GIS-BASED SCENARIOS FOR THE REORGANIZATION OF KANSAS COUNTIES

by

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Abstract

County consolidation and reorganization has been rare in the United States in the last 100 years, and recent literature on county consolidation and reorganization is limited. Still, county consolidation appears to be a possible method for reducing the cost of government in areas with declining rural populations. Seven consolidation scenarios were generated for Kansas using criteria based on distance from a county seat, population distribution, and local economic strength in terms of tangible assessed valuation. All the scenarios reduce the number of counties from the current 105 to 25. The goal of the study was not to advocate or oppose county consolidation, but rather to show a proficiency of GIS to implement user-defined consolidation and reorganization procedures. The seven scenarios each possessed strengths and weaknesses based on appearance and statistical measures of area and population. The population scenarios possessed the greatest apparent strength, based on measures of area and population as well as overall appearance.   Still, county consolidation and reorganization is a daunting task due to inertia and the social opposition that would likely result, due to loss of existing county identity and losses of government funding provided to numerous rural county seats.

Key words: consolidation, Kansas, counties

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CHAPTER 1 - Introduction

Reducing the cost of government is a major theme in society today, as tax cuts and associated budgeting issues continue to put pressure on legislators to find means to efficiently fund services. The balance between service provision and low taxes is often difficult to achieve, and has resulted in a tumultuous political climate in the United States. Government efficiency is very important in the operation of government at the lowest cost possible.

In many cases, reducing the number of government services or service providers has been a common practice in attempts to save money. School district consolidation has been ongoing for years as rural areas decline in population and transportation technology has increased. Social service provision has grown increasingly difficult in rural areas with population decline, and efficiency of social service provision in rural areas is less than the efficiency of social service provision in more populated areas. City-county consolidation has been proposed in numerous cases in an attempt to reduce the duplication of service provision in the two different levels of government that, in many cases, serve the same geographical area. None of these attempts to increase efficiency are devoid of controversy.

Other forms of reorganization have occurred due to political reasons. Political redistricting is constitutionally mandated to occur as new Census figures are available, in order to ensure fair and equal representation in legislatures. This process, too, can be extremely controversial and highly questionable in some cases, as politicians have attempted to redraw political boundaries in a manner that favors their party's electoral hopes, resulting in the gerrymandering of Congressional districts (Johnston 2005).

Thus, no form of consolidation or reorganization at any level is necessarily a smooth process. County consolidation would likely be no different. County consolidation has been extremely rare in the last 100 years, and literature discussing county consolidation and reorganization is rather limited and dated. Still, the procedures common in other forms of consolidation and reorganization would likely be applicable to county consolidation and reorganization.

This study involves the formation of various scenarios for county consolidation in Kansas using a GIS-based approach. The focus of this study is not to support, nor oppose, county consolidation. Rather, using various parameters and criteria, scenarios are created that present options for county consolidation in Kansas.

The beginning of this paper presents an in-depth review of literature associated with county consolidation and reorganization, declining rural economies, and other forms of consolidation and reorganization. A data and methods section presents the various data sources used in the formation of the scenarios and the methods used to produce the scenarios. Results of the scenario runs are presented with map and summary outputs, and these results are discussed in terms of their assumed feasibility.

Geography is steeped with a strong tradition in spatial analysis. Pattison (1964) identified the spatial tradition as one of the four traditions in geography, inclusive of "the act of separating from the happenings of experience such aspects as distance, form, direction, and position" (p. 211). The geometry of political units – an aspect of county consolidation and reorganization – is inherently spatial. The "positioning and layout" of political boundaries and political units is a critical study topic for geographers immersed in the spatial tradition. And, of course, the creation of scenario maps, which will be instrumental to this study, is indeed a science and an art that is entrenched in the spatial tradition of geography and cartography.

CHAPTER 2 - Literature Review

Introduction

Presented herein is a review of selected literature on county consolidation, reorganization, and redistricting. This review of pertinent literature includes information on four overlapping themes. Theme 1, on literature specifically related to county consolidation, is rather dated in nature, primarily from the first half of the 20th century. Still, this body of literature provides and important perspective into county consolidation, the foundations for consolidation, and related public responses. Theme 2 is a brief discussion of rural decline. While rural decline is not the focus of this study, declining rural populations and a low economic base in rural America are often cited as reasons for reducing the number of government services in rural areas. Theme 3 is a discussion of boundaries and other forms of consolidation and reorganization, primarily city-county consolidation and school district consolidation and reorganization. Other forms of literature within this set include political reorganization and gerrymandering. Included in this discussion are the characteristics of such consolidation and reorganization measures and public responses. This literature set, while newer than the county consolidation set, is, in many cases, more than 20 years old. Finally, Theme 4 briefly ties in some GIS procedures to consolidation and reorganization measures.

Theme 1: Historical Literature on County Consolidation

Within the United States, counties are a sub-unit of regional government within a state. The etymology of ‘county’ indicates that the word originated in northern Europe and was used to refer to the territory under the jurisdiction of a count. With the exception of Louisiana and Alaska, the name ‘county’ is used for a level of United States government organization immediately below the state level. For a number of reasons, the counties that were established at the time of statehood may not be the same entities that exist today. The bulk of literature on consolidation of multiple counties into one single county or amalgamation is rather dated. Most is from the first half of the 20th century and many of these articles provide case studies of specific counties in various states.

Shannon (1940) provides an overview of county consolidation by delving into the history and nature of the concept of a county as a form of local government, and discusses the issues that arise when consolidation is considered. The American county is derived from the English county, which was decidedly agricultural. In both countries, the county has been organized and restricted by the state, but consisted of representatives and personnel that were chosen by the local population. Shannon notes a negative connotation of the county government as the "dark continent of American politics," and immediately deems the county as a rural artifact, often regarded as a "country cousin by its superior city relatives" (p. 168).

According to Shannon (1940), counties were organized in a "helter-skelter fashion," primarily to serve the needs of rural citizens. County sizes were relatively small, since the 19th Century 'rule-of-thumb' was that a citizen needed to be capable of traveling to the county seat via horse and buggy and still return home in time to get the milking done by sunset. Advances in transportation technology have made this concept irrelevant. The advent of automobiles and the expanding road networks have shrunk what was a day's trip by animal to a few minutes/hours by machine. Shannon (1940) suggested that counties exist in wide ranges of population and size, and therefore "the American county is meaningless as a descriptive term" (p. 169).

The relative permanence of county boundaries, coupled with the shifting demographic and economic characteristics of the counties, results in inefficiencies, for "politically static boundaries suffer in an economically dynamic world" (Shannon 1940, p. 169-170). State government has seen an expansion of powers, expressed through state control of highway building and education, as well as the presence of a state police force. Many counties have seen declines in population and related declines in internal economic support-bases. In many cases, these counties in decline require additional state support for local government functions. This trend serves to further weaken the county, reducing its relative power and influence. Shannon argued that if the county is to maintain relevance, it must improve its efficiency, and that efficiency is served by consolidating counties to reduce the cost of government.

County consolidation has been rare, however, due to obstacles that are "real and genuine" (Shannon 1940). These obstacles frequently center around human emotions, as "habit or custom, reinforced by human inertia, makes it exceedingly difficult to change" (p. 170). Geographers have used the term 'topophilia' to refer to an attachment to place (Tuan 1974). This psychological connection to place is especially true in rural areas, where people generally have very strong ties to the local landscape. According to Shannon (1940), having close ties to their local governing body is an "expensive luxury" that does not exist with other levels of government. Rural counties have greater difficulty dealing with the increasing costs of providing basic services due to low and/or declining populations, as the population decline is frequently tied to a decrease in taxes collected and a decline is service provision. Given individuals' connection to the land, an odd situation can exist where the citizens of poorer counties, with a less self-sufficient government, have greater opposition to consolidation.

Shannon (1940) outlines three "criteria for consolidation," which in reality are measures by which consolidation could occur. One measure is a "test of area," or simply consolidation by size. Shannon notes, however, that sheer area does not directly relate to travel time, as the mode of transportation, the layout of the road network, and the topography vary considerably. A second measure suggested is population. However, area becomes an issue when divisions are also made based on population, as in sparsely populated regions. A rather large region may need to be amalgamated in order to meet some population standard. Finally, Shannon (1940) suggests a third measure, the "adequacy of the economic base." This would entail formulating units with adequate economic sufficiency. While providing examples of economic indicators that may be used (valuations, tax assessment, per capita wealth), Shannon stops short of endorsing a particular economic indicator.

Manning (1928) reviewed attempts to consolidate counties in Tennessee. The primary objective of state lawmakers was to reduce the cost of government, and it was noted that county government functions cost 19 times that of the state government. Manning mentioned two methods by which the number of counties could be reduced: 1) the "natural absorption" of a single small county or multiple small counties by one larger county; and 2) the "more artificial method" of using legislation or constitutional processes to consolidate all counties into a smaller number of total units.

Hamilton County, Tennessee (with Chattanooga as its county seat) absorbed the smaller, less populated James County in 1919 (Manning 1928). The state legislature approved this measure following a request of consolidation from James County and acceptance of the motion from Hamilton County. Following this success, smaller Meigs County, which borders Hamilton to the north, jointly applied with Hamilton County for absorption of the smaller county. It was noted that the existing tax rate in Meigs County was nearly three times that of Hamilton.

These successful consolidations resulted in multiple proposals for statewide county consolidation in the state legislature (Manning 1928). One proposal involved the reduction of counties in Tennessee from 95 to 11. Each county would comprise roughly 3,790 square miles and possess a population of about 211,884. The new counties would be grouped around a principal city that served as the highway and railroad center of each new county. If existing county expenditures were applied to the new counties, the total cost of county government in the state would have been reduced by roughly 88 percent. As of 2007, Tennessee still has 95 counties.

In a discussion of county consolidation in Colorado, Heckart (1934) briefly discussed the history of counties. Although many institutions of government have evolved through time, "the county is the only one that has been handed down to us in its original form" (p. 535). He relates this to the early formation of county boundaries based on travel times by horse and buggy. Thus, the organization of counties and the internal financial policies have remained remarkably static through time.

Expenditures for county government in Colorado were approximately 12 percent of the total taxes collected for the state in 1931 (Heckart 1934). Thirty-five percent of the taxes were delinquent in 44 percent of the counties, and Heckart noted "there will have to be a change in county government and county expenditures if the people are to continue to pay their taxes" (p. 535). Tax delinquency was confounded by the fact that a large area in many counties existed as non-patented lands that provided little no tax revenue.

Changing technology and demographics had altered the county status by the mid-1930s. Improvements in communication and transportation had made many counties "obsolete" (Heckart 1934). In Colorado, changes in natural resource extraction, such as mining, led to major demographic shifts. The population of 13 mining counties was 92,502 in 1900, but had declined to 26,332 in 1930 (a drop of 72 percent).

Abolishment of the county, with complete transfer of powers and duties to the state, would be harmful, Heckart (1934) argued, for "subdivisions are essential to any organization that must administer a large area." According to Heckart (1934) citizens interact with their county government more than any other form of government and abolishment of the county would be detrimental. Thus, the county needs to exist, but be made more efficient. Efficiency is greater, Heckart argues, in counties that have greater assessed valuation and more people.

By standards existent at the time, an arbitrary county unit standard of $20 million in assessed valuation and 20,000 people was suggested for Colorado (Heckart 1934). Heckart argues that unit area has "very little significance as a cost factor." However, it is argued that all counties in the state cannot be reorganized to this standard. To weigh the strengths and weaknesses of county consolidation, details regarding a consolidation plan that existed in the San Luis Valley were presented. The San Luis Valley is in the south central part of Colorado, bounded by the Continental Divide on the west and northwest and the Sangre De Cristo and Culebra mountain ranges on the east. The six-county region consists of 8,061 square miles, 71 percent of which was non-patented, with no collected taxes. Alamosa was the only community with over 5,000 residents. Most farmland was within 20 miles of Alamosa and 90 percent of all taxable land was within 40 miles. Therefore, it is argued that, instead of 20 percent of the land in the valley supporting six counties, it is logical that the natural boundaries serve as borders for one single county, with Alamosa as the county seat. Combining the six counties resulted in an assessed valuation of $41 million and a population of roughly 41,000, where, singularly, no single county had more than $10 million in valuation (Heckart 1934).

There were, however, multiple obstacles to this plan, most notably the prohibition of changing county boundaries and county seats by the Colorado state constitution (Heckart 1934). Unconstitutionality could be changed by modification of the state constitution; however, political opposition and the opposition of the people are much more difficult to overcome. Heckart stated that "political parties have their very foundation in the county machine and the people do not accept political change readily because they are afraid of the unknown" (p. 538). Some citizens also are strongly identified with their county seat (especially those living in rural areas), dating back to the "county seat wars" during county establishment, and therefore they may be reluctant to relinquish the county seat of its function.

Euler (1936), referring to Heckart's work in Colorado, provided a similar discussion on the potential consolidation of two counties in Kansas. Like other rural states, property values in Kansas were declining while tax rates were remaining steady. These financial changes were putting an increasing burden on local economies and related educational systems. Euler's study focused primarily on the social resistance to consolidation in Marshall, Washington, and

Republic counties in north central Kansas. This reluctance occurs despite numerous positives of county consolidation, including the expansion of essential services, a better education system, and reduced pettiness in local government. Through interviews conducted in Marshall, Washington, and Republic counties in Kansas, local rationale behind the opposition of county consolidation was uncovered (Euler 1936). The rationale included reluctance to change, community pride, local independence, fear of less local representation in government, and existing social and business networks that were based on the present county arrangement. Euler advocated a series of "adult education" programs geared at modifying this rationale.

Bradshaw (1937) discussed consolidation in Texas. The 1876 draft of the state constitution recognized 20 to 25 miles as a day's travel, thus delineating county boundaries based on those travel restrictions. There was also no rural mail or telephone service. By the time of Bradshaw's contribution in 1937, such limitations on travel and communication no longer existed, and therefore larger county units would be feasible.

Further exacerbating financial difficulties, the 1876 Texas state constitution mandated the same requirements for every county, regardless of size or population (Bradshaw 1937). Thus, each county was required to elect at least 18 countywide officers, maintain a courthouse and jail, and provide certain required services, regardless of the nature of county. This put a greater burden on rural counties with small populations. The primary reduction in cost for counties through consolidation would be the reduction of county officers and the consolidation of services over multiple counties. A study in 1933 on 38 rural counties showed that consolidation of counties would result in substantial savings (Bradshaw 1937).

Theme 2: Challenging Economic Conditions in Rural Areas

Struggling rural economies and a lack of self-sustaining governments in rural counties are frequently cited as bases for county consolidation and reorganization. Declining rural economies is not a new topic. Koven and Hadwiger (1992) point out a dwindling population in rural America continues to support a "plethora of local governments," and that "it seems appropriate to ask whether the number of rural governments should not begin to decline along with the population." The following discussion highlights some of the literature on rural decline.

Various examples of issues related to rural decline in Kansas exist. Recently, U.S. Department of Homeland Security officials indicated that those living in rural areas (including those in more than 80 rural Kansas counties) would have to drive longer distances to renew their driver's licenses at full-service license bureaus, which are only available in more populated locales, rather than at their local county treasurer's office (Carlson 2006). In June 2007, the Natural Resource Conservation Service (NRCS) announced it would close nine NRCS county field offices and consolidate them with nearby counties (NRCS 2007).

Batie (1988) indicates that the relatively recent urban-to-rural migration pattern has reversed, and rural-to-urban migration now continues to accelerate. White (1994) identifies characteristics of rural regional decline as "low density, the demise of small towns, continuous county declines in populations since the turn of the century, lack of economic opportunity, selective outmigration of the young, an ever-increasing median age, and reductions in the number of small-scale farms and farm population (p. 29). Reduced rural population has led to numerous school closures and school district consolidations (Guthrie 1979). In many rural areas, the local school was a cherished institution, and its loss was significant. White (1994) explains various "oases" of growth and economic vitality exist in rural areas, but these are frequently tied to some proximate economic benefit (such as groundwater and the related economic benefits groundwater pumping provide). This is especially true across western Kansas, where the prosperous communities rely heavily on "mining" the diminishing High Plains/Ogallala Aquifer for intensive irrigated agriculture, confined animal feeding, and the associated meat packing industry.

White (1994) contends that rural communities (specifically, on the High Plains) have difficulty luring manufacturing firms. Mayer (1993) links a decline of small town economies to the increase in agricultural technology. Such technology has reduced local ownership of many farms, with the owners of farms living in urban centers considerable distances away. In addition, the production of the agricultural technology generally occurs outside the rural area, and therefore the benefit to the small town itself is reduced. A weak rural economy is visible through numerous measures, including a reduction in rural lending by banks (Drabenstott and Morris 1989). The Federal government has generally taken a backseat to state governments in rural management, forcing individual states to implement new programs in rural areas. However, limited funding and existing infrastructure hamper rural development efforts on the part of state governments. Many federal farm programs are limited to farm activities, and do not incorporate rural population development. Attracting businesses to rural counties is difficult due to limitations in "highly trained work forces, excellent schools, excellent infrastructure, and public recreation facilities."

In 1987, Deborah and Frank Popper presented a controversial proposal, a Buffalo Commons, for the shortgrass prairie of the Great Plains, defining this region as "the center of the United States, between the Rocky Mountains and the tallgrass prairies of the Midwest and South," which includes much of western Kansas. This region was the nation's last to be settled, and since settlement, has been stricken with numerous environmental/climatic and (related) economic crises. Since the Dust Bowl of the 1930s, some limited prosperity benefited the Great Plains, with the agricultural demand of World War II, new agricultural technologies, and a boom in energy production.

However, the Poppers (1987) noted declines in prosperity during the 1980s. Small town population decline was accelerating. The over-tapped Ogallala Aquifer showed serious declines in water levels in some areas. Many of the energy boomtowns that flourished following the Great Depression had since withered or became severely depopulated. The Poppers identified a ripple effect; when one sector of the economy (agriculture) undergoes hard times, other sectors (retail, services, etc.) in turn experience declines in profit and sustainability. Unfortunately, Federal subsidies and state and local assistance were not enough to make up for the economic losses that were incurred. Thus, a "tragedy of the commons" resulted, where inappropriate land use in the Great Plains early in settlement left poor conditions for generations to come.

At the time of their writing, the future was unclear, though prospects were not promising (Popper and Popper 1987). Depopulation of rural areas was seen as likely to continue, with only a few urban centers prevailing. Attempts are being made to switch from the current water-intensive agriculture to other crops and livestock, but the feasibility of such agriculture (particularly in matching the economic viability of current agriculture) is unclear. Tourism has been suggested as a potential source of income, but the ability of local residents and farmers to tap the tourism market appears to be low.

As a result, the Poppers (1987) suggested we would see an on-going trend with changes toward returning the shortgrass Great Plains region to its pre-settlement condition – one of roaming buffalo and natural shortgrass prairie. Termed the "Buffalo Commons," such a measure might require a governmental entity to pay landowners not to cultivate their land, but rather to encourage a return of natural vegetation, following by a restocking of various forms of wildlife. Obviously, this would be a significant undertaking, and would be met by serious resistance at many levels, from individual landowners to governmental entities.

Trends toward a Buffalo Commons continue. The Buffalo Commons is inherently metaphorical, with the intent being a combination of responsible cultivation and wilderness (Popper and Popper 2006). Envisioned is a situation where buffalo outnumber cattle, environmental protection trumps extraction of resources, and ecotourism surpasses traditional rural development in terms of the regional economy. Proposals for a similar situation to the Buffalo Commons in the Great Plains existed among prominent observers of the Plains during the Euroamerican settlement period, and will likely continue to gain attention. Since the original proposal in 1987, numerous buffalo-based organizations have developed, and numerous companies have been named after the Buffalo Commons, indicating that the notion of a Buffalo Commons resonates with some citizens of the Great Plains region. According to Popper (1991), the 1990 film Dances with Wolves is viewed as the "world's first Buffalo Commons movie."

J. Michael Hayden, former Kansas Governor (1987-1991) and current Secretary of the Kansas Department of Wildlife and Parks, discussed his changing view of the Poppers' proposal (Hayden 2007). When the Poppers first presented their ideas in 1987, Governor Hayden "came out guns blazing like Matt Dillon," with vehement opposition to the idea, and criticism of the Poppers, as "East Coast academics" with what he imagined as little valuable perspective on the Great Plains. Since his original opposition, Hayden (2007) now admits he was wrong. He noted depopulation of portions of the Great Plains is greater than what the Poppers initially predicted. As Secretary of the Kansas Department of Wildlife and Parks, Hayden promoted the increase of public lands in the state. Despite being contrary to a well-established property rights tradition in Kansas, public lands offer outdoor recreation and ecotourism opportunities that offer rural economy diversification options.

Further rural population decline will likely be an impetus for the advancement of a Buffalo Commons and other proposals for the region. The population of Kansas grew an average of eight percent per decade throughout the 20th century, and consistently lagged behind the national average (Kulcsár 2007). The slow growth that has occurred in the state has not been distributed evenly, and has only become more polarized with time. Most rural counties now only account for less than 0.5% of the state's population, on average. Rural outmigration during the Dust Bowl and farm consolidation are just two of the many occurrences that have led to decreasing rural populations. The urban population in Kansas increased from 52 percent in 1950 to 71 percent in 2000. This increase has primarily occurred in the counties containing the Topeka, Kansas City, and Wichita metropolitan areas. The average 20th century population growth in the nine metropolitan counties in Kansas was more than 130,000; the average population growth for the remaining 96 non-metropolitan counties over the same time period was 152. Since 1950, 37 Kansas counties (or 35% of the counties in the state) had negative net migration rates.

Kansas is also experiencing a net aging of its citizens (Kulcsár 2007). Driven in part by increasing life expectancies and declining fertility rates, the proportion of older Kansans is increasing. However, the primary driver behind the increase in the average age of many Kansas counties is the outmigration of younger citizens. Younger Kansans are drawn to more urban areas, either in the state or outside of the state, where more job and educational opportunities exist. As deaths associated with an increasingly older population in rural Kansas counties continue, while not being replaced by a younger residents, the already low population of rural counties will continue to decline.

Theme 3: Boundary Studies, Other Forms of Consolidation/Reorganization, and Ties to County Consolidation/Reorganization

Political geographers have focused heavily on boundary studies, as boundaries are "perhaps the most palpable geographic phenomena" (Minghi 1963). The methodologies used by geographers in such studies have varied, resulting in different and sometimes conflicting findings. Political boundaries are frequently either natural (in concert with some physical feature or boundary, such as a river), or "anthropogeographical" (a boundary with no associated natural features). Over time, even a boundary associated with a physical feature (such as a river) may become more anthropogeographical, as the river migrates but the boundary remains fixed in the location. Boundaries can also reflect the cultural landscape of a given time (such as an extent of settlement). However, much of the literature written on boundaries is concentrated during World War I and World War II, and was focused on the military perspective of boundaries. Boundary studies have dealt primarily with how boundaries evolved, how disputes arose due to boundaries, and what effects boundary change presented.

County consolidation has taken a backseat to other forms of amalgamation in recent literature. Recently, school consolidation and political redistricting have garnered the most attention. However, the procedures involved in these other forms of consolidation also have linkages to county consolidation that are worthy of consideration. In all cases of consolidation, the effort is to create the most efficient governmental or administrative unit for the purpose of providing services (Cowing and Holtmann 1974). Creating "economies of scale" is the primary objective in consolidation, and this must be obtained to balance the reduction in the number of local political leaders and a loss of certain "identity symbols" (Koven and Hadwinger 1992). Marando (1979) states that consolidation of excess governments and service providers are simply "logical," despite the low number of successful consolidation measures.

Fuller (1991) points out that there is a "psychology" that exists in intergovernmental relations, and this relationship is perhaps most difficult when two or more governments attempt to combine. He makes this case in a discussion of city-county consolidation involving Aspen and Pitkin County, Colorado. However, in this particular situation, consolidation proved beneficial. As the area grew rapidly during the 1970s, increased demands on local government led to significant increases in city/county staff. Incremental consolidation efforts in the 1980s eased these massive personnel (and thus, cost) increases. Of particular importance was the reduction of service duplication, the provision of similar services by both the City of Aspen and Pitkin County, which resulted in an overall savings.

The Governmental Research and Implementation Project (GRIP), spearheaded by citizens in Aspen and Pitkin County, Colorado, with the Graduate School of Public Affairs (GSPA) at the University of Colorado, identified numerous key characteristics of government consolidation (Fuller 1991). Consolidation measures that are successful are not without controversy; however, the economic and efficiency benefits of consolidation frequently outweigh the social costs of the controversy. When consolidations are carried out, most people have found that they lead to more effective government and provision of services.

As Carey *et al*. (1996) indicate in their plan for a consolidation of municipalities in Alleghany County, Pennsylvania, consolidation measures have occasionally been proposed to deal with stagnant or declining revenues. Consolidation is geared at reducing the cost of functions associated with a government or service. Smaller jurisdictions face more expensive service costs per capita than larger jurisdictions. In many ways, the process of consolidating municipalities is similar to political redistricting, defining boundaries for health regions, and determining school district boundaries (Carey *et al.* 1996). Each involves creating a small number of large zones from an existing large number of small areas.

Despite dealing with municipal consolidation, Carey *et al*. (1996) present several guiding principles that are also relevant to county consolidation. For example, every location should exist in one county and only one county (a GIS concept known as "single membership"). New counties must also follow "topological constraints," in that they need to be contiguous and as compact as possible. Young (1988) indicates that compactness is never perfect, and there is no single definition of a compact geometric shape. For example, one test of compactness indicates a star is perfectly compact while a triangle is perfectly not compact, while another test indicates a triangle is perfectly compact and a star is perfectly not compact. Major defects are discernable with the known measures of compactness, including one situation where a salamander-shaped unit is more compact than a square due to limitations of the testing methods. Young notes, however, that a unit with more irregular boundaries is generally defined to be less compact. Koven and Hadwinger (1992) add that using existing locations and structures (such as existing county seats or service centers) for reapportioned services may lead to greater acceptability of the consolidation and reorganization measures.

Morrill (1973) expands on several criteria that should be considered in developing successful consolidation and/or reorganization proposals. In addition to keeping new areal units as regular and compact in shape as possible, utilizing existing political boundaries also furthers acceptance in that it involves already-known boundaries. Natural features also serve as acceptable, and sometimes preferred, political boundaries, as they are easily recognizable and have served as distinctive boundaries historically.

Forest (2004) discusses ambiguity concerning the term "communities of interest." It is often cited in court decisions and related academic literature that reorganization and redistricting should be performed in a manner that preserves communities of interest. However, little is provided in terms of a definition of a community of interest. Communities of interest are frequently defined as containing groups of people that share common interests and traits, and work together to solve communal problems (Fischer 2001). Examples of communities of interest include military bases and Native American reservations.

Achieving equity in property tax payments was a motive for consolidation of healthcare services in San Diego County, California (Cope and Tarshes 1954). San Diego (city) residents were bearing a greater financial burden than rural residents or residents of other incorporated areas in the county for healthcare services. In addition, operational efficiency was generally low due to varying requirements and standards between the City of San Diego, the other incorporated cities in San Diego County, and San Diego County. As a result, healthcare was consolidated at the county level, in order to make every county citizen share responsibility in paying for healthcare services.

Governmental and administrative reorganization also occurs outside of the United States. During the 1980s, New Zealand underwent dramatic administrative and economic restructuring in response to a severe domestic economic crisis and shifts in the global economy (Cocklin and Furuseth 1994). The framework for the restructuring that occurred had been deemed the "geographic restructuring model" and was driven by influences operating at the global, national, and local levels. Of particular concern were environmental management and planning, and the establishment of physical parameters for sustainable environmental management with respect to the indigenous Maori population.

New Zealand had an historical problem with consolidation, with nearly 700 local governmental bodies (Cocklin and Furuseth 1994). Still, the concentration of power with the central government and little concern with communities of interest in the administration of governmental services led to a situation of rather unresponsive administration. The spatial reorganization of administrative districts was one of the more contentious aspects of the restructuring model. The Local Government Commission, tasked with defining boundaries, determined "there should be regard for communities of interest, the identity and values of communities, and the efficiency and effectiveness of services, boundaries should conform as closely as possible to those used for the Census, and where possible the regional boundaries should conform to water catchments (Cocklin and Furuseth 1994, p. 464). It was also assumed that amalgamation would lead to greater economic efficiency due to the ability of larger administrative units to acquire economies of scale.

Honey (1977) discussed governmental reform in England. He argues for "jurisdictions large enough to internalize externalities so that jointness efficiency (minimizing unit costs and maximizing solutions to collective issues) is maximized. The Redcliffe-Maud Commission determined that districts with at least 250,000 people were necessary in order to guarantee a high level of service at a reasonable cost, and ultimately recommended 58 districts based roughly on city regions. The Labour Government accepted the proposal. However, when the Conservatives won the 1970 election, the Redcliffe-Maud Commission suggestions were modified. The 250,000-person minimum was maintained, but the organization of districts on city regions was modified.

School district and school consolidation is another issue affecting not only rural America, but also the educational system across the United States as a whole. School consolidation has a long history in the United States. Consolidations of southern schools became common around 1900, through desires to broaden school district boundaries to serve more individuals, and to reduce the number of single-room schoolhouses in favor of multi-room schoolhouses with several teachers and a principal (Maxcy 1976). In the south, these consolidations largely were measures to extend and provide education to marginalized populations such as minorities and the poor. Koven and Hadwinger (1992) indicate that successful school consolidations challenge the notion that governmental consolidation is not politically feasible. Similar political forces and opposition exist in both local governments and school districts, yet school district consolidation has been successful in many areas. As Guthrie (1979) indicates, the number of schools and school districts has continually declined, with fewer buildings and school administrations serving more students. This has particularly been true in rural areas with declining populations that have resulted in smaller class sizes and low enrollment. The number of school districts in Kansas has dropped from around 9000 to 304 in 2001 (Augenblick and Myers, Inc. 2004).

With amalgamation, "major cost savings should be obtainable through consolidation of rural schools which are too small (Holland and Baritelle 1975). Economic efficiency, operationally defined using a cost per student statistic, has been shown to increase (a decline in per student cost) as the number of enrolled students increases; Holland and Baritelle note that decreases in cost per student will level off as student numbers increase. Guthrie notes that cost savings due to school consolidation are mixed. While administrative costs do decline as a result of consolidation, increasing transportation costs and times may offset such administrative savings. Holland and Baritelle indicate that increasing fuel costs further exacerbate the transportation issue. Guthrie notes that larger class sizes (the number of students per grade level) tend to be tied to more course offerings and a better ability for the school to attract highly skilled and specialized teachers. However, other indicators suggest that students in small schools score just as well on standardized tests as students at larger schools. In addition, large class sizes (students per classroom/teacher) may be detrimental to individual education.

Governmental consolidation (county or otherwise) has been related to congressional/political redistricting. Of interest in political redistricting is misuse of the process, as "the United States is the 'home' of malapportionment and gerrymandering practices" (Johnston 2005). Gerrymandering is the drawing of political district boundaries to promote a party's electoral interests rather than simply basing the district boundaries on population distribution. Gerrymandering research has focused heavily on racial gerrymandering, the drawing of political district boundaries to dilute the effect of the minority vote (O'Loughlin 1982). The result is often very irregular, un-compact, and questionable district boundaries. In many cases, gerrymandering appears easy to identify on a map, but there have been few successful court cases against the practice, despite the fact that 49 states have reapportionment criteria identified. Because of the importance of the electoral process and party domination in the United States, geographers have more frequently researched political redistricting than other forms of political reorganization (Johnston 2005). Geographers have acted as consultants in political redistricting – either in terms of preventing gerrymandering, or as consultants for political parties who wish to draw political district boundaries in their electoral favor.

Despite numerous arguments in favor of consolidation (at various levels of government and administration), public resistance to consolidation occurs in most cases where consolidation is proposed. Much of the reasoning behind consolidation resistance was discussed (above) in the review of the historical county consolidation literature. However, resistance to other forms of consolidation, be it school district, social services, or city-county consolidation, continues. Marando (1973) indicated that voter acceptance of city-county consolidation has been rare. More recently, city-county consolidation continues to be limited. Leland and Johnson (2004) indicated that fewer than 15 percent of city-county consolidation attempts occur on the first try. While over 100 consolidation proposals have reached the referenda stage, as of 2007, there were only 19 successful passages resulting in a total of 38 consolidated city-county governments in the United States. As a result, there is an 85 percent failure rate (Leland 2007).

According to Rosenbaum and Henderson (1972), consolidation and reorganization of political boundaries is an anomalous form of political change in the United States. They suggest that most political change is generally incremental and gradual in nature. In addition, change is typically localized in its origin, with a gradual spreading or dissemination of the change, as with the growth of an urban area. However, consolidation and the associated reorganization of boundaries are rather sudden and can impact a widespread area.

Of particular concern is the resistance of citizens in economically prosperous areas to consolidation with an area of lower wealth (Filer and Kenny 1980). Filer and Kenny suggest that, in the case of the consolidation of a wealthier community with a poorer community, an individual in the wealthier community is made "unambiguously worse off" whereas an individual in the poorer community benefits. Voter analysis was conducted on 52 city-county consolidation referenda. Suburban voters were less enthusiastic about consolidation than city voters and this level of support was tied to perceived economic benefit or hindrance; when perceived economic benefit was higher, support for consolidation was greater. Marando and Wanamaker (1972), through a series of regression analyses on city-county consolidation referenda, found little statistical evidence to tie any single demographic characteristic with support for consolidation measures.

Henderson and Rosenbaum (1973) identify the importance of the support of local political leaders for consolidation referenda. When the local elite supports consolidation measures, the general population tends to follow through with support. The support of consolidation measures by local political leaders tends to deflate the idea that consolidation measures as work of "starry eyed idealists." To contrast this, opposition by the political elite toward consolidation measures hurts the chances that the measure passes.

Leland (2007) provides an analysis of city-county consolidation efforts that have succeeded and failed in an attempt to gain an understanding of how different methods affect consolidation outcomes. This analysis is applicable to other forms of government reorganization, including county consolidation and reorganization. The combination of campaign efforts for and against consolidation affects the probability of a successful consolidation referendum. Leland determined that campaign spending was not a factor in the outcome; in fact, consolidation proponents always outspent consolidation opponents. In addition, Leland determined that arguments for increased efficiency of government by pro-consolidation individuals are not enough to guarantee successful referenda. Proponents must also provide a strong message for economic development. In addition, proponents need to carefully and tactfully outline how a consolidated government would work internally, in order to erase or limit doubt and confusion. Finally, all of these aforementioned procedures must be performed while convincing voters that the existing political structure is inadequate and requires revision.

Worth mentioning is the literature that has not embraced consolidation. In fact, the wide body of literature presented here frequently notes the disagreement that exists on the actual benefits of consolidation. In his discussion of county consolidation in Texas, Bradshaw (1937) notes that the benefits of county consolidation would not be all that far-reaching. The mileage of roads to maintain and the amount of property to be assessed would not decrease; rather, the savings that could result from county consolidation must result from reducing the costs of administration, and there is uncertainty in whether this will occur with county consolidation.

Carey *et al.* (1996) discuss the nature of the services provided in consolidated governments. While smaller governments may perform services less efficiently, it is frequently believed that smaller governments are more responsive to the citizenry. Therefore, any cost savings would result in a degradation of the quality of the services provided. Therefore, finding an acceptable balance can be difficult. In their discussion of health systems in San Diego County, California, Cope and Tarshes (1954) noted that a particular set of conditions existed (such as proximity of service providers, a limited number of providers, and similar high-level authority), that facilitated the consolidation measure to be successful. Thus, the success and the feasibility of consolidation are not uniform across all situations, and can vary greatly depending on the characteristics of the entities involved. Cowing and Holtmann (1974) note the fact that an unequal tax burden that may result from consolidation needs to be strongly considered before consolidation methods are undertaken. It has also been mentioned that critics of consolidation charge that consolidation is geared toward benefiting the political and economic elite rather than the ordinary citizenry (Feiock and Carr 1997). Proponents of consolidation measures may support the measures merely to advance their own personal interests, which may not coincide with the interests of the general electorate.

Theme 4: GIS Applications in Consolidation

While spatial consolidation of units is not a new phenomenon, the use of Geographic Information Systems (GIS) for the study of consolidation is relatively new. Eagles *et al.* (2000) state that: "the widespread deployment of geographic information systems in the 1990s fundamentally altered the cartographic, and arguably the political, process of redistricting." Eagles *et al*. suggest that while GIS made redistricting easier due to the relative ease-of-use of the software, the abundance of additional available decision-making methods that GIS provides tends to increase the complexity of the procedure and the difficulty of a group agreeing on a specific solution. Morrill (1976) determined that computer-based redistricting in Washington State was just as good, if not better, than manual redistricting procedures. Boots (1980) provided an early method by which GIS-based consolidation could occur with a discussion of weighted Thiessen Polygons. Weighted Thiessen Polygons include not only the standard distance measure that is present in standard Thiessen Polygons, but also at least one additional variable that would place greater weight (or lesser weight) on each individual centroid.

Caro *et al.* (2004) discusses the use of GIS in school redistricting. Whether GIS is used simply as a guidance tool for manual redrawing of school district boundaries, or whether it is used to redraw boundaries through automatic computer algorithms, GIS can be an important tool in redistricting. Many GIS software packages include spatial analysis tools as standard functions that are useful in redistricting procedures. GIS has received more attention as of late in terms of political redistricting. Due to the controversial nature of political district boundaries, GIS has been seen as a tool that can be used to reduce the bias that might come from individual decision-making activity, and thus political preference, into the drawing of district boundaries. However, difficulties remain in using GIS in redistricting, including the difficulty of making operational "fuzzy" concepts such as that of communities of interest (Forest 2004).

The use of GIS allows for a relative ease in creating multiple scenarios for county consolidation and reorganization. Defining a scenario is no easy task. Scenarios are frequently used in climate prediction, for "scenarios are one of the main tools used to address the complexity and uncertainty of future challenges" (IPCC 2007). A scenario is essentially a generated product that presents a description of what could exist in the future given a selected set of assumptions or parameters. Studies involving scenarios frequently generate more than one scenario that include either different assumptions/parameters or variations in the same assumptions/parameters, because the impact of visualizing the scenarios is greatest when the scenarios are "presented as a small set with clear and striking differences" (Van der Heijden 1996). This is similar to the cartographic principle of "small multiples."

Summary

The preceding literature review discusses much of the published literature on county consolidation measures across the United States. The county consolidation literature set was rather dated, but provided an overview of the reasoning behind county consolidation measures in several states, as well as an indication of low public support and ultimately low success rates for the consolidation measures. Insight into other forms of consolidation provides some perspective on methods and techniques involved in consolidation and reorganization. However, the limited and dated literature set on county consolidation indicates a need for new research and publication on this important topic.

Of particular importance in the literature is the discussion of potential ways in which counties could be consolidation and reorganized. Various criteria exist in which new counties could be drawn. Commonly-referenced criteria in the literature are criteria involving a distance metric, a population metric, and an economic metric. These three criteria will serve as foci for this study.

CHAPTER 3 - Study Area

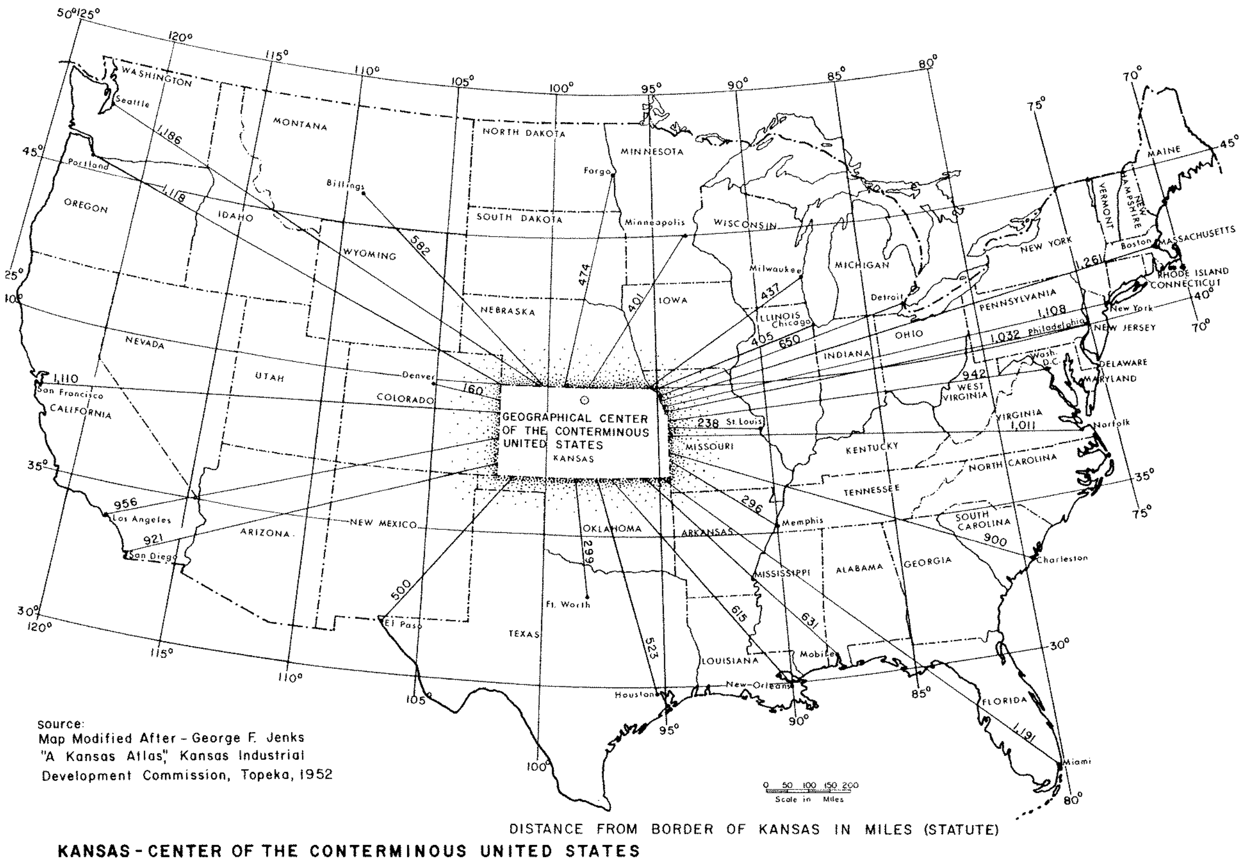
Introduction

This study develops potential scenarios for reorganizing/consolidating county boundaries in the state of Kansas. Kansas was granted statehood on 29 January 1861, and contains the geographic center of the 48 contiguous United States. The state is bordered by Nebraska to the north, Missouri to the east, Oklahoma to the south, and Colorado to the west. Kansas encompasses approximately 213,000 square kilometers in area, and is bounded geographically by latitude 37°N to 40°N and by longitude 94°38'W to 102°1'34"W (Figure 3.1). The U.S. Census Bureau state population estimate based on the 2000 census is 2,688,418, and the state's largest city is Wichita (344,284). Topeka is the capital city (122,377). There are a number of factors that might be used in determining how to consolidate Kansas counties. The subsequent discussion further explains characteristics of the state that are utilized in this development of the county reorganization scenarios. This discussion includes discussions on population distribution, economic characteristics, ecoregions, major river basins, and the state's transportation network.

Kansas Counties

There are 105 counties in the State of Kansas (Figure 3.2). Each county has a city that serves as its local government center, known as the county seat (Figure 3.3). The current geography of counties was established in 1893. During the Territorial Period prior to statehood in 1861, 34 counties, mostly in northeast Kansas, were organized. The first decade of statehood, 1861-1870, had 18 new counties organized, with Ellis County (Hays) being the furthest west. This period also saw an original Dorn County split into the present day Neosho and Labette Counties. During 1871-1880, Kansas had its greatest percentage increase in population of any decade and 28 new counties, mostly in west-central Kansas, were organized. The third decade following statehood, was the period when an additional 26 counties in western Kansas were added. Grant, Greeley, and Kearney Counties were the last to be organized in 1888. The 106 counties in place by 1890 were reduced to the present day 105 when Garfield County was ruled

Figure 3.1 Geographic location of Kansas. From Self 1978, p. 7.



to be too small and subsequently that land area was combined with Finney County in 1893 (Self 1978). The size of the 105 counties varies slightly with a median value of 1,891 square kilometers (Table 3.1); the range is from Wyandotte County (403 square kilometers to Butler County (3,746 square kilometers).

The location of the county seat has an interesting history in Kansas. Socolofsky (1964) discusses the numerous "county seat wars" in Kansas. For many, the county seat was a "position of political prestige within a given area" (p. 2). Disputes over the location of the county seat were not uncommon across the entire United States, which would be expected given the more than 3,000 counties that exist, but the more intense disputes took place in counties west of the Mississippi River. Socolofsky also notes, "Although western state and local histories abound in county-seat controversies, no state can approach the number, bitterness, bloodshed, and sheer stupidity exhibited in these conflicts in Kansas" (p. 3). In a 20-year period, Linn County had six different county seats, while Wilson County had five. While Linn County and Wilson County

Figure 3.2 Existing Kansas counties.

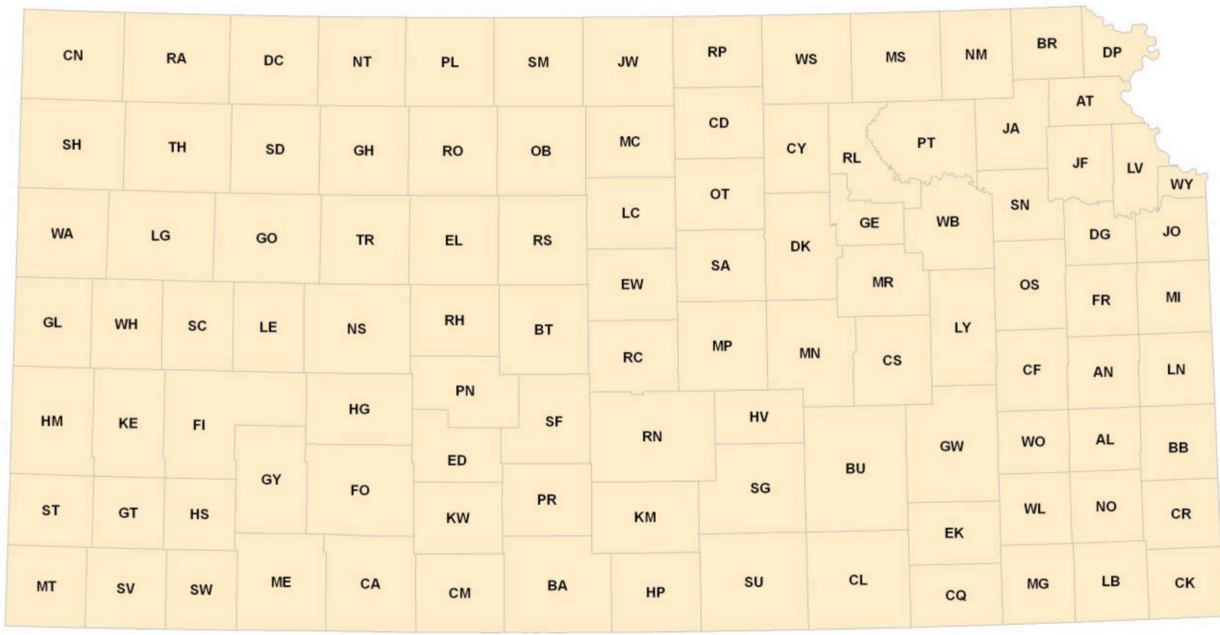
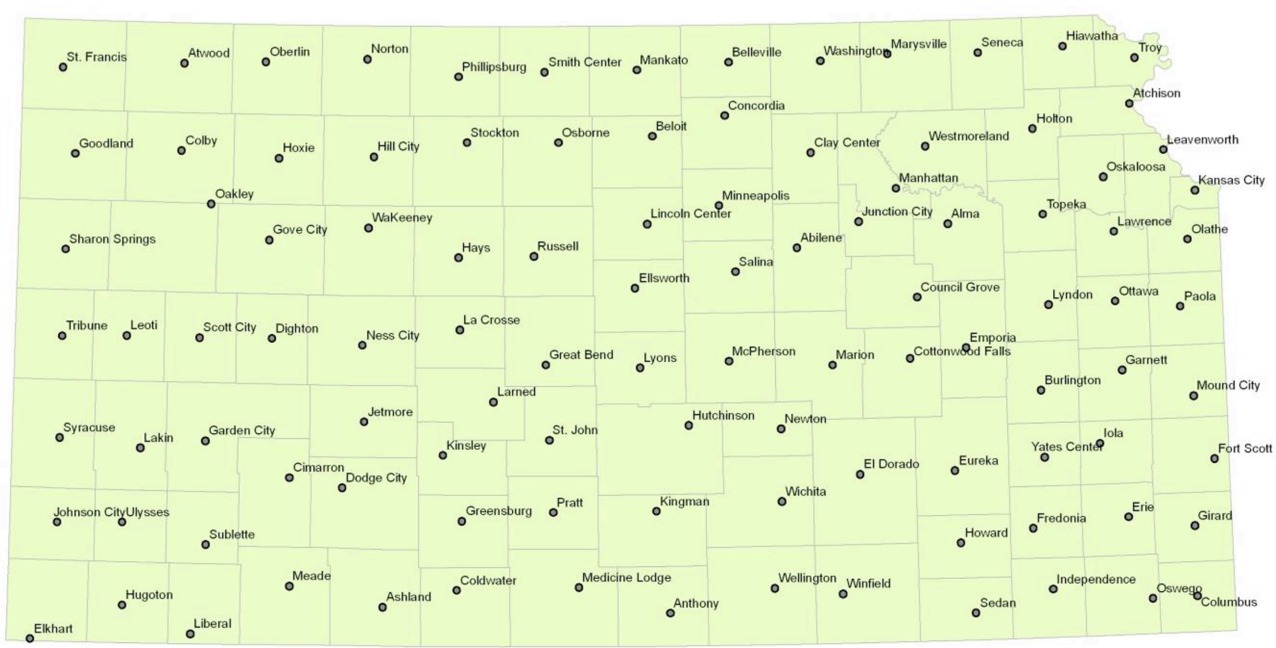


Figure 3.3 Existing Kansas county seats.



are in the eastern third of the state, the bloodiest disputes occurred in the western third, where several deaths due to gunfire resulted from standoffs over the relocation of a county seat and the associated paperwork. In general, Socolofsky (1964) notes, “these conflicts were the product of selfish greed and avarice, which was often clothed in an aura of righteousness” (p. 3).

Table 3.1 Abbreviations, county seats, 2000 U.S. Census population, and size of existing Kansas counties. **Continued on next two pages.**

COUNTY	ABBREVIATION	COUNTY SEAT	POPULATION (2000 CENSUS)	SIZE (KM^2)
Allen	AL	Iola	14,385	1,308
Anderson	AN	Garnett	8,110	1,513
Atchison	AT	Atchison	16,774	1,127
Barber	BA	Medicine Lodge	5,307	2,943
Barton	BT	Great Bend	28,205	2,332
Bourbon	BB	Fort Scott	15,379	1,655
Brown	BR	Hiawatha	10,724	1,482
Butler	BU	El Dorado	59,482	3,746
Chase	CS	Cottonwood Falls	3,030	2,015
Chautauqua	CQ	Sedan	4,359	1,670
Cherokee	CK	Columbus	22,605	1,531
Cheyenne	CN	Saint Francis	3,165	2,644
Clark	CA	Ashland	2,390	2,531
Clay	CY	Clay Center	8,822	1,698
Cloud	CD	Concordia	10,268	1,861
Coffey	CF	Burlington	8,865	1,695
Comanche	CM	Coldwater	1,967	2,045
Cowley	CL	Winfield	36,291	2,933
Crawford	CR	Girard	38,242	1,541
Decatur	DC	Oberlin	3,472	2,316
Dickinson	DK	Abilene	19,344	2,207
Doniphan	DP	Troy	8,249	1,028
Douglas	DG	Lawrence	99,962	1,229
Edwards	ED	Kinsley	3,449	1,611
Elk	EK	Howard	3,261	1,684
Ellis	EL	Hays	27,507	2,332
Ellsworth	EW	Ellsworth	6,525	1,874
Finney	FI	Garden City	40,523	3,374
Ford	FO	Dodge City	32,458	2,847
Franklin	FR	Ottawa	24,784	1,494
Geary	GE	Junction City	27,947	1,047
Gove	GO	Gove	3,068	2,775
Graham	GH	Hill City	2,946	2,328
Grant	GT	Ulysses	7,909	1,489
Gray	GY	Cimarron	5,904	2,252
Greeley	GL	Tribune	1,534	2,015
Greenwood	GW	Eureka	7,673	2,985
Hamilton	HM	Syracuse	2,670	2,584
Harper	HP	Anthony	6,536	2,080
Harvey	HV	Newton	32,869	1,400

COUNTY	ABBREVIATION	COUNTY SEAT	POPULATION (2000 CENSUS)	SIZE (KM^2)
Haskell	HS	Sublette	4,307	1,496
Hodgeman	HG	Jetmore	2,085	2,228
Jackson	JA	Holton	12,657	1,704
Jefferson	JF	Oskaloosa	18,426	1,442
Jewell	JW	Mankato	3,791	2,368
Johnson	JO	Olathe	451,086	1,244
Kearny	KE	Lakin	4,531	2,257
Kingman	KM	Kingman	8,673	2,245
Kiowa	KW	Greensburg	3,278	1,872
Labette	LB	Oswego	22,835	1,692
Lane	LE	Dighton	2,155	1,858
Leavenworth	LV	Leavenworth	68,691	1,213
Lincoln	LC	Lincoln	3,578	1,865
Linn	LN	Mound City	9,570	1,570
Logan	LG	Oakley	3,046	2,779
Lyon	LY	Emporia	35,935	2,215
McPherson	MP	McPherson	29,554	2,334
Marion	MN	Marion	13,361	2,470
Marshall	MS	Marysville	10,965	2,342
Meade	ME	Meade	4,631	2,537
Miami	MI	Paola	28,351	1,528
Mitchell	MC	Beloit	6,932	1,861
Montgomery	MG	Independence	36,252	1,687
Morris	MR	Council Grove	6,104	1,820
Morton	MT	Elkhart	3,496	1,891
Nemaha	NM	Seneca	10,717	1,863
Neosho	NO	Erie	16,997	1,497
Ness	NS	Ness City	3,454	2,784
Norton	NT	Norton	5,953	2,283
Osage	OS	Lyndon	16,712	1,863
Osborne	OB	Osborne	4,452	2,316
Ottawa	OT	Minneapolis	6,163	1,870
Pawnee	PN	Larned	7,233	1,954
Phillips	PL	Phillipsburg	6,001	2,318
Pottawatomie	PT	Westmoreland	18,209	2,233
Pratt	PR	Pratt	9,647	1,906
Rawlins	RA	Atwood	2,966	2,771
Reno	RN	Hutchinson	64,790	3,293
Republic	RP	Belleville	5,835	1,866
Rice	RC	Lyons	10,761	1,886
Riley	RL	Manhattan	62,843	1,611
Rooks	RO	Stockton	5,685	2,319
Rush	RH	La Crosse	3,551	1,861
Russell	RS	Russell	7,370	2,328
Saline	SA	Salina	53,597	1,868
Scott	SC	Scott City	5,120	1,859
Sedgwick	SG	Wichita	452,869	2,614

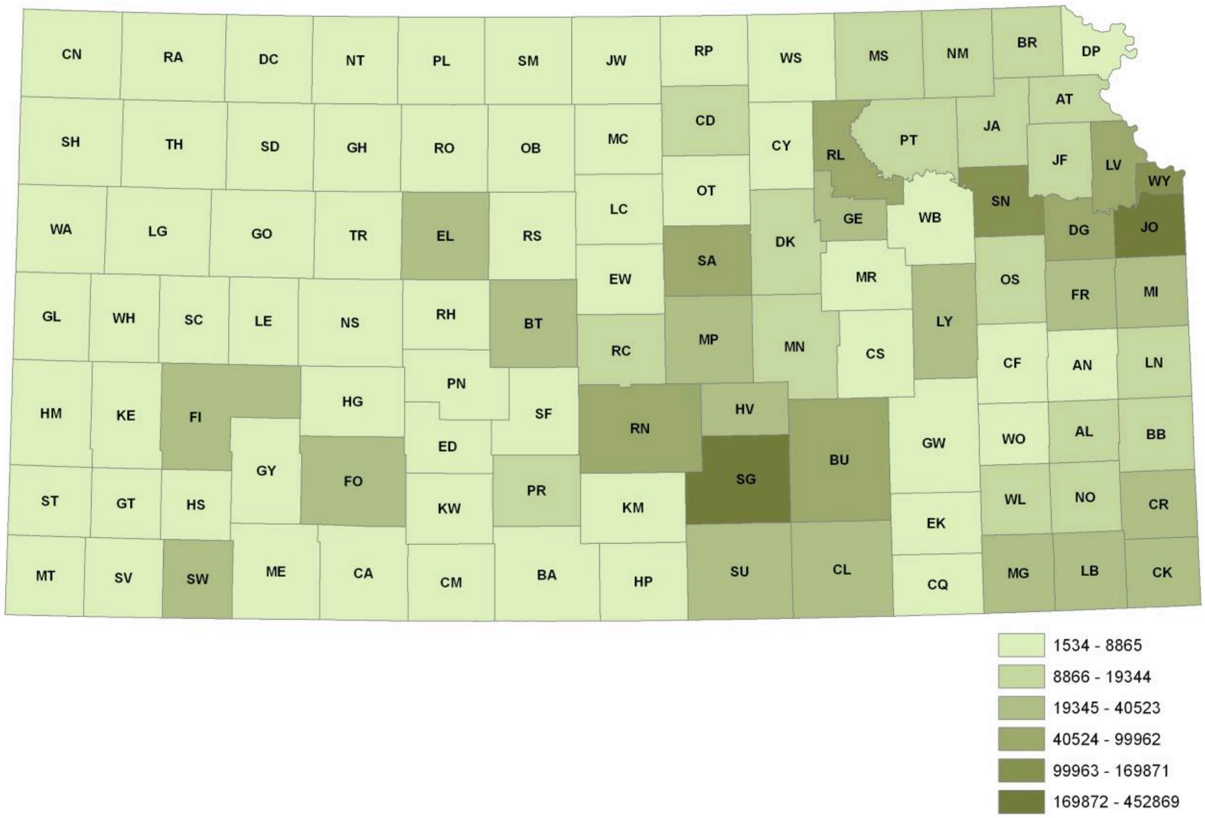
COUNTY	ABBREVIATION	COUNTY SEAT	POPULATION (2000 CENSUS)	SIZE (KM^2)
Seward	SW	Liberal	22,510	1,659
Shawnee	SN	Topeka	169,871	1,441
Sheridan	SD	Hoxie	2,813	2,322
Sherman	SH	Goodland	6,760	2,735
Smith	SM	Smith Center	4,536	2,322
Stafford	SF	Saint John	4,789	2,058
Stanton	ST	Johnson City	2,406	1,761
Stevens	SV	Hugoton	5,463	1,885
Sumner	SU	Wellington	25,946	3,069
Thomas	TH	Colby	8,180	2,784
Trego	TR	WaKeeney	3,319	2,328
Wabaunsee	WB	Alma	6,885	2,071
Wallace	WA	Sharon Springs	1,749	2,367
Washington	WS	Washington	6,483	2,328
Wichita	WH	Leoti	2,531	1,861
Wilson	WL	Fredonia	10,332	1,489
Woodson	WO	Yates Center	3,788	1,309
Wyandotte	WY	Kansas City	157,882	403

Population Distribution

The population in Kansas is far from evenly distributed, with the highest proportion of the population living in or near the major urban centers in the eastern half of the state. Of the roughly 2.7 million people that live in Kansas, 1,331,670 (or 50 percent of the total) live in five counties (Johnson, Sedgwick, Shawnee, Wyandotte, and Douglas), all in the eastern half of the state (Figure 3.4). Every city with over 30,000 residents exists in the eastern half of the state (Hutchinson is the furthest west). Only 10 counties have more than 50,000 people, and again, all 10 of these are in the eastern half of the state. Further examination of the population characteristics of Kansas indicates a large percentage of Kansans reside in two major metropolitan areas – the Kansas City Metropolitan Area and the Wichita Metropolitan Area.

Conversely, the western half of Kansas is limited in population compared to the eastern half. Only two cities (Dodge City and Garden City) have over 20,000 people (Figure 3.5). Garden City, with 28,451 residents in 2000, may soon provide the first population center in western Kansas to exceed the 30,000 threshold. The 12 least populated counties are in the western half, and none of these have over 3,000 people. Twenty-four of the 30 least populated counties are in the western half of the state, and none of these have over 4,500 people (Figure

Figure 3.4 Choropleth map of Kansas population by county, 2000 U.S. Census. Categorical breaks determined using a natural breaks scheme.

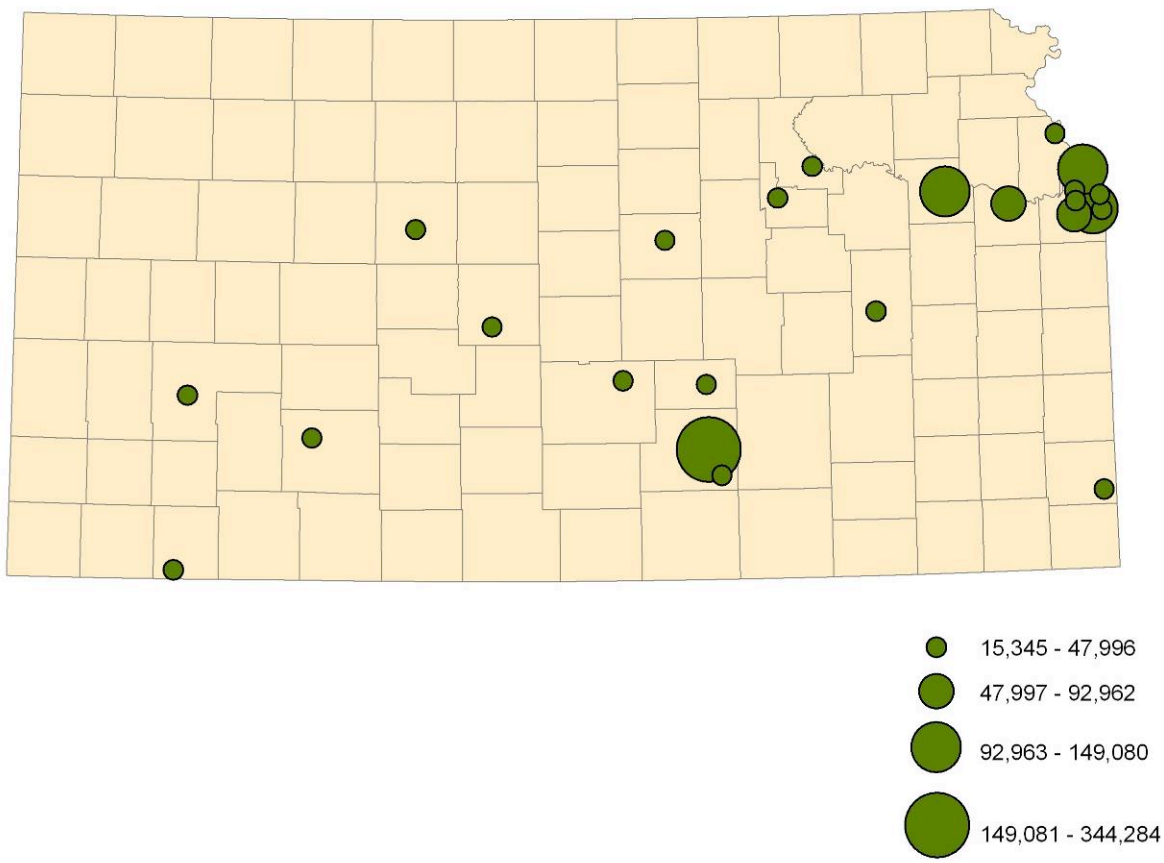


3.6). Statewide, 62 of the state's 105 counties have fewer than 10,000 people and 78 counties have fewer than 20,000 people.

Economic Characteristics

Economically, the state is also spatially diverse. Numerous indicators, including tangible assessed valuation, sales tax collected, and property tax collected, provide a glimpse of the economic characteristics of a county. Data were obtained from The University of Kansas Institute for Policy and Social Research, and are for the year 2005. Considered jointly, the three indicators show that clusters of economically more prosperous counties are found in the northeast and southwest portions of the state, as well as the Wichita area, while economically less well off counties tend to be located in northwest, north central, and southeast Kansas. Because tangible assessed valuation is used directly in the county reorganization scenarios, the discussion on tangible assessed valuation is more detailed compared to the discussion of sales tax collected and property tax collected.

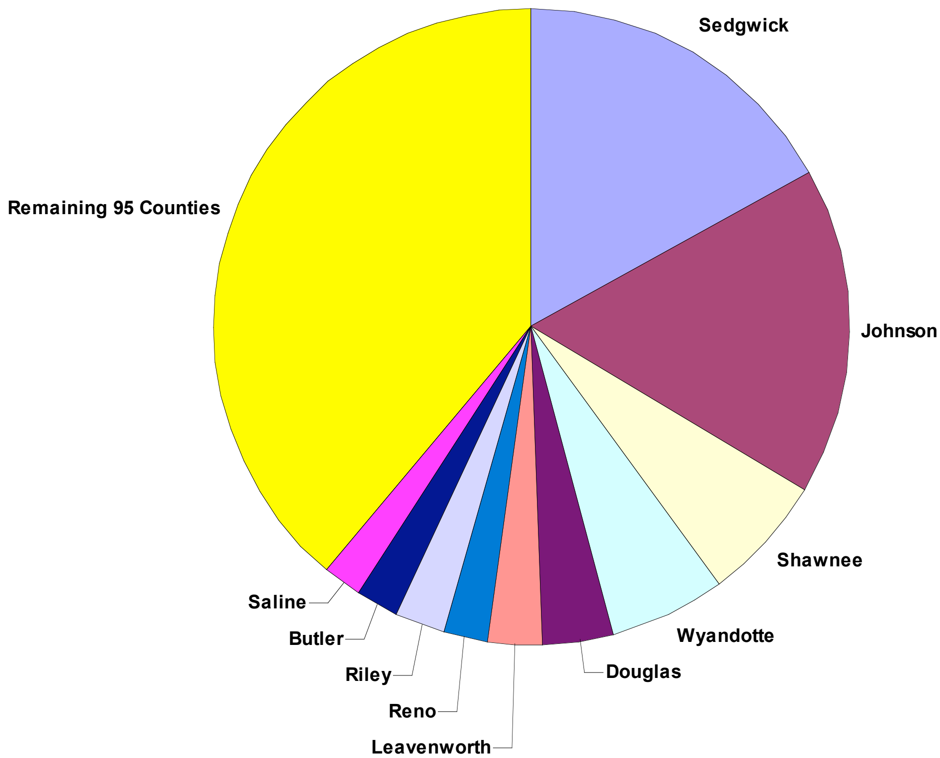
Figure 3.5 Proportional symbol map of Kansas cities with more than 15,000 people, 2000 U.S. Census.



Tangible assessed valuation

Nine of the ten counties with the highest tangible assessed valuations for 2005 are located in the eastern half of the state (Finney County is the western exception) (Figure 3.7). Johnson County, in the Kansas City Metropolitan Area, is an extreme outlier, with an assessed valuation of nearly $7.2 billion. Sedgwick County follows, with a tangible assessed valuation of roughly $3.6 billion. Seven of the ten counties with the lowest assessed valuations are found in the western half of the state. Statewide, the lower tangible assessed valuations were found in counties that were in the northwest, north central, and southeast portions of the state, while the higher values were found in the northeast portion of the state, as well as scattered counties in the southwest portion of Kansas.

Figure 3.6 Pie chart showing the relationship between the population of the 10 most populated counties in Kansas and the rest of the state.



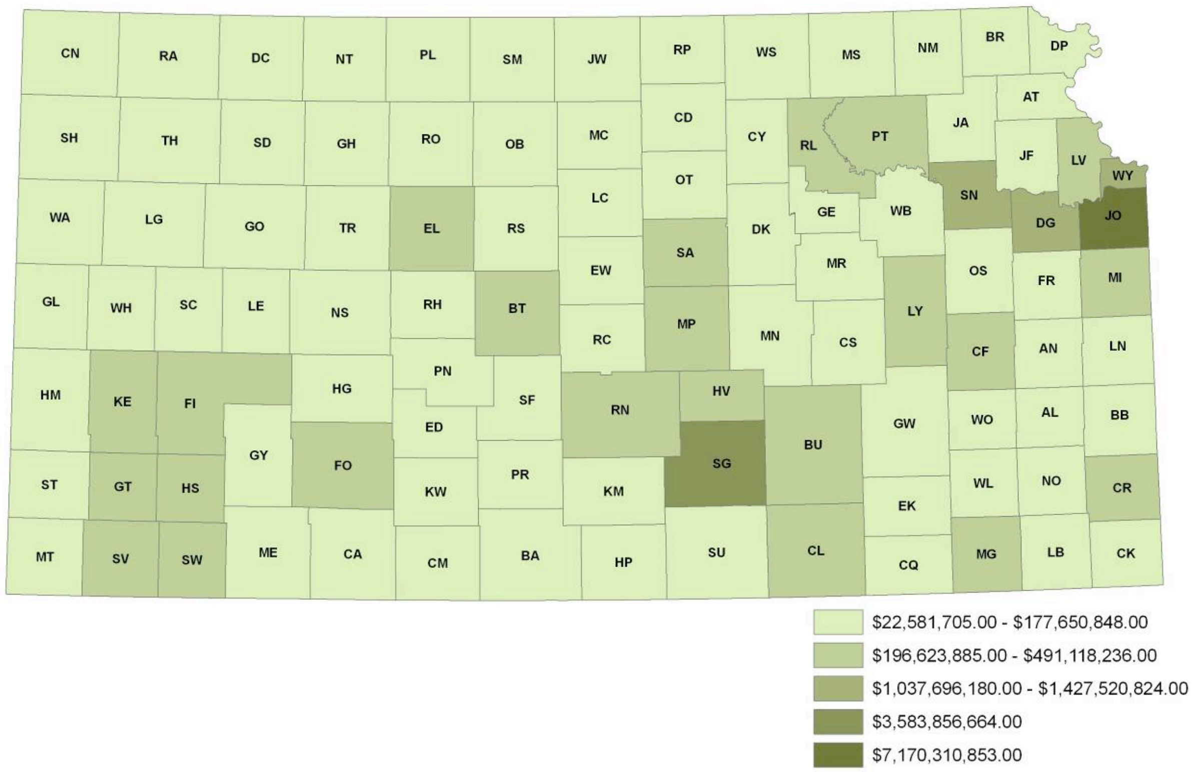
Sales tax collected

Nine of the ten counties with the highest sales tax collections are also located in the eastern half of the state (Finney County is again the lone exception). Seven of the ten counties with the lowest sales tax collections are located in the western half of the state. Statewide, the spatial organization of sales tax revenues is similar to the spatial organization of tangible assessed valuation. Counties with higher sales tax revenues are located in northeast Kansas, portions of southwest Kansas, and in the Wichita area. Lowest sales tax revenues are found in northwest Kansas, north central Kansas, and southeast Kansas.

Property taxes collected

Similar spatial patterns exist among property tax collections. Nine of the ten counties with the highest property tax collections are in eastern Kansas, with Finney County being the exception. Eighteen of the 20 counties with the highest property tax collections are located in

Figure 3.7 Tangible assessed valuation for existing Kansas counties, 2005.



the eastern half of Kansas. Conversely, seven of the ten counties with the lowest property tax collections are located in the western half of Kansas. Fourteen of the 20 counties with the lowest property tax collections are located in the western half of the state. Statewide, counties with higher property tax collections are located in northeast and southwest Kansas, and in the Wichita area, while lower property tax collections are found in counties in the northwest, north central, and southeast portions of the state.

Ecoregions, Major River Basins, and Topography

Ecoregions

Research geographers with the Environmental Protection Agency have delineated numerous ecoregions for the state of Kansas (Figure 3.8). Ecoregions are "relatively large units of land containing a distinct assemblage of natural communities and species, with boundaries that approximate the original extent of natural communities prior to major land-use change" (Olson *et al.* 2001). Ecoregions are irregularly shaped and have natural features for boundaries.

Level III ecoregions serve as the primary level of specificity for this discussion, though some additional insight, and mentioning of Level IV ecoregions, occurs in this section.

The northeastern portion of Kansas falls in the Western Corn Belt Plains Level III ecoregion, though primarily this involves Loess and Glacial Drift Hills and the Nebraska/Kansas Loess Hills, as this ecoregion marks the extent of Kansasan glaciation for the state. From Topeka and Kansas City south to the Oklahoma border, the Central Irregular Plains Level III ecoregion is found, most notably the Osage Cuestas. A small portion of far southeast Kansas is part of the Springfield Plateau, and therefore falls under the Ozark Highlands Level III ecoregion.

The unique Flint Hills Level III ecoregion exists to the west of the Central Irregular Plains ecoregion. The Flint Hills region stretches roughly from southern Marshall County to the Oklahoma border, and is relatively narrow in east-west extent. A small area is noted of the Central Oklahoma/Texas Plains ecoregion, particularly eastern portions of Elk and Chautauqua counties.

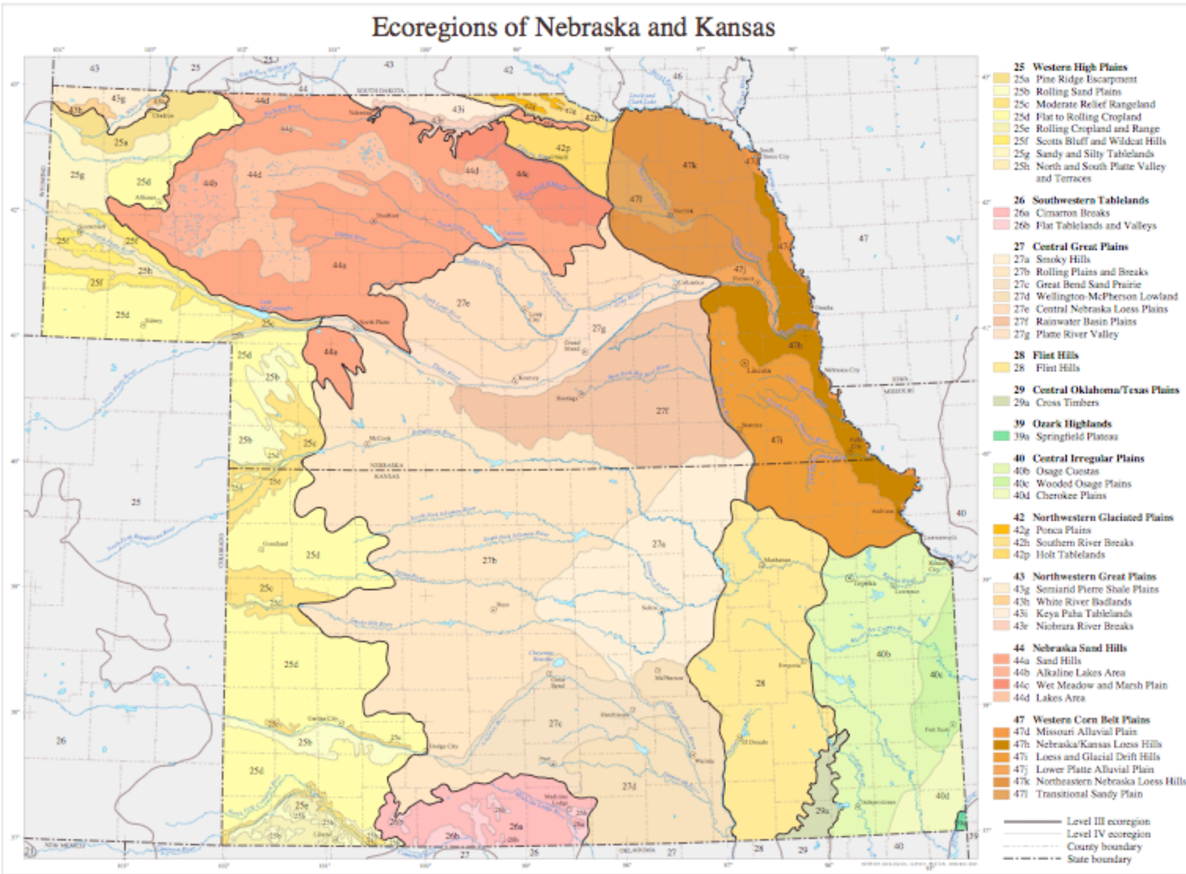
The majority of Kansas falls under the broadly-termed Central Great Plains Level III ecoregion, most notably the Smoky Hills and the Rolling Plains and Breaks Level IV ecoregions. Much of northwest, north central, central, and south central Kansas lies in the Central Great Plains ecoregion. A small portion of south central and southwest Kansas belongs to the Southwestern Tablelands ecoregion.

The remainder of Kansas, consisting of the western reaches of the state, falls in the Western High Plains Level III ecoregion. This area is primarily comprised of Flat to Rolling Cropland.

Major River Basins

The U.S. Geological Survey has divided the state into 12 major river basins (Kenny and Hansen 2004) (Figure 3.9). The "western basins" are the Upper Republican, Solomon, Smoky Hill-Saline, Upper Arkansas, Cimarron, and Lower Arkansas basins, which cover the western two-thirds of Kansas. The "eastern basins" are the Walnut, Verdigris, Neosho, Marais des Cygnes, Kansas-Lower Republican, and Missouri River basins. The eastern basins possess most of the available surface water in the state, and contain the major population centers, with the exception of Wichita. In the area of the western basins, irrigated agriculture is having a major

Figure 3.8 Level III and IV ecoregions of Kansas and Nebraska. Source: Environmental Protection Agency

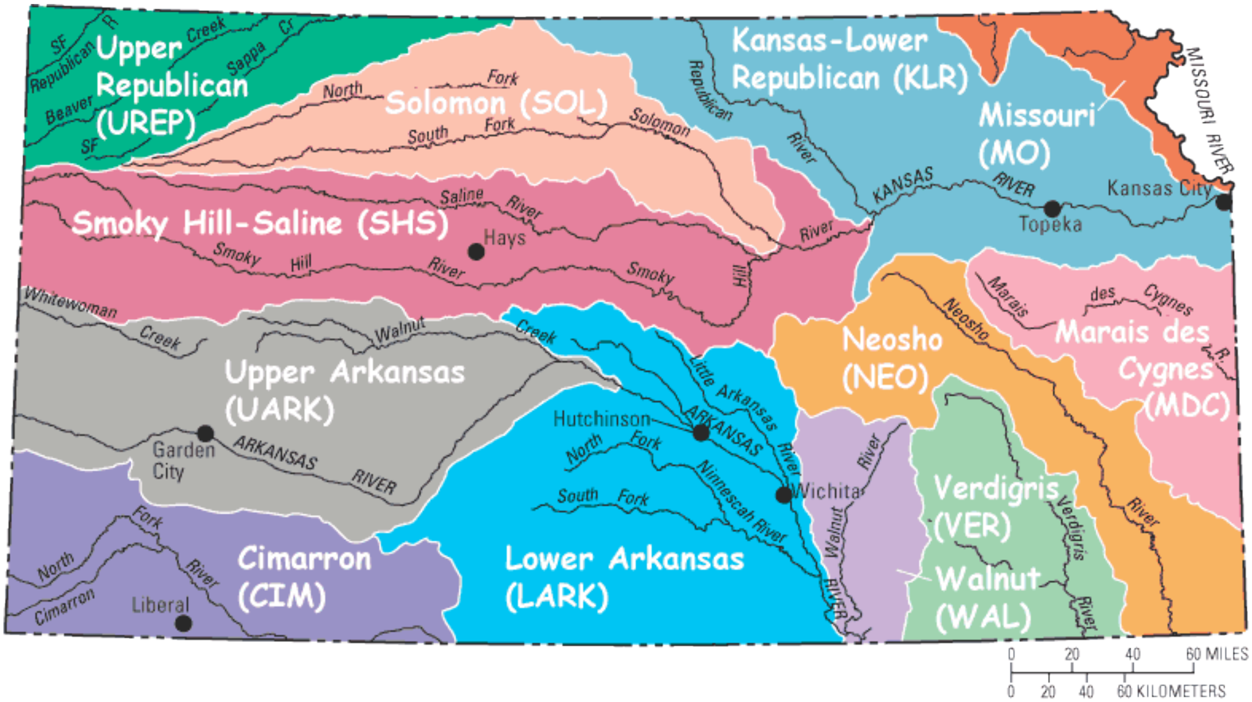


impact on available water resources. Hydrologic units from the United States Geological Survey (USGS) provide a cartographic format for watersheds at various spatial resolutions. In terms of Hydrologic Unit Codes (HUC), there are 355 larger HUC-11 units and 2020 smaller HUC-14 units in Kansas.

Topography

Topographically, Kansas possesses gradual relief (Figure 3.10). Lowest elevations of roughly 210 meters above sea level are found in the far northeast and southeast corners of the state. The elevation gradually increases as one travels westward. The highest elevations in the state are found in the far western portions, where elevation barely tops 1,230 meters in response to a gradual approach to the Rocky Mountains.

Figure 3.9 Major river basins in Kansas. Source: Kansas Water Office.



Transportation Network

Kansas possesses a broad transportation network of Interstate highways, U.S. highways, state highways, and numerous county and local roads (Figure 3.11). Interstates 70 and 35 serve as the two major interstate highway arteries through the state. Interstate 70 crosses Kansas east-to-west, and serves as the primary transportation route between Kansas City and Denver. Interstate 35 crosses Kansas north-to-south, though not in a straight line. Interstate 135 connects Salina with Wichita. The Kansas Turnpike, a major toll highway running from south of Wichita near the Oklahoma border to Kansas City, is maintained entirely through tolls collected, and is managed by the Kansas Turnpike Association. Interstate 35 from the Oklahoma border to Emporia, and Interstate 70 from Topeka to Kansas City, serve as stretches of the Kansas Turnpike. Interstate 335 serves as the connector between Emporia and Topeka. The mandated speed limit on interstate highways and the Kansas Turnpike is 70 miles per hour maximum, and these highways contain a minimum of four lanes (two in each direction).

Figure 3.10 Topographic relief of Kansas. Source: Kansas Geological Survey.

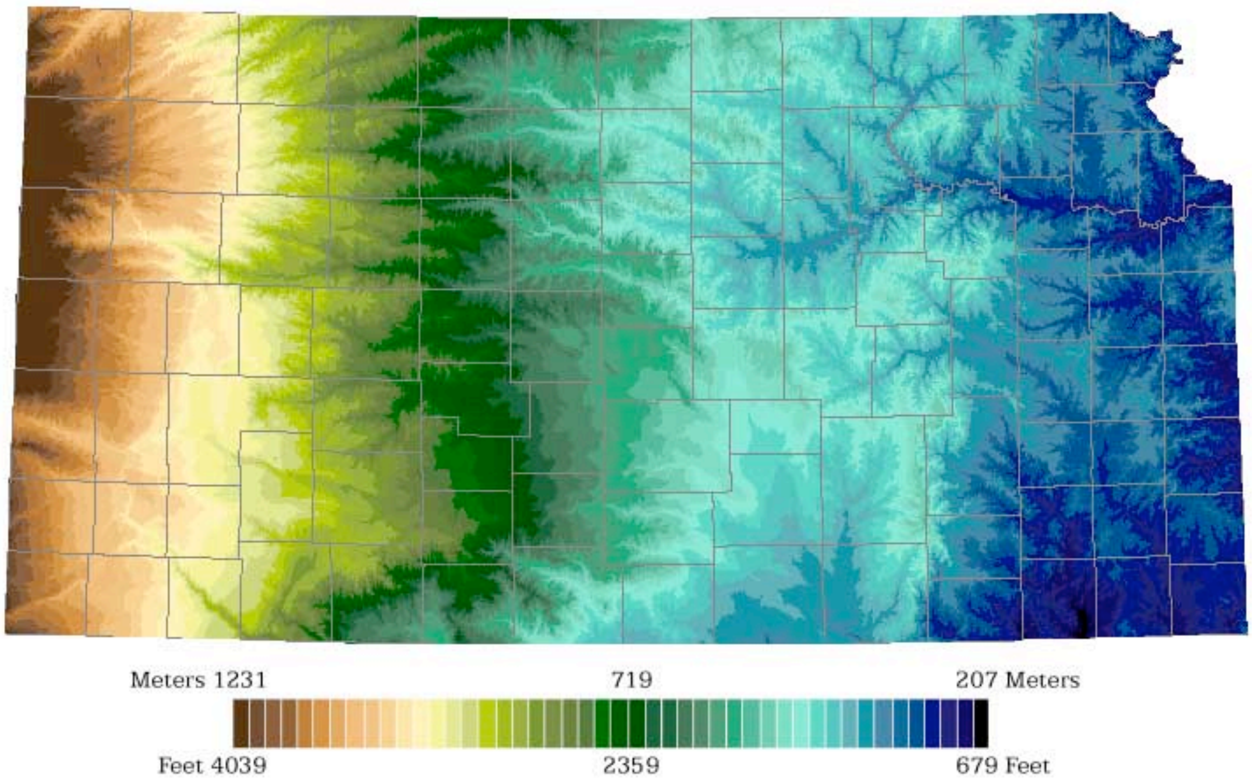
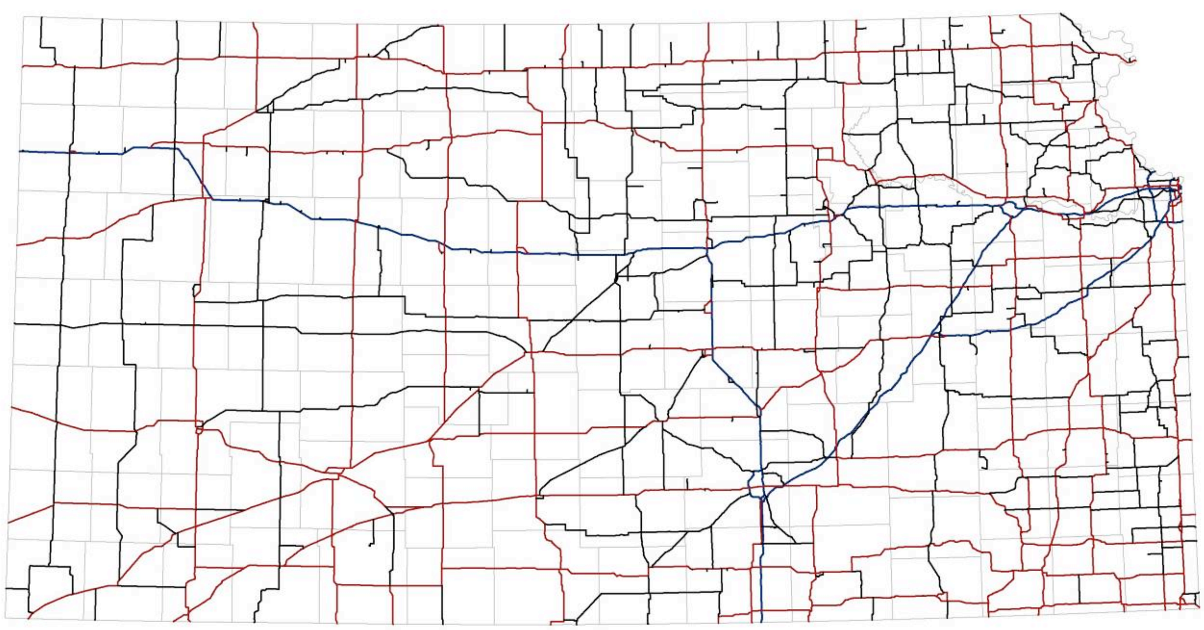


Figure 3.11 Kansas highways. Blue lines indicate controlled-access Interstate highways. Red lines indicate U.S. highways. Black lines indicate state highways.



Numerous U.S. and state highways exist across Kansas. Unlike interstate highways, these highways generally have uncontrolled access, and serve to connect local communities. These highways vary in condition, though many serve as high-speed thoroughfares. The majority of these highways are traditional two-lane highways, with one lane in each direction. The mandated maximum speed limit on uncontrolled access U.S. and state highways in Kansas is 65 miles per hour, though many highways possess lower speed limits due to local conditions. Some four-lane controlled and uncontrolled access U.S. and state highways in Kansas have a speed limit of 70 miles per hour.

Each of the aforementioned elements of Kansas could be used in a consolidation and reorganization scheme for Kansas. Population and economic characteristics are intrinsic in their involvement, and will be critical in this study. Ecoregions and watersheds could serve as foundations for new boundaries. Highways could be factored in for some chronologic/travel distance measure. Topography could aid in the development of new boundaries. Ultimately, numerous criteria and characteristics of Kansas could be used to draw new county boundaries.

CHAPTER 4 - Data and Methods

In his now classic text on the geography of Kansas, Environment and Man in Kansas, Self (1978, p. 30) indicated: "[w]ith modern transportation and computerized record keeping, it can be argued that a maximum of twenty-five counties could serve the state more economically and more efficiently." This study involved three different scenarios for reorganizing the area of Kansas into 25 counties. The three scenarios involved the reorganization of county boundaries based on 1) distance from a proposed county seat, 2) population, and 3) economic composition. Different data requirements existed for each of the scenarios, and thus different methods were used.

In identifying new ways to define the boundaries of 25 counties for the state of Kansas, an assumption was made that it might be possible to improve upon the existing political/county-level boundaries. Thus, in cases where data were available, alternatives to consolidating existing counties were chosen. Grouping existing counties arbitrarily in a GIS is not a difficult task. A goal in this study is to provide examples of consolidation and reorganization measures that utilized more advanced geospatial techniques or used data other than distanced from a local service center.

Scenario 1: County size

The first scenario for the study was based solely on minimizing the distance of all points in a county from a newly identified county seat. Selection of 25 county seats was the initial task. For the purposes of this scenario, a semi-arbitrary selection process was used. A relatively uniform statewide distribution of existing county seat locations based on the judgment of the author was selected (Table 4.1). Population of these cities was not a major consideration; rather, a primary goal was to maximize distance among the selected new county seats. For the purpose of this study, a Euclidian (straight-line "as the crow flies") distance of 100 kilometers was chosen to guide this process. This is an arbitrary assignment based in reason. With existing speed limits, a 100 km drive would likely take no longer than an hour and a half in normal driving conditions. This maximum travel time only applies to locations on or near a new county perimeter; most locations in the county would be closer to the county seat. Although the road network in Kansas is predominantly a grid pattern, the 100 km "as the crow flies" distance was deemed acceptable for two reasons. First, as opposed to mountainous states, Kansas possesses few topographic impediments to vehicular traffic. Second, Kansas maintains a well-developed road network with speed limits that would allow for any individual to make the drive to the county seat in under an hour and a half, if not much quicker, under normal driving conditions. Indeed, in most cases the counties drawn had maximum distances from the county seat to the county border that were less than the 100 km distance. The areal size of Kansas and the use of 25 county seats impacted the size of the resultant counties.

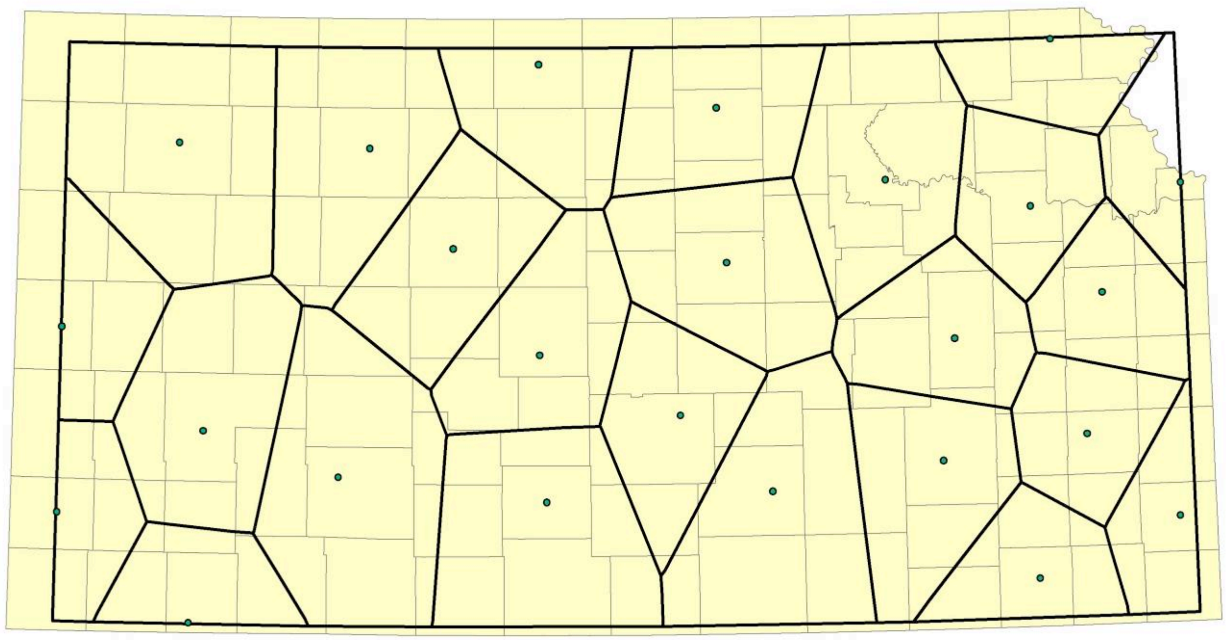
Table 4.1 County seats from Scenario 1. Population from 2000 U.S. Census.

County Seat	Population	County Seat	Population
Colby	5,450	Iola	6,302
Concordia	5,714	Johnson City	1,528
Dodge City	25,176	Kansas City	146,867
Emporia	26,760	Liberal	19,666
Eureka	2,914	Manhattan	44,831
Garden City	28,451	Ottawa	11,921
Girard	2,773	Pratt	6,570
Great Bend	15,345	Salina	45,679
Hays	20,013	Smith Center	1,931
Hiawatha	3,417	Topeka	122,377
Hill City	1,604	Tribune	835
Hutchinson	40,787	Wichita	344,284
Independence	9,846		

An allocation function was performed in ArcGIS version 9.2, a GIS-software package produced by the Environmental Systems Research Institute (ESRI), to generate a map that provided the proposed boundaries for counties based on the "100 km" distance (Figure 4.1). In the practical sense, this would be enough to delineate boundaries. However, a further step was taken to apply these proposed boundaries to some recognizable landscape feature. In many cases, rather than using geographic grid lines, natural features are utilized for political boundaries. For this scenario, watershed boundaries were used. Hydrologic units under the United States Geological Survey Hydrologic Unit Code (HUC) system were utilized. HUC 11

(Figure 4.2) and HUC 14 (Figure 4.3) boundaries were chosen for comparison purposes. There are 355 of the larger HUC 11 watersheds and 2020 smaller HUC 14 watersheds in Kansas.

Figure 4.1 100 km Allocation from Scenario 1 County Seats.



Areal consolidation was performed by overlaying the allocated boundaries to the HUC 11 or HUC 14 watersheds and grouping the appropriate watersheds to form a proposed county. The Select tool in ArcGIS 9.2 was used to group the HUC units. A watershed that was more than 50 percent contained in an allocated county was included in the unification. The created counties were exported as shapefiles and analyzed based on their new population, size, and perimeter.

As noted previously, measures of compactness are significant in the overall determination of the viability of a political unit. Thus, a compactness index was utilized in the analysis of Scenario 1 and the two additional scenarios. The formula utilized to develop this index is provided by MacEachren (1985). MacEachren indicates the compactness of a areal unit can be determined by:

$$\sqrt{(\text{Area})} / (.282 \times \text{Perimeter}) \quad \text{(Eq. 1 p.54)}$$

This equation identifies a circle as the perfect compact unit, with a compactness index value of one. Thus, the perfectly non-compact unit (a very long and nearly linear polygon) would have a compactness index value approaching zero. A perfect square, regardless of size, would have a compactness index value of 0.887. As mentioned in the literature review, there are multiple arguments for various compactness indices.

Figure 4.2 HUC-11 watershed boundaries.

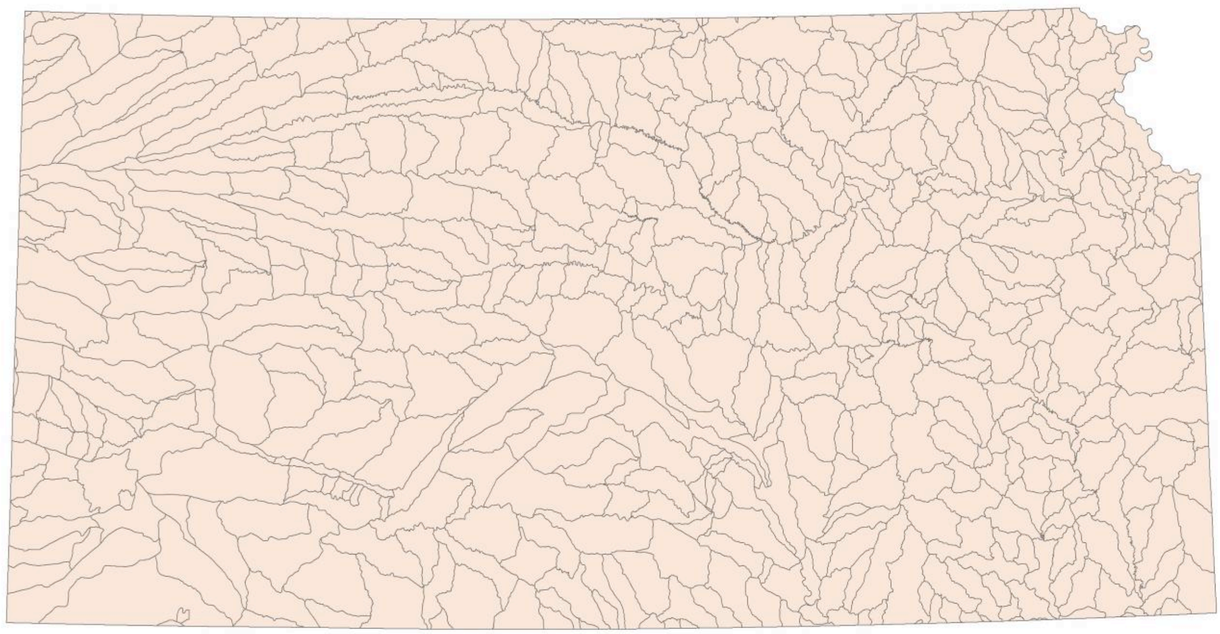
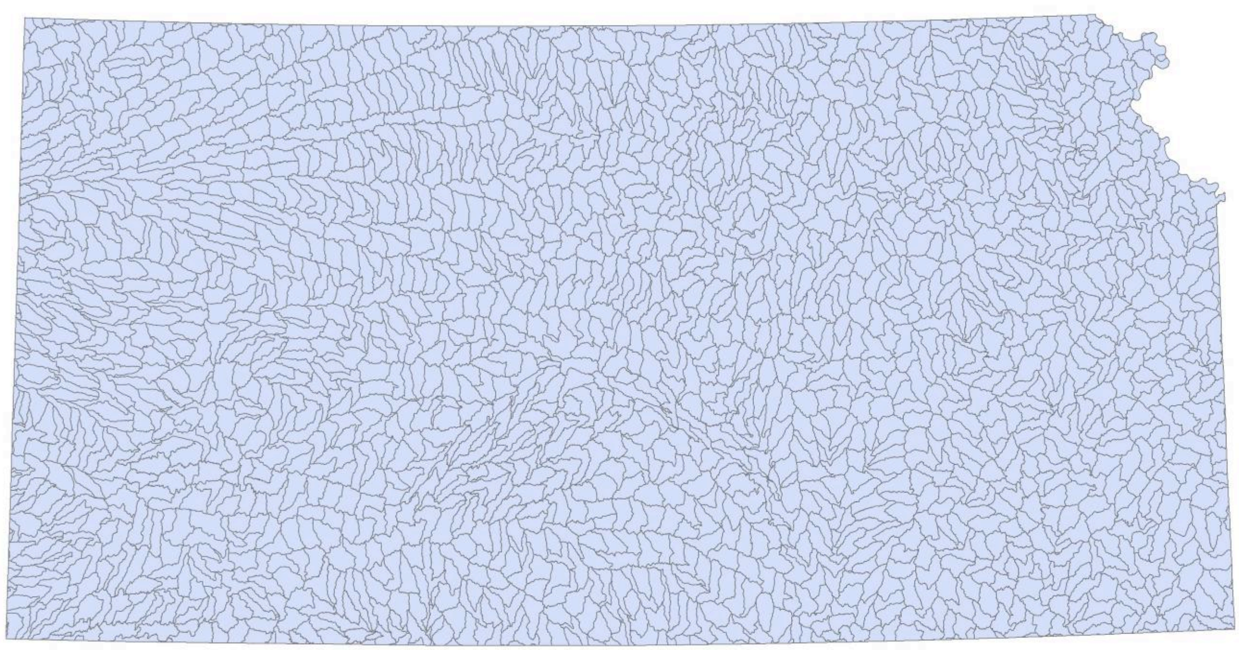


Figure 4.3 HUC-14 watershed boundaries.



Scenario 2: Population

The second scenario involved the consolidation of counties based on population. County size was not a consideration in this scenario. The population of Kansas is not uniformly distributed, and therefore some of the resultant counties were at risk of being large, especially in the western part of the state where population density is low.

Numerous criteria could have been chosen when selecting 25 county seats. There are countless options when making that determination. For this scenario, four options were considered. The first option involved selecting the 25 most populated existing county seats, per the 2000 U.S. Census. The second option involved implementing the 25 county seats chosen for Scenario 1. A third option consisted of 25 existing county seats selected in a semi-arbitrary fashion based on existing population of the county seats and the population distribution across the state (Table 4.2). Finally, a fourth option used a population-weighted distance measure and the semi-arbitrarily selected county seats to create new county boundaries.

County delineation on a population basis was performed utilizing Landscan data from 2003 (Figure 4.4). A Landscan image contains population estimates that are initially based on census tracts. This census tract data is subdivided into one-kilometer grid cells, and each grid cell is analyzed based on the likelihood of population existing in that grid cell. Analysis is based on four "primary geospatial input datasets" – land cover, roads, slope, and nighttime light emission (Dobson *et al.* 2000). This raster image was converted to a shapefile containing one square kilometer polygons.

In ArcGIS, a point shapefile with the 25 county seats was layered over the shapefile containing the polygons derived from the Landscan data. Population polygons were selected using the Select tool in ArcGIS. Statistics (including sum values for the Population field) were presented in real-time, indicating the combined population of all grouped polygons. In each population scenario, grouping of population polygons began in the southwest corner of the state. This grouping occurred so that a minimum population threshold was reached and that each county seat was contained in a county. In addition, every population polygon was assigned to a county. Each group of population polygons was exported to a new shapefile.

Table 4.2 Scenario 2 county seats for (A) Top 25 Populated County Seat scheme, and (B) Semi-Arbitrarily Selected County Seat scheme. Population from 2000 U.S. Census.

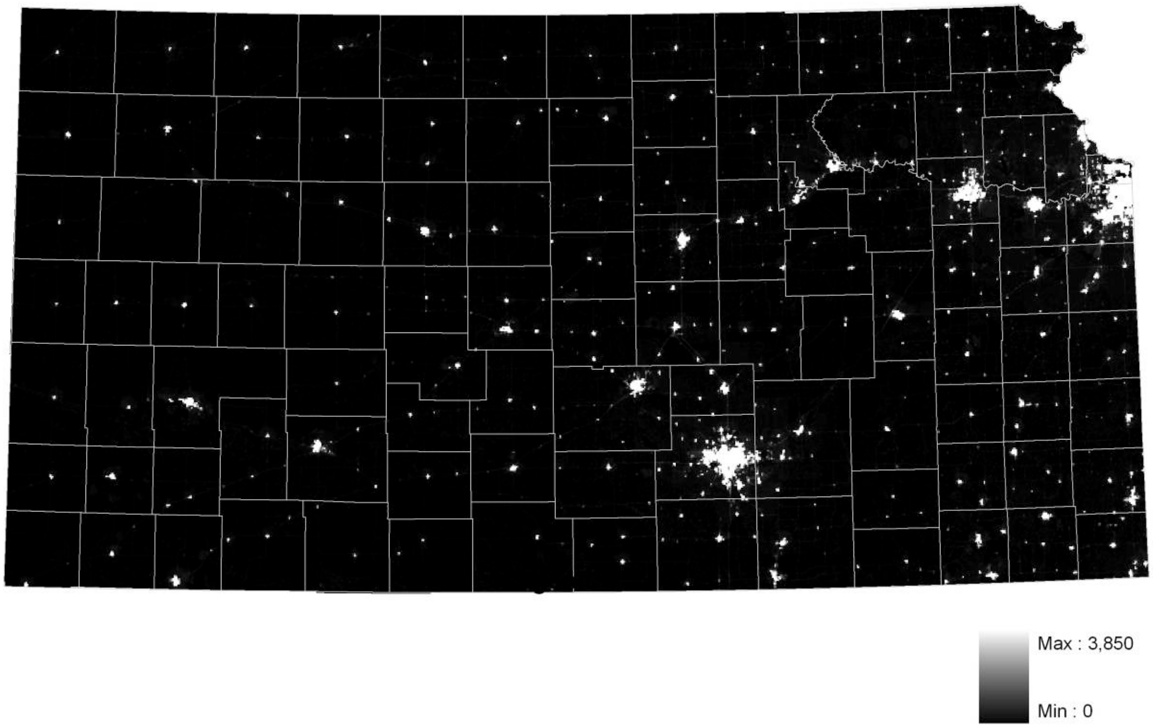
A

County Seat	Population	County Seat	Population
Atchison	10,232	Leavenworth	35,420
Dodge City	25,176	Liberal	19,666
El Dorado	12,057	Manhattan	44,831
Emporia	26,760	McPherson	13,770
Fort Scott	8,297	Newton	17,190
Garden City	28,451	Olathe	92,962
Great Bend	15,345	Ottawa	11,921
Hays	20,013	Salina	45,679
Hutchinson	40,787	Topeka	122,377
Independence	9,846	Wellington	8,647
Junction City	18,886	Wichita	344,284
Kansas City	146,867	Winfield	12,206
Lawrence	80,098		

B

County Seat	Population	County Seat	Population
Atchison	10,232	Kansas City	146,867
Colby	5,450	Lawrence	80,098
Concordia	5,714	Leavenworth	35,420
Dodge City	25,176	Liberal	19,666
El Dorado	12,057	Manhattan	44,831
Emporia	26,760	Olathe	92,962
Fort Scott	8,297	Ottawa	11,921
Garden City	28,451	Pratt	6,570
Great Bend	15,345	Salina	45,679
Hays	20,013	Topeka	122,377
Hutchinson	40,787	Wichita	344,284
Independence	9,846	Winfield	12,206
Iola	6,302		

Figure 4.4 Landscan raster population.



Population requirements varied among the first three county seat options for Scenario 2. These requirements are discussed in greater detail in the results section, but in each case the largest possible population minimum given the population distribution across the state was implemented. In all three options, the location of the county seat within the new county was not considered. Although effort was made to not divide communities of interest (such as sizeable population centers and their service areas), in some cases the county seat of a proposed county is located near its border.

Again, a researcher-driven assignment process was utilized in the initial techniques implemented in Scenario 2. The selected county seats were superimposed over the one-kilometer population polygons. New counties were manually drawn by summing the populations of polygons grouped around a particular county seat. Polygons were grouped around county seats in a fashion such that all polygons in the state were in a county and that the counties were as regular in shape as possible.

An additional technique was implemented in Scenario 2 in order to further reduce the input of the researcher in the reorganization of Kansas counties. This technique involved additional GIS-based methods that reduced the decisions required of the researcher in the appropriation of new counties. County seat selection remained a researcher task, and for this technique, the semi-arbitrary county seats were utilized.

The Landscan population raster data used for this previous researcher-driven technique in Scenario 2 were also used for the new technique. The goal was to use the Landscan raster as a 'cost surface' in order to appropriate Landscan grid cells to a particular county seat so that the 'cost' or population distance for that grid cell was minimized among the 25 county seats. The Landscan raster was modified using Raster Calculator, as part of the Spatial Analyst extension in ArcGIS 9.2, to generate an inverse raster for the Landscan data. The maximum value of any grid cell in the original Landscan raster is 3,850. The inverse raster was generated using Raster Calculator, and subtracting the original cell value from 3,850. The inverse was created because 'cost' or population distance needed to be maximized, rather than minimized, in grid cells that had lower population values.

The Spatial Analyst extension in ArcGIS 9.2 served as the impetus for the remainder of the analysis. Within the Spatial Analyst extension is the ability to create a cost weighted surface, using a point shapefile to serve as a central point of analysis and a raster file to serve as the cost surface. Shapefiles containing each individual county seat (or point) were exported from the original 25 county seat shapefile, and were used for this analysis. Twenty-five population-weighted distance surfaces (one for each county seat) were generated using the cost weighted tool in Spatial Analyst.

Analysis of the 25 surfaces proceeded with a goal to determine the lowest 'cost' or population distance for each grid cell and the particular population-weighted distance surface (of the 25 created) that contributed the lowest value. Each grid cell would be assigned to a new county based on the lowest population-distance determined for the grid cell. This was done using the "Lowest Position" tool found in the Spatial Analyst extension. The tool is located in ArcToolbox, and can be found under Spatial Analyst > Local > Lowest Position. All 25 population-weighted distance surfaces were imported into the Lowest Position tool, and an output identifying 25 different regions (or new counties) based on the lowest distance values for each grid cell was generated. These regions were output as shapefiles, and analyzed in a similar fashion as the generated counties from the previous researcher-driven method.

Scenario 3: Economic Composition

Determining the economic health of a county is no easy task. Numerous parameters exist that provide an insight into the economic viability of a county. For this study, tangible assessed valuation was considered an acceptable measure, as the assessed valuation of a county has direct ties to the property taxes levied by that county. Property taxes serve as the primary source of income for counties in Kansas. Tangible assessed valuation data from 2005 were obtained on a county-level basis from the Institute for Policy and Social Research at the University of Kansas.

Determining an appropriate minimum tangible assessed valuation figure to apply to new counties also poses a challenge, as there is no single known value. Since the purpose of this study is to indicate that such consolidation measures are feasible, rather than provide an end-all solution, less emphasis is placed on determining the most appropriate assessed valuation figure. Thus, a review of the dataset indicated that a minimum valuation figure of $300 million would be appropriate. $300 million was approximately the 66th percentile for the dataset, and this was deemed an adequate measure for demonstration in this scenario.

Spatial resolution limitations of the dataset required an altered method for reorganizing counties in Scenario 3. Because tangible assessed valuation data are only available at the county level, reorganization at that spatial scale was required. Interpolating county-level economic data to a finer scale (one square kilometer grid cells) was attempted, but the results were undesirable; tangible assessed valuation varies considerably across a county due to local conditions, yet the interpolation resulted in a smoothing of values with the highest values located near the county center (as the valuation figure for each county was assigned to a centroid of each county). Assigning proportional tangible assessed valuation figures to grid cells in a county based on the Landscan data was considered. However, because tangible assessed valuation of a county is highly affected by singular features (such as power plants), the links between tangible assessed valuation and population are far from direct. Thus, existing counties were merged to form new county boundaries. While finer spatial scale data would have been appreciated, the lack thereof allowed for a consolidation example at the existing county scale.

Five counties in Kansas (Sedgwick, Johnson, Wyandotte, Douglas, and Shawnee) had tangible assessed valuation figures of over $1 billion for 2005. Thus, these counties were left unchanged. Therefore, in keeping with the 25-county standard, 20 new counties were created by joining neighboring existing counties to reach the $300 million valuation threshold. When completed, the most populated existing county seat in each consolidated county was selected as the new county seat. This selection method was chosen over the county seat from the county with the most tangible assessed valuation. Tangible assessed valuation of a county can be heavily influenced by individual features in the county (such as power plants). Selecting the most populated county seat is a better guarantee that the county seat will be a regional destination for citizens in the new counties. The new counties were analyzed based on their new population, size, perimeter, and tangible assessed valuation.

CHAPTER 5 - Results

The completion of three scenarios resulted in seven maps (Figure 5.1-5.7). Each map depicts new county boundaries as drawn per the scenario criteria applied. Current county boundaries are shown for reference. To avoid confusion in this discussion, new counties are named by their resultant county seat. New county characteristics, such as area, perimeter, and population, are provided in Tables 5.1 – 5.7 and are referred to throughout the remaining discussion.

Scenario 1: Distance and the use of county size

Consolidation schemes based on HUC-11 and HUC-14 boundaries resulted in different county maps, and are shown in Figures 5.1 and 5.2. The areal extent of the produced counties was similar between the HUC-11 and HUC-14 schemes. The difference in average county size between the HUC-11 scheme and the HUC-14 scheme only differed by 13 square-kilometers, with similar standard deviations. However, differences did exist in some cases. In general, the HUC-14 scheme resulted in smoother county boundaries, with fewer irregularities in shape. This is due to the existence of far more HUC-14 units than HUC-11 units.

There are various examples where the HUC-14 method reduced irregularities in county shape. One such area is the anteater-like appendage extending from Hutchinson County to near Wichita along the Arkansas River in the HUC-11 scheme. This irregularity is corrected in the HUC-14 scheme. Another such example is the irregular shape of northern Garden City County in the HUC-11 scheme, which is modified in the HUC-14 scheme.

Although Scenario 1 was not formulated on the basis of population, population values for each new county were generated using Landscan population data. The average population per county of the HUC-11 scheme and the HUC-14 scheme was nearly identical due to only minor differences in the actual arrangement of the boundaries; however, subtle differences were noted in the actual distribution of population across the counties, as is shown in the percentage breakdowns per county. Another characteristic of note is the fact that the standard deviation of population in both schemes considerably exceeds the average, indicating that population varies widely among the counties. This is emphasized by the fact that two counties (Kansas City and Wichita) possess roughly 50 percent of the entire population for the state in both schemes.

Minor differences in the perimeters of the counties were noted in the HUC-11 and HUC-14 outputs. The HUC-11 counties had a slightly higher average perimeter and standard deviation in perimeter than the HUC-14 counties, indicating that in general the HUC-14 counties were more regular in shape than the HUC-11 counties.

Scenario 2: Population

Four maps were produced based on four different schemes in Scenario 2. The schemes were based on a county seat selection method and generated using population data from Landscan imagery. Three county seat selection methods were semi-arbitrary, while the fourth method was based on raw data.

The first scheme included county seats utilized in Scenario 1 (Figure 5.3). As a result, some of the county seats (particularly Tribute and Johnson City) are neither major population centers nor are they regional destination centers. Thus, a low minimum population requirement of 20,000 was set for this scheme. The result was a set of counties with a wider range of population than the other three schemes for this scenario, as the standard deviation of population values across the resultant counties was the greatest for this scheme. Tribune County was by far the least populated, with a population just over 20,000. Due to the dense population of the Kansas City metropolitan area, Kansas City County is burgeoning with a population around 750,000. Wichita County has nearly 500,000 people.

Because the county seat selection for Scenario 1 County Seat scheme was based on areal distribution, the resultant counties for the scheme were more uniform in size than one would expect for a population-based reorganization in Kansas, and there could not be small metropolitan counties. As a result, the standard deviation of county area in this scheme was the smallest of the four schemes in Scenario 2 (3,745 square kilometers).

The second scheme included county seats selected in a semi-arbitrary manner based on known population characteristics and regional destinations in the state (Figure 5.4). While some of the selected county seats are not major cities, all county seats in this scheme serve as regional destinations for services. Thus, a population minimum for redrawn counties was set at 30,000. This scheme resulted in both larger and smaller counties (in terms of areal size) than the first scheme of Scenario 2. Conversely, the population range was reduced somewhat, with multiple counties having populations around 35,000 to 40,000. The standard deviation of population for resultant counties in scheme two was considerably less than that for scheme one. Olathe County ended up with approximately 480,000 people (a dramatic reduction from the geographically-similar Kansas City County in scheme one).

Scheme two possessed a wider variation in county size. Smaller counties were drawn in densely-populated areas, and larger counties were drawn in sparsely-populated areas. Of the four schemes, the standard deviation of areal extent for the second scheme had an intermediate value (6,620 square kilometers).

The third scheme was based on the 25 most populated county seats in the state (Figure 5.5). As a result, the existing county seats chosen were major population centers (relatively speaking). Therefore, the minimum formulated county population was set at 45,000. This scheme resulted in very large counties in the western portion of the state, where population is more sparse, and smaller counties around the most heavily populated county seats. Conversely, because population data and characteristics were the sole factors in the arrangement of new counties, the population range of the new counties was the least among the first three schemes in scenario two, with no county containing fewer than 45,000. The standard deviation of population values for the resultant counties in this scheme was the least of the three schemes. Olathe County again contained approximately 480,000 people.

Because scheme three was formulated solely using population data, the areal extent of the counties varied widely, with very large counties and rather small counties resulting from the procedure. Small counties were produced near the densely-populated metropolitan areas, while very large counties were drawn particularly in the western part of Kansas, where population is sparse in many areas. The standard deviation of county size was the greatest for this scheme (7,726 square kilometers).

As noted in the discussion of methods, a fourth technique was utilized in generating new counties based on the county seats from scheme two (Figure 5.6). This technique was less researcher-driven, and involved specific ArcGIS-based techniques detailed in the Methods section. These generated counties were less regular in shape than the researcher-driven outputs for Scenario 2. Because this method technically involved distance weighted by population, rather than a minimum population value for each generated county, no minimum population value was set. Reorganization resulted in a population range of 26,861 as a minimum (Pratt County) to 537,735 as a maximum (Wichita County). In general, larger counties were found in the western part of the state where there is less population. However, the size of the counties in the population-weighted distance approach output showed less deviation in size than the researcher-driven counterparts.

Scenario 3: Economic Composition

County-level data limited the methods that could be used to accomplish Scenario 3. The resultant counties are composed of groups of existing counties joined together to achieve a tangible assessed valuation sum of at least $300 million (Figure 5.6). As noted previously, the five counties with tangible assessed valuations already exceeding $1 billion (Johnson, Wyandotte, Douglas, Shawnee, and Sedgwick) were left as independent counties. After doing this analysis, the five most-valued existing counties were joined by two new counties also possessing tangible assessed valuations over $1 billion. The remaining existing counties were successfully consolidated into eighteen additional new counties so that all new counties had a $300 million valuation minimum. The proposed county seats for all the new counties are the most populated existing counties seats within each prospective county.

A population analysis of Scenario 3 counties was conducted using the 2000 U.S. Census data readily available for the existing counties. When counties were joined, the sums of their initial population values were used to generate a resultant county population figure. Interestingly, this scenario output generated the smallest resultant county population standard deviation of all scenario runs (109,120 people), though the deviation is not significant between this scenario and the Semi-Arbitrary and Top 25-Populated County Seat schemes of Scenario 2 (114,825 people and 110,966 people, respectively).

Variations in county size for Scenario 3 were not overly significant, as was apparent in a comparison of the mean county sizes. Differences did exist due to the fact that 20 of 25 resultant counties were formed by consolidating existing counties. As a result, the standard deviation in county size for the resulting counties was 6,001 square kilometers, which essentially near the middle of the pack of standard deviations generated among all scenarios.

Figure 5.1 Scenario 1 HUC-11 output.

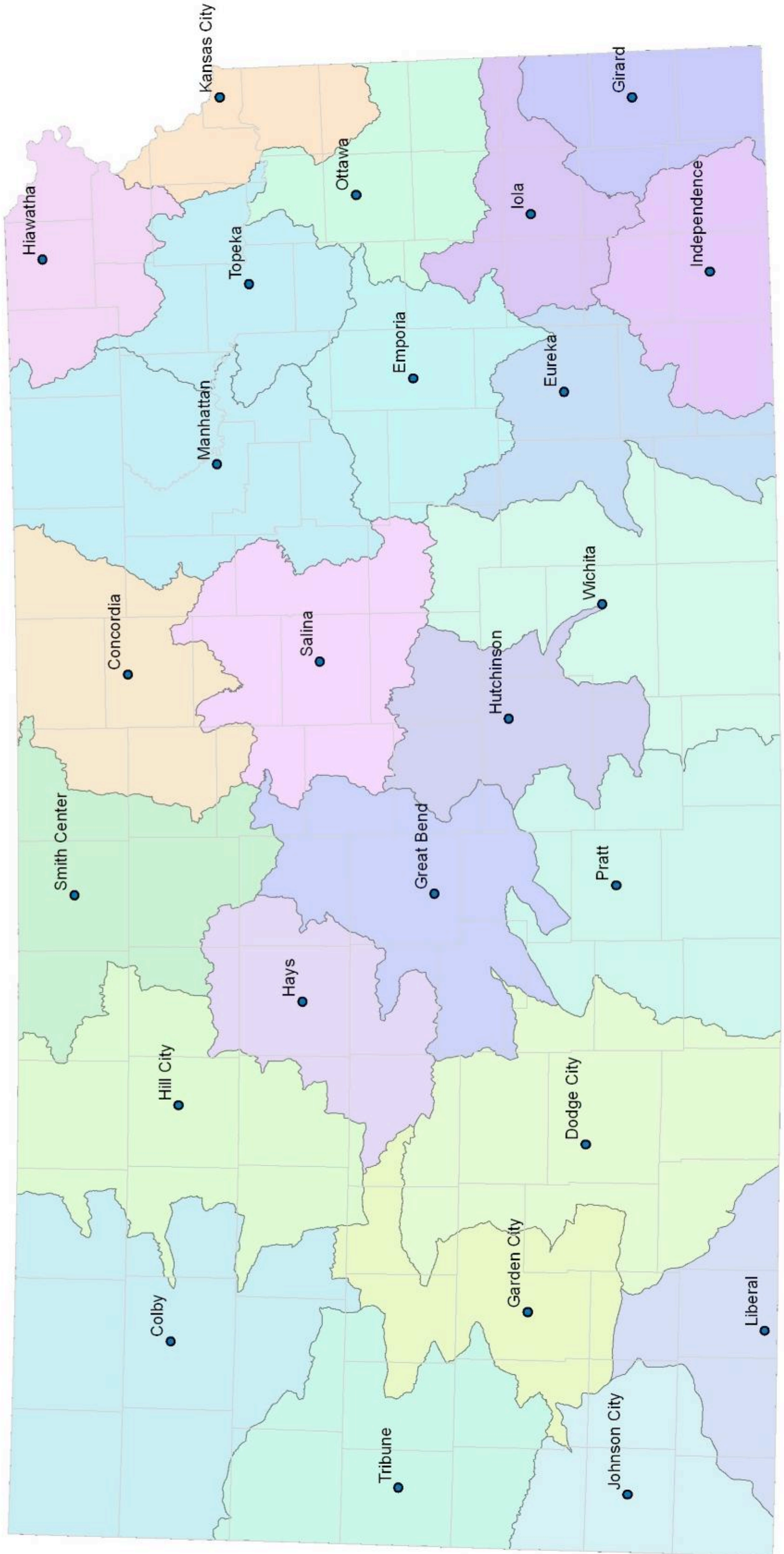


Table 5.1 Scenario 1 HUC-11 output summary.

County	Area (Km2)	Area (Pct. Total)	Perimeter (Km)	Population	Population (Pct. Total)
Colby	16595	7.8%	790	28439	1.0%
Concordia	8269	3.9%	598	28283	1.0%
Dodge City	14784	6.9%	740	52220	1.9%
Emporia	7247	3.4%	516	51473	1.9%
Eureka	7082	3.3%	629	15695	0.6%
Garden City	7868	3.7%	722	50318	1.8%
Girard	5105	2.4%	356	79534	2.9%
Great Bend	9461	4.4%	773	51381	1.9%
Hays	7006	3.3%	543	34512	1.3%
Hiawatha	5480	2.6%	417	49607	1.8%
Hill City	12148	5.7%	776	18833	0.7%
Hutchinson	6404	3.0%	565	114574	4.2%
Independence	6534	3.1%	398	69793	2.6%
Iola	5038	2.4%	468	38216	1.4%
Johnson City	6454	3.0%	392	14154	0.5%
Kansas City	3855	1.8%	344	737601	27.1%
Liberal	5500	2.6%	430	33957	1.2%
Manhattan	11928	5.6%	683	135963	5.0%
Ottawa	6195	2.9%	480	151945	5.6%
Pratt	12232	5.7%	654	31707	1.2%
Salina	8845	4.2%	679	88399	3.2%
Smith Center	9274	4.4%	627	16766	0.6%
Topeka	6167	2.9%	524	216150	7.9%
Tribune	10397	4.9%	567	8293	0.3%
Wichita	12948	6.1%	772	604263	22.2%
SUM	212813	100.0%		2722076	100.0%
AVERAGE	8513		578	108883	
STD. DEV.	3302		143	177225	

Figure 5.2 Scenario 1 HUC-14 output.

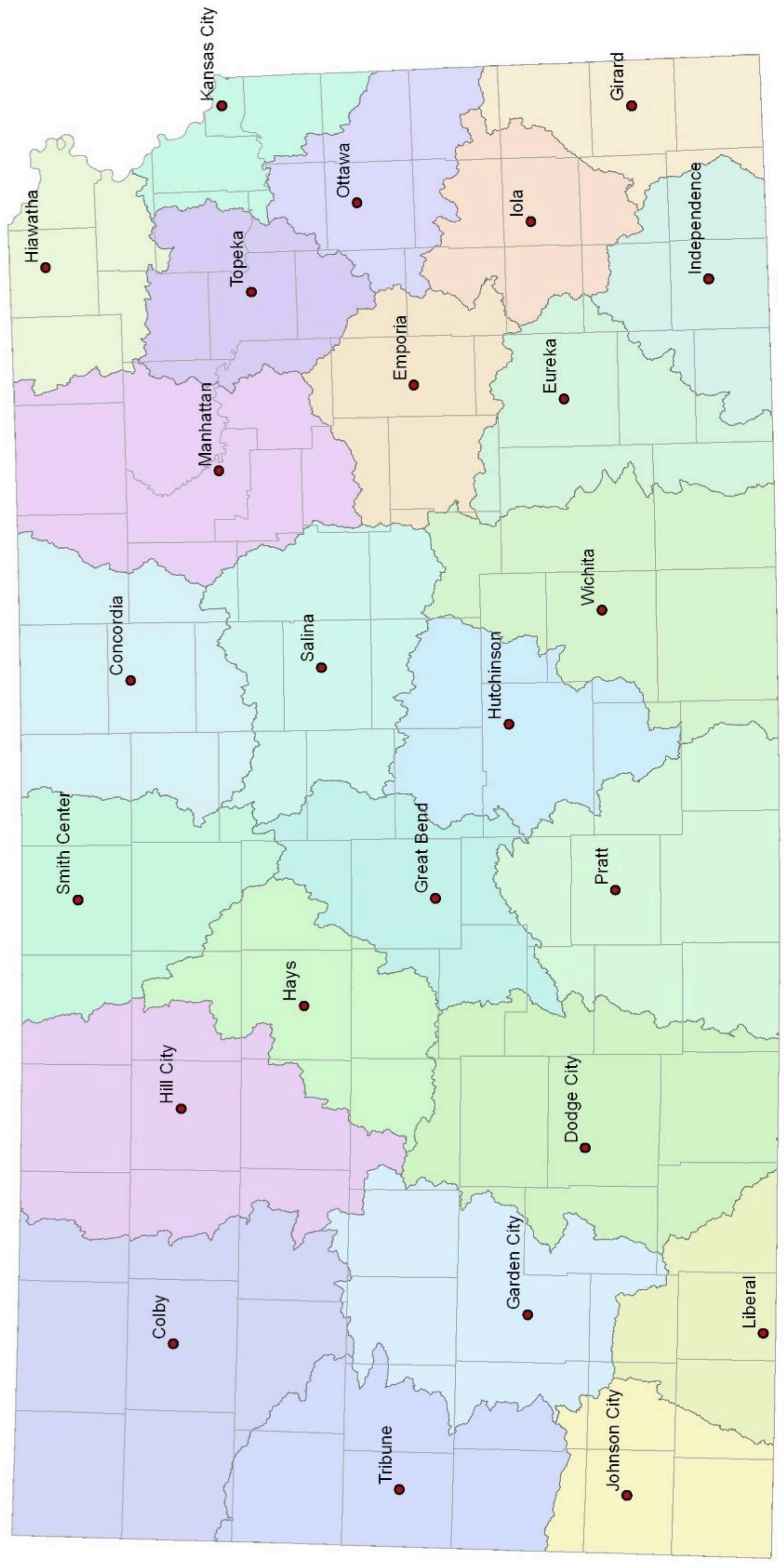


Table 5.2 Scenario 1 HUC-14 output summary.

County	Area (Km2)	Area (Pct. Total)	Perimeter (Km)	Population	Population (Pct. Total)
Colby	16592	7.8%	723	27207	1.0%
Concordia	9861	4.6%	558	32682	1.2%
Dodge City	13889	6.5%	740	49073	1.8%
Emporia	6738	3.2%	519	48702	1.8%
Eureka	7783	3.7%	621	16729	0.6%
Garden City	10490	4.9%	742	52205	1.9%
Girard	5339	2.5%	423	79105	2.9%
Great Bend	7367	3.5%	677	42487	1.6%
Hays	7664	3.6%	625	43046	1.6%
Hiawatha	5588	2.6%	443	46516	1.7%
Hill City	12863	6.0%	724	18533	0.7%
Hutchinson	7659	3.6%	618	110695	4.1%
Independence	6051	2.8%	436	68751	2.5%
Iola	5566	2.6%	498	42427	1.6%
Johnson City	6113	2.9%	394	13746	0.5%
Kansas City	3682	1.7%	407	762201	28.0%
Liberal	5483	2.6%	405	34107	1.3%
Manhattan	11105	5.2%	609	128738	4.7%
Ottawa	5736	2.7%	490	126057	4.6%
Pratt	12281	5.8%	662	31583	1.2%
Salina	9186	4.3%	660	91522	3.4%
Smith Center	8200	3.8%	509	15820	0.6%
Topeka	5953	2.8%	478	218063	8.0%
Tribune	9599	4.5%	578	8299	0.3%
Wichita	12342	5.8%	719	613774	22.5%
SUM	213131	100.0%		2722068	100.0%
AVERAGE	8525		570	108883	
STD. DEV.	3218		118	181790	

Figure 5.3 Scenario 2 with Scenario 1 County Seats output.

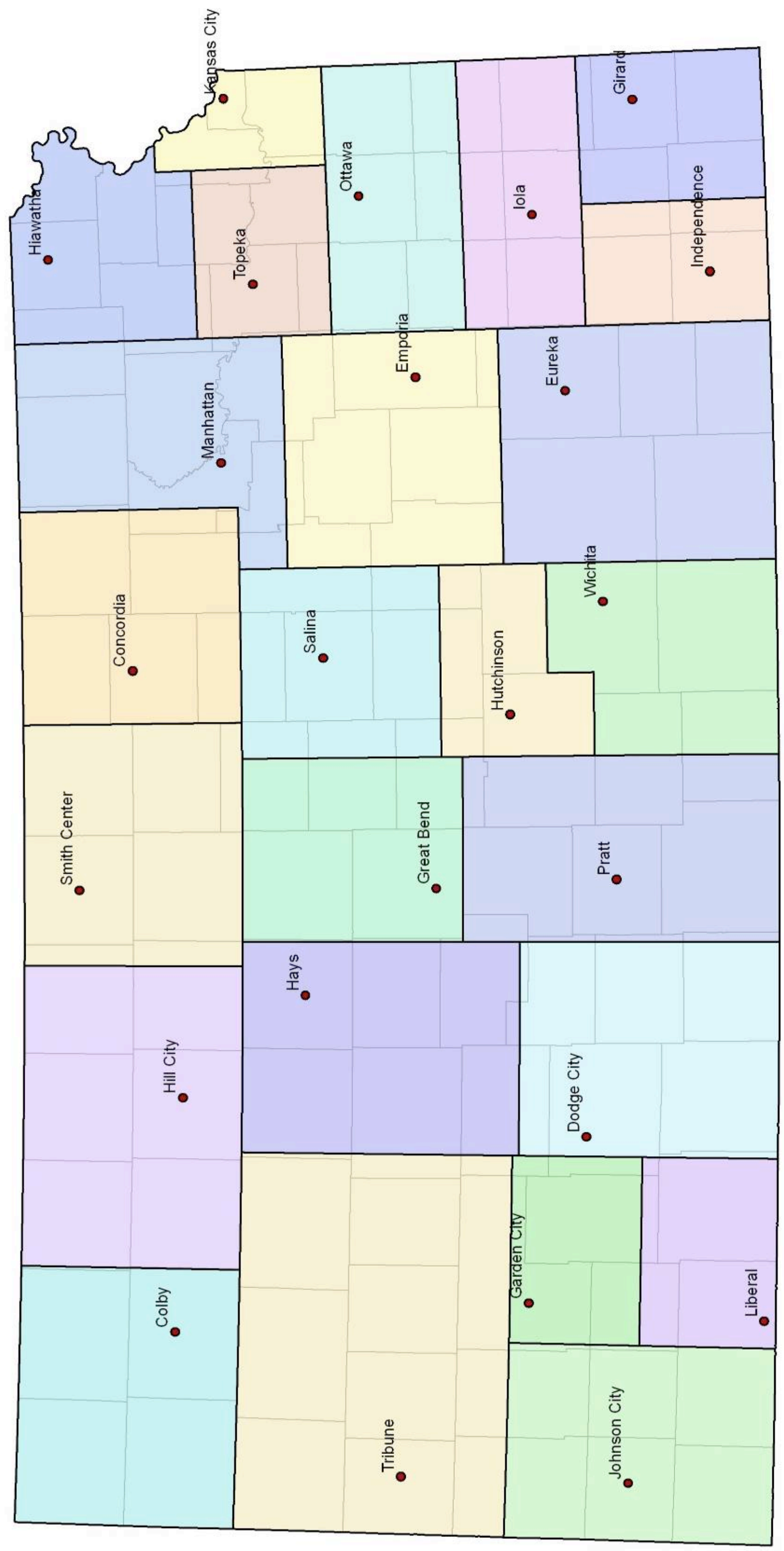


Table 5.3 Scenario 2 with Scenario 1 County Seats output summary. "STD. DEV. (1)" refers to the standard deviation of county population excluding those with 200,000 or more people.

County	Area (Km2)	Area (Pct. Total)	Perimeter (Km)	Population	Population (Pct. Total)
Colby	10954	7.8%	420	20018	0.7%
Concordia	9092	4.6%	381	33751	1.2%
Dodge City	10889	6.5%	419	43669	1.6%
Emporia	9836	3.2%	397	60656	2.2%
Eureka	12582	3.7%	450	110499	4.1%
Fort Scott	6273	4.9%	343	43896	1.6%
Garden City	4755	2.5%	281	45476	1.7%
Girard	5359	3.5%	295	85121	3.1%
Great Bend	7881	3.6%	357	49224	1.8%
Hays	11429	2.6%	431	44503	1.6%
Hiawatha	6313	6.0%	379	55850	2.1%
Hill City	12807	3.6%	459	24821	0.9%
Hutchinson	4743	2.8%	305	102022	3.7%
Independence	4393	2.6%	271	59597	2.2%
Johnson City	10177	2.9%	409	25872	1.0%
Kansas City	2641	1.7%	238	716746	26.3%
Liberal	5019	2.6%	287	31602	1.2%
Manhattan	9349	5.2%	439	127723	4.7%
Ottawa	7010	2.7%	355	79146	2.9%
Pratt	11502	5.8%	444	30453	1.1%
Salina	7384	4.3%	344	98933	3.6%
Smith Center	10259	3.8%	406	19499	0.7%
Topeka	4408	2.8%	267	294609	10.8%
Tribune	19963	4.5%	574	19189	0.7%
Wichita	7955	5.8%	375	499201	18.3%
SUM	212973	100.0%		2722076	100.0%
AVERAGE	8519		373	108883	
STD. DEV.	3745		77	163518	
STD. DEV. (1)				32121	

Figure 5.4 Scenario 2 with Semi-Arbitrary County Seats output.

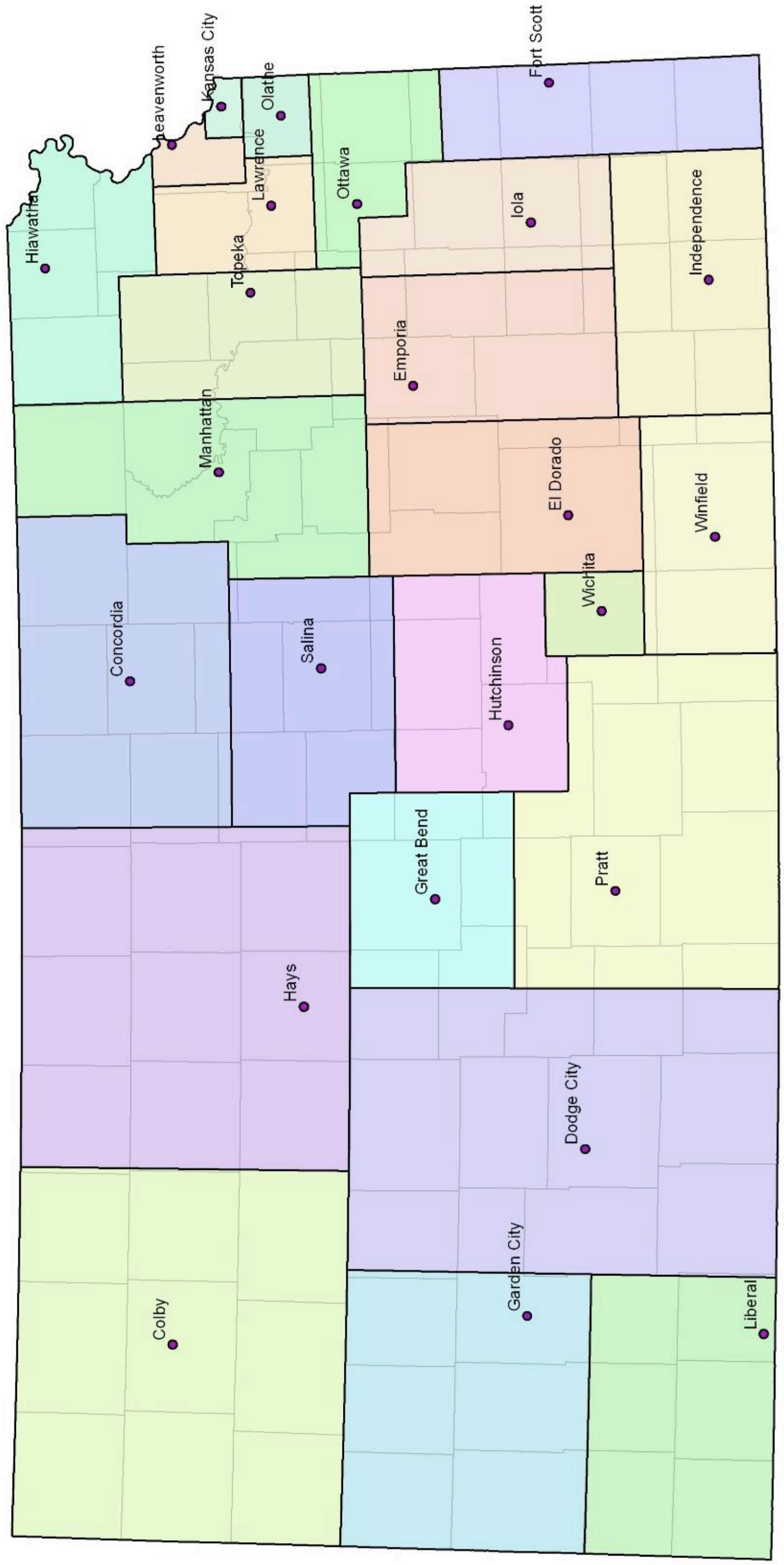


Table 5.4 Scenario 2 with Semi-Arbitrary County Seats output summary. "STD. DEV. (1)" refers to the standard deviation of county population excluding counties with 200,000 or more people.

County	Area (Km2)	Area (Pct. Total)	Perimeter (Km)	Population	Population (Pct. Total)
Colby	23618	11.1%	616	33405	1.2%
Concordia	12138	5.7%	460	39582	1.5%
Dodge City	23643	11.1%	628	63752	2.3%
El Dorado	8092	3.8%	375	68849	2.5%
Emporia	7226	3.4%	352	54811	2.0%
Fort Scott	5711	2.7%	363	80506	3.0%
Garden City	13102	6.2%	459	55113	2.0%
Great Bend	6195	2.9%	316	37401	1.4%
Hays	21652	10.2%	589	67646	2.5%
Hiawatha	5709	2.7%	393	45640	1.7%
Hutchinson	6913	3.2%	343	133702	4.9%
Independence	7843	3.7%	367	77609	2.9%
Iola	5030	2.4%	322	39865	1.5%
Kansas City	388	0.2%	87	145746	5.4%
Lawrence	3063	1.4%	240	124767	4.6%
Leavenworth	882	0.4%	145	66422	2.4%
Liberal	10085	4.7%	411	46153	1.7%
Manhattan	10076	4.7%	467	129243	4.7%
Olathe	1051	0.5%	130	489888	18.0%
Ottawa	3693	1.7%	286	71482	2.6%
Pratt	15652	7.3%	527	54849	2.0%
Salina	7584	3.6%	363	83318	3.1%
Topeka	5911	2.8%	324	201485	7.4%
Wichita	1597	0.7%	160	441256	16.2%
Winfield	6119	2.9%	329	69407	2.5%
SUM	212972	100.0%		2721897	100.0%
AVERAGE	8519		362	108876	
STD. DEV.	6620		143	114825	
STD. DEV. (1)				32864	

Figure 5.5 Scenario 2 with 25 Most Populated County Seats output.

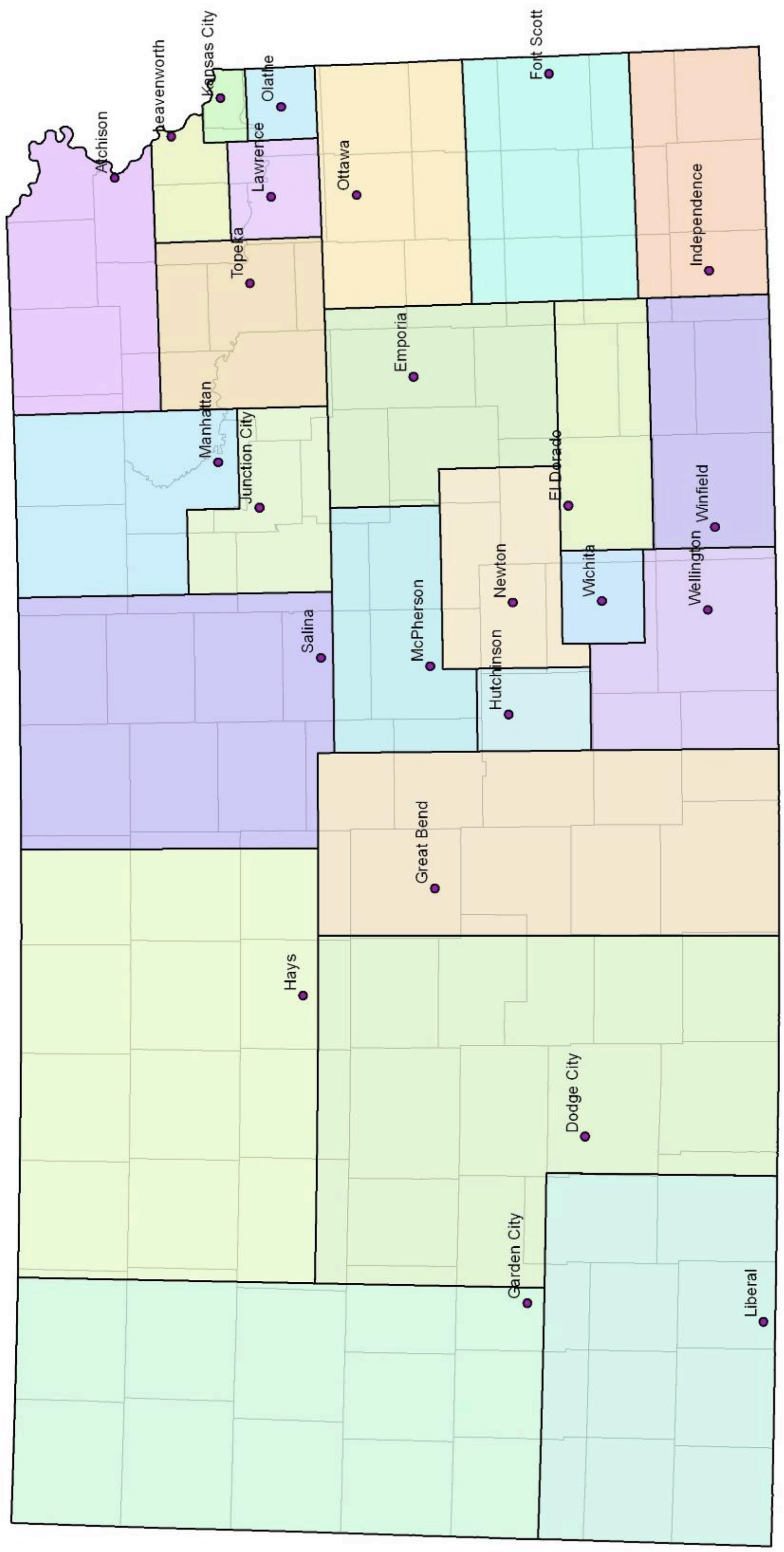


Table 5.5 Scenario 2 with 25 Most Populated County Seats output summary. "STD. DEV. (1)" refers to the standard deviation of county population excluding counties with 200,000 people or more.

County	Area (Km2)	Area (Pct. Total)	Perimeter (Km)	Population	Population (Pct. Total)
Atchison	7184	3.4%	410	54962	2.0%
Dodge City	26270	12.3%	715	63999	2.4%
El Dorado	4489	2.1%	302	46411	1.7%
Emporia	8050	3.8%	378	48494	1.8%
Fort Scott	7899	3.7%	362	63580	2.3%
Garden City	25337	11.9%	682	76714	2.8%
Great Bend	16469	7.7%	568	72396	2.7%
Hays	24793	11.6%	641	70608	2.6%
Hutchinson	1828	0.9%	173	60837	2.2%
Independence	6244	2.9%	333	114143	4.2%
Junction City	4113	1.9%	289	50542	1.9%
Kansas City	559	0.3%	103	194331	7.1%
Lawrence	1728	0.8%	166	116854	4.3%
Leavenworth	1623	0.8%	179	66985	2.5%
Liberal	16551	7.8%	529	57975	2.1%
Manhattan	7072	3.3%	358	83511	3.1%
McPherson	5746	2.7%	342	43126	1.6%
Newton	4787	2.2%	306	50204	1.8%
Olathe	974	0.5%	125	448618	16.5%
Ottawa	6963	3.3%	345	86771	3.2%
Salina	15121	7.1%	500	92314	3.4%
Topeka	5432	2.6%	295	204712	7.5%
Wellington	6301	3.0%	342	55221	2.0%
Wichita	1484	0.7%	154	453800	16.7%
Winfield	5956	2.8%	330	44938	1.7%
SUM	212973	100.0%		2722046	100.0%
AVERAGE	8519		357	108882	
STD. DEV.	7726		169	110966	
STD. DEV. (1)				33988	

Figure 5.6 Scenario 2 using population-weighted distance approach output.

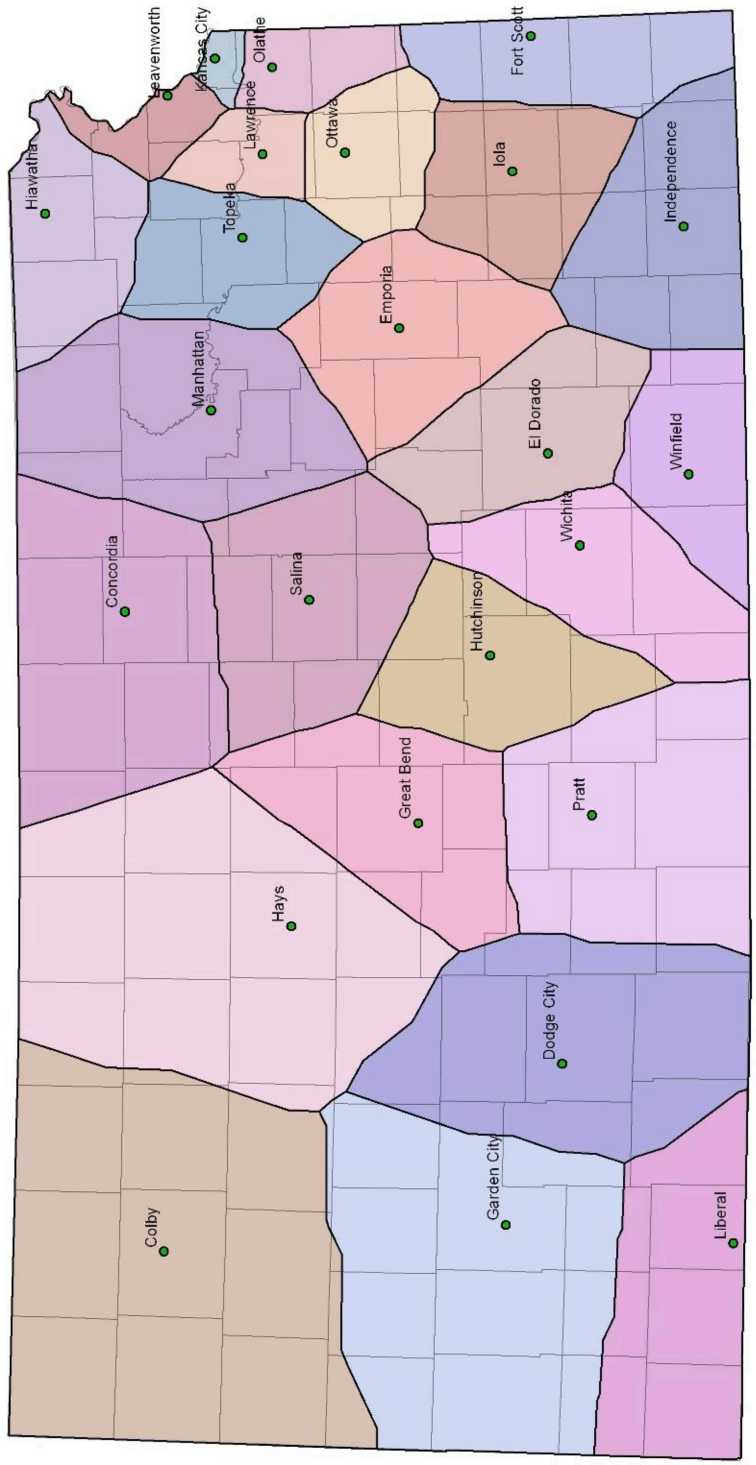


Table 5.6 Scenario 2 using the population-weighted distance approach output summary. "STD. DEV. (1)" refers to the standard deviation of county population excluding counties with 200,000 people or more.

County	Area (Km2)	Area (Pct. Total)	Perimeter (Km)	Population	Population (Pct. Total)
Colby	24773	11.6%	651	33640	1.2%
Concordia	12396	5.8%	459	34001	1.2%
Dodge City	13921	6.5%	479	50491	1.9%
El Dorado	6703	3.1%	345	52054	1.9%
Emporia	7646	3.6%	354	49727	1.8%
Fort Scott	5455	2.6%	360	81158	3.0%
Garden City	18049	8.5%	542	66223	2.4%
Great Bend	8562	4.0%	394	41016	1.5%
Hays	21149	9.9%	570	66273	2.4%
Hiawatha	5183	0.8%	321	30755	1.7%
Hutchinson	6871	3.2%	359	101591	3.7%
Independence	7768	3.6%	367	75339	2.8%
Iola	5879	2.8%	310	41637	1.5%
Kansas City	564	0.3%	102	238302	8.8%
Lawrence	2008	0.9%	189	116922	4.3%
Leavenworth	1735	0.8%	231	77195	2.8%
Liberal	9018	4.2%	436	39763	1.5%
Manhattan	11066	5.2%	419	134217	4.9%
Olathe	2336	1.1%	212	430925	15.8%
Ottawa	3696	1.7%	232	48906	1.8%
Pratt	11938	5.6%	436	26861	1.0%
Salina	9072	4.3%	380	93557	3.4%
Topeka	5192	2.4%	298	207956	7.6%
Wichita	7050	3.3%	380	537735	19.8%
Winfield	4971	2.3%	312	45827	1.7%
SUM	213001	100.0%		2722071	100.0%
AVERAGE	8520		366	108883	
STD. DEV.	5956		123	125405	
STD. DEV. (1)				29639	

Figure 5.7 Scenario 3 output.

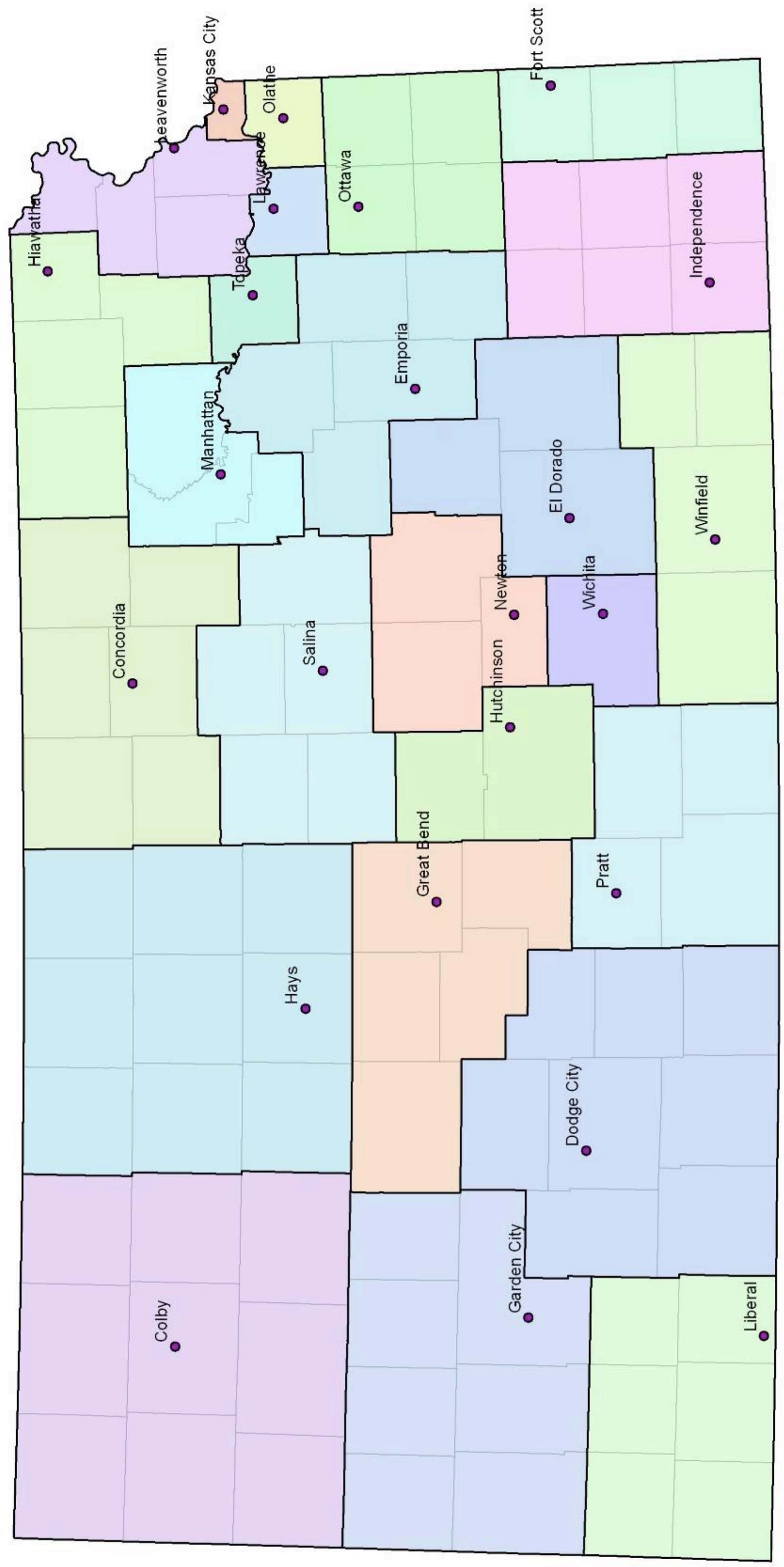


Table 5.7 Scenario 3 output summary. "TanVal" refers to the tangible assessed valuation of every county in millions of dollars.

County	Area (Km2)	Area (Pct. Total)	Perimeter (Km)	Population	Population (Pct. Total)	TanVal
Colby	23495	11.0%	618	35219	1.3%	381.2
Concordia	11976	5.6%	504	42131	1.6%	325.2
Dodge City	17912	8.4%	575	56162	2.1%	612.0
El Dorado	8749	4.1%	443	70185	2.6%	538.2
Emporia	9672	4.5%	524	74501	2.8%	911.2
Fort Scott	4738	2.2%	314	76266	2.8%	435.9
Garden City	15810	7.4%	534	59064	2.2%	1001.6
Great Bend	10982	5.2%	504	47232	1.8%	403.6
Hays	20859	9.8%	583	67769	2.5%	637.8
Hiawatha	7397	3.5%	426	45063	1.7%	323.3
Hutchinson	5175	2.4%	312	75551	2.8%	562.4
Independence	8997	4.2%	390	104589	3.9%	585.1
Kansas City	404	0.2%	101	157882	5.9%	1094.2
Lawrence	1231	0.6%	160	99962	3.7%	1037.7
Leavenworth	4819	2.3%	430	112140	4.2%	802.4
Liberal	10184	4.8%	414	46091	1.7%	1443.4
Manhattan	4893	2.3%	350	108999	4.1%	871.1
Newton	6202	2.9%	348	75784	2.8%	607.3
Olathe	1247	0.6%	152	451086	16.8%	7170.3
Ottawa	6119	2.9%	314	70815	2.6%	719.8
Pratt	9166	4.3%	397	30163	1.1%	331.0
Salina	9679	4.5%	457	89207	3.3%	751.1
Topeka	1443	0.7%	175	169871	6.3%	1427.5
Wichita	2613	1.2%	213	452869	16.8%	3583.9
Winfield	9358	4.4%	462	69857	2.6%	411.7
SUM	213121	100.0%		2688458	100.0%	26969.0
AVERAGE	8525		388	107538		1078.8
STD. DEV.	6001		144	109120		1428.3

CHAPTER 6 - Discussion

The three scenarios resulted in seven different proposals for new county boundaries in Kansas. These three scenarios varied in their criteria for reorganization. Each scenario possessed varying strengths and weaknesses that can be analyzed and compared. The following section discusses these strengths and weaknesses, from the perspective of the author, and provides a brief discussion on the feasibility and likelihood of county reorganization in Kansas.

Scenario 1 involved reorganization of Kansas county boundaries on the basis of distance from a county seat. A 100-kilometer Allocation was performed on the 25 semi-arbitrarily selected county seats, and new counties were constructed using this Allocation. USGS HUC-11 and HUC-14 watershed boundaries served as units for reorganization, and these units were combined to form new counties based on their presence within the 100 km allocation of a county seat. These watershed boundaries were used to provide a recognizable, natural framework for establishing new county boundaries. The resultant maps were similar; however, the HUC-14 reorganization provided slightly smoother county boundaries and slightly more regular-shaped counties. For example, the "anteater" appendage on Hutchinson County in the HUC-11 reorganization scheme was eliminated in the HUC-14 scheme.

Still, the resultant maps from Scenario 1 were less than stellar. The counties were (like nature) highly irregular in shape, and it is likely that demarcation of the new boundaries for political and administrative purposes would be highly difficult given the lack of lengthy straight lines. Straight lines are not necessarily the best boundaries in every situation, but they are likely easier to survey and administer. Given the highly irregular shape of the counties, our historical attachment to straight lines, and the significant variation in county population, it is unlikely that either scheme from Scenario 1 would serve as a candidate for county reorganization in Kansas. Thus, while literature has indicated that county size is likely not the most proficient means for creating new county boundaries, Scenario 1 serves as an indication the GIS can be used to create new counties based on county size.

Scenario 2 involved reorganization of Kansas county boundaries based on population. Four sub-scenario (theme) output maps were created based on three different methods of selecting county seats. Landscan population data served as the catalyst for allocating one-kilometer units to a particular county seat. Because population is an indicator of efficient dissemination of services and the ability of a county to sustain itself, population is a far better method for drawing new counties than county size. However, population is fluid; counties will continue to grow in population or decline in population, and it is difficult to account for such changes in the future.

Theme 1 of Scenario 2 involved reorganization of Kansas county boundaries based on population, using the county seats from Scenario 1. This approach involved county seats that were semi-arbitrarily selected based on their geographic location in the state, and the population of these cities and the population distribution of the state were not considered. As a result, while this scenario was based on population, the resultant map output produced counties that were more equal in size than equal in population due to the requirement of 25 counties. Thus, the population minimum for new counties was rather low (at 20,000), and the population of the most populated county was rather large (approximately 750,000), resulting in a rather large variation in county population. While a primary objective in county reorganization might be to increase the population of counties (rather than produce more equal population figures among counties), the existence of these mega-counties (by Kansas standards) is likely undesirable.

Theme 2 of Scenario 2 produced the optimal county output in this scenario. The county seats for Theme 2 were chosen in a semi-arbitrary fashion based on known population distribution characteristics of Kansas. This theme allowed for the minimum population threshold of 30,000 and this was met in almost all cases. No single county contained over 500,000 people. Using a semi-arbitrary method to choose county seats facilitated an ability to consider communities of interest, such as major shopping destinations across the region. This approach increases the likelihood that citizens will be traveling to these cities for other reasons.

Theme 3 of Scenario 2 involved reorganization of Kansas county boundaries based on population, using the 25 most populated county seats in the state. The result was a majority of county seats in the eastern half of the state, with few county seats located west of U.S. 81/I-135. As a result, in order to meet the minimum population requirement of 45,000, as well as to ensure that all locations in the state were included in a county, some counties were extremely large, especially in western Kansas. In addition, as was the case with Garden City County, the county seat was in the far southeast corner of a large county, which would create a burdensome drive time from St. Francis or Goodland (in the northwest part of the county). However, the existence of mega-counties in a population sense was reduced with this method. No single county had over 500,000 people.

An additional approach using the semi-arbitrarily selected county seats was implemented into Scenario 2. This approach involved a less researcher-driven method using a population-weighted distance surface derived from inverse Landscan data (see Methods chapter for complete description). The initial inherent benefit in this technique is that it arguably has less researcher bias, in that the assignment of grid cells to county seats is not up to the researcher entirely. In the previous schemes, I assigned grid cells to county seats, based on some minimum population criteria, while trying to keep as regular shape as possible. Still, there were alternative assignments of grid cells that could have taken place. This population-weighted distance approach provided absolutes for the assignment of the grid cells to county seats. Each grid cell was assigned to the county seat that corresponded with the lowest 'distance cost' generated from the 25 cost surfaces.

A potential weakness of the population-weighted distance approach is that there is no minimum population criteria set for each generated county. Still, this is likely not a significant weakness. The argument for consolidation is that the reduction of seats of government is key, and this method serves that argument well. In addition, there has been no determination of the minimum population requirement for counties to operate efficiently (as the literature indicates).

The population-weighted distance approach resulted in a slightly larger variation in population in the resultant counties than with the research-driven method and the semi-arbitrary county seats. The lowest county population was 26,861 (Pratt County), while Wichita County was most populous with 537,735. This is only a modest increase in the variation, as the standard deviation in county population did not increase considerably with the cost weighted approach.

As mentioned, I have chosen the second county seat selection theme of Scenario 2 – the semi-arbitrary county seat selection method that was based on known population dynamics across the state – as the optimal output for this scenario. I have determined this based on the visual appearance of the county layout and the fact that the statistics derived (*e.g.,* standard deviation of population, standard deviation of size) are roughly in the middle of those for the other scenarios. This output is also the optimal output of this study. As mentioned in the results section of this paper, this scheme resulted in counties that were not too large, nor extremely varying in size, yet also possessed an acceptable variation in county population, with no counties that were extremely large in population. This “middle ground” may not necessarily be the best scenario in existence, but it was the best scenario among those produced in this study.

Scenario 3 involved reorganization of Kansas county boundaries based on economic efficiency. Granted, there is no clear single measure of economic efficiency in a county, and the chosen method of assessed valuation is a single measure of how well a county is doing in a financial sense. However, since process was the primary objective, assessed valuation served as an appropriate measure for this study. Unfortunately, spatial resolution was limited to county-level data, which resulted in groupings of existing counties to form new counties. This negated the freedom to draw new boundaries based on some other standard, but did provide new counties with boundaries that already exist, and thus are more identifiable to citizens.

$300 million in tangible assessed valuation was used as a minimum, which, as previously alluded to, may or may not be significant in the operation of county government. Maintaining contiguity and considerations of compactness and regularity in shape, new counties were drawn, and the largest existing county seat within each new county was dedicated a new county seat. The five counties with over $1 billion in tangible assessed valuation were left unaltered, and remained independent counties. The resultant counties were not overly large, though population levels in some were likely too low.

Table 6.1 provides a statistical comparison of the 105 original counties with the 25 new counties in terms of tangible assessed valuation dollars per person. Somewhat surprising, the mean and median tangible assessed valuation dollars per person are lower for the consolidation scenario than for the 105 original counties. In retrospect, the result is not surprising given that tangible assessed valuation among individual counties will vary considerably given the local influences on the tangible assessed valuation summation (such as high-dollar entities like power plants). What provides credence to the consolidation scenario is the dramatically-reduced deviation in tangible assessed valuation among the counties, as demonstrated by the standard deviation statistic. This indicates that greater equity would exist among the 25 new counties and lends toward the notion that government will be more efficient and equitable among all counties.

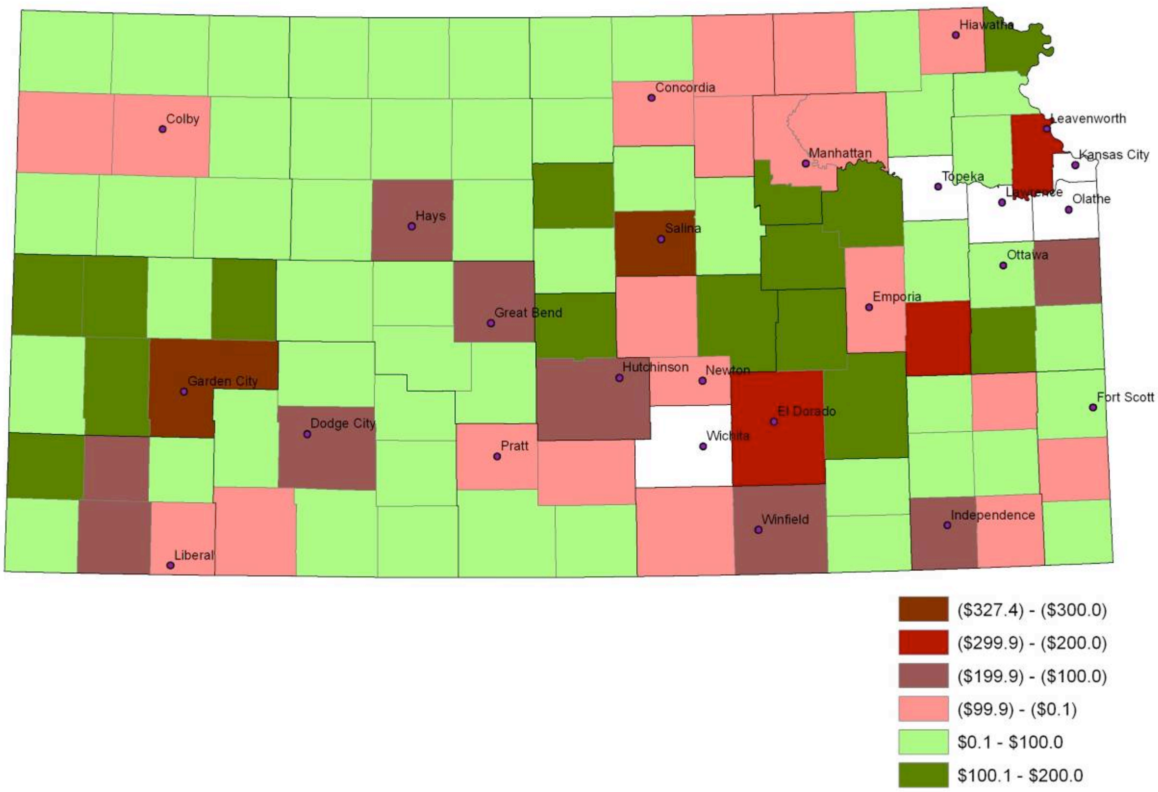
Table 6.1 Statistical summary of county averages of tangible assessed valuation dollars per person. Values in dollars per person. Tangible assessed valuation data for 2005; population data for 2000.

	Original 105 Counties	25 New Counties
Mean	12,760	9,985
Median	9,130	8,404
Std. Dev.	11,460	5,253
Minimum	4,791	5,594
Maximum	64,983	31,316

Figure 6.1 presents a county-by-county display of the net change in tangible assessed valuation between the 2005 individual county tangible assessed valuation and the county tangible assessed valuation after consolidation. This figure illustrates the concept of so-called "winners and losers" associated with this type of consolidation. In most cases, the rural counties saw an increase in valuation while the county hosting the new consolidated county seat saw decreases. Counties with significant local features (such as power plants and other high-value facilities) also showed decreases.

Despite the limitations of the spatial resolution of the valuation data, this scenario was likely the second best in the study. There are various reasons for this. The population of the counties did not vary extremely (based on the standard deviation of population), and was acceptable in most cases, though some were arguably too low. The size of the counties was also acceptable, with no counties extremely large and a reasonable standard deviation for county size. A favorable attribute of this scenario, to many who might wish to implement a scenario, would be the use of existing county boundaries. The existing boundaries are already well recognized, and the acceptance of a reorganization or consolidation proposal may be greater if existing boundaries are used in the proposal.

Figure 6.1 Derived differences between 2005 tangible assessed valuation of original county and per-original county consolidated tangible assessed valuation. Counties in white had no change due to no consolidation occurring.



A compactness index was derived to compare the compactness of the created counties and the average compactness delivered by each method. A complete description of the procedure used to calculate this index is discussed in the Methods section. Table 6.2 presents the compactness index scores for each method. Values range from zero to one, and a smaller number indicates a greater compactness for that particular unit.

Table 6.2 Compactness index values of counties created for all scenarios.

	Scenario 1 (Size)		Scenario 2 (Population)				Scenario 3
	HUC 11	HUC 14	Scenario 1 Seats	25 Most Populated Seats	Semi-Arbitrary Seats	Population-weighted distance	Tangible Assessed Valuation
Atchison				0.733			
Colby	0.578	0.632	0.884		0.885	0.857	0.880
Concordia	0.540	0.632	0.886		0.850	0.860	0.770
Dodge City	0.583	0.564	0.882	0.804	0.868	0.873	0.825
El Dorado				0.787	0.850	0.842	0.748
Emporia	0.585	0.561	0.886	0.842	0.856	0.876	0.666
Eureka	0.475	0.504	0.884				
Fort Scott				0.869	0.738	0.728	0.777
Garden City	0.436	0.490	0.818	0.828	0.884	0.879	0.835
Girard	0.712	0.613	0.872				
Great Bend	0.446	0.449	0.881	0.801	0.883	0.833	0.737
Hays	0.546	0.496	0.883	0.871	0.886	0.905	0.879
Hiawatha	0.630	0.599	0.879		0.681	0.795	0.716
Hill City	0.504	0.555	0.743				
Hutchinson	0.502	0.502	0.875	0.876	0.860	0.819	0.817
Independence	0.721	0.633	0.802	0.842	0.855	0.851	0.862
Iola	0.538	0.531	0.868		0.782	0.877	
Johnson City	0.728	0.703	0.875				
Junction City				0.787			
Kansas City	0.641	0.529	0.767	0.813	0.808	0.826	0.708
Lawrence				0.886	0.817	0.841	0.777
Leavenworth				0.799	0.726	0.639	0.573
Liberal	0.612	0.648	0.874	0.862	0.867	0.772	0.864
Manhattan	0.567	0.614	0.781	0.833	0.762	0.890	0.710
McPherson				0.785			
Newton				0.801			0.802
Olathe				0.887	0.883	0.808	0.824
Ottawa	0.581	0.549	0.835	0.858	0.753	0.929	0.882
Pratt	0.600	0.593	0.856		0.842	0.889	0.854
Salina	0.491	0.515	0.886	0.873	0.851	0.889	0.763
Smith Center	0.545	0.631	0.885				
Topeka	0.531	0.572	0.881	0.886	0.842	0.857	0.769
Tribune	0.638	0.601	0.874				
Wellington				0.822			
Wichita	0.523	0.548	0.842	0.885	0.883	0.784	0.851
Winfield				0.830	0.843	0.801	0.743
Average	0.570	0.571	0.856	0.834	0.830	0.837	0.785

As the data in Table 6.2 illustrate, the counties developed in Scenario 1 were less compact than those in Scenario 2 and Scenario 3. This is due to the irregularity of the boundaries of the counties generated in Scenario 1. The formula indicates a circle is the perfect compact shape, with a resultant index value of one. Counties generated in Scenario 1 would have shown the greatest compactness if the chosen boundaries were the original Thiessen-generated boundaries. However, the Thiessen polygons were applied to the highly irregular HUC unit boundaries. Counties drawn in Scenarios 2 and 3 were more regular in shape, and thus were deemed more compact than the counties generated in Scenario 1, and therefore had higher index values. The population-weighted distance approach in Scenario 2 did not appear to impact compactness much, despite the fact that the resultant counties in the population-weighted distance approach were not square in shape. In some cases, compactness was slightly improved with the population-weighted distance approach. In other cases, it was weakened.

Despite the presentation of various scenarios in this study, and despite the numerous case studies and examples of consolidation presented in the literature review section of this paper, an outcome as dramatic as redrawing county boundaries in Kansas seems unlikely. The thought of county reorganization and consolidation is not an unreasonable one. School districts in Kansas have been undergoing consolidation for years, as have numerous rural services such as NRCS offices. One only has to view the county map of Kansas, along with perhaps the cities and a population table, to discern that maybe the large number of small square counties is unnecessary.

However, reasonableness does not always result in action. As elaborated on in the literature review section, city-county consolidation has largely been unsuccessful in many locations across the United States. People tend to choose familiarity over efficiency. There is a legitimate, yet costly, sense of identity in place that is associated with the local county seat and the existing county boundaries. Numerous local sports and other rivalries exist across existing county boundaries. People continue to identify themselves as residents of a particular county in Kansas. The conflicts that result between the efficiency of consolidation and the identification with existing political structures are not easily resolved, and will likely continue to hamper and limit county consolidation measures in the future.

It might be good for someone interested in the cost of government services to follow on the lead provided by these scenarios and determine an estimate of savings that might accrue with 25 rather than 105 counties.

CHAPTER 7 - Conclusion

Consolidation and reorganization of governments and services is not a new phenomenon in the United States. While county consolidation has been uncommon in the last 100 years, and while literature on county consolidation is rather dated, other forms of government and service consolidation and reorganization (political redistricting, school district consolidation, city-county consolidation) provide some insight into the processes and procedures that would likely be involved in a county consolidation and/or reorganization procedure.

The use of GIS enhances the ability to inform interested parties on consolidation and reorganization decision-making. The examples of reorganization scenarios presented in this study are just a few of the possible outcomes that could be produced given various set input parameters. GISs not only increase the ease of which consolidation scenarios can be evaluated, but also can increase the impartiality in the process if performed correctly.

In this study, size/distance, population, and economic characteristics in the form of tangible assessed valuation were considered in seven county consolidation scenarios. The two distance or size scenarios showed how GISs can readily be used to create new areal units that minimized distance traveled to selected centroids. However, due to extreme population differences across Kansas, size is unlikely to be acceptable as a sole parameter for county consolidation and reorganization.

The population-based schemes used in four scenarios produced results that are likely to be more acceptable. In my opinion, the preferential scenario from the entire study was the population scheme with the semi-arbitrarily selected county seats. Both the researcher-driven approach and the cost weighted approached showed strength. Although this required some human element (in the selection of the county seats), this was required to ensure a preservation of major communities of interest and recognized that any GIS analyst would need some guidance in order to assign county seats.

The tangible assessed valuation scenario was limited in its spatial resolution by the lack of data at a level finer than a county. This, however, allowed (or forced) the preservation of existing county boundaries in the formation of new counties through the simple consolidation of existing counties. This limited the freedom with which new county boundaries could be drawn. However, the preservation of existing county boundaries could be deemed an advantage; some would likely prefer to maintain already-identified boundaries in the formation of new larger counties in order to ease the pains associated with consolidation.

The ultimate purpose of this study was not to select best or better consolidation or reorganization scenarios; rather, the goal of this study was to document that GIS procedures could be used to create various scenarios that could be used in consolidation or reorganization. The emphasis on GIS methods allows one to put aside the political component, and to consider strictly the areal, demographic, or economic parameters that would likely be used in consolidation or reorganization. While I have identified what I believe is the optimal scenario from this study, that selection does not imply it is necessarily the best out of all possible scenarios, and I concede that there are many additional possible scenario that could be created, with increasing complexity as more variables are added together in a scenario.

Thus, future research could include additional scenarios for consideration. There are too many of these to mention, but units other than HUC units for a boundaries of minimum distance or size scenario, other population requirements, or other economic parameters (such as sales or property tax) could be used in future scenarios. Future scenarios could work toward a different number of counties. Future research should also center on a GIS method that is fully automatic and devoid of (significant) human intervention other than setting the modeling parameters, with the population-weighted distance approach serving as an example. This would reduce (and nearly eliminate) any controversy due to human intervention that would likely result from many consolidation or reorganization schemes, as is frequently the case in political redistricting. The present inability of social scientists to provide highly detailed spatially-explicit data on communities of interest prevented the creation of a solely computer-based output in this study. Another tactic that future studies could pursue would be an economic analysis of the potential cost savings generated by a reduced number of counties and the associated reduction in local government service.

The feasibility of county consolidation in Kansas will be determined by the economic, social, and political acceptability of a proposal rather than the sheer technical feasibility of the process. Consolidation and reorganization procedures are not difficult, though selection of the criteria in which consolidation or reorganization is based could be highly controversial. Rather, the social and political acceptability of a consolidation or reorganization proposal would hinge significantly on the local attachment to the existing county and the reluctance to relinquish a county seat or operate within a new county. Proponents of county consolidation will likely need to draw upon examples of successful consolidation referenda in other forms of consolidation (i.e. city-county consolidation, Leland 2007) in order to gear efforts in a direction that favors voter support.

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