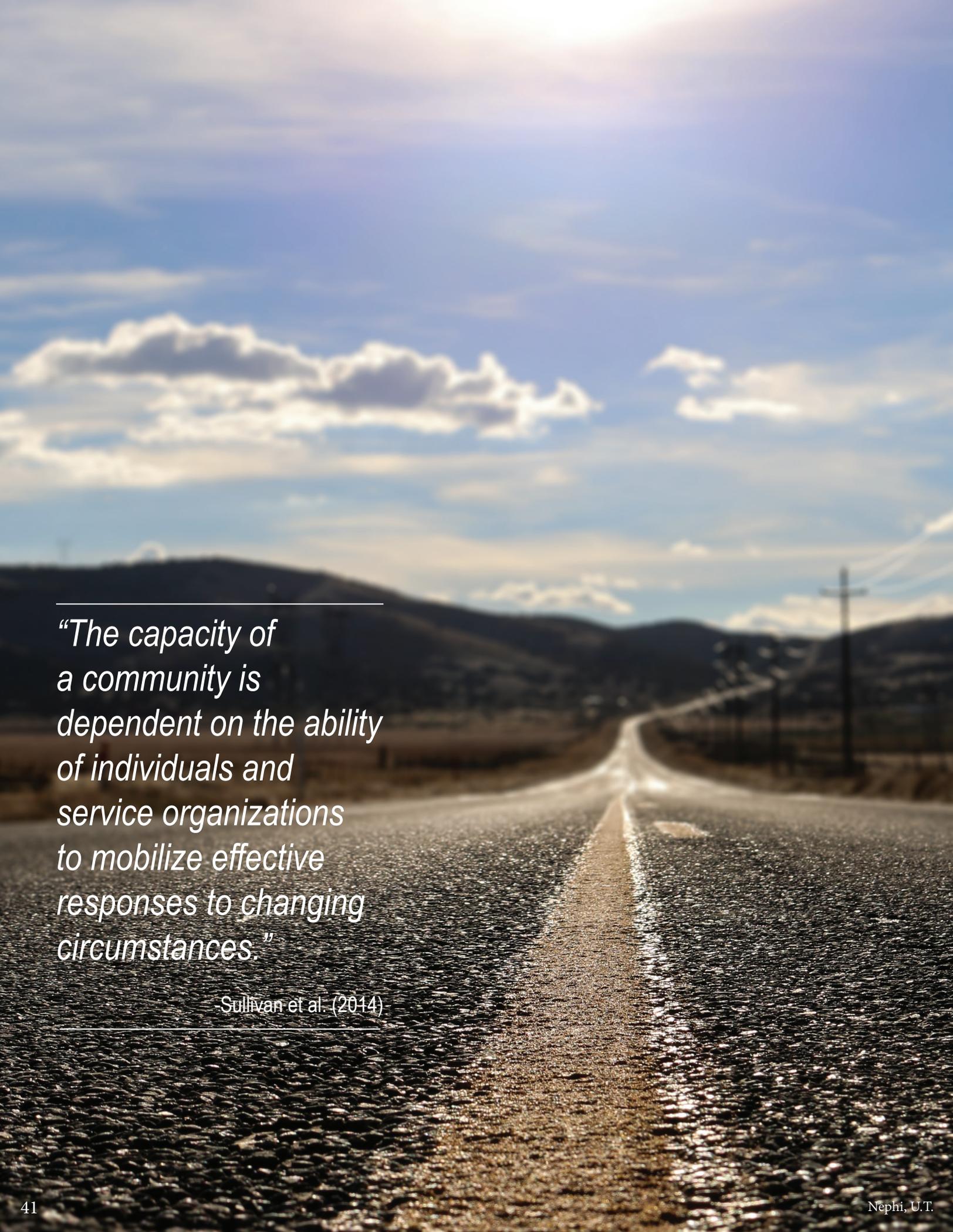
Several conclusions can be drawn from these results. The fact that both an economic and community amenity variable were found to have a significant influence on population change suggests that decline is the result of multiple factors. However, findings also suggest that economic variables have the greatest influence on local population trends. A variety of factors need to be considered in order to improve economic growth e.g. affordable housing for employees, attractive local amenities that improve livability, access to recreation, tourism, and other demographic, economic, and amenity-related factors all contribute to stronger economies.

Additionally, when variable categories are combined, such as a composite or index of economic variables, their combined influence is greater than if the variables are considered individually. This strengthens the argument that planning comprehensively will have a greater impact than planning for a single factor or issue. Analysis of economic variables also suggests that economic diversity has a greater impact on growth of rural communities than attracting a few large businesses. Decision makers should not only be focused on attracting large employers but also on attracting businesses and opportunities that create a more diverse economy.

Previous research has found that the absence of natural amenities is a strong indicator for rural population decline. This report did not find a significant relationship between natural amenities and population change when all variable categories were included. Instead, results suggest that economics are likely to have a greater impact than natural amenities at the community level. While these findings indicate that topographic variation is a desirable natural amenity, topography by itself did not equal growth. Other factors must be in place for natural amenities to make a difference. To be an effective mechanism for growth, natural amenities should be considered jointly with economic and demographic variables.

Economic restructuring has created opportunities and challenges for small towns. Outside forces, including economic and technological developments, will continue to change the demographic patterns and characteristics of rural communities. As these local, regional, and global trends continue to alter the characteristics of rural places, population change will be at the forefront of rural planning issues.

Population decline is a difficult and complex issue that requires consideration of many factors. For the decision makers, planning for rural population growth or decline should (1) be comprehensive, systematic, and flexible, (2) recognize the joint influence of factors and variables, (3) understand that different factors will be more effective in different time periods, (4) promote physical and social geographic linkages, and (5) acknowledge the leading role of economics.



“The capacity of a community is dependent on the ability of individuals and service organizations to mobilize effective responses to changing circumstances.”

Sullivan et al. (2014)

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APPENDIX A

GIS Analysis Methodology and Maps

GIS ANALYSIS METHODOLOGY

Data Sources:

- U.S. Census
- American Community Survey (ACS)
- North American Industry Classification System (NAICS)
- City-stats.org
- Utah Department of Heritage and Arts
- Utah Automated Geographic Reference Center (AGRC)

Datasets Analyzed:

- 2000-2010 population change
- 2000-2014 population change
- Population Index
- Economic Index
- Natural Amenity Index
- Community Amenity Index
- Total/ composite Index

Hotspot Analysis Methodology

Population data and index data were joined with the corresponding rural city location in ArcMap using the cities/town locations point feature from the Utah AGRC. The cities/town location point feature was used as the input feature class and each population dataset and index dataset were used as an input fields for each hotspot map.

Conceptualization of spatial relationships was done by using the fixed distance band which analyzes features within the context of other neighboring features. The distance band was left blank in order for a default distance to be calculated to ensure that every feature had at least one neighbor. Euclidean distance was used as the distance method.

Inverse Weighted Distance Methodology

The IDW spatial analyst tool constructs a raster surface from point data with interpolation results based on neighboring features. Input feature was the cities/town location point data and the population and index datasets were used as the Z value fields. A mask environment was set to the county shapefile outline.

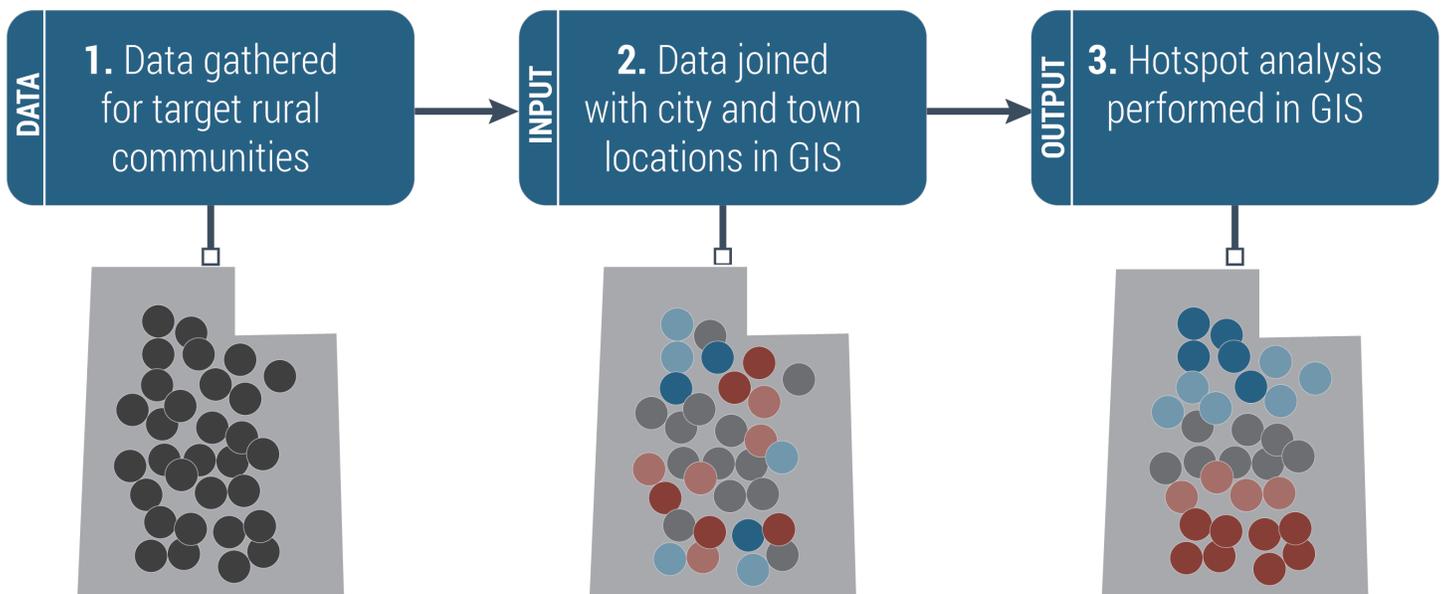


Figure A1. Hotspot analysis methodology.

MAPS

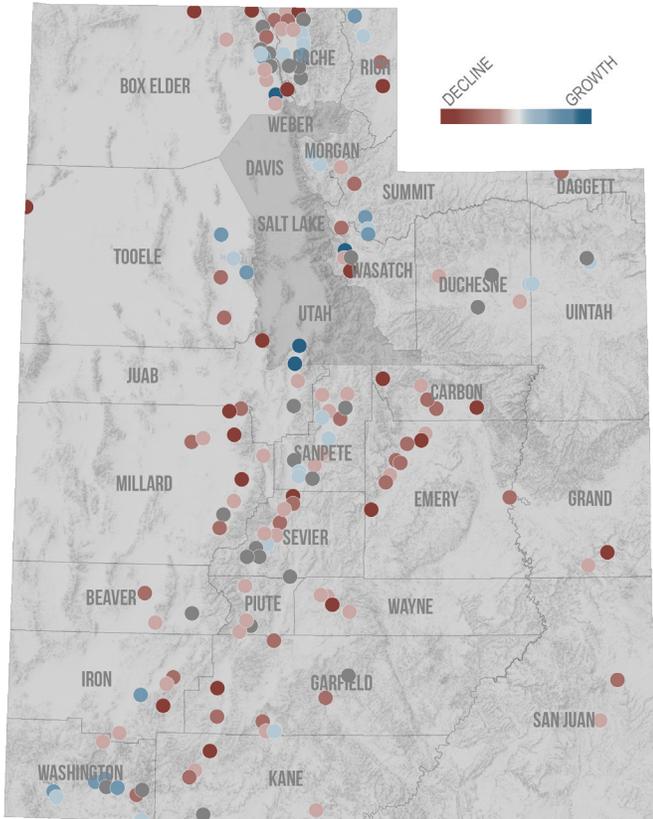


Figure A2. 2000- 2010 percent population change before hotspot analysis.

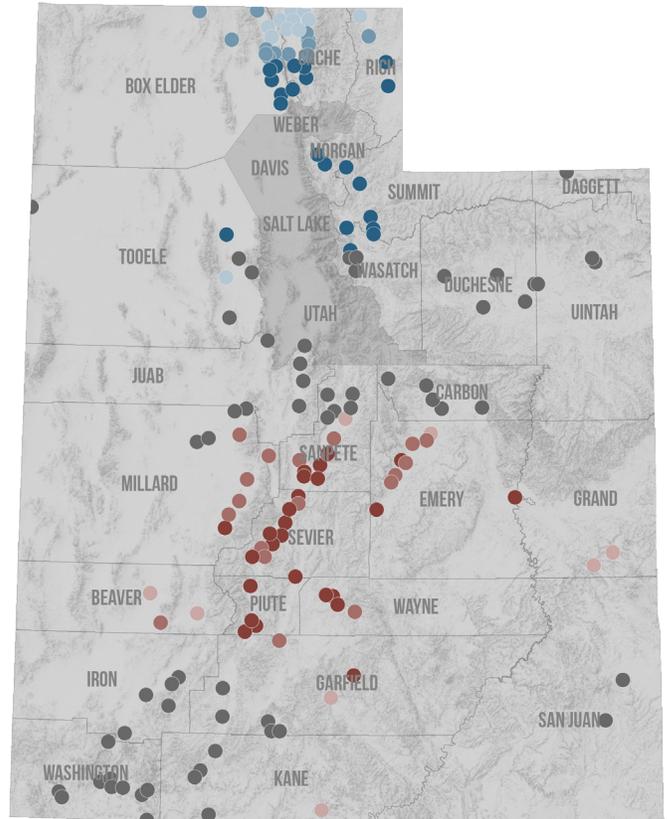


Figure A3. 2000- 2010 percent population change after hotspot analysis.

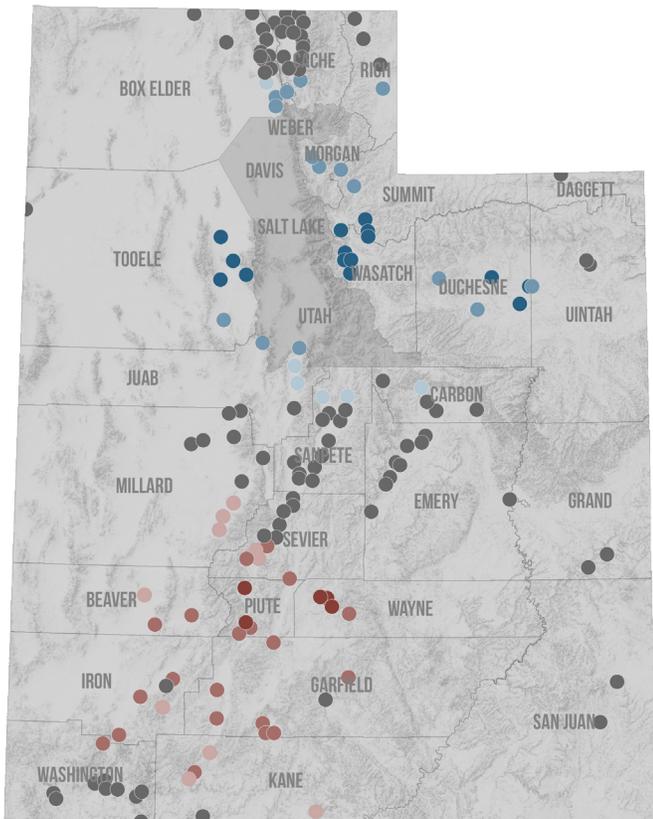


Figure A4. Economic index hotspots.

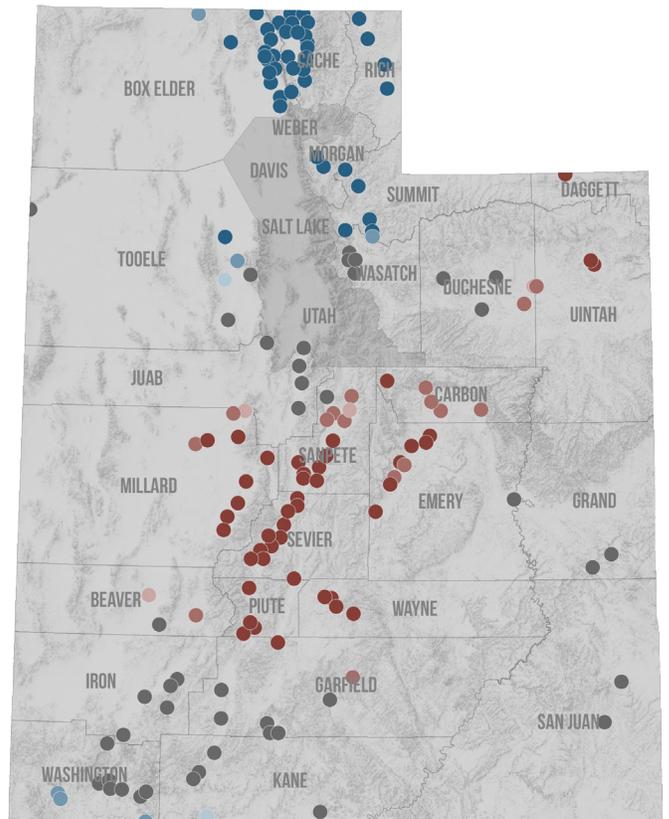


Figure A5. Hachman index hotspots.

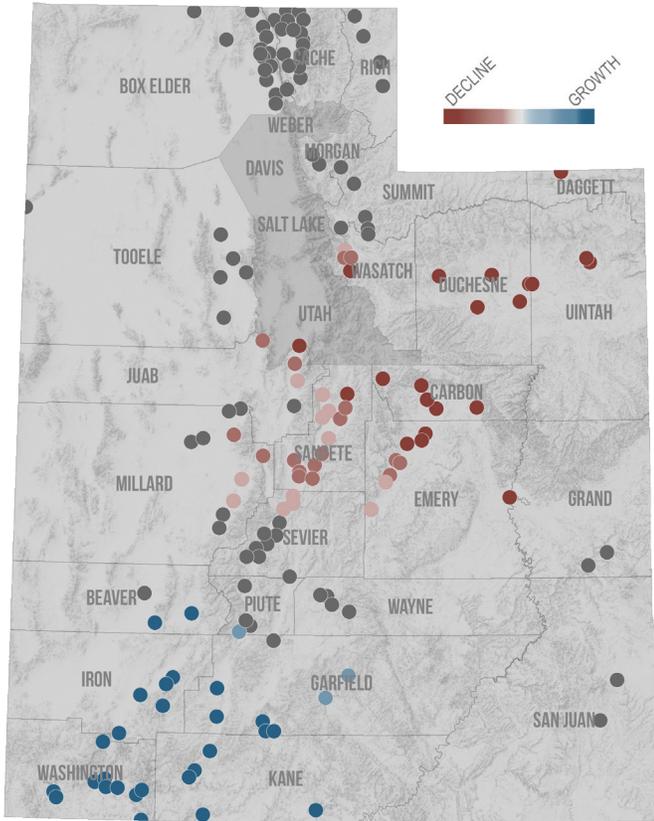


Figure A6. Natural amenity index hotspots.

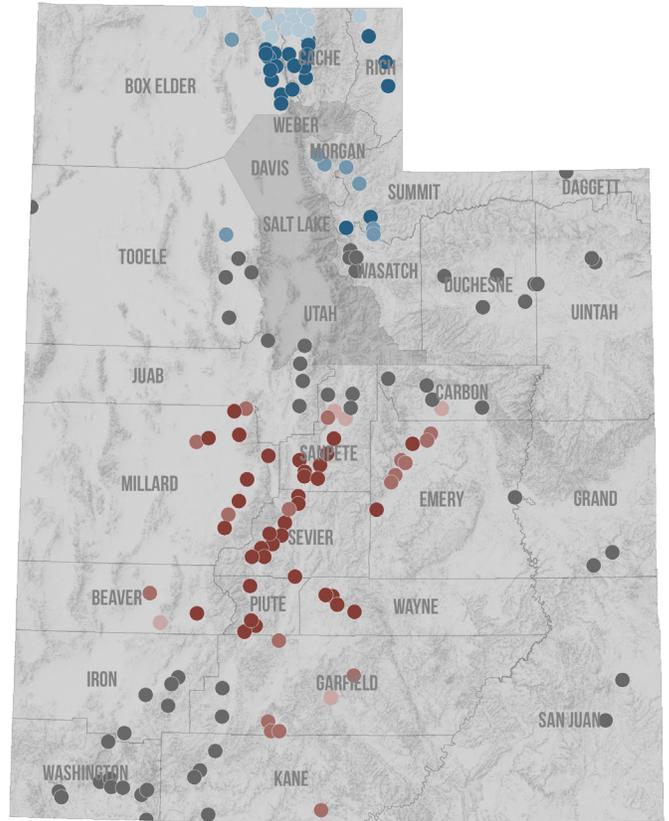


Figure A7. Community amenity index hotspots.

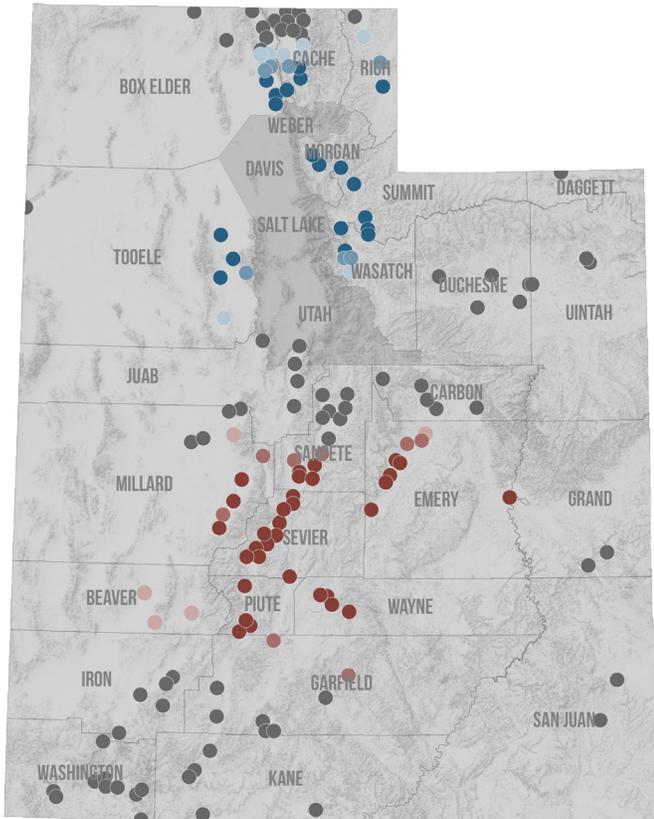


Figure A8. Total index hotspots.

Future Analysis

While the hotspot maps show interesting spatial patterns, they are limited in their usefulness. Future maps and analysis will incorporate the inverse distance weighted (IDW) technique to construct a raster surface from the point data. The IDW method assumes that the variables being mapped decrease in influence with distance, meaning that the influence of the variables associated with population decline decrease between neighboring cities with increased distance (pro.arcgis.com). IDW will offer a more nuanced visualization of the same data.

APPENDIX B

Correlation Matrices, Additional
Regression Models, and Scatter Plots

Table B3. Correlation matrix of the economic variables and 2000-2010 population change.

Variable	2000-2010 Population Trend	Hachman Index	Median Income Trend	Median Home Value Trend	Unemployment Rate Trend	Poverty Rate	Bachelor's Degree or Higher	Number of Large Employers
2000-2010 Population Trend	1.00							
Hachman Index	0.23	1.00						
Median Income Trend	0.23	-0.32	1.00					
Median Home Value Trend	0.10	-0.19	0.08	1.00				
Unemployment Rate Trend	0.11	0.01	-0.09	-0.05	1.00			
Poverty Rate	0.18	0.05	0.00	-0.06	0.29	1.00		
Bachelor's Degree or Higher	0.11	-0.08	0.07	-0.02	-0.08	0.17	1.00	
Number of Large Employers	0.10	0.13	0.03	0.03	-0.01	-0.05	-0.06	1.00

Table B4. Correlation matrix of the natural amenity variables and 2000-2010 population change.

Variable	2000-2010 Population Trend	Low January Temperature	Average Snowfall	Sunny Days	High July Temperature	Topographic Variation	Proximity to NP SP NM	Area of Open Water	% Forest Service Land	Recreation Opportunities	Comfort Index
2000-2010 Population Trend	1.00										
Low January Temperature	0.16	1.00									
Average Snowfall	-0.08	-0.08	1.00								
Sunny Days	-0.11	0.27	-0.22	1.00							
High July Temperature	0.15	0.61	-0.43	0.21	1.00						
Topographic Variation	0.24	0.43	0.13	0.16	0.11	1.00					
Proximity to NP SP NM	0.13	0.41	-0.19	0.20	0.27	0.10	1.00				
Area of Open Water	0.13	0.00	0.09	-0.29	-0.09	-0.09	-0.02	1.00			
% Forest Service Land	-0.05	-0.07	0.05	0.52	-0.19	0.43	-0.13	-0.06	1.00		
Recreation Opportunities	0.19	0.00	-0.05	-0.15	0.03	0.35	-0.10	0.30	0.15	1.00	
Comfort Index	-0.18	-0.44	0.29	-0.63	-0.37	-0.20	-0.31	0.13	-0.33	0.15	1.00

Notes on Correlation Matrices

Correlation matrices were used to determine the strength and direction of relationships between population change and variables from each population, economic, and amenity variable category (Rumsey, 2010).

Interpretation:

Exactly -1 = A perfect downhill (negative) linear relationship

-0.50 = A moderate downhill (negative) relationship

-0.30 = A weak downhill (negative) linear relationship

0 = No linear relationship

+0.30 = A weak uphill (positive) linear relationship

+0.50 = A moderate uphill (positive) relationship

+0.70 = A strong uphill (positive) linear relationship

Exactly +1 = A perfect uphill (positive) linear relationship

PRELIMINARY REGRESSION MODELS

Table B5. Preliminary regression results for natural amenity variables including comfort index.

Index	Coefficient	Std. Error	t-Statistic	Prob.
Comfort Index (Humidity)	-0.017	0.005	-3.064	0.003
Topographic Variation	0.000	0.000	2.348	0.021
Number of Sunny Days	-0.004	0.002	-1.771	0.079
Percent Forest Service Land	-0.199	0.148	-1.344	0.182
January Low Temp.	-0.006	0.005	-1.120	0.265
Area of Open Water	0.223	0.218	1.025	0.308
Recreation Opportunities	0.002	0.002	0.961	0.339
Proximity to NP ST NM	0.074	0.119	0.618	0.538
July High Temp.	0.003	0.006	0.501	0.618
Annual Snowfall	0.000	0.001	-0.282	0.779
Dependent Variable	2000-2010 Percent Population Change			
R Square	0.210			
Adjusted R Square	0.136			
Significance F	0.0038			
Observations	117			

Table B6. Preliminary regression results for natural amenity variables excluding comfort index.

Index	Coefficient	Std. Error	t-Statistic	Prob.
Topographic Variation	0.000	0.000	2.233	0.028
Area of Open Water	0.272	0.225	1.208	0.230
Proximity to NP ST NM	0.118	0.123	0.960	0.339
Annual Snowfall	-0.001	0.001	-0.798	0.427
July High Temp.	0.005	0.006	0.791	0.431
Number of Sunny Days	-0.001	0.002	-0.758	0.450
Percent Forest Service Land	-0.106	0.150	-0.708	0.480
January Low Temp.	-0.003	0.005	-0.470	0.639
Recreation Opportunities	0.001	0.002	0.429	0.669
Dependent Variable	2000-2010 Percent Population Change			
R Square	0.140			
Adjusted R Square	0.068			
Significance F	0.0536			
Observations	117			

Spurious Relationships

Results of preliminary regression models for both natural and community amenity variables showed a number of spurious relationships. Even though modeling shows a correlation, these variables are not likely causally related (such as humidity's correlation with population growth). These correlations are likely the result of the presence of a third, unseen factor (wikipedia.org).

For example, a population decrease of -1% for a community of 10,000 would be very different from a community of 1,000 people. The community of 10,000 would likely have more infrastructure such as churches or banks already in place; therefore more banks or churches would show a correlation with negative growth which is a spurious relationship.

Table B7. Preliminary regression results for community amenity variables.

Index	Coefficient	Std. Error	t-Statistic	Prob.
Hospitals	0.027	0.008	3.544	0.001
Higher Education	-0.141	0.053	-2.670	0.009
Retirement Centers	0.036	0.017	2.111	0.037
Places of Worship	-0.040	0.020	-2.044	0.044
Restaurants	0.010	0.008	1.165	0.247
Community Centers	0.076	0.067	1.137	0.258
Financial Institutions	0.029	0.033	0.892	0.374
Gas Stations	-0.012	0.015	-0.824	0.412
Emergency Medical Services	-0.015	0.029	-0.527	0.599
Medical Centers	0.008	0.021	0.350	0.727
Movie Theaters	0.020	0.062	0.328	0.744
Grocery Stores	0.013	0.045	0.278	0.782
Specialty Health Care	0.006	0.022	0.271	0.787
Interstate Access	-0.012	0.046	-0.267	0.790
Shopping Centers	-0.001	0.004	-0.256	0.799
Schools (K-12)	0.001	0.007	0.111	0.912
Dependent Variable	2000-2010 Percent Population Change			
R Square	0.265			
Adjusted R Square	0.147			
Significance F	0.0078			
Observations	117			

Eliminated Variables:

- Comfort Index
- Higher Education
- Places of Worship
- Gas Stations
- Emergency Medical Services
- Interstate Access
- Shopping Centers
- Movie Theaters
- Grocery Stores
- Specialty Health Care
- Schools (K-12)

DEMOGRAPHIC AGE GROUP REGRESSIONS

Table B8. Regression results for statistically significant variables and percent children 2000.

Index	Coefficient	Std. Error	t-Statistic	Prob.
Median Income Trend	0.235	0.068	3.472	0.001
Hospital	0.016	0.007	2.395	0.018
Hachman Index	0.222	0.102	2.179	0.031
Percent Children 2000	0.474	0.227	2.088	0.039
Topographic Variation	0.000	0.000	1.301	0.196

Dependent Variable	2000-2010 Percent Population Change
R Square	0.240
Adjusted R Square	0.205
Significance F	1.024E-05
Observations	117

Table B9. Regression results for statistically significant variables and percent labor force 2000.

Index	Coefficient	Std. Error	t-Statistic	Prob.
Median Income Trend	0.214	0.068	3.156	0.002
Hospital	0.017	0.007	2.509	0.014
Hachman Index	0.236	0.103	2.283	0.024
Percent Labor Force 2000	-0.344	0.339	-1.014	0.313
Topographic Variation	0.000	0.000	0.975	0.331

Dependent Variable	2000-2010 Percent Population Change
R Square	0.217
Adjusted R Square	0.182
Significance F	4.535E-05
Observations	117

Table B10. Regression results for statistically significant variables and percent retirees 2000.

Index	Coefficient	Std. Error	t-Statistic	Prob.
Median Income Trend	0.231	0.068	3.400	0.001
Hospital	0.014	0.007	2.114	0.037
Hachman Index	0.215	0.103	2.099	0.038
Percent Retirees 2000	-0.572	0.307	-1.863	0.065
Topographic Variation	0.000	0.000	1.377	0.171

Dependent Variable	2000-2010 Percent Population Change
R Square	0.234
Adjusted R Square	0.199
Significance F	1.518E-05
Observations	117

The labor force age group (20-59) had the highest Significance F when the three age categories were tested against other independent variables and P-Scores were similar between significant variables (see tables B8-B10). However, when each age category was tested as a dependent variable (see tables B12-B14), differences in Significance F and variable P-Scores showed more variation. This reinforces the fact that different age groups affect and are affected by population change differently.

Table B11. Regression results for statistically significant variables and 2009 birth rate

Index	Coefficient	Std. Error	t-Statistic	Prob.
Median Income Trend	0.191	0.067	2.846	0.005
Hospital	0.017	0.007	2.608	0.010
Birth Rate 2009	0.000	0.000	2.012	0.047
Hachman Index	0.199	0.103	1.926	0.057
Topographic Variation	0.000	0.000	1.160	0.249

Dependent Variable	2000-2010 Percent Population Change
R Square	0.238
Adjusted R Square	0.203
Significance F	1.175E-05
Observations	117

Table B12. Regression results for statistically significant variables and with percent children trend as the dependent variable.

Index	Coefficient	Std. Error	t-Statistic	Prob.
Median Income Trend	0.443	0.101	4.375	0.000
Hospital	0.030	0.010	3.071	0.003
Hachman Index	0.316	0.155	2.039	0.044
Topographic Variation	0.000	0.000	0.773	0.441

Dependent Variable	Percent Children Trend 2000-2010
R Square	0.279
Adjusted R Square	0.253
Significance F	1.885E-07
Observations	117

Table B13. Regression results for statistically significant variables and with percent labor force trend as the dependent variable.

Index	Coefficient	Std. Error	t-Statistic	Prob.
Median Income Trend	0.186	0.078	2.395	0.018
Hachman Index	0.236	0.119	1.984	0.050
Hospital	0.011	0.008	1.508	0.134
Topographic Variation	0.000	0.000	0.088	0.930

Dependent Variable	Percent Labor Force Trend 2000-2010
R Square	0.112
Adjusted R Square	0.080
Significance F	9.324E-03
Observations	117

Table B14. Regression results for statistically significant variables and with percent retirees trend as the dependent variable.

Index	Coefficient	Std. Error	t-Statistic	Prob.
Hospital	0.013	0.011	1.192	0.236
Topographic Variation	0.000	0.000	0.836	0.405
Median Income Trend	0.031	0.115	0.268	0.789
Hachman Index	0.023	0.176	0.128	0.898

Dependent Variable	Percent Retirees Trend 2000-2010
R Square	0.032
Adjusted R Square	-0.003
Significance F	4.591E-01
Observations	117

SCATTER PLOTS OF FINAL REGRESSION MODELS

Table B15. Scatter plot of economic variable regression residuals.

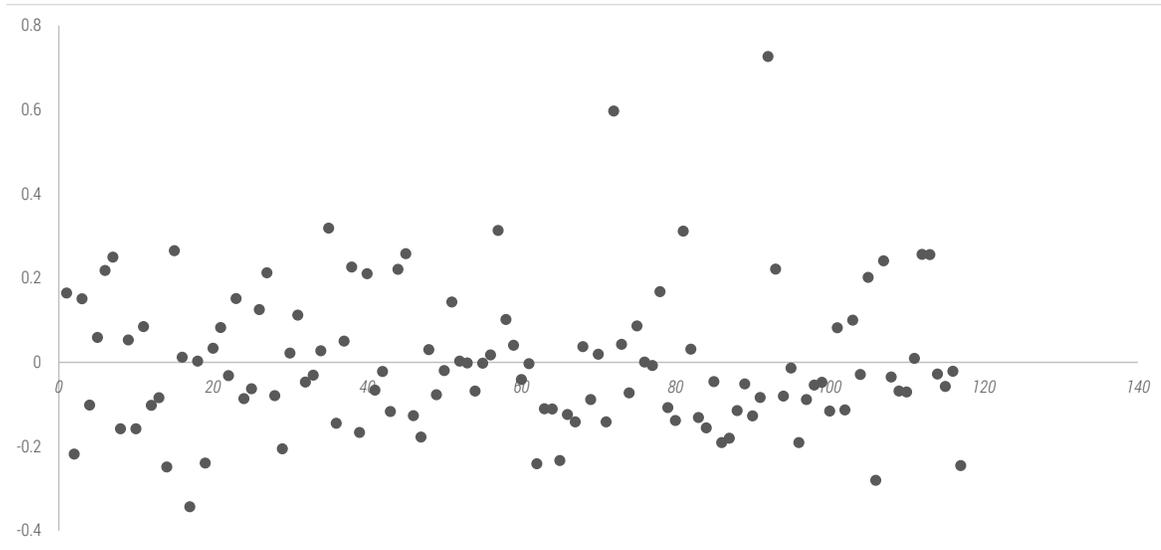


Table B16. Scatter plot of natural amenity variable regression residuals.

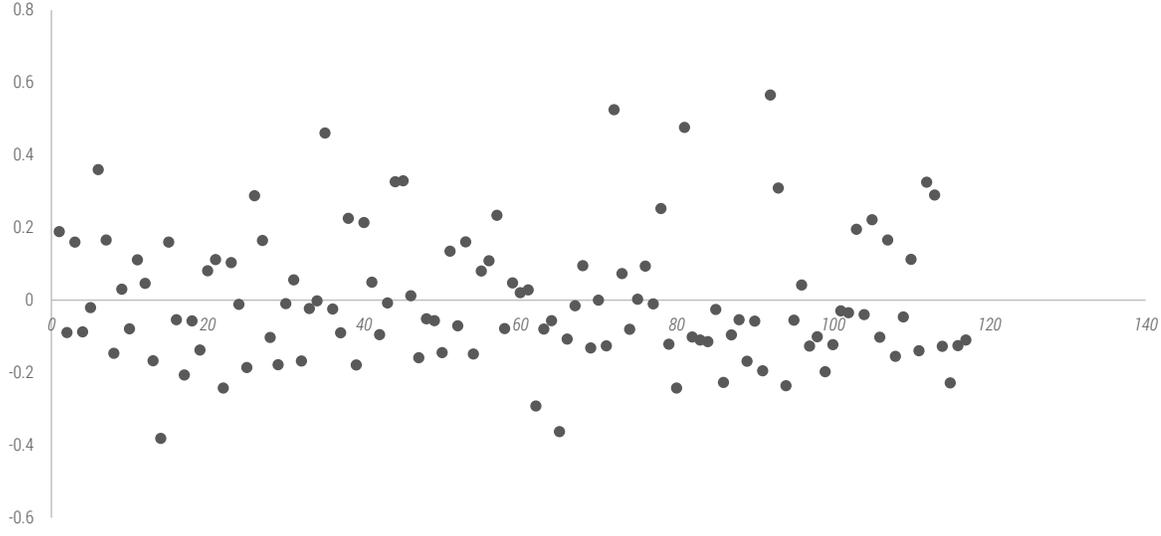


Table B17. Scatter plot of community amenity variable regression residuals.

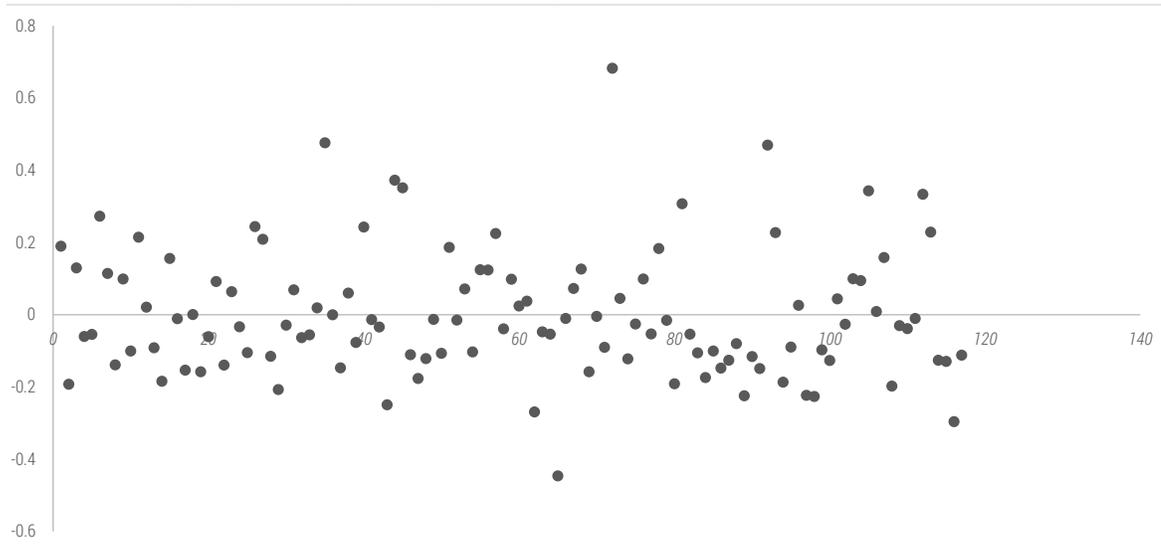


Table B18. Scatter plot of top three variable regression residuals.

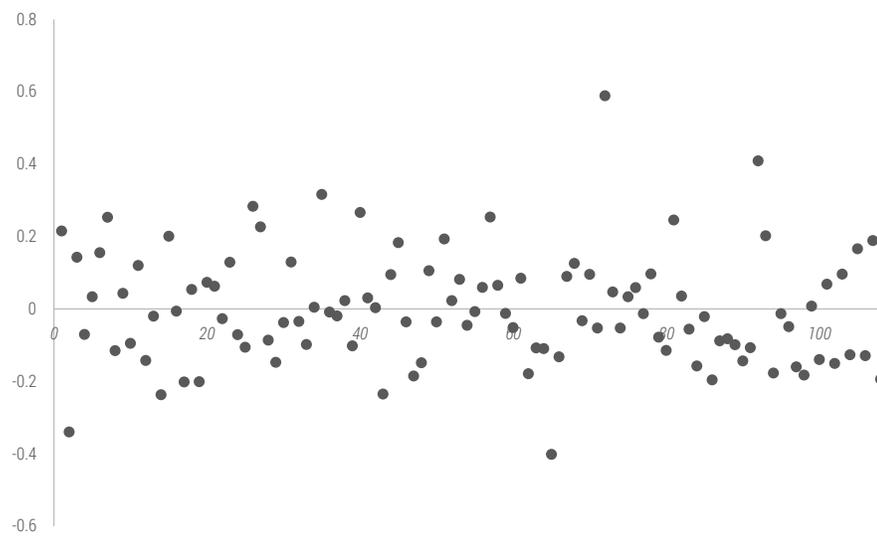
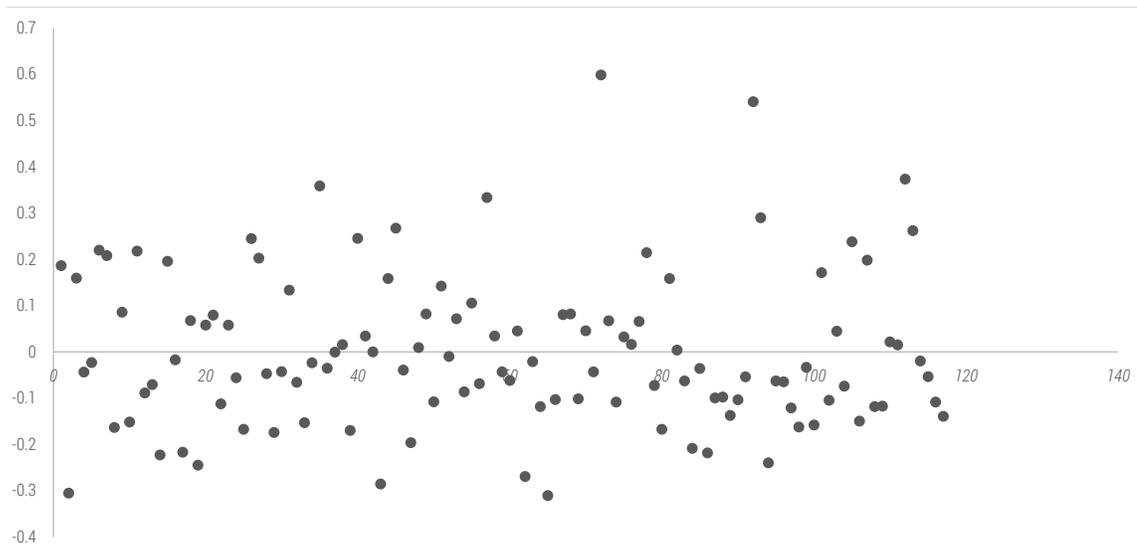


Table B19. Scatter plot of only statistically significant variable regression residuals.



Notes on Residual Scatter Plots

The residuals of each of the final regression models (see Findings pg. 25-26) were graphed using scatter plot charts.

Residuals are the difference between the actual value of the dependent variable (percent population change) and the predictive value of the dependent variable (Excelmasterseries, 2010). The scatterplot chart of residuals should:

1. Show no patterns,
2. Center around zero, and
3. Be somewhat normally distributed.

The scatter plots shown above reflect these three aspects but with some outliers. Future research and modeling will be needed to improve statistical analysis.

