

RESEARCH SYNTHESIS | *May 2010*

A detailed summary of the existing evidence base on a given topic that identifies gaps in the knowledge and steps for advancing the science.

The Economic Benefits of Open Space, Recreation Facilities and Walkable Community Design

Introduction

Overweight and obesity rates have risen dramatically in the United States since the 1970s,¹ and, during a similar time period, physical activity rates have declined in both children and adults.^{2,3} Being physically active is more than a personal decision; community design and the availability of open spaces and recreation areas strongly influence how active people are. The Guide to Community Preventive Services created by the Centers for Disease Control and Prevention identifies community designs in which residents can walk or bicycle to nearby destinations (often called compact, walkable or traditionally designed communities) as effective ways of promoting physical activity for adults,^{4,5} and other studies demonstrate similar findings for youth.^{6,7} People living in walkable neighborhoods get about 35–45 more minutes of moderate-intensity physical activity per week, and are substantially less likely to be overweight or obese, than do people of similar socio-economic status living in neighborhoods that are not walkable.^{8,9,10} Living close to parks and other recreation facilities also is consistently related to higher physical activity levels for both adults¹¹ and youth.¹² One national study found that adolescents with easy access to multiple recreation facilities were both more physically active and less likely to be overweight and obese than were adolescents without access to such facilities.¹³ The Institute of Medicine has stated that improving the walkability of neighborhoods and increasing access to recreation facilities are essential strategies for preventing childhood obesity.¹⁴



Walkable neighborhoods, parks and open spaces also are believed to generate economic benefits to local governments, home owners and businesses through higher property values and correspondingly higher tax assessments. The economic benefits of open, walkable spaces can play an important role in policy-makers' decisions about zoning, restrictions on land-uses, government purchase of lands for parks and similar initiatives. **This research synthesis reviews the sizable body of peer-reviewed and independent reports on the economic value of outdoor recreation facilities, open spaces and walkable community design. It focuses on “private” benefits that accrue to nearby homeowners and to other users of open space.** While parks may also generate “public” benefits to the whole community, such as alleviating traffic congestion, reducing air pollution, flood control, wildlife habitat, improved water quality and facilitating healthy lifestyles, the literature estimating the economic value of these types of benefits is not reviewed.

A Note on Economic Valuation Methods

One method for estimating the economic value of open space and recreation areas which do not have a market value is through hedonic pricing methods. This statistical approach is used to link a good traded in the marketplace (i.e. a house) with an environmental good (i.e. clean air) that is not traded in the market at a point in time. An established body of research has used this approach to estimate the value buyers in real estate markets place on seemingly intangible characteristics. Characteristics

such as land-use mix,^{15, 16} street pattern,¹⁷ municipal amenities,^{18, 19} proximity to transit stations and commercial centers,^{20, 21} among other factors have been shown to increase the value of residential properties located nearby.

While this review focuses on direct economic effects through property values and fiscal impacts, it is important to note that open spaces can also provide indirect economic benefits. Ecological services and mental health benefits, while outside the scope of this research synthesis, could also be considered as indirect effects of parks. Open spaces may also provide recreational benefits

to users who do not own adjacent property or live within the park municipality. These indirect recreational benefits typically are evaluated using different methods. Two examples of these methods are the Travel Cost Method, which attempts to capture the economic value of open space by calculating visitors' costs to travel to and use a park, and Contingent Valuation, an approach in which willingness to pay for public goods like parks is simulated in surveys.

Key Research Results

- **Open spaces such as parks and recreation areas can have a positive effect on nearby residential property values, and can lead to proportionately higher property tax revenues for local governments (provided municipalities are not subject to caps on tax levies).**
- **The economic impact parks and recreational areas have on home prices depends on how far the home is from the open space, the size of the open space and the characteristics of the surrounding neighborhood.**
- **Open space in urban areas will increase the level of economic benefits to surrounding property owners more than open space in rural areas.**
- **Open space, recreation areas and compact developments may provide fiscal benefits to municipal governments.**
- **Compact, walkable developments can provide economic benefits to real estate developers through higher home sale prices, enhanced marketability and faster sales or leases than conventional development.**

Details on Key Research Results

- **Open spaces such as parks and recreation areas can have a positive effect on nearby residential property values, and can lead to proportionately higher property tax revenues for local governments.**

A pair of studies conducted in 2000 and 2001 analyzed the same set of more than 16,400 home sales in Portland, Ore., using two different methods. The first found that the 193 public parks analyzed had a significant, positive impact on nearby property values. The existence of a park within 1,500 feet of a home increased its sale price by between \$845 and \$2,262 (in 2000 dollars). Additionally, as parks increased in size, their impact on property value increased significantly.²² The second study found that large natural forest areas had a greater positive impact on nearby property prices than did small urban parks, specialty parks such as playgrounds or skate parks, and golf courses. Homes located within 1,500 feet of natural forest areas enjoyed statistically significant property premiums, an average of \$10,648, compared to \$1,214 for urban parks, \$5,657 for specialty parks and \$8,849 for golf courses (in 1990 dollars).²³

Studies in Howard County, Md.; Washington County, Ore.; Austin, Texas; Minneapolis-St. Paul, Minn., and other areas, have used data from residential sales, the census and Geographic Information Systems (GIS) to examine the marginal values of different types of parks, and confirmed that different types of open space have different effects on property values.^{24, 25, 26, 27, 28} The studies found that, in general, urban parks, natural areas and preserved open spaces showed positive effects on property values.²⁹

Value increase to homes located within 1,500 feet of the following types of parks:

Natural Areas: **\$10,648**

Golf Courses: **\$8,849**

Specialty Parks: **\$5,657**

Urban Parks: **\$1,214**

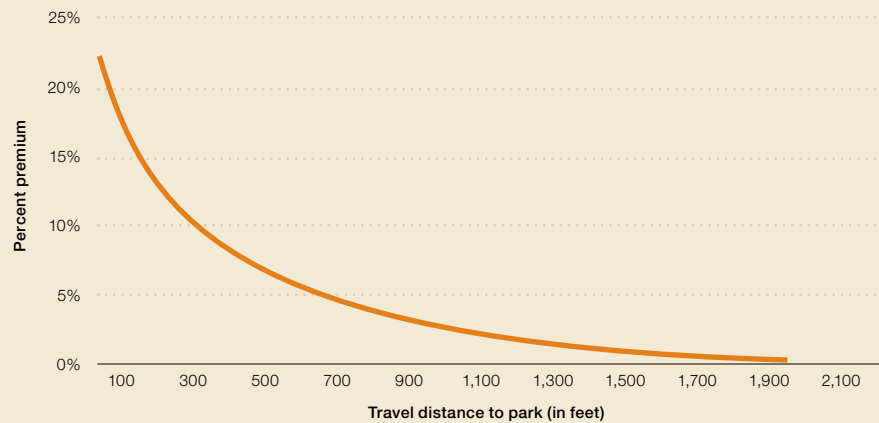
Some types of open space can reduce nearby property values, an outcome sometimes called ‘the nuisance effect.’ Studies have confirmed that parks that are excessively busy,^{30,31} located in highly desirable or undesirable neighborhoods, or unattractive or poorly maintained have a negative impact on home values. In these instances, parks detract from property values due to the perception that they are unsafe, unnecessary or unused. One study conducted in Greenville, S.C., found that attractively maintained small and medium parks have a positive influence on neighboring property values. However, it also found that such parks that are not improved or well maintained had negative impacts on residential property values.³²

The positive effect natural open space has on nearby property values can result in higher assessments and thus higher property tax revenues for local governments. In one Boulder, Colo., neighborhood, the overall value of the greenbelt was approximately \$5.4 million, which contributed potentially \$500,000 annually to the overall neighborhood property tax revenue. The purchase price of this greenbelt for the city was approximately \$1.5 million and, thus, the potential property tax revenue alone would allow a recovery of initial costs in just three years.³³ A study conducted in three Maryland counties calculated the economic benefits of preserved agricultural land to homeowners and estimated the property tax revenues generated from a 1 percent increase in permanent open space. It found that for a 1 percent (148 acre) increase in preserved agricultural land in Calvert County, Md., the increase in housing values within a one-mile radius generated \$251,674—enough tax revenue to purchase an additional 88 acres of parkland in one year.³⁴

At the same time, municipal governments must be aware that the level of property tax revenues will depend on the built environment around the park. An analysis of a 7.9 mile greenbelt in Austin, Texas found that the incremental tax base increases from properties in neighborhoods adjacent to the park were less than the cost of acquiring the greenbelt (\$14.89 million in 2004 dollars). Unlike the City of Boulder, which recovered the park purchase price in three years, the City of Austin met only 28.4 percent of the annual debt charges with property tax increases, in large part because substantial sections of the park had no adjacent private properties.³⁵

The impact parks can have on property values may actually underestimate the value of open space, by excluding the nonmarket values associated with passive uses, such as just knowing that open space exists. Stated preference surveys, similar to hedonic pricing methods, attempt to value nonmarket benefits by asking respondents about their willingness to pay for an amenity. Residents in one Boulder, Colo., neighborhood were willing to pay \$234 per household (in 1995 dollars) to keep a 5.5-acre parcel of undeveloped land preserved forever. Extrapolating to the whole neighborhood within a mile of the parcel, the total value was \$774,000, more than the \$600,000 cost of the land.³⁶ Another method for calculating the recreational benefits of parks and open space estimates the travel costs associated with visiting a park in order to estimate the total benefit to all park users. A study of the Monon Trail in Indianapolis/Marion County, Ind., found that the average property price premiums for 1999 home sales could total \$140.2 million, with an additional net present recreational benefit of \$7.6 million.³⁷

FIGURE 1. **Impact of 14 Neighborhood Parks on Adjacent Neighborhoods in Dallas–Fort Worth**³⁸



The 14 parks were between 2.5 acres and 7.3 acres except for two that were .05 and 0.3 of an acre. They were “intermittently maintained” and were selected because of their ordinariness rather than their excellence. The parks were in the neighborhood of single-family houses. The analysis was based on 3,200 residential sales transactions. The price effects compared against home values a half mile from the parks are shown below. Homes adjacent to parks received an approximate price premium of 22 percent relative to properties a half mile away. Approximately 75 percent of the value associated with parks occurred within 600 feet of a park.

■ **The level of economic impact recreational areas have on home prices depends on how far the home is located from a park, the size of the recreational area and the characteristics of the surrounding neighborhood.**

A review of over 60 studies on the impact open spaces have on residential property values showed that most do increase property values but the magnitude depends on the size of the area, its proximity to residences, the type of open space and the method of analysis. The review found that increases in property value existed up to 500–600-foot away from the park.³⁹ For community-sized parks over 30 acres, the effect may be measurable out to 1,500 feet, but 75 percent of the premium value generally occurs within the 500–600-foot range.^{40, 41} One study estimated that the average household living half a mile from open space would be willing to pay \$4,104 more for a home (in 1992 dollars) to live a quarter mile closer to the open space.⁴²

While the distance between a park and homes is important, park size also is a key determinant of the magnitude of a park’s impact on home prices. So, a small park located close to residential areas may have a larger impact on more houses than a large park located farther away. In Portland, Ore., house prices increased with the size of the natural area, leading the authors of the study to conclude the optimal size of parks and natural areas to be similar to that of a golf course.⁴³ Increasing the percentage of open space land surrounding a property can increase average house prices by up to 1 percent of the total property value.^{44, 45} A study conducted in 2001 also found that large parks are more valuable to residents than small parks.⁴⁶ However, because the property value premium is small relative to the value of proximity, creating a series of small parks with more total houses in their vicinity may produce a greater economic benefit to the overall community.

Increasing the visibility and accessibility of parks can help maximize their value to the surrounding community. Indirect paths from nearby homes into a park detract from the proximity value boost and decrease the level of benefit that could be experienced. Similarly, parks bordered by roads are substantially more valuable to the surrounding neighborhood than green space only bordered by private lots.⁴⁷ Access to open space can also play an important role in the magnitude of the effect. Homes located in a Dallas, Texas subdivision that had publicly usable open space between houses generally sold at a premium, but the effect of the open space was statistically insignificant, and much smaller than the effect of the size of the private lots themselves. Indeed, an additional square foot of private backyard space is estimated to be worth \$384 (in 1985 dollars), while an additional foot of open space is found to be worth less than \$4.⁴⁸

■ **Open space in urban areas provides a greater economic benefit to surrounding property owners than open space in rural areas.**

How much economic value open space provides to surrounding property may depend on its location.⁴⁹ For instance, the value of open space may be higher in urban areas than in suburban ones, with parks, greenways, forests and other natural areas providing greater economic benefits as population density increases.^{50, 51} Broadly speaking, urban residents in dense neighborhoods located near downtowns place substantial value on proximity to open space, while suburban and rural residents do not appear to value open space as highly. A study of four large, regional parks in Bastrop County, Texas confirms that open spaces in rural areas may have less of an impact on property values. In the largely rural county near Austin, Texas, the parks—both individually and as a group—had no statistically significant impact on property prices in the rural county in which they are located. The authors cite the relatively large amount of undeveloped land (whether publicly or privately owned) in the area, as well as the rather large size of lots compared to those in the typical American city as reasons why the price premium associated with living close to a public open space in a predominantly rural area might be limited.⁵²

Greenbelts, urban growth boundaries and open spaces in clustered subdivisions also appear to have value to the community, but the relationship is difficult to distinguish from the effect of the supply of buildable land.^{53, 54} A land containment program in Salem, Ore., added about \$1,200 more per acre (1979 dollars) to the value of urban land near the greenbelts than urban land located 1,000 feet away from the boundary. The impact greenbelt land has on urban land value extends about 5,000 feet inward from the urban growth boundary.⁵⁵

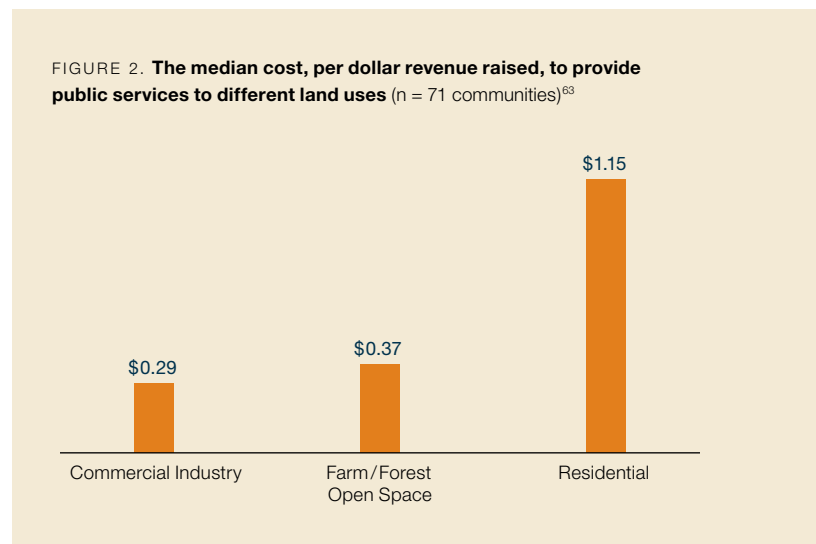
Preserved farmland in rural and suburban areas has a greater impact on surrounding real estate values than land that may be developed. Because many studies on the subject have been conducted in specific geographic areas, there is mixed evidence about how much households are willing to pay to preserve the farmland. However, studies do show there is a price premium when farmland perceived to be under the threat of development is preserved.^{56, 57, 58} A 2002 study found that people in Maryland were willing to pay \$3,307 more for a house near permanently preserved open space rather than pastureland that could be developed at some point in the future, suggesting that people value open space because it is not development.

■ **Open space land, recreation areas and compact developments may provide fiscal benefits to municipal governments.**

Compact, walkable development, which preserves open space and concentrates development on smaller lots, also provides financial benefits to municipalities related to lower infrastructure costs. Large-lot suburban development patterns require roads, water supply and sewer services that become more costly when extended over greater distances. One study found that a half acre lot in a centrally located, compact development costs \$198 less in annual water and sewer service and \$72,000 less in additional costs over 30 years than a comparable lot in the suburbs.⁵⁹

Locating a compact, walkable subdivision where there is existing infrastructure may also increase benefits of associated open space. A study conducted in Prince William County, Va., located outside Washington, D.C., found that providing municipal services to a house on a large lot far from existing infrastructure costs the county \$1,600 more than is returned in taxes and other revenues.⁶⁰ A study in Rhode Island found the state could save more than \$1.4 billion over 20 years, or \$71.6 million per year, if the state's next 20,000 housing units were built within existing urban areas instead of in undeveloped areas. The study showed savings on roads, schools and utilities and calculated the benefits of agricultural lands not lost and urban centers not decayed.⁶¹

Fiscal impact studies estimate the public costs and revenues associated with residential or nonresidential growth to determine the net fiscal impact of development. A review of fiscal impact analyses found that: Residential development typically resulted in a fiscal deficit; nonresidential development generated a fiscal surplus but attracted residential development; and open space was fiscally preferable to residential development and equal to or better than commercial and other nonresidential development.⁶²



Using a process pioneered by the National Park Service, studies in 125 communities have used a type of fiscal impact study, the Cost of Community Services, to develop a revenue-to-expenditure ratio for residential, commercial, industrial and open space land use categories.⁶⁴ While fiscal impacts to local governments do not represent the same type of economic benefit as increases in property value, the cost savings or revenue to jurisdictions through open space and parks may benefit a community through long-term infrastructure cost savings.

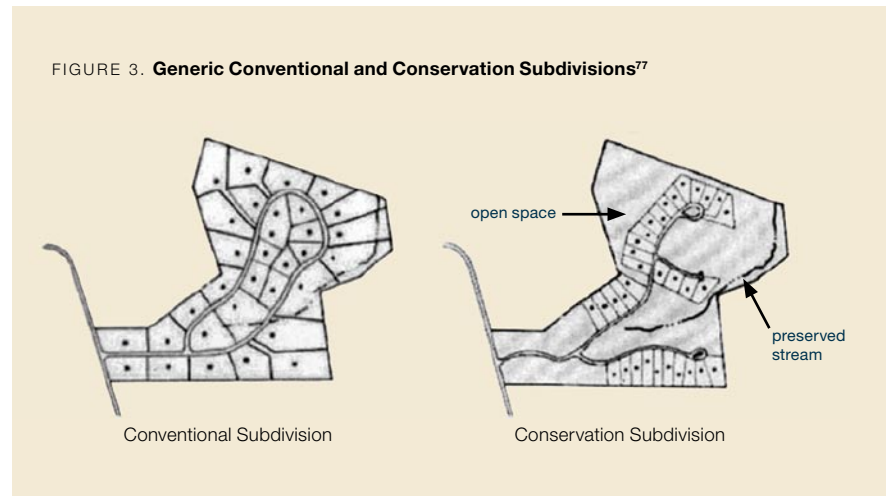
Open space and recreational facilities can require fewer public amenities and municipal services than new land development, offering a cost-effective alternative. The Northeastern Office of the American Farmland Trust, which has frequently used the Cost of Community Services approach, studied six rural towns in Connecticut, Massachusetts and New York and found that, on average, open space lands required only 29 cents in services per dollar of revenue generated.⁶⁵ A number of communities have reportedly elected to purchase park and open space land, rather than allow it to be used for residential development, because in the long term this results in less tax burden on existing residents than if new homes were built on the land.⁶⁶ Additionally, investment in parks and open space does not incur some of the costs that often accompany residential development, such as traffic congestion, noise, pollution, infrastructure deterioration and changes in community character.⁶⁷

■ **Compact, walkable developments can provide economic benefits to real estate developers through higher home sale prices, enhanced marketability and faster sales or leases than conventional development.**

Traditional neighborhood development, also known as compact or walkable development, concentrates neighborhood density, allowing room for large open space areas. Neighborhoods that feature open spaces, parks and greenbelts have higher home sale prices, enhanced marketability and often faster sales or leases than conventional development.⁶⁸ A national survey of developers found that they have noted considerable consumer interest in alternatives to conventional, low-density, automobile-oriented suburban development—including support for higher density, mixed use, pedestrian-oriented places.⁶⁹

This demand is expected to continue in the coming decade as demographic changes and consumer preferences shift toward denser, more compact residential environments.⁷⁰ One recent study listed additional factors that could support the market for walkable urban places, including: urban job growth, tight urban housing markets, preferences for urban amenities and support for public policies and investments that favor revitalization, alternative transportation modes, historic preservation and urban parks and open space.⁷¹ Open spaces enhance the value of nearby developable lands, allowing compact development to command a premium in the residential real estate market.⁷²

Developers who take into account the desire for compact development and the protection of natural areas may spend less on marketing because such projects can have a high profile within the community, solicit high community involvement in their development and design, and generate significant media interest.⁷³ Compact developments featuring open space, trails and greenways have sold more quickly than similar properties elsewhere⁷⁴ and often have a high rate of presold units.^{75, 76}



Consumers also seem willing to pay a premium to locate in walkable developments featuring open space.^{78, 79, 80} Sites that are more walkable command higher property values across property type, including office, retail, apartment and industrial. Depending on the property type, a 10 percent increase in walkability increases property values by between 5 percent and 8 percent.⁸¹ Lots in a compact, walkable subdivision in South Kingston, R.I., sold for \$122,000 to \$125,000 per acre, while lots in conventional subdivisions sold for \$107,000 to \$109,000 per acre. This translates into premiums ranging from \$13,000 to \$18,000 per acre for lots in walkable subdivisions over lots in conventional subdivisions.⁸²

For developers, these economic benefits can translate into reduced financial liability, faster sales and ultimately higher profits. A recent development in Lake Elmo, Minn., highlighted by the Urban Land Institute, demonstrated a similar principle by offering a high density alternative in an area of large-lot development. The developer used only 40 percent of the 241-acre site for the development of 111 homesites, leaving 60 percent of the land to permanent open space composed of farmland, a tree nursery, horticultural gardens, wooded slopes, two ponds and restored native prairie. Close to 80 percent of the homes sold within six months of their offering in two phases.⁸³

The design elements of compact developments may also present cost savings to developers. Watershed areas have been used in some developments as a form of natural drainage protection and open space, reducing construction and maintenance costs from storm water drainage systems. In one development, surface stormwater drainage through the use of swales that direct water over porous soils to irrigate agricultural areas saved \$800 per lot when compared to conventional storm sewer construction.⁸⁴ Because people can walk to more destinations, reduced parking ratios and shared parking have also been used to offset the increased costs of structured parking.

Finally, as the density of development in these neighborhoods increases, the per-unit cost to developers to supply infrastructure services decreases,^{85, 86} with some estimates of the average savings around 32 percent.^{87, 88, 89} As developers are often called upon to pick up a significant portion of the tab for the sewer and water capital expenditures associated with their projects, these cost savings have been passed onto them through changes to fee structures.

Conclusions and Implications

In addition to providing opportunities for physical activity, recreation areas and parks located in metropolitan areas provide economic benefits to residents, municipal governments and private real estate developers. Parks tend to increase the value and sale price of homes and property located nearby. In addition, the amount of local tax dollars required to operate and service recreation areas may be less than for other types of land use, such as residential developments, further increasing the fiscal impacts they have on municipal governments. Neighborhoods designed to preserve open space through compact development patterns may result in savings to private developers through reduced construction and maintenance costs, while communities designed for walkability can command price premiums in the marketplace. Other than the potentially negative economic effect of the “nuisance” factor associated with overly busy or unattractive parks, recreation areas and compact developments were found to produce positive economic outcomes for developers, homeowners and local governments. The implications of these findings are important, particularly given recent fluctuations in the real estate market, changing demographics and variable consumer demands for housing.

The limitations associated with these conclusions are clear. Many of the studies included in the literature rely upon local conditions and may not be widely generalizable to other areas. Evidence on real estate market prices are subject to a variety of local factors, such as schools, crime and accessibility, which can impact the applicability of conclusions in one area to conditions elsewhere. Thus, it is difficult to make conclusions about specific economic impacts. Although all reasonable studies were examined for this synthesis, to provide the first comprehensive look at the subject and identify priorities for further study, many of the studies cited were not from peer-reviewed sources, so their rigor could be questioned. Self-selection, or the tendency for certain residents to gravitate towards particular types of places, may also limit the findings. Some residents will place a higher value on open space and recreation areas and will pay significantly more to be located near these amenities than others.

Areas Where Additional Research is Needed

Research into citizens’ preferences for urban parks and their impacts on the local real estate market has been ongoing in the United States since the 1960s. While research continues, the hedonic pricing method has proven to be a useful indicator of willingness to pay for natural, green space amenities. However, this approach may not take into account the recreational benefits open space may provide to people who do not own property near the facility but do use it for physical activity purposes. Other methods, such as the travel cost method, may capture these values, but more research is needed to explore these effects.

Further research into the costs and benefits of parks, with respect to local government, regional economic development and private developers, is needed. Policy-makers and community members may need additional evidence of the types of parks, landscape elements and locations

where parks can be expected to generate the largest economic benefits while also considering physical activity impacts. These studies should be used to inform decisions about land development patterns and zoning decisions.

While this review focuses on direct economic effects through property values and fiscal impacts, it is important to note that open spaces can also provide indirect economic and non-economic benefits. Ecological services, greenhouse gas reductions, and mental health benefits, as well as recreational benefits, should also be considered as indirect effects of parks. These indirect benefits can be evaluated using the Travel Cost Method or Stated Preference Surveys such as Contingent Valuation.

Finally, gaps in the research quantifying the price premium of compact developments make conclusions about the expected increases difficult to determine. While past research suggests that compact communities designed to preserve green space may result in savings to private developers through reduced construction and maintenance costs, recent changes in the finance and construction industries require updates to the existing research.

Additional Resources and References

Active Living Research
www.activelivingresearch.org

American Farmland Trust, Cost of Community Services Fact Sheet
www.farmlandinfo.org/documents/27757/FS_COCS_11-02.pdf

American Trails, National Trails Training Partnership
www.americantrails.org/resources/economics/index.html

National Recreation and Park Association
www.nrpa.org

The Trust for Public Land, Center for City Park Excellence
www.tpl.org

Urban Land Institute
www.uli.org

This synthesis was prepared by Lilly Shoup, School of Architecture, Planning, and Preservation, University of Maryland at College Park; and Reid Ewing, Ph.D., Department of City and Metropolitan Planning, University of Utah; with support from the Active Living Research staff. Peer review was provided by Jacqueline Geoghegan, Ph.D., Clark University; Judith Shinogle, Ph.D., University of Maryland, Baltimore County; and Greg Lindsey, Ph.D., University of Minnesota, Humphrey Institute of Public Affairs.

For updates and a Web-based version of this synthesis, visit www.activelivingresearch.org.

Active Living Research, a national program of the Robert Wood Johnson Foundation, stimulates and supports research to identify environmental factors and policies that influence physical activity for children and families to inform effective childhood obesity prevention strategies, particularly in low-income and racial/ethnic communities at highest risk. Active Living Research wants solid research to be part of the public debate about active living.

Active Living Research
San Diego State University
3900 Fifth Avenue, Suite 310
San Diego, CA 92103
www.activelivingresearch.org

Endnotes

- 1 Ogden C, Carroll M, Curtin L, et al. "Prevalence of Overweight and Obesity in the United States, 1999–2004." *Journal of the American Medical Association*, 295(13): 1549–1555, April 2006.
- 2 Koplan J, Kraak V and Liverman C. "Preventing Childhood Obesity: Health in the Balance." Washington: National Academies Press, 2005.
- 3 Brownson R, Boehmer T and Luke D. "Declining Rates of Physical Activity in the United States: What Are the Contributors?" *Annual Review of Public Health*, 26: 421–443, April 2005.
- 4 Heath G, Brownson R, Kruger J, et al. "The Effectiveness of Urban Design and Land Use and Transport Policies and Practices to Increase Physical Activity: A systematic Review." *Journal of Physical Activity and Health*, 3 (suppl. 1), S55–S76, February 2006.
- 5 Saelens B and Handy S. "Built Environment Correlates of Walking: A Review." *Medicine & Science in Sports & Exercise*, 40(7), S550–S566, July 2008.
- 6 Frank L, Kerr J, Chapman, J, et al. "Urban Form Relationships with Walk Trip Frequency and Distance Among Youth." *American Journal of Health Promotion*, 21(14S), 305–311, March/April 2007.
- 7 Kligerman M, Sallis J, Ryan S, et al. "Association of Neighborhood Design and Recreation Environment Variables with Physical Activity and Body Mass Index in Adolescents." *American Journal of Health Promotion*, 21(4), 274–277, March/April 2007.
- 8 Ewing R, Schmid T, Killingsworth R, et al. "Relationship Between Urban Sprawl and Physical Activity, Obesity, and Morbidity." *American Journal of Health Promotion*, 18(1): 47–57, September/October 2003.
- 9 Heath G, et al.
- 10 Sallis J, Saelens B, Frank L, et al. "Neighborhood Built Environment and Income: Examining Multiple Health Outcomes." *Social Science & Medicine*, 68(7): 1285–1293, April 2009.
- 11 Humpel N, Owen N, Leslie E. "Environmental Factors Associated with Adults' Participation in Physical Activity: A Review." *American Journal of Preventive Medicine*, 22(3): 188–199, April 2002.
- 12 Sallis J and Kerr J. "Physical Activity and the Built Environment." *President's Council on Physical Fitness and Sports Research Digest*, 7(4): 1–8, December 2006.
- 13 Gordon–Larsen P, Nelson M, Page P, et al. "Inequality in the Built Environment Underlies Key Health Disparities in Physical Activity and Obesity." *Pediatrics*, 117(2): 417–424, February 2006.
- 14 Koplan J, et al.
- 15 Cao T and Cory D. "Mixed Land Uses, Land–use Externalities, and Residential Property Values: A Re–evaluation." *Annals of Regional Science*, 16(1): 1–24, March 1982.
- 16 Song Y and Knaap G. "Measuring the Effects of Mixed Land Uses on Housing Values." *Regional Science and Urban Economics*, 34(6): 663–680, November 2004.
- 17 Guttery R. "The Effects of Subdivision Design on Housing Values: The Case of Alleyways." *Journal of Real Estate Research*, 23(3): 265–274, 2002.
- 18 Shultz S and King D. "The Use of Census Data for Hedonic Price Estimates of Open-Space Amenities and Land Use." *Journal of Real Estate Finance and Economics*, 22(2): 239–252, April 2001.
- 19 Benson E, Hansen J, Schwartz A, et al. "Pricing Residential Amenities: The Value of a View." *Journal of Real Estate Finance and Economics*, 16(1): 55–73, January 1998.
- 20 Bowes D and Ihlanfeldt K. "Identifying the Impacts of Rail Transit Stations on Residential Property Values." *Journal of Urban Economics*, 50(1), 1–25, July 2001.
- 21 Song Y, et al.
- 22 Bolitzer B and Netusil N. "The Impact of Open Spaces on Property Values in Portland, Oregon." *Journal of Environmental Management*, 59(3): 185–193, July 2000.
- 23 Lutzenhiser M and Netusil N. "The Effect of Open Space on a Home's Sale Price." *Contemporary Economic Policy*, 19(3): 291–298, July 2001.
- 24 Geoghegan J. "The Value of Open Spaces in Residential Land Use." *Land Use Policy*, 19(1): 91–98, January 2002.
- 25 Song Y, et al.
- 26 Nicholls S and Crompton J. "The Impact of Greenways on Property Values: Evidence From Austin, Texas." *Journal of Leisure Research*, 37(3): 321–341, June 2005.
- 27 Anderson S and West S. "Open Space, Residential Property Values, and Spatial Context." *Regional Science and Urban Economics*, 36(6): 773–789, June 2006.
- 28 Payton S, Lindsey G, Wilson J, et al. "Valuing the Benefits of the Urban Forest: A Spatial Hedonic Approach." *Journal of Environmental Planning and Management*, 51(6): 717–736, November 2008.
- 29 Nicholls S. "Measuring the Impact of Parks on Property Values: New Research Shows That Green Spaces Increase the Value of Nearby Housing." *Parks and Recreation*, 24–32, March 2004.
- 30 Weicher J and Zerbst R. "The Externalities of Neighborhood Parks: An Empirical Investigation." *Journal of Land Economics*, 49(1): 99–105, February 1973.
- 31 Lutzenhiser, et al.
- 32 Espey M and Owusu-Edusei K. "Neighborhood Parks and Residential Property Values in Greenville, South Carolina." *Journal of Agricultural and Applied Economics*, 33(3): 487–492, December 2001.
- 33 Correll M, Lillydahl J and Singell L. "The Effect of Green Belts on Residential Property Values: Some Findings on the Political Economy of Open Space." *Land Economics*, 54(2): 207–217, May 1978.
- 34 Geoghegan J, Lynch L and Bucholtz S. "Capitalization of Open Spaces into Housing Values and the Residential Property Tax Revenue Impacts of Agricultural Easement Programs." *Agricultural and Resource Economics Review*, 32(1): 33–45, April 2003.
- 35 Crompton J and Nicholls S. "An Assessment of Tax Revenues Generated by Homes Proximate to a Greenway." *Journal of Park and Recreation Administration*, 24 (3): 103–108, Fall 2006.
- 36 Breffle W, Morey E and Lodder T. "Using Contingent Valuation to Estimate a Neighborhood's Willingness to Pay to Preserve Undeveloped Urban Land." *Urban Studies*, 35(4): 715–727, April 1998.
- 37 Lindsey G, Man J, Payton S, et al. "Property Values, Recreation Values, and Urban Greenways." *Journal of Park and Recreation Administration*, 22(3): 69–90, 2004.
- 38 Miller A. *Valuing Open Space: Land Economics and Neighborhood Parks*. Cambridge, MA: Massachusetts Institute of Technology Center for Real Estate, 2001.
- 39 McConnell V and Walls M. *The Value of Open Space: Evidence from Studies of Nonmarket Benefits*. Washington: Resources for the Future, 2005.
- 40 Miller A.

- 41 Crompton J. *The Proximate Principle: The Impact of Parks, Open Space and Water Features on Residential Property Values and the Property Tax Base*. Ashburn, VA: National Recreation and Park Association, 2004.
- 42 Walsh R. "Endogenous Open Space Amenities in a Locational Equilibrium." *Journal of Urban Economics*, 61(2): 319–344, March 2007.
- 43 Lutzenhiser M, et al.
- 44 Irwin E. "The Effects of Open Space on Residential Property Values." *Land Economics*. 78(4): 465–480, November 2002.
- 45 Geoghegan J, et al., 2003
- 46 Miller A.
- 47 Crompton J.
- 48 Peiser R and Schwann G. "The Private Value of Public Open Space Within Subdivisions." *Journal of Architectural and Planning Research*, 10(2): 91–104, Summer 1993.
- 49 Anderson S, et al.
- 50 Ibid.
- 51 Acharya G and Bennett L. "Valuing Open Space and Land-use Patterns in Urban Watersheds." *Journal of Real Estate Finance and Economics*, 22(2–3): 221–237, March–May 2001.
- 52 Nicholls S and Crompton J. "Impacts of Regional Parks on Property Values in Texas." *Journal of Park and Recreation Administration*, 23(2): 87–108, 2005.
- 53 Knaap G. "The Price Effects of Urban Growth Boundaries in Metropolitan Portland Oregon." *Land Economics*, 61(1): 26–35, February 1985.
- 54 Nelson A. "Using Land Markets to Evaluate Urban Containment Programs." *Journal of the American Planning Association*, 52(2): 156–71, June 1986.
- 55 Ibid.
- 56 Irwin E.
- 57 Geoghegan J, 2002.
- 58 Geoghegan J, et al., 2003
- 59 Speir C and Stephenson K. "Does Sprawl Cost Us All? Isolating the Effects of Housing Patterns on Public Water and Sewer Costs." *Journal of the American Planning Association*, 68(1): 56–70, March 2002.
- 60 Kotchen M and Schulte S. "A Meta-Analysis of Cost of Community Service Studies." *International Regional Science Review*, 32(3): 376–399, July 2009.
- 61 H.C. Planning Consultants, Inc. *The Costs of Suburban Sprawl and Urban Decay in Rhode Island*. Providence, RI: Grow Smart Rhode Island, 1999.
- 62 Burchell R and Listokin D. "Fiscal Impact Procedures and the State of the Art: The Subset Question of the Costs and Revenues of Open Space and Agricultural Lands." (Paper presented at "Does Land Conservation Pay? Determining the Fiscal Implications of Preserving Open Land" Cambridge, MA, 1992.)
- 63 *Fact Sheet: Cost of Community Services*. Northampton, Mass.: Farmland Information Center, American Farmland Trust, 2004. (No authors given.)
- 64 Kotchen M, et al.
- 65 Freedgood J and Wagner R. "Cost of Community Services Studies: Snapshots of Net Fiscal Impacts of Different Land Uses in Towns." (Paper presented at "Does Land Conservation Pay? Determining the Fiscal Implications of Preserving Open Land" Cambridge, MA, 1992.)
- 66 Lerner S and Poole W. "Open Space Investments Pay Big Returns." *Land and People Magazine*, Spring 1999.
- 67 Crompton J. *Parks and Economic Development*. Planning Advisory Service Report Number 502. Chicago. American Planning Association and the City Parks Forum, 2001.
- 68 Mohamed R. "The Economics of Conservation Subdivisions: Price Premiums, Improvement Costs, and Absorption Rates." *Urban Affairs Review*, 41(3): 376–399, January 2006.
- 69 Levine J and Inam A. "The Market for Transportation–land Use Integration: Do Developers Want Smarter Growth than Regulations Allow?" *Transportation*, 31(4): 409–427, November 2004.
- 70 Leinberger C. *The Option of Urbanism: Investing in a New American Dream*. Washington: Island Press, 2008.
- 71 Bailey J and Humphrey E. "Comment on Dowell Myers and Elizabeth Gearin's 'Current Preferences and Future Demand for Denser Residential Environments'." *Housing Policy Debate*, 12(4): 665–674, Fall 2001.
- 72 Lacy J. *An Examination of Market Appreciation for Clustered Housing with Permanent Open Space*. Amherst, MA: Center for Rural Massachusetts, University of Massachusetts, 1990.
- 73 Curran D and Leung M. *Smart Growth: A Primer*. Victoria, B.C.: Eco-Research Chair of Environmental Law and Policy and Smart Growth, 2000.
- 74 PFK Consulting. *Analysis of Economic Impacts of the Northern Central Rail Trail*. (Prepared for Maryland Greenways Commission). Annapolis, MD: Maryland Department of Natural Resources, 1994.
- 75 Rocky Mountain Institute. *Green Development: Integrating Ecology and Real Estate*. New York: John Wiley & Sons, Inc., 1998.
- 76 Curran D, et al.
- 77 Arendt R. *Conservation Design for Subdivisions: A Practical Guide to Creating Open Space Networks*. Washington, D.C.: Island Press, 1996.
- 78 Eppli M and Tu C. "Valuing New Urbanism: The Case of Kentlands." *Real Estate Economics*, 27(3): 425–451, September 1999.
- 79 Plaut P and Boarnet M. "New Urbanism and the Value of Neighborhood Design." *Journal of Architectural and Planning Research*, 20(3): 254–265, Autumn 2003.
- 80 Pivo G and Fisher J. "Effects of Walkability on Property Values and Investment Returns." Working Paper. Responsible Property Investing Center, Boston College and University of Arizona; Benecki Center for Real Estate Studies, Indiana University, 2009
- 81 Ibid.
- 82 Mohamed R.
- 83 The Fields of St. Croix. Washington, DC: National Association of Home Builders, 2009, www.nahb.org/generic.aspx?genericContentID=434 (accessed February 2010).
- 84 Rocky Mountain Institute.
- 85 Bise L. "Metropolitan Council Fiscal Impact Study." (Paper presented at American Planning Association National Conference, Denver, CO 2003.)
- 86 Arrington G. TCRP 128: *Effects of TOD on Housing, Parking and Travel*. Washington: Transportation Research Board, 2008.
- 87 Burchell R. *Impact Assessment of the New Jersey Interim State Development and Redevelopment Plan*. Trenton, NJ: Rutgers University Center for Urban Policy Research, 1992.
- 88 Duncan J, et al. *The Search for Efficient Growth Patterns*. Tallahassee, FL: Florida Department of Community Affairs, 1989.
- 89 Hammer, Siler, George Associates and Gould Evans Goodman Associates.

Table of Studies

The following tables include a more comprehensive list of studies and reports on the economic benefits of open space. The first includes a statement of key findings and conclusions for each item, which can be used as a basis for future research in this area. The second table includes items that are not cited in this synthesis but were reviewed during the writing process.

TABLE 1. **Studies Cited in this Synthesis: Authors, Methodology and Approach, and Key Findings**

Author(s)	Methodology and Approach	Key Findings
Acharya G and Bennett L. (2001)	A hedonic property value analysis was conducted for an urban watershed in New Haven County, Conn., using spatially referenced housing and land-use data to capture the effect of environmental variables around the house. Researchers calculated and incorporated data on open space, land-use diversity and other environmental variables to capture spatial variation in environmental quality around each house location. Using a rich data set of over 4,000 houses, they studied these effects within a watershed that includes areas of high environmental quality and low environmental quality as well as varying patterns of socio-economic conditions.	The results suggested that, in addition to structural characteristics, variables describing neighborhood socio-economic characteristics and variables describing land use and environmental quality are influential in determining values. Additionally, the scale at which researchers measured the spatially defined environmental variables was important.
Anderson S and West S. (2006)	The authors used hedonic analysis of home transaction data from the Minneapolis–St. Paul metropolitan area to estimate the effects of proximity to open space on sales price. They allowed the effects of proximity to vary with demographic and location-specific characteristics and include fixed effects to control for observed and unobserved neighborhood characteristics.	The value of proximity to open space was higher in neighborhoods that were dense, near the central business district, high-income, high-crime or home to many children. Using the metropolitan area's average value may substantially overestimate or underestimate the value of open space in particular neighborhoods.
Arrington G. (2008)	This report provided data on residential trip generation and parking in transit-oriented development (TOD), and the behavior and motivation of TOD residents, employees and employers in their mode choice. The report also identified best practices to promote, maintain and improve TOD-related transit ridership.	As the density of development in these neighborhoods increased, the per-unit cost to developers to supply infrastructure services decreased.
Bailey J and Humphrey E. (2001)	Commenting on an article titled "Current Preferences and Future Demand for Denser Residential Environments", the authors provide research evidence that there are additional factors that can explain the demand for compact, walkable development.	The study provided additional factors that could support the market for walkable urban places, including: urban job growth, tight urban housing markets, preferences for urban amenities and support for public policies and investments that favor revitalization, alternative transportation modes, historic preservation and urban parks and open space.
Benson E, Hansen J, Schwartz A, et al. (1998)	Estimated the value of the view amenity in single-family residential real estate markets of Bellingham, Wash.	Results from a hedonic price model suggested that willingness to pay for the view amenity is quite high.
Bise L. (2003)	This study assessed a tool to assist regional and local policy-makers to develop and evaluate cost-specific measures to support or justify the provision of regional services.	As the density of development in compact neighborhoods increased, the per-unit cost to developers to supply infrastructure services decreased.

TABLE 1. Studies Cited in this Synthesis (continued)

Author(s)	Methodology and Approach	Key Findings
Bolitzer B and Netusil N. (2000)	The impact of open-space proximity and type was examined empirically using a data set including the sales price for homes in Portland, Ore., geographic information system-derived data on each home's proximity to an open-space and open-space type, and neighborhood and home characteristics.	Results showed that proximity to an open-space and open-space type can have a statistically significant effect on a home's sale price. Researchers examined 193 public parks which were collectively found to have a significant and positive impact on the value of properties within 1,500 feet.
Bowes D and Ihlanfeldt K. (2001)	A hedonic price model and auxiliary models for neighborhood crime and retail activity is used to determine the role of property values and rail stations.	Stations may raise the value of nearby properties by reducing commuting costs or by attracting retail activity to the neighborhood. Possibly countering these positive effects are negative externalities emitted by stations and the access to neighborhoods that stations provide to criminals. Results show that all four effects play a role in defining the relationship between property values and rail stations, but the relative importance of these effects varies with distance from downtown and the median income of the neighborhood.
Breffle W, Morey E and Lodder T. (1998)	Contingent valuation (CV) was used to estimate a neighborhood's willingness to pay (WTP) to preserve a 5.5-acre parcel of undeveloped land in Boulder, Colo., that provides views, open space and wildlife habitat. Households were surveyed to determine bounds on their WTP for preservation. An interval model was developed to estimate sample WTP as a function of distance, income, and other characteristics.	The best estimate of neighborhood WTP, \$774,000, was greater than the estimated \$600,000 cost to purchase the property from the developer.
Burchell R and Listokin D. (1992)	Professors Burchell and Listokin of Rutgers University compiled the results of a great many fiscal impact studies, and created a list of fiscal impacts by development type.	Overall cost of compact development was significantly less than sprawl for the affected municipalities, particularly for infrastructure (roads, water and sewer). In the long term, ongoing operating costs for roads and infrastructure also would be reduced with compact development, and there would be less need to acquire land for public parks and recreation.
Burchell R. (1992)	Examined the effects of sprawl, or conventional development, versus managed (or "smart") growth on land and infrastructure consumption as well as on real estate development and public service costs in New Jersey.	In New Jersey, compact development can achieve a 30% reduction in runoff and an 83% reduction in water consumption compared with conventional suburban development.
Cao T and Cory D. (1981)	The purpose of this research was two-fold: 1) to construct a theoretical model of consumer behavior in which both the positive and negative effects of neighborhood land-use externalities are taken into account, and 2) to test this generalized model using hedonic pricing equations in Tucson, Ariz.	Increasing industrial, commercial, multi-family and public land uses tends to increase surrounding home values. The authors concluded that a mix of land uses should be sought in locating economic activities into residential neighborhoods.
Correll M, Lillydahl J and Singell L. (1978)	The paper examined the effect of three greenbelts in Boulder, Colo., using a multiple regression analysis to empirically evaluate the effect of proximity on property price.	The aggregate property value for the neighborhood was approximately \$5.4 million greater than it would have been in the absence of greenbelt. This increment resulted in an annual addition of approximately \$500,000 to the potential neighborhood property tax revenue. The purchase price of this greenbelt for the city was approximately \$1.5 million and, thus, the potential property tax revenue alone would allow a recovery of initial costs in only three years.

TABLE 1. Studies Cited in this Synthesis (continued)

Author(s)	Methodology and Approach	Key Findings
Crompton J. (2004)	Provided economical methods to estimate the local impact of parks and water features on property values. Shows the influence of the “proximate principle” on urban park development.	The economic boost in property value existed up to 500–600 feet away from the park. In the case of community-sized parks over 30 acres, the effect may be measurable out to 1,500 feet, but 75% of the premium value generally occurs within the 500–600-foot zone.
Crompton J and Nicholls S. (2006)	The researchers analyzed the 7.9 mile Barton Creek Greenbelt in Austin, Texas. The cost of acquiring the greenbelt in 2004 dollars was estimated at \$14.89 million, and the annual debt charges were assumed to be approximately \$1.1 million.	When the prevailing tax rates were applied to the property value increments attributable to the greenbelt, they generated tax revenues to the city of \$58,677 and \$311,844 to all the taxing entities. Thus, the tax revenues from the incremental tax base values met only 28% of the annual debt charges. However, a large majority of the greenbelt area users are likely to come from beyond the proximate neighborhoods, so it is likely that neighborhood residents were paying their “fair share” of the greenway’s costs.
Curran D and Leung M. (2000)	This study reviews the literature documenting the effect of natural open space preservation on property values, and briefly discusses the economic benefits such an approach has for land developers and municipalities.	Developers who take into account the protection of natural areas and use green products for their buildings spent less on marketing because of the media interest the developments generate. Green developments often have a high rate of units, presold often around 75% as was the case with 2211 W. 4th Avenue in Vancouver
Eppli M and Tu C. (1999)	This study assessed the impact of New Urbanism on single-family home prices using data on 2,061 single-family home transactions and several hedonic price models. Specifically, they use Duany and Plater-Zyberk’s traditional neighborhood development (TND) of Kentlands and surrounding conventional subdivisions to estimate the premium, if any, that single-family homeowners are willing to pay to reside in a community with new urbanist features.	Consumers are willing to pay a premium to locate in new urbanist developments.
Espey M and Owusu-Edusei K. (2001)	The effect on housing prices of proximity to different types of parks is estimated using a unique data set of single-family homes sold between 1990 and 1999 in Greenville, S.C. While the value of park proximity is found to vary with respect to park size and amenities, the estimates from this study are larger than previous studies.	The greatest impact on housing values was found with proximity to small neighborhood parks, with the positive impact of proximity to both small and medium-size parks extending to homes as far as 1500 feet from the park.
Freedgood J and Wagner R. (1992)	The Cost of Community Services approach compares annual revenues to annual expenses of public services for various land use categories. Local revenues and expenditures are apportioned to major categories of land use and the result is a set of ratios showing the proportional relationship of revenues and expenditures for different land uses at one point in time. Various assumptions are made in apportioning costs across land uses, and these are most often based on discussions with local staff and officials.	Calculations using the approach in six rural towns in Connecticut, Massachusetts and New York found that, on average, open space lands required only 29 cents in services per dollar of revenue generated.

TABLE 1. Studies Cited in this Synthesis (continued)

Author(s)	Methodology and Approach	Key Findings
Geoghegan J. (2002)	This paper developed a theoretical model of how different types of open spaces are valued by residential land owners living near these open spaces, and then, using a hedonic pricing model, tests hypotheses concerning the extent to which these different types of open spaces are capitalized into housing prices.	The empirical results from Howard County, a rapidly developing county in Maryland, show that “permanent” open space increases near-by residential land values over three times as much as an equivalent amount of “developable” open space.
Geoghegan J, Lynch L, and Bucholtz S. (2003)	Using a unique spatial database, researchers developed a hedonic model to estimate the value to nearby residents of open space purchased through agricultural preservation programs in three Maryland counties. After correcting for endogeneity and spatial autocorrelation, the estimated coefficients were used to calculate the potential changes in housing values for a given change in neighborhood open space following an agricultural easement purchase. Then, using the current residential property tax for each parcel, the expected increase in county tax revenue was computed and this revenue was compared to the cost of preserving the lands.	Findings show preserved open space did increase property values on adjacent residential parcels in two of the three counties in Maryland. Assuming the existing open space increases by 1%, using simulations based on the spatial econometric model, the increased property tax from these agricultural easements could generate enough revenue to purchase a significant portion of the 1% more open space acres, especially if one considers that the increases in tax revenue go on in perpetuity. In both Howard and Calvert counties, the revenue generated from an increase in permanent open space could purchase approximately 60% of the increase of the newly preserved lands in the first year alone.
Guttery R. (2002)	This study examines the sale prices of houses located in subdivisions utilizing rear-entry alleyways in the greater Dallas-Fort Worth-Denton metroplex. Regression analysis on a sample of 1,672 home sales, some of which are located on alleyways, reveals statistically significant impacts.	The regression results suggested that the alleyway subdivision design discounted sale prices about 5%, all else held equal.
H. C. Planning Consultants, Inc. (1999)	The study measures the costs of sprawl by projecting and comparing the gross costs of continued sprawl development with those of compact core development over the next twenty years (between 2000 and 2020).	A study in Rhode Island found the state could save more than \$1.4 billion over 20 years, or \$71.6 million per year, if the state's next 20,000 housing units were built within existing urban areas instead of in undeveloped areas. The study showed savings on roads, schools and utilities and calculated the benefits of agricultural lands not lost and urban centers not decayed.
Hammer Siler George Associates and Gould Evans Goodman Associates (2001)	This report summarized an analysis of the cost of development in the Kansas City region that was completed for the regional Metropolitan Planning Organization (MPO). It was a comparison of the costs of land development for both residential and nonresidential uses under two development concepts. One is “conventional,” which is characterized by a separation of uses and subdivision layouts typical of those that have been developed over the past several decades. The other is termed “alternative” and incorporates the principles of Creating Quality Places, such as mixed use, clustering and open space preservation.	The results of the exercise suggested the relative magnitude of the development costs and the relationship between the conventional and alternative concepts. Projects which include denser development in combination with a dramatic increase in the amount of open space had lower infrastructure costs than the conventional developments.

TABLE 1. Studies Cited in this Synthesis (continued)

Author(s)	Methodology and Approach	Key Findings
Irwin E. (2002)	The marginal values of different open space attributes were tested using a hedonic pricing model with residential sales data from central Maryland. The identification problems that arose due to endogenous land use spillovers and unobserved spatial correlation were addressed using instrumental variables estimation with a randomly drawn subset of the data that omitted nearest neighbors.	Results showed a premium associated with permanently preserved open space relative to developable agricultural and forested lands and support the hypothesis that open space is valued for providing an absence of development, rather than for providing a particular open space amenities.
Knaap G. (1985)	Using cross sectional data, this study measures the effects of Urban Growth Boundaries on vacant single-family land values in metro Portland, Ore.	Urban Growth Boundaries and other means of urban containment led to higher land prices by limiting the supply of developable land.
Kotchen M and Schulte S. (2009)	In this paper, authors conducted a quantitative meta-analysis of COCS studies focusing on three land-use categories: residential, commercial/industrial, and agricultural/open-space. The dataset consisted of 125 studies from across the United States. Using data from the studies themselves and the U.S. Census, authors estimated models to investigate underlying patterns regarding the effect of different methodological assumptions and the geographic and financial characteristics of communities.	They found clear support for the common perception that residential land uses tend to have ratios greater than one, while commercial/industrial and agricultural/open-space land uses tend to have ratios less than one. Recent population growth has little effect on COCS ratios for all land-use categories.
Lacy J. (1990)	A study in Amherst and Concord, Mass., found that clustered housing with open space appreciated at a higher rate than conventionally designed subdivisions. The clustered homes in Amherst appreciated at an average annual rate of 22%, compared to an increase of 19.5% for the more conventional subdivision. The home-buyer, speaking in dollar terms through the marketplace, appears to have demonstrated a greater desire for a home with access and proximity to permanently protected land, than for one located on a bigger lot, but without open space.	Market appreciation rates for cluster housing with associated open space can be equal to those for conventionally developed housing types.
Leinberger C. (2008)	This book explains the decisions that have made the “drivable suburban” model dominant in the US and highlights the recent demographic changes that are shifting the demand for this type of development.	The book documents that demographic shifts are converging and increasing the demand for compact development.
Lerner S and Poole W. (1999)	This article drew findings from a Trust for Public Land Report titled: “The Economic Benefits of Parks and Open Space: How Land Conservation Helps Communities Grow Smart and Protect the Bottom Line.”	A number of communities have elected to purchase park and open space land, rather than allow it to be used for residential development, because in the long term this reduces the net tax deficit for residents, which would occur if new homes were built on that land.

TABLE 1. Studies Cited in this Synthesis (continued)

Author(s)	Methodology and Approach	Key Findings
Levine J and Inam A. (2004)	This article studied, through a national survey with 676 respondents, US developers' perceptions of the market for pedestrian- and transit-oriented development forms.	Overall, respondents perceived considerable market interest in alternative development forms, but believed there was inadequate supply of such alternatives relative to market demand. Developers attributed this gap between supply and demand to local government regulation. When asked how the relaxation of these regulations would affect their product, the majority of developers indicated that such liberalization would lead them to develop in a denser and more mixed-use fashion, particularly in close-in suburban locales. The results favored land-policy reform based on the expansion of choice in transportation and land use.
Lindsey G, Man J, Payton S, et al. (2004)	This paper presented a taxonomy of the values of greenways and illustrated how two particular types of values can be measured using complementary techniques. Impacts of greenways on property values in Indianapolis, Ind., were measured with geographic information systems (GIS) and hedonic price modeling using residential real estate sales data from 1999. Recreation values were measured for a greenway trail in Indianapolis with the travel cost method using data from a 2000 survey of trail users and counts of trail traffic taken in 1996.	Results show that some but not all greenways have a positive, significant effect on property values and that the recreation benefits of a trail exceed costs. For homes within one half-mile of the Monon Trail, the model estimates that 14% (\$13,056) of the predicted sales price is attributable to the Trail. Assuming this value is correct, the premium for the 334 sales that occurred near the Monon Trail in 1999 would be more than \$4.3 million. Analyses of census data using GIS indicates approximately 8,862 households are located near the Monon Trail. If the average Monon premium were assumed to apply to each household, the total increase in property values associated with the presence of the Monon Trail in Marion County would be \$115.7 million.
Lutzenhiser M and Netusil N. (2001)	Information on home sales in the Portland Metropolitan area was analyzed to determine the effects of proximity of open space and recreational land on sale price. Three models were developed: model A projects the effect of any type of open space within 1500 feet of home; model B refines the analysis by distinguishing between the four open space types; and model C focuses on the effect of distance from an open space by introducing six dummy variables.	Homes that were within one half-block of any type of open space were estimated, on average, to experience the largest positive effect on their sale price.
McConnell V and Walls M. (2005)	This review of more than 60 articles attempted to estimate the value of different types of open space. Both contingent valuation and contingent choice studies, are reviewed.	Both the revealed and stated preference studies generally show a value in preserving most types of open space land, but the values tend to vary widely with the size of the area, the proximity of the open space to residences, the type of open space and the method of analysis. One conclusion drawn from this review was that the value of open space amenity estimates, even for specific types of open space, appear to be site- or location-specific.
Miller A. (2001)	This paper used hedonic regression analysis to quantify the effect of neighborhood parks on residential property values. Using data on housing quality, location and neighborhood characteristics at 14 sites near Dallas-Fort Worth, Texas, researchers used the regression to infer a rent premium gradient within walking distance of parks.	The research found that homes adjacent to parks received an approximate price premium of 22% relative to properties 2,600 feet away. However, because 75% of the value associated with parks occurs within 600 feet of travel distance and indirect paths detract from value, the connectivity of the street network is of great importance in maximizing that park's value to the surrounding residents.

TABLE 1. Studies Cited in this Synthesis (continued)

Author(s)	Methodology and Approach	Key Findings
Mohamed R. (2006)	The paper examined the price premiums, investment costs and absorption rates for lots in conservation versus those in conventional subdivisions in South Kingstown, R.I.	The results showed that lots in conservation subdivisions carry a premium, are less expensive to build and sell more quickly than lots in conventional subdivisions, suggesting that designs that take a holistic view of ecology, aesthetics and sense of community can assuage concerns about higher density. However, the potential negative consequences of conservation subdivisions require further study.
Nelson A. (1986)	This article developed a theory of how urban containment programs influence the regional land market and developed a model to apply the theory to Salem, Ore.	It found that the urban containment program divides the market into urban and rural land markets by making greenbelts out of farmland. The program was found to add an amenity value of about \$1,200 more per acre to urban land located near the greenbelts than urban land located 1,000 feet away from the boundary. The amenity influence of greenbelt land on urban land value extends about 5,000 feet inward from the urban growth boundary.
Nicholls S. (2004)	This paper reviewed recent hedonic price analyses conducted in Portland, Ore.; Dallas, Texas; Austin and College Station, Texas; and Indianapolis, Ind.	The author provides a table comparing the results of studies in the literature with respect to several open space types, three of which—urban parks, greenways and golf courses—increased property values.
Nicholls S and Crompton J. (2005)	This paper demonstrated empirical estimation of the economic value of a greenway in Austin, Texas, through analysis of its impacts on surrounding property prices. This type of analysis is based on use of the hedonic pricing method and allows measurement of two types of greenway value: physical proximity and aesthetics (view).	The authors examined three areas in Austin, with results suggesting that proximity to a greenbelt did trigger significant (12.2%) increases in property values, and that view of the greenbelt was not significant.
Nicholls S and Crompton J. (2005)	In this study, the hedonic pricing method is applied to four large parks in Bastrop County, near Austin, Texas.	The analysis revealed that these large, public open spaces had no statistically significant impact on property prices in the rural county in which they were located. Potential explanations for this lack of significance include the relatively large amount of undeveloped open space (whether publicly or privately owned) in the area, as well as the rather large lot-size compared to the typical American city. Combined, these factors suggest that the premium associated with living in close proximity to a public open space in a predominantly rural area might be limited by the large supply of this commodity.
Payton S, Lindsey G, Wilson J, et al. (2008)	This paper measured the benefits of the urban forest by examining its effect on housing prices. A Geographic Information System was used to develop a measure of the urban forest, the Normalised Difference Vegetation Index, from satellite imagery and to construct other variables from a variety of sources. Spatial hedonic housing the price models for the Indianapolis/Marion County area were estimated.	The models indicated that greener vegetation around a property has a positive, significant effect on housing price, holding everything else constant. This effect was dominated by measures at the neighborhood level, indicating that property owners value the urban forest, at least in part, by premium they pay to live in neighborhoods with greener, denser vegetation. These findings also indicate that public action to maintain and enhance the urban forest may be warranted. Planners and urban foresters can use these findings to inform public and policy debates over urban forestry programs and proposals.

TABLE 1. Studies Cited in this Synthesis (continued)

Author(s)	Methodology and Approach	Key Findings
Peiser R and Schwann G. (1993)	The study evaluates homes located in a Dallas, Texas between subdivision that had publicly usable open space houses.	Researchers found that homes generally sold at a premium, but the effect of the open space was statistically insignificant, and much smaller than the effect of the size of the private lots themselves. Indeed, an additional square foot of private backyard space is estimated to be worth \$384 (in 1985 dollars), while an additional foot of open space is found to be worth less than \$4.
Pivo G and Fisher J. (2009)	This study measured the degree to which an area within walking distance of a property encourages walking for recreational or functional purposes. The authors used data from the National Council of Real Estate Investment Fiduciaries (NCREIF) and Walk Score to examine the effects of walkability on the market value and annual investment returns of nearly 11,000 office, apartment, retail and industrial properties over the past decade.	The authors found that, all else being equal, the benefits of walkability are capitalized into office, retail, apartment and industrial property values with more walkable sites commanding higher property values. On a 100 point scale, a 10 point increase in walkability increases property values by 5% to 8%, depending on property type. They also found that walkability is associated with lower cap rates and higher incomes, suggesting that higher values are caused by both higher incomes and expectations of less risk, greater income growth or slower depreciation. Walkability only had a positive effect on historical investment returns for offices. It negatively affected returns for retail and apartments and had no effect on industrial property. All walkable property types generated higher income and therefore had the potential to generate returns as good as or better than less walkable properties, as long as they were priced correctly.
Plaut P and Boarnet M. (2003)	Authors tested the hypothesis that urban design, specifically the design attributes associated with New Urbanism, are reflected in housing prices, using a data set for Haifa, Israel. House sales from 1988 through 1996 were analyzed for three neighborhoods in which there were similar socioeconomic compositions, public services, schools, property taxes and other amenities. One of the neighborhoods had many characteristics of New Urbanism design, while the other two are more traditional urban or suburban developments. Hedonic regression analysis was used to control structure-specific characteristics.	The analysis of the regression values across neighborhoods shows a statistically significant price premium in the New Urbanism neighborhood. The evidence suggests that persons are willing to pay for living in a New Urbanism neighborhood, other things held equal.
Rocky Mountain Institute (1998)	Based on 80 case studies drawn from Green Development Services' extensive worldwide research and consulting work, this report distilled proven procedures, potential pitfalls and practical lessons.	The infrastructure and building design significantly reduced construction and maintenance costs. Narrow residential streets limited the land required for streets to just 20% of the site. Surface drainage handles storm water through the use of swales that direct water over porous soils to irrigate agricultural areas. This design saved \$800 per lot when conventional storm compared to sewer construction.

TABLE 1. Studies Cited in this Synthesis (continued)

Author(s)	Methodology and Approach	Key Findings
Shultz S and King D. (2001)	Hedonic price models for determining marginal implicit prices of open-space amenities and nonresidential land use were estimated using housing data from the census. Alternative model specifications were compared to evaluate the effects of aggregating land-use data by alternative levels of census geography as well as the use of different sample sizes of census blocks. The authors determined that land use was best aggregated at the block group level and that entire populations or very large sample sizes of census blocks should be used with hedonic models.	The results provided empirical evidence that proximity to the large protected natural areas, golf courses, and Class II wildlife habitats, as well as the percentage of vacant and commercial land use, positively influences housing values.
Song Y and Knaap G. (2004)	The authors first developed several quantitative measures of mixed land uses through the use of Geographic Information System (GIS) data and computed these measures for various neighborhoods in Washington County, Ore. They then incorporated those measures in a hedonic price analysis.	Housing prices increased with their proximity to—or with increasing amount of—public parks or neighborhood commercial land uses. Housing prices were higher in neighborhoods dominated by single-family residential land use, where non-residential land uses were evenly distributed, and where more service jobs were available. Finally, they found that housing prices tended to fall with proximity to multifamily residential units.
Speir C and Stephenson K. (2002)	This article assessed the public water and sewer costs associated with alternative housing patterns, defined in terms of lot size, tract dispersion and distance from existing water and sewer service centers. The engineering cost model presented here gives empirical evidence of how sensitive local government service costs are to the spatial pattern of single-family residential development.	The results showed that more spread out housing patterns are more costly to supply with public water and sewer services, but that shifting a majority of these costs to the private sector may be a relatively simple matter.
Walsh R. (2007)	This paper evaluated open space policies using an empirical approach incorporating the endogeneity of both privately held open space and land conversion decisions in a locational equilibrium framework.	The results suggested that increasing the quantity of land in public preserves may lead to a decrease in the total quantity of open space in a metropolitan area. The analysis suggested that while a growth ring strategy is most effective in reducing total developed acreage in the metropolitan area, this reduction was associated with a large net welfare loss, particularly for households that rent their homes.
Weicher J and Zerbst R. (1973)	The externalities of five urban parks in Columbus, Ohio were assessed and related to property values in surrounding areas.	The paper presents clear evidence that neighborhood parks generate externalities for surrounding property, though the relationship was greatest when the property was immediately adjacent to the facilities. Tax assessors in some areas have failed to recognize the positive benefits of proximity to natural open spaces.

TABLE 2. Studies Not Cited in this Synthesis: Full Citation, Methodology and Approach, and Key Findings

Citation	Methodology and Approach	Key Findings
<p>Asabere P, Hackey G and Grubaugh S. "Architecture, Historic Zoning, and the Value of Homes." <i>Journal of Real Estate Finance and Economics</i>, 2(3): 181–195, September 1989</p>	<p>The objectives of this paper were to detect any partial effects on home values due to architecture and to detect the potential impacts of historic zoning in Newburyport, Mass.</p>	<p>Premium prices were associated with the historical architectural styles like colonial, federal, garrison and Victorian, however the historic zoning district did not have any conclusive positive external effects.</p>
<p>Auger P. <i>Does Open Space Pay?</i> Durham, NH: University of New Hampshire Cooperative Extension, 1995.</p>	<p>The Cost of Community Services process was used to compare residential, commercial, industrial and open space land use categories in two communities: Fremont and Deerfield, N.H. The proportionate cost assignments were made using best judgment, reviewing intown records, and/or assigning costs based on the assessed value of the land-use. Expenditures and revenues were totaled by land-use and a ratio was calculated.</p>	<p>Residential land uses often cost communities more than they generate in revenues. Agricultural and open space land paid significantly more in taxes than it required in servicing from local governments. Open space costs as little as 35 cents for every dollar in revenue.</p>
<p>Bergstrom J, Cordell H, Ashley G, et al. "Economic Impacts of Recreational Spending on Rural Areas: A Case Study." <i>Economic Development Quarterly</i>, 4(1): 29–39, February 1990.</p>	<p>Recreational expenditures were collected as part of the Public Area Recreation Visitors Study (PARVS). Economic impacts of these expenditures were estimated using regional input-output models developed from the USDA Forest Service model (IMPLAN).</p>	<p>Recreational spending contributed substantially to gross output, income, employment and value added in the studied rural areas. Outdoor recreation may be a viable rural economic development strategy.</p>
<p>Brighton D. <i>Community Choices: Thinking Through Land Conservation, Development, and Property Taxes in Massachusetts.</i> San Francisco: Trust for Public Land, 1999.</p>	<p>"This study investigated the relationship between property tax bills and permanent land conservation, through public or nonprofit ownership of either land or conservation easements. To examine the short term effects, the study calculates the tax increase caused by removing \$500,000 of property value from the tax rolls in seven sample towns. The long-term effect of land conservation is explored by correlating the residential property tax rate in each Massachusetts town with various measures of development and with various measures of realness."</p>	<p>In the short term, land protection, by fully or partially exempting land from taxation, often reduced the tax base and resulted in a tax increase. In the long term, property tax rates were generally higher in more developed towns than in rural ones. The residential property tax rate was, on average, lower in more rural towns where there are more acres of open land per capita. The residential property tax rate was, on average, higher in more developed towns where there are more residents, there is more commercial and industrial property, and there are more jobs.</p>
<p>Cochrun S. "Understanding and Enhancing Neighborhood Sense of Community." <i>Journal of Planning Literature</i>. 9(1): 92–99, August 1994.</p>	<p>The authors reviewed the literature on creating a sense of community in the context of neighborhood, or community of place. It explored methods planners can use to enhance sense of community through social and physical means.</p>	<p>They found that open spaces are public spaces and provide a setting for planned and casual interactions among neighbors, contributing to the sense of neighborliness and community.</p>
<p>Corbett M and Corbett J. <i>Designing Sustainable Communities: Learning from Village Homes.</i> New York: Island Press, 2000.</p>	<p>This book offers a case study of Village Homes outside Davis, Calif. The area offers features including extensive common areas and green space; community gardens; orchards and vineyards; narrow streets; pedestrian and bike paths; solar homes; and an innovative ecological drainage system.</p>	<p>Village Homes in Davis, Calif., is a 60-acre community based around a village green with adjacent commercial, community and recreational facilities. It houses 220 single family homes, 24 rental apartments and 22 businesses.</p>

TABLE 2. Studies Not Cited in this Synthesis (continued)

Citation	Methodology and Approach	Key Findings
<p>Crompton J. <i>Parks and Economic Development</i>. Planning Advisory Service Report Number 502. Chicago: American Planning Association and the City Parks Forum. 2001.</p>	<p>This book explained how to measure and report the positive economic impact of parks and open space on the financial health of local businesses and government. It summarized the relevant literature on the subject and provided a comprehensive overview on the topic.</p>	<p>Investing in parks and other public amenities is a proven economic development tool that can help communities attract businesses and wealthy residents. Communities with high quality of life ratings have a competitive advantage in the recruitment and retention of talented workers. Quality of life for employees is the third most important factor in locating a business, according to an annual survey of chief executives conducted by Cushman and Wakefield in 1989.</p>
<p>Crompton J. <i>The Impact of Parks and Open Spaces on Property Taxes</i>. Chapter in “The Economic Benefits of Land Conservation.” Edited by de Brun C. San Francisco: Trust for Public Land, 2007.</p>	<p>The author surveys peer-reviewed studies of the Proximate Principal, providing visuals and results from a number of surveys.</p>	<p>Over 20 peer-reviewed studies have demonstrated that the proximate effect is substantial up to 500–600 feet away from the park (typically three blocks). In the case of community-sized parks over 30 acres, the effect may be measurable out to 1,500 feet, but 75% of the premium value generally occurs within the 500–600-foot zone. The studies suggested that a positive impact of 20% on property values abutting or fronting a passive park area is a reasonable point of departure for estimating the magnitude of the impact of parks on property values.</p>
<p>Crompton J. “The Impact of Parks on Property Values.” <i>Parks & Recreation</i>, 36(1): 62, January 2001.</p>	<p>Analyzed the impact of parks on the values of real estate property, covering: the proximate principle in real estate management, a hypothetical illustration of an investment in parks, results of research on urban park development in the late 1960s and 1970s, and the impact of greenways and golf courses on property values.</p>	<p>Twenty of the 25 studies reviewed concluded that parks and open space contributed to increasing property values. In 4 of the 5 that did not, the evidence was inconclusive. The proximate impact of park land and open space is likely to be substantial up to 500 feet, and 2,000 feet for community parks.</p>
<p>Curran D. <i>Economic Benefits of Natural Green Space Protection</i>. Vancouver, British Columbia: The POLIS Project on Ecological, Governance University of Victoria and Smart Growth British Columbia, 2001</p>	<p>This study reviewed the literature documenting the effect of natural open space preservation on property values, and briefly discussed the economic benefits such an approach has for land developers and municipalities.</p>	<p>Generally, research indicates that natural open space has a positive effect on real estate values. Quantified benefits to communities include higher residential property values in areas proximate to, and/or with views of, natural open space. Homebuyers are willing to pay a premium for properties near natural open space, and residents will pay to permanently protect a natural open space in their neighbourhood.</p>
<p>Dittmar H and Ohland G. <i>The New Transit Town: Best Practices in Transit-Oriented Development</i>. Washington: Island Press, 2004.</p>	<p>New Transit Town explored the key challenges to transit-oriented development, examined the lessons learned from the first generation of projects, and used a systematic examination and analysis of a broad spectrum of projects to set standards for the next generation.</p>	<p>The results documented the demographic shifts that are converging and increasing the demand for compact development.</p>
<p>Eppli M and Tu C. “An Empirical Examination of Traditional Neighborhood Development.” <i>Real Estate Economics</i>, 29(3): 485–501, December 2002.</p>	<p>This study analyzed the impact of the New Urbanism development on single-family home prices using the price differential that homebuyers pay for houses in new urbanist developments relative to houses in conventional suburban developments. Data on over 5,000 single-family home sales from 1994 to 1997 in three different neighborhoods were analyzed using hedonic regression.</p>	<p>Regression results revealed that consumers pay more for homes in new urbanist communities than for those in conventional suburban developments. To live in the new urbanist community, homebuyers pay a premium of approximately 14.9% of property value in Kentlands, 4.1% in Laguna West, and 10.3% in Southern Village. Further analyses indicate that the price premium is not attributable to differences in improvement age and other housing characteristics.</p>

TABLE 2. Studies Not Cited in this Synthesis (continued)

Citation	Methodology and Approach	Key Findings
<p>Eppli M and Tu C. Valuing The New Urbanism: The Impact of the New Urbanism on Prices of Single-Family Homes. Washington: Urban Land Institute, 1999.</p>	<p>This book examines the evidence that consumers will pay additional money to live in single-family homes in new urbanist communities. This study compares the sales transactions and characteristics of homes in four regionally diverse new urbanist developments with homes in nearby conventional neighborhoods.</p>	<p>After accounting for site traits, housing characteristics, unit quality, neighborhood and other market factors, the authors found that buyers were willing to pay a premium for homes in new urbanist communities. Ideal for convincing community groups, public officials and lenders.</p>
<p>Ernst and Young. Analysis of Secondary Economic Impacts of New York City Parks. New York: New Yorkers for Parks, 2003.</p>	<p>The study looked at real estate values, tax assessments and turnover in neighborhoods surrounding six parks: Bryant Park (Manhattan), Prospect Park (Brooklyn), Clove Lakes Park (Staten Island), St. Albans Park (Queens), Crotona Park and P.O. Serrano Park (The Bronx). The authors also researched the history of capital investments in these parks, and used 30 additional neighborhood parks for an aggregate citywide analysis.</p>	<p>Investments in parks, when properly managed and maintained, positively impacted the economic development of surrounding properties. Park investments must be maintained and adequately integrated into a strategic management plan or the capital investment will not serve as an economic development tool. Factors that influence this include effective planning and administration, the local business environment and community involvement. Strategic re-investments in parks, as a part of overall community planning, can effectively enhance local property values.</p>
<p><i>Cost of Community Services Studies Fact Sheet.</i> Northhampton, MA: Farmland Information Center, 2006.</p>	<p>The report surveyed Cost of Community Services (COCS) studies conducted in at least 125 communities in the United States.</p>	<p>COCS studies conducted over the last 20 years showed working lands generated more public revenues than they receive back in public services. Their impact on community coffers is similar to that of other commercial and industrial land uses. On average, because residential land uses do not cover their costs, they must be subsidized by other community land uses.</p>
<p>Frank J. Cost of Alternative Development Patterns: A Review of the Literature. Washington: Urban Land Institute, 1989.</p>	<p>The author reviews several decades of studies on the cost of providing community services for streets, utilities and schools.</p>	<p>The report concludes that site development costs could be reduced by \$2,400 per unit by clustering development as compared to conventional development patterns, mostly due to savings from road construction.</p>
<p>Gyourko W and Rybczynski E. "Financing New Urbanism Projects: Obstacles and Solutions." <i>Housing Policy Debate</i>, 11(3): 733–750, Fall 2000.</p>	<p>Researchers conducted a survey of 23 industry practitioners from the development and finance fields in order to evaluate the perceived obstacles to New Urbanist projects.</p>	<p>New Urbanist projects, particularly those located in the suburbs, were perceived as generally riskier than typical real estate projects due to their multiple-use nature. The relatively high perceived risk for most New Urbanism projects imposes relatively high required rates of return, which in turn require these projects to generate cash flow quickly to be financially attractive to investors.</p>
<p>Irwin E and Bockstael N. "The Problem of Identifying Land Use Spillovers: Measuring the Effects of Open Space on Residential Property Values." <i>American Journal of Agricultural Economics</i>. 83(3): 698–704, August 2003.</p>	<p>This paper used hedonic models to test whether people's perception of the value of open space amenities is hampered by the fact that a parcel's land use is in part determined by its residential value.</p>	<p>The results showed that the spillover effects were present in the models, resulting in errors estimated marginal value of open space downward.</p>

TABLE 2. Studies Not Cited in this Synthesis (continued)

Citation	Methodology and Approach	Key Findings
Jarasek M. "Back to the Future," <i>Professional Builder</i> , October 1, 2006.	The article profiled Whittaker Homes development, the New Town at St. Charles.	"We had more than one thousand people on the waiting list after those initial meetings. And word just continued to spread from there." The occupancy horizon was 24 months when sales began in 2004.
Kopits E, McConnell V and Walls M. <i>The Trade-off between Private Lots and Public Open Space in Subdivisions at the Urban-Rural Fringe</i> . Washington: Resources for the Future, 2007.	Authors used data on subdivision house sales occurring between 1981 and 2001 in a county on the fringe of the Washington, D.C., metropolitan area to estimate a hedonic price model. They examined how households value being adjacent to open space and having more open space in the subdivision, and how they may be willing to trade off those amenities with their own private lot space.	They found that private acreage matters to households—a 10% larger lot leads to about a 0.6% higher house price, all else being equal. Subdivision open space is also valuable to households, but the marginal effect is much smaller than the marginal effect of private lot space. They also found that subdivision open space does substitute for private land, but the extent of the trade-off is small. They used the results of the estimated hedonic model to simulate the effects on prices of jointly increasing open space and reducing average lot size, holding the size of the subdivision constant. Average house prices were lower with clustering, particularly for interior lots that are not adjacent to open space.
Lee C and Ahn K. "Is Kentlands better than Radburn? The American Garden City and New Urbanist Paradigms." <i>Journal of the American Planning Association</i> . 69(1): 50–71, March 2003.	The study compares two developments that exemplify the American Garden City and New Urbanist paradigms through a morphological case study and quantitative analysis. The subdivisions are similar in scale, development density and date constructed.	Both developments attempted to create a walkable neighborhood, but Kentlands' interconnected street grid creates conflicts between autos and pedestrians. Further, overemphasis on mixed housing styles reduces the marketability and long-term success of Kentlands.
Li M and Brown J. "Micro-neighborhood Externalities and Hedonic Housing Prices." <i>Land Economics</i> , 56(2): 125–141, 1980.	Authors used a multiple regression model to estimate the influence of location-specific attributes such as aesthetic attributes, pollution levels and proximity to amenities on housing prices.	Proximity to certain non-residential land uses affected housing prices by having a positive value for accessibility and negative value for external diseconomies such as congestion, pollution and unsightliness.
Lipscomb C. "An Alternative Spatial Hedonic Estimation Approach." <i>Journal of Housing Research</i> . 15(2): 143–160, Summer 2006.	In this paper, using detailed data on household attitudes and parcel attributes, hedonic regression residuals were used in a structural equations framework to check for additional spatial effects in the hedonic coefficients beyond those captured in the hedonic regression itself. In this way, a "nearest neighbors" approach utilizing parcel level distance variables is compared directly to OLS estimation using spatial variables, showing the relative efficiency of the estimates in the former approach.	Hedonic price analysis is a method of estimating demand or price for a good that does not have a traditional economic market.
Litman T. <i>Economic Value of Walkability</i> . Washington: Transportation Research Board of the National Academies, 2003.	This paper described ways to evaluate the value of walking (the activity) and walkability (the quality of walking conditions, including safety, comfort and convenience).	Walking and walkability provide a variety of benefits, including accessibility, consumer cost savings, public cost savings (reduced external costs), more efficient land use, community livability, improved fitness and public health, economic development and support for equity objectives. Yet current transportation planning practices tend to undervalue walking.

TABLE 2. Studies Not Cited in this Synthesis (continued)

Citation	Methodology and Approach	Key Findings
<p>Matthews J and Turnbull G. "Neighborhood Street Layout and Property Value: The Interaction of Accessibility and Land Use Mix." <i>Journal of Real Estate Finance and Economics</i>, 35(2): 111–141, August 2007.</p>	<p>This paper evaluated how consumers value differences in neighborhood composition and street layout, factors not previously included in empirical studies of house value. It used measures of neighborhood street connectivity and their interaction with other neighborhood attributes to evaluate how street layout affects property values. Authors employed two different methods of indexing street layout.</p>	<p>In pedestrian oriented neighborhoods, a more gridiron-like street pattern increases house value using one measure, but greater connectivity decreases house value using the other. In auto-oriented developments, a more gridiron-like street pattern reduces house value using either measure.</p>
<p>Meyers D and Gearin E. "Current Preferences and Future Demand for Denser Residential Environments." <i>Housing Policy Debate</i>, 12(4): 633–659, Fall 2001.</p>	<p>This article assessed the future demand for denser, more walkable residential environments in the US, providing a survey of the evidence on preferences and demographic projections and trends to construct a demand projection for the period 2000 to 2010. This project is then compared with demands between 1990 and 2000.</p>	<p>The results showed that home buyers older than 45 who prefer denser, more compact housing alternatives will account for 31% of total homeowner growth during the 2000–2010 period, double the same segment's market share in the 1990s.</p>
<p><i>Economics Impacts of Protecting Rivers, Trails and Greenway Corridors: A Resource Book.</i> Washington: National Park Service, U.S. Department of the Interior, 1995.</p>	<p>This Resource Book was produced to help local planners, park and recreation administrators, citizen activists and non-profit groups understand and communicate the potential economic impacts of their proposed or existing corridor project. It presented evidence that greenways and trails may increase nearby property values and demonstrated how an increase in property values can increase local tax revenues and help offset greenway acquisition costs.</p>	<p>Proximity to open space, parks and trails can increase sales price, increase the marketability of properties and promote faster sales. Clustering the residential development to allow for establishment of a greenway corridor might also reduce total development costs and increase savings to the developer.</p>
<p>Nelson A. "Demand, Segmentation, and Timing Effects of an Urban Containment Program on Urban Fringe Land Values." <i>Urban Studies</i>, 22(5): 439–443, October 1985.</p>	<p>This paper provided the results of regression models testing for the additional and reduced demand of the Salem, Ore., urban containment program on the urban fringe land market. Two hundred and nine sales of vacant land ranging in size from 90% of an acre to 100 acres were used in the analysis.</p>	<p>The Urban Growth Boundary may not have had any effects on the land market in the first year, but was shown to influence sales in the second and fourth years of existence.</p>
<p>O'Neill D. <i>Environment and Development: Myth and Fact.</i> Washington: The Urban Land Institute, 2002.</p>	<p>This is the fourth publication in a series designed to address myths and offer good examples on issues related to growth and land development. It discussed methods developers may use to balance development with environmental protection.</p>	<p>Prince William County, Va., found that providing municipal services to a house on a large lot far from existing infrastructure costs the county \$1,600 more than is returned in taxes and other revenues. Additionally, Rhode Island could save \$142 million in sewer infrastructure costs if development were more dense and contiguous to existing development.</p>
<p>Petit J. <i>Building Greener Neighborhoods: Trees as Part of the Plan.</i> Washington: Home Builders Press, National Association of Home Builders, 1998.</p>	<p>This review examines studies that show developed lots with trees sell for an average of 20% to 30% more than similarly sized lots without trees. Mature trees that are preserved during development add more value to a lot than post construction landscaping.</p>	<p>The National Association of Home Builders has endorsed the view that planting more trees can increase the marketability of new developments because of the environmental and public relations advantages greening creates.</p>

TABLE 2. Studies Not Cited in this Synthesis (continued)

Citation	Methodology and Approach	Key Findings
<p>Smith K, Poulos C and Kim H. "Treating Open Space as an Urban Amenity." <i>Resource and Energy Economics</i>, 24(1-2), 107–129, February 2002.</p>	<p>This paper estimated hedonic price functions over nearly 30 years to evaluate whether the distinctions between fixed and adjustable land uses help in measuring the value of open space amenities.</p>	<p>Results indicated open space amenities can be important to residential property values. Proximity to undeveloped land increased the real sales price by about \$2.30/ft in the model developed for sales during the 1995–1998 period and the 1985–1989 period; it was double that value during the 1990–1994 period. The estimates can reflect both the importance of open space to consumers and the changed expectations about the likely future uses of these lands. Markets do signal the overall importance of nearby landscape and open space amenities.</p>
<p>Song Y and Knaap G. "New Urbanism and Housing Values: A Disaggregate Assessment." <i>Journal of Urban Economics</i>, 54(2): 218–238, September 2003.</p>	<p>A hedonic price model is built using data from (1) The tax assessment files from Washington County; (2) Regional Land Information System (RLIS) from Portland metro area; and (3) Census data from the US Census Bureau.</p>	<p>Researchers found that some features of New Urbanism are capitalized into property values such as more connective street networks, more streets, shorter cul-de-sacs, smaller block size, better pedestrian accessibility to commercial uses, more evenly distributed mixed land uses and proximity to light rail stations. While features like higher density, containing more commercial, multifamily and public use (relative to single-family uses), and containing major transportation arterials are not attractive to property buyers.</p>
<p><i>The Economic Benefits of Parks and Open Space: How Land Conservation Helps Communities Grow Smart and Protect the Bottom Line.</i> San Francisco, CA: Trust for Public Land, 2009.</p>	<p>The report reviewed over 70 Cost of Community Services studies published in the U.S.</p>	<p>Studies showed that residential development was the least cost effective land use. Communities with larger and readily growing populations appear to experience greater net deficits in their residential land than communities with smaller, stable populations. Sprawling residential growth has higher costs than other types of residential land use.</p>