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Effect of conservation easements upon the price of adjacent residential properties: A study of Missoula County Montana

Jerome M. Grebenc
The University of Montana

THE EFFECT OF CONSERVATION EASEMENTS UPON THE PRICE OF ADJACENT RESIDENTIAL PROPERTIES: A STUDY OF MISSOULA COUNTY, MONTANA

by

Jerome M. Grebenc

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ABSTRACT

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The Effect of Conservation Easements on the Price of Adjacent Residential Properties: A Study of Missoula County, Montana

Director: Christiane von Reichert

Conservation easements are an important mechanism used by private and governmental entities to protect open space. It is important for these entities to understand the effects that conservation easements have beyond simply protecting open space and wildlife habitat. The impacts of open space on adjacent real estate values and property tax revenues are rarely considered when a conservation easement is established in Montana. Nationwide, empirical literature indicates that open space does have a positive effect upon housing price, but there is limited research in the Rocky Mountain West, particularly Montana. It is the intent of this research to examine the effect of conservation easements on the price of housing in Montana, specifically in Missoula County. Housing prices adjacent to conservation easements are expected to be higher than those for residential properties not adjacent to conservation easements. This study tests whether adjacency to a conservation easement results in higher residential property values. The data utilized for this research was gathered from the Missoula County Association of Realtor's multiple listings for home sales for the period between 1998 and 2002. The final database consisted of 1708 home sales. Initially, descriptive statistics were used to determine the strength of relationship between adjacency and housing price. A simple regression model was then used to test for the effect of adjacency on housing price. Adjacency was found to be statistically significant, but alone it was not a good predictor of housing price. To better understand the effect of adjacency, it was necessary to include the other attributes that affect housing price in a second regression analysis. The second regression model tested for the effect of adjacency on housing price, while controlling for housing characteristics such as lot size, city sewer service, the number of bedrooms, number of bathrooms and main floor square footage. Adjacency was found to be a statistically significant predictor of housing price in the second model, which included the other independent variables. In theory, this increase in the value of adjacent residential properties will translate into higher property tax revenues, which could be used to fund open space acquisition programs.

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INTRODUCTION

Between 1990 and 2000 the human population of the State of Montana increased by 103,130 persons (Census & Economic Information Center 2002). This statewide increase in population has generated a higher demand for residential housing. Private lands are the primary areas of residential development, since publicly owned lands are managed for purposes other than residential development and are not typically sold in real estate markets. Private lands are not only important for residential development but also provide views of undeveloped open space and important wildlife habitat. Additionally, much of Montana's water is located on private land, and almost every major stream or river traverses private land (Montana Natural Resource Information System 2002). In this respect, private lands are important for water quality, riparian and wetland functions (State of Wyoming 2002, 5). Additionally, private lands are an integral part of wildlife migration corridors (State of Wyoming 2002, 5).

Increasingly in Montana, privately owned open space, such as hillsides, ridge tops and riparian areas have been developed with year-round residences and vacation homes. In general, residential development not only reduces the visual appeal of the land but also can impact water quality, wildlife and native vegetation. The subdivision and development of private land may cause the loss of important wildlife habitat, increased human density and a greater potential for wildlife/human conflict. Residential development of open space may also affect groundwater quality, due to on-site wastewater treatment systems; native vegetation through the spread of noxious weeds; and public health and safety, because of an increased potential for damage from wildfires.

Conservation easements are the most important mechanism used to protect open space in the Rocky Mountain Region of the United States (Wright 1994, 385). Most conservation easements are held by private land trusts, but state and local governments may hold them as well (Wright 1994, 385). The Montana Land Reliance, for example has protected over 405,000 acres of open space in Montana through the establishment of conservation easements (Montana Land Reliance 2002). Conservation easements nationwide are used to protect lands for four purposes: recreational access, ecological conservation, preservation of open spaces such as farmland, ranchland and forestland, and the preservation of historic sites and structures (Wright 1993, 489). Though no comprehensive documentation exists, most of the conservation easements in Montana have been established to protect ecological resources such as wildlife habitat, to protect ranchland and farmland, and to provide access to outdoor recreation.

The establishment of a conservation easement involves the transfer of development rights from a landowner to another party, typically a land trust (Montana State University 1998). The easement may be established for a specified period of time, or may be perpetual (State of Wyoming 2002, 10). The transfer involves only certain development rights and not the actual ownership or "fee simple interest" in the land (Wright 1993, 487). The property owner retains the right to sell, give away, or transfer the ownership of the property (Witter 2002, 1). Additionally, if the easement is granted in perpetuity the property owner can generally take an income tax deduction (State of Wyoming 2002, 10). The type of development rights transferred through an easement may include the control of residential subdivisions, controls on domestic grazing, and limits on timber harvest (Boykin 2000, 420). The terms of each easement vary, and are determined through negotiations between the landowner and easement holder prior to the easement being granted (Wright 1993, 488). Conservation easements are acquired by one of two methods, purchase or donation. For purchased easements the development rights for a parcel of property are purchased outright from the landowner. Donated easements involve the donation of development rights from a landowner to another party (Wright 1994, 383).

It has been demonstrated that the benefits of conservation easements extend to the protection of wildlife habitat, view sheds and farmland. But do they extend also to measurable economic benefits, such as increased property values and the potential for increased property tax revenues? That is a question that remains unanswered in Montana. In many parts of the United States, people demonstrate that they value open space by paying higher sales prices for homes with an open space amenity nearby (National Park Service 1995, 1-3). If this holds true in Montana, it may have impacts for state and local governments, real estate appraisers and land trusts.

Government entities would likely benefit from higher property values which are generally associated with increased property tax revenues (National Park Service 1995, 1-8). Additional tax revenues could be used to further fund the acquisition of open space (Lerner 1999, 12). Professional real estate appraisers would be able to more accurately value property by considering the effect of adjacent open space. Unfortunately, private land trusts may find that the higher property values generated by open space will make it more difficult for them to protect multiple adjacent properties. Land trusts regularly attempt to protect multiple adjacent properties with conservation values, such as migration corridors. At any one time, land trusts typically have only the financial resources to acquire the development rights for a single property (Rasmussen 2002). As they protect one parcel, the value of the adjacent properties could increase, thus making it more expensive for them to purchase each subsequent property (Rasmussen 2002).

Study Area

Missoula County provides an excellent example of the land use challenges facing much of Montana. Between 1990 and 2000, the County had the second largest growth in population of any county in the state, with its population increasing by 17,115 persons. Only Gallatin County had a larger overall increase in population (Census & Economic Information Center 2002). Missoula County is coping with impacts of residential development that include the loss of wildlife habitat, the potential degradation of groundwater quality by on-site wastewater treatment systems, the spread of noxious weeds, and increased risks from wildfire associated with development in the wildland/urban interface.

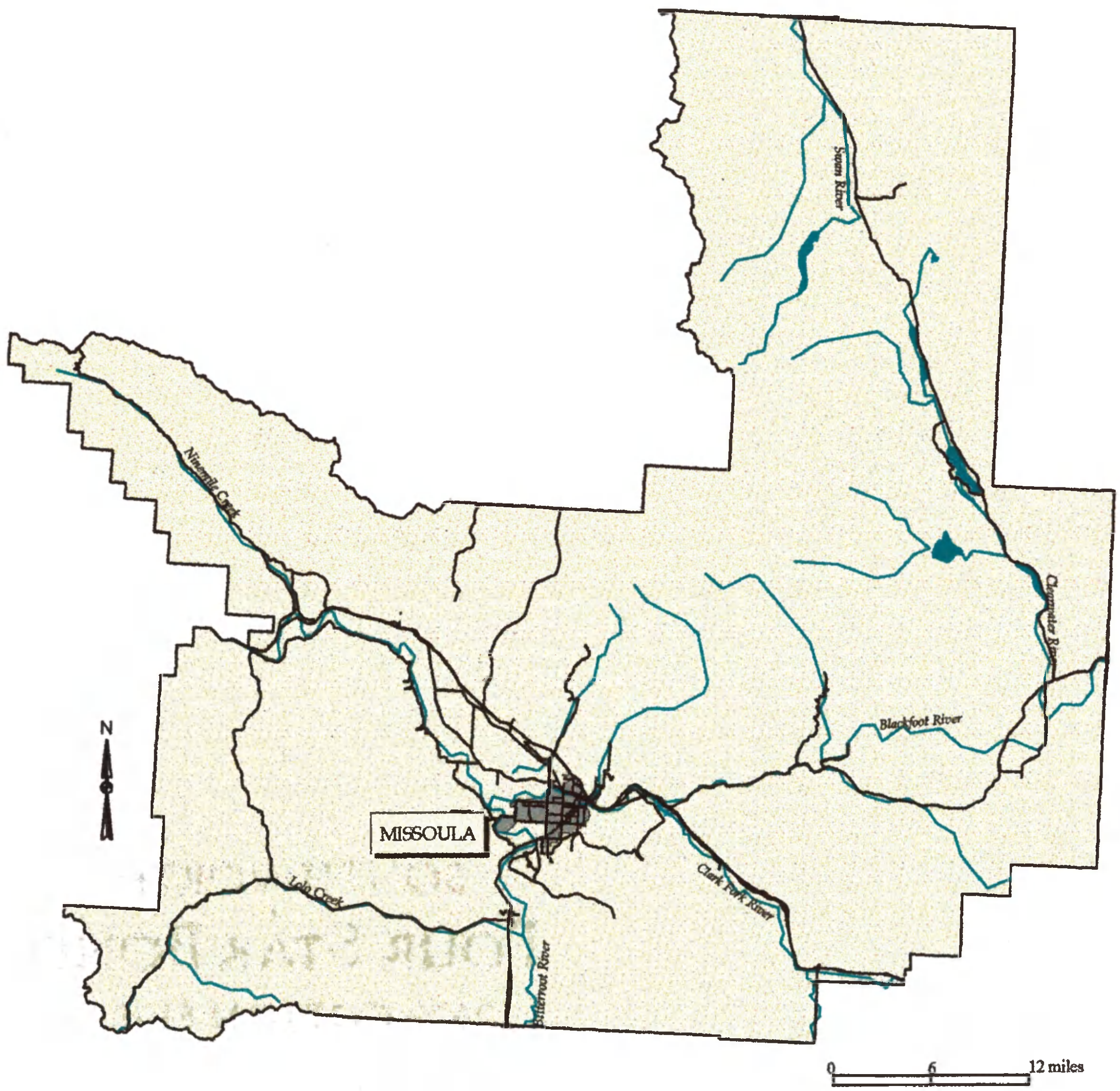
Of the 1,675,605 acres of land in Missoula County, it is estimated that only 301,918 acres is suitable as vital winter range for elk, due to high elevations and harsh climates (Missoula Measures 1999). While no exact figure is available, a large portion of that winter range is privately owned and has the potential to be subdivided and developed with residential homes (Missoula Measures 1999). Residential development in such critical areas may often preclude use by elk, deer and other big game species. Also, much of the residential development in the County uses on-site wastewater treatment, thus posing risks to groundwater quality. New development generally requires soil disturbance and in many cases the removal of vegetation, thereby allowing noxious weeds, which are already present throughout much of the County, to replace native vegetation. Also as the number of homes in the wildland/urban interface increases, the chance of property loss due to catastrophic wildfire in the County also increases. These challenges make Missoula County a good choice for this study. Map 1.1 shows Missoula County and its primary features.

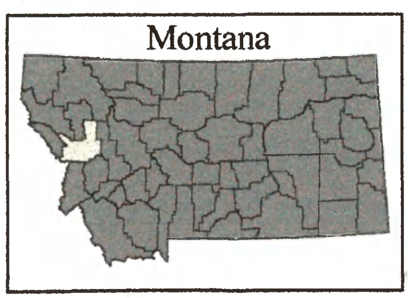
Purpose Statement

The purpose of this study is to determine if conservation easements affect the value of adjacent residential properties. Realtors and appraisers in the state generally believe that open space increases adjacent property values, but little, if any, research on the topic has been conducted in the state. Conservation easements are the focus of this study because they are the primary vehicles for protecting open space in Missoula County.

The effect of conservation easements on adjacent housing prices must be determined from the market prices paid for those properties. The effect of conservation easements on the value of adjacent properties would be apparent if housing prices were higher for properties adjacent to conservation easements than for properties not adjacent. However, when comparing the price of homes, one needs to take into account the other attributes that affect housing prices. Housing prices are affected by a host of factors, such as the size of the lot, the age of a home, the number of bedrooms and bathrooms, square footage and others. When testing for the effect of adjacency on housing price, these other housing attributes will need to be considered. The subsequent analysis of residential properties and housing price will include these other attributes as control variables in order to examine the effects of adjacency to a conservation easements on the price of comparable homes.

Map 1.1: Missoula County, Montana





Jerome M. Grebenc
Department of Geography
University of Montana

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CHAPTER II

CONCEPTUAL BACKGROUND

It is the goal of this research to determine the effect of conservation easements on housing prices in Missoula County, Montana. The study specifically examines whether residential properties located adjacent to conservation easements have higher housing values than properties not located adjacent to easements. Throughout the United States, people demonstrate that they value open space by paying higher sales prices for homes with an open space amenity nearby (National Park Service 1995, 1-3). Nationwide, researchers have verified the public's desire for open space by using market sales data to show that proximity to open space, does have a positive effect upon housing values (Crompton 2001, 28). In most localities, increased housing values result in increased property tax revenues. Potentially, state and local governments could create self-sustaining open space conservation programs by using the resulting increases in property tax revenues as a funding mechanism. This research could also help the real estate appraisal professionals in Montana to more accurately appraise residential properties. Real estate appraisers rely upon sound scientific research and statistical methods for appraising properties, and they would no doubt welcome research about the valuation of property. If open space does positively affect the price of adjacent property, it may financially impact the programs pursued by land trusts, which often attempt to protect multiple properties with conservation values, such as critical wildlife habitat and wildlife migration corridors. It is with these issues in mind that this research has been undertaken.

This chapter provides the conceptual background for the study by drawing on theoretical and empirical literature concerning effect of housing attributes and open space on housing prices. The first section, *Externalities Generated by Open Space*, discusses the theory of externalities and the benefits that open space may provide. This section specifically addresses the fact that open space may have an external effect on property values, and this section is particularly important because it conveys how open space could impact housing prices. The second section pertains to *Open Space as a Public Good.* This section focuses on open space as a good that may provide benefits to the public as a whole. This relationship is further refined when open space is examined as a local public good. The third section examines the *Determinants of Housing Price.* This section uses theory and empirical research to focus on the attributes that influence property values, including open space. The last section, *Empirical Research on Open Space and Housing Price* moves from the conceptual realm to the methodology of the hedonic price equation and the results of several studies on how open space affects housing prices.

Externalities Generated by Open Space

"An externality is a cost or benefit to a third party that results from imperfectly defined ownership rights to resources" (Link and Allen 1986, 151). There are many definitions for externalities available in the literature, but aforementioned is the one used for the purposes of this study. In general terms, an externality can be thought of as the uncompensated benefit or harm that the provision or consumption of a good may have on a third party. Pollution is the classic example of a negative externality, while the public vaccination of children would be a positive externality (Samuelson and Nordhaus 1998, 274). The types of externalities that exist are almost infinite and the magnitude of their benefit or harm can be vague and subjective (Orr 1976, 289-298). The focus of this research is on the potential monetary benefits generated by open space, so the following discussion shall center on positive externalities.

The theory of externalities is essential to defining the influences that open space may have on residential property values, but first one must understand the role that externalities play in a market economy. The theory of competitive equilibrium postulates that market efficiency exists under perfect competition and when no externalities exist (Orr 1976, 285). Under perfect competition all goods and services have a price and are traded in the market (Samuelson and Nordhaus 1998, 35). This competition creates an efficient allocation of resources, which in turn efficiently produces goods using the most efficient manufacturing techniques and minimum inputs (Energy Information Administration 1995, 5). The efficiency of the market then allocates goods to buyers who value them the most and conversely, the market allocates sales to sellers who can produce products at the least cost (Samuelson and Nordhaus 1998, 35). So the market produces the quantity of goods that will maximize consumer demand and producer surpluses (Samuelson and Nordhaus 1998, 52-53). In the free market, buyers and sellers are motivated by their own self-interest (Heilbroner and Thurow 1982, 29). This self-motivation is nonetheless coordinated, so that buyers and sellers are directed to the most efficient outcome (Smith 2000, 25). In other words, Adam's Smith's "invisible hand" helps the free market achieve efficiency (Heilbroner and Thurow 1982, 29).

The central tenet of market equilibrium is that perfect competition must exist or else the "invisible hand" will not work and the market fails (Smith 2000, 25). If a market system benefits or harms individuals other than the buyers and sellers, externalities are created (Hirsch 1984, 219). Externalities involve economic relationships between individuals other than just the buyer and the seller. Such relationships cause the market to fail because the given market price under or over states the true cost of producing the good (Link 1986, 152). The important point here is that the welfare or the income of an individual is affected by a market transaction, but in a manner outside the market system (Orr 1976 287).

For example, a rancher invests time and money into growing grass hay, which he or she will feed to cattle or will sell to other individuals. That same grass hay may also benefit wildlife such as deer and elk. In this country, such wildlife are considered a "public resource" that benefit everyone, not just the rancher. This provision of privately owned pasture for public wildlife would be an example of an externality. In this case, the rancher is unable to avoid costs imposed by the public, since wildlife is generally considered a public resource and it would be extremely difficult and expensive to keep wildlife off of the rancher's property. Defining ownership of natural resources such as wildlife and open space is a difficult if not impossible task (Link 1986, 151). The high cost of excluding individuals from benefiting in consumption of a good without proper payment results in the existence of externalities, which is a form of market failure (Hirsch 1984, 219).

There is no question that the public values the benefits generated by open space. Most of the benefits realized by the public are environmental in nature, including: rural landscapes free of residential or industrial development, wildlife habitat, aesthetically pleasing views, access to recreation, and continued operation of farms and ranches (Lerner and Poole 1999, 3). Unfortunately, the private owner of open space is rarely able to realize any economic benefit from providing the public with open space (State of Wyoming 2002, 7). Thus, externalities are generated by the uncompensated provision of open space by property owners. "This situation may reduce the private property owner's incentive for providing open space to the public" (State of Wyoming 2002, 7). Purchasing the development rights for such private open space provides compensation to the property owner and may reduce market imperfection.

Open Space's Effect on Property Values

In theory, individuals can choose to relieve themselves of the harm from a negative externality or to increase the benefit from a positive externality (Orr 1976, 300). The choice is up to the individual and he or she must decide how much they are willing pay to for relief or for more benefit (Orr 1976, 300). The market is able to internalize these externalities. For example, properties located in a floodplain have a negative externality attached to them, the very real threat of damage from floodwaters (Holway and Burby 1990, 259). The real estate markets indicate that properties located in a floodplain are worth less than those that are not (Holway and Burby 1990, 265). In this situation, people have made a conscious choice to pay less for property due to an externality. This is an example of how some externalities can be location specific (Diamond and Tolley 1982, 6). In the case of floodplains, people choose their residential location based in part on the externalities they must live with (Orr 1976, 301).

The positive externalities generated by open space may similarly extend beyond the environmental to the monetary or "pecuniary" (Energy Information Administration 1995, 7). If individuals benefit from the private provision of open space, would they be willing to pay higher prices for real estate adjacent to open space in order to increase their consumption of the benefits? Any willingness by individuals to pay more for such property would itself be a positive externality, since the individual selling the property adjacent to open space would garner the economic benefit and not the landowner providing the open space. The potential effect of open space on real estate prices would be termed a pecuniary externality, because the effect is on the monetary value of the property (Energy Information Administration 1995, 7). This pecuniary aspect of open space is influenced by the fact that open space is location specific, it cannot be moved or transferred, and there is a limited amount available at any on place (Diamond and Tolley 1982, 5-6). Therefore, if individuals wish to increase their consumption of the benefits provided by more open space they would need to relocate (Diamond and Tolley 1982, 6). Since the supply of open space available to individuals is limited, any increase in demand for property adjacent to open space would also increase the price of that adjacent property. Thus the locational nature of open space and its limited supply could influence the price of real estate (Correl, Lillydahl and Singell 1978, 211). The empirical literature indicates that any increase in property values would be followed by a corresponding increase in property taxes levied by local governments (Lerner and Poole 12-13).

Addressing externalities generally falls to government entities, due to the fact that it is extremely difficult and expensive for private parties to transform them into excludable goods (Samuelson and Nordhaus 1998, 33-35). Governments typically internalize externalities in three ways: by regulating them, such as pollution; by taxing them, such as real estate; or by subsidizing them, such as the public funding of parks (Heilbroner and Thurow 1982, 175-176). Closely linked to the theory of externalities is the concept of public goods. The next section discusses the relationship between externalities and public goods and how open space serves as a public good.

Open Space as a Public Good

Goods can be private or they can be public. A private good is one that can be consumed by only one person and only consumed once (Hirsch 1984, 220). In other words, consumption of the good is exclusive (Samuelson and Nordhaus 1998, 331). In a market of such goods, an individual has the ability to exclude others from consuming the goods (Hirsch 1984, 220).

Public goods are less easily defined. A public good for the purposes of this research has three characteristics. First, a public good is non-excludable, which means that a good is made available to all individuals, is jointly consumed, and no one can be denied access to it (Orr 1976, 302). Second, consumption of a good by one individual does not reduce the amount of a good available for consumption by another (Link 1986, 153). Lastly, and closely related to the theory of externalities, is that the cost of excluding consumers from public goods is so prohibitive, that the private market will not provide the goods (Link 1986, 154). Public goods are provided by government entities, due to the fact that there is no economic inccntive for private enterprise to provide them (Smith 2000, 31). National defense is the classic example of a public good and one that the private market cannot economically provide.

Most goods actually fall somewhere between being private and public goods (Hirsch 1984, 221). For example, open space is a location specific good that can be provided publicly (municipal parks) or privately (conservation easements). Therefore, open space would be defined as a quasi-public good (Correl, Lillydahl, and Singell 1978, 209). Theoretically, the open space provided by a municipal park is available to all individuals without exclusion, while the open space provided by a private property owner is generally only available to that individual. This example takes into consideration only the tangible attributes of property and not the potential externalities such as aesthetically pleasing views or wildlife viewing that may be provided by open space. Quasi-public goods such as open space do have exclusionary characteristics, which are due to locational factors (Correll, Lillydahl and Singell 1978, 209). Theoretically, the farther an individual resides from open space, the less benefit that individual receives (Lutzenhiser and Netusil, 2001 291-292). As with externalities, individuals can choose to increase their consumption of a public good. Because, open space is a location specific good and limited in supply, individuals must decide to relocate in order to increase that consumption and that relocation involves costs (Orr 1976, 300).

Public open space is commonly accepted as a good providing benefits to all people irrespective of their ability or inclination to pay for it. This is evident by the existence of municipal, state/provincial and national parks throughout the United States and the world. In 1999, voters in the United States indicated the importance they attach to open space, by approving 92 state and local referendums that generated $1.8 billion dollars for protecting open space (Kelly and Zieper 2000, 23). Protecting open space can also be self-financing. In several locations, such as Chattanooga, Tennesse and Boulder, Colorado, local governments have been in the unique position of subsidizing the protection of open space and then recouping the cost of the subsidy in higher residential property tax revenues (Lerner 1999, 12-13). The City of Missoula, Montana instituted an open space conservation program in 1995, with the approval of a $5 million dollar bond by the City's voters (Missoula Measures 1999). At this point the program is not specifically designed to recoup costs of the program through higher property tax assessments.

Open Space as a Local Public Good

The provision of public goods, such as parks and open space, by local governments is generally limited to a specific geographic area (Hirsch 1984, 221). Such goods are termed local public goods (Hirsch 1984, 221). A local public good is a commodity that is consumed only by those who live closest to the place of supply and can include libraries, fire and police protection, and parks (Samuelson and Nordhaus 1998, 289). A parcel of municipal open space could be considered a local public good, because those who live the closest to the open space will garner the most benefits. For example, those individuals who live the closest to a neighborhood park will garner most of the benefits, rather than those people who live farther away, such as in another city or state.

Let us assume for a moment that open space is a desirable local public good. According to the theory of local public goods, if the supply of open space is increased, this would make a community a more attractive place to live, and thus, migration to the community would increase (Kanemoto 1980, 80). This increased migration into the community would create a higher demand for housing, particularly for homes near the open space. Because of the increased demand, property values near open space would increase (Correll, Lillydahl and Singell 1978, 213). The benefits of open space would then be reflected in the higher land rents that individuals are willing to pay in order to reside near this local public good (Kanemoto 1980, 80). If it is true that people value open space, as the empirical literature indicates, then, increasing the amount of open space available would make a community a much more attractive place live. The provision of open space at public expense could be justified because it would be a public good that benefits the community as a whole (Orr 1976, 303).

The amount of a local public good that an individual consumes can only be varied through geographic movement (Diamond and Tolley 1982, 11). This geographic movement allows an individual to select the community that provides the optimal bundle of goods that he or she desires (Kanemoto 1980, 87). This principle follows Charles Tiebout's theory of "voting with one's feet" (Kanemoto 1980, 87). The essence of Tiebout's theory is that "an individual's moving or failure to move replaces the usual market test of willingness to buy a good, and therefore reveals the consumer/voter's demand for public goods" (Hirsch 1984, 223). "Thus, each locality has a revenue and an expenditure pattern that reflects the desires of its residents" (Hirsch 1984, 223). Surveys and research consistently indicate that urban and suburban residents regularly "vote with their feet" by relocating to areas in search of open space (Irwin and Bockstael 2001, 698). Open space provides amenities such as scenery, recreation, and an absence of traffic congestion and pollution (Lerner 1999, 14). Amenities are location-spccific goods that are important in determining a household's health, leisure time, housing quality and other characteristics (Diamond and Tolley 1982, 4). Open space could be considered such an amenity, if an individual desires an increase in the amount of open space available to him or her, they would need to purchase the ability to live in an area with more open space. The relationship between the location, property markets and amenities is the topic of the next section, *The Determinants of Housing Prices*. This section will incorporate theory and empirical evidence in order to illustrate the various factors that affect housing price.

Determinants of Housing Price

The research has made it increasingly clear that locational attributes such as open space are valuable to homebuyers (Lutzenhiser and Netusil 2001, 297; Seiler, Bond, and Seiler 2001, 294; Irwin and Bockstael 2001, 703), but this is only one of many variables that a person considers when purchasing a home.

Housing is generally considered a bundle of ownership rights and attributes (Beaton and Marcus 1992, 441). "These rights and attributes include the legal constraints on the land use, the size and quality of physical improvements, the location of the property with respect to employment, shopping and recreation, and finally the environmental attributes, such as population density, traffic congestion, crime and open space" (Beaton 1991, 176). The housing attributes are typically not sold separately, but as a single unit (Beaton 1991, 176). The sales price of a home is an indication of the buyer's valuation of the bundle of rights and attributes, and also reflects his or her choice of expenditures between competing alternatives (Darling 1973, 24).

Legal Constraints

The fee title ownership that a homebuyer purchases is frequently limited by legal constraints, which can affect property values. The legal constraints on private land generally derive from local government land use regulations, particularly the regulation of property subdivision and regulation of land use through zoning. "Subdivision regulations concern themselves with the provision of infrastructure, the layout and division of land, protection of public health and safety and the coordination of development" (Arnold 1979, 420). Zoning on the other hand regulates how an individual lot may be used or developed (Arnold 1979, 389-420). Empirical research indicates that the regulation of land use by a local government does affect the price of that property. Changing the type of zoning classification was found to affect property values in Caddo and Bossier Parishes in Louisiana (Bible and Hsieh 1999, 266). In this case a "business" classification increased the value of affected properties (Bible and Hsieh 1999, 266). Zoning regulations were also found to increase property values in Montgomery County, Maryland (Pollakowski and Wachter 1990, 323). The research in question examined zoning based upon the maximum lot size and the designation of property for townhouses and multi-family structures. (Pollakowski and Wachter 1990, 323). Mullins (2001) examined the effect that residential zoning density had on housing prices in Missoula, Montana. She found that high-density zoning significantly lowered housing prices in comparison to lower zoning densities (Mullins 2001, 34). High-density zoning was defined in her study as zoning with a minimum lot size of 3,600 square feet (Mullins 2001, 34). In Salem, Oregon, the establishment of an urban growth boundary and the designation of certain properties as "greenbelts" along the fringe of the growth boundary, reduced the value of the subject properties by as much as $3,400.00 an acre (Nelson 1986, 163). The designation of the greenbelt status was intended to prevent land speculation and the "premature" development of agricultural lands along the periphery of Portland (Nelson 1986, 159-160).

Other legal constraints on property may involve the existence of access and utility easements. Such easements may run perpetually with a residential lot and may not be controlled by the property owner. The easements can be subject to use by the general public or utility companies. Conservation easements are also a legal constraint on the use of property. The existence of a conservation easement on a parcel of land typically limits a property owner's ability to develop his or her property in exchange for some monetary benefit (Boykin 2000, 420). If the easement is perpetual, it runs with the land forever and any future property owner is bound by the terms of the easement, which may affect the sales price of the property (Boykin 2000, 420).

Physical Attributes

The physical attributes of a home also affect housing price. The size and quality of physical improvements include the size of a lot, the square footage of a home, the number of bedrooms and baths, other improvements and the over all condition of the building and the grounds. Real estate markets generally indicate that the larger the square footage of a home, typically the higher the price it commands. This is logical since in general, the larger a home is the greater the costs of labor and materials to construct it. This does not take into account the affect of mortgage interest rates (Broomhall 1995, 196). A study of housing cost data, from 1974 to 1983, for 58 Metropolitan Statistical Areas indicated that construction costs had by far the greatest effect on housing prices (Potepan 1996, 241).

The location of a home is an important factor in determining its price. "The choice of residential location by an individual household is the outcome of its pursuit for locational amenities" (Diamond and Tolley 1982, 22). Households choose a residence based upon the attributes provided by the location. Purchasing a home involves choosing a location, which will impact a household's access to employment, services such as shopping and schools and leisure pursuits. One would also have to assume that a household's choice of residential location would be influenced by their desire to "flee" of dis-amenities such as pollution and traffic congestion.

Urban economic theory postulates that households will maximize the utility or satisfaction that they receive from goods (Samuelson and Nordhaus 1998, 80). With regards to housing, they will choose a residential location that will allow them to optimize the amenities available and to minimize the dis-amenities experienced (Hirsch 1984, 61). This theory assumes that all individuals work in the Central Business District (CBD) and therefore must commute to it (Hirsch 1984, 61). The household must take into account transportation costs when choosing a location (So, Orazem and Otto 2001, 1036). The theory also implies that transportation costs will increase as distance to the CBD increases, therefore there is an advantage to living closer to the CBD (Hirsch 1984, 61). Due to increased transportation costs, one would expect that as distance from the CBD increased, land would become less expensive (So, Orazem and Otto 2001, 1037). The empirical research corroborates this: empirical studies consistently indicate that as distance from the CBD increases, housing prices are reduced (Bible and Hsieh 1999, 264; Shi, Phipps and Colter 1997, 90; So, Orazem and Otto 2001, 1045). So proximity to municipalities can be expected to affect housing prices.

As stated earlier, the choice of residential location by a household is in part affected by the pursuit of amenities (Diamond and Tolley 1982, 22). Environmental or neighborhood attributes are important factors in determining the price of housing, and therefore a household's choice of residential location. Population density, traffic congestion, crime rates, and parks all impact a household's selection of a home (Chen, Rufolo and Dueker 1997, 3). The empirical research has shown that neighborhood characteristics such as proximity to landfills, traffic noise and floodplain designations can negatively affect housing prices (Diamond and Tolley 1982, 140; Holway and Burby, 1990, 266; Nelson, Genereux and Genereux 1992, 362). The quality of public services provided by municipalities, such as schools, sanitation and police protection is another factor that affects housing prices (Meyerand and Wieand 1996, 126). As will be discussed in the next section, open space is also one of the neighborhood attributes that is consistently cited by the empirical literature as positively affecting property values (Crompton 2001, 1). Other factors such as household income, unemployment rates, inflation and mortgage interest rates affect housing prices, but these factors are beyond the scope of this study (Broomhall 1995, 196; Case and Marychenko 2001, 17-18).

Empirical Research on Open Space and Housing Prices

There have been many studies, which examine the relationship between open space and housing prices. The common thread between the studies cited here is that they utilize the hedonic price theory to determine the actual relationship between open space and residential property values. Because this research intends to also utilize the hedonic price equation, a brief description of the theory and its use is necessary.

The Hedonic Price Theory

Under the hedonic price theory, the value of a housing is based upon a variety of characteristics, including physical, locational and environmental attributes (Beaton 1992, 441). The theory as postulated by Sherwin Rosen implies that "housing is valued by households for its utility-bearing attributes or characteristics" (Rosen 1974, 34). The basic tenet of Rosen's theory is that the price of housing is related to its characteristics or the services it provides, and the value of that housing is revealed through the price it commands in the real estate market (Ecosystem Valuation 2000, 1). The theory assigns an implicit price to each housing attribute. Empirically this achieved by regressing the variables representing each desired attribute against the homes' selling price (Beaton 1992, 441). Numerous studies have utilized the theory to determine the implicit price for many housing attributes, ranging from the effect of historic district designation to the effect of traffic noise (Doss and Taff 1996, 121). With this research, the hedonic price equation is used to test the relationship between conservation easements and housing price. It is the intent of this research to determine the value of a non-market resource (open space) from the price of a market good (residential properties).

The hedonic price equation is tailored to observations gathered from real estate markets, where properties are in direct or indirect competition with one another (Beaton 1992, 442). The observation data should include the structural and environmental characteristics associated with housing (Lutzenhiser and Netusil 2001, 292). The structural characteristics should at a minimum include the age of the property, the size of the lot, the number bedrooms and bathrooms and square footage of the residence (Seiler, Bond and Seiler 2001, 289). For this study, adjacency and non-adjacency to a conservation easement is an important variable in the model. The completed data set is then analyzed using regression analysis, where the housing price is regressed on the attributes of the home and an implicit price is assigned to each attribute (Doss and Taff 1996, 121).

Studies on How Open Space Affects Housing Price

Empirical research on the relationship between open space and residential property values is ubiquitous for most regions of the United States, but similar research in the Rocky Mountain West is limited. In 2001, John L. Crompton examined 25 empirical studies that investigated the question of how open space affects property values in various regions of the country. All but five of the studies Crompton examined found that open space increased the value of "nearby" properties (Crompton 2001, 28). Of the five studies that did not lend support to the effect of open space, Crompton felt that four of them had methodological limitations (Crompton 2001, 28).

The following review of the empirical research examines the relationship between the locational amenity of open space and the value of residential properties. The studies cited all used the hedonic price equation to estimate the affect of open space on property values. Additionally, they all found proximity to open space did influence the price of residential property.

As early as 1973, Arthur H. Darling examined the impact of water parks on residential values in California. Darling found that properties with a view of certain lakes showed an increase in value (Darling 1973, 22-34). Research by Seiler, Bond and Seiler (2001) supports not only the idea that views of open space can affect the market value of residential properties, but also proximity to it. Their study examined how a view of and proximity to the Great Lakes affected the value of residential properties. They studied 1,172 residential properties in Cyuhoga County, Ohio that were near or adjacent to Lake Erie. The researchers used the hedonic price equation to examine the effect of several variables on residential housing values. Their analysis compared lakefront properties that had a view of the lake with adjacent properties that did not. The database they used was based upon tax assessment data. The variables included in the model were the presence or absence of a lake view, length of lake frontage, and typical housing characteristics ranging from age of the home to number of bedrooms and the quality of the construction. Their analysis indicated that in terms of dollars, a lakefront home with a view of Lake Erie was worth $115,000 dollars more than similar homes without lakefront or a view (Seiler, Bond and. Seiler 2001, 293).

A study by Doss and Taff (1996) that used the hedonic price equation, found that wetlands and lake views in Ramsey County, Minnesota affected residential property values. The study examined 2,976 residential properties in relation to three types of wetlands (forested, shrub and emergent vegetation). Other variables considered in the research were housing characteristics, distance to a lake, and a lake view. They found that increasing the distance from a forested wetland by 200 meters decreased the residential property values by approximately $960 dollars and $2,900 dollars for an equal distance from a shrub type wetland. The research additionally found that residential properties with a view of a lake were worth approximately $46,000 dollars more than similar properties without a view (Doss and Taff 1996, 127).

Research by Lutzenhiser and Netusil (2001) examined the relationship between the proximity of residential properties to open space and their sales price. They studied 16,636 residential properties in the Portland, Oregon metropolitan area using the hedonic price equation. In this case, the researchers attempted to determine the effect that proximity to different types of open space might have on residential property values. They segregated open space into five categories: cemeteries, urban parks, natural area parks, golf courses, and specialty parks. Specialty parks were defined as parks with one primary purpose, such as a boat ramp or fishing access site. They chose to differentiate the type of open space, due to the fact that recreational access and opportunity can vary with each. The important housing attributes considered other than open space were age, number of fireplaces, bathrooms, total square footage of home and lot acreage. Seven dummy variables were created to indicate the effect that distance to each type of open space might have on property values. The variables ranged in distance from less than 200 feet to open space, to between 1,201 and 1,500 feet to open space (Lutzenhiser and Netusil 2001, 296-297). The study found that open space does have a positive impact upon residential property values. Natural area parks and specialty parks had a positive effect upon property values in all seven proximity categories. Urban parks had a positive and significant impact on property values up to 600 feet in distance. Proximity to golf courses had the largest positive effect on residential housing values, but this decreased dramatically with distance (Lutzenhiser and Netusil 2001, 297).

Irwin and Bockstael (2001) examined the effect of open space on residential property values using the hedonic price equation. They examined the sale of 55,799 residential properties in the suburban region of Maryland surrounding Washington, D.C. The data was obtained from the Maryland Office of Assessment and Taxation. As Lutzenhiser and Netusil (2001) did in their research, Irwin and Bockstael (2001) distinguished between the types of open space available in the study area. Their categorization of open space included only three types: privately owned open space that was developable, privately owned open space that was protected by agricultural easements, and publicly owned open space. In addition to the physical housing characteristics of each property, they also included the distance of each residential property to Baltimore and Washington, D.C. in the analysis. The unique feature of this study was the inclusion of neighborhood demographics as variables in the analysis. The demographic variables included median household income, education level and the percent of the population that was African-American. Residential properties were assigned individual demographics by Census block group. The study concluded that as the proportion of publicly owned open space increased, so did the value of residential property. This held true also for the proportion of privately owned, but protected open space. Privately owned, but developable open space was found to have a negative, but insignificant effect on residential property values (Irwin and Bockstael 2001, 703).

The majority of empirical research indicates that open space can be expected to increase the value of residential properties in close proximity. The issue of proximity is an important one. The research shows that as distance to open space increases, property values will decrease. This would imply that people are willing to pay higher real estate prices for properties adjacent to or near open space in order to enjoy the benefits it provides, such as a pleasing view-scape, solitude, recreation and wildlife habitat. It is the hypothesis of this research that people value open space, and are willing to pay higher real estate prices to have it as an adjacent amenity. *Proximity or adjacency to open space/conservation easements is expected to have a favorable/positive effect on residential properties by increasing their value.*

CHAPTER III

METHODOLOGY

The effect of open space on property values has been well documented for most regions of the United States. However limited empirical research has been undertaken in the Rocky Mountain West. The intent of this study is to partially fill this void for one county in Montana, namely Missoula. This research will examine the affect that open space, in the form of conservation easements, has on residential property values. The hypothesis of this study is that conservation easements will increase the value of adjacent residential properties.

The following sections examine the construction of the database and its analysis in further detail. The *Data* section describes in detail the process of building the database by using Arc View GIS 3.2, the *Missoula County Association of Realtors* (*MCAR*) database, and Excel. The *Analytical Procedure* section discusses the regression analysis that was used to analyze housing price as the dependent variable and adjacency to a conservation easement as one of the independent variables. A detailed section on the *Variables* includes sub-sections describing the *Dependent Variable* and the *Independent Variables* in further detail.

Data

The database used to describe the effect of conservation easements on the price of adjacent residential properties consisted entirely of home sales from within Missoula

County. The primary distinction between the home sales utilized in the analysis is whether or not they are adjacent to a conservation easement. The home sales for Missoula County were acquired using the *Missoula County Association of Realtors* (*MCAR*) database. These sales represent every multiple listing area in Missoula County with exception of the central and downtown areas of the City of Missoula. These areas were excluded because they were the only areas from the multiple listings, from which no adjacent residential sales were identified. The *MCAR* electronic database contains residential sales with closing dates between January 1, 1998 and February 6, 2002. *MCAR* only maintains home sales in their database for only four years all housing sales older then this are purged from the system. Therefore, sales data is only available in electronic form for a four-year period. *MCAR* does maintain a paper database, the *Comprehensive Listings*, on all home sales since 1988.

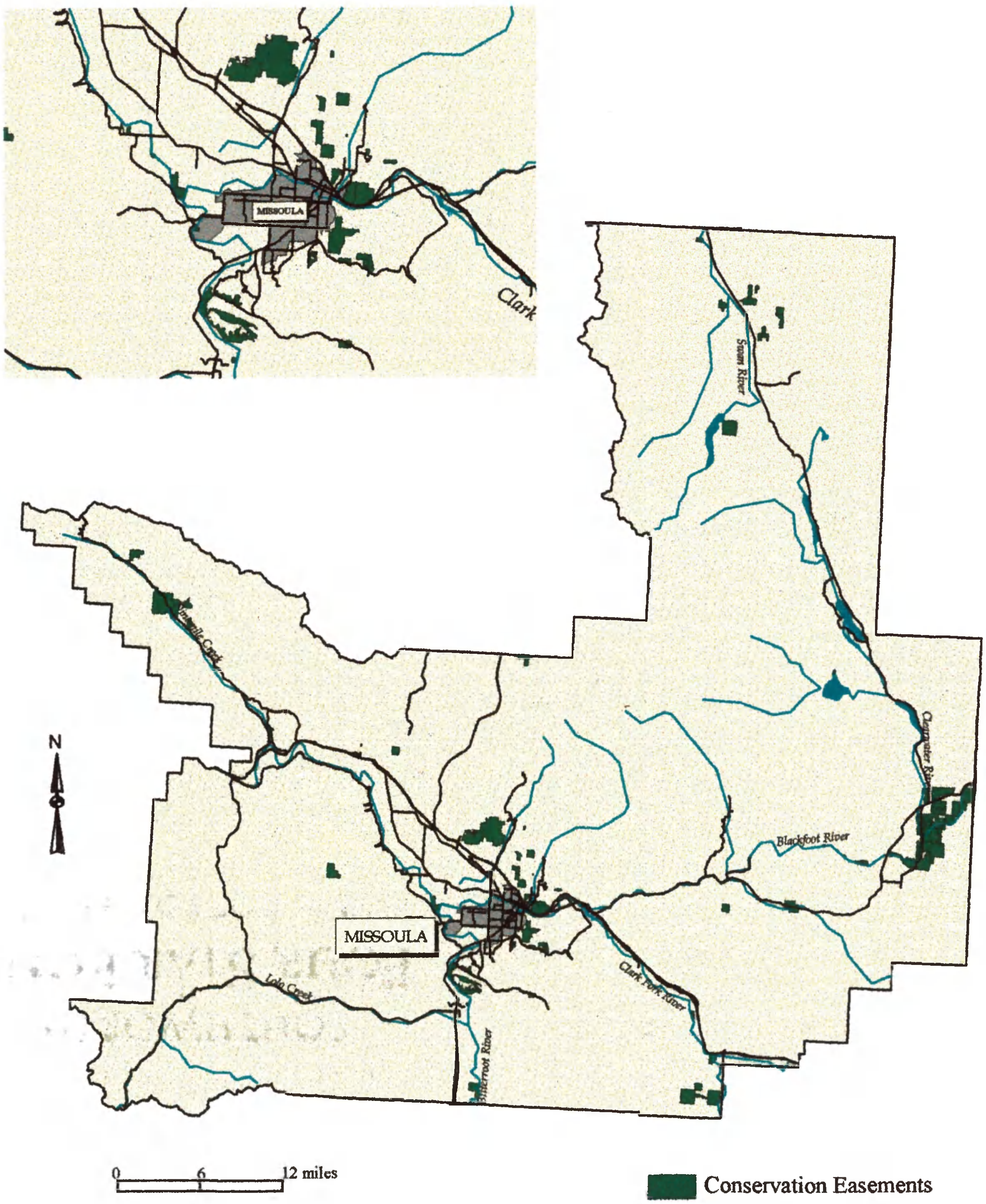
The initial step in building the database was to identify properties located adjacent to conservation easements. This was facilitated by the use of digital maps provided by the *Missoula County Office of Planning and Grants*. One of the digital maps included the conservation easements located in Missoula County and another contained data on all the parcels of land in the County. The conservation easement map simply contained the size, shape and location of each easement. The parcel data included information on acreage, tax assessments, address, and the legal description for each individual property in the County. The maps were provided as Arc View shape files. The conservation easement file was overlaid onto the parcel map using Arc View GIS 3.2 and the adjacent parcels were selected and converted into a separate shape file. The database for the adjacent parcels was then exported from Arc View GIS 3.2 into a Microsoft Excel spreadsheet.

The 116 conservation easement properties located in the County were used to identify a total of 904 adjacent parcels, a total of 433 were residential properties.

Once the adjacent parcels were identified, the next step was to determine the date that each of the conservation easements was established and to match it with the corresponding adjacent properties. This was particularly important, since an adjacent home sale would only be useful for this analysis if the home had sold subsequent to the establishment of the conservation easement. The conservation easements used for this research were established between February 28, 1973 and December 31, 1998. These dates were then added to the adjacent parcel database so that they corresponded with the correct properties. Conservation easements created subsequent to December 31,1998, were not included in the analysis. Map 3.1 shows the location of conservation easements in Missoula County.

The sales data for homes adjacent to conservation easements was also gathered from the *Missoula County Association of Realtors* (*MCAR*). A total of 40 residential home sales were identified as being adjacent to easements. These transactions took place between January 1, 1998 and February 6, 2002. The address of the home and the date of an easement's establishment were the two elements used to identify adjacent home sales. Addresses are the primary means of locating home sales in both *MCAR's* electronic and paper databases. The final database totaled 1708 observations.

Map 3.1: Conservation Easements in Missoula County



Conservation Easements

Jerome M. Grebenc
Department of Geography
University of Montana

Data Provided by: Missoula Office of Planning and Grants and the Montana Natural Resource Information Service.

Analytical Procedure

The central feature of this study is the use of multiple regression analysis. The multiple regression will test for any significant effects that adjacency to a conservation easement may have on residential housing prices, while controlling for other housing characteristics. The statistical analysis software package SPSS is used to conduct the analysis. The expectation is that housing prices will be higher for residential property that is located adjacent to a conservation easement. Other housing characteristics used in the analysis include lot size, the presence of city sewer, the number of bedrooms, the number of bathrooms, the existence of a basement, the number of garage stalls, lot size, main floor square footage, the age of the home and the year the home sold. Adjacency to a conservation easement and the housing characteristics will be regressed against the market price for homes. The hedonic price equation will assign an implicit price to each attribute, which will be indicated by the regression coefficients (Beaton 1992, 441 and 450). The effect of each attribute on housing price will be then be identified by the coefficients.

Prior to conducting the regression analysis, a bi-variate analysis will be used to describe the relationship between housing price and the other independent variables using descriptive statistics. The descriptive statistics will provide a indication of whether or not the independent variables are related to housing price in a linear manner. The analysis will include two models, the first will be a simple linear regression model using only adjacency as a predictor of housing price. The second regression model will introduce all the housing attributes into the analysis. This will help to identify the effect of adjacency on housing price after controlling for the other housing attributes.

The strength of the relationship between housing price and each of the independent variables as measured by Pearson's correlation coefficient is examined with the results shown in the Appendix. The Appendix also includes a discussion about multi-collinearity and the potential for violations of the regression assumptions.

Variables

Residential Housing Price: Dependent Variable

The intent of this research is to determine the effect of open space on housing price. The unit of analysis for this research is residential homes and the dependent variable used in the regression analysis is the sale price of homes. These sales were as observed in the real estate transactions that took place in Missoula County, Montana, between January 1, 1998 and February 6, 2002.

Independent Housing Variables

Independent housing variables are used to explain and predict housing prices. The independent variables are grouped according to the following: whether the property was adjacent to a conservation easement, the physical characteristics of the properties, and the year the property sold. The adjacency variable is used as the sole explanatory variable in the simple regression model for the prediction of housing price. The second and more inclusive regression model uses adjacency, the physical characteristics of housing, and year of sale to predict housing price.

Adjacency Variable

Properties in the database have been categorized as to whether or not they are adjacent to a conservation easement. The variable created is dichotomous in nature; either a property is adjacent, or it is not. The adjacency variable has been dummy coded, so if a property is adjacent to a conservation easement it was assigned a value of one and if a property is not located adjacent to an easement it was assigned a value of zero.

Physical Variables

The physical attributes of residential housing can be some of the most important factors in determining housing prices. The physical characteristics considered in this research include the actual size of the lot, the presence of city sewer, the number of bedrooms, the number of bathrooms, the size of garage, presence of a basement, main floor square footage, and the approximate age of the home. No distinction is made between single-family homes, duplexes and condominiums, due to identification problems in the *Missoula County Association of Realtor's* database. To properly control for the effects of adjacency on housing value, the regression model must control for the other housing characteristics that can affect housing price. Physical characteristics can be used as a measure of housing quality for each housing unit in the database. By using these characteristics, housing quality is controlled for and the effects of adjacency on housing price can be identified.

Lot Size

The lot size for residential properties was acquired from the parcel data provided by the *Missoula County Office of Planning and Grants.* Lot size is presented as the actual acreage for each observation. It is expected that housing price will increase as the lot size increases.

Bedrooms, Bathrooms, Basement, Garage

The number of bedrooms and bathrooms associated with a home is representative of the number of people who are able to live in a particular residential structure. The price of a home is expected to increase as the number of bedrooms and bathrooms increase. The presence of a basement is another housing feature that usually commands a higher housing price. The basement variable is nominal in nature, either a home has a basement or it does not. This variable has been dummy coded for use in the regression analysis. If an observation had a basement, then it was assigned a value of one and if it did not, it is assigned a value of zero. Finally, the presence and size of a garage is also expected to increase the price of a home. The variable for garages measures whether there is no garage or if it is a single, double, or triple car garage.

Main Floor Square Footage

Main floor square footage is an important factor in determining a home's size, and is therefore closely associated with the number of bedrooms and bathrooms in a home. As the main floor square expands the larger the expected increase in housing price. In the *Missoula County Association of Realtor's (MCAR)* database, main floor square footage is an ordinal variable. A variable is ordinal in nature when it can only be ranked or ordered. Main floor square footage is divided into eight categories in the *MCAR* database: under 799 square feet, 800 to 999 square feet, 1000 to 1249 square feet, 1250 to 1499 square feet, 1500 to 1749 square feet, 1750 to 1999 square feet, 2000 to 2499 square feet, and over 2500 square feet. For the purposes of the regression analysis, each category of main floor square footage was transformed into a dummy variable through coding. For instance, all of the homes with a square footage less than 799 square feet were assigned a one and the remainder a zero. All of the categories of main square footage were transformed into dummy variables using this method. The largest main floor square footage category, over 2500 square feet, will be the reference variable. The largest main floor square footage likely commands the highest housing price. The remaining main floor square footage dummy variables represent smaller homes which are expected to have lower values and therefore each is expected to have a larger negative coefficient as main floor square footage decreases.

City Sewer

Distance to a hub city or town is generally expected to influence the price of housing, in this case, distance to the City of Missoula. In lieu of distance, the influence of Missoula is measured by whether or not a home has city sewer service. First, the presence of city sewer service is an indication of whether a residential property is located within the city limits of Missoula. Second, the presence of city sewer is indicative of the infrastructure and services associated with a home. One would expect that a home with city sewer service would have higher standard roads, street lighting and higher quality services such as fire and police protection. It is expected that housing price will increase if a home has city sewer service. The variable created is dichotomous; and either a property has sewer service or it does not. As with the basements, this variable has been dummy coded for use in the regression analysis. If a property has sewer service it was assigned a value of one and if it did not it was assigned a value of zero.

Approximate Age

The newer a home is, the higher one would expect the price it would command. Similarly, older homes generally cost more to maintain, and therefore they are expected to have a lower housing price. However, older homes that may also be subject to gentrification, and therefore may be more expensive than newer homes (Kennedy and Leonard 2001, 14). Gentrification is the process by which deteriorated residential property is restored and upgraded by middle-class or affluent individuals (Kennedy and Leonard 2001, 1). It is expected that coefficient for the approximate age would become progressively negative as the age of a home increases, but factors such as gentrification may make it more difficult to anticipate the coefficient for this variable. Age is an ordinal variable in the *Missoula County Association of Realtor's* database. The categories for age of housing are: new and never occupied, less than 5 years, 5 to 10 years, 10 to 20 years, 20 to 35 years, 35 to 50 years and 50 years or older. For the purposes of the regression analysis, each housing age category was also transformed into a dummy variable through coding. Just as was done with the main floor square footage dummy variables, one dummy variable from age category must be left out of the analysis to avoid multi-collinearity. The reference variable in this case is for homes new or never occupied.

Time-Period Variable

Year Sold

The year that each residential property sold was determined by the closing date indicated in the *Missoula County Association of Realtor's* database. Housing prices are expected to increase over time and therefore the year of sale is included as a variable in the analysis. This variable is expected to control for the effects in the variation of mortgage rates and for inflation. The time frame utilized in the analysis is 1998 to 2002.

Summary

The database used for this research included home sales in Missoula County. The data included housing characteristics and sales prices. The distinction between the homes in the database is whether or not they are adjacent to a conservation easement. The intent of this analysis is to predict the dependent variable, housing price, by the utilizing the independent variable adjacency. Housing attributes are included in the analysis in order to control for the effects of the physical and time-period variables.

CHAPTER IV

FINDINGS OF ANALYSIS

This research tests for the effect of adjacency to conservation easements on housing prices. The methodology utilized in this study is the hedonic price equation, which assigns an implicit price to each housing attribute by regressing the variables representing each attribute of a homes' selling price (Beaton, 1992, 441). Therefore, housing attributes representing the physical characteristics and time-period are included in the equation. It is expected that residential properties adjacent to conservation easements will have higher sales prices than comparable properties not located adjacent to conservation easements.

This chapter will examine the findings of both descriptive statistics and several regression analyses. The first section discusses the dependent variable, housing price, and each of the independent variables in terms of central tendency and variability using descriptive statistics such as the mean and the standard deviation. The second section examines the results of two regression models that are used to test the hypothesis that adjacency to a conservation easement effects the value of residential properties. The first model is relatively simple, using only adjacency as a predictor of housing price. The second model is a multiple regression model that includes the adjacency variable and the physical and time-period characteristics as controls. The addition of the control variables will better explain the effects of adjacency on housing price.

Prior to conducting the regression analysis, Pearson's Correlation coefficient was used to measure the strength of the relationship between the dependent variable and the independent variables. Additionally, the correlation between the independent variables was examined to determine if any of them were correlated enough to be treated as identical variables. The significant results from the correlation matrix can be found in the Appendix. The results of a post regression analysis, including testing for multi-collinearity and testing for violations of the regression assumptions, are also described in the Appendix.

Descriptive Statistics

The descriptive statistics describe the relationship between each independent variable and the dependent variable without controlling for the influence of the other independent variables. They will provide a glimpse of the bi-variate relationship between the dependent variable, housing price, and each independent variable. The descriptive statistics included in the analysis are the mean as a measure of central tendency, and the standard deviation as a measure of variability amongst the variables. The minimum and maximum and the number of observations are also included.

Housing Price and Adjacency

The mean housing price for homes adjacent to conservation easements that sold between 1998 and 2002 is $213,241. The mean housing price for all non-adjacent homes sold between 1998 and 2002 in Missoula County, exclusive of downtown Missoula, is $155,182. Table 4.1 displays the price range for homes adjacent and non-adjacent. This provides some support for the hypothesis that adjacency to a conservation easement increases mean housing values.

Table 4.1 Housing Price by Adjacency

Adjacency	Mean	Minimum	Maximum	Standard Deviation	N Size
Adjacent	$213,241	$45,000	$475,000	$89,485	40
Non-Adjacent	$155,182	$40,000	$497,000	$64,496	1668
Missing					0

Housing Prices and the Physical, Time-Period Characteristics

The following series of tables display the mean and other descriptive statistics for the dependent variable, housing price, based upon the independent variables of physical attributes and time-period. The descriptive statistics for each variable give an indication of how much housing price will vary for each attribute.

Housing Price and Physical Characteristics

The physical characteristics of housing stock can be utilized to determine the quality of a residential unit and thus, housing price. Table 4.2 displays the price of housing, based upon the following physical attributes: lot size, presence of sewer, number of bedrooms, number of bathrooms, size of garage, and the presence of a basement. The mean, minimum, maximum, standard deviation and number of observations are displayed for each attribute. The physical attributes of main floor square footage and approximate age are displayed in later tables. Lot size is a continuous variable, which takes on a large number of values, so for the ease of display lot sizes have been grouped as ordinal categories and the corresponding descriptive statistics are shown in Table 4.2.

Mean housing prices increase as lot size increases, until the lot size reaches 9.99 acres in size. Then there is a decrease in housing price for the categories 10.00 to 19.99

acres and 20+ acres. Homes without city sewer service have a higher mean housing price than homes with city sewer service. As discussed in the Appendix, the correlation coefficient for the two variables is moderately negative, indicating that the larger the lot size the less likely the availability of city sewer and the more expensive the home. This may indicate that households are willing to make a tradeoff between open space and proximity to city services. With regards to the city sewer variable, one must note that there are 723 observations missing any information on city sewer service. The observations missing data will be removed from the regression analysis, therefore there will only be 985 observations utilized in the analysis.

As the number of bedrooms increases, so does mean housing price. The same holds true for the number of bathrooms; as their number increases, so does mean housing price. Also, the larger the number of garage stalls associated with a home, the higher the mean housing price. Finally, the presence of a basement also increases the mean housing price.

Main floor square footage is an indication of the size of a home and therefore the potential number of bedrooms and bathrooms. One could argue that main square footage is a redundant variable, because it does reflect the number of bedrooms and bathrooms, but as will be shown in the Appendix, the correlation coefficients do not bear this out. Table 4.3 displays each category of main floor square footage and the corresponding housing price. The descriptive statistics in Table 4.3 show that as main floor square footage increases, so does the mean housing price.

Table 4.2 Housing Price by Lot Size, Sewer, Bedrooms, Bathrooms, Garage & Basement

Housing Prices by Physical Characteristics	Mean	Minimum	Maximum	Standard Deviation	N Size
Lot Size					
Less Than .49 Acres	$141,025	$40,000	$450,000	$50,345	1110
.50 to .99 Acres	$170,662	$47,500	$495,000	$71,606	156
1.00 to 2.99 Acres	$180,312	$42,900	$475,000	$74,948	249
3.00 to 5.99 Acres	$203,737	$47,500	$497,000	$89,532	109
6.00 to 9.99 Acres	$237,298	$125,000	$464,864	$97,092	26
10.00 to 19.99 Acres	$195,971	$55,500	$360,875	$80,822	45
20 Acres or Greater	$181,818	$100,000	$325,000	$75,747	11
Missing					0
City Sewer					
Yes	$152,203	$42,500	$390,000	$54,003	733
No	$158,610	$42,900	$475,000	$74,673	252
Missing					723
Number of Bedrooms					
One	$106,600	$45,000	$229,900	$43,653	44
Two	$125,092	$40,000	$418,000	$49,993	324
Three	$149,885	$42,200	$450,000	$54,308	848
Four	$184,941	$54,000	$497,000	$71,361	379
Five	$228,891	$111,000	$430,000	$76,139	91
Six or More	$249,293	$137,000	$450,000	$81,234	15
Missing					7
Number of Bathrooms					
One	$103,939	$40,000	$275,000	$33,639	317
One and a half	$126,538	$58,575	$348,000	$43,743	56
Two	$147,245	$41,500	$450,000	$49,631	772
Two and a half	$184,414	$92,000	$418,000	$67,785	126
Three	$199,283	$108,000	$475,000	$62,220	376
More than Three	$270,059	$158,000	$497,000	$83,444	53
Missing					8
Number of Garage Stalls					
None	$105,241	$40,000	$315,000	$46,917	171
One	$116,732	$45,000	$318,900	$30,854	300
Two	$163,680	$42,200	$497,000	$57,380	1072
Three or More	$238,295	$84,000	$495,000	$84,313	159
Missing					6
Basement					
Yes	$165,636	$42,200	$495,000	$63,759	1257
No	$131,384	$40,000	$497,000	$65,073	443
Missing					8

Table 4.3 Housing Price by Main Floor Square Footage

Main Floor Square Footage	Mean	Minimum	Maximum	Standard Deviation	N Size
Less Than 799'	$100,255	$42,900	$310,000	$52,019	62
800' to 999'	$106,399	$40,000	$275,000	$33,522	178
1000' to 1249'	$124,186	$42,500	$268,000	$29,479	461
1250' to 1449'	$146,733	$42,200	$325,000	$39,839	370
1500' to 1749'	$174,407	$75,000	$325,000	$45,426	259
1750' to 1999'	$202,589	$62,500	$380,000	$58,643	152
2000' to 2499'	$228,023	$116,500	$495,000	$74,233	137
Over 2500'	$279,634	$87,000	$497,000	$94,225	83
Missing					6

The approximate age of the home affects housing price. This may be due to the fact that as a home ages it generally requires more maintenance and may also be reduced in quality. Table 4.4 displays housing price based upon age categories.

Table 4.4 Housing Price by Approximate Age

Approximate Age	Mean	Minimum	Maximum	Standard Deviation	N Size
New, Never Occupied	$183,435	$122,533	$301,000	$48,731	28
Under 5 Years	$183,292	$44,000	$495,000	$67,747	294
6 to 10 Years	$185,101	$65,000	$475,000	$66,497	225
11 to 20 Years	$152,707	$47,500	$450,000	$71,607	296
21 to 35 Years	$141,030	$40,000	$497,000	$56,340	518
36 to 50 Years	$134,297	$45,000	$330,000	$51,408	139
51 Years or Older	$118,441	$42,500	$305,000	$52,943	66
Missing					142

The relationship of housing price to the age of a home is not as apparent as it was with the other physical attributes of housing. The highest mean housing price is in the category of homes 6 to 10 years old, followed by new or never occupied homes, then homes under 5 years of age. Price continues to decrease for homes 11 to 20 years of age, 21 to 35 years of age, and then homes 36 to 50 years of age. The age category with the lowest mean housing price was for homes 51 years or older.

Housing Price and the Year of Sale Characteristic

The time-period variable indicates the year a home was sold, but more importantly it is an indication of appreciation in home value and also accounts for inflation. Table 4.5 displays housing prices by the year of sale. The relationship of housing price by year of sale is very evident. For the time period from 1998 to 2002, each year shows an increase in mean housing price of approximately $10,000.

Table 4.5 Housing Price by Year of Sale

Year of Sale	Mean	Minimum	Maximum	Standard Deviation	N Size
1998	$141,294	$40,000	$450,000	$55,749	399
1999	$150,939	$41,500	$450,000	$65,590	418
2000	$160,201	$42,200	$430,000	$63,370	410
2001	$170,553	$40,000	$497,000	$71,751	464
2002	$181,472	$60,000	$349,500	$82,228	17
Missing					0

This section used descriptive statistics to analyze differences in housing price based upon the independent variables. The next section will discuss how regression analysis is used to identify the implicit price of each independent variable that contributes to the total the price of housing.

Regression Analysis

Two regression models were used to test the effects of the adjacency variable, the housing attribute variables and the time-period variable on housing. The first model is a simple regression equation that utilizes only the dependent variable, housing price, and the independent variable of adjacency to a conservation easement. The second model is a multiple regression equation that regresses housing prices against adjacency, while controlling for the effects of the other housing attributes known to influence housing price. The equations for each regression model are shown below.

Regression Equations

1) Housing Price = f(adjacency)
2) Housing Price = f(adjacency, plus control variables: physical attributes and time-period)

Adjacency is measured by whether or not a residential property is located adjacent to a conservation easement. The control variables encompass the physical and time-period characteristics of housing. Physical characteristics include the following: lot size, city sewer service, the number of bedrooms, the number of bathrooms, the size of garage, the presence of a basement, the main floor square footage and approximate age. The time-period characteristic indicates the year of sale for each observation.

Analysis

The regression analysis results are displayed in Tables 4.6 and 4.7, which show the R-square, the constant, B-coefficient and the significance level for each variable. The R-square is an estimate of how well a model fits the data. This statistic is the square of the correlation coefficient between housing price and independent variable. The R-square is expressed as a proportion and indicates the variability in the housing price that is explained by the independent variables. The constant indicates the point at which the regression line intercepts the y-axis. This point can be interpreted as the value of the dependent variable on the y-axis, when all the independent variables have a value of zero on the x-axis. The B-coefficient predicts the change in the value of the dependent variable when there is an increase or decrease in one unit of an independent variable, when the value of all other independent variables is held constant. A positive coefficient indicates that the predicted value of the dependent variable will increase by one unit when the independent variable increases by one unit. Conversely, a negative coefficient indicates that the value of the dependent variable will decrease when the value of the independent variable increases by one unit. The significance level is the likelihood that the relationship between the dependent variable and independent variable is due to chance. Significance levels are expressed as proportions. A .05 level of significance indicates that there is only a 5 percent probability that the relationship between the dependent and independent variables is due to chance. If an independent variable is found to be significant at the .05 level, then it could be considered a predictor of the dependent variable and thus the null hypothesis that the variable has no effect can be rejected. This is also true for significance levels of .01 and .001. This research tests the relationship between the variables at the significance levels of .001, .01 and .05.

The first model is a simple regression model that displays the effects of adjacency to a conservation easement on housing price. Table 4.6 shows the results of the first model. It is expected that the coefficient for adjacency will be positive at a significant level, indicating that adjacency to a conservation easement will increase housing price. The results of the first model confirm this expectation, the coefficient for adjacency is positive at the .001 level. The B-coefficient estimates that the price for housing adjacent to a conservation easement is $58,059 higher than housing that is not adjacent. The R-square for this model is .018, suggesting that only 1.8 percent of the variability in housing price can be explained by adjacency to a conservation easement, without the consideration of other variables that affect housing price. Adjacency alone is a poor predictor of housing price, therefore it is necessary to use a more inclusive model.

Table 4.6 The Effects of Adjacency on Housing Price

First Model		
Constant	155,182	
Coefficient for Adjacency	58,059	***
R-Square	.018	

***=Significant at .001 level, **=Significant at .01 level, *=Significant at .05 level

The second model takes into consideration the variables most likely to influence housing price. This model will test the relationship between adjacency and housing price, after controlling for the other variables that are important predictors of housing price. The first model was mis-specified because it excluded these other important predictors; the second and final model attempts to eliminate bias by including them. The results of the model are displayed in Table 4.7. The R-square for the model is .660, thus, it explains approximately 66 percent of the variability in housing price. The model fits the data moderately well.

Adjacency to conservation easements has remained statistically significant at the .001 level and has a positive coefficient of $25,968. This is the implicit price and indicates that the price of a home increases by $25,968 if it is adjacent to a conservation easement. This result is impressive considering the small number of adjacent parcels in the data.

Table 4.7 The Effects of Adjacency and Control Variables on Housing Price

Second Model	Complete Model	Coefficient	Sig.
Constant		137,423	
Adjacency to Conservation Easements			
	Adjacency	25,968	***
Physical Characteristics			
	Lot Size	2,338	***
	City Sewer	-406	
	Bedrooms	2,807	
	Bathrooms	15,125	***
	Garage	10,830	***
	Basement	18,492	***
	Main Floor Square Footage (1)		
	Less than 799'	-105,235	***
	800' to 999'	-103,364	***
	1000' to 1249'	-99,734	***
	1250' to 1449'	-99,241	***
	1500' to 1749'	-76,411	***
	1750' to 1999'	-49,473	***
	2000' to 2499'	-41,446	***
	Approximate Age (2)		
	Under 5 Years	19,394	
	6 to 10 Years	18,198	
	11 to 20 Years	3,154	
	21 to 35 Years	-7,384	
	36 to 50 Years	-6,677	
	51 Years or Older	1,810	
Time Period Variable	Year Sold	7,870	***
R-Square		.66	
N Size		1708	

***=Significant at .001 level, **=Significant at .01 level, *=Significant at .05 level
Dependent Variable: Housing Price
Dummy-Coded Variables:
1) Based on comparison to main floor square footage of 2500' or greater
2) Based on comparison to new or never occupied homes

Most of the variables representing the physical attributes of housing had a significant effect upon the price of housing, including lot size, number of bathrooms, the size of garage, all categories of main floor square footage and the presence of a basement. The notable exceptions were all age categories, presence of City sewer service and the number of bedrooms, none of which were statistically significant.

The physical attributes of housing including lot size, number of bathrooms, size of garage and presence of a basement are all statistically significant predictors of housing price at the .001 level. Of these variables, the presence of a basement had the largest positive coefficient, which means that the presence of a basement increases the price of a house by $18,492; more than any other variable in the model. The next highest coefficient is for the number of bathrooms, with the implicit price for an additional bathroom being $15,125. The size of a garage increases housing price by $10,830 for every additional garage stall, and housing price increases by $2,338 for every additional acre of land associated with a home.

Interestingly, the number of bedrooms was not statistically significant at any of the alpha levels. Most other empirical research on the cost of housing indicates that bedrooms are a significant determinant of housing price. As mentioned earlier, 723 observations are missing any information on city sewer service, and therefore were removed from the regression analysis. The removal of these observations appears to have affected the statistical significance of the bedroom variable in the analysis. At the suggestion of my thesis committee, a third model that excluded the city sewer variable was analyzed. The results of this model found that bedrooms were a significant determinant of housing price at the .01 level, with a coefficient of 3,728. The complete results of that analysis are found in the Appendix.

As mentioned earlier, if one examines the correlation coefficient for bedrooms and bathrooms it is .557 and is significant at the .01 level. This would generally raise some concern about multi-collinearity between the two variables, but a tolerance statistic of .615 for bedrooms suggests that it is not a problem.

None of the categories of housing age were found to be statistically significant at any alpha level. Each category of the age variable was coded as a dummy variable, with all categories referenced to the youngest housing category, new or never occupied, which was considered the most expensive type of housing. Each age category was expected to have a negative coefficient, indicating that housing prices are lower when referenced to the youngest age category. Several categories had positive coefficients contrary to the expectation. Those categories were one day to 5 years, 6 to 10 years, 11 to 20 years and older than 51 years. This study would indicate that there is no evidence that older homes necessarily have lower housing prices, particularly when the category of older than 51 years had a positive coefficient when compared to the youngest housing category. As mentioned earlier, older homes can be subject to gentrification and increase in value as they are improved and maintained.

All categories of main floor square footage were found to be statistically significant, all at the .001 level. The main floor square footage variable is coded as dummy variables and all are referenced to the largest square footage of greater than 2500 square feet, which is likely the most expensive type of housing. All categories of main floor square footage were expected to have a negative coefficient, indicating that housing prices are lower as main floor square footage decreases. The results of the analysis bear this out. All of the categories did indeed have negative coefficients. The smallest main floor square footage category, less than 799 square feet, had the largest negative coefficient of $105,235, indicating that homes with under 800 square feet of main floor living space would cost $105,235 less than homes with more than 2500 square feet of main floor space. The smallest negative coefficient found for this variable was $41,446, for the square foot category of the 2000 to 2449 square feet, which would be expected since it is the second largest category of square footage.

The time-period variable was found to be statistically significant at the .001 level. The period of sales was from 1998 to early 2002. The year of sale variable had a positive coefficient of $7,870, indicating that for the passage of every year the value of comparable housing increased by $7,870. This coefficient could be considered an indication of housing price appreciation and inflation per year.

Adjacency and Property Values

Two regression models have been used to test for the effects of adjacency to a conservation easement on housing price. The first model only considered adjacency to a conservation easement. The second model included adjacency, the physical housing attributes and the time-period characteristics. Both models analyzed the extent to which adjacency of residential properties to a conservation easement resulted in higher housing prices, and in both models, adjacency significantly increased housing price. The first model explained approximately 1.8 percent of the variability in housing price, using only adjacency to explain housing price. This is model was mis-specified because many of the important determinants of housing price were ignored. The second model explained approximately 66 percent of the variability in housing price and fit the data moderately well. Adjacency was identified as a significant factor in explaining housing price, when the other housing attributes were controlled for. Housing characteristics, such the size of lot, number of bathrooms, the size of garage, the presence of a basement, main floor square footage, and year of sale are important variables in predicting housing price. The evidence generated by the regression analysis supports the research hypothesis, which states; people value open space and are willing to pay higher real estate prices to live next to it.

CHAPTER V

SUMMARY AND CONCLUSION

The goal of the research presented in this thesis was to examine the effect of adjacency to conservation easements on housing prices, using Missoula County, Montana as the study area. Housing sales from Missoula County for the time period 1998 to 2002 were studied. Descriptive statistics and regression analysis were used to determine the influence of adjacency on housing price. Residential properties adjacent to conservation easements were expected to have higher housing prices than residential properties not adjacent to conservation easements. Two regression analyses were conducted to test for the effect of adjacency on housing price. Along with adjacency, the final regression analysis included numerous housing attributes as controls. The analysis confirmed the expectation of the study. As predicted, housing prices were higher for residential properties adjacent to conservation easements. As expected, several of the housing attributes were also found to significantly influence housing prices.

Limitations of the Research

Every study has limitations and this one is no exception. The research examined home sales for the time period 1998 to 2002. In that time only 40 of the 433 residential parcels identified as adjacent to conservation easements were sold. In contrast, the same period saw over 1600 home sales within the County, excluding the downtown area of the City of Missoula. Additionally, most of the conservation easements located within

Missoula County were created in the mid- to late- 1990's. Although most of the conservation easements in the County have been in existence for a relatively short period of time, the real estate market has already shown a measurable increase in the price of homes adjacent to conservation easements. The small time period between the creation of the most of the easements and this study has actually left little time for the turnover of residential properties. Ideally, this research would have had a much larger number of observations from adjacent properties, but that will only occur over time. Further research at a later date, when more of the adjacent parcels may have sold, will be necessary to verify the findings of this study.

Conservation easements were the only type of open space examined in this study, but Missoula County contains other types of open space. As with most of the counties located in the western United States, Missoula County contains large amounts of federal- and state-owned lands. These ownerships typically manage land for purposes other than residential development; therefore, they tend to remain in open space. For example, lands managed by the United States Forest Service are typically managed for uses such as recreation, wildlife habitat, or timber management, unless designated as wilderness. Because these types of lands will generally remain in open space, they may also affect the price of housing that is in close proximity. Research to determine the effect of public lands on housing prices would be valuable in better understanding the effects of open space on housing price. Due to the scale of such an undertaking, this researcher did not consider examining the effects of publicly owned lands on housing price.

Publicly owned lands are likely not the only amenities that attract homebuyers. The rivers, streams and lakes in Missoula County provide additional open space and recreational opportunities for residents of the County. As was indicated in the literature review, proximity to water bodies or a view of water bodies can affect housing prices. Any further research into the pecuniary effect of open space in the County may also consider the affect of rivers, lakes and streams on the value of homes in close proximity.

Practical Implications of the Research

As this research has shown, open space, in the form of conservation easements, has a positive impact on adjacent real estate values. Higher real estate prices will eventually translate into higher property tax revenues. Property taxes in the state of Montana are calculated by multiplying the market value of the property by the taxable value of the type of property (agricultural, commercial or residential) and then by the mill levy for the specific taxing district (Montana Department of Revenue 2002). Market value is defined by the Department of Revenue as the value at which the property changes hands between a willing buyer and a willing seller. Thus, any positive effect on housing values by adjacent open space would be taken into consideration by State property tax assessments. Under the tax assessment system used by the State of Montana, statewide property tax reappraisals do not occur on regular intervals (Montana Department of Revenue 2002). The last reappraisal was completed in 1997, and property tax increases were phased in over a four-year period (Montana Department of Revenue 2002). The next appraisal cycle is scheduled for completion in 2003 (Montana Department of Revenue 2002). Therefore, any positive effect upon property values by open space would take some time to appear as higher property tax revenues. The City of Missoula instituted an open space conservation program in 1995, with the approval of a $5 million dollar bond (Missoula Measures 1999). Higher property tax revenues could be used to augment or offset the bond used for the City of Missoula's open space program, or to expand the program to include the entire County.

This research may be important for local government policy-making, but could also impact professional real estate appraisers. Real estate appraisers rely upon statistical methods to properly determine the value of real estate (Appraisal Institute 2000, 17). In most cases sales data or tax assessments are utilized in the analysis. While this research is not a substitute for the individual analysis of properties for appraisal purposes, it should provide better insight into how open space can affect adjacent property values and allow real estate appraisers to better tailor their analysis to specific properties.

Although local governments may welcome the pecuniary benefits of open space, especially the potential increase in property tax revenues, land trusts may find that these monetary impacts make their missions more difficult. The establishment of a conservation easement generally requires funds to purchase it. Occasionally, a landowner will donate his or her development rights to create a conservation easement, but more often than not a land trust or government entity must purchase them. Government entities use funds generated by tax revenues, while land trusts depend on private funding sources, such as donations and grants, which do not necessarily increase with land values as property taxes do. Increased values for properties adjacent to conservation easements may make it more expensive for land trusts to protect large tracts of land. For example, if a land trust purchases an easement on one parcel, the value of the adjacent parcels, and therefore the cost of any subsequent easement they might wish to purchase, increases. Land trusts frequently attempt to protect multiple and adjacent properties with conservation values, such as wildlife migration corridors or big game winter range. If conservation easements and other types of open space result in higher property values for adjacent parcels, this may financially preclude land trusts from protecting contiguous properties (Rasmussen 2002). Land trusts typically have the financial resources to acquire development rights for only one property at a time. If, over time, open space increases the value of contiguous properties identified as having important conservation values, the purchase of the development rights for those lands may become cost prohibitive for the trusts (Rasmussen 2002). This fact may provide trusts with further incentive to negotiate the option to purchase properties that are identified as having important conservation values before they are affected by adjacent conservation easements.

The problem would likely apply to local and state governments attempting to protect open space as well. This concern over increased property values points out that it would be in the interest of land trusts, governmental entities and other conservation organizations to work cooperatively on mechanisms to address this potentially negative effect of open space. Perhaps local and state governments, with the support of land trusts and the public could provide increased tax benefits or other incentives for property owners to place their lands in conservation easements at a cost below that commanded in the market. Nevertheless, this will be a complex and challenging issue to address and the information provided by this and similar research will enable both private and public entities to better prepare financially and administratively for any future increase in the monetary value of critical open spaces.

Open space is an amenity that is valued by everyone. Open space provides benefits including appealing views, room for individuals to recreate, and wildlife habitat that enhance the quality of life for all individuals having access to it. The mere fact that a municipality such as Missoula, Montana provides for parks in the midst of millions of acres of publicly owned National Forest lands attests to the importance of open space to the public. This research has found that open space in the form of conservation easements positively affects property values. This means that people value open space enough to pay higher real estate prices to increase their consumption of it. However, there may be a hidden danger associated with this increase in property values.

Access to open space could be limited to those individuals who are willing or financially able to purchase access to it. This may be exacerbated in communities where population pressures increase the demand for housing. A good example of this situation is Boulder, Colorado. Boulder has a very successful open space protection program, but it also has some of the highest real estate prices in the state of Colorado (Lerner 1999, 12-13). The high real estate prices in Boulder are partially attributable to the open space amenity available to homeowners (Correll, Lillydahl and Singell 1978, 213). Higher property values, such as those found in Boulder are likely to exclude individuals in lower income brackets. Thus, access to open space may be limited to those individuals who can afford to reside in close proximity to it. Access needs to be an essential part of open space planning, so that every member of the public can enjoy the benefits of public open space, not just the select few that can afford it.

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APPENDIX

Correlation Coefficients

Prior to conducting the regression analysis, it is important to understand the strength of the relationship between the dependent variable, housing price, and the independent variables. The bi-variate measure, Pearson's Correlation coefficient is used in this case to measure the strength of the relationship between the dependent variable and each of the independent variables. In this case we are expecting that adjacency will be correlated with housing price. In addition, this test will enable the research to determine if any of the independent variables are highly correlated with one another and should be treated as identical variables. Pearson's correlation coefficient determines if variables are correlated in a linear manner. The statistic utilizes a range of measure from –1 to +1, with –1 a perfect negative correlation relationship and +1 a perfect positive correlation.

The correlation coefficient between adjacency to a conservation easement and housing price is .134 and is significant at the .01 level, but the strength of the relationship is very low. The correlation of the other independent variables to housing price was moderate to low. For example, only four of the physical attributes had a coefficient exceeding .400. These coefficients were significant at the .01 level and are as follows: number of bedrooms, .428; number of bathrooms, .570; number of garages, .494; and main square footage over 2500 square feet, .412. None of the independent variables exhibited a high correlation with one another. Again, in only four instances did the independent variables have correlation coefficients higher than .400. The correlation between city sewer and lot size was -.605, indicating a moderate negative relationship. This suggests that as lot size increases, the less likely a home is to have city sewer service. The presence of city sewer and presence of basement had a correlation of .428, which suggests that homes located in the City of Missoula are more likely to have basements. The number of bathrooms and number of bedrooms had a correlation of .555, implying that as the number of bathrooms increases so would the number of bedrooms. The final correlation coefficient that exceeded .400 was between the number of bathrooms and the size of garage, at .443. This correlation suggests that as the number of bathrooms in a home increases, the more likely that home is to have a garage.

All the coefficients were significant to the .01 level. These weak correlations suggest that all of the independent variables should be viewed as separate and independent variables in the regression models. Table 4.1 shows significant correlation coefficients, those that are greater than .400.

Table A.1 Significant Correlations for Selected Variables

Variable 1	Variable 2	Correlation Coefficient
Price	Number of Bedrooms	.428**
Price	Number of Bathrooms	.570**
Price	Garage	.494**
Price	Main Floor Square Footage over 2500 feet	.412**
City Sewer	Lot Size	-.605**
City Sewer	Basement	.428**
Number of Bathrooms	Number of Bedrooms	.555**
Number of Bathrooms	Garage	.443**

***=Significant at .001 level, **=Significant at .01 level, *=Significant at .05 level

Testing for Multi-collinearity

Most regression models utilizing more than one independent variable are affected, to a greater or lesser extent, by multi-collinearity (Ott, 1993, 591). Multi-collinearity is a situation in which the independent variables are themselves highly correlated with one another (Ott, 1993, 591). The final regression analysis included the tolerance statistic for each independent variable. Tolerance is used to determine the existence of multi-collinearity by measuring the strength of the linear relationship amongst the independent variables. "Tolerance is defined as the proportion of variability for a variable, that is not explained by its linear relationship with other independent variables in a regression model" (Norusis, 1998, 467). The values for tolerance range from 0 to 1, with values close to 1 indicating that a variable has little of its variability explained by any other variable in the model. Values close to 0 indicate that a variable is close to being a linear combination of some other independent variable (Norusis, 1998, 467). Multi-collinearity may be a problem in a regression model if the tolerance values are less than 0.1 (Norusis, 1998, 468).

Only four of the variables used in the multiple regression analysis exhibit the potential for multi-collinearity. All of them are dummy variables that represent different categories of housing age. The category of homes under 5 years of age had a tolerance statistic of .059; homes 6 to 10 years of age had a statistic of .076; homes 11 to 20 years of age had a statistic of .062; and homes 21 to 35 years of age had a statistic of .043. It appears that these four variables may be a linear combination of each other. As mentioned earlier, none of the dummy variables for housing age were found to be statistically significant in the analysis. Overall, the variability amongst the other independent variables appears to be unrelated and multi-collinearity does not appear to be a problem for them.

Checking Regression Assumptions

To ensure the integrity of the research, it is essential to examine the regression analysis to check for violations of the assumptions necessary for regression analysis. The assumptions necessary for linear regression include (Ott, 1998, 692):

- Variables have to be measured on a minimum of an ordinal scale.
- All of the observations in the database must be independent.
- The relationship between variables should be linear in nature.
- For every independent variable, the distribution of the values of the dependent variable must be normal.
- The variance of the distribution of the dependent variable must be the same for all the values of the independent variable.
- The relationship between the dependent variable and the independent variables has to be linear throughout the population.

The first two assumptions have been satisfied. All of the variables used in the analysis are either measured as interval data or have been dummy-coded for use in the regression analysis. Also all the observations are independent, because none of the residential properties examined in the analysis have been utilized more than once.

To determine if the other regression assumptions have been violated several types of plots are examined. These plots use the residuals from the regression analysis (Ott, 1998, 692). This research utilizes a histogram, and a Q-Q plot to check for violations of the regression assumptions. The residuals used in the plots are the difference between the observed value of the dependent variable and the value predicted for it by the regression line (Norusis, 1998 432). Studentized residuals account for variability from value to value, while studentized deleted residuals are the residuals for each case that were excluded from the regression analysis (Norusis, 1998, 490). If none of the regression assumptions have been violated, the distribution of the studentized residuals should be approximately normal (Norusis, 1998, 435). "Studentized residuals are used to check for violations of the regression assumptions, because they make it easier to spot unusual points" (Norusis, 1998, 490). Figure 4.1 is a histogram of the studentized deleted residuals, which appear to be symmetrical and to have only one peak, thus the assumption of normality appears to be true. The next plot used to check for violations of the regression assumptions is the Q-Q plot. In a Q-Q plot, if the data used in the analysis are from a normal distribution most of the points should fall along a straight line (Ott, 1998, 698-700).

Figure A.1 Histogram

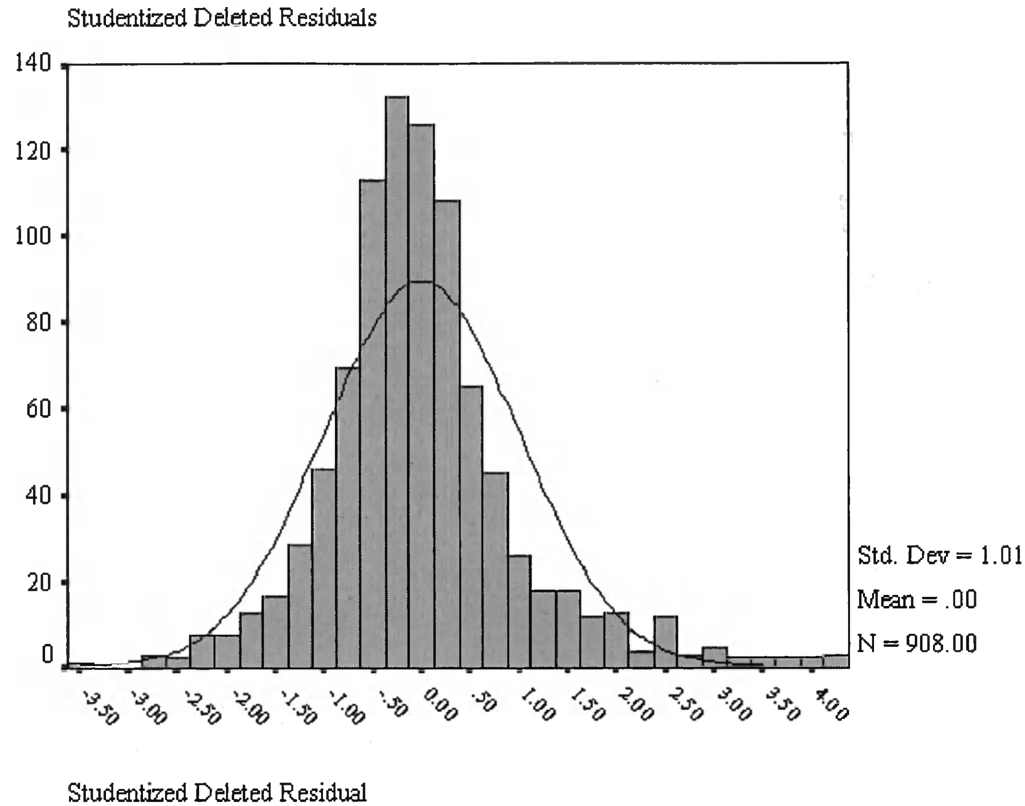
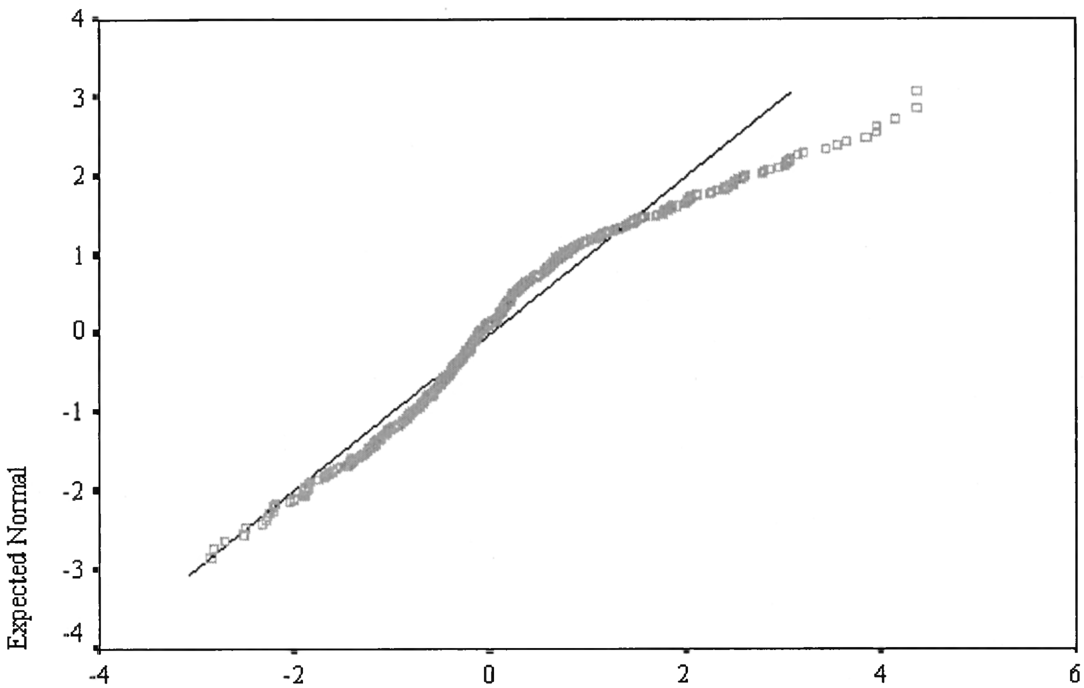


Figure 4.2 shows the Q-Q plot for the studentized deleted residuals. A majority of the points do fall along the line, but a number of them fall away from the line as the observed value of the dependent variable increases. While this reflects that the data is not perfectly normal, there also appear to be no major violations of the regression assumptions. None of the plots examined in the Appendix has identified any serious violations of the regression assumptions thus the linear regression model utilized in the research appears to be sound.

Figure A.2 Normal Q-Q Plot

Studentized Deleted Residual



Observed Value

Regression Analysis Excluding the City Sewer Variable

Table A.2 The Effects of Adjacency and Control Variables on Housing Price

Second Model	Complete Model	Coefficient	Sig.
Constant		135,241	
Adjacency to Conservation Easements			
	Adjacency	20,154	**
Physical Characteristics			
	Lot Size	3,700	***
	Bedrooms	3,728	**
	Bathrooms	16,496	***
	Garage	16,195	***
	Basement	17,399	***
	Main Floor Square Footage (1)		
	Less than 799’	-117,518	***
	800’ to 999’	-116,563	***
	1000’ to 1249’	-113,272	***
	1250’ to 1449’	-107,650	***
	1500’ to 1749’	-87,950	***
	1750’ to 1999’	-68,355	***
	2000’ to 2499’	-48,556	***
	Approximate Age (2)		
	Under 5 Years	10,790	
	6 to 10 Years	10,186	
	11 to 20 Years	3,758	
	21 to 35 Years	-6,018	
	36 to 50 Years	-1,993	
	51 Years or Older	5,569	
Time Period Variable	Year Sold	8,028	***
R-Square		.64	
N Size		1708	

***=Significant at .001 level, **=Significant at .01 level, *=Significant at .05 level
Dependent Variable: Housing Price
Dummy-Coded Variables:

1) Based on comparison to main floor square footage of 2500’ or greater
2) Based on comparison to new or never occupied homes

Conservation Easements Located in Missoula County 1973-1998

Location	Grantor	Grantee	Date Established	Acreage
Mt. Sentinel	Walter Cox	City of Missoula	12/16/82	501.00
Sawmill Gulch	Eldon Castor	National Wildlife Federation	11/30/83	20.00
Lower Grant Creek	Grant Creek Associates	National Wildlife Federation	12/31/84	1543.33
North Hills	N/A	National Wildlife Federation	12/23/86	77.64
Linda Vista & Bitterroot River	Western MT Retriever Club	Missoula County	11/01/89	7.39
Grant Creek	Horizon Enterprises	Five Valleys Land Trust	12/28/90	21.04
Grant Creek	Horizon Enterprises	Five Valleys Land Trust	12/28/90	2.06
Lolo Riverbottom Estates	Mike Turner	Missoula County	1/01/92	16.94
Waterworks Hill	Bill Randolph	Five Valleys Land Trust	12/21/92	160.00
Waterworks Hill	Bill Randolph	Five Valleys Land Trust	12/21/92	74.06
Pattee Canyon	Ron Erickson	Five Valleys Land Trust	12/30/93	45.00
Pattee Canyon	David Tawney	Five Valleys Land Trust	12/30/93	34.48
Pattee Canyon	David Tawney	Five Valleys Land Trust	12/30/93	40.00
Ninemile Prairie	William Sullivan	Nature Conservancy	01/01/76	6.44
Orchard Homes	David Maclay	Five Valleys River Park Association	02/28/73	4.86
Clinton	David Maclay	Five Valleys River Park Association	12/30/76	32.00
Clearwater Junction	Benedict Calvert	Nature Conservancy	12/13/77	341.70
Clearwater Junction	Land Lindbergh	Nature Conservancy	12/18/77	240.00
Ninemile Prairie	Thomas Collins	Nature Conservancy	12.28/77	21.26
Farviews	George Torp	Missoula County	07/12/78	63.87
Ninemile Prairie	William Davis	Nature Conservancy	12/27/79	63.57
Big Flat	Michael	Five Valleys Land	12/28/79	14.06

Location	Grantor	Grantee	Date Established	Acreage
	Heutmaker	Trust		
East Missoula	Jack Green	Five Valleys River Park Association	02/11/80	3.99
Deep Creek	Northwestern Union Trust	Missoula County	11/24/80	440.00
Swan Valley / Buck Creek	JM Kobayashi	Institute of the Rockies	12/31/80	79.25
Ninemile Prairie	Anne Lindbergh	Nature Conservancy	12/02/81	541.00
Clearwater Junction	Montana DNRC	Montana Department of Fish, Wildlife and Parks	01/01/82	320.00
Clearwater Junction	Montana DNRC	Montana Department of Fish, Wildlife and Parks	01/01/82	40.00
Clearwater Junction	Montana DNRC	Montana Department of Fish, Wildlife and Parks	01/01/82	535.00
Ninemile Prairie	Carlos Baranano	Nature Conservancy	12/16/82	23.18
Blackfoot River Valley	Land Lindbergh	Nature Conservancy	12/24/86	261.80
Blackfoot River Valley	Land Lindbergh	N/A	12/24/86	82.53
Swan Valley/Rumble Creek	David Berner	Nature Conservancy	12/08/87	114.55
Lindbergh Lake	Elizabeth Ortenberg	USDA Forest Service	08/01/89	637.76
Rock Creek & Clark Fork River	William Andrews	Montana Land Reliance	12/01/92	162.29
Blackfoot River by Bear Flat	Betty Dupont	Nature Conservancy	04/03/97	185.00
Swan Valley / Glacier Creek	Harold Haasch	Montana Land Reliance	08/06/93	160.00
Swan Valley	Mary Phillips	Montana Land Reliance	09/23/93	45.43
Frenchtown/Mill Creek	William Cunningham	Montana Land Reliance	11/04/94	160.00
Swan Valley / Condon	Edward Foss	Nature Conservancy	11/22/94	160.00
Duncan Drive	Eric Braun	Save Open Space	12/14/94	3.59
Swan Valley	Peter Guynn	Montana Land Reliance	12/20/94	40.00
Swan Valley	Al Cluck	Montana Land Reliance	12/20/94	22.02

Location	Grantor	Grantee	Date Established	Acreage
Waterworks Hill	Peggy Lee Peschel	Save Open Space	12/30/94	11.32
Ninemile Valley	Rosalie Qualley	Montana Land Reliance	12/21/94	2,000.00
Waterworks Hill	Peggy Lee Peschel	Save Open Space	04/05/95	94.64
Lincoln Hills	Ronald Hauge	Save Open Space	09/28/95	17.80
Arlee	Cornelia Francis	Montana Land Reliance	11/28/95	220.00
Miller Creek	Charlie Graham	Montana Land Reliance	11/28/95	80.00
Potomac	Annick Smith	Montana Land Reliance	11/28/95	160.00
Pattee Canyon	Peter Brinkley	Five Valleys Land Trust	12/06/95	66.00
Target Range	Alice Austin	Five Valleys Land Trust	12/07/95	16.00
Swan Valley	Peter Guynn	Montana Land Reliance	07/15/96	20.00
Ninemile Valley	James Gouaux	Montana Land Reliance	08/13/96	178.00
Butler Creek	Circle H Ranch	Five Valleys Land Trust	12/01/96	690.00
Swan Valley / Buck Creek	David Owen	Montana Land Reliance	04/11/97	80.00
Lower Miller Creek	Maloney Ranch	Five Valley Land Trust	12/01/96	898.50
Lower Miller Creek	Lloyd Twite	Five Valleys Land Trust	12/01/96	41.38
Swan Valley / Buck Creek	David Berner	Nature Conservancy	12/17/96	175.00
Rattlesnake Valley	Allen Fetscher	Five Valleys Land Trust	02/18/97	135.70
Mount Jumbo	Henson / City of Missoula	Five Valleys Land Trust	03/28/97	335.00
Mount Jumbo	Smith / City of Missoula	Five Valleys Land Trust	03/28/97	225.00
Placid Lake	Edgewater Ranches	Five Valleys Land Trust	06/27/97	35.00
Blackfoot River / Rainbow Bend	Russo & Frey	Five Valleys Lane Trust	12/30/97	20.02
Clearwater Junction	OW Potter	Nature Conservancy	07/17/98	317.80
Clearwater Junction	William Vietor	Nature Conservancy	07/17/98	80.00

Location	Grantor	Grantee	Date Established	Acreage
Clearwater Junction	David Vietor	Nature Conservancy	07/17/98	80.00
Clearwater Junction	Mary Potter	Nature Conservancy	07/17/98	80.00
Clearwater Junction	William Potter	Nature Conservancy	07/17/98	80.00
Clearwater Junction	OW Potter	Nature Conservancy	07/17/98	80.00
Clearwater Junction	OW Potter	Nature Conservancy	07/17/98	80.00
Clearwater Junction	OW Potter	Nature Conservancy	07/17/98	160.00
Clearwater Junction	N/A	Nature Conservancy	07/17/98	80.00
Clearwater Junction	OW Potter	Nature Conservancy	07/17/98	80.00
Clearwater Junction	William Vietor	Nature Conservancy	07/17/98	80.00
Clearwater Junction	David Vietor	Nature Conservancy	07/17/98	80.00
Clearwater Junction	OW Potter	Nature Conservancy	07/17/98	80.00
Blackfoot River / Bear Flat	William Potter	Nature Conservancy	07/17/98	80.00
Blackfoot River / Bear Flat	Mary Potter	Nature Conservancy	07/17/98	80.00
Blackfoot River / Clearwater River	OW Potter	Nature Conservancy	07/17/98	315.00
Blackfoot River / Clearwater River	OW Potter	Nature Conservancy	07/17/98	157.27
Blackfoot River / E Bar L Ranch	OW Potter	Nature Conservancy	07/17/98	570.00
Blackfoot River / Fish Creek	OW Potter	Nature Conservancy	07/17/98	640.00
Blackfoot River / Fish Creek	OW Potter	Nature Conservancy	07/17/98	80.00
Blackfoot River / E Bar L Ranch	OW Potter	Nature Conservancy	07/17/98	602.80
Blackfoot River / Bear Flat	L. Vero, M. Vero & W. Potter	Nature Conservancy	0717/98	82.00
Blackfoot River / Bear Flat	OW Potter	Nature Conservancy	07/17/98	81.30

Location	Grantor	Grantee	Date Established	Acreage
Blackfoot River / Clearwater Junction	Claud & Betty Reinoehl	Montana Department of Fish, Wildlife and Parks	10/29/97	634.00
Clearwater Junction	Claud & Betty Reinoehl	Montana Department of Fish, Wildlife and Parks	10/30/97	254.00
Lower Ninemile Valley	Qualley & Associates	Montana Land Reliance	11/10/97	20.60
East Missoula	Robert Deschamps	Five Valleys Land Trust	11/19/97	39.00
North Hills	Hilda Kreitzberg	Five Valleys Land Trust	12/03/97	120.00
East Side of Bitterroot	Bitterroot Featherhorn Ranch	Five Valleys Land Trust	12/03/97	320.00
Swan Valley / Condon	Richmond Thomason	Montana Land Reliance	12/24/97	246.00
Upper Ninemile Valley	Ralph & Bruce Thisted	Montana Land Reliance	12/29/97	320.00
Potomac	Robert Hall	Montana Land Reliance	07/07/98	350.00
Swan Valley	Thomas Parker	Montana Land Reliance	07/06/98	80.00
Clark Fork / Council Hill	James Cusker	Five Valleys Land Trust	12/22/98	213.00
Big Flat	Cecelia Cox	Five Valleys Land Trust	12/31/98	28.00
Big Flat	Cecelia Cox	Five Valleys Land Trust	12/31/98	13.00
Swan Valley	Arlene Braun	Montana Land Reliance	12/20/98	99.00
Pattee Canyon	Joanne Rubie	Five Valleys Land Trust	12/31/98	53.00