

The Economic Value of Open Space



Implications for
Land Use Decisions

OCTOBER 2005

The Economic Value of Open Space

Implications for Land Use Decisions

October 2005

Prepared by:

Paul A. Anton

Wilder Research

1295 Bandana Boulevard North, Suite 210

Saint Paul, Minnesota 55108

651-647-4600

www.wilder.org

Contents

<u>Executive summary</u>	1
<u>I. Introduction</u>	3
<u>Types of open space</u>	5
<u>II. Research on the value of open space</u>	7
<u>Research methods</u>	7
<u>National research findings</u>	10
<u>Minnesota/Twin Cities Research</u>	15
<u>Summary and lessons</u>	27
<u>III. A framework for open space analysis</u>	28
<u>Land use decision-making</u>	28
<u>A financial framework for value analysis</u>	34
<u>Tools for applying value analysis</u>	42
<u>Open space policy options</u>	44
<u>IV. Sample applications of the framework</u>	48
<u>Example 1: Open space in a comprehensive plan</u>	48
<u>Example 2: Reacting to a residential development plan</u>	51
<u>Example 3: Acquiring a small parcel of previously undeveloped land</u>	54
<u>Summary</u>	57
<u>Bibliography</u>	58



Figures

1. <u>Hedonic pricing studies of the effect of open space proximity on property values: Twin Cities metro area</u>	20
2. <u>Estimated effect on property value of a \$150,000 house from being located closer to an amenity</u>	22
3. <u>Estimated effect on property value of a \$150,000 house from being located closer to an amenity</u>	24
4. <u>Minnesota city and county referenda to raise money for parks, trails, and other open space</u>	26
5. <u>A value analysis framework for open space</u>	40
6. <u>Land use policy tools that can be useful in open space planning</u>	47
7. <u>Example 1: The value of green space in a comprehensive plan</u>	49
8. <u>Example 2: Valuing green space options in a residential subdivision</u>	52
9. <u>Example 3: The value of purchasing a small wooded parcel</u>	55



Acknowledgments

This study was commissioned by **Embrace Open Space**, a group of non-profit organizations conducting a campaign to encourage Twin Cities residents to become more involved in local land-use decisions.

Embrace Open Space Campaign Partners

Dakota County Farmland and Natural Area Program
Department of Natural Resources, State of Minnesota
Friends of the Minnesota Valley
Friends of the Mississippi River
Great River Greening
The McKnight Foundation
The Metropolitan Council
Metropolitan Design Center, University of Minnesota
Minnesota Center for Environmental Advocacy
Minnesota Land Trust
Mississippi National River and Recreation Area
Parks and Trails Council of Minnesota
Sierra Club, North Star Chapter
1000 Friends of Minnesota
The Trust for Public Land

The author gratefully acknowledges the assistance of the members of working group that oversaw the study, chief among them Cordelia Pierson, Ann Forsyth, Deb Detrick and Jim Erkel. These individuals provided valuable input during the research phase and many helpful comments on successive drafts of the report. The final draft was also improved by many valuable suggestions from three able outside reviewers, Ann Beckman, Thomas Wegner, and John Gunyou. Finally, the report would not have been possible without the able assistance of my Wilder Research colleagues. Heather Johnson and Deidre Hinz provided tenacious research assistance and Louann Graham typed and formatted the report to a standard the author had no chance of achieving on his own. All remaining errors and omissions remain the responsibility of the author.

Executive summary

Minnesotans value open space and that value is reflected in higher values for properties located in close proximity to open space amenities.

- Twin Cities research confirms that many types of open spaces, from parks and nature preserves to greenways, wetlands and lakes, have a positive effect on nearby property values.
- Moreover, the results of referenda conducted in Minnesota indicate that Minnesotans value open spaces enough to raise taxes to pay for open space acquisition and preservation.

Local governments should take that value into account in land use decision-making, but are not always able to do so.

- Decision-makers who understand the value of open space will be more likely to take the time to assemble the tools needed to implement their open space plans before priority lands are developed. They will pass ordinances and a land protection plan and will invest in a land protection fund.
- It is often hard to fully reflect the value of open space in the financial analyses underlying local land use decisions.
- The pressure for development sometimes makes communities commit to development before they implement comprehensive open space plans, especially in areas at or beyond the urban fringe.

This paper puts forward a more complete framework for evaluating the value of open space in land use decisions by adding several more financial impacts:

- the added property taxes paid by nearby properties,
- the avoided cost of public services generated by alternative development, and
- the potential cost savings from better storm water management.

Applying this framework can lead to better-informed local open space decisions, as several included examples show:

- A city making or updating its comprehensive plan may decide that it can afford to plan or protect more open space when it considers the cost savings on storm water management and the taxes generated from the higher values of homes located near open areas.
- A city considering a proposed subdivision may offer the developer a density bonus in exchange for the builder's ceding open space to the city, thus protecting or creating open space at a much lower cost to the city because of the reduced cost to acquire the land and the increased taxes to be paid by the additional housing units.
- A developed city that initially considers the purchase of a small, surrounded parcel of wooded land as too expensive may change its decision when it considers the full financial implications of protecting it (and may be able to protect it at lower cost through purchase of the development rights or conservation easements.)

Communities that have a more complete understanding of the fiscal implications of open space will be better equipped to set priorities and strike a balance between open space and other objectives that will lead to a higher quality of life for their residents now and in the years to come.



I. Introduction

- The problem defined
- Different types of open space

Almost everyone has a sense that there is value in open space. To some extent, we all feel that there is something “special” about certain open spaces. These spaces may range from natural spaces such as forests, lakes, and wetlands to designed spaces such as city parks or even golf courses. We may value these spaces, in part, because we enjoy the things we do there, hiking or boating, playing Frisbee or swinging a golf club.

Yet beyond their usefulness to us, these spaces often have additional, more abstract, value that most of us do not bother to label or analyze. That value can be as simple as the natural beauty (or built beauty) of a nature preserve or park or as complex as the varied environmental and ecological roles that a forested wetland may play. Some of us just enjoy nature; some of us can rattle off a long list of benefits that a forested wetland conveys to human society and to the planet at large.

Different members of society may value different open spaces for different reasons, reasons that they may or may not be able to put into words. Yet, whether we can put those values into words or not, one thing is common to all of us – we seldom, if ever, try to put those values into dollars and cents. In fact, some people might even take offense that someone would try to reduce the ethereal or aesthetic value of a beautiful natural area to such mundane terms.

Unfortunately, as metropolitan areas grow, and land is converted from natural or agricultural land state to denser, more urban uses, government decision-makers are forced to balance the abstract value of open space with the dollars-and-cents concepts of tax revenues, development costs, and infrastructure spending. Even after the decision to convert land has been made, cities and townships still find themselves having to balance the abstract against the concrete in making land use policy decisions about the density of development and provision of parks and natural areas.

Consequently, those who advocate for more open space rather than less are often at a disadvantage making qualitative or abstract claims when compared to those who can demonstrate the monetary advantages of developing open space. It is easy to sympathize with local governments that try to make the best decisions, but are frequently in a quandary as to how to balance development and conservation, so difficult to compare.

Therefore, in recent years there has been increasing interest in producing dollars-and-cents estimates of at least a portion of the abstract value of open spaces. Such estimates, while approximate and incomplete, can improve and sharpen the dialogue underlying land use decisions by permitting some comparison of the values of open space and developed land, and lead to decisions that are based on a more thorough understanding of the trade-offs.

Economics offers some of the tools for making estimates of the value of open space and is developing others that can be used to increase the scope and accuracy of those estimates. This paper summarizes the results of current research and draws some conclusions helpful for local land use decision-making. It is based on numerous research papers and survey articles but it is not intended to be as encyclopedic or detailed as an academic literature search. Its purpose is to provide non-technical readers with a clear sense of what can be usefully incorporated into the practice of land use decision-making from this developing field of economic research. Hopefully, both interested citizens and government officials will find the results interesting and informative.

- This paper begins with descriptions of the different types of open spaces being considered.
- The second section begins by explaining the various research strategies used to generate estimates of the value of open space and then discusses the results of national studies grouped by the types of open spaces each analyzes. It then goes on to focus on open space studies conducted in the Twin Cities area and the results of open space referenda conducted in Minnesota before drawing some lessons for open space analysis.
- The third section describes the current structure of open space decision-making and puts forward an operational model designed to incorporate the value of open space into land use decision-making.
- The final section includes three illustrative examples to show how use of this framework can better inform open space decision-making in Minnesota.

Types of open space

The term “open space” has many meanings, and authors and groups have suggested several carefully phrased definitions with somewhat different elements or emphasis. Rather than choose an existing definition or add yet another, we will list the types of open spaces to be considered in this study. Because this study is intended to inform land use decisions by local governments, the open space types on this list meet two criteria:

- at least one study has estimated the value of the particular type of space; and
- local governments in the Twin Cities must make decisions affecting either these open spaces or the land immediately adjacent to them.

At least some study exists for all the major types of open spaces within the purview of local governments in the Twin Cities. The second criterion eliminates at least two types of open spaces that have been studied but city councils and township boards in the Twin Cities do not affect: national parks and land with ocean views.

The types of open space fit broadly in two categories: land and water.

Land open spaces

The “land open spaces” include both public and privately owned open space. Some is used for active recreation, some is used passively, and some is devoted to non-recreational uses. This study includes six types of “land open space.”

Parks come in many types and sizes. Parks are areas that are dedicated to recreational uses and are usually publicly owned. Parks may include features devoted to active use such as ball fields or swimming pools but may also include some opportunities for passive recreation such as walking or observing nature.

Golf courses are a unique form of park and have been studied separately. Some are publicly owned, but many are private. They may provide only limited public access, yet they do provide an amenity in the forms of views to neighboring residents.

Greenways and parkways, for the purposes of this study, are linear areas of vegetation along transportation corridors, waterways, or other natural corridors. They may be either preserved natural areas or landscaped corridors. In the Twin Cities, some greenways provide for movement of people through more developed, less natural areas and include bike paths and walkways. Parkway are typically greenways centered on roads.

Greenbelts and preserves are larger natural areas that have been set aside and protected from development through zoning and other measures. These are typically larger than greenways and are often chosen for some exceptional natural beauty or features that are deemed important to preserve.

Undeveloped land is not currently used for any purpose but is not protected by any kind of moratorium or law that will preserve its character and status in the future. It is a form of open space, but should probably be considered as temporary unless some physical features disqualify the land from any other future use.

Forests are, quite obviously, stands of trees. In urban areas, they are usually found in one of the three preceding types of open spaces, in parkways or preserves, or in undeveloped land typically at the urban fringe. Forests on either public or private land are subject to the possibility of development unless explicitly protected.

Farmland is used for growing crops or grazing livestock. For the time being, it offers a view to neighbors, but like undeveloped land, may be converted to another use in the future because its development value may exceed its agricultural value in developing areas.

Water open spaces

Water-based open spaces also play an important role in land use planning at the local level. We consider three classifications here.

Lakes: open bodies of water, are features that have been either preserved or man-made. Although they can support some water-based recreation, much of their value in urban settings is in the views they provide. Usually lakes are publicly owned and, hence, protected from development, but development issues arise on their shorelines.

Rivers and streams: also provide views for homeowners and sightseers.

Wetlands: are a more varied group that includes swamps, marshes and other low-lying areas. Because the water table lies at or close to the surface of the land, shallow water either continuously or from time to time covers the area. Wetlands may also be filled to make way for development, though state law requires mitigation of most filling. Some small privately-owned lakes might also be developed subject to wetlands regulations.

II. Research on the value of open space

- Research methods
- National research results
- Twin Cities research results
- Minnesota open space referendum results
- Summary and lessons

Research methods

These types of open spaces provide a number of public and private benefits. A few of those benefits, such as the value of crops raised on farmland, can be calculated by considering transactions in private markets. Most of the benefits, such as scenic views, habitat protection, or improved water quality are not by themselves traded in any markets. Therefore, little direct information from which to construct estimates of those values exists, and economists must find indirect methods for valuing these non-market benefits.

Two principal methods have been used to estimate values for different types of open spaces: hedonic pricing models and stated preference models. Hedonic pricing models infer the value of open space through analysis of housing purchase data. Stated preference methods use public opinion survey data to establish the value people place on different types of open space. We will provide a brief description of each method, including its strengths and limitations and then consider the results of past studies with respect to different kinds of open spaces.

Hedonic pricing methods

Hedonic pricing models assume that differentiated products can be viewed as bundles of characteristics, and that consumers who buy a particular product are really buying the particular bundle of characteristics that meets their needs. These studies rely on extensive data on the characteristics of homes sold, such as specific distance from a defined “open space.” Through cross comparisons of the prices that people are willing to buy for different bundles, we can infer the prices they are willing to pay for particular characteristics, such as “open space.”

Estimating the value that people place on living across the street from a park requires a comparison of the prices and other attributes of houses near the park and houses located at some distance. The analysis elaborates on a common sense method. If we knew the prices of two houses that were identical in every aspect except that one was located across from a park and the other was a half mile away, we could estimate the value to a home owner of being near the park by taking the difference in the house prices.

Because normal housing markets provide few, if any, examples of homes that differ in only one characteristic, more elaborate statistical analysis of thousands of homes is required to provide estimates of the imbedded values of many of the attributes of the houses in a particular area. In essence, these statistical models must “explain” most of the variation in prices of houses by attributing the variation to different features of the houses. Only in this way can the analyst have confidence that the estimate of the proximity to open space is not acting as a proxy for other attributes that were not included in the analysis. Even so, the estimate remains just that: an estimate that provides a rough indication of the preferences of homebuyers extracted from the pattern of housing prices.

Two points about hedonic estimation are important to keep in mind. First, this estimation measures only part of the potential value of an open space to the surrounding community. People who live beyond the distance at which the park has impact on property values, often half a mile or less, still may value a park or open space. Second, a hedonic model measures only the actual value of the active use of the open space, where “active use” includes observing a pleasant view. People who do not actively use the space, but still would want to have it preserved, enjoy “passive use,” according to economists.¹

Economists point out a number of technical problems that may make the hedonic estimates of value less accurate or even misleading. The most important of these is what is called the “omitted variables problem.” If important factors affecting the price of homes are not included in the statistical estimation, then the estimate of the value of proximity to open space may be biased in a way that it hard to assess.

Stated preference methods

As the name suggests, stated preference methods attempt to estimate people’s valuations of open space by asking them to state their preferences. These methods involve using data from public opinion surveys to ascertain the value that people in a given area or city place on a particular open area. The fact that these methods do not use data from actual market decisions made by consumers is both a weakness and a potential strength.

¹ The meaning of this term in economics differs from usage in the parks and recreation literature where “passive use” includes activities like enjoying a view or, possibly, strolling – but not running.

Not using actual market data is a weakness because surveys need to be designed carefully to measure individual preferences accurately. The questions must be clearly stated so that different people interpret the question in the same way. If the respondent believes he or she will not actually be asked to pay the amount named, the respondent may overstate the true value to him or her. Researchers have made considerable efforts to improve survey methods to ensure more accurate results.

These methods are potentially stronger than hedonic pricing methods because asking citizens about their preferences enables researchers to estimate both the active and passive use components of value. Residents of an area who attach value to the open space in question even though they do not use it are giving information about passive use, which is beyond the scope of hedonic methods.

There are at two main estimation approaches to be considered: contingent valuation (CV), and contingent choice models. The contingent valuation method basically involves asking people what they would be willing to pay for a hypothetical open space amenity. Contingent choice methods present citizens with a detailed list of choices, ask them which they prefer, and then infer the values they place on different amenities by analyzing the choices. CV studies are much more common. At present, there are a just handful of the newer contingent choice studies and their results are hard to interpret. Therefore, we will restrict our attention to contingent valuation studies.

The CV approach has been widely studied, criticized and improved through research inside and outside the economics profession. As a result, these methods are gaining acceptance and are used for valuation in an increasingly wide array of circumstances, including litigation involving destruction of natural areas, such as the Exxon-Valdez case.

While the basic strategy of asking people about their willingness to pay (WTP) for the preservation of a certain open space is simple enough, the design and implementation of such studies greatly affects the accuracy of the results. It is crucial that the questions posed to survey respondents include careful descriptions and explanations of what they are being asked to value. To minimize possible misunderstandings, survey instruments are often tested on focus groups to correct possible informational problems.

It is also important to design questions to provide cues for people to think about how much they are actually willing to pay. For example, someone might initially say, "I'd pay \$100," but might revise that amount downward if the person were reminded of his or her actual financial situation by a follow-up question like, "Would you pay the \$100 from savings, spending reductions, or increased earnings?"

Of course, this latter situation highlights one of the central challenges of contingent valuation analysis: the hypothetical questions posed on surveys may result in overestimates of citizens' willingness to pay. As long as people know they are not actually going to be asked to pay the particular amount named, people tend to name a higher figure. The best survey would be one in which the participants actually had to pay the amount they name.

Such surveys exist outside of the world of research: referenda. When a city or county holds a referendum asking voters whether they support the city or county raising taxes to fund open space preservation, every voter knows that property taxes will increase if the referendum passes. Often a public information campaign preceding the vote addresses how much the tax increase will cost the owners of differently valued properties. Therefore, contingent valuation methods have improved by making them as much like referenda as possible. Just as survey design affects the accuracy of public opinion surveys, the ballot language significantly impacts referendum results.

A simple up or down vote on a particular project does not allow us to estimate either how much more the supporters would be willing to pay or what value the "no" voters might place on open space – no value, or something between zero and the amount requested in the referendum. A hybrid of theoretical contingent valuation studies and actual referenda results is a campaign poll that asks the specific question and then asks how much the respondent is willing to pay, instead of asking for approval of a specific number. However, the results of referenda provide interesting and useful information about the preferences of the voters that can, in principle, be applied to improve valuations using other methods. Therefore, in a later section specific to Minnesota, we will discuss both the results of Minnesota studies of the value of open space and the results of recent open space referenda in the Twin Cities area.

Now we will review both the hedonic pricing and contingent valuation studies already completed.

National research findings

Beginning in the early 1970s, researchers completed many open space studies in different places. We reviewed approximately 80 separate studies as background to this summary, and new papers are being published every month. The studies vary in approach, in types of open spaces, and in geographic areas analyzed.

This section synthesizes the results of national research on different types of open spaces. Key findings and representative papers are highlighted, but we do not attempt to

comment on every paper. Readers wishing to follow up in greater detail may refer to one of the following literature reviews:

- “The Economic Value of Open Space: A Review and Synthesis,” by Charles J. Fausold and Robert J. Lillieholm. Lincoln Land Institute, Paper.WP96CF1, 1996.
- “The Proximate Principle,” by John L. Crompton. National Recreation and Park Association, 2004.
- “The Value of Open Space: Evidence from Studies of Nonmarket Behavior,” by Virginia McConnell and Margaret Wells. Resources for the Future, January, 2005.

Land amenities

Some studies, especially early studies, of the impact of open spaces on residential property values have dealt with all open spaces in a single category. More recently, studies either have focused on a specific type of open space or differentiated between the effects of various kinds of open space. Here we present the implications of each of these types of studies.

Parks

The greatest number of studies has dealt with the impacts of parks in urban and suburban areas. Approximately 30 hedonic studies have estimated the impact of parks on housing values. Almost all studies of urban areas indicate that parks have a positive and significant impact on the prices of homes located very near the park, but the magnitude of the results vary widely. The results are hard to compare directly because some authors seek only to demonstrate a significant effect and do not create models in forms that make an actual dollar amount easy to calculate. Results also vary with regard to different attributes of parks. Here is our synthesis of what the studies show:

- Natural parks and passive use parks tend to have more impact than active use parks that have more recreational activity. For passive parks, the value is highest directly across from the park, where one also has a view, and then decreases as distance to the park increases. For more active parks, the pattern tends to be more complicated. While proximity to the park still has a net positive value for homes in the neighborhood, homes immediately adjacent to the park may show little impact (or even a negative impact) while houses in the next block from the park show a larger impact. This appears to be the case in situations where the nuisance value of added traffic and noise sets off the other positives of proximity to the park.

- Facing a natural or passive park has a positive impact but backing on either kind of park has less value and can actually detract from value, presumably because of privacy or safety concerns.
- All else being equal, parks in urban areas and more densely-populated suburbs tend to show greater impact on home prices than parks in more sparsely-populated areas. It is tempting to jump to the conclusion that open space is “less special” in rural settings. But other factors could explain that result, including the possibility that the particular study area does not have a broad enough range of data to distinguish different effects clearly or that the effects of variables left out of the model are masking the effect of the parks.
- Some evidence shows that larger parks have greater impacts than smaller parks.

With regard to size of impact, those studies that are comparable show a wide range of impacts. For passive use parks in urban areas, the highest estimated impacts can amount to as much as 15 percent of home value, though estimates in the 3 to 8-percent range are more common. While many studies consider only properties within a certain range of a park, the results of different studies seem to imply that the effect on prices becomes negligible somewhere between 500 and 1000 meters from most parks.

One author who focuses most heavily on parks (Crompton, 2004) goes so far as to offer rules of thumb for attaching premiums to houses within 500 feet of parks based on qualitative assessment of the park: 15 percent of value for parks of “unusual excellence; 10 per cent for “above average” parks; and 5 percent for “average” parks. However, the qualities of parks may not fit easily into the three classes that author defines.

Golf courses

Golf courses are a special case. In general, they have a strong positive value on most nearby houses, typically those with a view. For example, Quang Do and Grunitski (1995) found that homes abutting a golf course sold for a premium of 7.6 per cent over similar homes. However, it appears that the effect falls off much more rapidly than with other parks. A likely explanation for this is the common sense observation that the view of the golf course is pleasant but living a block from the course does not convey much value because one cannot walk to the course and use it as one would a nature preserve or recreational park.

Greenways and parkways

Greenways and parkways tend to have much smaller and less certain impacts on home values than do parks and other larger areas. A number of studies were undertaken in the 1990s as development of greenways became popular in cities across the country. About 40 per cent of those studies showed significant positive effects and the rest showed no significant effects. However, some of the greenways studied were configured in such a way as to raise privacy concerns, further complicating the analysis.

Little explicit research has been done on parkways (i.e., roadways lined with significant green space), but what has been done also gives mixed results that seem to be highly location dependent. Neither greenways nor parkways seem to have negative effects but beyond that it is hard to generalize. Several authors call for more research to sort out the effect of different attributes of these types of land uses.

Greenbelts, preserves and forests

Greenbelts and nature preserves appear to have strong positive impacts on the properties located near them. At least five hedonic studies of greenbelt impacts exist. The earliest is a Boulder, Colorado study (Corell et al, 1978), which showed an added value of about 8 percent of home value for homes located directly across from the greenbelt compared to those 1,000 feet away. Three other studies in Oregon and a recent study in Seoul, Korea provide similar confirmation of the value of greenbelts to nearby homes.

At least five studies focused solely on formal forest preserves, and many more have included natural forested areas in the analysis of several classes of open spaces. Four of the five specialized studies consider forest preserves in Europe and show strong price impacts of proximity to forested areas. The lone American study (Thorsnes, 2002) analyzed lot price data from three subdivisions in Grand Rapids, Michigan that border permanently protected forests. It found premiums of 19 to 35 percent in the value of lots bordering the preserves.

More evidence from generalized studies supports the view that natural forested areas add value to nearby homes and that the addition is higher than other types of open spaces. For example, a study of home prices of single-family home sales in Portland, Oregon in the early 1990s (Lutzenhiser and Netusil, 2001) found that natural areas had the largest effects, much larger than urban parks. Natural parks could add as much as 20 percent to the value of nearby homes, and the effect seemed to extend much farther from the park than for other open spaces. Moreover, they also found that the larger parks had the largest effects.

Undeveloped land and farmland

Farmland and other undeveloped lands have also been the subject of a number of studies. In general, these studies have placed quite different values on the value of proximity to agricultural land and other undeveloped property. For example, a study from Maryland (Geoghegan et al, 2003) concluded that the value of open space proximity was “highly location dependent.” Other studies have shown both positive and negative effects. A North Carolina study (Smith et al., 2002) found that vacant land had a positive effect on nearby land while agricultural land had a negative effect.

One complicating factor with these studies is that the vacant land and farmland in the studies are located, typically, at the fringes of urban areas. Hence they may be thought of as temporary rather than permanent land uses.

In a related finding, a very interesting contingent valuation study of a parcel of land in Boulder, Colorado (Brefle et al, 1998) estimated the WTP of a community and found that it was higher than the cost of purchasing the land from the developer. This willingness squares well with other hedonic studies in that area.

Water amenities

Water open spaces generally add to the value of nearby homes. They have not been studied in great detail, perhaps because it so obvious that they confer value.

Lakes

Several studies of the value of lakeshore to home values were conducted in the 1970s in Florida and, as might be imagined, they showed very substantial effects, on the order of 20 to 30 per cent of the value of homes that had lake views. A study in Texas in 1995 showed even larger effects. A study in Ramsey County, Minnesota (Doss and Taff, 1996) also showed additions to value of about 25 percent for houses with a lake view.

Rivers and streams

The value of rivers and streams on nearby properties has received even less attention than the study of lakes, probably for the same reason. Studies that have been done typically do not break out rivers and streams but include them with lakes and measure the pricing impact along urban shorelines. In one of the few studies that break out rivers separately (West and Anderson, 2003), rivers prove to add slightly more value than lakes in the central cities of Minneapolis and Saint Paul but distinctly less in suburban areas. Almost certainly, this result should not be generalized.

Wetlands

We found three hedonic studies of the effect of urban wetlands on nearby home prices. Two of these focused on Minnesota and one used data from Portland, Oregon. All showed positive effects from proximity to wetlands. In general, the sizes of the effects were distinctly less than lakes and rivers, though the equations of the models were not estimated in such a way as to make comparisons easy. The implications of one Minnesota study (Doss and Taff, 1996) are discussed in detail in the next section.

Minnesota/Twin Cities Research

Information on the economic value of open spaces in Minnesota and the Twin Cities is available from two sources: research and public referenda. A small number of hedonic pricing studies have been done in recent years and metro area cities and counties have held a number of public referenda on specific open space funding proposals.

Hedonic pricing studies

Recently, a number of studies of the value of open space in the Twin Cities area have been conducted. One focused on urban open spaces, including parks, golf courses, cemeteries and bodies of water. One focused on bicycle trails, but also estimated effects for parks. A third dealt with the proximity to wetlands. The fourth considered natural areas and farmland. All applied some form of a hedonic pricing model.

Open spaces – West and Anderson, 2003

A 2003 study² by Sarah West, an economics professor at Macalester College, and Soren Anderson estimated the value of proximity to parks, golf courses, cemeteries, and lakes or rivers in the central cities and suburbs of the Twin Cities metropolitan area. They analyzed sales price data on almost 25,000 single-family home transactions in 1997, which was provided by the Regional Multiple Listing Services of Minnesota, Inc. (RMLS). West and Anderson applied hedonic pricing models that showed values for both proximity to amenities and for the size of some of those amenities (for example, the acreage of area parks). [They estimated separate effects for regular parks and “special” parks, the latter group including national, regional, and state parks; arboretums, nature centers, and wildlife refuges.]

Their research showed that proximity to parks had a strong positive effect on home values in the central cities, but a much weaker and less certain effect in suburban areas.

² See Soren T. Anderson and Sarah E. West, *The Value of Open Space Proximity and Size: City versus Suburbs*, Macalester College, 2003.

Special parks produce even greater effects than regular parks, and lakes and rivers are especially effective in adding value. Cemeteries did not have significant effects in either the city or in the suburbs, while golf courses had some positive effect on housing prices in the suburbs but not inside the core cities.

While their statistical analysis supports the hypothesis that open space amenities have an impact on property values, the form of their equations makes extracting estimates of the actual size of those effects difficult.³ To get some idea of the size of the effect, it is possible to plug values into their equations to estimate the change in value for a given home located near each amenity or at some distance. To facilitate comparison of the different studies using data from the Twin Cities area, we have done consistent calculations of the effect of proximity implied by the equations in the different studies. The results are reported in Figure 2 later in this paper.

Bicycle trails (and parks) – Krizek, Mogush and Levinson, 2004

In a 2004 study,⁴ Kevin Krizek of the Humphrey Institute at the University of Minnesota and his coauthors used hedonic methods to estimate the value of proximity to three different kinds of bicycle trails in the central cities and in the surrounding suburbs. The study analyzed sales price data from the RMLS on 35,000 homes sold in the Twin Cities during 2001. The statistical models also included estimates of the effect of proximity to two kinds of parks as explanatory variables in the equations they estimated. So, even though the paper's primary objective was to estimate the effect of bicycle trails, the study also yields estimates of the effect of parks that can be compared with those obtained by West and Anderson using similar data.

The paper measured the pricing effects of three kinds of bicycle trails:

- “on-street lanes” located on streets and demarcated only by painted striping,
- “roadside trails” located next to streets but separated by curbs or mild landscaping, and
- “non-roadside trails.”

The statistical analysis of bicycle trails showed that:

- on-street trails had no significant effect on property values in the city and had a negative effect in the suburbs;

³ Because the hedonic pricing equations were estimated log/log form, it is not possible to read off a coefficient that estimates the dollar value of being close to the park or lake.

⁴ See Kevin J. Krizek, Paul Mogush and David Levinson, *The Value of Bicycle Trail Proximity on Home Purchases*, University of Minnesota, 2004.

- roadside trails had a negative effect in both the city and the suburbs; and
- proximity to non-roadside trails had a positive effect on home prices in the central cities but a negative effect in suburban areas.

As mentioned above, the equations also yield estimates of the effect of two kinds of parks on residential property values. The analysis differentiates between active open spaces like ball fields and swimming pools and passive open spaces that provide views and a more natural setting. The estimates showed that passive spaces had strong positive effects in both the central city and the suburbs, with the city effect being the stronger. Active spaces had a smaller but positive effect in the city. However, proximity to active spaces in the suburbs had a small but statistically significant negative effect on home prices.

As with the West and Anderson paper, the form of the statistical equations in this paper does not lend itself to an easy interpretation that yields estimates of the value of close proximity to specific amenities. Therefore, calculations of the implied proximity effects from this study are included in Figure 2 later in this paper.

Wetlands in Ramsey County – Doss and Taff, 1996

In a study published in 1996,⁵ Cheryl Doss and Steve Taff⁶ of the University of Minnesota's Department of Applied Economics developed hedonic pricing models of the effect of the proximity of wetlands on home values in Ramsey County. Their study analyzed the 1990 assessed values of 32,417 single-family residences that were located within 1,000 yards of some form of wetland, roughly 31 per cent of all of the homes in the county.

Doss and Taff distinguished between four different types of wetlands:

- Forested wetlands include wooded swamps and bogs typically located along streams and rivers.
- Scrub-shrub wetlands have waterlogged soil and a mixture of shrubs and some trees.
- Emergent-vegetation wetlands may have some shallow open water and vegetation that includes grasses, cattails and wild rice.
- Open-water wetlands include shallow ponds and reservoirs usually fringed by vegetation.

⁵ See Cheryl Doss and Steve Taff, *The Influence of Wetland Type and Wet land Proximity on Residential Property Values*, *Journal of Agriculture and Resource Economics*, July 1996.

⁶ Steve Taff co-authored at least two other papers on similar topics that we do not report separately here.

All four of these types of wetlands were shown to have a positive effect on the value of nearby property. Scrub-shrub wetlands had the largest effect, followed by open-water wetlands, forested wetland, and emergent-vegetation areas.

Their estimated equation also included variables for the distance from a lake and the presence of a lake view. Not surprisingly, proximity to a lake had a greater effect on a home's value than did any of the wetlands being studied. A lake view added almost \$46,000 (in 1990 dollars) to the value of residential property, according to their analysis.

The results of the regression equation estimated by Doss and Taff cannot be directly compared to the two studies considered above because of difference in the functional form of the equation. However, it is possible to plug common values into their equation to generate estimates of the price effect of moving a given home nearer to an amenity. Results of those calculations are listed in Figure 3.

Natural areas and farmland in Dakota County – Lake and Easter, 2002

In a study completed in 2002,⁷ Mary Beth Lake, now at Michigan State University, and K. William Easter of the Department of Applied Economics at the University of Minnesota used a hedonic pricing model to explore the impact of different types of open space amenities provided by prairie ecosystems. They analyzed the prices of over 1,400 houses that sold in Dakota County between October 2000 and September 2001.

Lake and Easter estimated a sequence of models, each step in the sequence including a finer breakdown of the open space types in their sample.

- The Simple model included only a single open space variable. It showed that open space had a significant positive effect on housing prices.
- The Intermediate model used two open space variables, one for natural spaces and the other for farmland. The estimated equation showed that proximity to natural spaces had a positive effect on home value but that proximity to farmland had a statistically significant negative effect on nearby property values.
- The Complex Model used a breakdown of natural open spaces into five different categories and distinguished between farmland that was deemed to have a high priority for being preserved and other farmland. The results from this equation were mixed. Public lands and forests were deemed to have a positive impact on home values; prairies and farmland (priority or not) were deemed to have a negative impact;

⁷ See Mary Beth Lake and K. William Easter, Hedonic Proximity to Natural Areas and Farmland in Dakota County, Minnesota, University of Minnesota, 2002.

water and wetlands had an insignificant effect on values. These last results (for lakes and wetlands) are very different from the findings of Doss and Taff cited above.

Lake and Easter went on to estimate their Complex Model separating their sample into two pieces: the urban areas, and the urban fringe areas. These two equations showed different effects for some variables. For a number of reasons, it appears as though the data set for Dakota County did not contain enough variation to make it possible to discriminate accurately between the effects of the different subclasses of open space that were included in the Complex Model.

Therefore, in making calculations based on Lake and Easter's equations to compare with the results of the other studies cited here, we have used only the Simple and Intermediate Models and included the results in Figure 3 below.

Comparison of Hedonic results

Attributes of the studies

The four hedonic studies of the effect of proximity to open space on property values in the Twin Cities used different data for different areas and different time periods.

- West and Anderson used MLS price data from 1997 for the entire Metro area;
- Krizek, Mogush and Levinson used MLS data from 2001 for the entire Metro area;
- Lake and Easter studied priced data from Dakota County for 2001; and
- Doss and Taff 1990 studied assessed values for house in Ramsey County located within 1,000 yards of the amenities they studied.

The four studies focused on the effect of proximity to different kinds of amenities.

- West and Anderson analyzed the effects of two kinds of parks as well as lakes, rivers, golf courses, and cemeteries;
- Krizek et al. also estimated the effects of two kinds of parks, defined somewhat differently from the West and Anderson study, but focused mainly on three types of bicycle trails;
- Lake and Easter compared the effects of proximity to natural areas and farmland; and
- Doss and Taff estimated the effects of lakes and four different kinds of wetlands and made a separate estimate of the value of a lake view.

Thus, taken together, the four studies provide information on the estimated effects of many different kinds of amenities but provide few common estimates that can be compared across studies. Figure 1 summarizes some of the key attributes of the four studies.

1. Hedonic pricing studies of the effect of open space proximity on property values: Twin Cities metro area

Authors/Title	Data	Coverage	Dependent variable	Open space variables	Form of equation
West and Anderson "The Value of Open Space Proximity and Size: City versus Suburbs"	1997	Twin Cities Metro City vs. Suburbs	MLS sales data	Regular parks Special parks Lakes Golf Courses Cemeteries Rivers	log/log
Krizek, Mogush, and Levinson "The Value of Bicycle Trail Proximity on Home Purchases"	2001	Twin Cities Metro City vs. Suburbs	MLS sales data	On street bike paths Non-roadside bike paths Roadside bike paths Active parks Passive parks	log/log – bike paths semi-log – parks
Doss and Taff "The Influence of Wetland Type and Wetland Proximity on Residential Property Values"	1990	Ramsey County (within 1000 yards of amenity)	Assessed value	Lake view Lake distance Wetlands: Forested Scrub shrub Emergent vegetation Open water	Level/Levels Lake view dummy quadratic distance
Lake and Easter "Hedonic Valuation of Proximity to Natural Areas and Farmland in Dakota County, Minnesota"	2001	Dakota County total and urban vs. rural/ urban fringe	Sale price (from Dakota County)	Natural areas Farmland	log/log

Comparison of results: Direction and size of effects

The form of the equations estimated in the different studies makes it difficult to make direct comparisons of the size of the effects that they found. To facilitate comparison, we used the equations from each study to generate estimates of the value of a standard home⁸ at different distances from the amenities studied. To analyze the effect of close proximity to an amenity, we compared the value of the home at 500 yards away to its value if it were placed 20 yards away. Then to compare how quickly the effect wore off, we compared the effect of moving each house from 500 yards away to 1,000 yards away.

Figure 2 below includes the effects calculated for the West and Anderson and Krizek, Mogush, and Levinson studies. Figure 3 includes the results for the Lake and Easter study and the Doss and Taff paper.

West and Anderson (see Figure 2) find significant effects for lakes, rivers, and golf courses. In their sample, golf course and lakes have significantly larger effects in the suburbs than in the cities, but proximity to the river has a much greater effect in the cities. These contrasts are probably the result of specific factors in the Twin Cities area. Some suburban golf courses have been developed jointly with higher-valued surrounding housing developments and thus could show a greater effect than city courses that are surrounded by relatively more modest houses generally. River view lots in the cities may generally contain homes that are relatively more highly valued than the city homes at a distance to the river, while suburban developments near rivers may be less unique. The shores of many city lakes have public access, while some suburban lakes have private shorelines, thus raising the value of lakefront properties relative to their neighbors.⁹

The estimates made in the Krizek study (see Figure 2) show much smaller effects for parks in the cities than those in West and Anderson, \$4,811 for passive parks and only \$1,730 for active parks. In the suburbs, passive parks have only a \$2,044 effect, while active parks have a negative effect of \$4,241 on home value. This negative effect could result from the nuisance value of the increased traffic near active parks. While all of the results are statistically significant, it is possible that replacing the partitioning between city and suburbs with other explanatory variables, such as the population density of different areas, might affect the contrast between city and suburb as it has in the additional unpublished work by West.

⁸ A home that would have been valued at \$150,000 if placed at the mean distance of all homes in each sample was used for the analysis. All of the other explanatory variables were set at their mean values for each sample.

⁹ Interpretation of the lakeshore data is especially difficult. There is some evidence that public access means the enhanced value carries further into the neighborhood surrounding the lake, while private lakeshore results in a sharper decline in property values as distance from the lake increases.

2. Estimated effect on property value* of a \$150,000 house from being located closer to an amenity

Change in Distance to Amenity	West and Anderson				Krizek, Mogush, and Levinson			
	500 yards to 20 yards		1000 yards to 500 yards		500 yards to 20 yards		1000 yards to 500 yards	
	City	Suburbs	City	Suburbs	City	Suburbs	City	Suburbs
Parks								
Regular parks	\$8,050	\$142	\$1,686	\$31				
Special parks	\$24,673	\$900	\$4,859	\$193				
Active parks					\$1,730	-\$4,241	\$1,818	-\$4,548
Passive parks					\$4,811	\$2,044	\$4,853	\$2,100
Other spaces								
Lakes	\$15,707	\$39,194	\$3,208	\$7,370				
Golf courses	\$1,646	\$7,300	\$352	\$1,528				
Cemeteries	NA	NA	NA	NA				
Rivers	\$20,967	\$8,818	\$4,189	\$1,836				
Bicycle paths								
On street paths					-\$1,845	-\$1,558	-\$400	-\$338
Non-roadside paths					\$3,765	-\$1,803	\$797	-\$1,803
Roadside paths					-\$10,137	-\$4,698	-\$2,281	-\$1,030

The study by Lake and Easter (Figure 3) shows that proximity to open space adds to residential property values in Dakota County. Their Simple Model estimates an effect of \$3,811 for moving the standard home within 20 meters of any open space. When they separate open spaces into two categories, proximity to natural areas adds \$6,194 while proximity to farmland subtracts \$4,631 from the value of the standard home.

Lake and Easter also estimated a more complex model, whose results are not reported here. That model attempted to distinguish between the effects of a number of different

spaces. In that model, proximity to farmland continued to have a negative effect while the results for the effects of different natural areas suggest that there was not enough variation in the sample data to estimate separate effects accurately. More research and a broader data set will be necessary to make distinctions between some of the variables in the more complex model from their paper.

Finally, the Doss and Taff study (Figure 3) shows positive and significant effects from proximity to lakes and wetlands in Ramsey County. They estimate that a lake view adds \$45,949 to the value of a standard house. Their equation implies an additional effect of moving from 500 yards to 20 yards away from a lake that amounts to \$7,423. This lake effect is somewhat higher than the effect of suburban lakes found by West and Anderson and distinctly higher than the effect of city lakes in their study.

Moving closer to different kinds of wetlands also has positive effects for the four classes of wetlands – effects ranging from a high of \$6,892 for scrub-shrub wetlands to a low of \$1,077 for forested wetlands. Open water wetlands are nearer the high end of the range while emergent vegetation wetlands have almost exactly same effect as the forested variety.

The four studies are broadly consistent in showing positive impacts from proximity to different types of open spaces and roughly comparable magnitudes for similar types of amenities. However, with the exception of the estimate of the value of a lake view in Doss and Taff's study, none of the models were designed to provide point estimates of the actual increment to the value of homes in close proximity. Thus, using the distance parameters from those equations as we have done here is not necessarily an accurate estimate of those effects.

This point that adapting the equations from the models to estimate actual dollar impacts across a broad area may not produce meaningful results is supported by comparing the implied effects of moving the standard house from 1,000 meters distance to an amenity to 500 meters distance. In general, the implied effects on home value are lower than the effects of moving from 500 yards to 20 yards¹ but the size of the effects seems to be significantly larger than seems reasonable. In the case of the Krizek et al. and Doss and Taff studies, it is easy to see that the effects are strongly influenced by the functional form of the equation estimated. Only the effects in Lake and Easter tail off in a way that accords with the common-sense notion that the proximity effect should be weaker on properties located further from open space.

¹ The Doss and Taff model actually shows for emergent vegetation wetlands that moving from 1,000 to 500 yards has a much higher impact than moving from 500 yards to 20 yards away. This is completely an artifact of the type of quadratic distance function used and the curvature generated by their particular sample.

3. Estimated effect on property value* of a \$150,000 house from being located closer to an amenity

Change in Distance to Amenity	Lake and Easter Dakota County				Doss and Taff Ramsey County	
	500 yards to 20 yards		1000 yards to 500 yards		500 yards to 20 yards	1,000 yards to 500 yards
	Simple Model	Inter Model	Simple Model	Inter Model		
Open Spaces	\$3,811		\$809			
Natural Spaces		\$6,194		\$1,301		
Farmland		-\$4,631		-\$756		
Lake View					\$45,949	NA
Lake (distance)					\$7,423	\$4,598
Wetlands						
Forested					\$1,077	\$1,421
Scrub shrub					\$6,892	\$1,935
Emergent vegetation					\$1,185	\$15,756
Open water					\$4,333	\$1,765

In summary, while these four papers support the notion that proximity to open spaces has positive effects on home prices in the Twin Cities, they provide little practical guidance as to what the actual sizes of those effects are. They were not designed for that purpose.

Referenda

In recent years, several cities and counties have asked voters to approve tax increases to fund park development and open space protection. Since 1988, 18 referenda on open space acquisition have been held in cities and counties in Minnesota. Figure 4 below summarizes the results of those votes.

In general, Minnesotans have been supportive of raising funds for parks and open space. Thirteen of the 18 referenda approved funding, while two (Eden Prairie in 1989 and Washington County in 2000) were narrowly defeated. Of the five proposals that did not pass, three emphasized recreational facilities investments over open space: Eden Prairie (2004), Elk River, and Eagan. Seventeen of the 18 elections asked voters to approve the issuance of bonds to finance open space and recreational amenities and one asked approval of a local sales tax whose proceeds would be dedicated to open space use.

Most of the city proposals asked voters to approve funds for some combination of park land acquisition and development, recreational trails, and, in a few cases, municipal recreational facilities. One bond issue also included funds for a library. The two county proposals were focused exclusively on preserving open spaces. The Washington County initiative was an attempt to acquire land and/or development rights to preserve a continuous corridor of green space running the length of the county. In Dakota County in 2002, voters approved the Farmland and Natural Areas Program, a \$20 million dollar initiative to preserve farmland and other natural areas through the donation or sale of permanent easements from willing landowners. In most of these elections, voters clearly understood passage of the referendum would raise their taxes to fund open space projects.

Overall, Minnesota voters approved 13 local referenda that generated a total of over \$70 million for open space projects. It is important to recognize that these open space proposals were supported not only by residents living in close proximity to the open spaces but also by residents whose property values would not be affected by protecting those spaces. This broad community support shows the value that many people place on preserving open spaces.

Minnesota voters also showed overwhelming support for environmental protection and natural resources in a statewide election in 1998. At that time, Minnesotans considered a constitutional amendment to dedicate a portion of the state's revenues from the Minnesota Lottery to the Minnesota Environment and Natural Resources Trust Fund from 1998 through the year 2024. The amendment passed with a 77 percent positive vote, ensuring that over \$20 million per year would flow into the trust fund for the next two and a half decades.

All in all, the record from open space referenda in Minnesota reinforces the notion that many Minnesotans value parks and open space and are willing pay out of their own pockets to ensure that land continues to be used for these purposes.

4. Minnesota city and county referenda to raise money for parks, trails, and other open space

Jurisdiction	Date	Purpose	Conservation Funds at Stake	Pass/Fail	% YES
Shoreview	11/8/1988	Bond for parks, recreation	\$1,000,000	Pass	64%
Eden Prairie	5/25/1989	Bond for land acquisition	\$3,000,000	Fail	49%
Eden Prairie	5/24/1994	Bond for land and forests	\$1,950,000	Pass	85%
Woodbury	6/4/1994	Bond for parks, recreation	\$1,200,000	Pass	52%
Plymouth	5/23/1995	Bond for open space, trails	\$2,235,000	Pass	85%
Maple Grove	6/20/1995	Bond for open space, parks	\$5,000,000	Pass	65%
Eagan	9/10/1996	Bond for open space, parks	\$3,800,000	Fail	38%
Prior Lake	2/25/1997	Bonds for library, parks, trails	\$7,800,000	Pass	52%
Chanhassen	6/14/1997	Bonds for open space, recreation, parks, trails	\$4,900,000	Pass	62%
Woodbury	6/2/1998	Bond for open space, parks, recreation	\$5,000,000	Pass	74%
Elk River	11/3/1998	Bond for parks, trails, land acquisition, aquatic center	\$100,000	Fail	45%
Washington County	11/7/2000	Bond issue to acquire and manage conservation easements to establish a corridor of green space	\$13,025,000	Fail	48%
Blaine	11/7/2000	Bond issue for land acquisition	\$3,500,000	Pass	54%
Minnetonka	9/11/2001	Bond for parks renewal and open space preservation	\$15,000,000	Pass	52%
Dakota County	11/5/2002	Bond to protect farmland, open space, water, and natural areas.	\$20,000,000	Pass	57%
Wayzata	11/4/2003	Bond for acquisition of forest lands	\$3,135,000	Pass	52%
Eden Prairie	5/11/2004	Bond for acquisition and improvement of land and facilities for public recreation	\$1,000,000	Fail	43%
Saint Cloud	11/2/2004	17-year, one-half percent sales tax increase to fund regional parks and trails	\$10,000,000	Pass	71%

Source: Trust for Public Land LandVote Database

Summary and lessons

Our review of hedonic pricing studies in the Twin Cities, in the context of the broader national research, strongly supports two conclusions:

- First, Minnesotans value open space and that value is reflected in higher values for properties located in relatively close proximity to open space amenities.
- Second, the size of the effect of open space on property values, and hence on property taxes, is large enough to have significant financial implications for cities, townships, and counties that make land use decisions.

The results from referenda in the Twin Cities area support a third conclusion:

- Even citizens who live beyond areas where property values are raised by a particular open space may value that space enough to have their own taxes raised to preserve it.

Thus, in making land use decisions that strike a balance between development and open space, it is important that governments pay explicit attention to the economic value of open space. It is possible that doing so may increase the allocation of land to open space in one of three ways:

- The additional future tax revenues generated by residential properties near an open space may be sufficient to pay the debt service on funds borrowed to acquire and/or develop a park. In some specific cases, the amenity may pay for itself.
- A more common situation is that the additional future tax revenues will offset a portion of the apparent costs of preserving and maintaining a particular open space amenity. Thus, proper consideration of the true net cost of the space may result in a different decision.
- Third, even when the net cost of a particular open space is beyond the current financial capacity, citizens may express their willingness to bear that net cost by voting in favor of a tax increase to protect open space.

In order to make the best possible land use decisions, it is important that local governments analyze the full fiscal and economic implications of alternative development strategies. This requires that decisions be based on a comprehensive framework that permits consideration of all relevant quantifiable values. While communities and situations differ, a common framework for ensuring that all factors are considered and balanced would be of use to informed planners, developers, conservationists, local officials and citizens as they address land use decisions. In succeeding sections of this report, we provide such a framework and then give examples to demonstrate its application to different types of local decisions.

III. A framework for open space analysis

- Land use decision-making
- A framework for local open space value analysis
- Making the framework operational
- Open space policy options

Land use decision-making

While it is clear that residents of the Twin Cities area attach value to open spaces of different kinds, there is no generally accepted framework that local governments can apply to ensure that the economic value of open space to the public is included in land use policy decisions in a systematic fashion. Since all local land use decisions are made in the context of the market for developable land, we will begin with a description of the forces affecting land markets near the Twin Cities and the different types of decisions faced by different local governments. Then we will propose a value framework that integrates the traditional fiscal analysis that many, though not all, local governments perform with additional measures of the value of open space based on research quoted earlier in this report. To complete this section of the study, we shall list and explain some quantitative tools specifically designed to help Minnesota communities make this framework operational for local decision-making.

Economic pressures affecting development

The Twin Cities and the surrounding area are growing. The Metropolitan Council estimates that the seven counties that it oversees added almost 130,000 new residents and almost 60,000 new households between 2000 and 2004. And estimates produced by the Minnesota Office of Demographics confirm that development pressure extends well beyond those seven counties.

This growth, moreover, is expected to continue. The latest planning projections from the Metropolitan Council anticipate adding around 386,000 residents in the seven-county area for the entire current decade and another 612,000 from 2010 to 2030. That translates to 181,000 new households by 2010 and another 294,000 over the following 20 years. State projections for the counties ringing those seven only add to the growth.

Therefore, it is not surprising that the demand for undeveloped land has increased in the Twin Cities and surrounding counties, thereby pushing up the price of acreage that is

suitable for development. Developers buy land not only for near-term development but also to ensure themselves of control of the land for future development as the population continues to expand.

Superimposed on the general trend toward higher prices of land throughout the area, the growing congestion of Twin Cities roadways complicates the picture further. As commuting times increase, the market attaches an ever-greater premium to the value of land located nearer to the core of the Twin Cities and its value rises even faster. This congestion also increases the pressure for redeveloping land in the central cities and inner-ring suburbs at greater densities.

Finally, the increasing presence of national builders in the Twin Cities market has produced additional upward pressure on area land prices. Well-capitalized firms that build on a national scale consider the Twin Cities to be an attractive market for current and future building and are interested in assuring themselves of adequate land to sustain their building activity in this market for years to come. Therefore, they are willing not only to bid higher prices but also have an interest in acquiring large parcels of land. This forces locally-based developers to look for ever-larger parcels themselves.

The pressure for development and the concomitant rise in land prices have at least three important implications for local governments that are called upon to make decisions that affect the amount and types of open spaces within their boundaries.

- **Delay in acquiring priority open space is expensive.** A city or county that wishes to acquire open space for some public purpose, either for park development or as natural space, must pay more, sometimes much more, than it may have expected to pay just a few years ago. A local government with a complete and well-articulated plan for acquiring parkland and natural areas may find its plans compromised by the rising price of that land. As a result, a city may have to forego or scale back some parts of its open space plan if it does not act quickly to acquire priority open space.
- **Time to make and implement open space plans is shortened.** As private developers move to lock up more and more land for future development, cities have less time to form their plans and often must commit to purchases earlier in the land use planning process or risk losing control of desirable parcels. As a result, a city may not get an open space plan in place in time to bid for land that would be most attractive for public use, or it may not be able to muster the financial resources to purchase that land at the time it is put up for sale. In some cases, developers build parks and trails themselves or preserve natural areas via clustered development. While these actions do add to open space in the community, they may not be as effective as possible if they are not part of an overall community plan.

- **Some communities have to face more complicated land use policy decisions.** As developers move further from the urban core, purchasing and developing larger parcels of land, cities and townships that are basically rural in character suddenly find themselves facing land use decisions that are new and challenging. If the city lacks the planning resources or experience to consider the open space aspects adequately, it may approve development proposals that, upon later reflection, do not provide for sufficient public open space. More generally, that city or township may approve a development plan without a full understanding of the ultimate financial consequences for the city after the influx of new residents raises demand for an array of new or expanded public services, including parks and other open spaces.

Decisions at different levels of government

Decisions affecting land use and, hence, the availability of open space are made at several different levels of government.

- **State** – At the state level, the Department of Natural Resources develops and administers state parks, water access, forests, nature preserves and wild-life management areas. The state also regulates wetlands and certain critical areas. The state owns undeveloped land and its plans for some of that land may change. As a result of recent budget pressures, the state has been selling off some parcels that it regards as surplus.
- **County** – Counties develop and administer their own systems of county parks and set certain broad land use policy parameters within their boundaries. They also make land use decisions in areas not included inside cities in the county but typically stay out of land use decisions in the cities themselves. Counties may enact more or less detailed green space plans and then implement them, coordinating with affected municipalities.
- **City** – Cities set zoning and development policies within their boundaries and ensure that buildings meet local standards and harmonize with overall plans for land use inside the city. Most comprehensive local plans include allowances for open spaces, both for recreational uses and as scenic amenities.
- **Township** – Townships are an alternative form of organization to cities. They also make land use decisions within their boundaries, but, typically, provide a smaller array of services than cities. Townships usually do not have full-time planning staff and often have only minimal plans for provision and protection of open spaces. In many, if not most, townships, the county takes on planning responsibility.

- **Watershed District** – Watershed districts are units of government organized across city and county boundaries to help deal with water management issues. They partner with other local entities in water planning, flood control, and wetlands protection and management. Hence, they are involved in decisions that affect open spaces.
- **Metropolitan Council** – The Metropolitan Council has broad authorities and responsibilities that impact land use and infrastructure decisions in the seven-county Minneapolis-Saint Paul metropolitan area. Cities and counties work with the Council to set comprehensive land use plans, including the acquisition and development of parks and trails, and the Council develops regional park policies and provides partial funding for regional park acquisition and development. In addition, the Council has a big impact on development through its investments in the regional wastewater system and its transportation policies. The Met Council has recently published its 2030 Regional Development Framework that sets goals, policies, and benchmarks for the region.

Decisions in different geographic areas

Cities and townships in and around the Twin Cities face different types of land use decisions, many of which have repercussions for open space. The types of decisions vary with the location of the community and its place in the development cycle.

Fully developed areas

In fully developed areas, changes in land values and interest in different types of housing can generate a host of different land use decisions. The community was developed under certain past market conditions, and changes in conditions often require a response. Here are some examples of land use decisions that may have an open space dimension.

- **Redevelopment of a residential area.** The redevelopment of an existing residential area, usually either as higher-density residential or as a mixed-use development, can include an open space component. Sometimes the provision of open space for the community is a key element of the overall plan, as in the Humboldt Greenway development in Minneapolis, where 212 single-family houses and other structures were acquired and replaced with a new greenway and an equal number of new housing units. (Incidentally, when the entire build-out of new housing units is completed, the project will have generated a net increase in the local tax base in excess of growth in other parts of the city.) But even where development proceeds on a smaller scale, there often is an opportunity to provide additional open space, especially when the redevelopment includes higher residential density in its housing component.

- **Redevelopment of a commercial area.** Distressed commercial areas in a developed community often present an opportunity to address the changing needs and preferences of the community, including expanding or improving open space. The Phalen Corridor Initiative on St. Paul’s East Side is a good example. It involved a 100-acre area that included the mixed-use redevelopment of two old industrial/ railroad corridors and the restoration of a wetland that had been filled in to develop a shopping center. But again, even on a smaller scale, providing added open space as part of redevelopment often makes sense.
- **Development or acquisition of a previously undeveloped parcel.** For a variety of reasons, a parcel of land may have been “skipped” in the first wave of development in an area and then remains undeveloped as the community matures. However, at a later date, perhaps when a private owner wishes to sell, the city must decide whether to acquire the land and preserve it or allow private development there. In addition to a private fundraising of over \$1M, citizens of Wayzata passed a \$3M bond initiative to protect the Cenacle Big Woods, a 23-acre wooded parcel surrounded by commercial development.

Developing areas at the urban fringe

In the areas at the urban fringe, development is a continuous process as previously undeveloped land is zoned and converted to other uses. Hence, many, if not all, of the land use decisions that local governments face involve open space considerations. Here are some examples.

- **Comprehensive planning and zoning.** At the general policy level, cities must decide in broad terms how much land will be devoted to different uses – commercial, residential, parks, natural spaces. These policy decisions balance the needs to provide housing for new residents, permit commercial development to supply needed services, and meet the recreational needs of the growing residential population.
- **Implementing parks and open space plans.** At a more operational level, cities must choose which lands to acquire and develop as parks, walking trails, or bike paths. They must also decide which lands to preserve as natural spaces protected from development and choose strategies to ensure that outcome. Finally to implement these plans, localities must pass ordinances to preserve certain areas and allocate the funds to buy and develop properties or, in some cases, to buy the development rights to certain land. Sometimes this may involve a local referendum to ask voter approval for tax increases to generate the funds. Municipalities can also obtain land or cash in lieu of land from developers to provide open space and park amenities. In recent years, most municipal parkland has been acquired in this manner. (See next paragraph.)

- **Approving specific private development proposals.** In the process of approving private developers' plans and granting permits, local governments make decisions that affect the amounts and types of different kinds of open spaces in their communities. Cities can employ a variety of regulations and incentives to ensure that adequate open space is provided inside or near large developments and that important natural resources are protected. For example, a developer might be given permission to build more units per acre if a certain amount of open space is preserved within the development. Alternatively, the developer might be charged fees that would be used to acquire parkland and open space somewhere nearby.

Freestanding growth centers and rural areas

Freestanding growth centers and rural townships located beyond the edge of contiguous urban development face their own set of decisions and planning challenges. The pressure for development and the interest in large lower-cost parcels mean that some smaller communities are being asked to make complicated land use decisions before they have well-articulated comprehensive land use plans or detailed parks and open space strategies. In some cases, development may be moving outward faster than the planning expertise to manage that growth. An example:

- **Approving a large-scale residential subdivision.** A city council or township board may be asked to approve a proposal to develop 500 new single-family housing units inside the community's boundaries. The local board has little experience in negotiating the specifics of such a proposal. As a result, the board may lack a complete understanding of its options to ensure that adequate open space is provided for. As development proceeds, it becomes clear that the new residents expect a certain level of open space amenities, but, if these were not included in the original agreement, it may be too late to get concessions from the developer. And providing those open space amenities may be beyond the financial capacity of the community, at least without raising taxes dramatically. Even worse, some natural resource such as a wetland or forest may be lost to development and only later do community leaders come to realize the value of preserving that resource for public use and the community's cost in replacing its natural functions, including storm water retention and water quality protection.
- **Approving low-density, large-lot development.** Even before the pressure of large, urban-style development reaches these areas, governments may be called upon to approve smaller-scale housing proposals with large lot sizes. For example, a builder may ask approval to develop from two to ten units on lot sizes ranging from five to ten acres in size. While such a plan may appear to make economic sense at that time in light of current housing demand and the city budget, approving the plan might

seriously affect the city's land use options in the future. Initial development at this density could make it more costly to redevelop at higher densities as the city grows and also restrict the city's ability to assemble desirable open space parcels as its land use planning becomes more formalized.

A financial framework for value analysis

In making land use decisions of the types listed in the preceding section, local government officials take the immediate financial implications of their decision into account. In considering a redevelopment plan, a developed city will consider the cost of acquiring properties and assembling land. In deciding whether to protect a small natural space that has been passed over in the first stages of development, a city will weigh the cost of acquiring the parcel and/or the cost of purchasing the development rights to the property. In negotiating with a developer, a city or township will focus on the infrastructure costs tied to or generated by a proposed development. Even in a broad comprehensive planning, a city may look at the overall tax capacity and infrastructure costs implied by the plan.

Yet most, if not all, of these decisions have additional financial implications for their communities beyond the direct costs that are foremost in decision-makers' minds. These additional implications are often hard to anticipate and difficult to quantify. As a result, decisions are often based on partial information about the financial consequences of the choices being considered rather than a complete analysis of the immediate and long-term financial effects of land use alternatives.

This lack of comprehensive financial analysis makes it difficult to factor the full value of open space into the decision calculus of local land use decisions. As far as we can tell, no standard, widely-used financial framework is applied by different local governments to the varied types of land use decisions discussed above. So, in general, it is not possible to simply estimate the value of an open space and add that value as a line item in an existing spreadsheet of other financial tool. Therefore, we will examine the different components of the value of open space and put forward a framework in which the financial implications of different types of open space decisions can be analyzed.

The public financial impact of open space

We will consider a list of the different components of the value of open space and examine the public financial implications of each to arrive at a framework in which the total financial impact of open space decisions can be analyzed.

Preservation or creation of open space

The first and most obvious financial impact of the decision to preserve open space is the public cost of acquiring the land itself. An alternative to actual acquisition of title to the land is to acquire the development rights from the private owner. In either case, the community must expend public funds to compensate the private owner of the property. If the land is already in public hands, then this element is, of course, the money foregone by not selling the land for private use. In some cases, especially when there is no immediate private interest in developing a particular parcel, this item may be the only element considered in the financial analysis of the open space decision. It should be noted that there are also ongoing management costs associated with maintaining public open space even if it is not converted to active recreational use. Habitat restoration and site security are among these potential costs.

Additions to the value of nearby property

As detailed in the research surveyed earlier in this study, open space is an amenity that often adds value to the properties located nearby. This actual change in market value is, in most cases, a private benefit that accrues to the owners of that property. However, if that property is taxable, there is a concrete benefit to the public in the form of higher property tax receipts from those properties. This effect of open space should be part of all analyses of open space decisions. At the comprehensive plan level, including this effect of open space is a recognition of the increased tax base that can be generated on the land not designated for open space, whether as park land, bike trails, or natural areas. At a more micro level, the present value of the added future taxes should be netted against the cost of acquiring a parcel to provide a more complete financial picture. And, when a developed city is considering allowing development on an open space parcel surrounded by previous development, it should recognize that the property taxes collected from surrounding properties will either decline or grow more slowly than if the open space were preserved.

Avoided net costs of alternative development

In attempting to capture the full financial implications of an open space decision, a community should estimate the full financial impact of the alternative development that would occur on the land. This is easier to do when the city is considering a concrete, specific proposal than when it must assume what the alternative development is likely to be. However, in either case, a full financial analysis should consider three elements:

- the avoided cost of the public infrastructure improvements needed for the alternative development;

- the stream of future property taxes foregone if the land is not developed; and
- the avoided (net)cost of the added future public services that would have been needed if the development had occurred.

The cost of public infrastructure and the stream of future property taxes are routinely considered in evaluating development proposals and are usually evaluated in great detail. In fact, many communities have used the stream of future tax revenues from a proposed development as the source of funds to help pay for the public infrastructure investment through the mechanism of tax-increment financing (or TIF).

However, the net cost of public services engendered by the development is not always addressed in detail and can vary highly from one project to the next and from one city to the next. In particular, this item is listed as “net cost” because it includes not only expenditures for such items as law enforcement, street maintenance, and sewer/water systems but also a large number of revenue items, taxes and fees of different kinds.

Very detailed analyses have highlighted the wide variations among different communities on per capita spending on different services, so an analysis of the net cost of public services can be very complex. In recent years, a number of computerized tools have been produced that can be of help to communities in doing this analysis. We will discuss a number of such tools that have been designed specifically for use in Minnesota communities later in this report.

Recreational use of land

If a particular parcel of open space is not simply preserved but is to be used for recreational purposes, there are additional factors that need to be included in the full financial analysis:

- the one-time cost of capital improvement to prepare the land for recreational use, and
- the operating costs of the recreational facilities (net of any anticipated fees).

The benefits of the recreational use of land accrue, as do additions to property values, to the private individuals who make use of the recreational facilities. Those benefits are clearly important in the policy decision faced by the community, perhaps through its parks department. They do not, however, affect the finances of the community except to the extent that fees are charged for the use of particular facilities.

Storm water and flood management

If a particular open space project can make a contribution to the management of storm water runoff, the lowered cost of water management should also be reflected in a thorough analysis of the project. Undeveloped land can often absorb more water than land with residential or commercial development. Wetlands can make a significant contribution to storm water management and that contribution needs to be recognized in the financial implications for the local community. And sometimes the geology of a certain area can enable a large green space to absorb significant amounts of water during floods and yet be available for recreation as dry land during normal times.

So, a complete analysis of the preservation of a wetland, the creation of a storm water holding pond, or some large green space projects needs to include the saved cost from not having to provide pipes and other so-called “grey infrastructure” for alternative flood management. On a larger scale, greenways and countywide green corridors can also have a substantial impact on water management. Most of the financial impact is on capital cost of constructing water management systems, but there can also be an ongoing management cost component and both should be included in assessing the full financial impact of an open space project.

Water quality protection

Protecting water quality is a significant and growing issue nationwide and in Minnesota. Recently, expansion of a wastewater treatment system was barred because the system would increase phosphorous in the already phosphorous-rich Lake Pepin watershed. More generally, protecting lands to maintain water quality can have an even greater financial benefit than previously appreciated. When a proposed land use will affect water quality in a way that will require remediation, the costs of that remediation should be included in a statement of the full financial impact of the development.

A full financial framework

The different elements discussed above can be melded into a full financial framework that should serve as the basis for analyzing the total net cost of an open space project. Figure 5 below shows how the different factors fit together in one financial analysis.

The figure summarizes all of the financial factors considered above in two columns, the one-time or capital costs of the project and the ongoing annual impact of the project on local budgets. This framework should prove helpful in analyzing both pure open space initiatives, such as a proposal to purchase and preserve a small woodland area, and larger development projects and policies that impact the amount of open space in a community.

The figure also illustrates how using this framework can expand the information available to local decision-makers in a way that could well affect the choices they make. For example,

- In considering whether to buy and preserve a natural area, local government will consider other factors beside the direct cost of acquiring the parcel. Taking account of the value of that amenity to adjacent properties means that the stream of added future property taxes may serve as a partial offset to that direct cost.
- In considering whether to include storm water holding ponds in a development plan, a city will include not only the value of the ponds as amenities to nearby development but also the potential saving in water management and water quality. These added factors could change the decision that would be made if only direct cost were considered.
- In deciding on the open space component of a large scale development or in forming a comprehensive community plan, cities often focus on the immediate costs of acquiring or protecting any open space, the immediate cost of public infrastructure to support development, and the future stream of property taxes to be generated. However, adding in the amenity value of open space as reflected in higher values and higher taxes and taking a detailed look at the cost of future public services may modify the city's policy choice. It may turn out that, at the margin, allowing for additional residential development on a particular parcel may, in fact, generate a cash drain on a city rather than a net addition to local revenues. If so, the city may change policy in a number of ways. For example, it might include more open space in its land use plan or change development fees and tax policies to address the full financial implications of development.

5. A value analysis framework for open space

Components of economic value	Public financial impact	
	One-time Impact	Annual Impact
Preservation/creation of open space	- one-time cost of acquiring or protecting open space	- management costs
Addition to value of nearby property		+ increased property taxes from nearby units (or avoided reduction in future taxes)
Avoided costs of alternative development	+ avoided cost of public infrastructure	- lost property taxes from foregone development
		+ avoided net cost of public services
Recreational use of land	- Cost of improvements for recreational use	- net operating and maintenance costs
Storm water and flood management	+ Lowered capital cost of alternative water management	+ lowered water management costs
Water quality protection		+ lowered water treatment costs
<u>Other Factors:</u> Additional recreational use and enhancement of value of existing park and open space areas Preservation value Wildlife habitat and movement Improved air quality Other environmental impacts	Not estimated	Not estimated
Totals	Total one-time capital cost (-) or capital investment savings (+)	Total annual cost (-) or savings (+)

In a subsequent section, we will go on to show how this framework can be made operational, specifically how the different boxes in Figure 5 can be filled in with actual numbers for financial analysis. But first we should consider those elements of the value of open spaces that are not translated into monetary terms in Figure 5.

Addressing additional components of value

While the framework put forward above does expand the values of open space that can be included in the analysis of particular proposals, it does not purport to capture all of the components of the value of open space in quantitative terms. There are several additional components of value that should be considered though it is hard to assign concrete dollar values to them.

Additional recreational use and scenic value

The recreational or scenic value of a particular open space is only partially reflected in the framework put forward above. Residents of a city or people from outside the city may patronize a recreational area or enjoy the views, yet their preferences are only picked up in this framework to the extent that some sort of admission fees are charged for a particular type of recreational facility. It can then be inferred that anyone paying such fees values that area and the services it provides by an amount greater than the fee. However, since fees are seldom charged for access to public open spaces, the values that residents and non-residents place on the use of those spaces are not fully reflected in Figure 5.

Adding to an existing park or open space or extending a trail can also enhance the value of existing open space, and can contribute to an increase in the property values further away from the addition or extension.

Preservation value

Beyond actual recreational use or viewing of certain areas, people attach value to preserving significant areas for a number of reasons. These would include maintaining them for future generations to enjoy and keeping them intact for scientific study. As mentioned earlier, it is possible to investigate and estimate this value to a broad range of people through survey techniques and this is done increasingly, especially in litigation that seeks to assess environmental damage. The elaborate indirect methodologies involved in those cases are, in general, not practical for assessing individual projects of the type being considered here and, hence, this item has not been assigned dollar values in this framework.

Wildlife habitat and movement

Another benefit of natural spaces and some parks is that they provide significant habitat for wildlife of various kinds. It is becoming increasingly difficult to maintain sufficient habitat for birds and other animals as development proceeds. Moreover, areas that offer significant habitat can often be much more effective if they are connected by greenways that allow movement between areas without the need to traverse developed (and often dangerous) areas.

This should be an important element in forming open space plans over large areas, citywide or countywide plans. An individual project should attempt to coordinate with and complement these general plans. But we know of no practical, market-based way to estimate this component and include it in the financial analysis framework presented here.

Air quality improvement

Open spaces, green spaces in particular, can improve air quality in their immediate vicinity. It is possible to calculate the impact of reducing or increasing pollutants as a result of a given development project. This is done most often in evaluating industrial development or transportation projects, especially in urban settings. In theory, it would be possible to estimate and include improvement in air quality as an element in analyzing a particular open space project. And, at the broader levels of planning, it is extremely important for society to maintain adequate open space to support air quality. In putting forward an operational framework for analysis, we have chosen to not to include it because the marginal contribution of a parcel of open space to nearby air quality when compared to, say, residential development is hard to measure. However, if in a specific instance, a community is considering an alternative land use that would involve significant emissions of solids and other pollutants, avoiding that pollution should clearly be included as a plus for the open space alternative. Recently in Louisiana, for example, funding from the private sector helped protect a wildlife and wetland area based on its ability to sequester carbon and protect air quality.

More generally, the difficulty of estimating the values of these factors in dollar terms should not preclude their being considered by land use decision-makers. However, since it is, in most cases, not possible to make use of market data to form estimates, we have not included these elements in Figure 5 above.

In summary, all of these non-measured elements should be considered in an open space decision. We do not put forward an *ex ante* method for estimating their value, but, in some cases, there is a way to infer their value *ex post*. In cases where a particular open space plan is put forward for a referendum, voters can (and hopefully do) take these factors into account in casting their votes. In a sense, the more complete financial framework above can be used to provide an estimate of the “net cost” and a referendum can be the vehicle for the public’s expressing whether they think the “net benefits” outweigh those costs. These factors are part of the list of benefits that voters evaluate in making their decision whether or not to support the referendum. Thus, in a very rough sense, referendum results can provide some indication of the value of these factors, at least to the voters in that community.

Tools for applying value analysis

In order to apply this framework, it is necessary to have a method for filling in the boxes in Figure 5, the table that summarizes the complete public finance impact of an open space proposal. We will consider the line items for the different value components and how they should be estimated.

Preservation of open space – This item is just the one-time cost of purchasing land in fee simple or the cost of purchasing the development rights to the land. This is the direct cost usually considered, often without further financial analysis.

Recreational use of land – If land is to be used for recreational purposes, then the fiscal impact of that use has two components; the one-time capital cost of any improvements made to the land and the annual net operating and maintenance costs of the recreational facilities. The capital costs will include access roads, buildings, and other infrastructure. In addition, an annual budget should be prepared and the anticipated operation and maintenance costs should be netted against any proposed recreational fees that are to be collected. The parks department or other public officials with responsibility for the proposed facility would prepare these items.

Storm water and flood management – This element of fiscal impact must be calculated by comparing the costs of storm water management incorporating the proposed open space use with the costs that would be incurred if water had to be managed without using the natural absorption provided by the open space. These amounts will vary widely depending on the size and character of the open space and the underlying geology of the area being studied. The local watershed district can be an effective partner in developing this estimate. If the provision of open space reduces the need for, and hence the cost of, restoring water quality, that savings should also be included.

Addition to value of nearby property – Estimating this element (and the associated increase in tax receipts) makes use of the results of local and national research on the effect of open spaces on property values. There are a number of steps to go through:

- First, count the number of houses within 500 feet of the proposed or existing green space or amenity. If there are no existing houses, use an estimate of the number that will be built in that area.
- Then, add up (or project) the total value of those housing units.
- Third, apply some appropriate premium to the total market value of the houses. At the current time, the research available on the Twin Cities market does not give a

clear signal as to the size of this premium. Until further research sharpens our view, we recommend using a conservative figure of 7 percent.

- Fourth, apply the appropriate tax rate for the jurisdiction being analyzed.

This process should give a serviceable estimate of the added tax revenue to be generated from nearby properties.

Avoided cost of alternative development – Estimating the total public costs of development is a complicated process that goes by the name of fiscal impact analysis. Because it is so complicated, there have been numerous attempts to produce tools that can aid local governments in conducting such analyses. These computer programs or spreadsheets take inputs that include the particulars of proposed development, detailed information about the tax structure and finances of a locality and specific information about the range, extent, and quality of public services to produce estimates of the actual impact of adding a new development (and its residents) to a city. This is especially tricky since a small increase in development may lead to a large civic expenditure if the addition pushes the community's service need past its current capacity, necessitating a sizable capital expenditure.

Because tax regulations and civic attributes vary so much across states, it would be very hard to adapt a model that had been designed for another state. We are aware of at least three such tools that were designed specifically for use in Minnesota communities. Here is a brief description of each.

Fiscal impact tools for Minnesota communities

1) Ryan and Taff Workbook – In 1996, two economists at the University of Minnesota, Barry Ryan and Steve Taff, produced a workbook that remains the most user-friendly framework for cities who wish to begin to conduct fiscal impact analyses.¹¹ Their paper includes a series of easy-to-follow and easy-to-use worksheets that cue the user to enter the necessary input numbers and then lead the user through the operations to produce fiscal impact estimates. While their framework was designed with smaller Minnesota communities in mind, on the assumption that they will often lack the staff resources to produce fiscal analyses from scratch, their framework is quite usable for any community as a first step.

¹¹ See Ryan, Barry and Steve Taff, "Estimating Fiscal Impacts of Residential Developments in Smaller Communities," Minnesota Extension Service, December, 1996.

2) Development Impact Assessment Model: a Technical Resource (DIAMaTR) - This model is an extremely complete computer-based model developed for the Minnesota Department of Agriculture by consultant James Duncan and Associates. It has modules that allow separate analyses of the fiscal impact of a given development on counties, cities, townships, water and sewer utilities and local schools. Somewhat like the Ryan and Taff workbook, it is aimed primarily at rural or freestanding communities but would be a usable framework as a starting point for other cities.

The model is available on loan from the Department of Agriculture for use by any city. Agriculture staffers are available to assist users. To date there has been little use of the model by cities but the model is being reprogrammed to be more user-friendly and the Department is exploring ways to bring the model to more cities that could benefit from using it. Interested communities should contact the Department of Agriculture for further details including the possibility of consultation with professional staff on using the model to analyze local development options.

3) Federal Reserve System Fiscal Impact Tool (FIT) – This fiscal impact tool was developed by the Community Affairs Department of the Federal Reserve System to be a resource to local communities. It is actually a series of models customized for the state in each Federal Reserve district. It includes files of a lot of data on local communities, so a user in a small or medium-sized city in Minnesota would request the Minnesota model and find that much of the information that would need to be input to DIAMaTR or the Ryan and Taff Worksheet has been preloaded and stored in the computer file. The model is available for free download or on diskette from the Federal Reserve Board in Washington.

Open space policy options

The framework discussed above is designed to help a community evaluate a specific open space project or alternative development in a systematic way and, thereby, to make more fully informed land use decisions regarding open space. Hopefully, a community that uses such a framework will make decisions that weigh all the relevant factors and, hence, stand the test of time.

However, applying this framework on a case-by-case basis does not ensure that a community will make the most effective and advantageous open space decisions. Even applying this framework at a general planning level is not sufficient to ensure that a community's open space decisions will be the best for its future and its quality of life.

In addition to a framework for analysis, two additional things are needed:

- a detailed open space plan that sets both broad parameters and specific goals, and identifies specific implementation strategies; and
- knowledge of the broad array of options available to cities to implement their open space plans.

The framework put forward here can be most effective when used in a community where these two additional elements are present. This study is not designed as a primer on how to plan or how to manage development. But there are aspects of open space planning that, in our view, should be paid attention to in order to ensure that the use of this framework leads to truly effective public open space policy decisions.

Strategy formation

Most cities and some townships have a land use plan and all of these plans have an open space component to them. However, with regard to open space strategy, not all of them have taken two steps that could improve policymaking. The two steps are:

- conducting a Natural Resource Inventory and Assessment (NRI/A), and
- prioritizing open space goals in the land use plan.

A Natural Resource Inventory is a thorough listing of natural resources in a city or county that incorporates existing disparate information and adds new information to form a complete picture of land and natural features inside an area. A Natural Resource Assessment is an evaluation of the relative importance of the natural resources identified in the inventory. The Minnesota Department of Natural Resources provides guidance on how to conduct an NRI/A and a checklist and instructions are located on the DNR website. In the past, there have been some matching financial grants available to help communities pay for these inventories.

Once an NRI/A has been conducted, it is important for the community, both government officials and residents to use the information to form or modify land use plans. The NRI/A can lead to partnerships in funding and managing priority conservation lands. If, as is typically the case, the community finds that it does not alone have the financial resources to acquire or protect all of the open spaces that are deemed desirable, priorities can be set to assure that the most important areas or features are addressed, and partnerships can be created to protect areas of greater than local importance. Even if the community cannot afford the cost of an NRI/A at the current time, it is still important to

set priorities with regard to the open spaces in the community and to produce a plan at whatever level of detail is feasible.

There are at least three possible ways in which undertaking these steps can improve open space policymaking. First, going through the NRI/A and translating the results into detailed plans can act as an impetus for communities, alone or in partnership, to take action to initiate the implementation of elements of the open space plan proactively, rather than waiting later in the cycle of development. As a result of the community discussions involved in setting land use plans, government officials and residents may be better able to agree that certain actions need to be taken sooner rather than later.

Second, having set its priorities in advance, a community is better able to make effective, timely responses to private development plans. For example, knowing that a developer's proposed plan affects a planned future greenway will enable a city to make a timely response to the plan and negotiate any changes that might be necessary to preserve, or even complement, the city's open space plan.

Third, completing an inventory and assessment positions a community to partner with land conservation agencies and nonprofit organizations, and to compete for private and public funds for conservation. This work shows that the community is prioritizing, and thinking ahead pays off – literally and figuratively.

Implementation tools

Once an open space plan has been formed, the effective implementation of that plan depends, increasingly, on a community's employing the full set of policy tools available to it. Whether acting proactively through open space initiatives, using its powers of parkland dedication, or reacting to a private development proposal, the community can achieve the most satisfactory results by utilizing all of its options.

Figure 6 includes some of the most common policy tools that are utilized by Minnesota communities to achieve open space objectives. The list is by no means exhaustive and is excerpted from a much longer list of land use policies included in a report prepared for the Metropolitan Council in 2000.¹² That report listed over 60 different types of initiatives, regulations, incentives, and financial policies and designated 14 of them as being “primarily” designed to further conservation or open space objectives. This list is drawn from the 14 cited in that study, but new approaches are being constantly invented and refined as development plays out in the Twin Cities area.

¹² See Freilich, Leitner, & Carlisle, “Tools & Techniques: Smart Growth in the Twin Cities,” March 31, 2000.

6. Land use policy tools that can be useful in open space planning

Tool	Description
Fee Simple Acquisition	Permanent purchase of land
Purchase of Development Rights	Acquisition of easements or other interests in the property in order to control and/or restrict future development
Density Bonuses and Incentive Zoning	Granting a developer the privilege to build at higher densities or exemption from other zoning restrictions in exchange for providing open space amenities not otherwise required by local regulations
Clustered zoning	Reducing lot sizes in certain areas in order to preserve environmentally sensitive areas or open space
Transfer of development rights	Permitting landowners to transfer development rights from an area that is to be protected as open space to another area more suitable for development or increased intensity
Environmentally sensitive lands ordinances	Regulations that require new development to avoid wetlands or other sensitive areas
Critical areas regulations	Restrictions on development that threatens natural systems that perform functions of greater than local significance, i.e. the effects extend beyond the single municipality
Impact fees	Charges imposed on new development in order to provide for public facilities (including parks, for example) necessitated by new development

Source: Adapted from Freilich, Leitner & Carlisle, "Tools & Techniques: Smart Growth in the Twin Cities"

The hallmark of many of the successful new policies is that they enable cities to provide open space without the need to acquire all lands in fee simple, an approach that is, almost always, prohibitively costly. Identifying which lands must be acquired and others that can be protected with other tools is essential for a successful land conservation plan. Private and public partners will then be able to provide assistance more efficiently. Since there is a growing understanding that open spaces are amenities that convey value on nearby property, communities and developers find increased opportunities to craft "win-win" situations in which the provision of open space benefits the community at large while enabling the developer to make expanded profits, as well.

IV. Sample applications of the framework

The purpose of the value framework put forward here is to give local decision-makers a broader perspective on the full financial implications of open space choices that they face. In order to illustrate how the use of this framework can change decisions or, at least, facilitate consideration of a wider set of options, we examine three examples drawn from the types of open space decisions that communities currently face in the Twin Cities area and beyond. These examples incorporate assumptions about local taxes, property values, water management costs, and levels of public services that are in line with those of similar communities located in or near the Twin Cities. Of course, actual conditions vary from city to city, but these examples convey an idea of the range of outcomes and show how considering the value of open space in a more complete framework can broaden local perspectives.

Example 1: Open space in a comprehensive plan

- A city or township located beyond the urban fringe is deciding on its general approach to the amount of open space of different types to incorporate into its comprehensive plan.

The city is setting the broad parameters of its land use plan and also designating the range of uses in different areas through zoning. It has decided the desired amount of active recreation areas it will need, but decision-makers are uncertain about the amount of space to devote to preserved natural areas. One specific option involves designating a linear greenway with the loss of some potential housing and preserving a wetland that could either be filled in for development or retained as a scenic amenity.

Initial policy discussion

In considering the question of whether to incorporate expanded open space into the plan, the most obvious financial consequences are the direct costs of implementing the open space option: either the cost of acquiring the land in question or the dollars foregone by not selling the land to a private party if it is already under public ownership. In this hypothetical, the actual cost is roughly \$2 million for the total of 200 acres that would need to be acquired if the greenway land is to be acquired and the wetland is to be retained in public hands.

On the other hand, if the land were developed in single-family homes, the addition to the local tax base would be \$45 million of new homes that generate \$855,000 per year of added property taxes. Of course, officials know that they would be asked to provide

additional services for those added residents. But still, a cursory inspection could leave the impression that the city was paying \$2 million for the chance to collect \$855,000 less in annual taxes. A more complete fiscal analysis of the situation is far different, however.

Value analysis

As a result of the added financial elements in the value framework, we see a very different picture. The *one-time cost* of acquiring the open space is partially offset by the avoided costs of not having to provide certain infrastructure for the added development and reduction in capital costs from incorporating the wetland into storm water management rather than using additional piping and other underground structures.

7. Example 1: The value of green space in a comprehensive plan

Components of economic value	One-time impact	Annual impact
Acquisition of open space	-\$2,000,000	
Change in property taxes of nearby homes		\$125,400
Avoided costs of public infrastructure for new homes	\$250,000	
Lost property taxes from foregone development		-\$855,000
Avoided cost of public services		\$930,000
Lowered capital cost for water management	\$300,000	
Lowered operating cost for water management		\$30,000
<u>Other Factors:</u>		
Preservation value		
Wildlife habitat and movement		
Improved air quality		
Other environmental impacts		
Totals	-\$1,450,000	\$230,400

The *annual costs* of the open space alternative are also different from cursory impressions. In fact, the open space option generates a net annual savings for the city in this example. The value added to existing or future homes located near the greenway and pond translates into roughly \$125,000 per year of added revenue to the city. Even more importantly, the actual cost of providing needed public services to the added houses (and their residents) exceeds the taxes and fees that would have been generated by the added

development.¹³ There is also a small saving from storm water management operating expenses.

A calculation of the net present value of the added open space provides a clear statement of the true cost of the open space to the community. Initially, discussion centered on the one-time \$2 million cost of the acquisition and the lost tax revenues of \$855,000 per year. The apparent net present value¹⁴ of providing the additional open space was approximately -\$11.7 million, a number that includes both the additional outlay and the value of the lost taxes over the next twenty years. However, the more complete analysis provided here shows that the net present value of the project is actually a positive \$1.2 million because the added annual cash flows over 20 years outweigh the initial outlay for the land.

All-in-all, this analysis shows not only that the one-time net cost of implementing the open space option is not only reduced but it is also offset over future years in positive cash flows generated chiefly from the added value of other homes in the city and the savings on future public services.

Subsequent policy choices

This financial analysis should give city policymakers a different perspective on the proposed open space option and could lead them to some different policy choices.

- The city could acquire the greenway land and the wetland either from existing funds or it could ask voters to approve bonding to purchase the land.
- Based on this revised view of the fiscal impact of the greenway, it might explore other greenway options within the city boundaries.
- The city might also reconsider some of its regulations for new construction, perhaps by raising development fees to help pay for some of the costs of providing public services for new residents. It might also require that land be dedicated as a condition for approving development on the site in question to ensure that a portion would remain as open space.

¹³ In some fiscal impact analyses, the public capital costs of new development that are broken out separately in this table would be annualized in the form of servicing cost on the debt used to finance the added infrastructure. In this example, such treatment would increase the apparent one-time cost of the open space but also increase the annual cost savings. Capital costs for storm water management could be treated similarly.

¹⁴ Net present value calculated by applying an appropriate discount factor to future dollar values and adding the resultant values to any current dollar spending. The figures quoted in the text and the present values in subsequent examples were all calculated using a discount rate of 7 percent and a time horizon of twenty years.

Example 2: Reacting to a residential development plan

- A city located at or beyond the urban fringe is asked to approve a developer's plan for a residential subdivision.

The city is asked to approve a large private development plan that involves building 100 new single-family homes on a 100-acre parcel of land. The development company is willing to sell as much as 15 acres to the city for use as open space or for park development at \$65,000 per acre, a figure that reflects the profit it would make by building homes on the land.

Initial policy discussion

The cost of acquiring the whole 15 acres at the developer's price is \$975,000, which would stretch the city's financial capacity and take funds away from other planned open space uses. It is also calculated that reducing the number of units in the development by 15 would reduce prospective property taxes by almost \$100,000 and the city is eager for growth.

Further analysis indicates that a particular 15 acres could be connected to other open space currently owned by the city and slated for improvement as recreational land. But the cost of improvements to the added acreage just increases the cost of the open space acquisition by another \$150,000 dollars, bringing the total tab to \$1,125,000.

Value analysis

Application of the value framework yields some additional perspective on the possible acquisition of this open space. The *one-time costs* are offset slightly by savings in the capital cost for storm water management because the particular land in question will absorb water and has favorable drainage characteristics.

There is more interesting action with regard to the annual impact of the proposed project. The added open space increases future property taxes in two ways. First, it raises the market value and, hence, the taxes paid by the remaining 85 homes that will be built in the proposed subdivision. This would generate estimated tax receipts of almost \$40,000 per year. Second, because of its location near the edge of the subdivision, it would also increase the value of some other homes located outside the subdivision by a modest amount.

In this example, it is assumed that the city's circumstances are such that the proposed development just pays for itself in terms of net cost of public services so the foregone

cost of providing services just cancels out the foregone revenue from the 15 houses that are not built.

8. Example 2: Valuing green space options in a residential subdivision

Components of economic value	One-time impact	Annual impact
Acquisition of open space	-\$975,000	
Added property taxes from neighboring homes outside the proposed development		\$7,980
Added property taxes from homes in the development		\$39,568
Lost property taxes from foregone development		-\$99,750
Avoided cost of public services		\$99,750
Added capital cost for recreational use	-\$150,000	
Lowered capital cost for water management	\$100,000	
Lowered operating cost for water management		\$10,000
<u>Other Factors:</u>		
Preservation value		
Wildlife habitat and movement		
Improved air quality		
Other environmental impacts		
Totals	-\$1,025,000	\$57,548

Therefore, on net, the acquisition of the open space remains expensive, but it actually generates net positive cash flow from increased taxes on homes that will be valued more highly.

A net present value analysis again highlights the difference between the perceived value of the open space and the actual value. If only the land acquisition cost of \$975,000 and the annual property taxes on the new homes are considered, the net present value of the project would appear to be -\$2.1 million. However, including all of the other factors that are part of the more complete statement in Figure 8 changes the net present value to -\$372,000, a much smaller number.

Subsequent policy choices

The value analysis leads to the consideration of several policy options. For one thing, the development firm is able to market the open space as an amenity to its prospective customers and to make more profit on each unit that it sells because of the presence of the open space. Therefore, there may be the possibility of negotiating an agreement that will

reduce or eliminate the upfront costs to the city while retaining the pecuniary advantage to the developer.

- The city could negotiate an agreement where the developer or an association retains title but agrees to covenants that preserve the open space and allow certain forms of public recreational usage.
- The city could offer the development company the right to develop more units than current zoning permits (a density bonus) in exchange for its transferring title to the city.
- Gaining control of the 15 acres of open space might make it feasible for the city to plan and develop a more extensive greenway system that would add value to additional properties in the city. The city might conduct a referendum to provide the funds to implement the expanded greenway plan.

The value of open space as an amenity and the potential for higher profits is not news to the development community with the result that private developers often see it in their interest to dedicate a portion of developments to open space and, on occasion, provide parks and other amenities that have typically been provided in the public sphere. In this example, if the city were to give the developer a density bonus in exchange for title to the open space parcel, the net present value of the transaction would actually be positive. The city would be money ahead over the next twenty years and the developer would make a larger profit by building more houses.



Example 3: Acquiring a small parcel of previously undeveloped land

- A more or less fully developed city becomes aware that a private owner wants to sell a parcel of undeveloped land surrounded on three sides by single-family homes.

The city becomes aware that the settlement of the estate of a long-time resident will include not only the sale of a home but also the sale of a 7-acre parcel of moderately wooded land. The parcel was bypassed in the development of this suburban city because it was inconvenient to develop. However, as land nearer the urban core has become more scarce, and, hence, more valuable, the owner has had numerous inquiries about the property but has chosen not to sell. Therefore, the city can be certain that, if it does not purchase the land, it will be developed, probably with seven upper-bracket single-family homes.

Initial policy discussion

Initial discussions focus on the cost of the parcel, \$50,000 per acre or \$350,000 total. Once again, it is also easy to focus on the net loss of tax revenues, which are estimated at roughly \$93,000. Therefore, the total net cost of preserving this bit of woods could appear to be the purchase price of \$350,000 plus the present value of the stream of foregone future tax revenues from the new homes that could be built on the site. A more complete analysis modifies this picture slightly.



Value analysis

The *one-time cost* to the city is reduced slightly by the avoided cost of certain public infrastructure that will be required by the alternative residential development, but this impact is not large because the community is a mature one and the development is a small infill project. The public savings only offset a small portion of the cost of acquiring the land, reducing the net cost to \$320,000 from \$350,000.

The ongoing *annual cost* picture is also different. Preserving the open space does cost the city money on an annual basis but the total net impact is a loss of only about \$8,000 per year, not \$93,000. The main factor in lowering the cursory figure is the avoided cost of public services for the development. The taxes for the new construction more than cover its additions to public service costs since the development is small and does not impact the capacity of different public systems. But a second factor also reduces the city's loss, avoiding reduction in the taxes collected from 30 neighboring homes whose market values would be affected by the loss of the woods. In fairness, it should be noted that the assessed values of these houses would probably not drop immediately but they would be likely to rise more slowly over the future. So this annual impact may be thought of as more of a long-term, steady-state calculation.

9. Example 3: The value of purchasing a small wooded parcel

Components of economic value	One-time impact	Annual impact
Acquisition of open space	-\$350,000	
Avoided decline in property taxes of nearby homes		\$23,940
Avoided costs of public infrastructure for new homes	\$30,000	
Lost property taxes from foregone development		-\$93,100
Avoided cost of public services		\$61,000
Other Factors:		
Preservation value		
Wildlife habitat and movement		
Improved air quality		
Other environmental impacts		
Totals	-\$320,000	-\$8,160

A net present value comparison again highlights how a more complete fiscal analysis gives a clearer picture of the true cost of providing open space. Narrow consideration of only the acquisition cost and the foregone taxes would imply a present value of the open space of \$-1.4 million. However, taking the factors in Figure 9 into account reduces that

amount to \$-412,000. This is a reduction of the apparent cost by almost two-thirds. Moreover, if the city could arrange to purchase only the development rights, the cost could be reduced even further.

Subsequent policy choices

The results of the value analysis of this transaction do not overturn the fact that the city will have to pay to acquire the parcel and will collect lower tax revenues in the future. But the analysis does alter the net costs and might lead the city to take a number of actions that it might not have considered without looking at the numbers in Figure 9.

- The city could decide to purchase the land and keep it as open space.
- As a result of seeing that the net annual impact is minimal, the city might explore reducing its upfront cost by purchasing development rights only. This might be attractive to the owner's heirs if they (and the owner) had a special attachment to the woods but hadn't made any provisions to protect them.
- The city might protect a portion of the site by allowing a portion of the parcel to be developed while the rest would be protected from further development by a conservation easement.

The three foregoing examples all highlight how decisions could be altered by explicit consideration of the overall financial impact of open space decisions. The three elements that can be quantified and included in this value analysis are

- added property taxes paid by nearby properties,
- avoided cost of public services generated by alternative development, and
- potential cost savings from better storm water management.

Of course, other important environmental impacts are not so readily converted to dollars and cents. However, these three elements can affect the perceived net cost of open space projects and affect the balance between abstract benefits and tangible costs. At the very least, applying this value framework should improve land use decisions and open the door to consideration of policy options that may currently be ignored in many cases.

Summary

In their planning and land use decisions, communities face a long list of goals and priorities: providing housing of different types, planning for commercial development, providing for schools and infrastructure, building a tax base in order to afford to provide needed services, and providing open space are some of the main ones. In setting priorities and striking a balance between these different goals, it is important that communities have a clear picture of the synergies and trade-offs between them. Unfortunately, providing open space can be seen as a luxury that uses scarce public dollars and precludes the use of land for residential or commercial development. Where that limited view of open space is adopted, less open space will be provided.

The preceding examples illustrate the central theme of this study: open spaces have positive economic value. That value takes many forms and some of those forms can be expressed in dollars and cents to be included in the financial plans of cities and townships. Communities that have a more complete understanding of the fiscal implications of open space will be better equipped to set priorities and strike a balance between open space and other objectives that will lead to a higher quality of life for their residents now and in the years to come.

Applying the financial framework put forward in this study can help communities to a more complete understanding of the value of providing additional open space for their residents. Even where full and detailed financial projections are not made, consideration of the different ways in which open space adds value can lead the community to a broadened perspective in land use decision making.

The preceding examples are focused on decision-making at the local level by cities and townships. This financial framework, even if fully implemented, does not capture one additional element of the value of some of the open space provided within a city. That is the value that a significant natural area or a recreational resource or a portion of a longer trail may have to people who live outside of the community itself. Therefore, it will continue to be important for the state of Minnesota, counties, and cross-jurisdictional entities like the Metropolitan Council to remain active in planning for and providing open spaces if the quality of life in our region is to be maximized.

Bibliography

- Acharya, G. and B. Lynne Lewis (2001). "Valuing Open Space and Land-Use Patterns in Urban Watersheds." Journal of Real Estate Finance and Economics **22**(2/3): 221-237.
- Anderson, S. (2000). The effect of open space on single-family, residential home property values, Macalester College: 1-7.
- Anderson, S. and S. E. West (2003). The Value of Open Space Proximity and Size: City versus Suburbs, Macalester College: 1-34.
- ANJEC (2002). Open Space is a Good Investment, Association of New Jersey Environmental Commissions: 1-12.
- B. Bolitzer and N. R. Netusil (2000). "The impact of open space on property values in Portland, Oregon." Journal of Environmental Management **59**: 185-193.
- Babcock, M., E. Poscher, et al. (1999). The Social, Aesthetic, and Economic Values of Open Space. Open Spaces in Expanding Urban Environments, University of Arizona: 1-14.
- Bates, L. J. and R. E. Santerre (2001). "The Public Demand for Open Space: The Case of Connecticut Communities." Journal of Urban Economics **50**: 97-111.
- Benhart, J. E. and S. Davis (2002). "The Effects of Greenways and Trails on Environmental Quality and Property Values in Pennsylvania." Pennsylvania Geographer **40**(2): 157-175.
- BonestrooRoseneAnderlik (2001). Infrastructure Cost Analysis, Metropolitan Council: 1-15.
- Boyer, T. and S. Polasky (2004). Valuing Urban Wetlands: A Review of Non-Market Valuation Studies, Department of Applied Economics, University of Minnesota: 1-41.
- Breffle, W. S., E. R. Morey, et al. (1998). "Using Contingent Valuation to Estimate a Neighbourhood's Willingness to Pay to Preserve Undeveloped Urban Land." Urban Studies **35**(4): 715-727.
- Burchell, R. W. (1998). The Costs of Sprawl - Revisited, Transit Cooperative Research Program: 1-268.
- Burchell, R. W. (2000). Costs of Sprawl - 2000, Transit Cooperative Research Program: 1-551.
- CityParksForum (2002). How cities use parks for. Economic Development, American Planning Association: 1-4.

- Correll, M. R., J. H. Lillydahl, et al. (1978). "The Effects of Greenbelts on Residential Property Values: Some Findings on the Political Economy of Open Space." Land Economics **54**(2): 207-217.
- Cox, L. J. and G. Vieth (1997). The Importance of Open-Space Value for Land Use Policy in Hawaii, College of Tropical Agriculture and Human Resources, University of Hawaii at Manoa.
- Croke, K., R. Fabian, et al. (1986). "Estimating the Value of Natural Open Space Preservation in an Urban Area." Journal of Environmental Management **23**: 317-324.
- Crompton, J. L. (2001). The Impact of Parks on Property Values. Parks & Recreation: 90-95.
- Crompton, J. L. (2001). The Impact of Parks on Property Values. Parks & Recreation: 62-67.
- Crompton, J. L. (2001). "The Impact of Parks on Property Values: A Review of Empirical Evidence." Journal of Leisure Research **33**(1): 1-31.
- Crompton, J. L. (2004). The Proximate Principle, National Recreation and Parks Association.
- Crompton, J. L., L. A. Love, et al. (1997). "An Empirical Study of the Role of Recreation, Parks, and Open Space in Company (Re)Location Decisions." Journal of Park and Recreation Administration **15**(1): 37-58.
- Diamond, D. B. (1980). "The Relationship Between Amenities and Urban Land Prices." Land Economics **56**(1): 21-32.
- Do, A. Q. and G. Grudnitski (1995). "Golf Courses and Residential House Prices: An Empirical Examination." Journal of Real Estate Finance and Economics **10**: 261-270.
- Doss, C. R. and S. J. Taff (1996). "The Influence of Wetland Type and Wetland Proximity on Residential Property Values." Journal of Agricultural and Resource Economics **21**(1): 120-129.
- DuncanAssociates (1999). Cost of Public Services Study, Minnesota Department of Agriculture: 1-147.
- Dwyer, J. F., E. G. McPherson, et al. (1992). "Assessing the Benefits and Costs of the Urban Forest." Journal of Arboriculture **18**(5): 227-234.
- Earnhart, D. (2001). "Combined Revealed and State Preference Methods to Value Environmental Amenities at Residential Locations." Land Economics **77**(1): 12-29.

- Espey, M. and K. Owusu-Edusei (2001). "Neighborhood Parks and Residential Property Values in Greenville, South Carolina." Journal of Agricultural and Applied Economics **33**(3): 487-492.
- Fausold, C. J. and R. J. Lillieholm (1996). The Economic Value of Open Space: A Review and Synthesis, Lincoln Institute of Land Policy: 1-38.
- Fausold, C. J. and R. J. Lillieholm (1999). The Economic Benefits of Open Space in Utah. Utah Recreation and Tourism Matters, Utah State University Extension.
- Forsyth, M. (2000). "On Estimating the Option Value of Preserving a Wilderness Area." Canadian Journal of Economics **33**(2): 413-434.
- Frank Lupi, J., T. Graham-Tomasi, et al. (1991). A Hedonic Approach to Urban Wetland Valuation, Department of Applied Economics, university of Minnesota: 1-29.
- Freilich, L. C. (2000). Tools & Techniques: Smart Growth in the Twin Cities, Metropolitan Council: 1-37.
- Harpankar, K. and S. J. Taff (2004). Tracking the Effects of Conservation Easements on Property Tax Values, Department of Applied Economics, University of Minnesota: 1-13.
- Harpman, D. A., M. P. Welsh, et al. (2004). "Unit Non-Response Bias in the Interval Data Model." Land Economics **80**(3): 448-462.
- Hendon, W. S. (1972). "The Park as a Determinant of Property Values." The American Journal of Economics and Sociology: 289-300.
- Holtman, C., S. J. Taff, et al. (1996). An Inquiry into the Relationship of Wetlands Regulation and Property Values in Minnesota, Department of Applied Economics, University of Minnesota: 1-32.
- Howell-Moroney, M. (2004). "What Are the Determinants of Open-Space Ballot Measures? An Extension of the Research." Social Science Quarterly **85**(1): 169-179.
- Irwin, E. G. (2002). "The Effects of Open Space on Residential Property Values." Land Economics **78**(4): 465-480.
- Irwin, E. J. and N. E. Bockstael (2001). "The Problem of Identifying Land Use Spillovers: Measuring the Effects of Open Space on Residential Property Values." American Journal of Agricultural Economics **83**(3): 698-704.
- Kalambokidis, L. and D. Leishman (2003). Toward a Minnesota Model of the Fiscal Impacts of Residential Development, Department of Applied Economics, University of Minnesota: 1-19.

- Kelly, M. C. H. and M. Zieper (2000). Financing for the Future: The Economic Benefits of Parks and Open Space. Government Finance Review: 23-26.
- Krizek, K. J., P. Mogush, et al. (2004). The Value of Bicycle Trail Proximity on Home Purchases, Humphrey Institute, University of Minnesota: 1-25.
- Lake, M. B. and K. W. Easter (2002). Hedonic Valuation of Proximity to natural Areas and Farmland in Dakota County, Minnesota, Department of Applied Economics, University of Minnesota: 1-31.
- Landis, J. (1995). "Imagining Land Use Futures: Applying the California Urban Futures Model." Journal of the American Planning Association **61**(4): 438-457.
- Lerner, S. and W. Poole (1999). The Economic Benefits of Parks and Open Space, Trust for Public Land.
- Lindsey, G. (2003). Public Choices and Property Values: Evidence from Greenways in Indianapolis, Center for Urban Policy and the Environment, Indiana University-Purdue University Indianapolis: 1-12.
- Lindsey, G. and G. Knaap (1999). "Willingness to Pay for Urban Greenway Projects." Journal of the American Planning Association **65**(3): 297-313.
- Lutzenhiser, M. and N. R. Netusil (2001). "The Effect of Open Spaces on a Home's Sale Price." Contemporary Economic Policy **19**(3): 291-298.
- Mahan, B. L., S. Polasky, et al. (2000). "Valuing Urban Wetlands: A Property Price Approach." Land Economics **76**(1): 100-113.
- McConnell, V. and M. Wells (2005). The Value of Open Space: Evidence from Studies of Nonmarket Benefits. Washington, D.C., Resources for the Future: 1-78.
- Metropolitan Council (2001). The Non-Fiscal Impacts of Growth, Metropolitan Council: 1-55.
- Meyers, P. (1999). Livability at the Ballot Box: State and Local Referenda on Parks, Conservation, and Smarter Growth, Election Day 1998, Brookings Institution.
- Miller, S. (1992). The Economic Benefits of Open Space. The Benefits of Open Space: 1-16.
- Montgomery County Lands Trust (2002). Saving Land Saves Money, Montgomery County Lands Trust: 1-10.
- More, T. A., P. G. Allen, et al. (1985). "Measuring the Economic Value of Urban Parks: A Caution." Leisure Sciences **7**(4): 467-477.

- More, T. A., T. Stevens, et al. (1988). "Valuation of Urban Parks." Landscape and Urban Planning **15**: 139-152.
- Nahuelhual, L., M. L. Loureiro, et al. (2004). "Using Random Parameters to Account for Heterogeneous Preferences in Contingent Valuation of Public Open Space." Journal of Agricultural and Resource Economics **29**(3): 537-552.
- National Park Service (1995). Economic Impacts of Protecting Rivers, Trails, and Greenway Corridors.
- Nicholls, S. (2004). Measuring the Impact of Parks on Property Values. Parks & Recreation: 24-32.
- Palmquist, R. B. (1992). "Valuing Localized Externalities." Journal of Urban Economics **31**: 59-68.
- Phillips, P. L. (1991). Real Estate Impacts of Urban Parks, Economics Research Associates: 1-8.
- Rails-to-Trails Conservancy (2003). Economic Benefits of Trails and Greenways, Rails-to-Trails Conservancy: 1-4.
- Regional Greenways Collaborative Vocabulary of Greenways in the Twin Cities, Regional Greenways Collaborative: 1-10.
- Riddell, M. (2001). "A Dynamic Approach to Estimating Hedonic Prices for Environmental Goods: An Application to Open Space Purchase." Land Economics **77**(4): 494-512.
- Romero, F. S. and A. Liserio (2002). "Saving Open Spaces: Determinants of 1998 and 1999 "Antisprawl" Ballot Measures." Social Science Quarterly **83**(1): 341-352.
- Ryan, B. and S. J. Taff (1996). Estimating Fiscal Impacts of Residential Developments in Smaller Communities, Minnesota Extension Service: 1-30.
- Smith, V. K., C. Poulos, et al. (2002). "Treating open space as urban amenity." Resource and Energy Economics **24**: 107-129.
- Tischler & Associates (1999). Fiscal Impact Analysis: Growth Scenario & Land Use Prototype Study, City of Shakopee, Metropolitan Council: 1-35.
- Tischler & Associates (1999). Service Levels, Cost & Revenue Assumptions, City of Shakopee, Metropolitan Council: 1-52.
- Tischler & Associates (2001). The Fiscal Impact of Growth on Cities (draft), Metropolitan Council: 1-61.
- Trust for Public Land (2004). LandVote 2004, Trust for Public Land: 1-18.

- Turner, M. A. (2004). "Landscape Preferences and Patterns of Residential Development." Journal of Urban Economics.
- Tyrvaainen, L. and H. Vaananen (1998). "The economic value of urban forest amenities: an application of the contingent valuation method." Landscape and Urban Planning **43**: 105-118.
- Vossler, C. A., J. Kerkvliet, et al. (2003). "Externally validating contingent valuation: an open-space survey and referendum in Corvallis, Oregon." Journal of Economic Behavior and Organization **51**: 261-277.
- Wandey, F. N., B. Patton, et al. (2004). Preparing to Use DIAMaTR, Minnesota Department of Agriculture: 1-37.
- Weigher, J. C. and R. H. Zerbst (1973). "The Externalities of Neighborhood Parks: An Empirical Investigation." Land Economics **49**(1): 99-105.
- Wolf, K. L. (2004). Public Values of Nature: Economics of Urban Trees, Parks and Open Space. Design with Spirit: Proceedings of the 35th Annual Conference of the Environmental Design Research Association. D. Miller and J. A. Wise, Environmental Design Research Association: 88-92.



