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Local land preservation in Washington

Kellee C. Timpson
Western Washington University

LOCAL LAND PRESERVATION IN WASHINGTON

By

Kellee C. Timpson

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Moheb A. Ghali, Dean of the Graduate School

ADVISORY COMMITTEE

Chair, Dr. Grace A. Wang

Dr. Troy D. Abel

Dr. Michael M. Medler

MASTER'S THESIS

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ABSTRACT

Preserving open space is an important component of growth management policy because protected lands can help shape the patterns of growth. Washington State provides a unique opportunity to analyze the role of local land preservation efforts within a mandated growth management framework to preserve open space and conserve natural resources. The purpose of this study is to evaluate how and why land preservation happens, and the conditions under which some communities preserve more open space than others. This thesis builds on existing research by expanding analysis to smaller communities in the Pacific Northwest. An environmental policy capacity model is used to identify community characteristics potentially affecting conservation efforts as they relate to variations in local land preservation. The degree of association between policy indicators (population density, median household income, education attainment, the number of environmental nonprofit organizations and local land trusts) and policy outcomes (total acreage, percentage of open space and open space per 1,000 residents) is analyzed at the county-level through statistical analysis and a descriptive case study of two rapidly growing counties: Clark and Whatcom. The results suggest environmental nonprofit organizations and local land trusts are significantly associated with protected open space; however, median household income was unexpectedly shown to be negatively correlated. Hence, social capital and civic environmentalism emerge as essential components of successful local land preservation efforts. Many communities continue to face development pressures, and given the competing needs and uses for available land, this research will contribute to ways communities can respond to the land preservation challenge.

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Preserving open space is an important component of growth management policy because protected lands can help shape the patterns of growth. Washington State provides a unique opportunity to analyze the role of local land preservation efforts within a mandated growth management framework to preserve open space and conserve natural resources. The purpose of this study is to evaluate how and why land preservation happens, and the conditions for creating effective local institutions for land preservation whereby some communities preserve more open space than others. Specifically, how do community characteristics, including economic and social resources, affect collective environmental outcomes such as land preservation across Washington?

The goal of this research is, then, to assess how community characteristics relate to protected open space though statistical correlation and a descriptive case study of two selected counties. Many communities continue to face development pressures, and given the competing needs and uses for available land, this research will contribute to ways communities can respond to the land preservation challenge.

This chapter will describe the natural features of Washington, introduce the idea of local environmental capacity and provide background on statewide growth management policy. Lastly, the purpose of this research will be explained in further detail.

Area of Interest

The natural history of the Pacific Northwest is shaped largely by its geography and climate. Situated in the far northwest corner of the contiguous United States, the Evergreen

State is bordered by British Columbia, Canada along its northern border, Idaho to the east, and Oregon to the south, across the mighty Columbia River. The Pacific Ocean lies to the west and the coastline is characterized by rocky, driftwood-strewn beaches. The Olympic Peninsula is situated opposite the large landmass of Vancouver Island across the Strait of Juan de Fuca, the sole nautical route from the Pacific into Puget Sound. Puget Sound transects much of western Washington, creating a unique marine environment home to a diverse number of fish and other animal life.

The climate is strongly influenced by moisture-laden air masses created in the Pacific Ocean. The Olympic Mountains on the Olympic Peninsula produce a rain shadow effect, resulting in some of the wettest and driest places in the state on the western and northern flanks, respectively. The rugged Cascade Mountains traverse the length of the state and, west of the Cascades, the most visible landmarks are the snow-peaked volcanoes that dominate the skyline on clear days. The west side of the Cascades, known for its ample rainfall, is more intensely urbanized than the drier and more sparsely populated east side, which shares many cultural and ecological characteristics with the Intermountain West states of Idaho and Montana (Jackson and Kuhlken 2006).

Industries and livelihoods historically depended on fishing, logging, mining, and agriculture. The landscape is shifting, though, as rapid population growth swells urban areas and increased demand for high quality of life brings residents and recreationalists into once rural communities. As a result, growth and development is occurring throughout the region, in small and large cities alike. Desirable amenities include scenic landscapes and recreational access, such as the picturesque San Juan Islands and Cascades Mountains. Considerable recreation opportunities also exist on National Forest, Wilderness and state

resource lands on both sides of the Cascades However, although Olympic National Park and the North Cascades National Park are among the region's gems, surrounding communities remain isolated and remote, rather than tourist resort destinations (Jackson and Kuhlken 2006). Nevertheless, across Washington, amenity-rich communities are grappling with important land use issues related to community growth and rural land use changes.

Figure 1.1: Map of Washington State

Local Environmental Policy Capacity

Traditional approaches to environmental policy typically center around "command and control" regulation and market-based incentives (Fiorino 2006). Command-and-control is essentially a top-down regulatory approach that mandates compliance through oversight, such as inspections, and punitive fines that ensure compliance is more cost-effective than polluting. A command-and-control, top-down approach characterizes numerous federal policies enacted during the 1970s, including the Clean Air Act, Clean Water Act, National Environmental Policy Act, and Endangered Species Act (Kubasek and Silverman 2005). According to Fiorino (2006), one drawback of this approach is that it does little to foster innovation and there is no incentive to go "beyond compliance." During the late 1980s and 1990s, a market-based incentive approach emerged that sought to create a system whereby companies are rewarded for innovation (Fiorino 2006). However, another approach to environmental protection that has flourished in the past ten years is *community-based* and discretionary or voluntary in nature (Press 1998). Press (1998) argues that this "third way" is distinctive because activities primarily involve local actors and voluntary action, thus lacking both specific mandates from the top and explicit incentives. Community-based, voluntary approaches to environmental protection includes: research and data collection on environmental health and quality; resource restoration and protection; and political lobbying or campaigning on local issues (Press 1998).

To evaluate whether community-based voluntary efforts are effective, Press (1998) developed a model of local environmental policy capacity to explain community willingness to "engage in collective action that secures environmental public goods and services" (37). The theory behind policy capacity models is based on the premise that "some communities

are more capable of mounting environmental protection activities than others" (Press 1998, 37). Furthermore, land preservation is essentially place-based and local in nature, and is therefore likely differs across the landscape.

Policy models take into account several reasonably possible independent variables that affect environmental outcomes. Press describes five factors that influence a community's willingness and ability to engage in environmental efforts: 1) access to social resources (i.e. social capital), 2) political leadership and commitment, 3) economic resources, 4) administrative resources, and 5) environmental attitudes and behavior. Thus, a community's political capacity is shaped by both internal and external constraints and opportunities, as well as collective social norms that influence policy choices and, ultimately, policy outcomes.

Press (2002) applied this model to local land preservation efforts in California counties by correlating community characteristics and protected land acreage. All of the relevant elements are then combined into a comprehensive index of policy capacity for each county. Ultimately, Press (2002) concludes that local land preservation efforts represent the potential of both sustainability and democracy, and that the landscape itself is evidence of achievements for people and nature alike.

Statewide Growth Management

Oregon is nationally recognized for its pioneering Land Use Act, which is among the more highly structured statewide growth management programs in the country (Gale 1992; Jackson and Kuhlken 2006). In 1973, Oregon created a policy framework to balance resource conservation and development through coordinated land use planning among

federal, state and local governments (Howe 1993; Jackson and Kuhlken 2006). Environmental, economic and quality of life concerns are central to Oregon's nineteen statewide planning goals. The primary purpose is to manage growth by encouraging development in established urban areas in order to protect rural, forest, agricultural and shore lands (LCDC 2004).

City and county governments are required to develop comprehensive plans that are submitted for approval to a centralized administrative agency, the Land Conservation and Development Commission (LCDC). The local comprehensive plan must comply with statewide standards and relevant natural resource goals, such as coastal and estuary issues. A compact urban form is implemented through urban growth boundaries (UGB), whereby development encroachment into rural landscapes is minimized (LCDC 2004).

Numerous studies have subsequently attempted to evaluate and quantify the effectiveness of Oregon's policies (Abbott, Howe, and Adler 1994; Abbott 2002; Anthony 2004). Researchers have also analyzed subsequent growth management programs enacted by other states by comparing the respective structure and relative success to reduce sprawl. The literature suggests that statewide programs limit sprawl to some extent, and at least more than states lacking any growth management planning; and that the more structured programs stand a better chance to reduce sprawl, as long as the policies are enforced (Anthony 2004; Carruthers 2002; Gale 1992; Innes 1993; Nelson 1999).

Since 1973, a dozen other states have enacted growth management programs modeled after Oregon's experience. Washington State followed Oregon's lead by adopting its own Growth Management Act (GMA) in 1990. Like Oregon, Washington initiated its program in response to concerns over diminishing forestlands and farmland encroachment by urban

development (CTED 2006). While the specifics differ in their respective policies, Oregon and Washington share many of the same goals and overall objectives. For instance, both Oregon and Washington mandate local comprehensive land use planning that is compatible with state goals to control development, conserve natural resources and preserve open space (see Appendix A).

Problem Statement and Purpose

Land development typically outpaces preservation by a wide margin. Given the imperative of growth, it is all the more noteworthy when land is set aside as protected open space. Although individuals may dispute the idea of land preservation or the conservation value of specific parcels, parks and open space are commonly understood to be public goods that benefit society. Land preservation efforts frequently emerge in response to a given place that may be threatened by development or has unique features worth protecting. In addition, growth management policies typically integrate open space as both a function of overall community planning and quality of life, as well as part of a parks and recreation network.

Washington's statewide land use framework seeks to manage growth by encouraging local governments to use open space for recreation, to preserve natural resources, and as a buffer between urban and rural areas. Rapid growth and development is occurring in many communities across the state; however, researchers have focused primarily on environmental issues in major cities, such as Portland and Seattle. Therefore, how smaller communities manage growth warrants further study, especially the conditions under which land preservation occurs.

This thesis explores growth management and community-based resource protection through the lens of local land preservation efforts to protect open space in Washington, where land preservation occurs locally, yet within a framework of state-mandated growth management policy. The purpose of this study is to evaluate how and why land preservation happens, and the conditions for creating effective local institutions for land preservation whereby some communities preserve more open space than others. Specifically, how do community characteristics, including economic and social resources, affect collective environmental outcomes such as land preservation across Washington?

Previous studies, including elements of Press' research on local environmental policy capacity are incorporated to identify community characteristics potentially affecting conservation efforts and strategies as they relate to variations in local land preservation. In particular, community characteristics such as population density, education attainment, economic and social resources are analyzed to assess how each potentially shapes land preservation across the state. In order to evaluate variations in local environmental policy outcomes, the degree of association between community characteristics and the amount of protected open space is analyzed through statistical correlational analysis. The research questions are:

1) Do urban counties protect more open space than rural counties?

2) Do counties with greater economic resources protect more open space?

3) Is social capital associated with a community's ability to protect open space?

Thus, population attributes, economic characteristics and community-based social resources are evaluated to explain variation in local policy outcomes related to land preservation.

This study employs statistical analysis to assess Washington counties, followed by a descriptive comparative case study to illustrate two counties experiencing rapid population growth and a changing rural landscape, which often characterizes the land use debate. The results of this study will contribute to ways communities can respond to the land preservation challenge by informing community leaders, policy makers, and residents alike as to the conditions for creating effective land preservation institutions at the local level.

Figure 1.2: Map of Washington counties

Chapter 2: Literature Review

Parks and open space have long played a role in city planning and urban design. However, public attitudes towards parks and open space have changed over time in response to shifting ideas about the value of nature and the land itself. This literature review presents an overview of the land use debate as it relates to land preservation for open space, followed by a historical review of the role of parks in the United States, and the role of land trusts today. The role of federal, state and local governments in growth management is then discussed as it relates to land preservation and the challenge presented by opponents of land use regulation. The chapter ends by addressing how this thesis contributes to policy research and existing studies on environmental preferences and open space.

Overview

Across the country, and particularly across the West, a common set of land use issues related to community growth and rural land use changes presents a challenge to communities everywhere (Jackson and Kuhlken 2006). As Garreau (1991) argues, the land use debate emerged as a result of dissonance over the value of the land itself: some see inherent value in the land as it is and always was, while others only see value when the land is put to productive use. Currently, the conflict over land use persists within the context of land use planning, which seeks to rationally accommodate the impacts of growth by regulating the amount, location, and timing or rate of community growth (DeGrove and Metzger 1993; Kelly 2004). And the debate over land use only grows more heated as undeveloped land becomes increasingly scarce (Press 2002).

Generally, land preservation efforts arise in response to urban growth and development that underscores diminishing open space (Kline 2006; Rome 2001). As such, Rome (1998) argues that the effects of sprawl often catalyze local support and grassroots campaigns to save open space. Further, Rome characterizes the "bulldozed landscape" as a potent symbol of the destruction of nature that prompts reassessment of the costs and benefits of economic growth in favor of greater land use regulation. Hence, efforts to protect open space typically emerge locally and in direct response to the effects of rapid growth.

In addition, Daniels and Lapping (2005) maintain that better scientific understanding of ecological relationships, the importance of wildlife habitat and biodiversity reinforce arguments for land preservation. Moreover, research suggests that natural areas provide important environmental services, such as air and water purification, flood protection and microclimate stabilization (Chiesura 2004). As a result, Rome (1998) contends that open space plays an important role within the context of land-use and urban planning on one hand, and the environmental issues, on the other.

Rome (1998) breaks down the arguments for open space into three categories: conservation, aesthetics and outdoor recreation. The conservation argument arose primarily as prime agricultural lands were converted into residential subdivisions (Rome 2001). The role of natural areas in flood control and absorbing storm runoff further expanded efforts to preserve wetlands, floodplains and woodlands (Benedict and McMahon 2006). Finally, conservation proponents build on scientific ideas and ecological principles relating the role of open space to the larger ecological balance in the environment and the natural systems that ultimately sustain human society (Rome 1998).

The aesthetic argument traces back to a basic appreciation for the beauty of nature. Aesthetic appreciation is generally associated with the intellectual romanticism movement of the 18th and 19th centuries (Cronon 1995; Duncan and Duncan 2001; Rome 1998). Cronon (1995) asserts that elite social identities constructed an idealized view of nature that persists today. Nevertheless, Burgess et al. (1988) claim that, by the 1950s, appreciation for nature became more widespread and everyday opportunities to engage with nature became more expected.

Lastly, the recreation argument emerged in the years following World War II. Cranz (1982) suggests that the booming population and rising leisure time increased demand on existing urban parks and recreational facilities. Researchers examined the benefits of exercise and productive leisure time, focusing on healthy social development of children and adults alike (Chiesura 2004). Moreover, as rapid development continued, loss of nearby natural areas, such as woods and streams, provoked action as the lack of permanent open space became more noticeable (Rome 2001).

Land preservation efforts currently address a range of ecological and quality of life issues, such as protecting wildlife habitat and corridors, and protecting water quality with riparian and floodplain buffers. Advocates also seek to preserve working rural landscapes, including forest and farm lands; as well as separate rural or natural areas and urban development by way of open space buffers, in order to separate divergent land uses and contain urban sprawl (Kelly 2004). Finally, urban parks and recreational trails are preserved for urban green space, to encourage alternative modes of transportation, and to provide recreation opportunities (Benedict and McMahon 2006). Overall, land acquisition and preservation remains an essential component of growth management programs and, thus,

protected lands help shape patterns of growth and urban development (Daniels and Lapping 2005).

Local governments are the principal entities engaged in growth management planning and implementation. However, inconsistent adoption of growth management planning, spillover effects from communities without growth management, and the cumulative effect of incremental land-use decisions presents a formidable challenge. In response, state-mandated growth management programs have emerged during the past forty years as states recognize the need for regional consistency to control urban development, promote open space and greenways, and support natural resource conservation. Therefore, state policies are providing new incentives for open space planning and development.

Parks to Open Space: A Historical Review

18th & 19th Centuries

Ideas of nature and wilderness once evoked fear of the wild and unknown in a worthless wasteland redeemable only if converted for productive human use (Cronon 1995; Nash 1982). However, the intellectual romanticism movement during the 18th and 19th centuries sparked an appreciation for nature in an increasingly urbanized society. Thus, in cities, the primitive qualities of nature were more and more favored and idealized (Cronon 1995; Nash 1982).

This changed perception of nature is manifested in the 19th century writings of American transcendentalists Ralph Waldo Emerson and Henry David Thoreau. Emerson likened nature to the human mind and spirit; a clear break from the dark, savage and desolate associations of preceding centuries. Likewise, Thoreau related wild nature journeys with the

exploration of one's own potential, as part of an inner journey to a simpler, more authentic life (Nash 1982). Moreover, Thoreau (1863) famously declared wilderness to be the preservation of the world (Moldenhauser 2006). Thus, as wilderness was pushed further and further from everyday life, the solitary and mysterious qualities of nature were increasingly more desirable (Nash 1982).

By the late 19th century, the preservation movement emerged as the eastern United States was increasingly developed. Preservationists valued nature for its own sake and sought to set aside large portions of western public lands as intact wilderness (Weber 2000). Moreover, the use of land was best determined by its intrinsic character (Benedict and McMahon 2006). Preservationists also sought nature as a "spiritual haven" for themselves and future generations (Weber 2000). In addition to wilderness lands, nature was increasingly incorporated into urban areas to humanize cityscapes and to provide relief and solace for urbanites.

During the 19th century, large American parks were built to improve cities that had become too big, noisy, artificial and corrupting. These "great pleasure grounds" offered escape to peace, quiet and psychic renewal. Furthermore, the idealized virtue of nature and rural countryside played a role in subsequent park design emphasizing outdoor recreation and exercise. Ideally, an entire day was spent enjoying the picturesque landscape. Not only were pedestrian paths separated from horses and carriages, but the parks themselves were bordered by shrubs and trees designed to block out city streets (Cranz 1982).

During this time, prominent 19th century landscape architect, Fredrick Law Olmsted, championed the idea of nature integrated within the city. Olmsted believed parks and tree-lined avenues provided relief for city dwellers during their harried day amidst crowded

streets, buildings and congestion. Hence, Olmsted sought to utilize natural scenery to improve human health and well-being (Sprin 1995). Not only did Olmsted bring nature and a sense of wild into the city, but he also advocated for integrated networks of parks, greenways and public transportation systems to connect various parts of the city in order to make green spaces more accessible to all citizens (Ryder 1995).

20th Century

The idealistic and preservationist values gave way to conservationists of the early 20th century who emphasized a more utilitarian use of public lands. Natural resource development and benefits to society became the focus, rather than maintaining public land in a relatively natural condition (Lowry 2000). Hence, nature was valued as a commodity to benefit society and serve human needs, rather than claiming any intrinsic worth (Weber 2000).

At the national level, thousands of acres are designated under federal protection and management for recreational use and enjoyment, including the newly created National Park System which is the first of its kind in the world. States are also becoming more involved in land conservation and resource preservation (Benedict and McMahon 2006). In 1915, twenty acres of land is donated to the state to become Washington's first state park. Today, Larrabee State Park is the largest public park in Whatcom County with over 2,680 acres[1].

During this period, utilitarianism emerged as the dominant idea in urban park design. Utilitarianism is based on the value of usefulness. As a result, efficiency and function reigned as park directors replaced landscape architects and park designers and sought to

[1] Washington State Parks and Recreation Commission. "Larrabee State Park." http://www.parks.wa.gov/parkpage.asp?selectedpark=Larrabee (17 Oct 2008).

organize recreation in such a way as to make the most of leisure time. Thus, utility replaced artistry. Parks remained artificial and deliberate, but the overall layout grew increasingly formal and symmetrical compared to the more naturalistic pleasure grounds. More everyday than special occasion, neighborhood parks, school parks and playgrounds also emerged during this time. By the mid-20th century, park elements were standardized and economized into basic municipal packages that tended to resist design innovation (Cranz 1982).

By the end of the 20th century though, land preservation rationale typically embraced natural resource conservation and habitat preservation (Paehlke 2000). Moreover, as environmental problems, related to industrialization and urban development, were increasingly recognized by the public, the contemporary environmental movement focused again on nature's intrinsic value and the adverse impacts humans have on natural systems (Weber 2000). Public health researchers and psychologists increasingly joined the ranks of ecologists and biologists advocating the benefits natural areas provide. Consequently, the literature emphasizes the environmental services, social functions and psychological benefits that natural areas provide. In particular, not only is nature and recreation beneficial to human well-being, but functioning ecosystems provide services essential to clean air and water. A scientific and ecological approach, then, increasingly serves as the basis for park, open space and landscape design in urban planning (Benedict and McMahon 2006).

21st Century

Today, combinations of park design types persist across urban landscapes. Large pleasure grounds remain as restorative havens within urbanized landscapes; neighborhood parks continue to contribute a sense of community to urban living; and open space builds on

the recreation era of park systems and an enlarged, regional view of interconnected park design (Cranz 1982). Therefore, recreation persists alongside conservation as justification for land preservation efforts in both rural and urban areas.

Ultimately, park design is constantly evolving as values and attitudes change over time. In general, Cranz (1982) suggests the changing conception of park function echoes an increasingly positive view of cities and urban living. Thus, park renewal may follow or precede urban revitalization in a given area as a way to enhance the quality of life for urban dwellers. While Chiesura (2004) maintains that green spaces may not create quality of life per se, parks and open space may support or favor the conditions under which a sense of community and quality of life develops. That is, parks and open space may increase the likelihood of improving a community's quality of life.

In summary, natural areas and open space continue to play a role in urban development partly as a vestige of romantic ideals of nature. Olmsted's legacy continues to influence modern ideas about urban landscape design in the U.S. (Sprin 1995). While the debate over productive land use versus inherent value continues, a broader view of land value persists in current land use policy in light of increased understanding of ecological interconnectedness and awareness of the environment as a whole; hence, land retains its value as a resource rather than a commodity. Furthermore, as population growth and urban development continue to encroach into rural and natural areas, land preservation takes on a sense of urgency (Press 2002). As a result, the awareness of the value of open space has contributed to growth management and land preservation initiatives around the country.

Land Trusts - Land Acquisition for Conservation

Public resources to preserve land are frequently limited by budget constraints, public values, political climate and economic conditions. As a result, private initiatives have emerged in the form of land trusts, greenway groups and conservancies as key players in land preservation efforts (Merenlender et al. 2004; Whittaker 1999). Land trusts and conservancies are nonprofit organizations that preserve open space by providing the financial and fundraising resources needed to acquire land and negotiate conservation easements with private landowners (Kline 2006). In addition, land trusts increasingly provide professional knowledge and skills related to real estate and financial transactions; and public relations (Fairfax et al. 2005). Therefore, land trusts act in partnership with land owners and government entities alike to protect land from future development.

Since the 1980s, land trusts have become increasingly popular in land acquisition and conservation strategies across the country. By the end of the 1990s, nearly 22 million acres had been protected by land trust organizations (Fairfax et al. 2005). Nationally, The Nature Conservancy (TNC) continues to surpass all other leading environmental nonprofits in terms of membership growth, budgets and financial assets. In addition, statewide and regional land trusts operate in nearly every state. However, most land trusts are locally-based and are often formed in response to the threatened loss of a unique natural, historical or cultural feature (Fairfax et al. 2005). According to Whittaker (1999), land trusts are central to community-based land preservation efforts because they characterize the significant role of concerned citizens to organize around a common interest to preserve natural or historical elements.

However, while research suggests land trusts are positively correlated with population density, the prevalence of land trusts may decline once there is so much development that

little land remains to preserve. On the other hand, key resources may be lost before local residents recognize the need for preservation (Fairfax et al. 2005). Moreover, communities may initially prioritize scenic amenity or rural character preservation; however, Kline (2006) asserts that once land is increasingly scarce, protecting local open space lands for daily recreation may be sufficient for many residents. Thus, perceptions of how much land should be protected changes as factors related to local preservation change.

Nevertheless, at the state and local level, ballot measures for financing land conservation have been more successful than other environmental policy proposals (Fairfax et al. 2005). Given that researchers use voting preferences to measure public attitudes, ballot measures related to land preservation and conservation appear to be less controversial in many communities and suggest public enthusiasm for land preservation (Press 2002, 2003).

Although the national land trust movement has undoubtedly benefited conservation, Fairfax et al. (2003) argue that the emphasis on ecological values and controlling sprawl overlooks the importance of equity in conservation goals if the movement is to sustain support in the future. Equity in land preservation includes protecting land in all communities, as well as ensuring public access to those lands. Community land trusts (CLT) are an example of a small but growing movement of land trusts that seek to protect land around urban areas and underserved populations while working to provide affordable housing (Fairfax et al. 2005). On a larger scale, the Trust for Public Land (TPL) is an example of a national organization that works with communities and local governments to protect parks and open space in cities and urban areas, as well as in natural areas, as part of its mission to conserve land to benefit people, ensure livable communities and increase accessibility. Therefore, land trusts have an important role to play as both brokers between

land owners and government, and to work towards equitable distribution of lands for people in all communities.

Government & Land Preservation

Federal Government

The federal government has a long history of public land management. Historically, federal land policy focused on agrarian and resource use purposes (Jackson and Kuhlken 2006). However, public lands have also been protected for future generations since the 19th century. By the late 1800s, federal and state governments were becoming more involved in both land conservation and resource preservation. In 1864, Congress gave the Yosemite Valley to the state of California as a public park; and in 1872, Yellowstone was dedicated as the first national park. Between 1901 and 1909, President Theodore Roosevelt designated 230 million acres for federal protection, including five National Parks under the newly created National Park System (Benedict and McMahon 2006). The first of its kind, the National Park System is a global model for protected areas, attracting visitors from around the nation and world every year, and today includes 84 million acres in forty-nine states[2].

Nevertheless, many protected areas are insufficient in size to adequately function as sustainable sanctuaries and sole providers of habitat, especially for roaming animals, and ecologically essential pollinators and migrating birds (Wilcove et al. 1998). Moreover, inadequate buffers often surround protected areas to mitigate the effects of human encroachment (Theobald, Miller, and Hobbs 1997; Wilcove et al. 1998). By the mid-1960s, the expansion of urban growth and the rise of the automobile threaten even the most remote areas. In response, Congress passes the Wilderness Act in 1964, stating the importance of

[2] National Park Service. "About Us." http://www.nps.gov/aboutus/index.htm (17 Oct. 2008).

preserving land in its natural or "wild" condition as an "enduring resource" (Benedict and McMahon 2006). Over the past four decades, nearly 106 millions acres have been designated as wilderness (Vig and Kraft 2000).

In addition, Congress established the Land and Water Conservation Fund in 1965, which provides federal funding for the acquisition and development of greenways and open space for outdoor recreation and natural resource protection[3]. As a result, during the 1960s, states such as Oregon and Vermont led the nation in landscape preservation and conservation initiatives (Ryder 1996). Hence, the federal government plays a role in preserving landscapes of national significance, as well as contributing to state and local efforts to protect open space.

At a smaller scale, private land has been protected from development as part of the national trust since the late 1700s (Fairfax et al. 2005). Nevertheless, from colonial times through the 19th century, there was little government control over natural resources because resources were viewed as "perpetually abundant". However, as natural resource policies have developed, government has retained its role as the primary policy maker (Lowry 2000).

At the turn of the twentieth century, land-use controls emerged as the frontier receded and the perceived abundance of land diminished. Recognizing the limited supply of land, urban areas began developing local ordinances and land-use restrictions to control development (Bosselman, Callies, and Banta 1975). In the 1920s, the federal government formally delegated land-use planning to local governments. Since then, land-use decisions remain principally under the purview of local government.

[3] National Park Service. "Land and Water Conservation Fund." http://www.nps.gov/lwcf/ (10 Nov. 2008).

Local Government

Communities rely on regulatory laws and policies to guide growth and development. Traditional planning primarily relies on zoning, which is a system of local ordinances and land-use restrictions (Bosselman, Callies, and Banta 1975). Zoning is still the most widely used regulatory tool to influence patterns of development (Benedict and McMahon 2006).

However, traditional planning was challenged by the rapid growth of the late 1980s and 1990s. Population growth and development pressures led to the outward expansion of residential and commercial developments into rural and natural areas. Communities grew increasingly frustrated with incessant conversion of farmland, open space and natural areas into dispersed, low-density, sprawling land-use patterns. By the late 1990s, sprawl was recognized as the leading land-use problem in the U.S. (Daniels and Lapping 2005).

Moreover, Bosselman et al. (1975) claim that the multitude of local jurisdictions creates a real problem with the zoning structure has proven largely ineffective against social and environmental problems, especially those with statewide and regional significance. Lack of coordination and consistency led state agencies to look for new solutions to better manage growth. Thus, the limitations of local land use regulation were manifested by regional-scale growth pressures that transcend political boundaries (Gale 1992).

State Government

According to Carruthers (2002), state-mandated growth management policies initially emerged from rising public concern for the environment and natural resources during the environmental movement of the late 1960s and early 1970s. Hawaii (1961), Vermont (1970), Florida (1972) and Oregon (1973) led the nation in growth management planning and

environmental protection (Nelson 1999). During this time, other states, including Massachusetts, Wisconsin, and California, adopted land-use controls over sensitive natural areas, such as wetlands, shore lands, waterways and coastal areas (Bosselman, Callies, and Banta 1975). During the 1980s, a second wave of states-mandated growth management programs were enacted, including New Jersey (1986), Maine (1988), Rhode Island (1988) and Georgia (1989). These states built on the environmental focus of earlier programs but also incorporated quality of life concerns and emphasized containing urban sprawl (Carruthers 2002).

Termed a "quiet revolution" by Bosselman et al. (1975), this new trend towards state and regional land-use controls continues to influence and gain support (Gale 1992). In 1990, Washington State enacted comprehensive growth management legislation and, by 2001, at least eleven states had joined the "quiet revolution" at the state level (Carruthers 2002). In addition, local growth management programs have been developed at the municipal and county level. For instance, while California does not mandate local planning, according to Gale (1992) local growth management is so popular and widespread that it is a state-mandated program in practice.

Researchers compare and contrast types of programs by evaluating the regulatory structure and relative success of these programs to reduce sprawl and achieve their stated goals. In general, the literature agrees that statewide programs limit sprawl to some extent and more than states without any growth management planning. There is also general agreement that the more structured programs stand a better chance to reduce sprawl, as long as the policies are enforced (Anthony 2004; Carruthers 2002; Gale 1992; Innes 1993; Nelson 1999).

Growth management efforts reflect a coordinated and comprehensive effort to address physical, social and economic impacts of growth (DeGrove and Metzger 1993). The challenge for state growth management policies is to balance regulation and planning goals for overall benefit. Rather than getting overwhelmed with bureaucracy, the role of the state is to separate major developments with regional effects from small-scale projects where the existing role of local government is adequate. Furthermore, if the regulatory system is too complex, local innovation will be hampered (Bosselman, Callies, and Banta 1975). Likewise, at the national level, the federal system allows states to experiment with growth management planning and, thus, pursue multiple solutions that fit regional conditions.

According to Kelly (2004), recognizing land as a scare resource is central to adopting growth management policies. And although Fiorino (2006) asserts public support for land use and environmental regulation continues to rise, a private property rights movement has emerged in many western states that challenges environmental and land use regulations.

Takings Challenge

Under the Fifth Amendment of the Constitution, and the due process clause of the Fourteenth Amendment, property owners are protected from federal or state governments taking private property for public use without just compensation (Kubasek and Silverman 2005). Property right proponents argue government regulations diminish the value and restrict the use of their land (Jackson and Kuhlken 2006). The argument, then, is that a taking occurs when a government action precludes all substantially beneficial or economically viable uses of private property, without compensating the owner.

Regulations are intended to benefit the greatest social good. Zoning and comprehensive land use planning have consistently been upheld in court, even though there is a consequential effect of reducing some property values and increasing others, because they are not arbitrary, but rather based on factual rationale and implemented by fair and reasonable procedures (Jackson and Kuhlken 2006).

In several states, ballot initiatives have attempted to explicitly require state and local governments to pay monetary compensation to any landowner when a government action reduces the fair market price of their property, or to repeal any land use regulation that effectively devalues the property by limiting the use of the property. Oregon voters approved such an initiative in 2004 (Measure 37[4]) but similar ones have failed in other states, including Washington (Howe 1993; Jackson and Kuhlken 2006). Subsequently, in 2007, Oregon voters approved development limits that effectively replaced Measure 37 with a more moderate property rights law, Measure 49[5]. Ultimately, land use regulation challenges are frequently resolved in courtrooms where judges seek to balance property rights with the public good.

Utility of Research

Development pressures and controlling sprawl are significant issues faced by communities across the nation. Moreover, the same actors, including local government, land trusts, developers, nongovernmental civic organizations, and concerned citizens, are involved

[4] DePlace, Eric. "This Land: Measure 37's Impact on Oregon." Sightline. http://daily.sightline.org/daily_score/series/this-land-measure-37s-impact-on-oregon (15 June 2009).
[5] Mortenson, Eric. "Oregon Fights Land-Use Battles One by One." The Oregonian. http://www.oregonlive.com/news/oregonian/index.ssf?/base/news/1215397534155480.xml&coll=7 (13 Jan 2009)

in the struggle between growth and land preservation. In addition, state and local governments share the same limited tools to preserve land and manage growth, including direct acquisition and land use controls. Therefore, land use issues facing communities in Washington State are relevant nearly everywhere.

Kline (2006) suggests socio-economic trends, such as population growth, rising incomes, development and obvious effects of urban sprawl, and increasing open space scarcity tend to motivate public support for preserving open space. Researchers are also focusing on how socio-economic factors affect access to social resources, termed *social capital* (Parisi et al. 2004). According to Press (2002), the idea of social capital is frequently employed to bridge the gap between institutional-level analysis and individual behavior by bringing society and culture into policy research. Social capital is defined as a social resource comprised of the norms and networks that make collective action possible (Parisi et al. 2004; Savage, Isham, and Klyza 2005). Social capital may help drive policy outcomes by contributing to public beliefs and policy preferences, which relates to community activeness and civic environmentalism (Press 2002). In other words, social capital affects how involved and engaged individuals are, influencing how people, and by extension communities, view the environment and open space. Thus, both economic and social resources potentially influence how local populations act collectively to preserve open space.

Therefore, this thesis builds on existing research by expanding analysis to smaller communities in the Pacific Northwest. Correlating open space with socio-economic variables and community resources will better inform planners, policy makers and community leaders seeking to build community support and prioritize open space preservation efforts. Many communities continue to face development pressures, and given

the competing needs and uses for available land, this research will contribute to ways communities can respond to the land preservation challenge.

Finally, growth is increasingly recognized as the means to an end, rather than the end itself. Instead, quality of life is the ultimate end. Kline (2006) asserts that to be successful, open space advocates should emphasize "local open space as an investment in residents' future quality of life" (656). Thus, even where open space lands grow scarce, protecting local water quality and open space access for recreation remain compelling reasons for local support for land preservation (Kline 2006). Finally, Press (2002) concludes local land preservation efforts, "ultimately affirm the twin promises of sustainability and democracy [and] the landscapes themselves confirm for their communities that democracy can work for nature and people" (146).

Chapter 3: Methods

To assess the relationship between community characteristics and open space preservation based on an environmental policy capacity model, statistical analysis is utilized to evaluate Washington counties collectively; while descriptive comparative analysis of Clark and Whatcom counties is employed to further illustrate the policy capacity model. This chapter is divided into five sections. The first section discusses the rationale for the selected study area. The second section describes the objectives of the study; while the third section elaborates on the study design. Section four details how data is collected and section five describes the statistical tests used to analyze the data.

Study Area

Currently, there is limited research on open space preservation in Washington State. In contrast, Oregon has been the subject of a great deal of research since the enactment of its Land Use Act in 1970. However, the literature primarily focuses on land use and growth management issues around major metropolitan areas. Hence, Portland has garnered significant attention for its pioneering leadership in numerous environmental issues, including parks and greenways. Therefore, smaller communities warrant further research, especially where rapid population growth and development threaten remaining open space.

County-level analysis is appropriate for this study because parks and open space tend to be managed at the county level. And under Washington's GMA, counties are the principal decision-maker when it comes to local comprehensive planning, including parks and open space. Therefore, all thirty-nine Washington counties are analyzed; however, two counties in

particular are further examined in order to better assess open space preservation and environmental policy capacity at the local level.

Whatcom County was selected primarily because of proximity and familiarity with the area. However, rather than focus exclusively on a county that may not be representative of the entire state, comparative analysis enables further discussion of the processes assessed for all counties. Given that the land use debate is typically characterized by population growth and a changing rural landscape, Clark County was selected because of rapid population growth and relatively high population density, whereby the hypothesis that urban populations and land scarcity lead to greater perceived need to protect remaining land can be explored. Moreover, Clark County is separate from the Seattle metropolitan area and is geographically distinct from Whatcom County. Therefore, although both Clark and Whatcom counties are experiencing rapid population growth and a changing rural landscape; they differ in county area, population size and economic interests.

Clark County is located in the southwestern corner of Washington and was the fastest-growing county between 1990 and 2000. The county seat and largest city is Vancouver, Washington, which lies across the Columbia River from Portland, Oregon. Vancouver is the fourth largest city by population, behind Spokane and Tacoma, but with less than half the population of Seattle. Clark County is the fifth most-populated and third densest counties in the state. Due to Clark County's proximity to Portland, and potentially Olympia or the Seattle-Tacoma metropolitan area, residents have the opportunity to commute to larger cities for work. According to county records, overall job growth is stable and increasing in service and retail sectors.

Whatcom County is located in the northwestern corner of Washington. Bellingham, the county seat, frequently ranks high on quality of life surveys of cities nationwide. Although predominantly a rural county where agriculture remains the dominant land use, Whatcom County nevertheless experienced considerable population growth during the past three decades, especially during the 1990s. Bellingham is the seventh most-populated city, and Whatcom County is the ninth most-populated county in the state. According to city records, current job growth is predominantly in the healthcare and service industries; however, agriculture remains an important component of the county's overall economy.

Figure 3.1: Map of Washington showing Clark & Whatcom Counties

Objective

The purpose of this study is to assess geographic patterns in land preservation based on population and community characteristics. The literature suggests socioeconomic trends, such as population growth, rising incomes, urbanization, and open space scarcity, typically spur support for land preservation efforts. The underlying hypothesis, then, is that local preservation is neither widespread nor uniform, but rather clustered around urban populations.

The idea of local environmental policy capacity as described by Press (1998, 2002) looks beyond socio-economic trends and suggests additional community characteristics that potentially shape environmental protection activities. Hence, the policy capacity model is used to analyze why some communities preserve more open space than others. Elements of Press' research are incorporated to identify community characteristics potentially affecting conservation efforts and strategies as they relate to variations in open space preservation in Washington.

Once identified, the community characteristics are statistically correlated with the amount of protected open space, in order to assess whether there is an association. Thus, the community characteristics serve as indicators of policy capacity and should shape policy outcomes, which, in this study, is the amount of protected open space. If the policy capacity model is accurate, communities demonstrating relatively more social capital or those with greater access to resources (e.g., public or private funding or expertise) are expected to preserve more open space.

The policy indicators selected for this research are: population density, median household income, educational attainment – high school and Bachelor's degree, the number

of environmental nonprofit organizations and the number of local land trust organizations. Population density (persons per acre) characterizes external constraints related to urbanization and development pressures and, thus, may be associated with a greater perceived need to protect remaining available land as open space (see Kline 2005). Press (2002) also found that urban counties in California protected more open space than rural counties. Median household income is selected because the literature suggests local governments with greater resources are better able to invest in environmental or sustainability programs (see Kline 2005, Parisi et al. 2004, Portney 2003). Likewise, education is typically included as an indicator of local economic conditions but is also linked to community activeness and, by extension, civic environmentalism. Researchers suggest higher education attainment develops personal efficacy related to improving or maintaining environmental quality as a collective good (see Parisi et al.)

The number of environmental nonprofit organizations relates to community resources by way of civic participation and potential institutional leadership on environmental issues. Local land trust organizations are also associated with community resources and may be more prevalent where there is both a perceived need and greater community willingness to protect open space. Therefore, community characteristics, socio-economic factors, community resources, and civic engagement and participation related to environmental attitudes (i.e. civic environmentalism) are examined to assess how each may potentially shape geographic patterns of land preservation.

In addition to quantitative statistical analysis of land preservation statewide, a more qualitative approach is employed through descriptive comparative analysis that focuses on two counties, Clark and Whatcom. Both counties are experiencing the rapid population

growth and changing rural landscape that often typifies the land use debate. The ultimate goal of this research, then, is to apply the environmental policy capacity model to Washington, thereby expanding analysis to smaller communities and offering possible explanations as to why some communities protect more open space than others.

Study Design

Washington's Growth Management Act (GMA) acts as a centralizing force whereby counties conduct comprehensive planning for their parks, recreation and open space. Local responses to development, then, emerge as indicators of policy outcomes, according to the policy capacity model. Once land preservation acreage is determined for each county, geographic patterns can be evaluated to determine if land preservation is widespread and relatively uniform in distribution, random, or clustered.

Elements of Press' environmental policy capacity model are used to identify community characteristics that serve as measurable policy indicators potentially affecting land preservation efforts. Statistical correlation is then conducted to assess whether there is an association between each of the community characteristics and the amount of protected open space, which is measured as total acreage, as a percentage of total land area and open space per 1,000 residents, in order to account for differences in population and land area. Finally, because total protected acreage ranges across orders of magnitude, from 200 to more than 250,000; a natural logarithmic (base *e*) function is applied to the total open space acreage in order to remove some of the varying amplitude. The resulting natural log (ln) of protected acreage exhibits far less variation, from 5.2 to 12.4, and a normal distribution

(symmetrical around mean, bell-shaped curve), which the total acreage lacked (see Appendix D).

Statistical analysis is limited, however, by simplifying social phenomena into measurable variables that may or may not explain the causal mechanisms indicated by the findings. Therefore, a descriptive case study approach is employed to better illustrate the patterns suggested by the overall statistical analysis, as applied to two rapidly growing counties. Clark and Whatcom County are assessed through their respective comprehensive planning documents for the county in general, and for the parks, recreation and open space specifically. The principal local land trust in each county is also considered, through their goals and objectives, as an indicator of local land preservation efforts.

The purpose of the statistical analysis, then, is to apply the environmental policy model to Washington overall and thereby guide the qualitative discussion, in order to further assess protected open space and differences in community characteristics. Ultimately, the effectiveness of the environmental policy capacity model as applied to Washington is evaluated.

Data Collection

In order to situate Washington both regionally and nationally, some state-level analysis is included. In April of 2008, the Trust for Public Land (TPL) released its Conservation Almanac, a nationwide database of permanently conserved state and federal lands aggregated to the state-level. Baseline data of land acquired prior to 1998 is updated annually through 2005 from state and federal agency or program reports, including the Bureau of Land Management (BLM), the U.S. Forest Service (USFS), the National Park

Service (NPS) and the U.S. Fish & Wildlife Service (USF&W). Currently, the data does not include city, county or land held by land trusts and relies on state and federal agency estimates of lands owned in fee or held with conservation easements. Because the data were aggregated to the state-level, it does not capture local nuances in open space preservation and was therefore used primarily to situate Washington's land preservation efforts.

Table 3.1: Conservation Almanac (TPL) data sources used

DATA	SOURCE *
Total Acres Conserved	State & federal lands – aggregated 1998-2005
Total Conserved Acres per Capita	State & federal lands – aggregated 1998-2005
Percent of Total State Land Conserved	State & federal lands – aggregated 1998-2005

* Reporting agencies/programs: BLM, USFS, NPS, USF&W

The majority of data for the independent variables were collected from secondary sources, at the county level. 2000 Census data were collected from the U.S. Census Bureau for total population, median household income, and education attainment (High School and Bachelor's degree). Estimated population data for 2006 and 2008 were obtained from the Washington State Department of Financial Management (OFM), as well as county land area. The number of environmental non-profit organizations registered with the IRS as of 2007, was obtained from the National Center for Charitable Statistics (NCCS). And the number of local land trusts operating in each county was tallied from those registered with the Land Trust Alliance (LTA) as of 2008.

Table 3.2: Data sources for population and community characteristics

DATA *	SOURCE
Total Population	U.S. Census Bureau (2000)
Median Household Income	U.S. Census Bureau (2000)
Population Estimates	Washington State Office of Financial Management (2006, 2008)
County Land Area (acres)	Washington State Office of Financial Management
Education Attained - High School & Bachelor's degree for population over 25 years of age	U.S. Census Bureau (2000)
Number of Registered Environmental Non-profit Organizations	National Center for Charitable Statistics (2007)
Number of Registered Land Trust Organizations	Land Trust Alliance (2008)

* All data collected at county level and aggregated to state-level as needed.

Open Space Data

Parks and open space data is not available from a central source; therefore, it is less reliable and more difficult to come by than the preceding datasets. Parks and open space include lands owned by city, county, state or special district government bodies. These lands may have been purchased outright, donated by private actor, transferred to a government agency by conservation land trust or managed by local preserving group. These lands are less susceptible to development that areas merely zoned as greenbelts or agricultural lands. Thus, the focus is land acquisition and explaining patterns of land acquisition.

Moreover, the emphasis is land acquisition that represents major commitments to nature-oriented recreation and wildlife habitat preservation. Although they may contribute to city and neighborhood quality of life, parcels smaller than ten acres and parcels used primarily as sporting facilities are excluded. Therefore, only permanently protected lands greater than ten acres are counted to make the analysis as robust as possible.

Furthermore, federally managed and tribal lands are excluded from analysis. Federal lands are acquired through different channels by way of congressional approval or executive

order to protect natural resources of national importance. While federal lands are often large tracts that often provide critical wildlife habitat, not all are permanently protected from resource extraction or leasing by private actors. Moreover, while the federal park system is essential to land preservation efforts, there are too few to be the sole providers of wildlife habitat or recreation opportunities. State parks, though, are included because they are often closer to urban areas and population centers and typically preserve a natural resource with regional or statewide significance.

Public lands data was derived from 2003 spatial datasets compiled by the Department of Natural Resources (DNR), Fish and Wildlife Service (FWS), Washington's Parks and Recreation Commission (P&RC). Therefore, state, county and city-owned lands, including parks, wildlife refuges, recreation areas and other publicly-accessible, non-working lands, preserved for recreation, open space or wildlife habitat are included. Although considerable effort is made to make the green space data as complete as possible, time and resources limit total accuracy and precision.

Clark County completed their Comprehensive Plan, including a parks and open space inventory in May 2007. Likewise, Whatcom County's Parks and Recreation Department completed an inventory of parks, greenways and open space in April 2008, as part of the County's overall Comprehensive Plan. From these inventories, parcels less than ten acres are excluded, as well as those used as sporting facilities or fairgrounds. Therefore, the availability and comprehensiveness of the data allows local-level examination of Clark and Whatcom Counties.

Statistical Analysis

The statistical software packages Excel and SPSS 16.0 were used for data analysis. Descriptive statistics were performed to visualize patterns and trends in the data (see Appendix C). All data collected is measured on a ratio scale; therefore, the magnitude of difference between variables can be determined (McGrew and Monroe 2000).

The purpose of this study is to better understand the conditions under which land preservation efforts occur in some communities and not in others. Are community characteristics related to open space preservation? To examine this question, each of the community characteristics selected for this study were statistically correlated with the total acres of protected open space, percentage of protected land, and protected open space per 1,000 residents, respectively. For instance, if population density is associated with land preservation, a strong correlation will emerge, suggesting that population density, and implied land scarcity, spurs land preservation, or, perhaps, that maintaining greater open space in the county overall requires higher population densities in urban areas.

Spearman's rank correlation is a straightforward technique used to measure the strength of association between two variables (McGrew and Monroe 2000). Spearman's Rank Correlation was chosen for analysis because the data collected does not meet the conditions of a normal distribution and is suitable for sample sizes less than 100. Spearman's is appropriate for ranked (ordinal) data or interval/ratio data that is converted to a ranked scale. Spearman's correlation coefficient (r_s) ranges from a value of 1.0 for perfect positive correlation, to -1.0 for perfect negative correlation. A value of zero represents no association between variables. Spearman's coefficient of variation (r^2) represents the percentage of

variation of the independent variable that is attributable to the dependent variable, which, in this case, is protected open space.

Several of the variables do not exhibit a normal distribution; therefore, Spearman's rank correlation test is used for the majority of this study. However, land trusts are given closer examination with the natural log of protected acreage, both of which are derived from normal distributions. Therefore, Pearson's correlation coefficient is utilized in this instance.

Pearson's correlation is the most powerful and widely used test used to measure the association between two variables (McGrew and Monroe 2000). Data must be measured on an interval or ratio scale, and assumes a normal distribution (symmetrical around mean, bell-shaped curve). Pearson's correlation coefficient (r) is comparable to Spearman's and ranges from a value of 1.0 for perfect positive correlation, to -1.0 for perfect negative correlation. A value of zero represents no association between variables.

The Kruskal-Wallis *H* Test determines whether or not several independent samples come from the same population. The Kruskal-Wallis test is equivalent to the one-way Analysis of Variance (ANOVA), without assuming the data have a normal distribution, and only assumes the data to be an ordinal (ranked) level of measurement (McGrew and Monroe 2000). For this study, Kruskal-Wallis is used to determine whether the counties, grouped by the number of land trusts, differ from each other based on the mean ranking of total protected acreage for each group. The Kruskal-Wallis test statistic (*H*) is given as a chi-square value which, given a significance value less than the 0.05 threshold, indicates that the groups indeed differ from each other.

Chapter 4: Results

This chapter presents data analysis results. The first section situates Washington regionally and nationally, based on state and federally protected lands. The second section briefly summarizes descriptive patterns for protected open space in Washington counties. The third section explains results of the Spearman's Rank Correlation and Chi-square analysis; and the final section presents a descriptive comparative analysis of Clark and Whatcom counties.

Washington State

Based on the Trust for Public Land's (TPL) Conservation Almanac data, as of 2005, Washington has conserved more acres of open space than most other states, after accounting for differences in state size. Most of the western states are at the higher end of land conservation, which is expected given the large federal public land parcels in the West. Alaska is found to be a significant outlier and so the data is evaluated for all fifty states and then just the contiguous forty-eight (see Appendix B).

After excluding Hawaii and Alaska, both Oregon (5.29) and Washington (2.47) are well above the median acreage per capita (0.5), indicating greater acreage conserved per resident than most other states. While Washington is closer to the mean of the contiguous U.S. (2.59), Oregon clearly conserves more acreage per person. Nevertheless, both Oregon (32.3%) and Washington (37.6%) have conserved roughly one-third of their total land area, which is typical for the region - most of the western and Rocky Mountain states have protected more than a quarter of their total land area. Washington is third in the country for

conserving land as a percentage of total land area, after California and Idaho, and followed closely by Utah and Oregon (see Appendix B for charts and tables).

Descriptive Statistical Patterns for Protected Open Space

Across the state, the total acreage protected ranges from less than 200 acres (Wahkiakum) to more than 200,000 acres (King and Kittitas). As a percent of total county land area, protected open space ranges from less than 1% to 17%, with Adams and Wahkiakum at the low end, and King and Kittitas at the high end of the distribution. The mean is 3.18%, and only six counties protect 5% of more of their total land area. Land protected per 1,000 residents ranges from 22 acres (Pierce) to 7,600 acres (Kittitas), with a mean of 960.55 acres[6]. In contrast, as a normalized measure of total protected acreage, the natural log of total acreage exhibits far less variation. More counties are clustered near the center of the distribution, which ranges from 5.2 to 12.4, with Wahkiakum at the very low end and King and Kittitas Counties at the high end of the distribution. Overall though, substantial variation in protected open space exists across the thirty-nine counties (see Appendix C for additional tables and charts).

Table 4.1: Descriptive statistics of protected open space in Washington counties

Open Space	Mean	Median	Standard Deviation	Variance
Total Acres Protected*	36,876	15,871	55,873	3,121,731,062
Open Space as a Percent of Total Land Area	3.2%	1.8%	3.7%	0.1%
Protected Open Space Acres per 1,000 Residents*	961	341	1,545	2,386,103
Natural Log of Total Acreage	9.66	9.67	1.44	2.08

* rounded to nearest whole number

[6] According to the National Recreation and Park Association, "per 1,000 residents" remains the most widely-used standard to establish benchmarks or goals for public parks, trails, and open space.

General Findings of Statistical Analysis

Considerable variation for both protected open space acreage and population and community characteristics is apparent across Washington. Moreover, clear patterns do not readily emerge between the community characteristics and open space. In particular, the counties with more land trusts or greater protected acreage are found to be dispersed throughout the distribution for median household income and education attainment. Nevertheless, counties with greater protected acreage or at least three land trusts are generally dispersed around the top-third of population density values, number of environmental nonprofits and local land trusts.

Based on the statistical analysis, neither population density nor the percentage of Bachelor degree holders is found to be statistically associated with the amount of protected open space. However, the results do suggest that the percentage of high school graduates, the number of environmental nonprofit organizations and local land trusts are positively correlated with protected open space. Unexpectedly, the findings also indicate a negative relationship between median household income and open space. Further explanations follow in the following sections.

Kolmogorov-Smirnov Test for Normality

The Kolmogorov-Smirnov test for normality was used to establish whether the data meets the normality assumptions required for parametric statistical tests, that is, whether the data has a normal or non-normal distribution. Kolmogorov-Smirnov was run for all variables, including the four open space measurements. Most of the variables were considered non-normal, having a significant value less than 0.05 (see Appendix D).

Therefore, non-parametric tests were primarily used for statistical analysis, meaning no assumptions were required as to the underlying distribution of the data.

Spearman's Rank Correlation Test

Spearman's rank correlation test is used to measure the degree of association between two variables and whether the relationship is positive or negative (McGrew and Monroe 2000). In this study, Spearman's measures the degree of association between each community characteristic and protected open space. In other words, Spearman's is used to determine whether there is an association between two variables, that is, whether each community characteristic is related to the amount of protected open space, and to what degree. For this research, the correlation coefficient value should be 0.40 or above with a confidence level at or above 0.05 to be accepted as a significant correlation.

A negative association exists between open space and median household income, although it is a very weak relationship. The correlation value for population density is nearly zero, indicating no association. Environmental nonprofits and land trusts exhibit the highest, positive relationships; however, while neither shows a strong correlation, the significance level is high enough to accept for environmental nonprofits. Education attainment is effectively unrelated to protected open space. Given nearly 0.40 correlation value, and 98% confidence level, a significant relationship is accepted between the number of registered environmental nonprofit organizations and the total acreage of protected open space.

Table 4.2: Spearman's rank correlation coefficient values (r_s), total acreage protected

Variable (n=39)	**r_s value**	**Significance (two-tailed)**
Population Density (persons per acre)	-0.06	0.74
Median Household Income	-0.23	0.16
Number of Environmental Nonprofits	0.38	0.02*
Number of Local Land Trusts	0.25	0.12
High School Graduates (percentage of total population over 25 years of age)	0.17	0.30
Attained Bachelor's degree (percentage of total population over 25 years of age)	0.02	0.89

* Correlation value is significant at the 0.05 level

Correlations are also performed between each variable and the percentage of open space as a proportion of land area and the amount of open space per 1,000 residents, respectively. Using protected open space acreage as a percentage of county land area allows comparison across counties of varying size. The number of environmental nonprofit organizations is positively correlated (0.50) with open space as a percentage of total land area, with a confidence level exceeding 99%. No other variables suggest an association with enough confidence to be a significant correlation.

Table 4.3: Spearman's rank correlation coefficient values (r_s), percentage of open space

Variable (n=39)	**r_s value**	**Significance (two-tailed)**
Population Density (persons per acre)	0.22	0.19
Median Household Income	-0.01	0.96
Number of Environmental Nonprofits	0.50	0.001*
Number of Local Land Trusts	0.22	0.18
High School Graduates (percentage of total population over 25 years of age)	-0.05	0.75
Attained Bachelor's degree (percentage of total population over 25 years of age)	0.23	0.17

* Correlation value is significant at the 0.05 level

Correlating open space per 1,000 residents allows the open space data to be normalized in such a way as to account for stark differences in population across the thirty-

nine counties. The correlation values suggest that population density is not associated with open space, although median household income shows a strong negative correlation (-0.70). Neither environmental nonprofits, nor land trusts are associated with enough confidence to be significant; although it is interesting to note that both suggest a negative, albeit weak, association. However, while high school graduates are positively associated with open space, bachelor's degree holders are not associated enough to be significant.

Table 4.4: Spearman's rank correlation coefficient values (r_s), open space per 1,000 residents

Variable (n=39)	**r_s value**	**Significance (two-tailed)**
Population Density (persons per acre)	-0.07	0.000*
Median Household Income	-0.70	0.000*
Number of Environmental Nonprofits	-0.17	0.30
Number of Local Land Trusts	-0.20	0.22
High School Graduates (percentage of total population over 25 years of age)	0.48	0.002*
Attained Bachelor's degree (percentage of total population over 25 years of age)	0.25	0.12

* Correlation value is significant at the 0.05 level

Finally, the natural log of total protected acreage is correlated with each of the variables as another normalized measure of protected open space that demonstrates far less variation than the other open space measures. Again, the number of environmental nonprofits shows a significant, positive association with open space. The correlation results suggest no other variables are associated with open space; except land trusts, which show a weak, positive association, though the relationship lacks sufficient confidence to be accepted.

Table 4.5: Spearman's rank correlation values (r_s), natural log of total protected acreage

Variable (n=39)	**r_s value**	**Significance (two-tailed)**
Population Density (persons per acre)	-0.06	0.74
Median Household Income	-0.23	0.16
Number of Environmental Nonprofits	0.38	0.02*
Number of Local Land Trusts	0.25	0.12
High School Graduates (percentage of total population over 25 years of age)	0.17	0.30
Attained Bachelor's degree (percentage of total population over 25 years of age)	0.02	0.89

* Correlation value is significant at the 0.05 level

Land Trusts

Kruskal-Wallis *H* Test

The data for local land trusts presented an unexpected challenge due to the limited range of values, from zero to four, and small sample size. Although the number of environmental nonprofits organizations shows an association with open space, the most relevant nonprofit organizations, land trusts, show only weak association with limited confidence that there is a relationship. Therefore, a Kruskal-Wallis *H* test was performed to assess if the counties, grouped by the number of land trusts, differ significantly from each other in terms of protected acreage. The Kruskal-Wallis *H* test is the nonparametric equivalent of the one-way analysis of variance (ANOVA) and tests whether independent samples, or in this case, counties grouped by the number of land trusts, come from the same population. The only requirement of the test is that the data needs to be ordinal (ranked) level of measurement.

The number of land trusts is assumed to be the independent variable and open space acreage is assumed to be the dependent variable. The test is run for both total acreage and acreage per 1,000 residents, to account for population differences. A Kruskal-Wallis test was conducted comparing the total amount of protected open space by county with varying

numbers of local land trusts. Counties, grouped by the number of local land trusts, are compared based on the mean protected acreage. No significant result was found ($H(4)=4.40$, $p>0.05$) indicating that the groups did not differ significantly from each other. Counties with no local land trusts averaged 20.3 acres and counties with one land trust averaged 17.4 protected acres, while counties with three land trusts average 24.6 acres and counties with four land trusts averaged 29 protected acres. Therefore, although among the counties with land trusts, greater mean acreage was protected with increasing numbers of local land trusts, land trusts did not seem to influence the amount of protected open space.

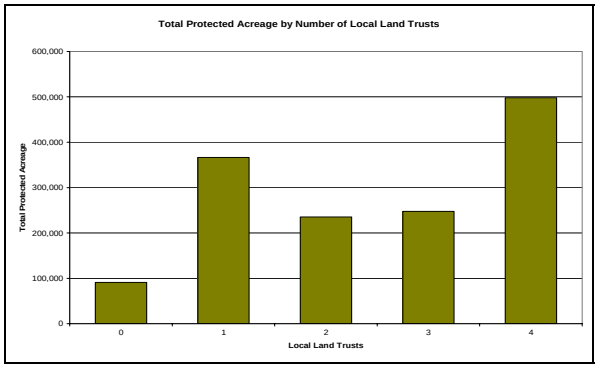
Table 4.6: Kruskal-Wallis test statistics, land trusts and total acreage protected

Test statistic (*H* value)	4.40
Degrees of freedom (df)	4
Significance	0.36

Table 4.7: Kruskal-Wallis summary statistics, land trusts and total acreage protected

Number of Local Land Trusts	Number of Counties (frequency)	Mean Rank of Total Protected Acreage
0	3	20.3
1	17	17.4
2	10	18.5
3	5	24.6
4	4	29.0
Total	39	

Figure 4.1: Counties grouped by number of local land trusts, total protected acreage



A Kruskal-Wallis test was also performed comparing protected open space per 1,000 residents and the number of local land trusts. No significant difference was found ($H(4)=2.91$, $p>0.05$) indicating that the groups did not differ significantly from each other after normalizing the counties for population differences. The mean acreage did not increase as the number of land trusts increased, and, in fact, the counties with no local land trusts averaged the highest acreage. Therefore, land trusts did not seem to influence the amount of protected open space per 1,000 residents.

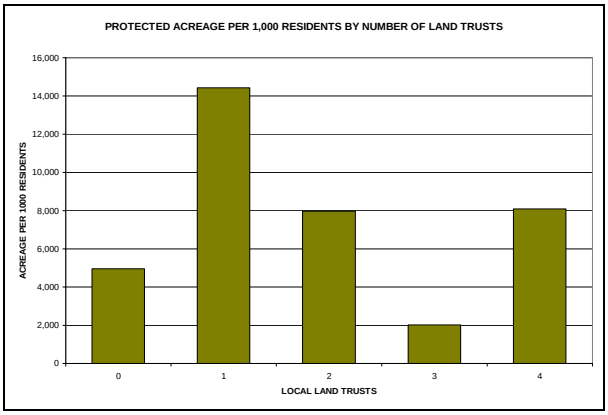
Table 4.8: Kruskal-Wallis test statistics, land trusts and open space per 1,000 residents

Test statistic (*H* value)	2.91
Degrees of freedom (df)	4
Significance	0.57

Table 4.9: Kruskal-Wallis summary statistics, land trusts and open space per 1,000 residents

Number of Local Land Trusts	Number of Counties (frequency)	Mean Rank of Protected Acreage per 1,000 Residents
0	3	29.7
1	17	20.6
2	10	17.6
3	5	17.4
4	4	19.5
Total	39	

Figure 4.2: Counties grouped by number of land trusts, showing protected acreage per 1,000 residents



Pearson's Correlation Test

Building on the Kruskal-Wallis test, the mean acreage is compared among the counties, which are categorized by the number of local land trusts. As shown in Table 4.10, counties with no local land trusts protect a fair share of open space compared to counties with one or two local land trusts. However, protected open space is considerably higher in counties with three and four land trusts. The expected mean acreage is the average acreage across all counties (population mean), and, assuming there is no relationship between land trusts and protected open space, is therefore equal among the groups. Counties with none or few land trusts protect less than expected, while counties with three or four land trusts exceed the expected mean. Although not statistically significant, these findings seem to suggest that there is some threshold whereby counties a greater number of land trusts is associated with greater protected open space.

Table 4.10. Observed and expected mean acreage by number of local land trusts

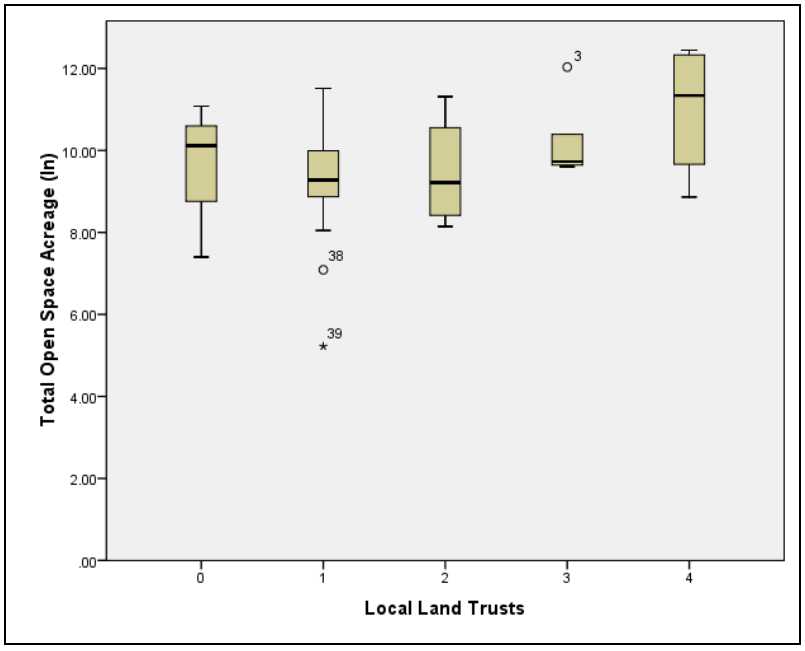
Number of Local Land Trusts	Observed Mean Acreage	Expected Mean Acreage
0	30,350	36,876
1	21,543	36,876
2	23,517	36,876
3	49,588	36,876
4	124,442	36,876

Furthermore, due to the limited range of values for local land trusts, combined with the considerable variation exhibited by the open space measures, a closer analysis of land trusts and the natural log of protected acreage was deemed appropriate. Spearman's rank correlation was utilized for this study because the test does not require variables to be derived from normally distributed populations. Spearman's correlation coefficient indicated a weak association between land trusts and the natural log of total acreage with limited confidence in

the relationship. However, given the limitations presented by the land trust variable, a more powerful correlational analysis was conducted.

Pearson's correlation coefficient was calculated to measure the degree of association between local land trusts and the natural log of total protected acreage. Pearson's product-moment correlation is the most widely used measure of association when both variables are derived from normally distributed populations (McGrew and Monroe 2000), The coefficient output is similar to Spearman's, where the coefficient (r) ranges from a value of 1.0 for perfect positive correlation, to -1.0 for perfect negative correlation. A value of zero represents no association between variables. A significant positive correlation was found ($r((37)=0.35, p < 0.05$) at a 0.03 confidence level, indicating that more land trusts are indeed associated with greater protected open space acreage.

Figure 4.3: Box plot of local land trusts and natural log of total open space acreage



Exclusions

Initial statistical analysis is conducted for all thirty-nine counties. However, it became clear that King County is a significant outlier and likely biased the data as a result, potentially masking patterns and relationships. Seattle and the surrounding areas of King County are home to far more residents than any other county; as a result, both total population and population density far exceed every other county. Median household income and education attainment are higher as well. Moreover, there are substantially greater numbers of environmental nonprofit organizations based in Seattle and, by extension King County, than anywhere else.

In addition, counties at the low end of the population distribution likely fall outside the typical pattern of land preservation. Hence, counties with fewer than 5,000 residents and population densities less than 0.006 were excluded based on the assumption that there is little imperative to protect open space at such low population levels. However, rather than change the focus of the study, these results are included in addition to the correlation results for all counties.

Columbia, Ferry, Garfield, and Wahkiakum counties have the smallest, least dense populations. Ferry County is also comprised almost entirely of federal and tribal-owned lands, which means there is little opportunity for local governments or land trusts to purchase private land for public open space and so falls outside the pattern of preservation that occurs elsewhere. And Garfield County, in particular, is primarily agricultural land with no nearby urban area development threatening to convert farm land.

Spearman's Rank Correlation Test is used to measure the degree of association between the population variables and the total number of acres protected. Spearman's Rank

Correlation was run for all counties except King County, and again without King County and the least-populated counties. Overall, the results do not differ considerably from the results of all thirty-nine counties in terms of general trend (i.e. positive or negative); however, the correlation value for median household income suggests a nearly significant negative association with total acreage and greater confidence than when King County is included. In addition, the decreased correlation with environmental nonprofit organizations and local land trusts suggests King County indeed biased the data. However, none of the correlation values are strong enough to be accepted as significant.

Table 4.11: Spearman's rank correlation coefficient values (r^s), total acreage protected excluding King County

Variable (n=38)	**r_s value**	**Significance (two-tailed)**
Population Density (persons per acre)	-0.14	0.42
Median Household Income	-0.32	0.05*
Number of Environmental Nonprofits	0.34	0.04*
Number of Local Land Trusts	0.19	0.24
High School Graduates (percentage of total population over 25 years of age)	0.25	0.13
Attained Bachelor's degree (percentage of total population over 25 years of age)	-0.55	0.75

* Correlation value is significant at the 0.05 level

After excluding the highest and lowest outliers, median household income shows a stronger negative association with total acreage protected. At the 90% confidence level, the number of environmental nonprofit organizations and the percentage of high school graduates suggest a slight, positive correlation with protected open space.

In summary, the significant variation across Washington counties with significant outliers in the most sparsely-populated counties and King County, the most populated county in the state, suggested a potential for bias in the data. Overall, the exclusions did not alter the

statistical findings dramatically; however, the association between environmental nonprofits and total protected acreage is reduced once King County is removed.

Table 4.12: Spearman's rank correlation values (r^s), total acreage protected after exclusions

Variable (n=34)	**r_s value**	**Significance (two-tailed)**
Population Density (persons per acre)	-0.28	0.12
Median Household Income	-0.37	0.03**
Number of Environmental Nonprofits	0.29	0.10*
Number of Local Land Trusts	0.15	0.40
High School Graduates (percentage of total population over 25 years of age)	0.33	0.06*
Attained Bachelor's degree (percentage of total population over 25 years of age)	-0.09	0.60

** Correlation value is significant at the 0.05 level * Correlation value is significant at the 0.10 level

Descriptive Case Study

A descriptive comparative analysis of Clark and Whatcom counties is useful to more thoroughly evaluate the relationship between population characteristics and protected open space at the local level. These two counties differ most in regards population density and county size. Clark County's largest city, Vancouver, is much more urbanized than Bellingham or any of Whatcom County's small cities. Both counties, though, have increased in population over the past eight years, although Clark County (+18.6%) grew slightly faster than Whatcom (+12.6%).

In contrast, Whatcom County encompasses a much larger area than Clark County, and while both may claim a historical rural, agriculture-based economy, Whatcom remains a largely rural county where agriculture comprises twenty-five percent of the local economy. Farms and orchards surrounding Vancouver, however, have largely been developed over the past twenty years. Given the more rural economy, it may be expected that Whatcom County has a lower median household income; however, per capita income for the same period is nearly equal, with $21,448 and $20,025 reported in Clark and Whatcom, respectively.

Education attainment, as a percentage of the population over the age of twenty-five, is approximately equal for high school graduates. Bachelor degree-holders comprise a slightly higher percentage of the population in Whatcom, compared to Clark County, even though both counties are home to a medium-sized university. The rural character of Whatcom County compared to the more urban Clark County and its proximity to Portland for education and employment opportunities run contrary to the education attainment findings.

In addition, Whatcom County clearly has more environmental nonprofit organizations, suggesting greater community resources related to environmental issues.

Local land trusts, however, are approximately equal given that two of the land trusts operating in Whatcom County are primarily based on Lummi Island and the San Juan Islands, respectively. Hence, only one land trust chiefly operates in the county.

Therefore, household income and local land trusts are essentially held constant; while community characteristics related to population density, education attainment and the number of environmental nonprofit organizations likely affect local policy outcomes related to protected open space. For instance, greater urbanization and population density in Clark County is expected to drive land preservation efforts due to a perceived need to protect remaining available land from development.

On the other hand, Whatcom County land preservation efforts may very well be driven by development pressures; however, the role of local environmental nonprofits generally, and local land trusts specifically, is expected to influence land preservation efforts by providing institutional leadership to inform and mobilize public engagement and participation, thereby increasing civic environmentalism.

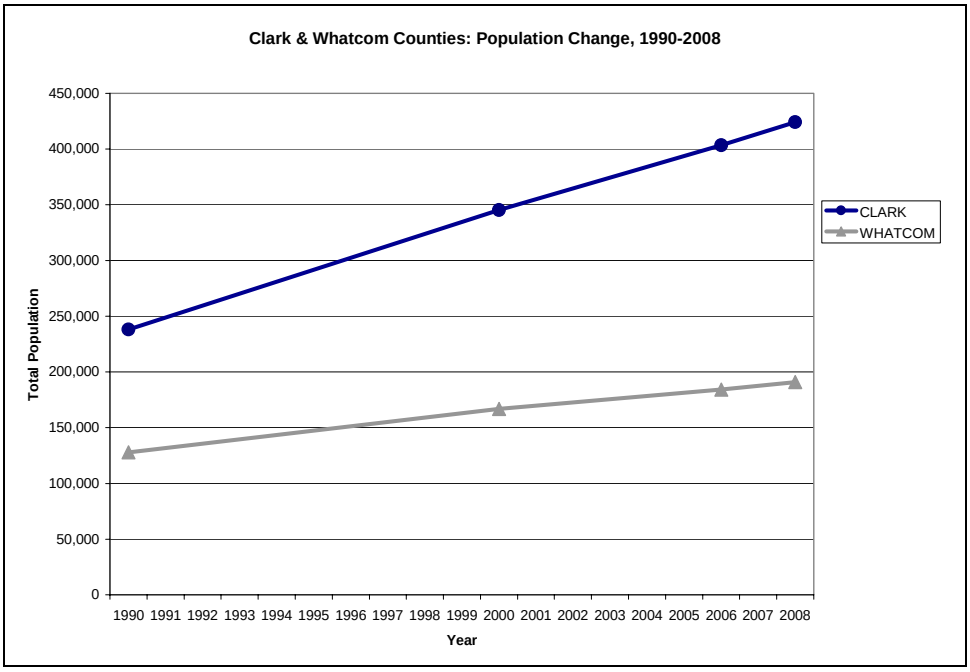
Table 4.13: Population and community characteristics of Clark & Whatcom counties

Variable	Clark	Whatcom
Total land area - acres	402,062	1,356,506
Population density (2000) – persons per acre	0.86	0.12
Population density (2008) – persons per acre	1.06	0.14
Median household income (2000)	$48,376	$40,005
Per capita income (2000)	$21,448	$20,025
Number of Environmental nonprofits (2007)	31	80
Number of Land trusts (2007)	1	3
High school education - percentage of total population over 25 years of age, rounded (2000)	27%	28%
Bachelor's degree percentage of total population over 25 years of age, rounded (2000)	14.5%	18%

Table 4.14: Protected open space in Clark & Whatcom Counties

Protected Open Space	Clark	Whatcom
Total Acreage of Protected Open Space	9,476	14,826
Open Space as Percent of Total Land Area	2.36%	1.09%
Acres of Open Space per 1,000 residents	27.45	88.88
Natural log of total protected acreage	9.16	9.60

Figure 4.4: Clark and Whatcom total population, 1990-2008



Given the considerably larger land area occupied by Whatcom County, and the greater total acreage of protected open space, it is notable that Clark County protects slightly more open space as a percentage of total land area. However, Whatcom County clearly protects more open space much per resident. On the other hand, the normalized value of total protected acreage (natural log) situates both Whatcom and Clark Counties near the total mean value (9.66). Nevertheless, both counties rank towards the low end for protected open space when all thirty-nine counties are taken in account.

Taken within the context of the entire state, the number of nonprofit organizations is high for both counties, and environmental nonprofits remarkably high for Whatcom County. As a raw number, education attainment is relatively high in both counties, but less so when taken as a percentage of the total population (over age 25), with the exception of Bachelor degree holders, which is higher in Whatcom County. Hence, social resources and civic environmentalism are expected to be relatively high in both communities, suggesting high environmental policy capacity.

Table 4.15: How Clark and Whatcom rank statewide

Variable (n=39)	**Clark County Ranking**	**Whatcom County Ranking**
Total population (2000)	5th	9th
Population Density (2000, persons per acre)	3rd	12th
Land Area (acres)	34th	12th
Median household Income (2000)	3rd	11th
Number of Environmental Nonprofits	13th	3rd
Total Number of Number Nonprofits	5th	8th
High School Education Attained (2000)	5th	9th
Bachelor's Degree Attained (2000)	5th	8th
Percent High School Graduates	25th	22nd
Percent Bachelor's Degree-Holders	14th	6th
Total Acres Protected	26th	22nd
Percent Acreage Protected	17th	27th
Acreage Protected per 1,000 Residents	38th	25th

However, both Clark and Whatcom counties represent rapidly growing communities in Washington with relatively unremarkable records for land preservation, when compared to the rest of the state. Although on a relative scale, annual median household income varies considerably, it is only marginally higher in Clark than in Whatcom County (by $8,000) and does not capture fiscal resources such as local economic growth or local budget expenditures.

Therefore, policy indicators that may be low or absent include fiscal resources or political leadership, which may hamper land preservation efforts.

Nevertheless, both counties take open space seriously, based on their respective county and parks comprehensive planning documents. Under the GMA, the planning process includes inventory of current land holdings, public input and identification of future needs, based on population projections. Both counties emphasize their purpose as protecting quality of life for residents, serving as responsible land stewards and protecting land for future generations.

Whatcom County's 2008 Parks and Recreation Plan emphasizes inventory of current land holdings and specific strategies for meeting future needs over the next 20 years. In contrast, Clark County's Parks and Recreation Plan more fully describes its goals and vision for the community, such as reflecting community values, building partnerships with community groups and organizations, and utilizing green infrastructure principles. As part of its most recent Parks, Recreation and Open Space Plan, the Vancouver-Clark Parks & Recreation Department (VCPRD) offered the following as part of its guiding principles, or "overarching ideals" that govern the department:

> *Green Infrastructure:* The VCPRD will build and maintain a more environmentally sustainable parks, recreation, and open space infrastructure. With an eye to the future, the Department will foster community stewardship, implement environmentally sensitive design, construction, and maintenance practices, and create a system of parks and open space that will enrich the community for years to come. (2007, ii)

Hence, the shift from parks to open space, as described in the literature review, captures the 21st century emphasis on a variety of types of parks and open space for multiple purposes. Community planning today frequently considers quality of life principles, whereby parks and open space benefit individuals and enhance communities, an essential

component. Likewise, looking forward to future generations and preserving land for multiple purposes is a common theme. Local neighborhood parks, scenic areas larger regional parks, natural areas for wildlife habitat, forest lands, and riparian and greenway corridors collectively contribute to the open space network or mosaic at the county, and even regional, level.

However, Clark County breaks parks into more specific categories, such as neighborhood parks, community parks, urban natural areas and regional parks; while Whatcom County focuses on parklands more generally. Both counties, though, seek to identify threatened species and prioritize habitat such as riparian corridors along major waterways, shorelines and estuaries, as well as forestlands.

Land Trusts

Partnerships between city and county governments and local organizations are evident in both counties. Citizen advisory groups participate in local decision making, including identification of new parks, trails and greenways. Local land trusts actively work to protect lands with scenic, recreation or habitat qualities and emphasize land stewardship and conserving working farmlands by working with land owners who donate development rights or full ownership. The land trust arranges the financial transactions, then develops a stewardship plan and manages the land, or, in some cases, sells or donates the land to the county for public parkland. Increasingly, land trusts are also developing proactive strategic plans to identify priority lands for purchase, in addition to working with willing land owners. Moreover, some land purchases are successful due to the participation of multiple groups, including land trust members, community members, charitable foundations and other

environmental groups, such as bird conservancies or salmon recovery groups, as well as grants and donations.

Clark County's Columbia Land Trust (CLT) states that rapid growth and development threatens agriculture and forestry lands, scenic views of Mt Hood and the Columbia River, and wildlife habitat, driving unique northwest species nearly to extinction. In response, CLT works to protect lands along the Columbia River, Pacific Coast estuaries, the Columbia Gorge and the eastern Cascade watersheds. CLT focuses on Clark County but also works to protect land in surrounding areas. The land trust's mission statement is, "conserving signature landscapes and vital habitat together with the landowners and communities of the Columbia River region"(CLT 2008). Between 1999 and 2004, CLT acquired over 6,000 acres for permanent conservation, including outright ownership, conservation easements and transferring lands to a public agency[7].

The Whatcom Land Trust (WLT) was created in response to development encroachment into agricultural lands, reflecting the rural nature and agricultural heritage of Whatcom County[8]. Since 1984, WLT has permanently protected more than 9,700 acres and helped create fourteen public parks[9]. WLT works with willing landowners across the county, and in addition to agricultural lands, works to protect shorelines, critical habitat and forested areas. Like the Columbia Land Trust, the WLT works in partnership with local residents and land trust members to control invasive species, plant local species and educate the community about land trust-managed properties. WLT's motto is simply, "preserving the *Nature* of Whatcom County"(WLT 2008).

[7] Columbia Land Trust. "News." http://www.columbialandtrust.org/news (19 Sept 2008)
[8] Whatcom Land Trust. "History." http://www.whatcomlandtrust.org/contact/history (19 Sept. 2008).
[9] Whatcom Land Trust. "The Steward" winter 2008/2009 newsletter. Volume 17, number 3

Environmental Policy Capacity

According the policy capacity model, Clark County is expected to engage in land preservation and environmental protection efforts as population growth and development threatens remaining open space, especially when the effects of urbanization are visible. However, higher policy capacity may be limited by fewer funding resources, lack of political commitment or leadership. Using the number of environmental nonprofit organizations as an indicator of social capital, Clark should have lower levels than Whatcom County; hence, civic environmentalism is also expected to be lower in Clark County. However, both counties have one primary locally-based land trust actively working to protect lands through direct acquisition and conservation easements. Therefore, the potential for both leadership and civic volunteerism exists. As such, both land trusts mobilize groups of volunteers for various projects related to land management, suggesting civic engagement in environmental programs.

Based on the statistical findings in this study, the negative correlation between median household income and protected open space may be relevant in Clark County, where the income is higher, yet the protected open space per resident if much lower than in Whatcom County. This finding is in contrary to the environmental capacity model, and may indicate personal income is a poor measurement of fiscal resources. Median home prices may be a better indicator since both counties make use of property tax revenue to fund land acquisition. However, median home prices are approximately equal for each county (roughly $225,000), as of 2006, suggesting fiscal resources may not disparate enough to account for differences in protected open space.

The primary significant result of the statistical analysis is the number of environmental nonprofit organizations and land trusts, which supports the greater acreage protected in Whatcom County. As expected, the 2007 annual reported assets of the environmental nonprofits were much higher in Whatcom ($27,833,602) than in Clark County ($2,844,335). Therefore, Whatcom County's protected open space appears to be an example of the greater resources created by environmental nonprofits, which seems to be an effective indicator of both greater social capital and potential leadership for environmental protection activities, including land preservation efforts.

Further discussion of findings will be addressed in the following chapter.

Chapter 5: Discussion/Conclusion

The purpose of this thesis was to examine the role of community characteristics in local land preservation. This chapter will discuss in greater detail the results presented in the previous chapter, present conclusions drawn from the research, describe the limitations of the research, and make suggestions regarding future research

Discussion

The research questions outlined in the introductory chapter capture the bivariate relationships analyzed in this study. Based on the statistical findings that show no association between population density and open space, urban counties in Washington do not appear to protect more open space than rural counties. Likewise, as an indicator of development pressure, population density in a given year is not shown to affect a community's ability to protect open space.

Secondly, greater economic resources, as measured by median household income, are not associated with greater protected open space. Instead, greater economic resources appear related to less protected open space. In Washington counties then, internal constraints, related to less fiscal resources, do not seem to hinder effective land preservation efforts.

Finally, social capital is indeed associated with greater protected open space. Community-based social resources and the role of environmental nonprofits as leadership institutions that likely influence social norms and expectations, community engagement through political strategy and advocacy is clear. Furthermore, land trusts in particular increase social capital through their networks of land owners and community supporters that help bridge various groups within the community, in both the public and private sectors.

Overall, this study suggests that while socio-economic attributes are not associated with protected open space, community or social resources related to social capital and civic environmentalism are more closely related to the ability of communities to protect open space. Significant correlation exists between protected open space and environmental nonprofit organizations, explaining nearly 14% (r^2) of the variation in the total acreage of protected open space. Clearly, there are other factors that have an effect, but these results do suggest civic environmentalism is, to some extent, positively associated with local land preservation.

Moreover, after accounting for differences in county size, environmental nonprofits are more strongly positively associated with open space as a percentage of total land area, explaining 25% of open space variation. These results are in accordance with the expectations of the environmental policy capacity model. Environmental nonprofit organizations, including local land trusts, are instrumental in promoting community participation and awareness, providing institutional leadership, pursuing fundraising efforts and state or federal grant programs, and expertise related to land acquisition and financial transactions. By extension, communities with greater civic environmentalism are more likely to be successful in land preservation efforts.

Whatcom County effectively illustrates the association between environmental nonprofits and protected open space, in comparison to Clark County. Although environmental nonprofits, including land trusts, are active in both counties, a greater number of nonprofits and much higher average annual assets suggest greater resources to engage in environmental protection efforts (Clark: $91,752 average; Whatcom $347,920 average), as well as a likely association with greater community participation.

Unexpectedly, median household income is very strongly negatively associated with open space after normalizing the data to account for population differences, explaining nearly 50% of variation in open space per 1,000 residents. The data suggests economic resources are not positively associated with open space as expected under the environmental policy capacity model. However, household income is only one indicator and there are various other variables that contribute to a community's economic resources, such as budget expenditures and fundraising through state and federal grants.

In this study, education attainment is used as a potential indicator of community activeness related to environmental issues. A fairly strong positive correlation between high school graduates and open space per 1,000 residents and a non-existent association with Bachelor degree-holders suggests higher education attainment is not very indicative of how much open space is protected. Overall, education attainment does not play a strong role in explaining protected open space. A more suitable indicator of civic environmentalism may be a more direct qualitative approach that better captures the attitudes and behaviors of a community through individual surveys, interviews or ballot measure results.

While environmental nonprofits show the strongest correlation with open space as a percentage of total land area, median household income displays the strongest negative correlation with open space per 1,000 residents. Therefore, the variance in both county size and total population across Washington are factors that influence the outcomes of this study. When county area is normalized, the role of environmental nonprofits is magnified. This suggests that successful counties likely have a greater number of environmental nonprofit organizations, and their success in protecting open space is not associated with the overall size of the county and availability of potential open space lands.

However, when population disparity is removed, the inverse relationship between income and protected open space increases. This is unexpected partly due to the lack of variation in median household income across Washington. Therefore, the influence of total population and protected open space is more relevant in explaining the strong correlation. In Washington, median household income may be a poor indicator of economic resources, given that public revenues come from property or sales taxes. Although communities with fewer personal resources seem less likely to devote time or money to land preservation efforts, this study suggests otherwise.

Finally, Thurston and Kittitas Counties emerge as exceptions to general trends in several cases. Thurston County is located at the southern end of Puget Sound. The largest city and county seat is Washington's state capital, Olympia. Thurston County has a relatively large total population with a high population density and median household income. Thurston is among the top quarter in terms of environmental nonprofits and has four local land trusts operating in the county; however, the protected open space is relatively low for total acreage, as a percent of land area and per 1,000 residents.

Therefore, according to the policy capacity components, Thurston County is expected to have higher social capital, greater fiscal resources and impetuous to preserve open space; however the findings here suggest other indicators are likely lacking. For instance, political commitment or general civic engagement may be relatively low or absent. Much of the population is concentrated in urban areas where parks may include small neighborhood parks and trails not counted for this study. Further, residents in the surrounding rural countryside may not perceive land scarcity or need to permanently protect land from development.

Kittitas is currently the fourth-fastest growing county in the state and historically has had an agriculture-based economy. Kittitas County, in contrast to Thurston, has the most protected acreage in the state with four local land trusts in operation but relatively few environmental nonprofits, which may be expected given the large land area, relatively low total population and low population density. Median household income is also relatively low. Thus, the greater availability of land overall and likelihood of larger parcels may promote land preservation efforts. Similarly, whereas fiscal resources may be lacking, resources supplied by the land trusts are likely higher, including leadership and administrative capabilities.

In addition, proximity to King County and the Seattle metropolitan area, by way of the primary transportation corridor across the Cascades, may well affect land preservation efforts. Likewise, Seattle's role as leader and driver of environmental protection activities extends beyond King County into the rest of the state. One example of a regional approach to conservation is the Cascade Land Conservancy (CLC), one of the land trusts operating in Kittitas that relies on active volunteer groups in King, Kittitas, Pierce, Mason and Snohomish Counties. CLC is currently developing a "Cascade Agenda" whereby significant conservation lands are linked as part of a regional landscape and connected to livable cities and towns[10]. Nevertheless, Kittitas represents a rural county that protects a large amount of land for public open space, both in terms of total acreage and as a percentage of total land area, and rivals protected open space in the very urbanized King County.

[10] Cascade Land Conservancy. "Kittitas County." http://www.cascadeland.org/conservation-program/by-county/kittitas-county/kittitas-county (5 Feb. 2009).

Exclusions

Once King County is removed from analysis, no significant correlations remain above the 0.40 threshold for the correlation coefficient value. Evidently, the highly urbanized, metropolitan population center of Seattle eclipses the rest of the state by a substantial margin. Nevertheless, environmental nonprofits remain the strongest correlation, followed closely by a negative association with median household income, with both explaining about 10% of open space variation. Hence, while environmental nonprofits are associated with protected open space, the large number based in Seattle and King County does bias the data to suggest a stronger relationship than is evident in the rest of the counties. Nevertheless, the influence of environmental nonprofits should not be overlooked as considerable resources contribute to Seattle and King County's leadership role in environmental issues, including parks, open space and greenways, that likely extends to surrounding areas.

Excluding the most-sparsely populated counties and the most-densely populated county did not have a dramatic effect on the correlation values. In general, the trend indicated by the correlation increased with the exclusions, with the exception of environmental nonprofits. The negative association with median household income suggests that either economic resources are not as indicative of success in land preservation efforts in Washington as elsewhere, or income is a poor policy indicator because Washington lacks a state income tax and revenue is more likely to come from property or sales taxes.

Land Trusts

At least one local land trust operates in nearly every county (36) across the state. Although the results of the Kruskal-Wallis test are not significant, they nonetheless suggest that among the counties where at least one local land trust operates, greater acreage is protected as the number of land trusts increases. However, lacking a locally-based land trust does not preclude land preservation as local government retains its role in park, recreation and open space planning. In addition, national and statewide land trusts may act to protect specific lands with habitat value or regional significance.

Moreover, a positive correlation was found between land trusts and total acreage, once acreage was normalized by deriving the natural logarithmic value. Hence, environmental nonprofits, and land trusts specifically, do affect a community's environmental policy capacity as indicators of increased social capital and civic environmentalism. Cultivating civic environmentalism can be as simple as implementing school or volunteer groups that adopt a creek, watershed or park and participate in clean-up, restoration or natural history education. An additional benefit of volunteer clean-up activities is that they are intrinsically worthwhile to the environment, regardless of how many people participate (Press 1998).

Clark & Whatcom Counties

As part of the required comprehensive planning under the state's GMA, both Clark and Whatcom Counties have identified existing parks and open space, as well as potential lands for acquisition. In addition, both counties promote public participation by way of committees and commissions that advise the Parks and Recreation department. Lastly, both communities have approved bond measures for property tax levies to help fund land acquisition efforts. Therefore, since both counties protect open space in accordance with the state's GMA, differences in community characteristics may offer insight into open space variation.

The descriptive comparative analysis helps illustrate the general trend described by the statistical findings for the counties overall. The number of environmental nonprofits and land trusts in Whatcom County exceeds the number in Clark County, suggesting greater potential for social networks and nonprofit leadership related to land preservation efforts, and Whatcom protects more open space per resident than Clark. Yet, while Whatcom is third in the state in terms of environmental nonprofits, protected open space is ranked fairly low in the state. However, if federally protected lands, such as Wilderness Areas and National Forests are included, a larger portion of Clark, and nearly two-thirds of Whatcom County, are currently protected from development (see Appendix E).

Nevertheless, available land is likely diminished in both counties in regards to future efforts to protect open space, especially in the much smaller Clark County. Whether the percentage of protected land decreases over time remains to be seen; however, imperative to protect remaining undeveloped areas is expected to continue, especially in areas deemed valuable, such as forested lands, near water bodies, and scenic parcels, or undevelopable

lands, such as floodplains and steep slopes. Clark County's inclusion of "green infrastructure" principles suggests, though, that the county is forward-looking and progressive in how it values parks and open space as part of the overall community. Therefore, as population growth continues and available land declines, both communities are likely to continue supporting ongoing and future land preservation efforts in order to maintain, if not increase, their quality of life.

The influence of population growth and population density is less clear: how much open space was protected between 1980 and 1990, compared to today, could help clarify whether population growth drives land preservation efforts in either county. In other words, did land acquisition begin prior to or in response to the rapid population growth of the 1990s? Did land preservation efforts gain momentum more recently or were efforts continuous and steady over the past few decades? Future research, then, could track protected open space over time alongside population growth. On the other hand, the 1990s were also a decade of considerable growth in the number land trusts across the country and, subsequently, land acquisition acreage increased as well; therefore, positive economic conditions may be more relevant than population growth itself.

An underlying assumption of this research, based on local environmental policy capacity, suggests that community characteristics shape policy outcomes, affecting open space preservation. However, the amount of open space may attract people of certain demographics or tendencies related to environmental attitudes and values. Whatcom County, for instance, is a good example of a community historically shaped by the rural nature of the surrounding countryside and is increasingly attracting residents to its existing large tracts of national forestlands and parklands for recreation. Therefore, the question remains whether

the community helps drive land preservation efforts, or rather, do new residents relocate to communities due to the proximity to recreational opportunities, thus, over time, altering the demographic structure of the community?

Although this assumption is not directly addressed by this study, ongoing land preservation efforts depend on community values and attitudes to engage the public and support funding measures. Over time, community attributes are apt to shift as residents moves in and out of the community. Therefore, if a population is drawn to a place on account of the open space, environmental protection efforts may ultimately benefit, driving future efforts. On the other hand, new residents may not feel compelled to engage in land preservation efforts. However, because land is inherently a finite resource, scarcity is expected to continue to drive local land preservation, at least among some members of the community, especially when unique natural features are threatened by development.

Parisi et al. (2004) found notable in their study of community environmental activeness found that smaller communities had significantly lower levels of environmental activeness than larger communities, after controlling for differences in local social and economic conditions. Lack of leadership, access to economic resources or diminished ties between social groups are offered as possible explanations. In this study, community size may indeed be limiting factor in terms of county area. There is undoubtedly more opportunity in larger counties such as Whatcom County to protect open space than where available land is limited. The fact that the CLT works in surrounding areas suggests several possible explanations. Clark County may have neared a threshold where remaining land scarcity effectively shifts a community's focus to neighborhood and community parks in order to enhance daily recreation opportunities and quality of life close to home.

Alternatively, county boundaries are not barriers but rather opportunities to approach land preservation strategies regionally and extend the overall mosaic of protected open space as part of a regional strategy.

Conclusions & Recommendations

In conclusion, this research highlights the importance of social capital, civic environmentalism and political leadership in a community's ability to protect open space. The results generally follow the expectations set forth by the environmental policy capacity model, with the exception of median household income. In addition, whereas Press (2002) found greater protected open space in urban counties, no clear distinction emerged in Washington between urban and rural counties. Nevertheless, this research is important because it emphasizes smaller communities and the largely rural character of Washington State. This study also shows how variation in land preservation efforts may not conform to conclusions drawn from previous research.

Portney (2003) suggests that although there is little indication of a relationship between household income and public support for environmental issues, cities with greater resources are better able, and more likely to, "afford" sustainability initiatives. However, this study raises more questions than it answers in this regard. Parks and Recreation department budget expenditures and dedicated funds for park acquisition from property or sales taxes may better capture economic resource capabilities in Washington counties.

However, while several researchers, including Press (2002), suggest that greater dollars spent generally results in greater acreage protected; there is also acknowledgement that dollars and acres are not necessarily the best way to measure success. Likewise, they are

not good indicators of land quality, ecological function or suitability for desired uses. As land grows increasingly scarce, the purpose of public lands may shift from an aesthetic amenity to recreational emphasis to growing food for local consumption. How we value and use the land continues to shift over time. Therefore, how open space is measured and evaluated deserves more comprehensive analysis.

The idea of social capital has emerged as a powerful driver of policy outcomes by contributing to public beliefs and policy preferences. Environmental nonprofit organizations may help create and sustain expectations for public benefits and environmental protection, which in turn provide a means to provide or facilitate public goods and services and, finally, reinforces the effectiveness of social networks to provide collective goods and services. Environmental organizations also play a leadership role in political strategizing and advocacy that engages the community in specific issues. The results of this research suggest that social capital plays a role in local land preservation efforts and environmental nonprofits are important community players as part of the network of partnerships engaged in environmental protection activities.

The number of land trusts operating in each county is also indicative of social capital and civic environmentalism, but is specifically related to land acquisition and open space preservation. Land trusts have emerged in nearly every state over the past three decades and numerous communities have more than one land trust working with land owners and local government to protect land from development. As expected, the role of land trusts is increasingly studied in land use planning and environmental policy analysis. However, the relative influence and success of local land trusts likely varies by county. Future research could more precisely account for the number of acres directly acquired by land trusts and

compare membership or donated contributions to better reflect the influence of a given organization.

The contrast between the urbanized counties along Puget Sound, west of the Cascades and the more rural, sparsely-populated eastern counties cannot be overlooked. While many west-side counties have population centers surrounded by rural countryside, overall, communities have fundamental differences based on their local economies and population characteristics on either side of the Cascade Mountains. However, it was outside the scope of this study to delve into these nuances. Studying only west-side counties, where the imperative to protect open space may be greater, neglects the potential within eastern counties where agricultural lands may be susceptible to development now or in the near future. Therefore, while separating the counties was not attempted here, acknowledging the differences remains central to the underlying conclusions drawn from this research.

Limitations of Research

The small sample size and the considerable variation among Washington counties limit the depth of statistical analysis that could be performed in this study. Generalizations are also limited by small sample size; therefore, future research could expand to Oregon, for instance, to allow for more thorough, comparative analysis.

The community characteristics themselves also present limitations as policy indicators. This study utilized population density to capture external constraints, such as development pressure, that limits the effectiveness of land preservation efforts. However, total population divided by total land area ignores large tracts of undevelopable lands; federal lands, such as National Forests and National Parks; and tribal lands. Population density also

represents more urban counties; however, population density at the county level may inadequately capture the typical model of a relatively dense population center surrounded by rural countryside. Finally, population density in a given year ignores population changes over time and changes in land supply over time. Therefore, generalizations drawn from this study are limited in regards to population density.

Secondly, as an indicator of social capital, membership-based nonprofit organizations more accurately measures community social networks, rather than the number of nonprofits overall. However, data related to the activities and membership composition of the organizations was not readily available for this study. Nevertheless, environmental nonprofit organizations may capture aspects of community engagement and civic environmentalism specifically. However, the official lists of nonprofit groups as reported to the IRS may significantly undercount the number of local nonprofits.

Likewise, the number of land trusts registered with the Land Trust Alliance does not include community land trusts (CLTs) that emphasize affordable housing and sustainable rural development, in addition to land acquisition. While considerably smaller in numbers, CLTs may nevertheless be increasingly important in urban communities. Furthermore, the land trusts operating in each county are not mutually exclusive. Many, in fact, operate in multiple counties as land preservation efforts are not necessarily confined to county boundaries and instead emphasize regional landscapes. However, each land trust operating in a given county nevertheless contributes towards permanent open space protection.

The open space data itself was limited by accuracy and precision. Data was obtained from reporting agencies and not verified on the ground for all counties. Therefore, the completeness of the data cannot be entirely validated. In addition, the amount of protected

open space does not address the type of land acquired or for what purpose, nor how much acreage was acquired by land trusts as a proportion of total protected open space.

Finally, there is a risk of committing an ecological fallacy: generalizations made at the local or individual level are limited by using aggregate data. The focus of the thesis is local land preservation efforts, but the question remains whether county-level analysis captures local nuances in environmental policy capacity, which limits conclusions drawn from this study.

Future Implications of Research

The role of protected open space as a mosaic of linked landscapes and communities is likely more important than how much is protected in a given area. Whether land is protected for recreation, habitat, growth management or food production is as important as how it links with other lands on a local and regional scale. "Green infrastructure" is a growing body of literature that puts land preservation into the context of the larger, regional landscape. Thus, how land is planned and managed as part of a network is an important component of future research.

Press' environmental policy capacity model provided a useful starting point for this study. However, more comprehensive analysis would be necessary to reproduce Press' research in California. Future research could build on this thesis by incorporating individual surveys and community leader interviews, as well as incorporating results of environmental policy ballot measures, in order to more fully apply the policy capacity model to Washington.

In addition, capturing temporal changes in population, education and income, as well as available land supply, would be a valuable direction for further study, in order to better

assess the conditions for effective land preservation. Development pressure, in particular, would be better represented by a measure that changes over time.

Finally, social justice issues regarding spatial inequalities and fairness in access to public lands is important in order to ensure that people are full participants in all aspects of land preservation, from acquisition to management to use of the land. Moreover, land preservation should focus on all communities, including urban areas and working landscapes. Because public lands are protected as public commons or collective goods for future generations, ensuring equitable access is an essential component of future land preservation efforts.

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Appendix A

Washington's Growth Management Act (GMA)
Adopted in 1990

All cities and counties required to:

- Designate and protect wetlands, frequently flooded areas and other critical areas
- Designate farm lands, forest lands, and other natural resource areas
- Determine that new residential subdivisions have appropriate provisions for public services and facilities

GMA Goals: 14 goals summarized below:

- Focus urban growth in urban areas.
- Reduce sprawl.
- Provide efficient transportation.
- Encourage affordable housing.
- Encourage sustainable economic development.
- Protect property rights.
- Process permits in a timely and fair manner.
- Maintain and enhance natural resource-based industries.
- **Retain open space and habitat areas and develop recreation opportunities**.
- **Protect the environment**.
- Encourage citizen participation and regional coordination.
- Ensure adequate public facilities and services.
- Preserve important historic resources.
- Manage shorelines wisely.

In addition, 29 counties and the 218 cities within them, represent the fastest-growing counties and cities required to adopt comprehensive plans, as well as other jurisdictions that chose to plan under the GMA. Plans must be put into action by development regulations, such as zoning and concurrency. Local comprehensive plans are required to include the following chapters:

- Land Use
- Utilities
- Housing
- Transportation
- Capital Facilities
- Rural (for counties only)
- Shorelines

Source: Washington State Department of Community, Trade and Economic Development. "Growth Management: Overview of the Growth Management Act"

Oregon's Land Use Act
Adopted in 1973

Oregon requires each city and county to adopt a comprehensive plan and the zoning and land-division ordinances needed to put the plan into effect. Local comprehensive plans must be consistent with Statewide Planning Goals. Plans are reviewed for consistency by the state's Land Conservation and Development Commission (LCDC). When approved, the plan is said to be "acknowledged" and then becomes the controlling document for land use in the area covered by the plan.

Planning laws apply to local government, special districts and state agencies. Emphasizes coordination and consistency among plans and programs; statewide goals; and acknowledged local plans.

Summary of 19 statewide planning goals:

1. Citizen involvement. Involve citizens in all phases of planning process. Citizen involvement program and committee for citizen involvement to monitor and encourage public participation in planning.
2. Land use planning. Land use decisions are to be made in accordance with comprehensive plans, based on "factual information," coordinated with plans of other jurisdictions and agencies, and that plans be reviewed periodically.
3. Agricultural lands. Inventory, preserve, and maintain agricultural lands through farm zoning.
4. Forest lands. Inventory and "conserve forest lands for forest uses."
5. **Open spaces, scenic and historic areas and natural resources**. Establishes a process to inventory and evaluate more than a dozen natural and cultural resources, including wildlife habitats and wetlands.
6. Air, water and land resources quality. Requires consistency with state and federal regulations, such as groundwater pollution.
7. Areas subject to natural disasters and hazards. Jurisdictions must apply "appropriate safeguards" when planning for development in areas such as floodplains.
8. Recreation needs. Communities evaluate areas and facilities for recreation and plan according to projected demand for such areas.
9. Economy of the state. Diversification and improvement of economy by inventorying commercial and industrial lands to project future needs and zone accordingly to meet those needs.
10. Housing. Cities must plan and accommodate housing types. Inventory buildable residential lands, project future needs and zone to meet those needs.
11. Public facilities and services. Public services, such as sewer, water, law enforcement and fire protection, should be planned in accordance with community's needs and capacities, rather than in response to development as it occurs.
12. Transportation. Seeks to provide a "safe, convenient and economic transportation system."
13. Energy. Land use and development shall be managed and controlled so as to maximize the conservation of all forms of energy, based on sound economic principles.

14. Urbanization. Estimate future growth, plan and zone enough land to meet those needs. Establish an "urban growth boundary" (UGB) to separate urbanized and rural lands.
15. Willamette Greenway. Procedures for administering 300 miles of greenway around Willamette River.
16. Estuarine Resources. Requires classification of 22 major estuaries and describes types of land uses and activities permissible in those "management units."
17. Coastal shorelands. Defines a planning area between coastal highway SR 101 and ocean beaches. Specifies how certain types of land and resources are to be managed.
18. Beaches and dunes. Planning standards for development on various types of dunes.
19. Ocean resources. Aims to conserve natural resources of the nearshore ocean and continental shelf. Deals with matters such as dumping of dredge spoils and discharging of waste products into the open sea. Major requirements primarily for state agencies, rather than cities and counties.

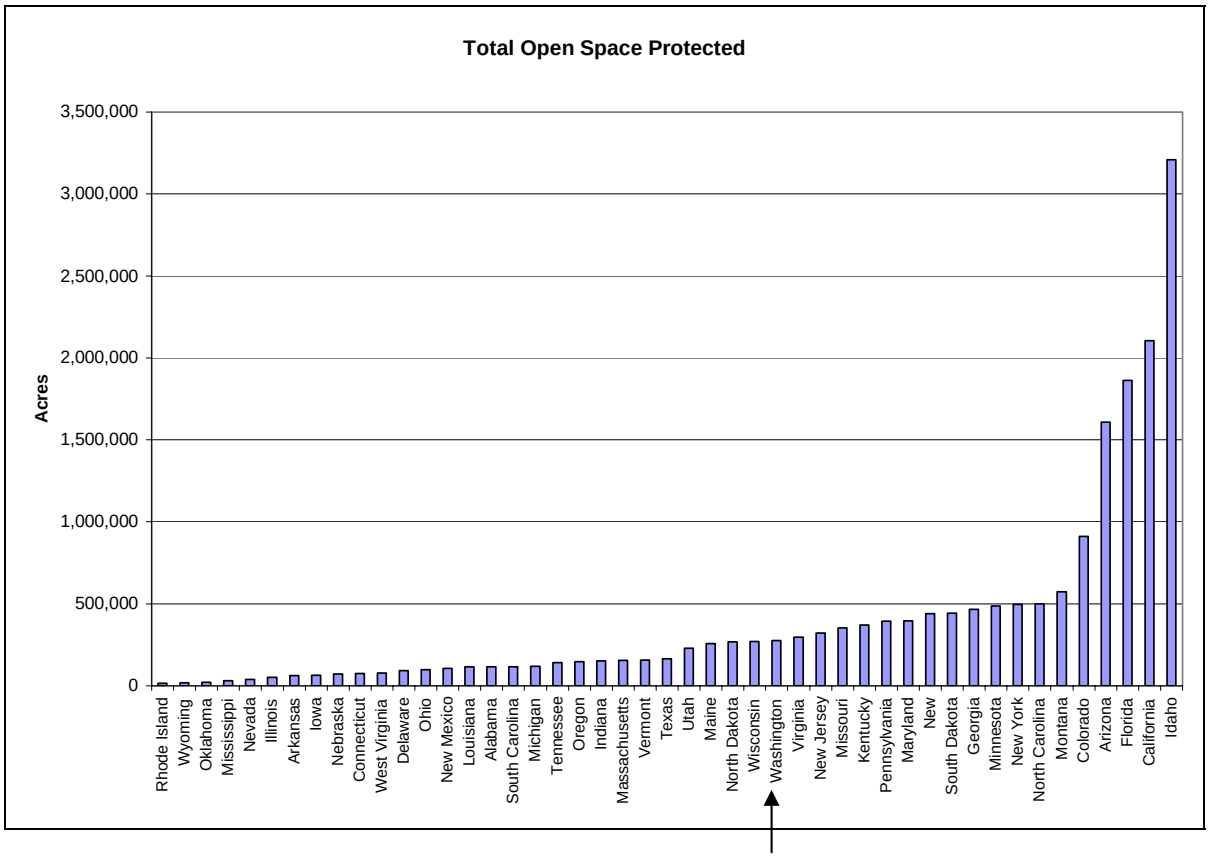
Source: Oregon Department of Land Conservation and Development. "Statewide Planning Goals"

Appendix B

Trust for Public Land (TPL) Conservation Almanac data:

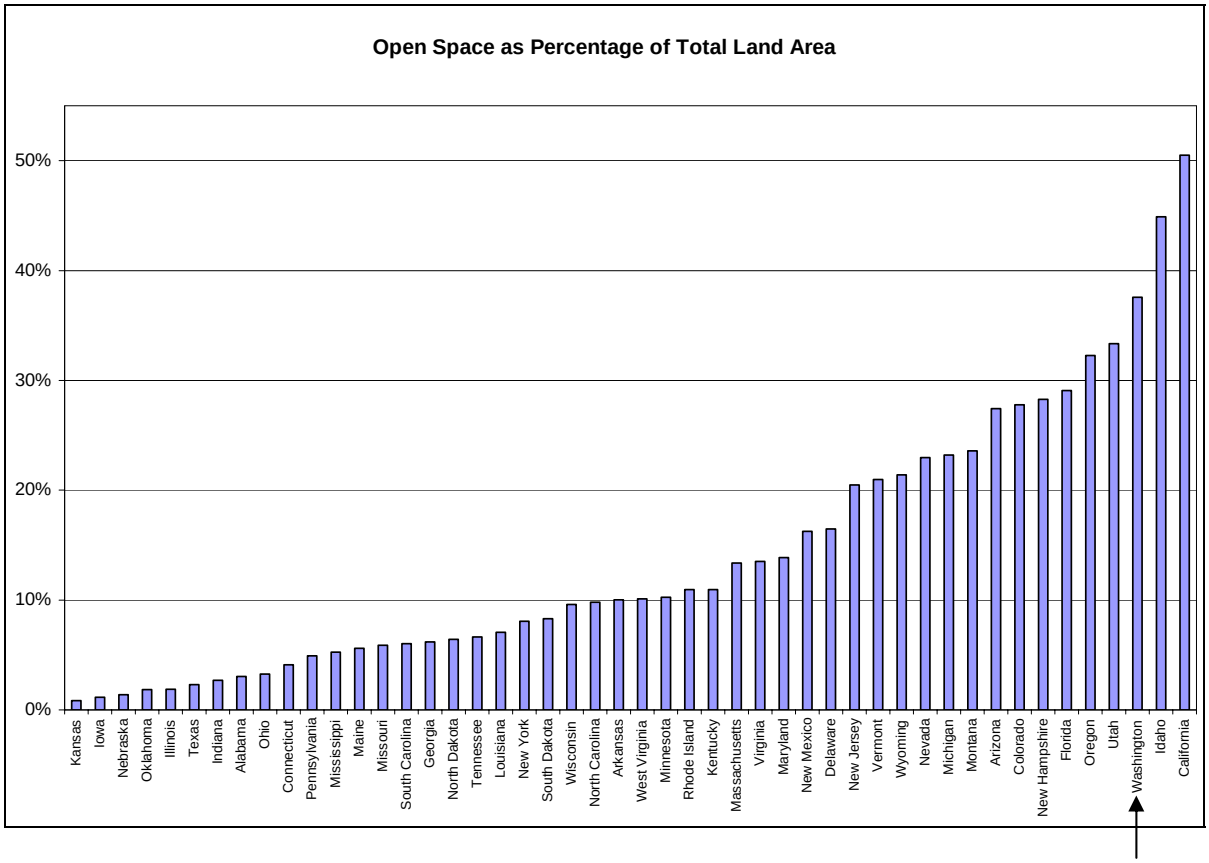
State and federal land conserved, as of 2005, by state.

Figure B.1: Total acres of state and federal lands conserved, 1998-2005 (TPL data)



The Trust for Public Land (TPL) compiled a Conservation Almanac of state and federal lands conserved, as of 2005, and aggregated to the state-level, for all 50 states.

Figure B.2: Protected Open Space as a Percentage of State Total Land Area (TPL state data)



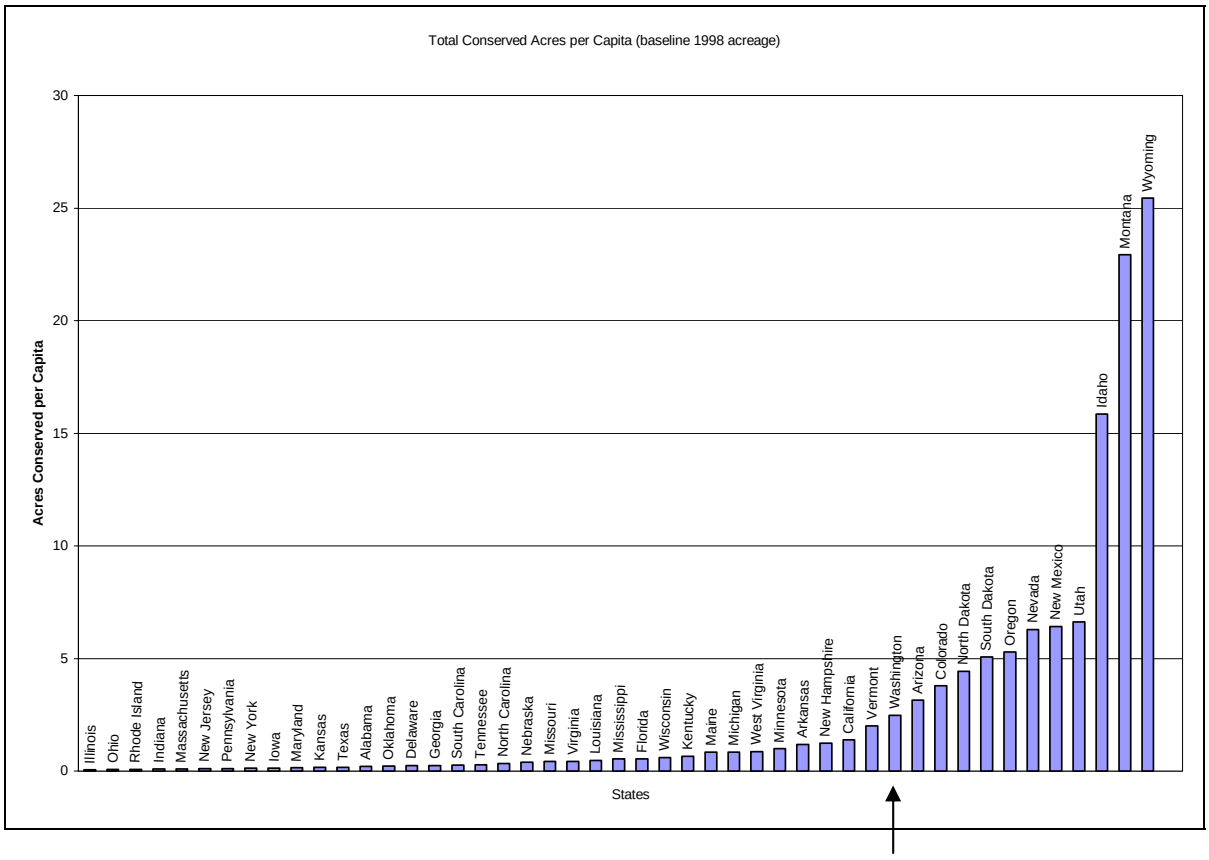
The Trust for Public Land (TPL) compiled a Conservation Almanac of state and federal lands conserved, as of 2005, and aggregated to the state-level, for all 50 states.

Table B.1: Total acres conserved per capita, summary statistics (TPL data)*

Variable	All 50 States	Lower 48
Mean	7.29	2.59
Median	0.55	0.5
Standard deviation	33.91	5.35
Variance	1,149.80	28.63
Washington	2.47	2.47
Oregon	5.29	5.29
Maximum	239.44 (AK)	25.45 (WY)
Minimum	0.04 (CT)	0.04 (CT)

* baseline acreage through 2005

Figure B.3: Acres conserved per capita, by state (TPL data)



The Trust for Public Land (TPL) compiled a Conservation Almanac of state and federal lands conserved, as of 2005, and aggregated to the state-level, for all 50 states.

Table B.2: Acres conserved: through 2005, by state (TPL data)

Region: West			
State Name	**Total Acres Conserved**	**Conserved Acres per Capita**	**Percent of State Conserved**
Alaska	163,648,848.7	239.44	44.8%
California	50,407,691.4	1.38	50.5%
Hawaii	1,132,695.4	0.88	27.6%
Nevada	16,135,515.2	6.29	23.0%
Oregon	19,815,664.2	5.29	32.3%
Washington	**16,003,418.0**	**2.47**	**37.6%**

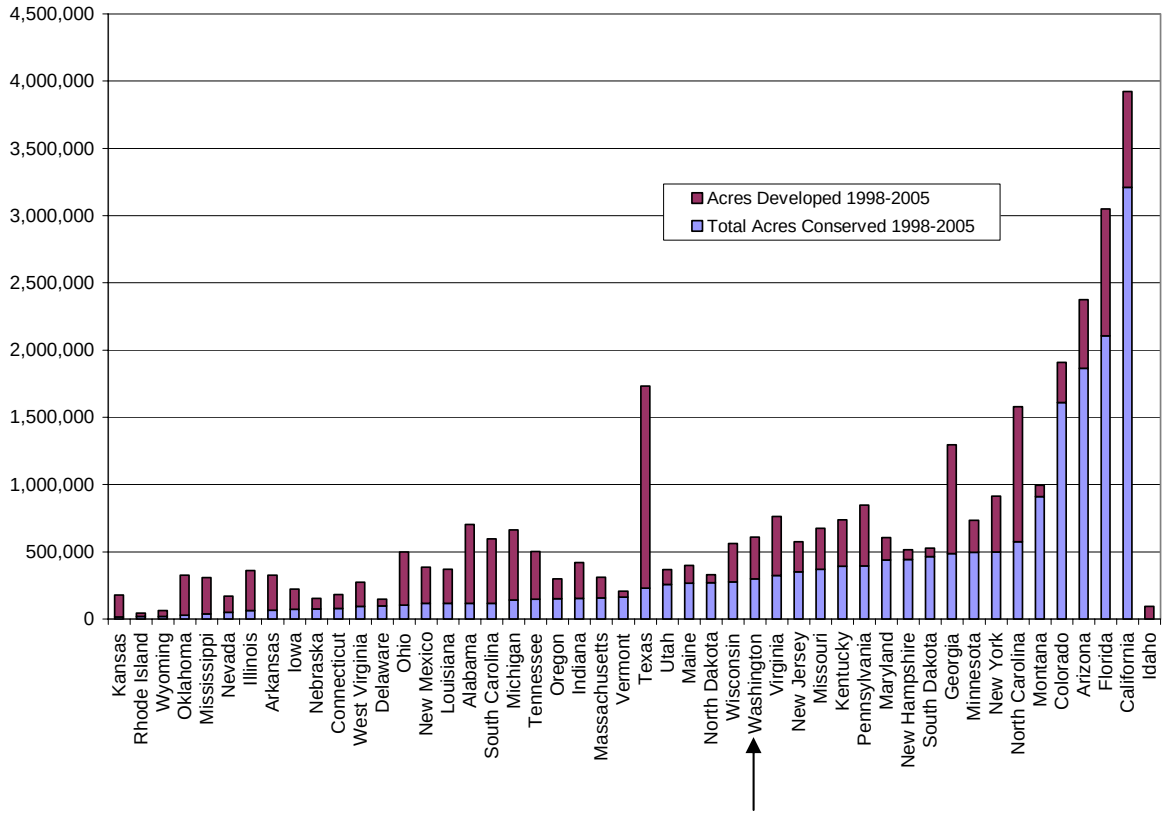
Region: Rocky Mountain			
State Name	**Total Acres Conserved**	**Conserved Acres per Capita**	**Percent of State Protected**
Colorado	18,431,313.7	3.79	27.80%
Idaho	23,772,953.5	15.85	44.90%
Montana	21,968,263.1	22.93	23.60%
Utah	17,534,701.7	6.63	33.30%
Wyoming	13,308,567.4	25.45	21.40%

The Trust for Public Land (TPL) compiled a Conservation Almanac of state and federal lands conserved, as of 2005, and aggregated to the state-level, for all 50 states.

Table B.3: Acres Conserved: through 2005, by region (TPL data)

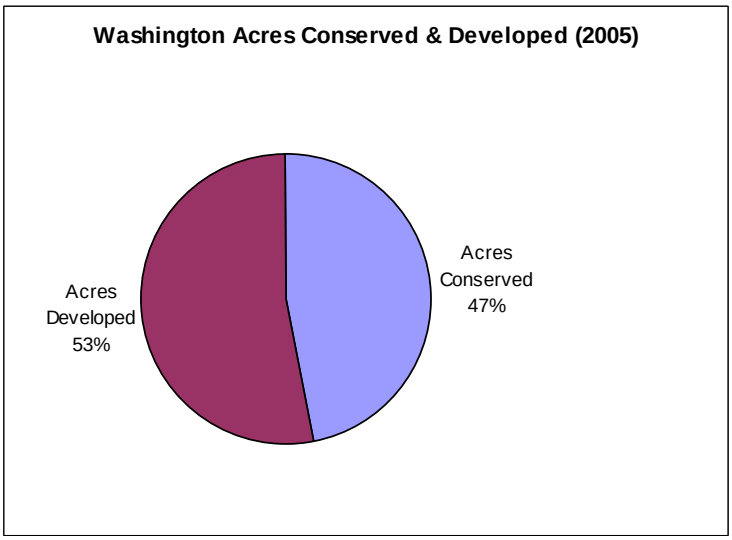
Region	**Total Acres Protected**	**Protected Acres per Capita**	**% of Region Protected**
Mid-Atlantic	10,304,151.6	0.18	9.20%
Midwest	30,139,330.5	0.45	6.30%
New England	4,839,352.7	0.34	12.00%
Rocky Mountain	95,015,799.3	9.06	29.00%
Southeast	28,960,508.7	0.44	9.70%
Southwest	37,250,994.8	1.04	10.30%
West	**267,143,832.8**	**5.21**	**41.50%**
Total	473,653,970.5	1.57	20.50%

Figure B.4: Acres Developed & Acres Conserved for Contiguous U.S., sorted by acres conserved, 1998-2005 (TPL data)



The Trust for Public Land (TPL) compiled a Conservation Almanac of state and federal lands conserved, as of 2005, and aggregated to the state-level, for all 50 states.

Figure B.5: Percent acres conserved & developed in Washington State, as of 2005 (TPL data)



Appendix C

Descriptive Statistical Patterns of County Data:

Table C.1: Descriptive statistics of population and community characteristics

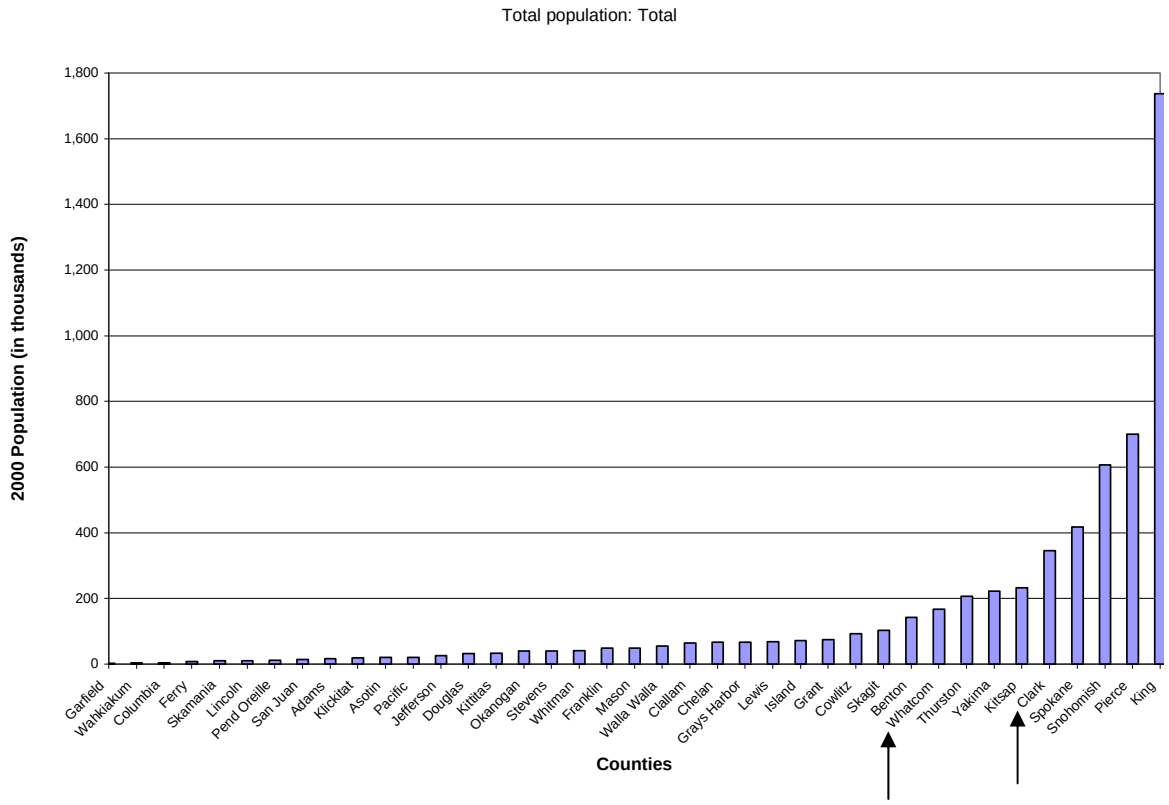
VARIABLE	MEAN*	MEDIAN*	STANDARD DEVIATION*	VARIANCE*	COEFFICIENT OF VARIATION
Total Population	151,131	49,405	305,164	93,124,854,059	2.02
Population Density (persons per acre)	0.18	0.05	0.30	0.09	1.66
Median Household Income	$38,331	$37,308	$6,200	$38,445,080	0.16
Nonprofits Organizations	882	355	1,923	3,696,534	2.18
Environmental Nonprofit Organizations	35	17	61	3,702	1.74
Local Land Trusts	1.74	1	1.12	1.25	0.64
Education Attained: High school (proportion of total)	0.19	0.19	0.035	0.001	0.19
Education Attained: Bachelor's degree (proportion of total)	0.09	0.09	0.03	0.001	0.38

* rounded to nearest whole number (except population density, land trusts, education attainment)

Total Population

Eastern Washington is considerably more sparsely populated than the more urbanized western counties. There is a substantial difference between the least populated Garfield County and the most populated King County, resulting in a mean that is three times larger than the median. Graphing the distribution reveals the heavily populated King County is a significant outlier as the majority of the state's counties (26) have populations less than 100,000 and six counties have less than 10,000 people. Eight counties are between 100,000 and 500,000 and only four have more than 400,000 people.

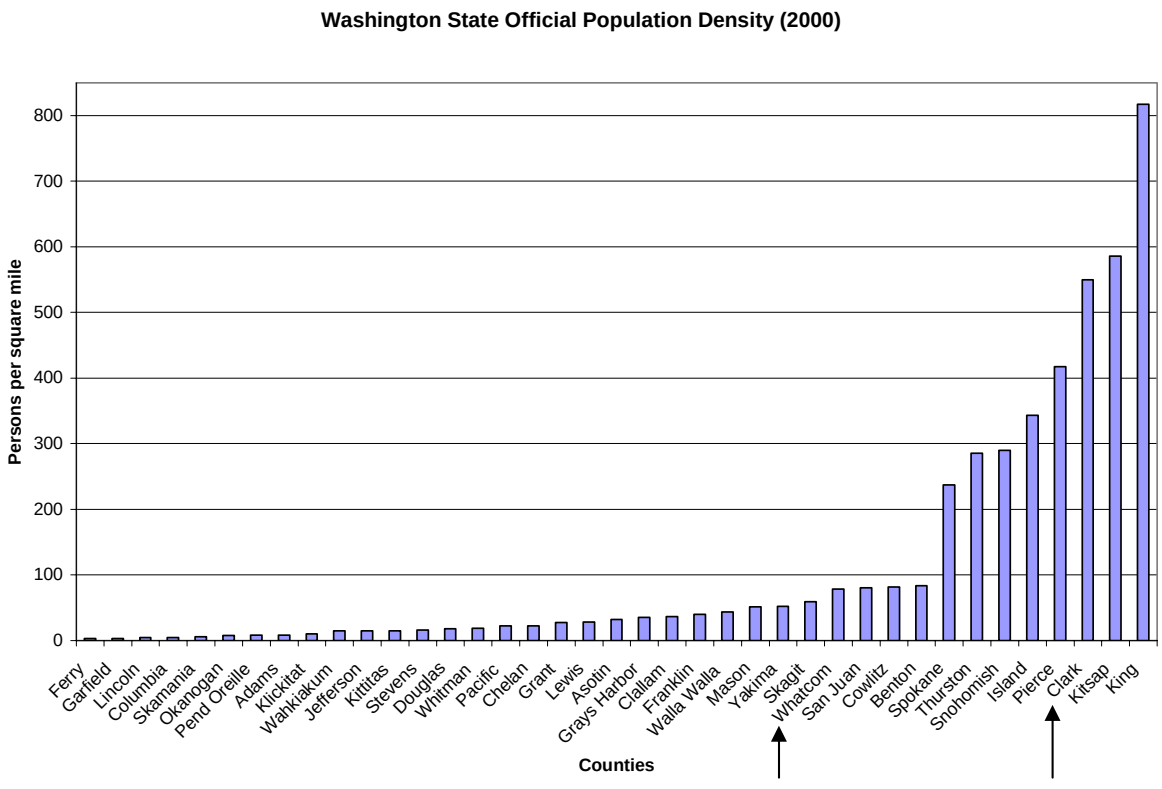
Figure C.1: Total population (2000) for all Washington counties



Population Density

Population per acre, based on 2000 census data, shows a similar trend as the total population with a considerable range between the minimum (0.005) and maximum (1.28) values. The difference between the mean value (0.18) and the median (0.05) indicates a negatively skewed distribution. Sorting the counties by population density and graphing the output shows a cluster of sparsely populated counties on one end of the distribution, indicating the majority of counties (31) have relatively low population densities, which gradually increase and then jump up to a group of eight notably more densely-populated counties.

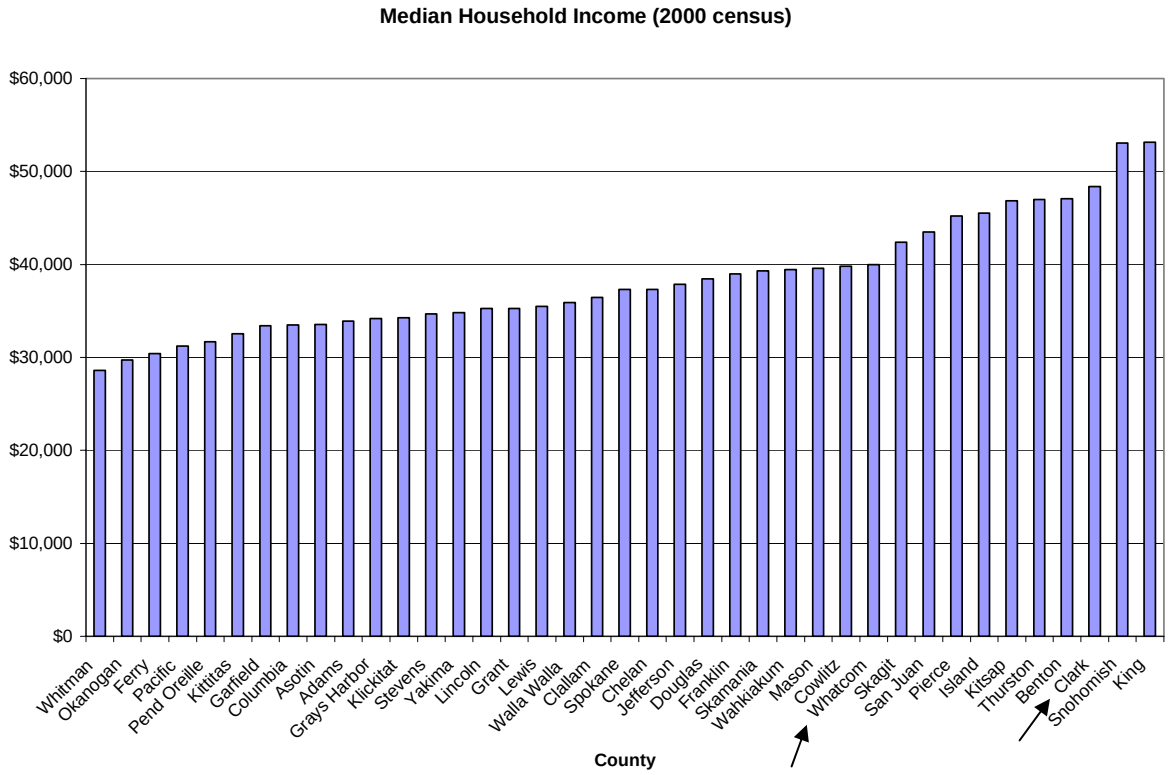
Figure C.2: Population density (2000), per square mile



Median Household Income

Median Household Income show a relatively level (platykurtic) distribution that gradually increases from the low ($28,584) to high ($53,175) end. The median and mean are nearly approximate, suggesting a very slightly skewed distribution. The relative lack of variation, then, should contrast with results from the other more skewed population datasets.

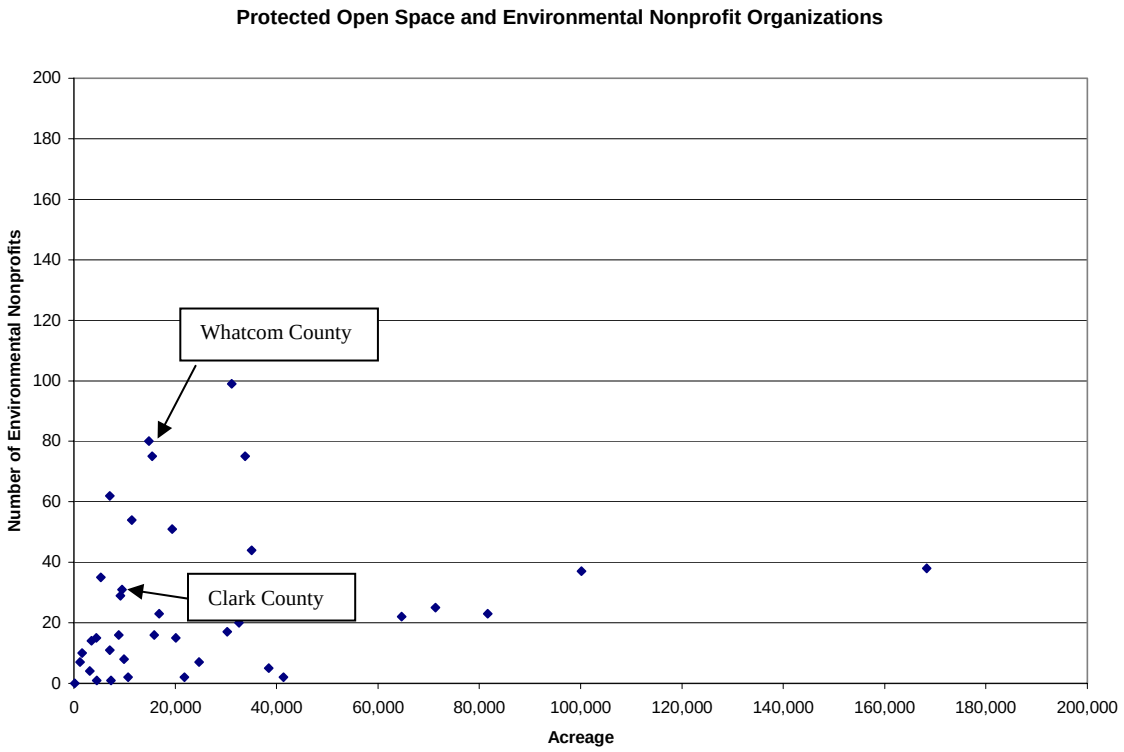
Figure C.3: Median household income



Environmental Nonprofits

The majority of counties fall within the lowest quarter of environmental nonprofits, less than 1,000, yet range from the lowest to highest in terms of protected open space. King and Kittitas Counties are excluded as significant outliers from the graphed output in order to better display the rest of the counties. King County has over 370 registered environmental nonprofit organizations and over 200,000 protected acres, while Kittitas has only fifteen registered environmental nonprofits but over 250,000 protected acres. Therefore, the trend suggests there is no strong correlation between the number of environmental nonprofits and open space preservation.

Figure C.4: Environmental nonprofit organizations and protected open space



Local Land Trusts

The data is somewhat limited because the range of values ranges only from zero to four. The majority of counties (17) have only one land trust and ten counties have two, yet those twenty-seven counties are distributed across a considerable range of protected open space. Nevertheless, counties with three (5) to four (4) local land trusts tend to protect more acres of open space. Therefore, although the relationship is not significantly, it is nevertheless notable that there is some association between environmental nonprofits, which included local land trusts, and protected acreage.

Figure C.5: Counties grouped by number of land trusts

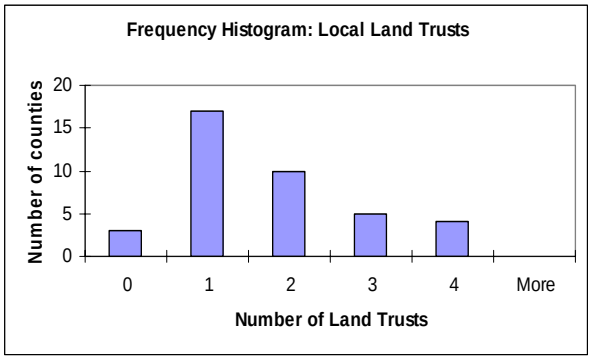
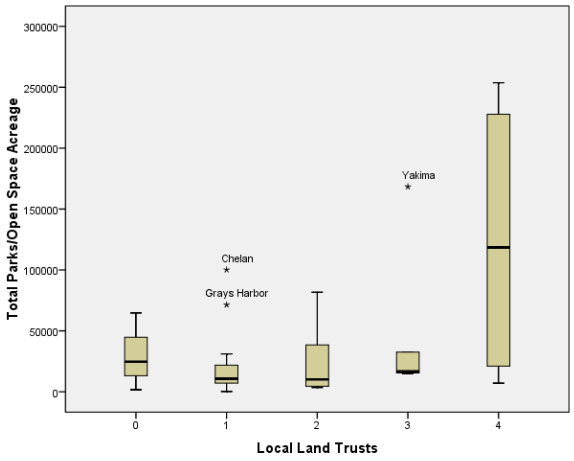


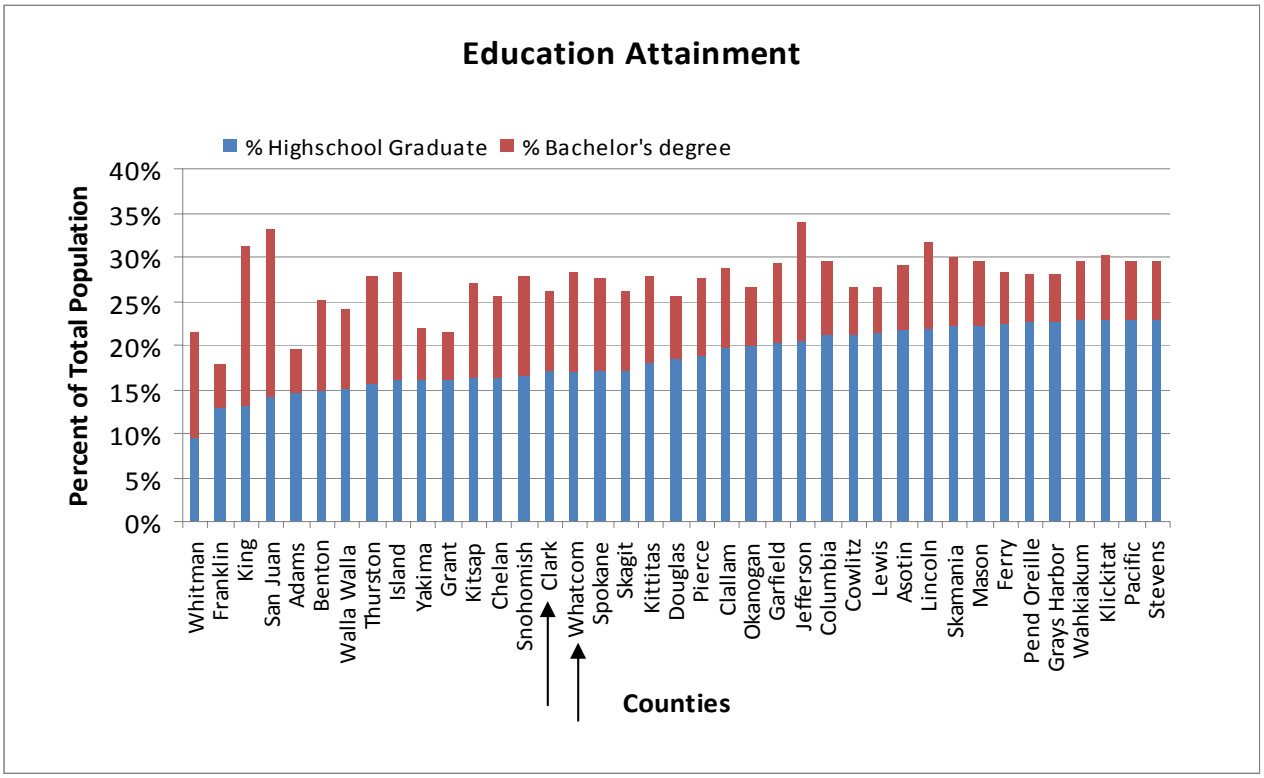
Figure C.6: Box plot of land trusts and total protected acreage



Education Attainment

High school and college-educated residents vary across all counties. For total number, King County has by far the highest numbers given its large general population. However, as a proportion, it falls behind Jefferson and San Juan counties. The lowest proportions of high school or college educated residents are the most rural counties, including Adams and Ferry.

Figure C.7: Education Attainment as a percentage of the total population (2000), sorted by high school graduates



Counties With and Without Local Land Trusts: Comparing Education Attainment

Figure C.8: Education attainment for counties without a local land trust (n=3)

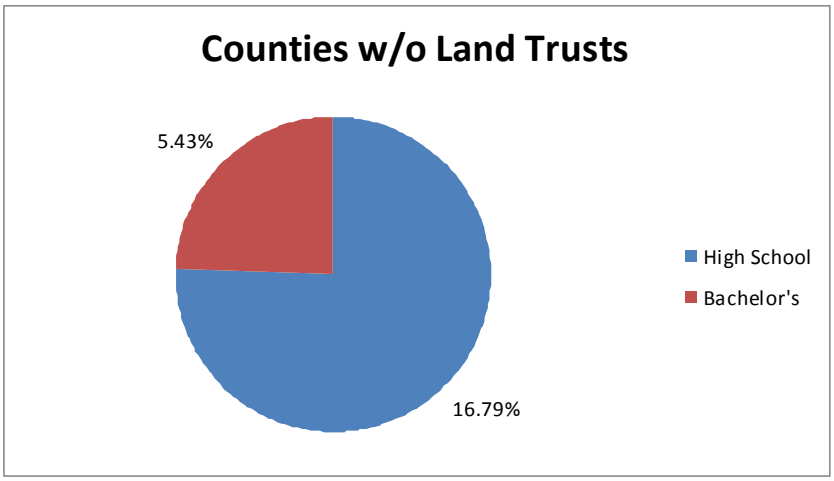
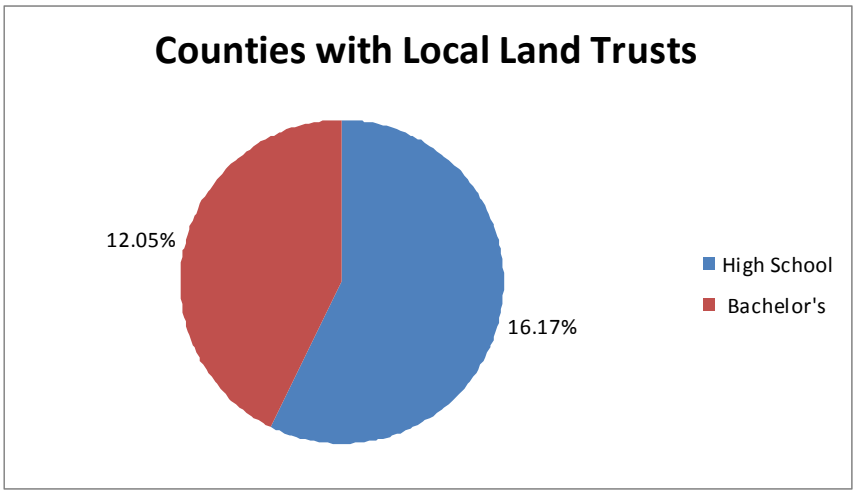


Figure C9: Education attainment for counties with at least one local land trusts (n=36)



Protected Open Space

Figure C.10: Protected open space, total acreage

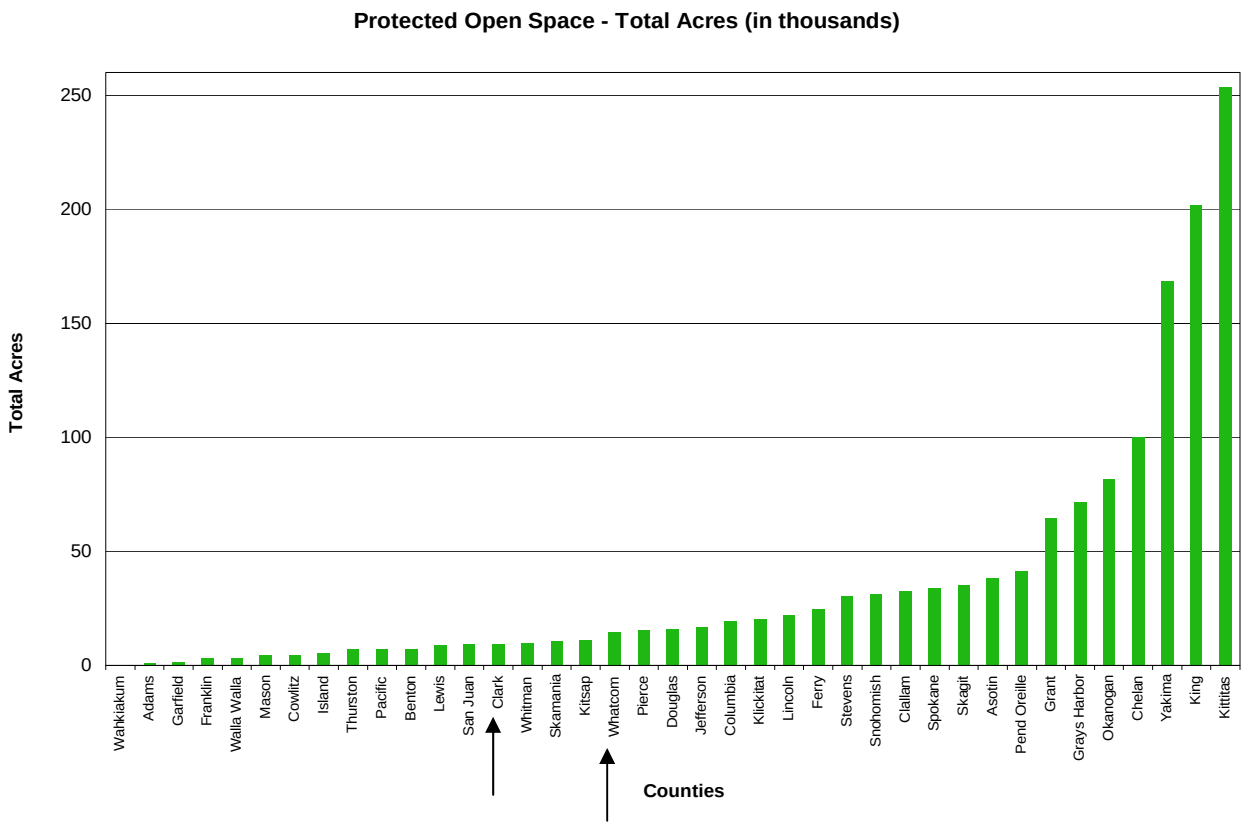


Figure C.11: Protected open space as a percent of total county area

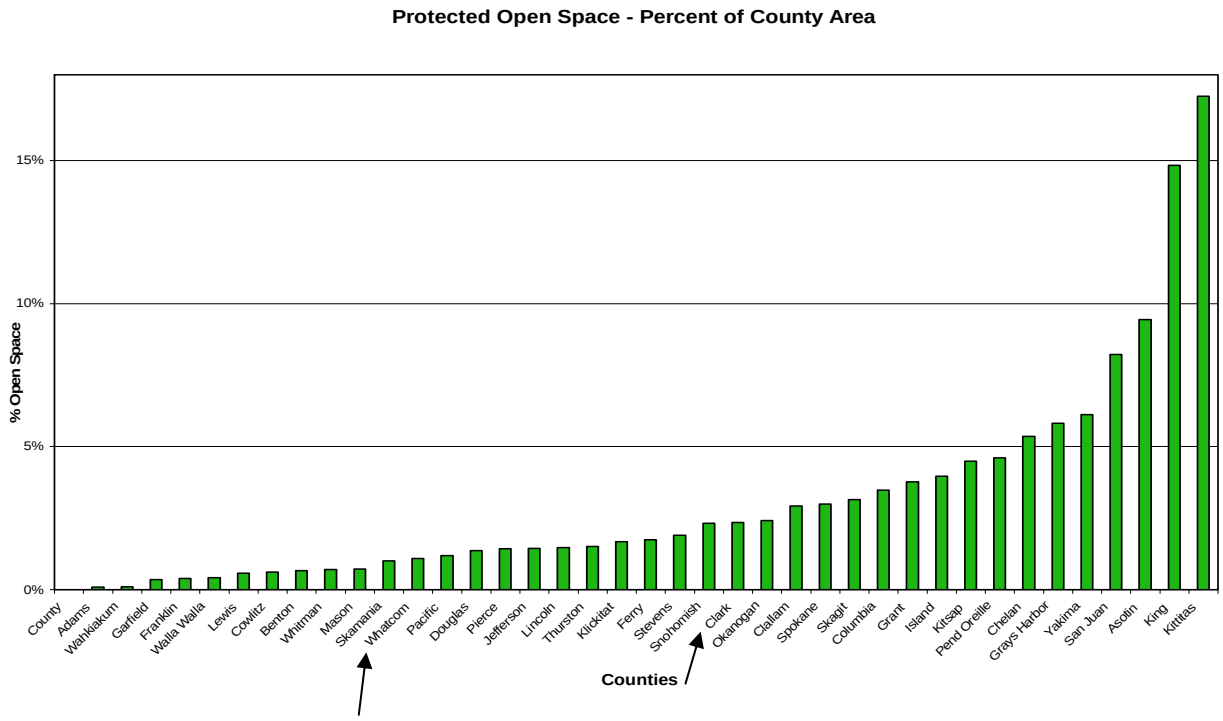


Figure C.12: County protected open space per 1,000 residents

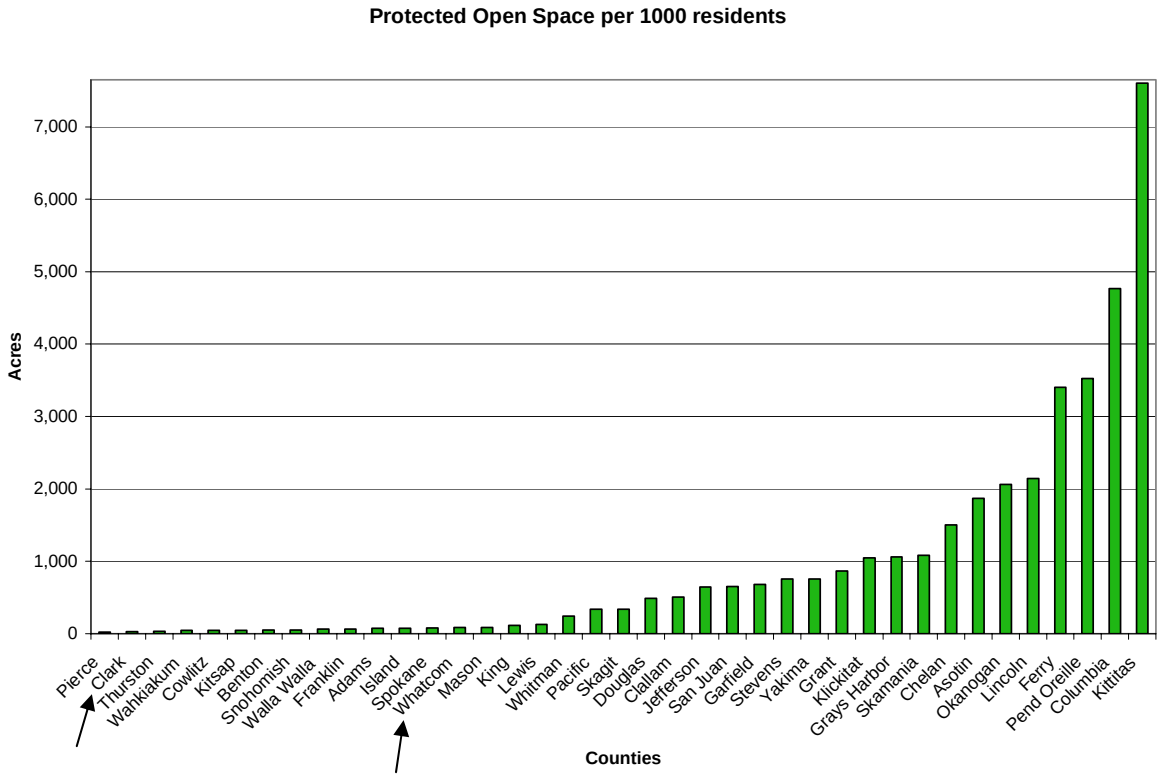


Figure C13: Map of counties showing total acreage of protected open space

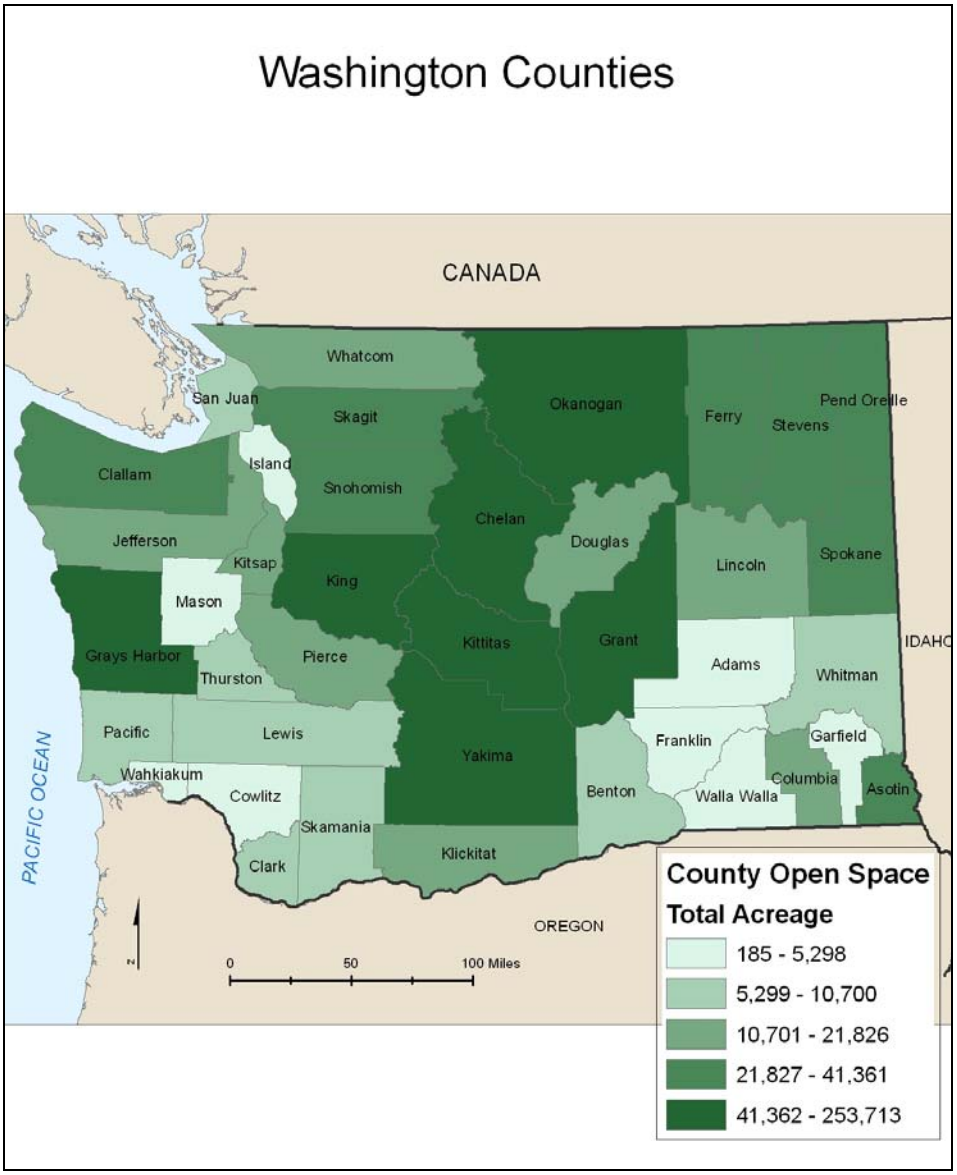


Figure C.14: Map of counties showing percent of open space

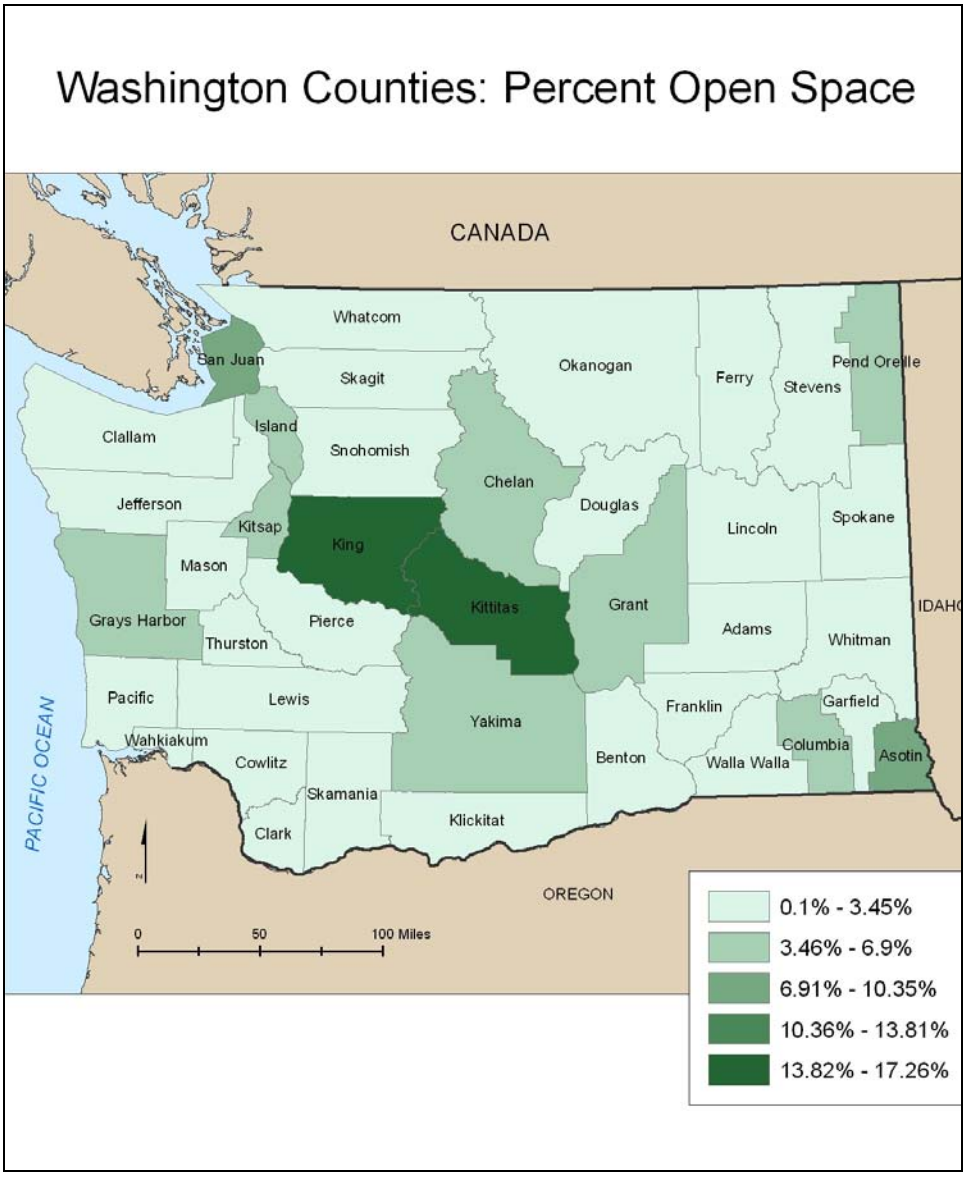
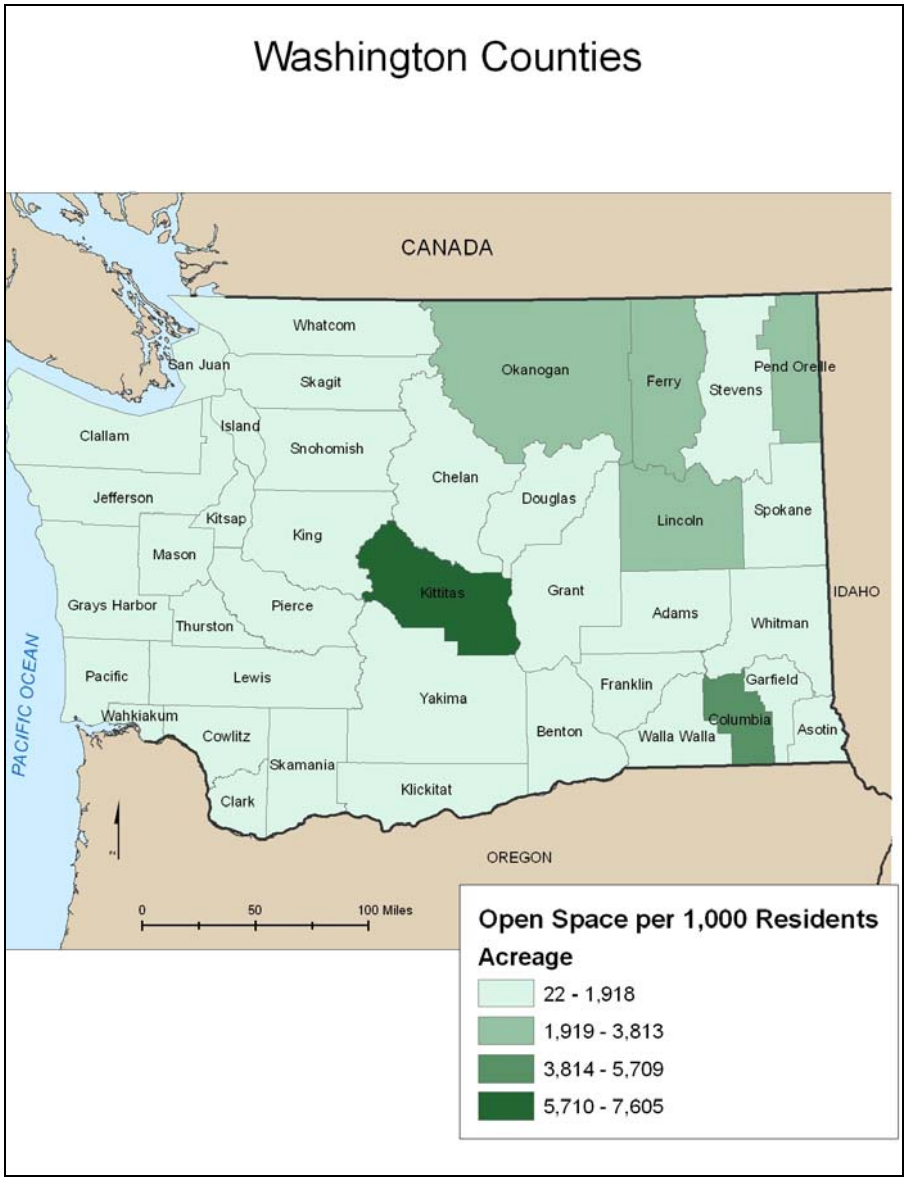


Figure C.15: Map of counties showing open space per 1,000 residents



Appendix D

Table D.1: Kolmogorov-Smirnov Test for Normality

Variable	D_{actual} (absolute value of maximum difference)	Z Test Statistic	Significant Value (< 0.05	Normal Distribution
Population Density (persons per acre)	0.313	2.241	0.000	N
Median Household Income	0.137	0.857	0.455	Y
High School graduates – percentage of population over 25 years of age	0.088	0.547	0.925	Y
Bachelor's degrees – percentage of population over 25 years of age	0.118	0.739	0.546	Y
Number of Environmental Nonprofit Organizations	0.283	1.766	0.004	N
Number of Local Land Trusts	0.260	1.623	0.10	Y
Total Open Space Acreage	0.289	1.802	0.003	N
Percent Open Space	0.205	1.282	0.075	Y
Open Space per 1,000 Residents	0.272	1.697	0.006	N
Natural log (ln) of total protected acreage	0.036	0.538	0.934	Y

Appendix E

Figure E.1: Washington State map showing federal and tribal lands